

# FISH

for  
the

# PEOPLE

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**UPLIFTING THE SOCIO-ECONOMIC CONDITIONS OF FISHERS  
VIA SUSTAINABLE FISHERIES MANAGEMENT**



Southeast Asian Fisheries Development Center

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# Editorial

Many factors have contributed to the extreme deterioration of the fishery resources in the Southeast Asian waters. These could include over-exploitation of the limited resources linked with excessive fishing capacity, irresponsible use of destructive fishing gears and practices, and absence of appropriate regulatory system for fisheries. Such worsening state of the regions' fishery resources has brought significant impacts aggravating poverty in the region's fisheries communities. In an effort to mitigate the impact of the deteriorating fishery resources on the socio-economic conditions of the small-scale fishers, SEAFDEC has been promoting responsible fishing practices and methods as well as improving fisheries management towards sustainable development goals.

In promoting sustainable fisheries management in the Southeast Asian region, SEAFDEC has been guided by the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region that were adopted during the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium "Fish for the People" in November 2001. Specifically, Paragraph 6 of the Resolution pointed out the need to: Recognize the need to progressively replace "open access" to fisheries resources with "limited access regimes" through the introduction of rights-based fisheries which may also facilitate the management of fishing capacity and promote the use of responsible fishing gears and practices. Attempts have therefore been made to develop alternate fisheries management systems that could be more applicable to tropical fisheries often characterized as small-scale fisheries. Although many initiatives are still being confronted with the unclear ownership of the fishery resources where the users tend to be irresponsible in their manner of exploiting such resources, SEAFDEC has been promoting "rights-based fisheries: group user right for small-scale/coastal fisheries" and encouraging governments to delegate management responsibility/right to resource users through "co-management arrangement with government intervention".



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## C O N T E N T S

In fact, as part of such efforts, SEAFDEC published the “Regional Guidelines on Co-Management Using Group User Rights” to promote alternate fisheries management system accommodating the region’s specificities in fisheries as well as the social and economic conditions in the Southeast Asian region. Nevertheless, the development of the national policy and guidelines would still be necessary in order to have practical fisheries management system in each country in Southeast Asia. SEAFDEC is also advancing the various fisheries management approaches in the region with the hope that boosting sustainable fisheries management could uplift the socio-economic conditions of fishers in the Southeast Asian region. Moreover, it is also the goal of SEAFDEC that the fisheries management system developed by SEAFDEC and the countries in the region, more particularly for the small-scale coastal fisheries, could be placed in the international agenda such as the international policy initiative on ecosystem-based fisheries management so that attention could also be made on the need to develop and promote alternate fisheries management system in addition to the resource management system which is being promoted in the international arena.

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

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# The Surimi Industry in Southeast Asia: Trend and Demand for Raw Materials

Somboon Siriraksophon, Siripon Pangsorn and Penchan Laong-manee

A significant portion of catch from trawl fishing in the Southeast Asian waters (40-70%) is considered as low-value. While before this portion was either discarded at sea or preserved with ice for the production of feeds for livestock and fish, the development of the surimi industry in the region has provided the market for what was considered before as low-value fishes. Considering that many fish species could now be utilized as raw materials for surimi production, this paves the way for the improvement of the socio-economic conditions of the fishers through increased income and reduced wastage from fishing.

Fish paste products have long been part of the Asian traditional cuisine. The recently-developed surimi has been considered one of the most popular fish paste products and a very dynamic commodity in the Asian seafood industry in view of the latest innovations in its production and utilization. Surimi literally means “fish puree”, which was developed to simulate the texture and taste of the more expensive seafood products. From surimi, analogs of crab legs, lobsters, abalone, shrimps, scallops, etc. can now be produced. Surimi is an intermediate product made from minced fish meat that has been washed, refined, and mixed with cryo-protectants to attain a suitable fish texture when cooked. Although fish paste commodities have been manually produced in the Asian region for centuries, the

factory production of frozen surimi started only in the early 60s in Japan, providing the impetus for expanding the surimi industry in the Southeast Asian region and the market in exporting countries. Before, surimi production in Japan was intended to process its increasing fish catch and revitalize its fishing industry, these days surimi has been considered a means of making the by-catch from fisheries useful.

## Surimi Production in Southeast Asia

Recently, many fish products have been improved or developed in the Southeast Asian countries not only for domestic consumption but also for export. These include comminuted products made from minced fish meat or surmimi, such as fishball, fishcake, fish/prawn sausages and burgers, chikuwa, imitation crab stick, cuttlefish products, etc. (Ng *et al.*, 1996). The production of surimi in Southeast Asia primarily makes use of demersal fish species considered before as by-catch such as the threadfin bream (*Nemipterus* spp.), big-eye snapper (*Priacanthus* spp.) and lizardfish (*Saurida* spp.). These demersal species are the most abundant low-value fishes distributed from the coastal areas to the continental shelves and slopes in the Southeast Asian waters and exhibit the appropriate characteristics for processing export-quality surimi. In addition, other demersal fishes are also being used for surimi production in the region, such as croaker (*Johnius* spp., *Pennahia* spp.) and goatfish



or red mullet (*Upeneus* spp., *Parapeneus* spp.). Malaysia also makes use of the barracuda (*Sphyraena* spp.) for the country's surimi production (Siriporn *et al.*, 2007). By utilizing as surimi raw materials the by-catch and low-value species that were discarded before, the fishers can now earn additional income from their fishing operations.

Reports in 2005 have indicated that the total surimi production in the Southeast Asian region was estimated at 347,000 mt (Fig. 1). Thailand is the biggest producer of surimi in the region followed by Malaysia and Vietnam, with annual production of 150,000 mt (43%), 100,000 mt (29%) and 84,000 mt (24%), respectively. Moreover, Indonesia and Myanmar also produce surimi contributing about 4% of the total surimi production.

Although other countries like the Philippines, Brunei

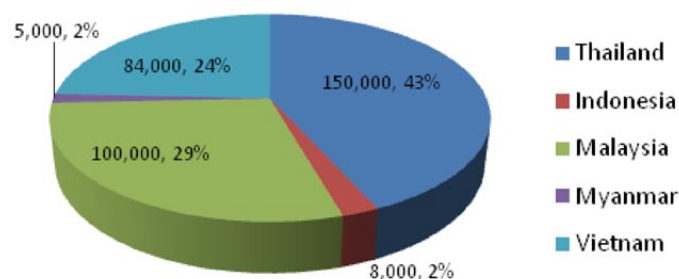


Fig. 1. Surimi production by the Southeast Asian countries (2005)

Darussalam, and Cambodia are still developing their surimi industry, these countries have also been producing comminuted products such as fish ball, fish burger, fishcake, etc. using low-value fishes. Small pelagic fishes such as scads (*Decapterus* spp.) and mackerel (*Rastrelliger* spp.) as well as other under-utilized freshwater fish species such as the soldier barb (*Cyclocheilichthys enplos*), feather-back fish (*Notopterus* spp.) and snakehead (*Channa* spp.) are now being used for the production of surimi-based products in the region (Goh and Yeap, 2007).

The maximum utilization of fish by-catch and low-value fishes as raw materials for the production of surimi and surimi-based products in the Southeast Asian region has been promoted by the SEAFDEC Marine Fisheries Research Department (MFRD) based in Singapore (Goh *et al.*, 2008). Through continuous R&D efforts and with funding support mainly from the Japanese Trust Fund (JTF), MFRD has been successful in advancing the promotion of surimi and surimi-based products not only for domestic consumption but also as export commodities from the region. Moreover, through improved product development and advances in technological approaches, MFRD has continued to promote greater use of fisheries by-catch and low value species through training and extension activities and providing technical assistance to the fish processing industry in the

region for the commercial application of such technologies. As of 2005, only five countries in the region have developed their respective surimi industries. Tan (1998) cited that in many countries in the region however, such as the Philippines, by-catch from fisheries is fully utilized as food in the form of salted, fermented or dried products.

### Thailand

Surimi production in Thailand which started in 1978, had increased from 65,000 mt in 1994 to 150,000 mt in 2005. More than 20 surimi processing plants in Thailand make use of demersal fish species such as the threadfin bream (*Nemipterus* spp.), big-eye snapper (*Priacanthus* spp.), lizardfish (*Saurida* spp.), croaker, goatfish (*Upeneus* spp.), red snapper (*Lutjanus* spp.), etc. as raw materials for the production of surimi. Other small pelagic species such as sardines (*Sardinella* spp.) and the rainbow runner (*Elagatis bipinnulata*) are also being used to produce surimi.

In the late 70s, the fish species used as raw materials in the country's surimi industry especially the threadfin bream and big-eye snapper, were still abundant in the Thai waters (Gulf of Thailand and Andaman Sea). However, due to the rapid growth of the surimi industry in Thailand as well as the depletion of its demersal fisheries resources, Thailand had to expand its source of surimi raw materials to neighboring countries such as Myanmar, Indonesia and Malaysia. The quantity of fish raw materials supplied to the surimi industry in Thailand was 530,000 mt/year in 2005, comprising about 189,000 mt of threadfin bream, 190,000 mt of lizardfish and croaker, 119,000 mt of big-eye snapper and goatfish, and 32,000 mt from other species (Siriporn *et al.*, 2007). In 2005, about 70% of the total frozen surimi production of Thailand were exported to Japan, Singapore, Taiwan, Korea, Malaysia, Hongkong, Europe, China, Canada, and the USA, while about 30% was used in the country's surimi-based fish paste commodities production. Singapore imports about 8,600 mt of surimi per year from Thailand for its fish ball and fish cake industry (Tan, 1998).

### Malaysia

Malaysia produces three types of surimi products, namely: surimi, otoshimi and surimi-based products. The country registered six surimi processing plants, producing about 100,000 mt in 2005-2006. Almost 670,000 mt of the country's marine fish production were supplied to the surimi processing plants in 2005 and used as raw materials for surimi production. The main fish species used are: barracuda (32%), lizardfish (23%), threadfin bream (19%), big eye (15%), croaker and goatfish (10%), and other species (1%). The raw materials for the country's surimi production come from its EEZ waters such as the Malacca Strait and east coast of Peninsular Malaysia as well as in the waters of Sarawak and Sabah. In Malaysia, surimi is being used to

manufacture local surimi-based products and also exported to many countries. The main importers are the USA and Chile sharing about 65%, and about 15% and 10% are exported to Japan and Singapore, respectively.

### **Vietnam**

Information from Vietnam's National Fisheries Quality Assurance and Veterinary Directorate (NAFIQAVED) showed that the country's frozen surimi production from 17 processing plants was about 84,000 mt in 2005, an increase of more than 500% from its production of 16,500 mt in 2003. The fish species used as raw materials for surimi production in Vietnam are the King snapper (*Priptipomoides filamentosus*) about 24%, lizardfish (23%), big eye snapper (19%), white croaker (19%), and other species (15%). These raw materials come from the country's EEZ waters especially from the Gulf of Ton Kin and from the southern part of Vietnam such as Cat Ba Island, Hai Phong and Bach Long Island, Da Nang, Kien Giang, Kan Hoa, Ca Mau, Vung Tau, Kien Giang, Tien Giang, and Binh Thuan.

Five of the processing plants share about 50% of the county's total frozen surimi production while the other 12 share the remaining 50%. Almost 90% of the total frozen surimi production of Vietnam is exported to Korea and Japan (about 60% and 28%, respectively) while the other 10% is exported to Singapore, Thailand, Malaysia, China, Taiwan, USA, EU, Australia, New Zealand, Russia, and Mexico.

### **Indonesia**

Indonesia is the largest country in the Southeast Asian region also having the largest shelf area (up to 200 m) which is about 2,700,000 km<sup>2</sup> and an EEZ area of 2.7 million km<sup>2</sup>. Although many fishery resources of the country can be used as raw materials for surimi processing, there are only eight processing plants located mainly in mainland Java, producing an estimated of less than 8,000 mt of surimi products. The raw materials used for the country's surimi production are the threadfin bream (68%), goat fish (13%), croaker (10%), big eye snapper (8%), and other species (1%), which come from Java Sea, and the seas around Riau and Jambi Province in west Kalimantan. The quantity of frozen surimi produced by the six processing plants in Indonesia was about 8,000 mt in 2005, which was exported to the Asian countries only such as Korea, Japan, Singapore, Taiwan, and Hong Kong.

### **Myanmar**

The people of Myanmar have a long tradition of producing fish paste, fish sauce, dried fish, salted fish and pickled fish, fish crackers, etc. Shrimp heads, very small fish and even mollusk shells are used for animal feeds. However, better utilization of the country's fisheries by-catch is now being promoted to produce surimi products. In Myanmar, there is one surimi plant located in Yangon which was established in 1994-95 and produces mainly surimi from low-value fish species. In 2007, there were five processing plants





producing surimi and one was still under construction. The production capacity of the county's surimi processing plants was 5,000 mt in 2005. The fish species used as raw materials by the surimi processing plants in Myanmar, include the threadfin bream (58%), big head pennah croaker (16%), goatfish (14%), lizard fish (6%), big-eye snapper (4%), and small barracuda (2%). All raw materials come from the Myanmar waters namely in Rakhine, Ayeyawaddy, Mon, and Tanintharyi fishing grounds. In 2004-2005, Myanmar exported 4,230 mt of surimi to many countries, mainly to Japan which imported about 80% of the country's total surimi production. The other importing countries are China (18%) with Australia, Singapore, Taiwan, and Malaysia importing the remaining 2% of the surimi production.

### Demersal Fish Resource as Main Supplier of Surimi Raw Materials

A further analysis of the status of the surimi industry in the Southeast Asian countries conducted by the SEAFDEC Training Department (TD) based in Samut Prakan, Thailand has established a linkage between the demand for raw materials (by the surimi industry) and the region's demersal resources as the supplier of the raw materials (Siriporn *et al.*, 2007a). However, the development of the surimi industry in the Southeast Asian region is still constrained by the unstable supply of raw materials even considering that the region produces considerable quantities of marine, coastal, demersal and pelagic fishes (**Table 1**), the significant portions of which could be used as raw materials for surimi production.

It has therefore become necessary to specifically understand the status of the demersal fish resources as raw materials for surimi production and to search for new fishery resources in the region to supply the demand of the region's surimi industry. In order to address such concern, TD conducted an

activity on information collection of economically important species as surimi raw materials under the Japanese Trust Fund Project on the Development of Demersal Fishery Resources Living in Un-trawlable Fishing Grounds in the Southeast Asian Waters. The results of the information collection activity indicated that most common demersal species used as raw materials for surimi production in the region belong to five families, namely: Nemipteridae, Synodontidae, Priacanthidae, Mullidae, and Sciaenidae. Together with the demand of the surimi industry in Southeast Asia, the results also showed that production growth for these five families of demersal fishes (SEAFDEC, 1976-2005), has been increasing during the past 30 years to a level of about 625,000 mt in 2005 (**Fig. 2**).

The 2005 production trend of the five demersal families, namely Nemipteridae, Synodontidae, Priacanthidae, Mullidae, and Sciaenidae which are used as raw materials for surimi production indicated that Thailand contributed about 45% while Indonesia shared about 28%, Malaysia and the Philippines contributed about 15% and 12%, respectively while the contribution of Singapore was almost nil (Siriporn *et al.*, 2007a).

These demersal fishes considered before as by-catch are now also being used for a wide range of fish products for local consumption. Tan (1998) reported that Malaysia has been successful in the production of fish "satay" using the goatfish (Family Mullidae). In addition, several processing plants in Thailand have also produced surimi-based product analogs of the cuttlefish and squid slices using a mix of the several fisheries by-catch. Although the surimi industry targets to produce high grade surimi for export, processing plants in the region have benefited from using surimi as raw material in the production of fish products for the domestic market, thus production of lower grade and lower-priced surimi for the local processing markets has increased.

**Table 1.** Production of miscellaneous marine fishes from capture fisheries in the Southeast Asian region

Countries	2001	2002	2003	2004	2005	2006
Brunei Darussalam	1,186	1,528	1,594	1,771	1,750	1,750
Cambodia	26,500	28,550	33,747	34,330	37,000	37,400
Indonesia	567,047	523,403	798,820	780,343	874,198	912,633
Malaysia	413,421	445,613	446,141	437,991	440,963	428,745
Myanmar	926,070	1,006,160	1,030,720	1,109,640	1,206,330	1,351,670
Philippines	14,656	16,527	14,725	14,024	12,559	14,854
Singapore	1,325	1,031	707	651	507	769
Thailand	984,490	937,848	964,203	953,340	931,426	946,369
Vietnam	1,101,761	1,168,691	1,210,025	1,315,811	1,349,000	1,377,500
Total	4,036,456	4,129,351	4,500,682	4,647,901	4,853,733	5,071,690

Source: FAO FishStat Plus (2008)

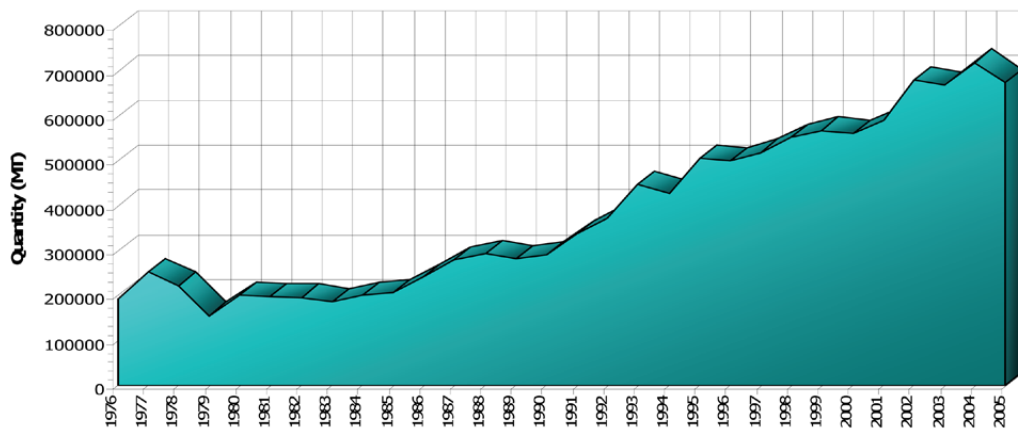


Fig. 2. Production trend of five important demersal fish species used as surimi raw materials in the Southeast Asian region (Source: SEAFDEC (1976-2005))

### Threadfin bream (Nemipteridae)

The Philippines which posted the highest production of threadfin bream from 1976 to 1990 experienced a continued decrease starting in 1991, during which time the production of Thailand overtook that of the Philippines. Since then Thailand's production had been rapidly increasing and was the highest producer of threadfin bream among the countries in the region for 15 years (1991-2005). Threadfin bream production of Indonesia and Malaysia also slowly increased during the same period.

### Lizardfish (Synodontidae)

Thailand's production of the lizardfishes had been increasing annually and after 1990 the increase was very rapid following the same pattern as that of the threadfin bream production. On the other hand, the lizardfishes production of Indonesia and Malaysia also increased but not as much as Thailand while that of the Philippines slowly decreased starting in 1978 until 2005.

### Big-eye snapper (Priacanthidae)

The production growth of the big-eye snapper posted by Thailand was the same as that of the threadfin bream and lizardfishes which rapidly increased from 1990 which made Thailand the highest producer of this species too. The production trend of the big-eye snapper posted by the other countries was quite low.

### Drums and croakers (Sciaenidae)

Indonesia had the highest production of drums and croakers since 1977. Although Thailand's production trend followed the same pattern as that of the other three families described above, its production of drums and croakers came second only after Indonesia. For Malaysia, production of drums and croakers was increasing every year while the production trend of the Philippines slowly decreased year by year.

### Goatfish (Mullidae)

Starting from 1976, the Philippines had the highest production of goatfish compared with the the other Southeast Asian countries until 1996 when its production decreased, although its production increased again in 2002. Indonesia's production of goatfish from 1976 slowly increased and after 1992 the trend had been strongly increasing making Indonesia the highest producer of goatfish starting in 1997 until 2005. Likewise, Malaysia's production of goatfish was also increasing year by year.

### Other demersal fishes

Small pelagic fishes such as sardines, round scads and mackerel have laso been considered low-value species and under-utilized especially during the fishing season. As such, these fishes usually end up as cheap raw materials for the production of fish meals. Through product development and value-adding, these pelagic fish species could now be processed into surimi-based products for the production of traditional fish snacks, e.g. the kerupok or fish cracker, fish chips, etc.

## Issues and Constraints

The development of the surimi industry in the Southeast Asian region is constrained by many factors, the most significant of which is the unstable and unpredictable supply of raw materials brought about by the depleted demersal fish resources in the region. Other factors that caused the slow take off of the region's surimi industry include the low quality of materials caused by improper handling of the fishes onboard the fishing vessels, the lack of storage facilities onboard considering that the distance between the fishing grounds and the fishing ports could be quite far, and also the number of days spent by fishers in the fishing grounds which could be about one month. The current fuel crisis in 2008 also impacted on the development of the surimi industry in the region as this leads to a number



of consequences including high cost of raw materials and ingredients, increasing transport costs, increasing labor costs, etc. The strict product quality control imposed by the surimi importing countries such as the EU, USA, Japan, etc. has greatly influenced the production of export-quality surimi using high-grade fish species as raw materials, which has become expensive considering the decline of the demersal resources in the region. Considering that the price of export-quality surimi in the trading arena has remained low, the use of mixed species of fisheries by-catch to produce mixed-grade surimi could not be very sustainable as the price of mixed-grade surimi in the domestic and regional processing plants is also cheap.

## Way Forward

SEAFDEC through the Training Department (TD in Thailand, the Marine Fisheries Research Department (MFRD) in Singapore, and the Marine Fishery Resources Development and Management Department (MFRDMD) in Malaysia, has conducted a number of projects and activities that could address the problems and constraints encountered by the surimi industry in the Southeast Asian region. Among the major activities include the series of surveys of the demersal fishery resources in the region conducted by SEAFDEC with the collaboration of the Member Countries. Such surveys specifically aim to collect data on the relative abundance of demersal resources in the untrawlable waters of Southeast Asia and to investigate the existing potential demersal fishery resources in the Southeast Asian waters.

Funded by the JTF Program, results of the surveys using the bottom vertical longline gear have indicated that high-value demersal fishery resources specifically the groupers and snappers are found in the untrawlable waters of Southeast Asia. The data from the surveys also suggested that the fishery resources in the untrawlable fishing grounds are potential resources that could be explored in deep sea fisheries (Nakaret, 2008).

To specifically address the concerns of the surimi industry, SEAFDEC conducted in December 2007 the Regional Workshops on Information Collection of Demersal Resources as Surimi Raw Materials in Southeast Asian Waters and on the Findings of Demersal Resources from the M.V. SEAFDEC 2, with the main objectives of evaluating the status of demersal fishery resources as surimi raw materials in the region, reviewing the trend of demersal fisheries resources as surimi raw materials in SEAFDEC Member Countries, and discussing future exploration plans on demersal fisheries resources. The fisheries resources particularly the demersal resources in the seas of Southeast Asia was also scientifically assessed during the Workshops, considering that such resources have been reported to be

### Box 1. Recommended measures to mitigate the conflicts between man and processing industries in exploiting the region's demersal resources (SEAFDEC, 2007)

- (1) develop appropriate fisheries management systems
- (2) strict enforcement of MCS
- (3) explore the possibility of increasing the price for resource utilization, e.g., increasing price of surimi but striking a balance between price and resource management
- (4) fishing operations should target only species for surimi production and avoid the catch of juveniles of other commercially important species, e.g., promoting the use of JTEDs
- (5) promote the continued use of trash fish or low-value fish for surimi production
- (6) develop technology for using pelagic fishes in surimi production, e.g., horse mackerel
- (7) reduce post-harvest losses through good preservation and handling techniques onboard fishing vessels
- (8) tap potential sources of raw materials outside the region for surimi production
- (9) continue promoting the use of trash fish mainly for surimi instead of promoting it for the production of fish meal for aquaculture and livestock
- (10) maximize the use of trash fish for human consumption in terms of fish meat or production of traditional fish products
- (11) continue developing technology for the utilization of freshwater fishes for surimi production

already depleted. The said phenomenon could also be observed from the total marine fish catch which comprises almost 60-70 trash fish and the size of fish which had been getting smaller, greatly affecting the surimi industry in the region.

The state of the region's fishery resources which have been reported to be declining could even lead to a worst scenario in the future if the competition for fish between man and the fish processing industries is not averted. The December 2007 Regional Workshops therefore recommended a number of mitigation measures (**Box 1**). Nevertheless, some countries have carried out exploratory fishing operations in their respective untrawlable waters where commercial fishing is already occurring for some species. In this connection, Somboon (2008) recommended that any decision to migrate or introduce new effort to offshore fisheries should give due consideration to the biological, technological and economic factors associated with such moves. In cases where "to move offshore" can be justified biologically and economically, care must be taken to ensure that the offshore resources are harvested sustainably and thus effective management regimes and responsible fishing practices will be the key to long term viability. Given the current interest in Southeast Asia to develop offshore fisheries, policy makers, resource managers, the fishing industry, investors and other interested

stakeholders should understand the risks and uncertainty associated with such developments (Somboon, 2008).

Moreover, TD and MFRDMD have also been conducting assessment surveys of the fisheries resources in both offshore and deep sea areas in the Southeast Asian waters and in adjacent areas of the region such as the Eastern Indian Ocean, using various fishing sampling gears such as the bottom trawl, longline and traps. The surveys have been conducted mainly in the South China Sea, the Andaman Sea and Eastern Indian Ocean to assess the status of the fisheries resources in each particular area and search for new fishing grounds and new potential resources existing in the region to facilitate future sustainable utilization and promote responsible fishing practices.

As there is evidence that most near-shore coastal areas in Southeast Asia are overfished, a common policy response is for governments in the region to encourage fishing operations in deeper off-shore waters for pelagic and demersal fishes. In a related development for the region's surimi industry, MFRD continues to develop integrated fisheries post-harvest technologies that would optimize limited resources, enhance value-added products, and reduce post-harvest losses and wastage. MFRD also continues to promote the harmonization of analytical methods for the improvement of the quality of the region's fish products and upgrading of the region's fish processing industry in order to meet the requirements of the importing countries.

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# Ensuring Sustainable Fisheries Management: The Regional Advisory Committee for Fisheries Management in Southeast Asia

Somboon Siriraksophon, Pirochana Saikliang and Virgilia T. Sulit

Having taken cognizance of the current declining status of the region's fishery resources due to unsustainable utilization, the SEAFDEC Council during its 40<sup>th</sup> Meeting in 2008 in Bali, Indonesia endorsed the establishment of the Regional Advisory Committee on Fisheries Management in Southeast Asia (RAC) to ensure the sustainable management of fisheries in the Southeast Asian region for the peoples' food security.

The depleting fisheries resources in coastal areas of the Southeast Asian region have contributed to the worsening poverty of the fishermen and in the deteriorating social economies of many countries in the region. Such scenario, which has greatly affected the outlook of national and regional food security, could be due to the general oversight on the part of many countries, of the need for appropriate fisheries management policy to promote sustainable fisheries. The present resources could no longer cope with fishing activities because fish demand is higher than whatever resources are available which have also been gradually decreasing. Although many countries started to introduce rehabilitation programs to protect and conserve their coastal resources (e.g. deployment of artificial reefs, imposing closed seasons, establishing marine protected areas and/or fishery refugias, etc.), there is a need to consolidate such efforts in order to sufficiently supply the fish demand of the region's growing population. Exploring potential fishery resources could be an option. Nonetheless, the fishing capacity in the coastal areas should be reduced in order to enhance stock recruitment. This could mean pushing off excess fishing capacity to the offshore waters. Although plausible, such effort should however be pursued in an appropriate and sustainable manner (Somboon, 2008).

During the past few years, the need to improve fisheries management have been discussed in many regional and international fora, as means of mitigating the declining state of the world's fishery resources. Along this vein, the Southeast Asian countries also discussed on various occasions ways and means to strengthen fisheries management in the region not only through individual country's efforts but also taking advantage of existing regional and sub-regional cooperation. More particularly, the discussions have focused on the need to improve fisheries management in the region by addressing issues related to over-fishing capacity and Illegal, Unreported and Unregulated (IUU) fishing.

While recognizing the importance of developing a regional mechanism, the countries in the region generally agreed to regulate fishing capacity at sub-regional level considering that the vast water resources of Southeast Asia could be divided into sub-regions, where more area-specific management issues could be addressed such as habitats, fish species and transboundary potential conflicts (Ekmaharaj *et al.*, 2009). The sub-regional fishing areas in Southeast Asia that cover two or more countries and deal with marine and inland fisheries could include: the Gulf of Thailand, Lower Mekong River Basin, Timor-Arafura Sea, Southern and South Eastern South China Sea and Sulu-Sulawesi Sea, Andaman Sea, and Northern South China Sea and the Gulf of Tonkin.

In this connection, the countries in the region requested SEAFDEC to investigate the possible establishment of a regional Scientific Advisory Committee that could facilitate and enhance the collection of information to be used by the countries in promoting sustainable fisheries management. Thus, during the 39<sup>th</sup> Meeting of SEAFDEC Council in Siem Reap, Cambodia in April 2007, the proposed establishment of such regional Scientific Advisory Committee within SEAFDEC was endorsed in principle. This signaled the seriousness and commitment of the Southeast Asian countries in improving their fisheries management which they also echoed during the Meeting of ASEAN Sectoral Working Group on Fisheries in Singapore in May 2007.

## The Regional Advisory Committee for Fisheries Management

While revisiting the proposal to establish a regional Scientific Advisory Committee, the SEAFDEC Council during its 40<sup>th</sup> Meeting in Bali, Indonesia in April 2008, endorsed the establishment of the Committee which henceforth is known as the Regional Advisory Committee for Fisheries Management in Southeast Asia or RAC including its guiding principles and terms of reference (**Box 1**).

As a subsidiary body of the SEAFDEC Council of Directors, RAC is mandated to provide technical/scientific advice to the SEAFDEC Council for the improvement of fisheries management in Southeast Asia specifically on issues covering management of fisheries generally conducted in marine waters within the EEZs and inland waters in Southeast Asia including fisheries with particular attention to transboundary fish stocks. RAC is also tasked to assist

### Box 1. Guiding Principles of the Regional Advisory Committee for Fisheries Management in Southeast Asia (RAC)

- RAC is mandated to review and assess the current status of the fishery resources in particular transboundary fish stocks, the status of fishing industries, and fisheries management measures and administrations in the region; provide advice on priority fisheries management issues including policy considerations, coordinated fisheries management actions, and human and institutional capacity building, and to formulate recommendations for improved fisheries management; facilitate in addressing the identified issues through assessment and in-depth studies possibly by ad-hoc technical working group(s); and collaborate with international/regional organizations, programs or projects concerned with fisheries management and sustainable use of fisheries resources in formulating the relevant and necessary advice.
- To be chaired by a representative of SEAFDEC Member Countries on an annual rotational basis, RAC shall comprise one standing member representing each SEAFDEC Member Country by nomination with two-year fixed tenure of members but with the option for reappointment.
- RAC could also invite experts from the Member Countries and other international/regional organizations to participate in an ad-hoc basis.
- SEAFDEC Secretariat in collaboration with relevant Departments shall serve as the RAC secretariat.
- RAC is expected to meet at least once a year, the timing of which should be set in accordance with the SEAFDEC annual programming cycle.

the SEAFDEC Member Countries in achieving sustainable utilization of fisheries resources through improved fisheries management for the socio-economic development and sustainable livelihoods of their populace.

## Policy Recommendations to Improve Fisheries Management in Southeast Asia

During the First Meeting of RAC convened by SEAFDEC in Bangkok, Thailand in September 2008, issues and initiatives relevant to the improvement of fisheries management and practices in the Southeast Asian region were discussed and policy recommendations (**Box 2**) were formulated for the consideration of the SEAFDEC Council (SEAFDEC, 2008). Such emerging issues and initiatives that aimed to improve fisheries management, initially included: (1) Promotion of Innovative Fisheries Management; (2) Exploration and Sustainable Utilization of Potential Fisheries Resources; (3) Promotion of Aquaculture and Feed Management; (4) Enhancing the Exchange of Data and Information; and (5) Supporting the RPOA for Responsible Fishing Practices Including Combating Illegal, Unreported and Unregulated (IUU) Fishing in the Region.

### Promotion of Innovative Fisheries Management

Although some management practices may have been successfully implemented in the temperate areas such

as stock assessment-based resources management, such practices could not be applicable for the tropical areas due to the differences in ecosystems, resources structure, fisheries structure, and other socio-economic conditions (Kato, 2008). Considering that many Southeast Asian countries have already established fisheries management policies under the responsibility of their respective central governments, there is a need to decentralize certain management authority at the local level in order to further enhance effective fisheries management.

The adoption of fisheries management approaches applicable for tropical fisheries should therefore be considered for the Southeast Asian countries, where and when appropriate, to enhance the effectiveness of fisheries management. While alternate fisheries management could be an option, the involvement of all stakeholders (e.g. fishermen and fishing communities) should be promoted as this could be the key to successful management of fisheries. More particularly, monitoring and assessment of the resources status using appropriate indicators (e.g. Catch per Unit Effort (CPUE), feedback from fishermen, etc.) as well as local/indigenous knowledge, should be used as basis for promoting such an alternate fisheries management approach.

In another development, while it is clear that fisheries in the Southeast Asian region is more socially and economically linked with the fishing communities where these are operated on a daily basis due to a relatively short range of operation and small sizes of fishing boats, in the temperate areas fishing boats are relatively large with multiple days of operation in contrast to the small-scale fishing boats in the region. The methodologies adopted by such large-scale operations focus on “resource management” system which excludes the social and economic considerations of fisheries. Due to the apparent difference of the characteristics between temperate and tropical fisheries, it is necessary to carefully evaluate the fisheries management theories and methodologies developed in the temperate areas should these be introduced and adapted in the region (Kato, 2008).

As Kato (2008a) has also aptly declared, fishing operations in the Southeast Asian region have always been promoted under two unique conditions based on the fact that fisheries depend on common natural resources compared with other industries. Firstly, the “unclear ownership for the resources” has aggravated the serious competition among fishers under the current understanding that ownership belongs to those who finally caught the fish. Secondly, the absence of a “government intervention for the management” of the resources has made the fishers not responsible for their operations and can do anything just to harvest the resource.



## Box 2. Recommendations on regional fisheries management issues (SEAFDEC, 2008)

### 1. Promotion of Innovative Fisheries Management

- Southeast Asian Countries should consider applying management approaches applicable for tropical fisheries, e.g. rights-based fisheries (co-management using group user rights for small-scale fisheries exploiting local stocks, and fisheries licensing for commercial fisheries), delegation of management responsibility to local level and resource users, institutional building for fisheries management at local level, involvement of stakeholders, etc., where appropriate, to enhance the effectiveness of fisheries management.
- Regional Guidelines on Fisheries Licensing in the Southeast Asian Region should be further developed to support responsible fishing practices and reduction of fishing capacity. In this regard, a Technical Working Group should also be established to provide technical input to the Guidelines.

### 2. Exploration and Sustainable Utilization of Potential Fisheries Resources

- SEAFDEC should continue to collaborate with Member Countries in the exploration of potential fishery resources in the region, and investigate the appropriate fishing gears and techniques as well as the social-economic feasibility studies.
- In order to support the assessment of fisheries resources in sub-regional areas e.g. Sulu Sea, Celebes Sea, Andaman Sea and some part of the South China Sea, the M.V. SEAFDEC 2 could be utilized in conducting fishery resources survey.
- Technical Working Group(s) should be established to develop appropriate fisheries management for shared stocks and highly migratory species (e.g. tunas, neritic tuna and important small pelagic species) as well as under-utilized resources (e.g. oceanic squid, demersal fish resources in untrawlable and deep fishing grounds), taking into consideration the outcomes from research studies undertaken by SEAFDEC and information available from countries and other organizations (e.g. FAO, UNEP-GEF, etc.), to ensure sustainable exploitation of the resources for further consideration by RAC and SEAFDEC Council, respectively.
- Southeast Asian Countries should support the implementation of Regional Framework for Tuna Information Collection in the Southeast Asian Region, in order to enhance the collection of data and information on capture of tunas including neritic tuna species for future support on the management of tuna resources at national and sub-regional level. In addition, all countries should also develop appropriate national mechanism to collect information on tuna fisheries.
- SEAFDEC should develop the appropriate fishing gear and post-harvest technology for oceanic squid fisheries targeting purpleback flying squid which are identified as potential fisheries resources in the deep areas of the Southeast Asian waters.

### 3. Promotion of Aquaculture and Feed Management

- Southeast Asian countries should consider developing a balanced management policy in fisheries and aquaculture considering the impact of aquaculture to fisheries especially for securing the required feeds.
- Southeast Asian Countries should initiate national efforts to investigate such impact.
- SEAFDEC in collaboration with Member Countries should explore the possibility of conducting activities to study the impact of aquaculture on local food security especially on the use of low-value fish as feeds.
- The Technical Working Group could be established to specifically discuss and develop appropriate technical recommendations on the priority fisheries management issues relevant to aquaculture.

### 4. Enhancing the Exchange of Data and Information

- Southeast Asian Countries in collaboration with SEAFDEC should exchange data and information and maximize the use of data and information for supporting fisheries management actions including fisheries statistics, fisheries indicators, outcomes from ports monitoring and research studies/surveys, etc.
- SEAFDEC should provide regional framework/platform to facilitate information gathering, sharing and exchange on priority fisheries management issues of the region

### 5. Supporting the implementation of RPOA for Responsible Fishing Practices Including Combating Illegal, Unreported and Unregulated (IUU) Fishing in the Region

- SEAFDEC should continue to provide scientific and technical advice and assistance to the Member Countries particularly in supporting the implementation of responsible fishing practices in the region and the effort to increase the public's awareness regarding the laws and regulations to improve compliance.
- Southeast Asian Countries should strengthen their monitoring and control system, and further coordinate with neighboring countries in the region to implement the required activities/measures to combat IUU fishing, including coordinated surveillance activities.

These two unique problematic conditions should be modified in order that sustainable fisheries could be achieved. Thus, under the regional policy on fisheries management guided by the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region, all fishing operations in the region would be gradually modified based on the concept of rights-based fisheries. This approach could eventually modify the two aforementioned unique conditions of the region's fisheries development.

However, Kato (2008b) also cited that two important regulatory measures should also be considered under the rights-based fisheries approach. These are: (1) licensing

system, and (2) group user right system. While the former has not yet been developed, the latter concept has been included in the "Regional Guidelines for Co-Management Using Group User Rights for Small-Scale Fisheries in Southeast Asia" (SEAFDEC 2006). On the other hand, although many countries in the region have already established their fisheries licensing systems, Regional Guidelines on Fisheries Licensing for the Southeast Asian Region could be further developed to support responsible fishing practices and reduce fishing capacity as well as accelerate the promotion of sustainable fisheries management in the countries as well as in transboundary or sub-regional areas. In this regard, a Technical Working Group should also be

established to provide technical input to the Guidelines giving more focus on commercial fisheries. The Regional Guidelines could also take into consideration the fisheries management theories and methodologies that have been developed for fisheries in temperate areas that could be transformed into practical approaches by making these applicable to fisheries operating in a tropical ecosystem. The Regional Guidelines could be used as reference in the improvement of existing licensing systems already adopted in some countries in the region.

### **Exploration and Sustainable Utilization of Potential Fisheries Resources**

In order to support the assessment of fisheries resources and explore potential fishery resources in the Southeast Asian region, SEAFDEC in collaboration with its Member Countries initiated efforts to investigate the fisheries resources and the appropriate fishing gears and techniques suitable for such fishery resources, and also conducted relevant social-economic feasibility studies. For such activities, the M.V. SEAFDEC 2 has been utilized in conducting the relevant fishery resources surveys. However, the arrangements on the utilization of the M.V. SEAFDEC 2 include a cost-sharing scheme between SEAFDEC and the Member Countries in order to defray the expenses during the vessel's operations. Since the Member Countries during the recent years had difficulty in sharing the operations' cost because of the increasing fuel prices, SEAFDEC therefore proposed that the M.V. SEAFDEC 2 should be utilized for conducting collaborative surveys in the sub-regional areas in collaboration with relevant countries on a multi-lateral basis. This could reduce the financial burden of the concerned countries in sharing the operations cost for the vessel during the resources surveys.

Furthermore, since results from single country's information collection and fishery resources survey in the sub-regional seas may not be sufficient enough for the analysis of the fishery resources in the Southeast Asian waters considering the highly migratory species or/and shared stocks of some pelagic fishes, and since using the M.V. SEAFDEC 2 by a single country could be costly even if the operation is conducted under the cost-sharing policy of SEAFDEC, therefore, collaborative arrangements between SEAFDEC and Member Countries concerned should be considered in conducting fisheries resources surveys in particular seas where the fish stocks are shared. SEAFDEC therefore is developing the appropriate proposal applicable for the sub-regional fisheries surveys under its programming exercises. The Member Countries for its part should investigate their respective needs and requirements relevant to the conduct of resources surveys utilizing the M.V. SEAFDEC 2 specifically in the assessment of the fisheries resources at the sub-regional level.

Moreover, in order to develop appropriate fisheries management for shared stocks and highly migratory species (e.g. tunas, neritic tuna and important small pelagic species) as well as under-utilized resources (e.g. oceanic squid, demersal fish resources in untrawlable and deep fishing grounds), the establishment of Technical Working Group(s) has been proposed to undertake such activity. The study could take into consideration the outcomes from various research studies undertaken by SEAFDEC and the information available from countries and other organizations (e.g. FAO, UNEP-GEF, etc.), to ensure the sustainable exploitation of the potential fisheries resources.

On the other hand, while the potential offshore fishery resources (in areas where the depth of water is over 100 meters) could be sustainably exploited, various types of the potential offshore fisheries should also be promoted in the Southeast Asian region (i.e. large pelagic and tuna fisheries, small pelagic fisheries associated with Fish Aggregating Devices (FADs), bottom longline in un-trawlable grounds, gillnet/drift gillnet targeting large pelagic fish, oceanic squid fisheries, and deep sea fisheries). Nevertheless, there is a need for the countries in the region to evaluate their respective policies in promoting offshore fisheries or transferring of fishing operations from coastal areas to offshore waters since under the limited access regime, there is the possibility that such policies could backfire. Thus, offshore or deep sea fisheries should therefore be promoted with caution, taking into account the experiences and lessons learned from coastal fisheries.

### **Promotion of Aquaculture and Feed Management**

The aquaculture sector in the region, which has been contributing significantly to improvement of food security and economic growth, is growing and is predicted to meet the increasing demand for aquatic food in the years to come (FAO, 2006) and will continue to grow and contribute to national economies. However, despite the bright prospects, aquaculture development is confronted with many challenges which could impede the efforts in advancing towards sustainability. The expansion of the aquaculture industry could increase fishing pressure considering that low-value fish or trash fish are converted into aquaculture feeds while seedstocks of commercial aquatic species are harvested for aquaculture purposes. In order to mitigate the impacts of aquaculture to fish production, the aquaculture sector must adopt approaches that support responsible fisheries management within the context of social, economic, environmental, and political circumstances.

Many cultured fish species are carnivorous and require fish protein in their diets while some species would also require fish products in their diets. In the aquaculture industry,



such nutritional requirements are provided by feeding the cultured fish with low-value fish or trash fish or fish meal-based feeds. Now the aquaculture sector is at the stage where its further development would depend on the availability and supply of fishmeal and other fish-based products (Platon *et al.*, 2007). Considering that a large proportion of the total fishmeal supplies are also utilized to produce feeds for terrestrial animals, this would lead to further increased in the demand for fishery products resulting in increased pressure to the fishery resources as the same resources are mainly utilized for direct human consumption.

Platon *et al.* (2007) therefore suggested that for the sustained growth of the aquaculture sector, suitable and cost-effective substitutes for fish meal and fishery products in fish diets should be explored. This could include protein sources from vegetables and animals which could be incorporated in the diets of several fish species. In addition, the use of biotechnology and enzyme treatments could also improve the nutritive value of various plant and animal ingredients. Bioconversion of waste products can also be pursued as initiated by Indonesia using the larvae of an insect (Hem *et al.*, 2008). Moreover, the possible involvement and integration of the R & D efforts of the private sector with those of the governments and on the development of a policy and regulatory framework that addresses the issue of quality criteria and standards for manufactured feeds should also be explored. Furthermore, awareness building on the environmental impact of using inappropriate feeds, feeding practices and overfeeding should be made part of the promotion of sustainable aquaculture development.

### **Enhancing the Exchange of Data and Information**

The importance of fishery statistics and information to support fisheries planning and management has been well recognized. Thus, the Southeast Asian countries in collaboration with SEAFDEC have been strengthening their data and information collection systems, particularly for shared stocks and small pelagic species. The information currently being collected include production, seasons, fishing area, size of fish, types of fishing gears, etc. In a related development, while the Regional Fisheries Management Organizations (RFMOs) have attempted to estimate the tuna stocks in the Indian Ocean Tuna Commission (IOTC) and the Western Central Pacific Fisheries Commission (WCPFC) areas, in response to the seemingly declining tuna stocks in the high seas, there is still no clear picture of the tuna capture information in the Southeast Asian region.

In order to support the RFMO information collection as well as to clarify the status of tuna capture production in the region, the development of the Regional Framework for Tuna Information Collection in the Southeast Asian Region

has been proposed. Under the Framework, information on capture of tunas including neritic tuna species could be collected either through the SEAFDEC fishery statistical system and/or from fishing vessel logbooks in collaboration with the countries' respective fishing licensing agencies.

### **Supporting the implementation of RPOA for Responsible Fishing Practices Including Combating Illegal, Unreported and Unregulated (IUU) Fishing in the Region**

Fishing activity provides an important contribution to the food security and economic well-being of the peoples in the Southeast Asian region. However, overexploitation and illegal fishing practices have hastened the depletion of many fish stocks. Thus, the fishery resources must be managed sustainably while responsible fishing practices should be promoted. Although some of the major causes of the depletion of fisheries resources can be addressed at the national level, there are other issues that can only be successfully addressed through regional and sub-regional cooperation. In the long-term sustainable protection of the living marine resources and the marine environment, regional and sub-regional cooperation is necessary particularly in the areas with interdependent marine ecosystems, adjoining maritime boundaries and shared fish stocks.

IUU fishing has been a major problem that affects the sustainable development of fisheries in the Southeast Asian region, where it is not unusual for one single IUU fishing operation to be carried out in the waters of different countries or that the operators involved are of different nationalities. International cooperation is therefore essential to prevent, deter and eliminate such activities. In this regard, the Southeast Asian region has been encouraged to implement the RPOA IUU Regulation. The Regional Plan of Action (RPOA) for Responsible Fishing Practices Including Combating Illegal, Unreported and Unregulated (IUU) Fishing in the Region is a voluntary instrument and takes its core principles from already established international fisheries instruments for promoting responsible fishing practices, and is consistent with existing treaties, agreements and arrangements as well as other plans and programs relevant to the sustainable management of the region's living marine resources. The objective of the RPOA is to enhance and strengthen the overall level of fisheries management in the region, in order to sustain the fisheries resources and marine environments, and to optimize the benefits of adopting responsible fishing practices. Currently, the RPOA covers conservation of fisheries resources and their environment, managing fishing capacity, and combating illegal, unreported and unregulated (IUU) fishing in three sub-regional areas, namely: (1) Gulf of Thailand, (2) South and East of South China Sea and Sulu-Sulawesi Sea, and (3) Timor-Arafura Sea.

During the 40<sup>th</sup> Meeting SEAFDEC Council in 2008, the Council provided directives for SEAFDEC to provide technical support and advice as well as assist the Southeast Asian countries in the implementation of the RPOA. In line with such directives, RAC has been tasked to provide the technical advice and assistance to the SEAFDEC Member Countries particularly in supporting responsible fishing practices and in increasing awareness of the related laws and regulations in order to enhance compliance of the RPOA. In addition, RAC would also develop technical advice on specific issues under the RPOA. Specifically, the First Meeting of RAC in September 2008 offered some suggestions that are relevant to the promotion of responsible fishing practices and in combating IUU in Southeast Asia (**Box 3**).

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### Box 3. Suggestions relevant to the promotion of responsible fishing practices and combating IUU in Southeast Asia

- As there is no high sea area in the Southeast Asian region and fishing practices have been operated mainly in the national waters of the respective countries, management of responsible fisheries should be implemented along line with the existing national laws and regulations.
- Since the countries in the region have implemented certain levels of MCS measures to combat IUU fishing, national agencies responsible for fisheries should further strengthen the monitoring and control systems for fisheries in their respective countries, and further coordinate with other countries in the region for the implementation of the required activities/measures to combat IUU fishing including coordinated surveillance activities.
- The concept of MCS should be separated into M, C, and S, where M and C could be promoted considering the competence of the current fisheries related agencies in the region. The importance of the roles and functions of M and C should also be promoted in order to improve fisheries management.
- RAC should focus on the improvement of fisheries management to avoid duplicating the functions of the RPOA which focus on IUU, and that the definition of IUU in the context of the national waters compared with that for the high seas should be carefully evaluated and when necessary should be revised where appropriate.
- RAC Secretariat (through SEAFDEC) should explore the possibility of collaborating with the information networks of the RFMOs specifically in exchanging information on IUU vessels.

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# Securing Sustainable Utilization of Fishery Resources: Guidelines for Fisheries Licensing and its Register in Southeast Asia

Yasuhisa Kato

Recognizing the importance of fisheries licensing to promote effective fisheries management, the First Meeting of the Regional Advisory Committee on Fisheries Management in Southeast Asia (RAC) convened by SEAFDEC from 22 to 24 September 2008 in Bangkok, Thailand, endorsed the Draft Regional Guidelines on Fisheries Licensing and its Register in the Southeast Asian Region. During the Meeting, RAC recommended that the Draft should be developed further as it is a management tool to ensure sustainable utilization of the fishery resources. Moreover, FAO would also take up such recommendations with the FAO Headquarters for possible collaboration with RAC on the development of the Regional Guidelines on Fisheries Licensing.

In the Southeast Asian region, fisheries are more socially and economically linked with the fishing communities and are operated on a daily basis due to a relatively short range of operation and small sizes of fishing boats. However, fisheries in the region have been constrained by the fact that these are being operated under two unique conditions, such as unclear ownership for the common natural resources and government intervention for the management due to such special nature of the resources (Kato, 2008). Nevertheless, the Southeast Asian countries have considered exerting efforts in order to achieve sustainable fisheries through the introduction of rights-based fisheries as well as the promotion of effective management of fisheries through delegation of selected management functions to the local level as provided for in Para 5 and Para 6 of the Resolution on Sustainable Fisheries for Food Security for ASEAN Region adopted at the Millennium Conference in 2001 (SEAFDEC, 2001). Such policy frameworks could offer options to modify the aforementioned problems of the region's fisheries. Furthermore, fisheries in the region, especially in the South China Sea area can only be characterized as national fisheries, as there are no regional (high sea) fisheries (Box 1). While the small-scale fisheries through the introduction of rights-based fisheries using group user rights and co-management have already been discussed and promoted (SEAFDEC, 2006; Kato, 2008), the need to improve the fisheries management for the part of commercial fisheries through licensing system is also being recognized, in order to promote improved fisheries management in its entirety.

As endorsed during the first RAC Meeting in September 2008, in the preparation of the Regional Guidelines for Fisheries Licensing, the existing systems of licensing

fisheries in the countries that have already been established could be considered and modified when necessary. For example, the “*Guidelines for Commercial Fishing Vessels*” and “*Guidelines for Licensing and Registry of Small-scale Fishing Boats*” developed by the Philippines could be used as reference in the finalization of the Regional Guidelines on Fisheries Licensing. Furthermore, as prerequisites to the introduction of rights-based fisheries for commercial fisheries, policies should be clarified and legal frameworks on the zoning of national waters should be established while the management responsibilities of government agencies under co-management arrangement should be defined (Box 2 and Fig. 1).

## The Fisheries Licensing System

Fisheries licensing system, which includes a registry of licensed boats and fisheries licenses, is aimed at managing the commercial fisheries. In the general picture of the

Box 1. Categories of Fisheries in Southeast Asia	
<b>1. Small-Scale Fisheries</b>	Definition of small-scale fisheries by each country is provided in the Regional Guidelines for Responsible Fisheries in Southeast Asia: Responsible Fisheries Management (SEAFDEC, 2003)
<b>2. Commercial fisheries</b>	Based on the definition of commercial fisheries of each country (SEAFDEC 2003), the fisheries could be further categorized considering the geographical areas where the fishing boats are operating
	(A) Fishing boats operating only within one provincial water (B) Fishing boats operating across more than one provincial waters (C) Fishing boats operating in the coastal waters of other countries through bilateral agreements (D) Fishing boats operating in the high seas, not in the South China Sea (very small area) but in the Indian Ocean

Box 2. Provincial waters and zoning arrangement	
	<ul style="list-style-type: none"> <li>In general, national waters (territorial waters and exclusive economic zones) could be divided into appropriate sizes of local waters corresponding to the respective administrative units of the governments (i.e. province, municipality, state, etc.). Provincial waters can be the waters surrounded by provincial coastline, with extended provincial border with other provinces up to 200 miles from the shoreline and concerned 200 miles EEZ or appropriate ranges. Geographical administrative units should be identified by the respective countries considering such factors as appropriate size for economic fishing operations (not too small geographical areas considering the feasible operation of the said target fisheries) and appropriate manageable size to conduct the effective management.</li> </ul>

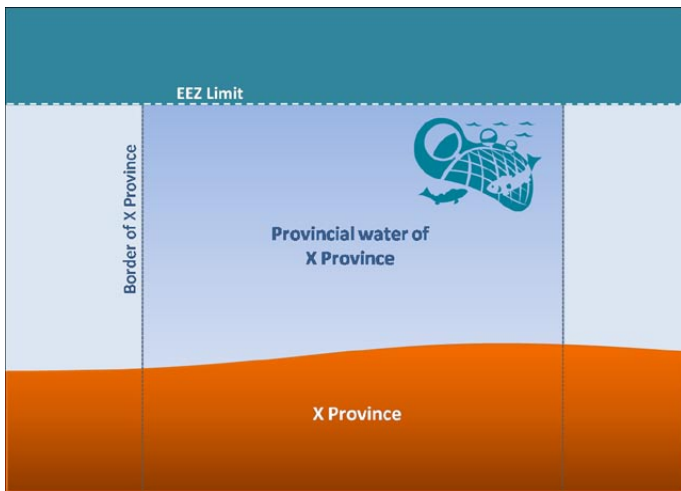


Fig. 1. Definition of provincial waters

national fisheries structure, the total number of commercial fisheries could be less than 10% of the total number of fishing boats, since most of the fisheries in the region are small-scale (90% of the fishing boats involved). It might be necessary to establish the “provincial waters” where the provincial governments or similar government units should be responsible for the management of fisheries categorized under 2(A) in **Box 1**. The rest of the fisheries from categories 2(B) to 2(D) should be managed by the central governments with appropriate arrangements including bilateral negotiations while the active participation of concerned Regional Fisheries Management Organizations (RFMOs) should be promoted.

Nevertheless, based on Paragraph 5 of the Resolution (SEAFDEC, 2001) the responsibilities for the management of licensing for categories 2(A) and 2(B) in **Box 1** could be shared with the local communities. Thus, the established Community Fisheries Management Organizations (CFMOs) (SEAFDEC, 2006) or similar local organizations could serve not only the small-scale fisheries but also the fishing boats under the commercial fisheries categories. Such arrangement could help address any conflict (encroachment) against the limited resources between the small-scale and commercial fisheries sub-sectors. The delegation of management right and authority to the CFMOs under co-management for licensed fisheries could also enhance the level of compliance of the requirements for the licenses.

### Registry of Licensed Boats

The different roles of vessel registration and registry of the licensed fishing boats should be clearly distinguished. While the former has been developed to monitor the status of safety arrangements for the vessels, welfare of the crew, effects on the environment by the vessel operation, etc. mainly in line with the IMO requirements for larger boats (more

than 24 meter LOA), the registry of licensed fishing boats should be specifically developed to manage the fisheries. Thus, it is not necessary to accommodate the role of the registry of licensed fishing boats into the vessel registration system that has already been developed in many countries of Southeast Asia. Considering the different priorities of the agencies responsible for vessel registration, a simple registry of licensed fishing boats could be developed within the national fisheries related agencies under the policy on delegation of work to appropriate collaborating agencies (provincial government offices or CFMOs, etc.). As the license will be provided to the fishing boats not to the people who operate the boats, information contained in the national registry of licensed fishing boats would mainly be related to the capacity of the fishing boats in terms of exploiting the fisheries resources. Thus, the information in the registry of the licensed fishing boats could include: date of license, name of boat, name and residential address of responsible operator, name of CFMO, geographical location of fishing base, dimension of boat (LxBxD), engine capacity, size of fish hold, fishing gear used, date of construction, etc.

### Fisheries License

Four kinds of fisheries licenses could be envisaged in accordance with the different fishing grounds and the responsibilities in the management of licensing (**Box 3**). The fisheries license should cover all non-small-scale fisheries in the beginning and no-new entry, considering the current overcapacity status. The validity of the fisheries license could be one year while revision of fisheries license could be issued by the responsible government agencies subject to the outcomes of the physical investigation and inspection of the boats as well as the performance record of their operations in the previous year. In this connection, respective countries should develop their national marking systems distinguishing the different licensing categories by painting the developed license numbers and color on the respective licensed fishing boats specifically related to the licensed fishing areas (or fishing grounds) as indicated in **Box.3**.

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### Box 3. Types of fisheries licenses based on fishing grounds and management responsibilities

#### 1. Licensing Fisheries Operating within Particular One Provincial Water

This type of licensing could be applied for majority of commercial fisheries in the region, where the range of navigation to the fishing ground is 30-50 miles with fishing operations mainly done on daily basis, and the average size of boats could be 5-30G/T. The license should be issued by particular provincial governments in collaboration with central fisheries related agencies. The license could include various requirements to be followed in the operation of the licensed fishing boats, such as fishing gear and practices (use of luring lights), closed season and areas, etc. based on the fisheries management policies and provisions of the respective countries.

##### 1.1 Eligibility for Fisheries License

The general criteria and evaluation of the eligibility of applicants (to operate in particular provincial waters) should be stringent. The selection of the licensed fishing boats should be based on the qualifications of the operators, namely: (1) evidence that the fishing boat is involved in the fisheries in the province in the last three years (new entry and expanding the capacity of boats are not allowed, except in the case of promotional work by the governments); (2) responsible operator(s) of the boat is resident(s) in the province; and (3) no record of having been involved in illegal fishing in the previous years.

##### 1.2 Management and Monitoring the Performance of Licensed Fisheries

The licensed fisheries will be managed and monitored by particular provincial governments in collaboration with central fisheries related agencies. Under the co-management arrangement, day to day management activities including monitoring the performance of the licensed fisheries should be delegated to community-based organizations (CFMOs). Registry of the respective fishing boats should be developed, maintained and revised by provincial governments with copies also to be maintained in the relevant CFMOs and central governments for effective co-management.

#### 2. Licensing Fisheries Operating across More Than One Provincial Waters

The range of navigation to the fishing ground of this type of licensed fisheries could be 50-200 miles with fishing operations normally conducted in a number of days including staying at the ports of neighboring provinces for obtaining provisions and services. The license should be issued by the central governments for proper coordination with government offices of the provinces where the fishing boats operate. The contents of the license would be similar to that of Type 1, but reflecting the fisheries policies and regulations of the countries and concerned provinces.

##### 2.1 Eligibility for Fisheries License

The policy for the eligibility of fisheries license for this type of license (to operate beyond one provincial waters) can be similar with those of 1.1 above but reflecting the nature of the fisheries, such as (1) evidence that the fishing boat is involved in the fisheries in the provinces in the last three years (new entry and expanding the capacity of boats are not allowed, except in the case of promotional work by the government); (2) responsible operator(s) of the boat is resident(s) of the areas considered; and (3) no record previous involvement in illegal fishing.

##### 2.2 Management and Monitoring the Performance of Licensed Fisheries

The licensed fisheries will be managed and monitored by central fisheries related agencies. However, collaboration with concerned provincial government offices and community organizations would be required, especially in monitoring the performance of the licensed boats. Registry of the respective fishing boats would be developed, maintained and revised by the central fisheries related agencies. The copy of the registry will also be maintained in the relevant CFMOs and the provincial government for effective co-management operation.

#### 3. Licensing Fisheries Operating in the Coastal Waters of Other Countries Through Bilateral Agreements

The license of this type of fisheries will be issued by the central government of the concerned countries in order to coordinate with the other countries where the former's boats are operating. The detailed contents including various obligations will therefore be reflecting with the management requirements of other countries where the boats are operating based on the bilateral government agreements

##### 3.1 Eligibility for Fisheries License

The policy for eligibility for the issuance and revision of the fisheries license of this type should be based on the performance records by the countries where the boats are operating, reflecting the obligations provided for in the bilateral governments agreements, such as (1) evidence that the fishing boat is involved in the fisheries in the countries in the last three years (new entry and expanding the capacity of boats are not allowed); and (2) no record of previous involvement in illegal fishing.

##### 3.2 Management and Monitoring the Performance of Licensed Fisheries

The licensed fisheries will be managed and monitored by the central fisheries related agencies in both countries (countries sending their fishing boats to other countries and countries receiving the fishing boats from other countries). The registry of the respective fishing boats should also be developed, maintained and revised by the central fisheries related agencies of both countries that are sending their fishing boats and receiving the foreign fishing boats. Information on the national registry should be shared by the countries concerned for effective management.

#### 4. Licensing Fisheries Operating in the High Seas

The license as well as appropriate registry of the fishing boats engaged in high sea fisheries should be developed and issued by the central governments of the concerned countries. Since management responsibility of high sea fisheries is under the Regional Fisheries Management Organizations (RFMOs), the requirements and obligations of the license should follow these already developed by such RFMOs.

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### About the Author

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# Towards Sustainable Community-based Fishery Resources Management: The Tagal System of Sabah, Malaysia

Jephrin Zefrinus Wong, Seiichi Etoh and Arthur Besther Sujang



Map of Malaysia showing Peninsular Malaysia (left) and East Malaysia (right)

Sabah and Sarawak comprise East Malaysia, one of the country's two federal territories, the other being Peninsular Malaysia. East Malaysia occupies the northern third of the island of Borneo, having an area of approximately 202,020 km<sup>2</sup>, of which about 72,500 km<sup>2</sup> belongs to Sabah. With a coastline of about 1,440 km, Sabah is surrounded by the South China Sea in the west, Sulu Sea in the northeast and Celebes Sea in the east. Sabah's fishing zones are divided into coastal (less than 12 nautical miles (n mi) from the shore line) and offshore areas (12 n mi and beyond the EEZ boundary). The EEZ of Sabah is reported to be about 90,000 km<sup>2</sup>.

As the second largest state in Malaysia, Sabah has a population of about 2.5 million with more than 70% living in coastal areas and mostly dependent on agriculture and fisheries for their livelihoods. Sabah has a heterogeneous population varying in terms of their cultural backgrounds,

with the indigenous population making up some 30 groups using more than 50 indigenous languages and 80 dialects. Inhabitants of Chinese origin make up the main non-indigenous group. Islam is the main religion which was introduced towards the end of the 15<sup>th</sup> and 16<sup>th</sup> centuries through the Arab and Indian traders and also as a result of the expansion of the Brunei Malay Sultanate.

In 1775, the British East-India Company opened a trading base in Balembangan Island but it was the British North Borneo Chartered Company who effectively ruled Sabah from 1881 until 1942. After the World War II, Sabah became a British Crown Colony until August 1963 when it obtained self-government from Great Britain. In September 1963, Sabah together with Sarawak, Singapore and Malaya joined the Federation of Malaysia. The capital of Sabah is Kota Kinabalu, formerly known as Jesselton before its name was changed in 1968. The capital town Kota Kinabalu is situated at the foot of Mount Kinabalu.



Map of Malaysia showing Peninsular Malaysia (left) and East Malaysia (right)

More than one half of the total land area of Sabah is covered with tropical forests with deciduous woodlands. Many small islands near Kota Kinabalu on Sabah's western coast have some of the world's most diverse coral reefs and marine life. Its favorable climate and geographical location make Sabah one of Malaysia's major fish producing states. With the total fish production of 202,678 mt worth RM733.1 million in 2004 based on Sabah's Annual Fisheries Statistics Report of 2004, Sabah contributed more than 13% to Malaysia's total fish production in 2004 of 1,542,071 mt (FAO FishStat Plus 2008).



total fish production in 2004 of 1,542,071 mt (FAO FishStat Plus 2008).

The marine fisheries sector is the main contributor to the total fish production of Sabah. In 2004, a total of 190,371 mt were landed from the marine fisheries with a wholesale value of RM 584.1 million (Sabah Annual Fisheries Statistics, 2004). The major landing areas in Sabah are Kota Kinabalu, Sandakan, Tawau, Kudat and Semporna (Isnain, 2007). The statistics also imply that only a small amount (about 12,307 mt) came from inland fisheries (including aquaculture).

For the rural communities in the interior areas of Sabah, freshwater fish is an important source of protein and the rural inhabitants have always depended on riverine fisheries for their livelihoods. While in the past fish could be easily harvested from the inland rivers, the development of the timber industry and extensive agricultural development including massive oil palm plantations have resulted in soil erosion, pollution and consequent destruction of the fish breeding grounds and habitats. Also as a result of overfishing, the freshwater fish stocks in its rivers have been rapidly decreasing, a situation that has greatly affected the poor rural communities that have been dependent on river fishes for their food and livelihood. Recognizing the declining status of the freshwater fish stocks, the Department of Fisheries (DOF) Malaysia and the State Government of Sabah took steps to address the concern by introducing freshwater aquaculture and introducing the concept of community-based fishery resources management in an attempt to revive Sabah's freshwater fishery resources.

### **Community-based Fisheries Management: The Tagal System of Sabah, Malaysia**

Being aware of the role of the coastal communities in co-managing the coastal and inland resources in the country, the DOF Malaysia has undertaken initiatives and approaches under an integrated resources management concept in order to achieve sustainable fisheries throughout the country. Specifically, the Tagal System which actually originated as a traditional system of forest stewardship was therefore adapted for the protection, restoration, conservation and management of the freshwater fishery resources of the country and most specifically in Sabah.

A “smart-partnership” approach between the local communities and the Sabah State Government, the Tagal System was adopted with the main objective of protecting and reviving the depleted freshwater fishery resources of Sabah. The implementation of the Tagal System is being promoted by empowering the concerned local communities based on Section 58 of the Sabah Native Courts Rules of 1995 (Native Customary Law) and Section 36 of the Sabah

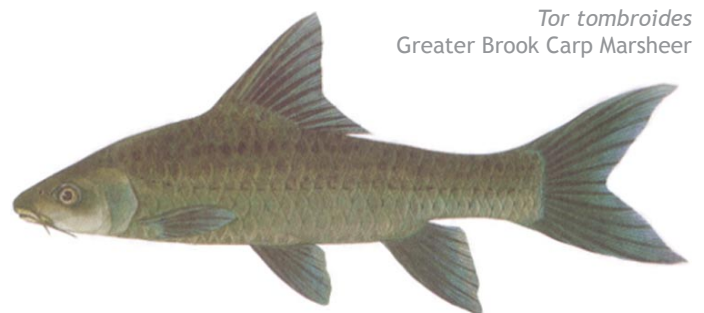
Inland Fisheries and Aquaculture Enactment (2003). These regulations specifically give the Fisheries Department of Sabah State the authority to manage and regulate all fisheries activities in its inland waters. “Tagal System”, which literally means “fishing in rivers is prohibited by the concerned communities for a certain pre-agreed period of time” aims to restore the depleting fisheries resources, keep the rivers free from pollution, and generate income to the communities concerned. Under the Tagal System however, concerned communities are still allowed to harvest fish from the rivers but in a sustainable manner.

The Tagal System was developed by the Sabah State Government and the Department of Fisheries (DOF) of Sabah upon recognizing the urgent need to address the problems of depleting freshwater fishery resources as indicated in the State's decreasing production from freshwater fisheries. Although the State did not have adequate fisheries laws for regulating inland fisheries in the past, the State Fisheries Department managed to successfully implement the Community-Based Fishery Resources Management (CBRM) concept which is now locally called the “Tagal System”.

### **Target Species for the Tagal System**

Before the Tagal System, Sabah had very little experience in community-based freshwater and inland fishery resources management. However, the need for co-management was deemed necessary in view of the impact of irresponsible fisheries in many rivers in Sabah on the fishery resources with many fish species becoming almost extinct including the most famous “Malaysian Red Mahseer or Greater Brook Carp” (*Tor tombroides*) also known as “kelah” in Bahasa Malaysia.

The Malaysian Red Mahseer or kelah belongs to the *Tor* Genera under the Family Cyprinidae. It lives in particular deep water pools in rivers and does not usually migrate to other pools, which makes a kelah resource management system practically feasible. As a food fish, kelah commands a high market price and is an extremely expensive fish, costing around RM 200 (USD 57) per kg. Kelah is a potential candidate species for aquaculture as it can survive



*Tor tombroides*  
Greater Brook Carp Mahsheer



*Fish massage (above) and foot massage (below) at the Luanti Tagal System*

in highly oxygenated waters. In addition, Kelah is also highly esteemed as a game fish and to catch a good size kelah is always a challenge for sports fishers because of its fighting ability. Found mainly in the upper parts of the rivers particularly in highly oxygenated waters, kelah was once abundant in many rivers of Sabah. However, several kelah stocks have suffered serious decline and are now considered threatened because of pollution in the rivers, loss of habitats and irresponsible fishing. Generally, Mahseers are known to inhabit the rivers and lakes, specifically in rapid streams with rocky bottoms where the fish also breeds. Mahseers are omnivorous that feed on algae, crustaceans, insects and other fishes as well as on fruits and other particles that fall from trees overhead their habitats.

## Extent of Adoption of Tagal System in Sabah, Malaysia

Before the formal Tagal System was practiced in Sabah, the communities along the rivers were already practicing sustainable river fishing in order to conserve the kelah fishery resource. But after 2001, the State Fisheries Department of Sabah expanded such community-based effort by demarcating the rivers depending on the size of the deep pools along the villages near the river, an approach which was patterned after the original Tagal management system. Therefore, under the Tagal management system each

pre-assigned stretch of a river is divided into three zones: **red**, **yellow** and **green** zones.

The **Green Zone** is an “open fishing zone” where fishing is allowed all year round for all Tagal members under strict Tagal regulations, e.g. using regulated fishing methods (no gillnet fishing allowed but only cast-netting and angling). The **Yellow Zone** is open once or twice a year particularly during community celebrations or festivals. In this zone encircling gillnets could be used and the catch is shared by the Tagal members after deducting some portions for the Tagal committee’s administrative costs. The **Red Zone** is exclusively for the conservation of the Tagal fishery resources and is opened for sports fishing after paying certain but reasonable entrance fees. The cost of sport fishing is RM50/day from 0800 to 1600 plus cost of local guides at RM50/two guests.

Under such demarcation or zoning, one community could have as many as five deep pools (also called “lubuk”) which are identified as Deep Pools 1-5, in the pre-assigned stretch of a river depending on the location of the community. In case five “lubuks” are assigned to one community, Deep Pool 1 could be reserved as a **Red Zone** where no fishing is allowed while Deep Pools 2-4 could be **Yellow Zones**, where harvesting of fish is allowed only once or twice a year. In Deep Pools 2-3 for example, the quantity of fish caught is equally shared among the members of the local Tagal system, while in Deep Pool 4 (also a **Yellow Zone**) where fishing is also allowed once a year, the amount of fish caught is sold to public markets to generate funds for the Tagal committee. In Deep Pool 5, which is indicated as **Green Zone**, fishing is allowed all year round for all Tagal members under the strict Tagal regulations.

Sabah has now more than 240 Tagal Systems, where each Tagal is required to have a Tagal committee, and must be registered with the DOF of Sabah. Although the Tagal System already existed for sometime in Malaysia, its operations and management have never been codified before in the way that it is being done in Sabah. Therefore, the Sabah experience can serve as a lesson and learning experience on how such a system could be implemented properly and very effectively. Malaysia’s fisheries authorities are now looking at the details on how the system works including its enforcement and the participation of the local people at the community level. Some of the most successful and popular Tagal Systems in Sabah include those in Babagon, Notoruss, Kiburot, Nalapak, and Luanti.

The Babagon Tagal System is located near the Fish Hatchery Center of DOF Sabah with 128 members from 100 households. This Tagal System comprises two zones only: **red** and **yellow** zones. Since this Tagal System is situated

near the capital town of Kota Kinabalu, many sports fishers visit the locality regularly. Nonetheless, the sports fishers are required to follow the catch-and-release rule when fishing thus, the sports fishing activity would have no adverse effect to the kelah fishery resources. The Notoruss Tagal System is the oldest system and is also located near Kota Kinabalu, with about 100 members. The system has two zones: **yellow** and **red**, and regular fishing activities are not practiced. The Kiburot Tagal System has three zones with about 120 members.

The Nalapak Tagal System is located in Ranau District some 70 km away from Kota Kinabalu. It was established in early 2008 with its Chair, the first chair-lady among all the Tagal systems in Sabah. It has 400 members from 40 households (those who own lands along the river also join the system as members). There are three zones with its red zone just recently developed. Three cases of violations were reported in 2008; with the two cases resolved by the village chief based on the Native Law resulting in the punishment and settlement of one cattle, and the other case which was a violation of the electric fishing regulation is being settled in the district native law court.

Luanti Tagal System is also located in Ranau District with 293 members. Established in December 2002, the Luanti Tagal System is one of the most active Tagal groups in Sabah and is more oriented towards eco-tourism. The chairman of Luanti Tagal System also serves as chairman of the Ranau District Tagal Group comprising 72 Tagal committees. The “fish foot and body massage”, which was initiated by the Luanti Tagal System in 2006, is a very unique innovation to play with the river fishes without hurting them. The Luanti Tagal Committee has been promoting the “fish massage” but making sure that the fishes are not harmed. Reports showed that over 7,000 visitors were received in 2008 of which about 10% were foreigners. The charge per person for a 15-minute “fish massage” is RM10 for Malaysians and RM20 per person for foreigners. The DOF of Sabah constructed a dressing room for tourists while additional facilities like guest houses were constructed by the Luanti Tagal Committee. As this eco-tourism business venture in the locality has been successful, it has benefited the members through additional incomes. The Luanti Tagal System is restricted to only the **red zone** which focused on the protection of the fishery resources, and has been given the Malaysia River Care Award in 2006 by the Sabah State Administration for their successful efforts in conserving the riverine resources.

## Management of the Tagal System

Although the Tagal System is directly under the Fisheries Department (DOF) of Sabah as the lead agency, the

communities along the rivers could participate in this system’s partnership. However, the communities must have traditional use rights to several deep pools in certain stretches of a river. With technical advice from the District Fisheries Officer, the concerned communities also form their respective Tagal committees to manage and utilize their assigned fishery resources under the leadership of a community headman. The responsibilities of the communities are mainly to protect their respective fish stocks from poachers, overfishing, illegal fishing and any other activities that could pollute the rivers and water bodies, and destroy the fish habitats. The communities also have the privilege to harvest the fish, as the case may be, in a sustainable manner and in accordance with the regulations related to their designated zones.

Under the Tagal System collaborative and partnership arrangement, the community protects their Tagal sites by putting up sign boards at strategic sites as well as promoting public awareness programs. Under the Native Customary Law and the Sabah Inland Fisheries and Aquaculture Enactment, offenders of the Tagal regulations could be fined certain amount of money or even imprisonment for a maximum of two years. Angling is allowed under the Tagal System on a “catch-and-release basis”, where exotic fishes such as the African catfish once caught should be culled and sold bringing additional cash to the communities. The Tagal regulations also stipulate that sports fishers and anglers must hire a local guide (one guide for a maximum of two anglers) and must pay the prescribed amount for the sports fishing. Financing the operations of the Tagal System is mainly sourced from the annual contributions of the Tagal committee members, annual sale of catch in the green zone, sale of catch from fishing competitions during sports fishing, and ecotourism such as boat rentals, sale of food and souvenirs, charges from home-stay, charges for sports fishing, fish feeding ventures, and fish “body and foot” massage, etc. The funds are used to cover administrative expenditures and to support some community members having financial difficulties and to defray certain expenses during the celebration of community festivities.

In addition to providing technical advice to the Tagal committees, the DOF of Sabah also monitors the progress of all existing Tagal Systems, conducts research to further improve the system, and promotes human resources capacity building. The DOF further promotes ecotourism activities including sports fishing and fish feeding in waters under the Tagal management system in order to generate additional income for the local communities. As a result of the adoption of the Tagal System, rehabilitation of many depleted freshwater resources of the upstream rivers of Sabah has been successful especially the indigenous fish species. The Tagal System of Sabah has been well known all



over Malaysia and was awarded in 2005 the “Outstanding Sabah Environmental Friendly Project Award 2005” by the Sabah Environmental Action Committee.

## Issues and Concerns

It is obvious that the success of any Tagal System approach would depend on very specific conditions and the system can only be effectively applicable to areas where similar surroundings exist (**Box 1**). In addition, the certain peculiarities of the target fish species and its surroundings should be taken into consideration in order to sustain the success of a Tagal System.

In the State of Sabah, while logging activities expanded a few years ago, many loggers have reached the deeper parts of the forests and discovered the previously unreachable stretches of rivers where the prized kelah are now being fished sometimes with the use of chemicals. While irresponsible catching of kelah continued, it has now become difficult for anglers to produce even a small sized kelah and the fish was feared to be at the edge of becoming extinct.

With the adoption of the Tagal System, few kelah sanctuaries have been established where certain stretches of the freshwater systems are preserved mainly for the breeding of this fish species. After 1-3 years of implementing the Tagal System, a successful harvest of kelah had been achieved. Although the Tagal System is a native tradition of preserving and protecting fish stocks for the benefit of the communities, the adoption of such system has not been successful in some areas. Among the reasons cited were the large population of some communities, changes in agricultural practices with cash-trapped economies, and the general lack of interest and indifferences of the people in the communities. Considering that the Tagal System is simple to manage, the community’s responsibility is mainly to look after a stretch of river waters nearby with the community members serving as policemen and where nobody is allowed to fish in their areas of responsibility. The communities also make sure that the river is not polluted and can only harvest



Protected river by a Tagal Committee, where cutting of trees in the river basin is not allowed



Sign board describing the rules and regulations of the Tagal System

the fish in a pre-agreed period for the benefit of the whole community. The communities also make it a point to release the small-sized fish as well as breeders that are caught in order to sustain the fish stocks.

## Way Forward

As a natural river conservation system, Tagal System has been a phenomenal success in Sabah, reaping bumper harvests for the communities that have embraced it. The system has also provided the anglers the chance to catch the elusive kelah in clean river environments. The eco-tourism potential of the Tagal System, with rivers being returned to their natural state, is unprecedented in Sabah, Malaysia. After the successful rehabilitation of the State’s depleted freshwater resources, the DOF of Sabah is currently promoting the expansion of the system to new areas throughout the whole country that do not yet adopt the system.

The Tagal System had been initiated by the communities in coping with the hard situation where the fishery resources had been dwindling due to degradation of the fish habitats and over-fishing including the use of illegal fishing methods. The fish that was once abundant and available in the rivers could hardly be seen in the mid-1900s. Many village leaders started to take actions by persuading the inhabitants to restore the fish habitats and control fishing activities

### Box 1. Specific conditions and peculiarities of the Tagal System in Sabah, Malaysia

- The target fish (Malaysian red mahseer or kelah) stays in one deep pool of a river throughout its life cycle and hardly migrate to other areas unlike other types of river fishes
- The fish is omnivorous and feeds on the particles falling from trees along the river in addition to animal feeds
- *Kelah* is an extremely expensive fish that costs at around RM 200 (USD 57) per kg
- The communities along the rivers hardly rely on fisheries as their full-time occupation as the members are mostly engaged in other business ventures in forestry and agriculture
- A strong community native law governs the villages

starting in the late 1900s. In fact, the local people agreed to stop fishing for a while. Such efforts were materialized when the Tagal System in Tuaran District was practiced starting in 1987 and the second attempt which followed in 1991 in Kota Belud District, with the third system made operational in 1997. The State Fisheries Office initially supported this system until 1999 and thereafter the number of Tagal Systems has increased to more than 240 riverine communities. This is an ideal development under the co-management model, where the initial idea is derived from the motivation of community inhabitants considering their acute needs and thus, initial actions are initiated by them. The authorities actually came into the picture through their support in such movement and in the further development of the system. The evolution process and the outcome in terms of co-management approach of the Tagal System are therefore very commendable.

It has been almost 20 years after the commencement of the first Tagal in Sabah. Nevertheless, it is evident that the riverine fishery resources of Sabah have been rehabilitated and in many communities the system has contributed to local business development like eco-tourism. It is important that the efforts in community-based resources management (CBRM) should coincide with the community development in an integrated manner.

In the states of Sabah and Sarawak, special attention has been focused on the Tagal System for the last seven or eight years with notably increasing number of communities getting involved in the system. The DOF Malaysia is also attempting to introduce this system in other states. In addition, the DOF Sabah has initiated the expansion of similar approach to be applied in marine fisheries. Basically, the approach of CBRM in either marine fisheries or freshwater fisheries is identical, but the scale of area coverage differs, especially in the case of the riverine fisheries.

The peculiarities and advantages of the target fish species for the Tagal System lie in their characteristics to live in the same deep pools throughout their lives. Therefore, a scientific research should be conducted to trace the movement of the fish by tagging in order to substantiate this theory or belief. In case of marine waters, a similar system can be applied straightaway to some non-migratory species of fish or crustaceans or shellfishes. But, it could be difficult to apply the same system in the case of a common fish, without combining various approaches or having some modifications. The approach incorporating fish aggregating or enhancing devices as employed in the SEAFDEC project on Integrated Coastal Resources Management in Pulau Langkawi, Malaysia (ICRM-PL) can be one of the suggested models. The planned implementation of the Tagal System in the marine waters in Kota Kinabalu using artificial reefs

(ARs), may work for protecting some non-migratory species of fish as the ARs can retain to some extent, the fish schools in a certain zone.

The enforcement of self-regulatory measures by the Native Law is the backbone of CBRM in the Tagal System. There are a number of native laws in most fishing communities, but these should be importantly legislated with the authorities as these could be used as tools for local enforcement like the case of the Tagal System. This model is certainly applicable to the marine fisheries sector together with supporting fisheries laws enacted by the authorities.

It was also observed that in some deep pools, there were too many fish stocked, which could be beyond the optimum level of holding density of a certain deep-pool. A scientific research should be conducted to determine the optimum density level and that over-stocked fish should be effectively harvested.

Considering also that a hatchery technique for Masheer may have already been developed in Sabah, such effort should be verified and provided with technical support. Since the cost of the fish is quite expensive, releasing fish fingerlings could also be considered as means of rehabilitating the fish stocks. However, this would be effective only if the fish really stays in one deep pool as the people believe.

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# Balancing Development with Resource Conservation

## Poverty alleviation in lake communities amidst power generation for progress: The case of Lake Lanao in Mindanao, Philippines

Manaros Boransing and Virgilia T. Sulit



Satellite picture of Lake Lanao in Lanao del Sur, Philippines

Lake Lanao is located near Marawi City the capital of Lanao del Sur Province in Mindanao Island, Philippines. It is the largest lake in Mindanao and the second largest lake in the Philippines after Laguna de Bay near Metro Manila (BFAR, 2005).

A rift lake, Lake Lanao is 33 km long and 20 km wide, with a surface area of 340 km<sup>2</sup>, a maximum depth of 112 m and a mean depth of 60.3 m. Its shore length is estimated to be about 115 km and the lake has a surface elevation of 700 m. The lake basin is shallowest towards the north and gets progressively deeper towards the south. Lake Lanao is counted as one of the 19 ancient lakes in the world (LAKENET, 2008), and the only ancient lake in Southeast Asia. The Lake is believed to be between two to twenty million years old.

As a rift lake, Lake Lanao may have been formed by the tectonic-volcanic damming of a basin between two mountain ranges and the collapse of a large volcano. Its pondage (water volume) is 28.28 km<sup>3</sup>, with a flushing period of 7.33 years, and a watershed area of about 1,678.3 km<sup>2</sup>. The Lake has four tributaries out-flowing through the Agus River southwest into Iligan Bay in Lanao del Norte via two channels, one over the Maria Cristina Falls and the other over the Linamon Falls. Hydroelectric plants installed in Lake Lanao and the Agus River system, generate electricity used by 70% of the people of Mindanao (DILG, 2008).

### The Formation of Lake Lanao and Agus River

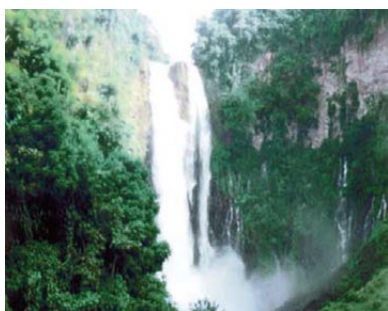
The natives of Lanao del Sur are called Maranaos or dwellers of the lake, in their local dialect. In the Maranao myth (Saber and Madale, 1975; Madale, 2001), the formation of the lake was described as a work of a group of angels to remove the vast and powerful population of Mantapoli and prevent the world from tipping over (Eugenio, 2008). The hole that was left was filled with water and since it threatened to drown the rest of the world, an outlet had to be carved. The hole became Lake Lanao (situated east of Dansalan, now Marawi City) and the outlet became the Agus River where the waters of Lake Lanao poured out to the sea. A high cliff along the Agus River near Iligan City in Lanao del Norte, make the waters cascade in majestic volume forming the beautiful water falls which was named Maria Cristina Falls, after a famous Queen of Spain.



World's ancient lakes (left) include Lake Lanao (in Philippines), and map of the Philippines (right) showing the country's major lakes  
Sources: LAKENET (<http://www.worldlakes.org>); BFAR (2005)







The majestic Maria Cristina Falls (Lanao del Norte, Philippines), outlet of Lake Lanao towards Iligan Bay

The attachment of the Maranaos to Lake Lanao is insurmountable. American writer Washburn (1978) described the relationship between the Maranaos and their watering place, the Lake Lanao as: “To the Lake, the Maranaos have bound their identity. In their own eyes and in the eyes of the outsiders, they are Maranaos known as the Peoples of the Lake. On its shores, they established their villages and towns and built their mosques. With its water, they purify themselves for prayer. In its wetlands, they cultivate their rice. From its depths, they gather fish. Across its spans, they transport goods and people. From it they take water for drinking and cleaning. Each boulder and island in the Lake, each hill and valley in the land surrounding it is woven into the legend and epics of the people. Each Maranao can willingly trace his ancestry to the original “pat-a-pangampong,” the four encampments on the lake, their mythical founders, also known as the four winds, in the Maranao mythology that prevented the inundation of the Lake by cutting an outlet. Thus, it is with some justification and no little pride that the Maranaos consider the Lake Lanao as Our Lake.”

Agus River flows for 36.5 km from Lake Lanao to Iligan Bay cutting across the provinces of Lanao del Sur and Lanao del Norte. Settlements along the banks of the river include Marawi City (in Lanao del Sur), Linamon Municipality and Iligan City (both in Lanao del Norte). Before draining to Iligan Bay, the river descends for about 2,200 feet from its

source in two channels, one going over the Maria Cristina Falls while the other supplies the Linamon Falls. Agus River is relatively shallow (only 4 feet deep in some areas) and its watershed spans about 11,320.00 ha. It has a discharge of about 10 second-meters flowing from a narrow depression off the northwestern rim of the lake over a basalt rock formation. A long narrow valley has been etched by the river suggesting the occurrence of rock erosion.

Lake Lanao is used by the lake community settlements for small-scale as well as sports fishing, and to some extent for recreational activities such as boating and swimming. The Agus River, on the other hand, in its entirety except in very few areas known to have slow current, is not navigable because the current in most areas could reach a maximum of thirty miles per hour. Taking full advantage of the waters of Lake Lanao and Agus River, the Philippines’ National Power Corporation (NPC) has installed a number of hydroelectric plants in and near Lake Lanao as well as along the Agus River and near Maria Cristina Falls. Such hydroelectric plants and the requisite regulatory dams constructed by the NPC have changed the fluctuations of the water level of Lake Lanao, affecting the indigenous people and leading to conflicts between the NPC and the local peoples who have always depended on the Lake for their food and livelihood.

## Biodiversity in Lake Lanao

FishBase (2003) cited that Lake Lanao is home to a highly unusual group of fishes known as a “species flock, and used to be home to 18 endemic fish species that cannot be found anywhere else. However, such species are now gone and several native species are becoming extinct including the *Puntius lindug*, *P. baoulan*, and *P. tumba*). The Lake Lanao eco-region is also home to 41 endemic freshwater crab species and supports a large number of waterfowls. The 18 species endemic fish species are thought to have evolved from one species, the spotted barb. The remaining major fish species found in Lake Lanao are shown in **Table 1**.

Table 1. Major fish species in Lake Lanao

Species	Family	Habitat	Total Length (cm)	Status
<i>Anabas testudineus</i>	Anabantidae	demersal	25	introduced
<i>Chanos chanos</i>	Chanidae	benthopelagic	220	native
<i>Cyprinus carpio</i>	Cyprinidae	benthopelagic	147	introduced
<i>Glossogobius giuris</i>	Gobiidae	demersal	61	introduced
<i>Hypseleotris agilis</i>	Eleotridae	demersal	8	native
<i>Micropterus salmoides</i>	Centrarchidae	benthopelagic	97	introduced
<i>Oreochromis niloticus</i>	Cichlidae	benthopelagic	74	introduced
<i>Puntius sirang</i>	Cyprinidae	benthopelagic	12	endemic
<i>Puntius tumba</i>	Cyprinidae	benthopelagic	16	endemic
<i>Trichogaster pectoralis</i>	Belontiidae	benthopelagic	25	introduced

## Issues and Constraints

Marawi City used to be a municipality named Dansalan which means a “place of destination” or a rendezvous. According to a well-known Maranao scholar and Sociology Professor of MSU, the late Dr. Mamtua Saber, Marawi City was chartered in 1940, and later the official name of Dansalan was changed to Marawi through a congressional amendment in 1956 and embodied in Republic Act No. 1552 of 16 June 1956. Marawi City is an Islamic cultural center for Muslim Filipinos, and is popular for both its beautiful veiled Maranao women and the sparingly “hot political passion”.

The Mindanao State University (MSU) was established in the rolling hills overlooking Marawi City in 1961 for the main purpose of cultural integration among the Muslims and Christians as well as for the promotion of affordable higher education in Muslim Mindanao. MSU has been monitoring the ecological status of the Lake through its able researchers until some problems occurred including the uncontrolled exploitation of the Lake. In order to address the issue, various initiatives have been advanced by many individual persons, government agencies, the private sector, and the academe including the MSU to promote the ecological conservation of Lake Lanao. In related attempts to save the Lake from destructive human exploitations, researchers from MSU conducted a scientific study in October 2006, after receiving alarming reports on the massive algal contamination in the Lake (Gallardo, 2006).

The study was mainly aimed at preventing possible occurrence of an environmental disaster in Lake Lanao following reports of algal contamination of the lake waters. The study initially concluded that such phenomenon was caused by poor sewage and inadequate agricultural waste management. Such findings were however contradicted by the Department of Agriculture (DA) and the Bureau of Fisheries and Aquatic Resources (BFAR) through an environmental assessment report, indicating that the cause of the contamination was mainly soil erosion brought about by indiscriminate logging and extensive land use and irresponsible farming. The MSU researchers finally recommended that the “greening of the lake waters” should be checked as it could affect the lives of thousands of peoples in the lake communities who have always depended in the Lake for food and livelihood.

Agus River is the only outlet of Lake Lanao to the sea. From 1953 to 1978, the NPC has constructed five hydroelectric power plants along the Agus River with combined daily generating power capacity of more than 630 mega watts. During that period, there was no opposition to the NPC from operating the power plants because these were only

taking advantage and using the high-energy stream of the Agus River. After 1978, the fate of Lake Lanao changed when an NPC regulatory dam was constructed near the Lake at the mouth of the Agus River (Naga, 2008). When the dam became operational, the lake communities felt the impacts from the flooding and drying of the shorelines. The residents in the lake communities reported an unstable water condition in the Lake, citing that while before when there is more rain, more water outflows to the river, when there was less rain, less outflow, now the situation changed to the opposite and something which they consider as against the laws of nature.

The residents also believe that the lake condition would be worsened when the construction of Agus-1 (the sixth of the seven planned hydroelectric plants) was completed in 1979. The peoples in the lake communities rallied against and strongly opposed the operationalization of Agus-1 for it could lead to a potentially disastrous direction along environmental and social dislocations, considering that Agus-1 will not make use of the natural outflow of the water through Agus River but will draw water directly from the Lake. The volume and rate of the water that Agus-1 will draw from the Lake will be controlled by the human operators of Agus-1, which would virtually replace Agus River as the natural outlet of the Lake. Many Maranaos feel that the replacement of Agus River as an outlet by the human-controlled Agus-1 is an ecological nightmare with alarming consequences to man and the environment. Many Maranaos cited the situation as a classic example of “man tinkering with nature that is fraught with grave and irreparable results.” Having been alarmed by the brewing conflict between the lake communities and the NPC and prompting the worsening civil unrest caused by the operations of the NPC hydroelectric installations, the Philippine Government under the leadership of then President Corazon C. Aquino directed a temporary suspension of the commissioning of Agus-1 until such time that the peoples were clarified on issues and their complaints addressed.

The worsening socio-economic conditions of the lake communities still prevail despite hosting the Agus power



*View of Lake Lanao (in Marawi City) from the rolling hills of MSU with the “Sleeping Beauty Mountain” in the background (Photo: www.maranao.com)*

grids of the NPC. Reports have indicated that the Province of Lanao del Sur and its 39 municipalities and Marawi City belong to the poorest local units in the Philippines. Such situation has been compounded by the irony of lack of inadequate supply of electricity in the whole province. This led the local government units and the civil society of the province to push for the protection of the lake watershed and its environment, advancing that the host province of the Agus grids of NPC and its municipalities including Marawi City should benefit from the electric power supplied by the NPC.

The MSU, in a separate assessment of the problem, recommended the establishment of a Lake Lanao Development Authority in order to preserve the Lake and to be responsible in protecting, conserving, and developing Lake Lanao and its watershed. The establishment of such Agency would strike a balance between power generation for progress and alleviating poverty in lake communities. Along this development and recognizing that Lake Lanao is the second largest inland body of freshwater and a vital part of the powerful river system that generates bulk of the electric supply of Mindanao, former Philippine Senator Loren Legarda (a strong campaigner for environmental conservation) batted for the legislation of a bill seeking to establish a special agency that would look after Lake Lanao.

This also came in the light of the environmental concerns raised by the lake communities that have experienced flooding due to illegal logging, wastewater discharge by a growing population and the presence of six hydroelectric power plants operated by the NPC. In this connection, then Senator Aquilino Pimentel, Jr. supported Senator Legarda's proposal after receiving reports that the water level of Lake Lanao continues to decline and strongly pushed for the immediate legislation of the bill for the conservation of the Lake due to the looming power and civil crisis in the whole Mindanao. Many House Representatives from Lanao del Sur as well as from Marawi City have also advanced the need for the establishment of the Lanao Lake Development Authority to oversee the development and protection of the Philippines' second largest freshwater lake, however, until the present the creation of such agency has not yet been realized.

## Recommendations and Future Actions

The MSU Alumni Association (MSUAA) during a workshop on the role of the MSUAA in promoting peace in Mindanao conducted on 15 August 2008 in Metro Manila, Philippines, recommended that peace can only be achieved in Mindanao if the socio-economic status of the peoples is improved. While discussing the present volatile peace situation in

Mindanao, the MSUAA workshop proclaimed that without livelihoods and where stomachs are empty, peace could never be attained. One of the approaches being considered by the MSUAA was to push for the establishment of a Lake Lanao Development Authority, the proposal of which has been initiated more than ten years ago. The MSUAA strongly believes that the conservation of the Lake could lead to improved livelihoods and ensure food security of the peoples in the lake communities.

Many members of the MSUAA who participated in the workshop belonged to the first students of MSU when it opened in 1962. They recalled that Marawi City and Lanao del Sur in the early 60s was a very peaceful place and there was good interrelationship between the Muslims and Christians in the whole province. It was also during the mid-60s until early 70s that many ecological studies were conducted in Lake Lanao by the MSU professors and students. However, after some progress and development in the province, the socio-economic status in the lake communities has ironically deteriorated that led to civil unrests.

The MSUAA therefore put forward a resolution which will be submitted to the MSU Administration and hopefully to be taken up with the Philippine Government, pushing for the establishment of the Lake Lanao Development Authority to be responsible for the conservation of the Lake and the development of the lake communities. The establishment of the said authority should take into consideration the lessons learned and experiences gained from the Laguna Lake Development Authority (LLDA) in order not to repeat the failures of the LLDA but to make use of the LLDA success stories. The development of the lake communities should also consider the creation of alternative livelihoods for the peoples through human resource development inculcating the need to conserve the resources of the lake which has been the source of food for the lake communities.

The MSUAA also recommended that the proposed Lake Lanao Development Authority should take into consideration the experiences from other countries in Southeast Asia specifically on co-management of lake fisheries using group user rights. Co-management has been considered as a strategy to strengthen the efficiency of lake fisheries management considering that increasing population and over-exploitation of the lake resources have accelerated the decline of the resources causing negative impacts on the livelihood of the people who depend on the lake for food. Under the co-management approach (Napaporn and Ekmaharaj, 2008), the participants are the users, the lake communities and the government, where their responsibilities, authority and roles in the management of the resources could be enhanced.



Together with the creation of the Lake Lanao Development Authority, the MSUAA also strongly recommended for the revival of Lanao del Sur and Marawi City as a tourist attraction. This would also provide additional livelihoods for the lake fishers by training them to become tourist guides. Many MSUAA members during the 15 August 2008 workshop recalled that in the 60s and 70s, the lake communities were once tourist spots visited by local and foreign tourists.

Reactivating these tourist spots could help provide alternative livelihoods to the peoples, increasing their incomes, filling their stomachs, and eventually achieving peace in this area in Mindanao. Home-stay could be promoted in the still existing “torogan”, an antique royal high roofed house with unique roof carvings, typical of a Maranao design. There are also ancestral homes that can be tapped for the home-stay program, where the visitors could be treated to a tour of the lake and observe the fishing and other related activities in the lake. There are also beaches like the Bagang Beach at the Caloocan Gulf located near Marawi City. Part of the guided tour could be the appreciation of the swiftest river in the Philippines, the Agus River, located in between Saduc and Lilod in Marawi City. Such recommendations however, would need financial support in order to be able to conduct human resource development as well as capacity building for the lake communities.

The development of the natural water resources for electric power generation such as the Lake Lanao and the Agus River is being tempered by a genuine concern for the protection and conservation of the resources in the Lake and Agus River. There is no problem about producing energy power for the sake of development but a problem could arise if there is no careful consideration of the need to preserve the natural wealth. As reiterated by the MSUAA during the August 2008 workshop, Lake Lanao is a God-given wealth to the present and the future generations. Therefore, the Lake must be preserved, conserved, protected, and developed in order that it could sustain its role in alleviating poverty in the lake communities and generating power for the peoples of Mindanao as well as in achieving peace in Mindanao.

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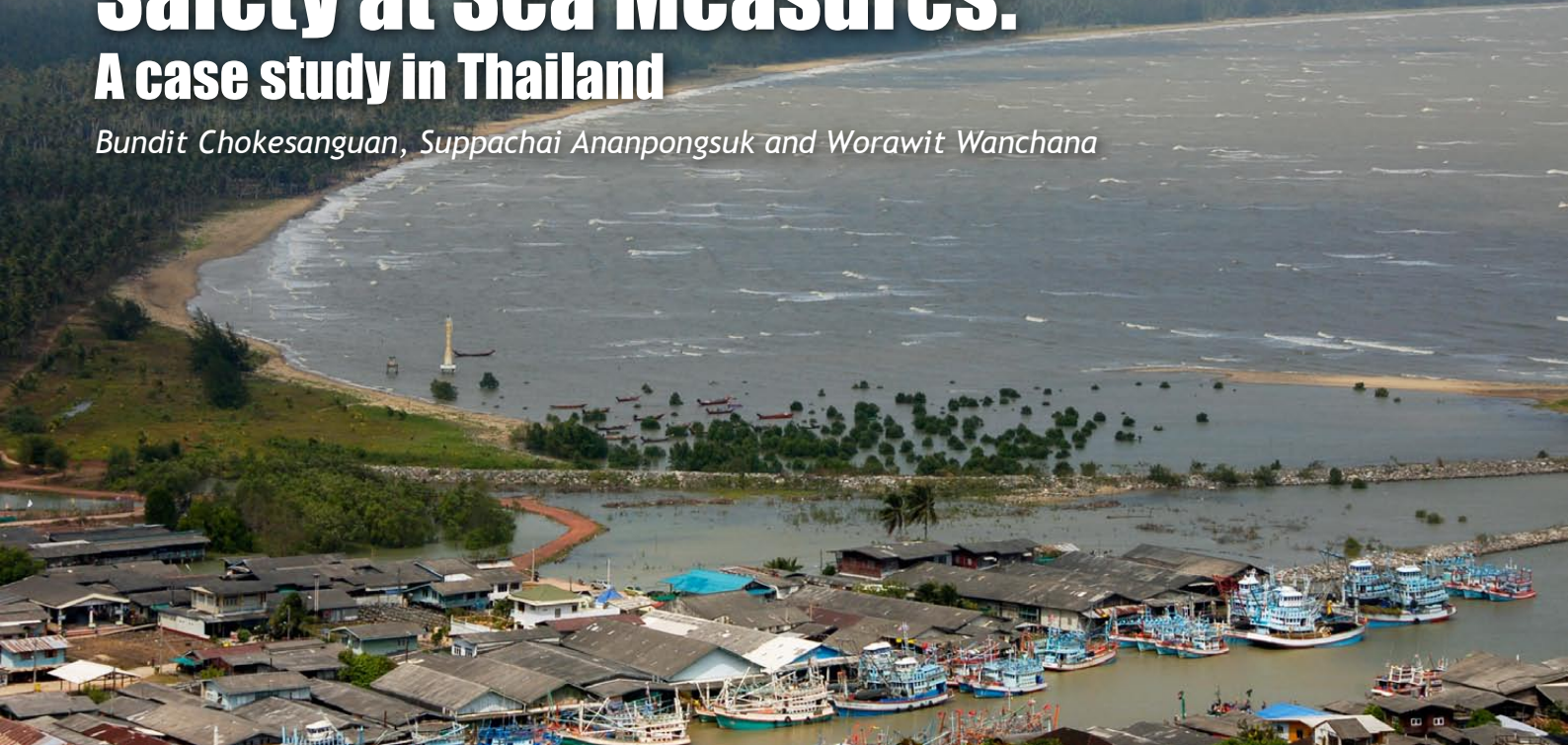
## About the Authors

Dr. Manaros Boransing is the Undersecretary of the Philippine Department of Education. In 1961, he was a member of the pioneering finance staff (the first University Accountant) and Professor in Business Administration of the Mindanao State University (MSU) in Marawi City, Lanao del Sur starting in 1962. Before his appointment as Undersecretary of the Education Department, Dr. Boransing held the position of Vice President for Academic Affairs of MSU in Marawi City and later as Vice President of the MSU-Iligan Institute of Technology in Iligan City, Lanao del Norte. He attended the MSUAA Workshop on the Role of the MSUAA in Promoting Peace in Mindanao (Philippines), held in Metro Manila, Philippines on 15 August 2008, where he has been requested to serve as the spokesperson for the MSUAA in advancing the recommendations of the workshop to the MSU Administration.

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# Impact of Fisheries Management in Improving Safety at Sea Measures: A case study in Thailand

Bundit Chokesanguan, Suppachai Ananpongsuk and Worawit Wanchana



This article is based on a case study conducted by the SEAFDEC Training Department to assess the impact of effective fisheries management approaches on the improvement of safety at sea measures for trawlers and purse seiners in Thailand. The study focused on the fishing boat conditions, navigation and safety equipment, the crew and their competency, working conditions, weather forecasting systems, etc., and was carried out in four areas, namely: the central, eastern and southern parts of the Gulf of Thailand, and the Andaman Sea. The data collected through the survey were backed up by interviews with boat owners, crew and other stakeholders concerned. The results of the study could be used as reference for the other countries in the Southeast Asian region in their efforts to improve safety at sea measures and promote fisheries management.

Thailand is a peninsular country with an area of approximately 514,000 km<sup>2</sup> and a coastline of 2,614 km. The country's marine fisheries are operated in two major fishing areas, viz. the Gulf of Thailand and the Andaman Sea off the west coast of Thailand. The Gulf of Thailand is a semi-enclosed sea that covers an area of about 320,000 km<sup>2</sup> and being part of the Sunda continental shelf in the South China Sea, the Gulf is rather shallow with an average depth of about 45 m. On the other side, the Andaman Sea is deeper with an area of about 126,000 km<sup>2</sup> having the features of oceanic waters.

Thailand's Exclusive Economic Zone (EEZ) covers 420,280 km<sup>2</sup> of which 304,000 km<sup>2</sup> is in the Gulf of Thailand and the other 116,280 km<sup>2</sup> in the Andaman Sea.

Fishing has a long history in Thailand and it is especially important for the people in the coastal provinces who fish to feed their families and supply fish food to domestic and foreign markets. Of its total production of 4.16 million mt in 2006, Thailand exports about 1.7 million mt valued at 5.24 billion US Dollars (**Table 1**). Marine fisheries production





**Table 1.** Fish production and trade of Thailand (1997-2006)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total	3,442,715	3,524,933	3,646,070	3,735,279	3,648,095	3,797,124	3,914,133	4,099,595	4,118,483	4,162,096
Marine capture	2,699,227	2,729,639	2,745,468	2,795,719	2,631,474	2,643,728	2,651,277	2,636,412	2,615,523	2,579,025
Inland capture	203,671	200,715	206,840	201,405	202,500	198,700	198,447	203,200	198,747	197,270
Aquaculture	539,817	594,579	693,762	738,155	814,121	954,696	1,064,409	1,259,983	1,304,213	1,385,801
Total Export (qty)	1,013,936	1,160,453	1,204,215	1,162,099	1,217,310	1,246,543	1,401,915	1,395,531	1,527,659	1,700,160
Total Export (value)	4,334,222	4,038,054	4,122,627	4,384,437	4,054,130	3,692,158	3,919,824	4,053,938	4,474,405	5,244,879
Total Import (qty)	701,113	716,304	913,316	813,789	977,350	1,006,011	1,078,620	1,240,181	1,444,911	1,470,203
Total Import (value)	897,715	864,580	868,077	826,699	1,072,467	1,079,379	1,133,815	1,254,617	1,457,125	1,573,144

Source: FAO FishStat Plus 2008

Note: Quantity (qty) in metric tons (mt); Value in thousand US dollars

comes from coastal aquaculture and marine capture fisheries both within the EEZ of Thailand and neighboring countries' waters.

## Trawling and Purse Seining in Thailand

Otter-board trawls were introduced in Thailand in the 1960s, from which the beam trawl was developed for catching shrimps, and became a popular gear among the Thai fishers along with the otter-board trawl. As a result, the total number of registered trawlers increased from 99 units in 1960 to 11,000 in 1989 but decreased to 8,008 in 2000 and then to 4,806 in 2007.

Another effective gear is the purse seine also well known as the pelagic fish hunter. After the Chinese purse seine was introduced in 1925 for the chub mackerel fishery in the Gulf of Thailand, many Chinese purse seines were modified into Thai purse seines after World War II, using 2.5 cm mesh size. Later, the mackerel encircling gill nets or green purse seines using 4.7 cm mesh size were also introduced, and in 1973, several luring techniques were introduced one of which is the payao constructed using coconut leaves. Pelagic fishes are mainly caught by purse seines that make up about 82-85% of all gears used in Thailand, and the number of registered purse seiners increased from 585 units in 1979 to 1,504 in 2000 but decreased to 1,140 in 2007.

Moreover, the information from the Department of Fisheries (DOF) of Thailand indicated that fishing boats registered under "less than 5 GT" category decreased from 3,257 units in 1999 to 2,160 in 2003 while fishing boats registered under "more than 5 GT" category increased from 13,664 in 1999 to 13,823 units in 2003 but started to decrease to 11,824 in 2005 (Table 2). The number of registered fishing boats by type of fishing gears in 2003 comprised mainly the trawl fishing boats (Fig. 1).

With the development of more efficient gears, the total fisheries production of Thailand increased but this also led to over exploitation of the fishery resources. In this regard, many fisheries management approaches and methods were adopted and used in order to address such concern. However, the aspect of safety at sea has always been overlooked even considering that fishing is among the most dangerous occupations pursued by man. The fishermen depend on their vessels for their survival, and when a vessel is lost at sea, it is probable that some or all of the crew also lost their lives. Generally, the most common fishing vessel casualties are

**Table 2.** Number of registered fishing boats in Thailand (by gross tonnage (GT))

Year	Less than 5 GT (units)	More than 5 GT (units)
1999	3,257	13,664
2000	2,786	14,509
2001	3,329	12,616
2002	2,517	13,407
2003	2,160	13,823
2004	2,751	13,681
2005	2,160	11,824

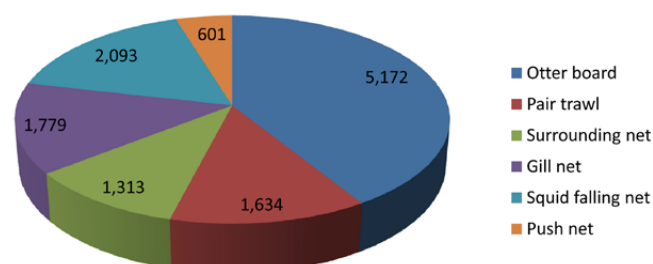


Fig. 1. Number of fishing boats registered by type of fishing method in Thailand (2003)



due to vessel capsizing, poor vessel structure, fire/explosion, and collision.

## Fisheries Management Policies of Thailand Concerning Safety at Sea

With the aim of controlling the fishery activities of Thailand, Fisheries Act. B.E. 2490 (1947) provides that fishing operations are subject to various regulations (revision of the Act is ongoing). As the lead national agency for fisheries policy development in Thailand, DOF promoted the National Fisheries Development Policies that include the Policy on Management of Fisheries Resources and Environment, of which fisheries management policies are covered specifically those that relate to safety at sea such as appropriate vessel registration and fishing licensing; closed area and closed season; promotion of offshore fisheries and joint ventures; and employment of foreign labor for fishing vessels.

### Vessel Registration and Fishing Licensing

While the DOF of Thailand issues licenses for fishing gears such as trawls, purse seines and gill nets, the country's Marine Department has been legally mandated to register all vessels including fishing vessels. The divided tasks of licensing fishing vessels and fishing gear by two Departments could have led to the incomplete and ineffective control of all fishing operations in the country. To solve this problem, the DOF enacted a new regulation in 1979 prescribing that applications for fishing gear licenses must attach the certificate of vessel and the license to use such vessel. This regulation, however, caused another problem since many fishing vessels, less than 14 meters in length are unable to register and acquire the necessary certificate of vessel registration. This subsequently leads to the problem of issuing a license to fish when the certificate of vessel registration is unavailable. Thus, the DOF recently

enacted an additional regulation to register fishing operators with fishing vessels smaller than 14 meters in length. Such certification can be used in lieu of the required certificate of vessel registration issued by the Marine Department.

### Closed Area and Closed Season

During the spawning season of the Indo-Pacific Mackerel, certain areas in the Gulf of Thailand and in the Andaman Sea are closed for three months annually. From 15 February to 15 May each year, approximately 26,400 km<sup>2</sup> in the Gulf of Thailand is considered a conservation area to protect several commercially exploited demersal and pelagic fish species during their spawning and breeding seasons.

Fishing by all types and sizes of trawlers (with the exception of beam trawlers) as well as all types of purse seiners (except for anchovy purse seiners operating in the daytime from February 15 to March 31 only) is prohibited specifically along the coastline of Prachuap Khirikhan, Chumphon and Surat Thani Provinces as well as in the Khanom District of Nakhon Sri Thammarat Province in the Gulf of Thailand. Around the Andaman Sea, an area of approximately 1,800 km<sup>2</sup> at Phangnga and Krabi is declared as a conservation zone where selectively controlled fishing (closed season) and/or prohibition of selected fishing gear is imposed from 15 April to 15 June of each year. These approaches allow the fishery resources to recover for another round of recruitment.

### Promotion of Offshore Fisheries and Joint Ventures

Recognizing that the inshore resources of the country are already over-fished, Thailand had promoted offshore fisheries while some Thai commercial-scale fishing vessels mostly trawlers, continue to fish outside Thailand's waters. Many Thai fishers have entered into joint venture fishing agreements with Bangladesh and India to fish in Myanmar



*A Thai purse seiner (left) and trawler (right)*

waters, and also with other countries such as Indonesia, Malaysia, Myanmar, Somalia, and Madagascar with the arrangement to share local crew onboard as well as landings in their respective coastal states. This has led to an exchange in the access to fisheries resources and enhancing the capacity of the fishing vessel crew.

However in many cases, many fishers are unfamiliar with offshore fisheries where fishing trips could last for several days, regardless of the fact that most vessels have been constructed to fish near-shore and suitable for a few days trip only. In addition, many fishing vessels have limited space for carrying safety equipment, spare parts for engine repairs, or even heavy fishing gears commonly used, posing considerable risks to the crew. There have also been instances where fishers acquire second hand fishing boats from neighboring countries that are quite old with outdated safety equipments. Many such small fishing boats or old boats sail farther out to sea beyond their designed capacity and construction. Nonetheless, the country's policy on the promotion of offshore fisheries and joint ventures could still have positive effects on improved standards and capacity of trawlers and purse seiners, as this includes regulations on the size of boats as well as the communication, navigation and safety equipments to be carried onboard.

### **Employment of Foreign Labor**

While Thailand has shifted from an agriculture-based economy to a more industrial one, many fishers have left the fishing industry which has led to the employment of foreign labor from Cambodia and Myanmar as members of the fishing vessel crew. It was only after Typhoon Gay in 1989 and the 2004 Asian Tsunami that hit Thailand that Thai fishing vessel crew were trained on the basics of safety at sea. On the other hand, while it would take some time for foreign crew to be familiar with fishing operations, minimum attention is usually given by fishing operators to the aspects of safety. This has been cited often as one of the causes of accidents during fishing operations.

### **Effects of Natural Disasters on the Improvement of Safety at Sea Measures in Thailand**

Besides the various fisheries management approaches, the massive natural disasters which affected Thailand in a way, led to the improvement in the safety at sea measures for the country's trawlers and purse seiners.

### **Typhoon Gay**

Typhoon Gay in November 1989 caused significant damages to the Gulf of Thailand, especially in Chumpon Province. It was a unique full typhoon (wind speed was 120 mph at landfall), that claimed the lives of more than 600 fishers who were reported missing while two hundred fishing vessels were lost at sea. After the typhoon, the Thai Government intensified its program in improving the safety at sea measures and established the Fishermen Training Center in Chumpon Province to provide training on fishing and safety at sea onboard, boat building and weather forecasting. Moreover, early warning systems were also improved in many fishing communities along the coastal areas of the Gulf of Thailand.

### **Asian Tsunami 2004**

The 2004 Asian Tsunami damaged many communities around the Indian Ocean including 422 fishing villages in the country's six provinces (Ranong, Phangnga, Krabi, Phuket, Trang and Satun) along the Andaman Sea coast of Thailand. In terms of fisheries, about 700 fishers died, 6,100 fishing boats were damaged and many kinds of fishing gear valued at Thai Baht 160 million were lost. After this experience, the Thai Government with the assistance from the European Union (EU) and other international organizations provided immediate rehabilitation plans (short-term and medium term/long-term) that include training in natural disasters and sea safety for fishing communities, boat building and repair under the medium- and long-term plans.

### **The Case Study**

Considering the various fisheries management approaches and capacity building measures on safety at sea promoted by the Government of Thailand, the case study was conducted with support from the Food and Agriculture Organization (FAO) of the United Nations to assess the current situation of safety at sea on trawlers and purse seiners in Thailand as well as evaluate the improvements resulting from the promotion of effective fisheries management measures and the lessons learned from the impact of natural disasters on the fishing communities in Thailand.

The study was carried out in four areas, namely: the central part of Thailand (Samut Prakan, Samut Sakorn, and Samut Songkram Provinces), the eastern part of Thailand (Chonburi, Trat, Chantaburi, and Rayong Provinces), the southern part of the Gulf of Thailand (Songkha, Chumporn, Nakorn Srithammaraj, and Surat Thani Provinces) and the southern part in the Andaman Sea area (Phuket, Ranong, Phangnga, and Satun Provinces) as shown in **Fig. 2**.





## Results of the Case Study

The results indicated different conditions of the safety at sea measures for trawlers and purse seiners in Thailand, varying in terms of the size of the fishing boats. On the average however, safety conditions of about 50% of fishing boats met the standard set by the Marine Department and the DOF.

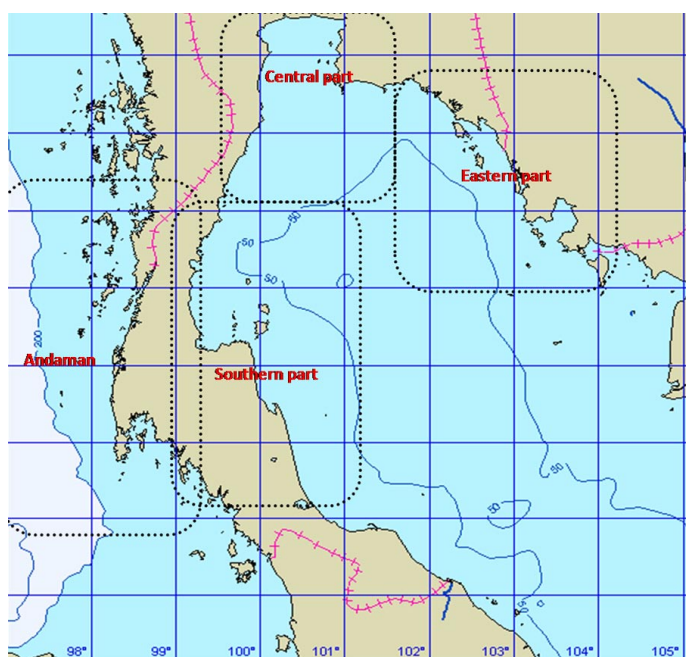


Fig. 2. Map showing study areas in the central, eastern, southern parts in the Gulf of Thailand and the Andaman Sea

## Hull and Engine of Vessels

The regulation on vessel inspection of the Marine Department of Thailand provides that inspection of fishing boats including inspection of the hull, engine and fire fighting equipment as well as safety equipment onboard should be done every year while docking inspection is done every two years. Annual inspection is done when a fishing boat is afloat so that both the hull and all engines could be visually inspected for their conditions as well as for its performance. The results of the study indicated that only around 50% of boats from the central part of the Gulf of Thailand and about 65% in the Andaman Sea were checked by authorized officers annually. Furthermore, in the eastern and southern parts of the Gulf of Thailand only about 65% follow the regulations of docking within two years for overhauling the hull and other parts while only 39% of the fishing boats in the southern part of the Gulf of Thailand perform routine hull maintenance. As for navigational equipment, most fishing vessels conduct good maintenance of their equipment specifically the RADAR, GPS and Echo sounders. Special attention has always been given to Echo sounders, since these are used for navigation as well as for successful fishing operations.

## Safety Equipment

In accordance with the regulation of the Marine Department, life rafts, life rings and life jackets must be carried onboard by all fishing boats regardless of size. However, most Thai fishing boats do not have any life rafts carried onboard. In fact, less than 50% of fishing boats in the central part



of the Gulf of Thailand and in the Andaman Sea have life rings while in the eastern and southern parts of the Gulf of Thailand, only small number (0-4 boats) carried life rings, respectively. The respondents also confirmed some fishing boats use the fishing gear floats as substitutes for life jackets.

### Safety of Vessel Crew

In the study area, a trawler (LOA less than 15 m) fishing in areas more than 12 nautical miles away from the shore, has about 15 crew members working onboard but without having life rafts, life rings and life jackets on board. On the other hand, purse seiners (LOA equal or more than 15 m) that fish more than 24 nautical miles away from the shore, carry onboard some safety equipment such as life rings and life jackets. However in general, many fishing boats do not install life rafts. Furthermore, considering that the distance traveled by fishing boats from shore to the fishing grounds is directly related to the accidents due to bad weather conditions, alert methods employed by fishing boats should be assessed as the distance from the shore to the fishing grounds is critical during the search and rescue operations in case of accidents.

### Competence of Vessel Crew

The number of crew onboard trawlers is not more than 20 persons, while that of purse seiners is about 20-40 persons. As shown in **Fig. 3**, the highest percentage of crew working onboard Thai fishing boats are Burmese nationals (50.95%) followed by Thais (24.58%) and Cambodians (24.47%). There are no Cambodian crew onboard fishing boats in the Andaman Sea while there is less than 0.5% Burmese crew in the eastern part of the Gulf of Thailand.

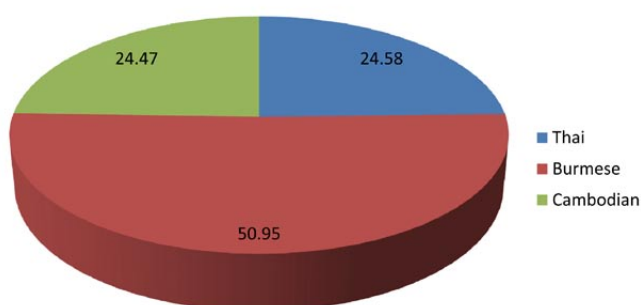


Fig. 3. Nationalities of crew working onboard Thai fishing boats

Specifically, in the central part of the Gulf of Thailand, the vessel crew is also dominated by Burmese nationals (about 58%) followed by Thais (36%) and Cambodians about 6%. In the eastern part, the vessel crew is dominated by Cambodians (about 91%) while the Thai crew comprises only about 8%. In the southern part, most of the vessel crew

comprises the Thais (49%) and Burmese (43%), and the remaining 8% are Cambodians. On the other hand, the crew of fishing vessels in the Andaman Sea is mostly Burmese and Thais, comprising 80% and 20%, respectively.

### Working Periods Onboard Thai Fishing Vessels

The working hours and period of fishing operations are different in trawlers and purse seiners. Fishing operation time of trawlers starts before sunrise and is completed before midnight from net setting, net hauling until catch sorting. Normally fishing operation is done about 3 times a day, and takes about four hours for towing. During towing time, the crew sorts the fish to be kept in the fish hold. The total working time per day is 15 hours. On the other hand, purse seiners start fishing after sunset (about 22.00 hrs) and finish after sunrise, with a total working time of about 12 hours per day including time spent for net arrangement.

### Weather Forecasting Facilities

The country's weather forecast services for fishing boats have been improved after Typhoon "Gay" hit Thailand in 1989. The services have been expanded to cover all fishing grounds up to 40 nautical miles in the Gulf of Thailand and up to 60 nautical miles in the Andaman Sea. Broadcasting is conducted through various media such as television and radio as well as through the coast and onshore radio station services for fishing boats. Results of the study indicated that all fishing boats sampled have communication systems onboard for receiving weather broadcasts in the fishing grounds. However, most fishing boats have no weather facsimile receivers installed.

### Communication Systems

Most fishing boats use CB transceivers to communicate among ships and between ships as well as to the shore. In the eastern part of the Gulf of Thailand, more than 50% of fishing boats use SSB transceivers compared with the other areas where the use of SSBs was limited to few vessels only. However, the study also confirmed that many fishing boats usually do not use VHF transceivers because VHF radio signal could not be accessed from long distances, thus, CB transceivers have been most effectively used instead.

### Environmental Responsibility

Almost all sampled fishing boats return to shore with waste materials generated during their fishing trips. The waste materials include inorganic garbage such as damaged buckets, damaged fishing gear, PE ropes, waste oil, etc., which are usually sold by the crew upon getting on shore.

## Ship Facilities

The traditional Thai fishing boats have no toilets, bathrooms nor mess rooms. It was only recently that some fishing boats already have toilets or bath rooms. This means that the living quality of the crew in most Thai fishing boats is still low compared with other jobs on land. The respondents confirmed that in general, owners of fishing boats in Thailand do not pay considerable attention on safety issues and the quality of life of the crew working onboard.

## Conclusion

Results from the study indicated that most Thai fishing boats (more than 70% of the fishing boats sampled) passed the annual inspection conducted by the Marine Department for docking and maintenance of engines with gear and navigational equipment installed onboard. However, life rings and life jackets are mostly not available onboard with less than 50% of fishing boats in the central part of the Gulf of Thailand and the Andaman Sea carrying these safety equipments and with corresponding very low percentages in the southern and eastern part of the Gulf of Thailand. This is in spite of the number of boat accidents at sea having been reported.

The number of vessel crew and their competence which are indicators of the safety conditions of fishing boats also varied in the areas surveyed. The number of crew in purse seiners is large compared with that of trawlers because of the differences in the fishing operation methods. There is a large number of foreign crew working onboard the fishing boats in the Andaman Sea, central and eastern parts but smaller in number in the southern part of the Gulf of Thailand, with competence not usually meeting the standard because many foreign crew did not receive any training on the basic sea safety measures. Lack of competence of the boat crew and the poor working conditions, long period of working hours may have contributed to more than 40% of fishing boats in Thailand meeting accidents at sea which is considerably high. With regards to weather forecasting system in Thai fishing grounds, it seems that this has been much improved after the catastrophic natural disasters that occurred in Thailand in 1989 and 2004.

Viewing the general picture of safety at sea for trawlers and purse seiners in Thailand, the various fisheries management measures still do not seem to promote improvements of the safety conditions of the fishermen. This may be because the responsibilities for boat registration including safety at sea promotion and fishing licensing are done by various authorities. Good cooperation among responsible sectors should therefore be promoted in various aspects of safety including collection and sharing of data. Implementation of fisheries management plans will not be successful when safety aspects on the part of the fishers are overlooked. Strengthening safety at sea inspections and enhancing awareness of responsible officers are also needed in order to increase the efficiency of inspection and enforcement. Moreover, awareness building about safety at sea for vessel crew, owners and responsible officers should also be promoted while information on disastrous accidents at sea should be monitored and disseminated in order to discern how safety at sea could be improved.

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# Adapting the Target Category Approach in Fisheries Extension Work: Advantages and Disadvantages

Savitree Rangsihaht and Supaporn Thaipakdee

The thirteen participants in the International Training Course on Coastal Fisheries Management and Extension Methodology organized by the Training Department (TD) of SEAFDEC from 2 to 29 September 2008, were taken as the population for a case study which aimed to: analyze the need for target category approach in extension activities, assess the advantages and disadvantages, illustrate the application of such approach in participants' work responsibilities, and present the outcomes from carrying out a program for the small-scale fishers. Results of the case study could be adapted by the countries in the Southeast Asian region with modifications that suit the specific context and situation of the respective countries.

Fisheries extension approach is an organized and coherent combination between strategies and methods. In order that any fisheries extension work becomes effective in a certain area, many approaches have been adapted. However, in choosing a particular approach, the contexts and conditions in the area should be taken into consideration (Seevers et al., 1997). Although there is no single best approach, the target category approach has been regarded as a key feature in fisheries extension work because it has been found to function well with the fishermen, more particularly in successfully responding to their needs (Chokesanguan and Weerawat, 2008). In the target category approach, the needs of specific group of clientele are targeted while the acceptability by such group of an appropriate technology is considered, from the social and economic points of view. The SEAFDEC Training Department (SEAFDEC/TD) organized the International Training Course in Coastal Fisheries Management and Extension Methodology in Samut Prakarn, Thailand on 2-29 September 2008 with the aim of familiarizing the trainees from the Southeast Asian countries on the various fisheries extension approaches relevant to coastal fishery resources management. The 13 training participants from 10 countries were fisheries officials or fisheries extension officials with at least three years experience in fisheries or related work, and had minimum of 10 years active service before retirement, the minimum requirements set for the training course to ensure that the knowledge gained from the training could be carried out in their respective work assignments.

During the training, the researchers (who served as resource persons in fisheries extension approaches) introduced the concepts of the various fisheries extension approaches relevant to fisheries extension activities including the

target category approach. The participants were given the opportunity to analyze, discuss and share their professional experiences on: the advantages and disadvantages of the target category approach, why a target category approach is necessary in working with the small-scale fishers, how to apply the target category approach in the respective participants' work responsibilities, and the possible outcomes from the application of a target category approach.

Using the aforementioned training session as a case study, the 13 participants in the training course representing 10 countries; namely, Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Philippines, Thailand and Vietnam were considered as the respondents of the study. Questionnaires were used to conduct an in-depth interview of the participants, while focus group discussions were also conducted to obtain the participants' responses to the research questions.

## Fisheries Extension Approaches

Various fisheries extension approaches were introduced during the training course which include: (1) target category approach; (2) technical change approach; (3) functional group approach; and (4) clients organization approach. Considering that the "fisheries extension approach" in general, refers to an organized and coherent combination of strategies and methods of carrying out extension plans in order to meet the needs of the fishers, the "target category approach" could be appropriately adopted in fisheries extension. In addition, the target category approach focuses on the specific activities of specific groups of fishers, where such groups are formed on the basis of their needs, interests, goals or characteristics. Under this approach, an appropriate technology could be applied which suits the preferences of the said organized groups. The "advantages of target category approach" as the favorable opportunities with respect to the groups' needs oriented towards the clientele, while the "disadvantages of target category" which refer to the unfavorable opportunities towards their needs, were therefore identified during the case study.

The "technical change approach", which is one of the most popular approaches used in fisheries extension work, is aimed at maximizing the adoption of technological innovations from national or regional research centers where researchers attempt to find solutions to the clients' major technological problems. Once a solution is arrived at, this



is developed into a recommended practice that the clients can apply in their work areas.

Usually under the “technical change approach”, innovations are introduced first to a small number of progressive clients and opinion leaders with the hope that the information could be adopted later with other clients. However, the “technical change approach” has major limitations because the technologies or packages of technologies recommended to the fishers could oftentimes be irrelevant or incomplete. More often than not, decisions to promote fisheries practices or technological solutions are usually made without assessing first the clients’ real needs and their socio-economic conditions, as practiced in a top-down approach. Moreover, this approach does not reach out to the appropriate stakeholders as only the highly selected clients could be served.

The “functional group approach” is aimed at working with particular groups of people joined together to achieve a shared goal. Transforming the behavior of the group members could be attained through different elements, such as: mobilization, organization, and training as well as through technical and resource support. In this approach, groups of people are first *mobilized* for action through participatory way and action-oriented research, where it is necessary that the stakeholders should understand their own situation, potentials for change and own possible roles. Then the groups could be *organized* to allow group decision-making, group responsibility, resource pooling and other collaborative arrangements. A *training program* for the staff at the village level and the group members is a must. Developing and utilizing innovations at the local level require *technical and resource support* to attain results, which can be in the form of funds to support the program as a whole or technology that promotes income-generating activities.

The “clients’ organization approach” utilizes independent, self-managed and in most cases permanent organizations such as fishermen’s associations or cooperatives, which are formed mainly for the social or economic development of the members. In this approach, the fishermen organize, direct and manage their own associations and cooperatives. This approach is very common in developed and some developing countries, such as the Netherlands and other Western European countries where the fishermen are organized to a certain degree that they can have access to their Ministries of Agriculture and even to their Parliaments, and in some cases, have influence in the development of agricultural policies. In some countries, fishermen’s organizations even have their own learning centers and extension programs, and their organizations are partners of government agencies in

the formulation and implementation of fisheries extension activities (Maine Sea Grant, 2008).

## The Target Category Approach

In the “target category approach”, the selected groups serve as targets of the fisheries extension works. The groups could be the small-scale fishers or the out-of-school young fishers. This approach gives attention to small-scale producers, who can readily adapt technological packages and recommendations that harmonize with their interests, preferences and needs.

### Assessment of Fishermen’s Needs, Interests and Preferences

Results from many studies in various countries indicated that by using various elements as shown in **Box 1**, the fishermen’s needs could be addressed while their interests and preferences could be identified and assessed. Once the fishers’ needs are identified, specific plans, programs and activities in response to their needs could then be carried out.

In extension work, the fact that small-scale fishers in general need access to low-cost technologies as they have minimal capital for investment as indicated in the various studies, should be taken into consideration. While commercial fishermen, on the other hand, could be more interested in technologies having higher capital cost, the technologies promoted in fisheries extension activities should result in one or more factors exemplified in **Box 2**.

## Basic Information on the Respondents

The 13 participants in the training course who have been considered as respondents in the study were administrators,

### Box 1. Elements that could be used in assessing the fishermen’s needs, interests and preferences

1. **Block supervisors’ diary** is a structured page layout for recording problems of the fishermen, which they expressed and corresponding collected and recorded during the day to day work of extension field staff.
2. **Problem census** is a structured meeting with a group of fishermen, and designed to ensure the full participation of the fishermen in order to identify and fully understand the fishermen’s needs.
3. **Participatory rural appraisal** is a continuously developing set of different techniques designed to ensure full participation of the fishermen in identifying the needs and to initiate the planning of the appropriate responses.
4. **Consultation with other organizations** is done through working committees at the village level, district and regional levels where the needs of the fishermen can be obtained.

Source: Ministry of Agriculture, 1999 and Examples of Community Management and Research in the Fisheries Sector, 2008

### Box 2. Favorable outcomes from the promotion in fisheries extension plans

1. Decrease in input costs including labor
2. Increase in outputs
3. Increase in the quality and market value of outputs
4. Increase in the production of nutritional food stuff for household consumption
5. Improved fisheries practices to promote environmental sustainability
6. Reduced dependence on externally purchased inputs and greater use of local resources

Source: Ministry of Agriculture, 1999 and SEAFDEC, 2003

scientists and fisheries officials who have worked with small-scale fishermen. Most of the respondents had been occupying their present positions for an average of six (6) years and at their present office for an average of nine (9) years, and that most of them (about 85%) have been directly involved in extension work. Most of the respondents learned about target category approach from their work (69%) while the others acquired more information about the approach from the training course (31%). Considering the multiple responses, about 77% confirmed that they received information on target category approach from the training, 69% learned the approach from their work and 46% from printed and published materials. Moreover, about 39% of the respondents indicated that their roles in extension work were mainly as agents of change and group members with another 23% called themselves as external experts. Furthermore, about 85% confirmed that they have worked with small-scale fishermen, 46% with fisherwomen, about 39% have worked with young fishermen while about 39% have worked with large-scale fishermen.

## Findings from the Case Study

Based on the results of the focus group discussions, the respondents confirmed the importance of carrying out programs based on the needs, interests and preferences of fishers in order to gain the fishers' acceptance and participation. Using "the target category approach" therefore could create awareness and enhance commitment to practice and perform their responsibilities. Being time-saving with easy problem-solving method, the target category approach could make the fishers to become more resourceful. Although in certain cases, such approach could also be serving the needs of specific groups as it is oftentimes time consuming to form a committed group.

### Necessity

The participants agreed on the need to carry out programs according to the interests, preferences and needs of specific groups of clientele in order to set up acceptable and adoptable programs. Clients' participation could be enhanced once the

advantages from joining the program such as development in skills, knowledge and attitude, could be perceived. On the contrary, if a certain program is conducted not in accordance with the stakeholders' needs, implementation of such program would never give positive results.

### Advantages

Grouping people to work on a specific activity based on their interests and needs could create awareness and commitment to practice what they have learned. They would easily understand, take responsibilities to do the activities and be able to plan and carry out programs within a short period of time. With their own cooperation and initiative, problems could be solved easily. Stakeholders became resourceful and self-reliant because their preferences and needs are being met.

### Disadvantages

On the other hand, the respondents also confirmed that the target category approach could also lead to the formulation of specific programs that do not serve the needs of the other fishers, mainly because grouping people together could take a lot of time and commitment. The respondents also confirmed that in some cases, the fisheries extension agents could sometimes fall into the trap set by the policy imposed by the government and the programs required by the fishers.

In addition, during the focus group discussions, the participants also shared their professional experiences on how to handle problem-solving situations (Box 3). The respondents also suggested that the application of the target category approach should start from where and what the fishers are, and working with them using the appropriate extension methods (Box 4).

### Box 3. Factors to be considered in handling problem-solving situations

**Be a good moderator:** Fisheries extension agents should convey the message and open the line of communication between senders and receivers. Information gathered from clientele could be sent to agencies concerned while at the same time, extension agents should provide beneficial and relevant information back to the clientele to assure them that their preferences are being addressed.

**Be honest and trustworthy:** Fishermen would only come near and consult with fisheries extension workers if trust has already been established with them. In order to bridge the gap between government officials and small-scale fishermen, more activities should be boosted that could serve the interest of the fishermen.

**Create participatory management atmosphere:** Fisheries extension agents should promote a forum where discussions with fishermen are held in a participatory manner. Encouraging fishermen to voice out their views and ideas could create the needed participatory atmosphere.

**Box 4. Activities where target category approach could be applied**

- **Creating a linkage between extension agents and the community where extension agents are assigned**
- **Identifying the needs, interests and preferences of clientele in areas of responsibility**
- **Grouping the clientele according to their needs and interests**
- **Organization of training courses based on the needs, requirements and interests of clientele**
- **Assistance in seeking credit or loan packages from financing institutions or facilitating the sourcing of financial support to finance specific projects**
- **Monitoring and evaluation of technology adoption, as introduced to each specific target group**
- **Showcasing of successful programs and initiation of documentation for future reference**
- **Conducting demonstration or field days for successful programs**
- **For unsuccessful programs, weaknesses should be identified and improvements should be explored**

As part of the training course, the participants discussed issues related to over-fishing and illegal fishing in their respective countries. In the case of the Philippines for example, the use of destructive fishing methods such as dynamite, cyanide fishing and the use of fine mesh net fishing gear resulted in rapid habitat degradation and decline of the fishery stocks. Therefore, the training recommended that monitoring, control and surveillance (MCS) of fisheries system should be addressed as among the priority concerns in fisheries extension.

It was also noted during the discussion that in the Philippines, most information have been gathered from the fishermen such as those on fishing effort, catches, vessel traffic and other related data because of the active promotion of the country's MCS system, and such information have been used for the formulation of national policies and laws. Therefore, the case of the Philippines can be considered as having the most progressive programs for public awareness and promotion of participatory management for its coastal resource areas (Chokesanguan and Weerawat, 2008).

## Discussions and Conclusions

Outcomes of any program that fulfills the stakeholders' needs would provide a learning process, strengthen responsibilities and promote self-reliance of the target group (Fig. 1). In the training course, the participants indicated that fishers would learn to be responsible of their own decisions if their requirements are addressed through the programs implemented in their areas because most fishers believe that the results from such programs or activities would serve as inputs and provide lessons for their future activities. Therefore, the ultimate outcomes from an application

of the target category approach depend on the learning responsibilities and self-reliance of the target group.

Even though the thirteen participant-respondents of the case study had various positions and varied work background, they arrived at a consensus that target category approach is necessary in working with fishermen particularly the small-scale fishers. Almost all of them have learned this approach from their work since they had been directly involved in fisheries extension work. However, some of them have learned the target category approach only from the training session.

Based on their work responsibilities, most of the participants in the training course were agents of change, group members and external experts. Their viewpoints on target category approach were basically extracted from their professional experiences and background. The findings from the focus group discussions however, showed that the participants had the common agreement to accept the necessity to carry out an extension program based on the needs, interests and preferences of fishers.

The participants further agreed that the target category approach had more advantages than disadvantages since it is focused on the interests, needs and preferences of the fishermen. From the results of further discussions on how to bridge the gap and misunderstanding between policy makers and local fishermen, the respondents confirmed that this could be done by creating common understanding and alternative solutions to the situation. The most significant advantage of the target category approach is the ability of the approach to respond to the requirements of a specific group of clientele which could lead to creating awareness and commitment. On the other hand, a disadvantage could be the inability to serve the needs of other groups in view of their attitude towards organizing a committed group which could be time consuming. As regards the application of the target category approach, the participants agreed on a series of activities considering the fishermen's present situation, program implementation as well as monitoring and evaluation. The participants also confirmed that the outcomes from the implementation of the target category approach would help the fishermen in strengthening their activities, responsibilities and self-reliance.

## Recommendations

Based on the outcomes of the case study, it is suggested that participants in the training course and in similar training courses conducted in the future, should be encouraged to practice the target category approach in their respective work areas. The participants could initiate implementing such approach by writing individual action plans and



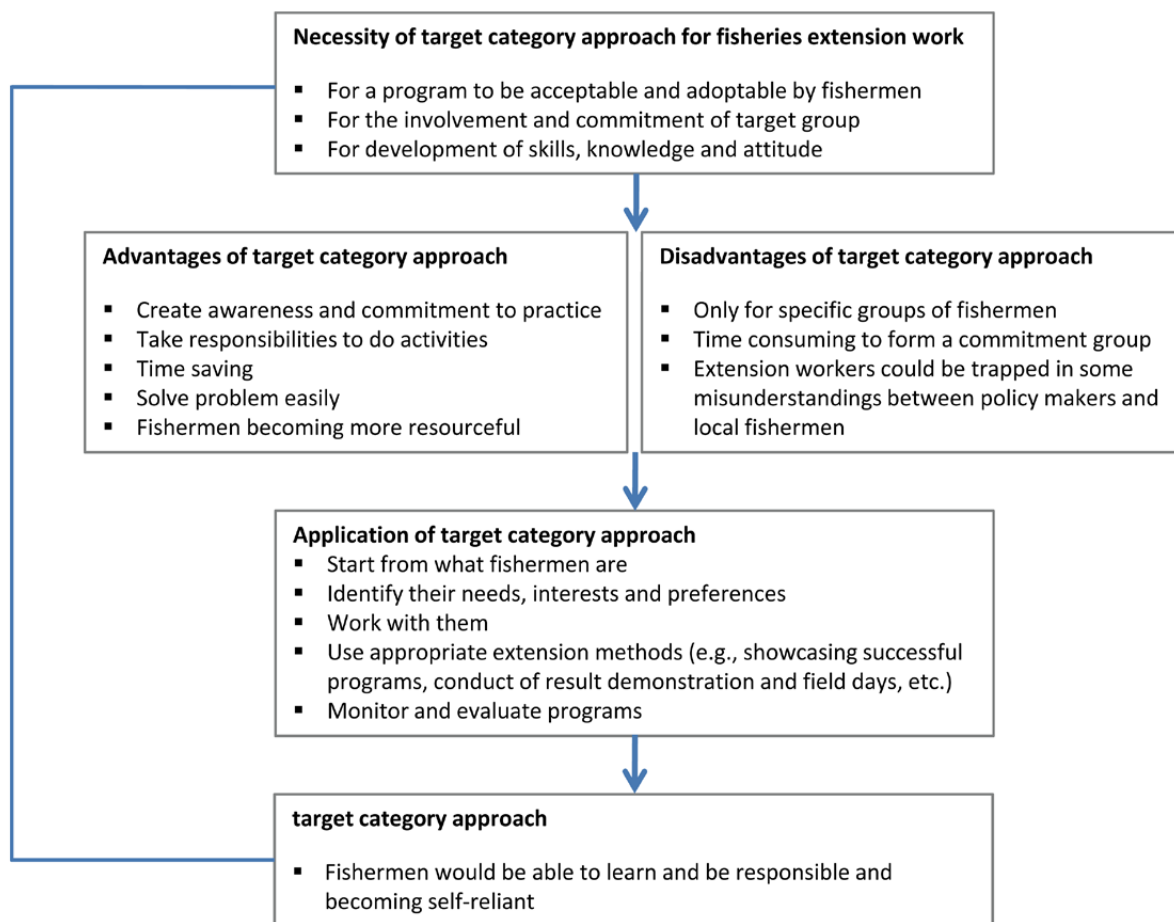


Fig. 1. The necessity, advantages, disadvantages, application and outcomes of target category approach

indicating in the plans the process on how to apply the target category approach. The most important thing to consider is for SEAFDEC/TD to make sure that the target category approach is put into actual practice by the participants. In this regard, SEAFDEC/TD should encourage the participants to formulate their respective programs as well as coordinate and formalize linkages with the participants in order to monitor and evaluate the adoption of the target category approach in the extension activities in their respective countries. It is essential to expand the cooperation across the representative countries to ensure that the knowledge gained from the training course specifically on the extension approaches will prove beneficial and practical.

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# Breeding of “Foli” for the Socio-economic Upliftment of Rural Fish Farmers

Md. Idris Miah

Foli, *Notopterus notopterus* (Family: Notopteridae) has been successfully bred in Bangladesh through induced spawning by a group of researchers led by Prof. Dr. Md. Idris Miah of the Bangladesh Agricultural University in Mymensingh, Bangladesh under their project on “Induced breeding, larval rearing and culture management techniques of Foli.” The experience of Dr. Miah and his group could also be adapted in the Southeast Asian countries where the “foli” fish is found and could be cultured as means of uplifting the socio-economic conditions of the region’s rural fish farmers.

Foli (*Notopterus notopterus*), also known as Asiatic knifefish or bronze featherback fish, is an economically important freshwater fish in South and Southeast Asia, specifically in Bangladesh, India, Cambodia, Indonesia, Malaysia, Myanmar, Thailand and Vietnam. The fish is called by different names in these countries. Known as foli in Bangladesh, the notopterid fish is called “Trey slat” in Cambodia, “Kapirat” in Indonesia, “Belida” in Malaysia, “Nga-pe” in Myanmar, “Pla cha lat” in Thailand, and “Cá thát lát” in Vietnam. Its relative, the *Notopterus kapirat* is known as “kanduli” in Assamese, although the Philippine “kanduli” (*Arius* spp.) is known to belong to the Ariidae family.

## Significance of the Project on Artificial Breeding of the “Foli” Fish

According to the International Union for Conservation of Nature (IUCN) in 2000, out of 266 living fish species (freshwater and brackishwater fish species) in Bangladesh, 12 are critically endangered, 28 are endangered and 12 are vulnerable and more are under increasing threat for sustainability (Mazid, 2002; Ahmed and Wahab, 2003). Foli is one of the endangered freshwater fishes in Bangladesh, and considering its economic importance, Prof. Dr. Idris Miah assisted by Md. Mokhlesur Rahaman, S.M. Farid, Md. Sayeed Harun, Harun Ar Rashid, Nasimul Islam, and Azadul Islam conducted studies on the induced breeding, larval rearing and culture management techniques for the “foli” fish at the Bangladesh Agricultural University in

Mymensingh, Bangladesh with funding support from the University Grants Commission. Their efforts led to the first successful induced breeding of the “foli” fish in Bangladesh in 2007.

Bangladesh is one of the richest countries of the world in terms of aquatic biodiversity, where many indigenous fish species are found in its natural water bodies such as in haors (natural depressions on floodplains), boars (or Oxbow lakes are formed by loops of zigzagging waters cut-off by floods when the river adopts a shorter route), beels (natural depressions), rivers, canals, flood plains, etc. The country’s indigenous fish species, e.g. the foli fish, are part of the cultural tastes of the Bangladeshi considering their nutritional value. In 2006, Bangladesh produced 2.3 million mt of fish where almost 80% comes from inland fisheries, of which 46% was contributed by aquaculture and 52% from capture fisheries (Table 1). The inland capture fisheries sub-sector contributes 4.92% to the country’s GDP where about 2 million people are engaged in inland capture fisheries, either fulltime or part time.

However, reports have indicated that the inland freshwater fish stocks have been lost due to over-exploitation, indiscriminate destructive fishing activities, ecological imbalance, soil erosion, siltation, breeding ground destruction and other factors caused by human development activities. Recent estimates suggested that worldwide 20% of all freshwater fish species have become extinct or endangered (Moyle and Leidy, 1992). The main objectives of the project are to develop suitable technology for the artificial propagation of the “foli” fish and develop methods for larval rearing and culture. Specifically, the project aims to study the complex breeding biology and breeding techniques of this fish species; breed the “foli” using pituitary gland (PG) extract and HCG hormone; determine the fertility and hatching rate of eggs in relation to varying temperature and time; study the embryonic processes; assess the growth performance and yield of the species under monoculture system; and develop a sound and economically viable technology package for large-scale culture of the “foli” fish.

Table 1. Fisheries production of Bangladesh (in metric tons)

Source of production	2001	2002	2003	2004	2005	2006
Inland capture fisheries	688,920	688,435	709,333	732,067	859,269	956,686
Marine capture fisheries	379,497	415,420	431,908	455,207	474,597	479,810
Aquaculture	712,640	786,604	856,956	914,752	882,091	892,049
Total	1,781,057	1,890,459	1,998,197	2,102,026	2,215,957	2,328,545

Source: Fishstat Plus (2008)

## Commercial and Economic Value of the “Foli” Fish

Bangladesh has the potentials for culturing freshwater fishes considering the countries 43.10 million hectares of inland waters (BBS, 1994). Many indigenous fishes are becoming endangered, and being economically and nutritionally important to the country, these fishes are now being conserved through artificial propagation. One of the most important freshwater fishes is the “foli” (*Notopterus notopterus*). A biochemical study conducted by Kamal et al (2007) showed that the “foli” fish is a rich source of protein having a protein content of 19.8% and lipid content of about 5.0%. Considering the present per capita annual fish consumption in Bangladesh which is 14 kg/year compared to the recommended minimum requirement of 18 kg/person/year, there is a need to improve the country’s fish consumption (FAO, 2005). Grown under natural conditions maintaining the original text and texture, and consumed in fresh as well as dried state, “foli” fish could therefore contribute to the supply of protein to the peoples of Bangladesh. However, its sustainable culture should be further ensured.

In the Southeast Asian region, SEAFDEC (2008) reported that the 2005 production of miscellaneous freshwater fishes that include the Asiatic knifefishes was 497,000 mt valued at USD 49,305,000 from inland fisheries; and 920,659 mt valued at USD 566,356,000 from aquaculture (Table 2). Under the International Standard Classification of Aquatic Animals and Plants (ISSCAAP) developed by FAO, knifefishes have been grouped under miscellaneous freshwater fishes. ISSCAAP has been used by SEAFDEC in reporting fisheries statistics in the Southeast Asian region (SEAFDEC, 2008a).

In many Southeast Asian countries, specifically in Myanmar inland freshwater resources have been considered as important areas for freshwater fish fauna in terms of

diversity and endemism (Chavalit *et al*, 2005). Situated in the intermediate zone of the Indian Sub-continent and mainland Southeast Asia, Myanmar shares the fish taxa of both sub-regions. One of the most economically important freshwater fishes found in Myanmar is the notopterids. “Nga-pe” (in Burmese) is one of the smallest featherback spars with shorter jaws with its body having long anal fin and small dorsal and pelvic fins (Chavalit et al, 2005).

### Breeding of the “Foli” Fish (*Notopterus notopterus*)

The fish has plain brown color with slightly concave dorsal head. The juveniles are silvery-white having dark bars on their whole body and numerous fine grey spots on body and head. The adult male is smaller than the adult female. The dorsal fin is short, situated slightly nearer to the snout tip than to the base of the caudal pelvic fin. The anal fin is very long which extends more than 2/3 of the length of the fish confluent with its very small caudal fin. The fish is generally dark on its back and silvery on the sides.

“Foli” fish is abundant in the freshwater areas throughout Bangladesh. The largest specimen examined by the project was only about 280 mm in total length. It is observed to breed during May and June. It is mainly carnivorous and offers parental care. It is good for sports fishing with rod-and-line. Reports have indicated that the largest fish which was 355 mm in length and weighing 315 g was recorded at the Gachar Dahar Beel in the Sylhet District (Rahman, 1989).

For the research project, about 200 pcs of “foli” were collected from different areas of the Mymensingh District, and were stocked at the University Fisheries Complex ponds. When the male and female were observed to have attained maturity, they were caught with net and kept under shower for 12 hours. The female were kept under shower after PG hormone injection. After 6 hours of the 1<sup>st</sup> dose

**Table 2.** Production of miscellaneous freshwater fishes in Southeast Asia (2005)

Countries*	Production from inland fisheries		Production from aquaculture	
	Quantity (mt)	Value ('000 USD)	Quantity (mt)	Value ('000 USD)
Cambodia	323,500	na	6,000	na
Indonesia	28,105	29,139	na	na
Malaysia	1,575	3,523	2,543	4,438
Myanmar	na	na	323,778	3,737
Thailand	124,500	na	3,197	76,256
Vietnam	na	na	585,100	36,400
SEA Total**	497,500	49,305	920,659	566,356

\* Refers only to countries where the Asiatic knifefishes are found

\*\* Refers to total production from all Southeast Asian countries

Source: SEAFDEC (2008)





*Notopterus notopterus*  
Source: Chavalit et al, 2005

and 2<sup>nd</sup> dose given to the female fish, the 1<sup>st</sup> dose was given to the male fish. The eggs were stripped from the female using pressure method 6 hours after the 2<sup>nd</sup> dose of hormone injection. The sperms were collected from the male, and the sperms and eggs immediately mixed properly. The fertilized eggs were kept on a tray which is supplied with water shower by small drops. The eggs were hatched within 6 days, however, hatching rate was observed to depend on the temperature. After five days from hatching, the fry were given boiled egg emulsion as feed.

## Way Forward and Conclusion

The research study being conducted at the Bangladesh Agricultural University in Mymensingh expects to apply more developing methods and more intensive activities during the coming breeding season of the “foli” fish. As envisaged, the technology would be extended commercially with the technology package to be disseminated to the field farmers, which would include the artificial breeding technique, brood fish management, stocking density, water quality management, and feed management including optimum dosage of the hormones used. It was also envisaged that after two to three years, the cost benefit analysis could be derived from the aquaculture of the “foli” fish.

The Southeast Asian countries could also benefit from the results of the research study especially in countries where the “foli” fish is one of the most economically important freshwater fishes. This could bring socio-economic upliftment of the rural fish farmers as reflected in terms of increased fish production, increased supply of protein to mitigate malnutrition problems, increased income, creation of employment opportunities, and ensuring food security.

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# CALENDAR OF EVENTS

Date	Venue	Title	Organizer
<b>2009</b>			
18-22 May	Colombo, Sri Lanka	Regional Workshop on Practical Implementation of Ecosystem Approach to Fisheries and Aquaculture in the APFIC Region	FAO RAP
18 May-23 Jun	Philippines	Training on Marine Fish Hatchery	AQD
26-27 May	Thailand	Preparatory Meeting of the ASEAN Fisheries Consultative Forum (AFCF)	ASEAN
26-28 May	Samutprakarn, Thailand	Regional Workshop on the Standard Operation Procedure and Development/Improvement of Sampling Gears for the Deep-Sea Resource Exploration	TD
27-28 May	Bangkok, Thailand	ASEAN-FAO Regional Conference on Food Security	ASEAN, FAO
1-2 June	Vietnam	1 <sup>st</sup> Meeting of the ASEAN Fisheries Consultative Forum (AFCF)	ASEAN
3-5 June	Vietnam	17 <sup>th</sup> Meeting of the ASEAN Sectoral Working Group on Fisheries (ASWGF)	ASEAN
8-23 June	Samutprakarn, Thailand	Training Course on Coastal Fisheries Management and Extension Methodology for Thai Officers	TD
15-19 June	Indonesia	HRD Workshop for the Promotion of "FOVOP" in Indonesia	Secretariat
15-19 June	Bangkok, Thailand	FAO-SEAFDEC Workshop on the Assessment of Fishery Stock Status in South and Southeast Asia	FAO-SEAFDEC
25-26 June	Bangkok, Thailand	SEAFDEC Departments' Chief Meeting	SEAFDEC
29 June - 3 July	San Sebastian, Spain	2 <sup>nd</sup> Joint Meeting of Tuna Regional Fisheries Management Organization 2009	CCSBT, IATTC, ICCAT, IOCT, WCPFC
3-23 July	Philippines	Training on Abalone Hatchery and Grow-out	AQD
7-17 July	Lao PDR	3 <sup>rd</sup> Joint Regional Training on Community-Based Freshwater Aquaculture for Remote Rural Areas of Southeast Asia	Secretariat
30-31 July	Samutprakarn, Thailand	Regional Workshop on Information Gathering and Cetacean Research in the Southeast Asian Waters	TD
27-29 July	Satun, Thailand	Fishing Record and Inventory	SEAFDEC/Sida
3-13 August (tentative)	Myanmar	HRD Workshop for the Promotion of "FOVOP" in Myanmar	Secretariat
17-18 August	Manado, Indonesia	International Seminar on Building a Comprehensive Maritime Security and Possible Benefit to the Effort to Minimize Illegal Fishing in the Region	RPOA-IUU
19-21 August	Manado, Indonesia	Workshop on MCS Curriculum Development and Capacity Building	RPOA-IUU
2-4 September (Tentative)	Thailand	Regional Technical Consultation on Regional Advisory Committee for Fisheries Management in Southeast Asia (RAC)	SEAFDEC
August (tentative)	Phuket, Thailand	Meeting of the Sub Regional: Andaman Sea	SEAFDEC/Sida
Aug /Sep (tentative)	Singapore	Regional Technical Consultation on Chemical and Drug Residues in Fish and Fish Products in Southeast Asia (Biotoxins Monitoring in Fish and Fish Products in ASEAN)	MFRD
Aug /Sep (tentative)	Singapore	End-of-Activity (EOA) Workshop on Good Manufacturing Practices for Traditional Products Establishments	MFRD
5-9 October	Bangkok, Thailand	2 <sup>nd</sup> FAO-SEAFDEC Workshops on the Assessment of Fishery Stock Status in South and Southeast Asia'	FAO-SEAFDEC
12-14 October (tentative)	Thailand	10 <sup>th</sup> Meeting of SEAFDEC Information Staff Exchange Program (ISEP)	SEAFDEC
23-27 November	Manila, Philippines	East Asian Seas Congress 2009	EAS

## Southeast Asian Fisheries Development Center (SEAFDEC)

### What is SEAFDEC?

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

### Mandate

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

### Objectives

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

### SEAFDEC Program Thrust

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



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