FISH for the PEOPLE

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

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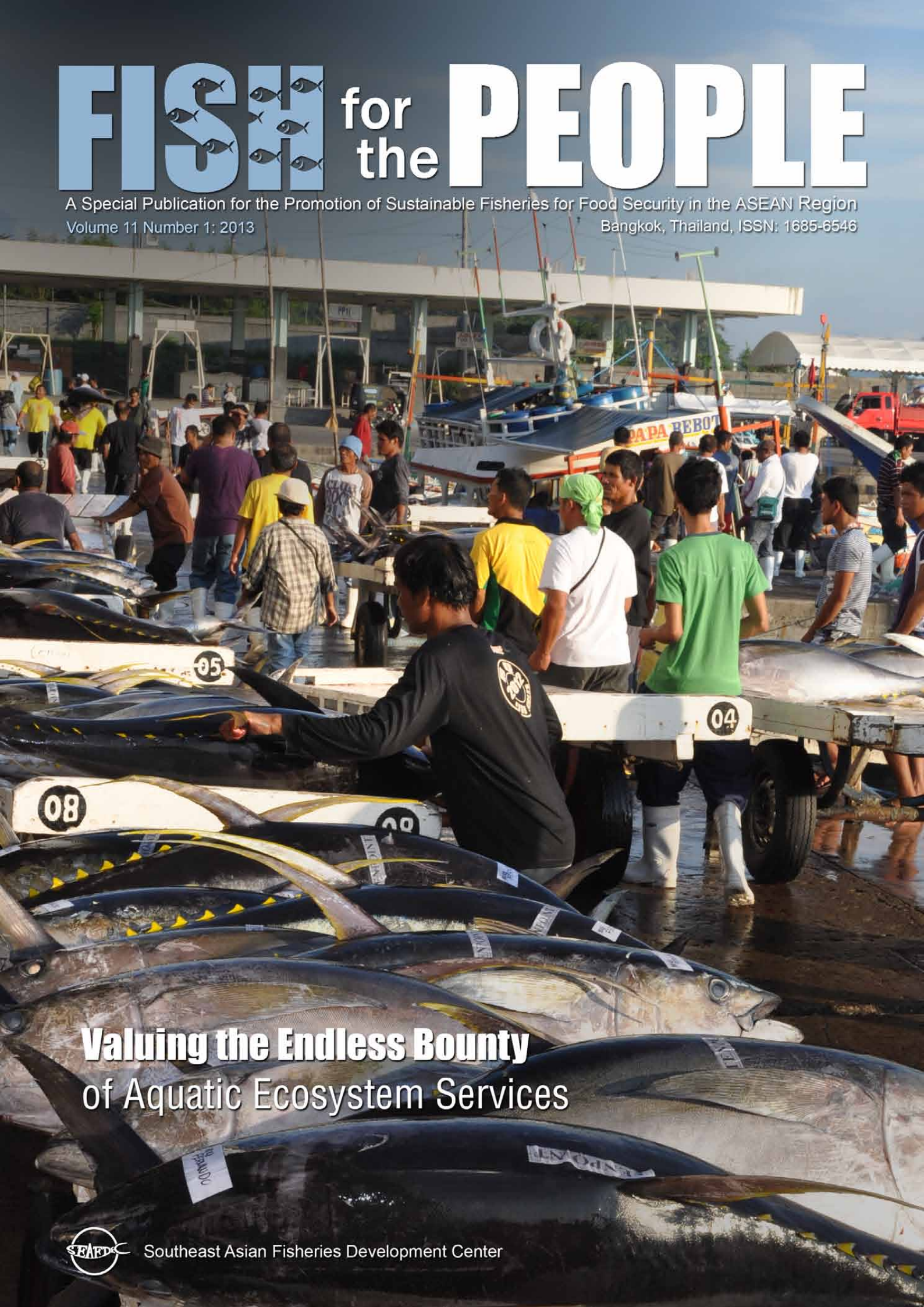

Valuing the Endless Bounty of Aquatic Ecosystem Services

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Editorial

Since time immemorial, mankind has been reaping the benefits of a myriad of resources from natural ecosystems. Given the present state of advancements however, such benefits may not be able to sustainably render ecosystem services necessary for the well-being of human due to natural causes and the impacts of anthropogenic activities. Specifically, fisheries as one of the most important ecosystem services provided by marine and freshwater aquatic ecosystems may not be able to sustain its role in providing food and income to peoples in the long run. Although not a very optimistic insight but based on numerous reports, marine resources in general have been over-exploited while freshwater resources have been continually challenged by man-made interference courtesy of massive constructions of dams and other water barriers resulting in overly reduced water flows. Added to this woe are some unregulated activities of human such as the irresponsible use of chemicals in agriculture which transports residues to the waters and introduction of alien aquatic species that ravages the native breed affecting ecological diversity in waters.

It is recognized that peoples of the Southeast Asian region have been harvesting the bounties from marine and freshwater aquatic ecosystems not only for food but also for economic revenues. From such endeavors, human tends to make alterations of the natural ecosystems to maximize harvests necessary to meet the growing demand for seafood. Granting that such changes might have swollen the coffers of national governments, it is dismal to note that the impacts of such efforts on the ecosystems are often disregarded and taken for granted. The continued weakening benefits offered by the aquatic ecosystem services through fisheries, therefore impedes the attempts of many countries to attain their respective socio-economic development goals of reducing poverty.

At the current rate of fisheries development, pressure on the aquatic ecosystems is expected to increase globally as the demand for food fish continues to rise proportionately to the world's increasing population. In the midst of such a situation, the attitudes and actions of human have not changed and as a matter of fact, human's behavior continues to be attuned with such indications. Human still seems not to take into account the value of the aquatic ecosystem services as could be seen from their irresponsible

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exploitation of the fisheries resources. At this point in time, it has therefore become necessary that governments recognize such situation and pool their efforts in protecting and conserving the nature's aquatic assets and strive to mainstream in policy-decisions the need to appreciate the full value of the aquatic ecosystem services.

Although it can be said that the Southeast Asian countries are exercising caution in exploiting the resources to ensure that productivity of the aquatic ecosystems is sustained, intensified efforts remain crucial in order that the continued contribution of these ecosystems to human well-being is assured through steady supply of food and adequate livelihood opportunities. The Southeast Asian countries are also becoming much aware of the present condition of the aquatic fisheries resources which may not be sufficient to satisfy the potential increasing demand for food fish while the quantity and quality of the resource being extracted remain degraded. Thus, working hand-in-hand with SEAFDEC, the Southeast Asian countries are now taking great strides to adopt the ecosystem approach to fisheries management to minimize the impacts of fisheries on the environment, and subsequently, to value the significance of aquatic ecosystem services for the well-being of the present and future generations. Correlated with the provisions stipulated in the ASEAN-SEAFDEC Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020, such endeavors are also meant to correspond to the fundamentals of the ASEAN Economic Community and ASEAN Socio-Cultural Community, which are expected to take place by 2015.

Meanwhile, our Special Publication *Fish for the People* had already completed ten years of continued portrayal of the achievements of SEAFDEC and the Southeast Asian countries in implementing two sets of Resolutions and Plans of Action, the first of which was adopted in 2001 while the second in 2011. As the Special Publication enters into its 11th year, it is our wish that more support could be mustered from our audience, clients, patrons, and other stakeholders in order that the contents of the subsequent issues could be enhanced with sustained accounting of regional movements, and that it would be able to continue championing SEAFDEC, as in the past 10 years, in its effort to boost its visibility. ***-Eds***

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CONTENTS

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

Improved Time Series of Fisheries Catch Data for Estimating Potential Yields

Somnuk Pornpatimakorn and Suppachai Ananpongsuk

Information on production from the exploitation of marine and freshwater resources as well as from aquaculture is vital for developing economic and social plans as well as management programs. In the Southeast Asian region, the existing systems for collecting fisheries data and information still reflect the traditional monitoring practices that focus on total catch and value. Moreover, in the synthesis of the region's fisheries production, small-scale fisheries are often not being given due attention may be because there has been no proper monitoring of this particular fisheries. Considering that small-scale fisheries constitute the biggest chunk of the region's fisheries, it is therefore necessary that multi-sectoral approaches in collecting fisheries data be actively developed including the compilation of information on the socio-economic and livelihood aspects of small-scale fisheries. Therefore, in order to fully support development plans and implementation of sound policies and sustainable management, appropriate indicators should be developed and their utilization optimized to be able to present circumstances behind the region's fisheries development. SEAFDEC has been playing an important role in compiling fisheries data and information of Southeast Asia, and publishing such data into the annual SEAFDEC Fishery Statistical Bulletin of Southeast Asia which has become one of the recognized sources of fishery information. The fisheries data in the Statistical Bulletin are also available in the Fisheries Statistical Database maintained by the SEAFDEC Training Department (TD). In spite of certain shortcomings, attempts have been made by SEAFDEC/TD to use the existing database in estimating the potential yields from fisheries in Southeast Asia, as summarized in this paper. Furthermore, in addressing the aforementioned concerns, SEAFDEC is also spearheading a regional approach in the compilation of relevant information from small-scale fisheries of the Southeast Asian region, and organizing such data into time series to estimate the potential fisheries yields.

The SEAFDEC Fishery Statistical Bulletin of Southeast Asia, which is published annually by SEAFDEC since 1979, aims to provide fisheries data for management planners, administrators and scientists engaged in research, development and conservation of the fisheries resources, based on standardized classifications and definitions to facilitate data comparison and analysis. The data and information contained in the Bulletin are provided by the Southeast Asian countries based on their respective systems of collecting fishery statistics. The SEAFDEC Secretariat also attempted in 2012 to assemble the compiled information into the status and trend of the region's fisheries resources (SEAFDEC, 2012). During the period from 1976 to 2007, the said Fishery Statistical Bulletin covered the South China Sea Area designated as FAO Fishing Area 71 and the territorial waters of the Andaman Sea belonging to Malaysia and Thailand. Recognizing that the usefulness of the data set is not only for regional management purposes but also for the benefit of transboundary countries sharing the same waters in a particular sub-region, *e.g.* Gulf of Thailand, Andaman Sea, Sulu-Sulawesi Sea, the Southeast Asian countries, SEAFDEC and FAO harmonized in 2008 the minimum requirements and data set while agreeing to the coverage of the Bulletin which should be the Southeast Asian countries only. The fishery statistical items and data sets collected by Southeast Asian countries could differ in accordance with their respective priority needs and objectives. Thus, harmonization was deemed necessary to address the need for fishery statistics which does not only occur at national but also at regional and international levels, especially in analyzing the over-all status and trends of fisheries for development planning and fisheries management from the global point of view.

General Review of the Fishery Statistics of Southeast Asia

The interpretation or translation of important fishery statistics could be summarized taking into account the importance of fish as a main agricultural commodity that provides significant contributions to food security. From the compiled fishery statistics, it could be gleaned that the Southeast Asian countries provided about 19% to the world's total fisheries production in 2010 (**Fig. 1**). The fisheries production trend of the Southeast Asian countries from 2001-2010 is shown in **Table 1**.

The Southeast Asian countries have always recognized the importance of fishery statistics, even if some countries still do not have their fisheries statistical collection systems properly in place. Nevertheless, during the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium *"Fish for the People"* in 2001 and the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 *"Fish for the People 2020: Adaptation to a Changing Environment"* in 2011, the ASEAN-SEAFDEC Member

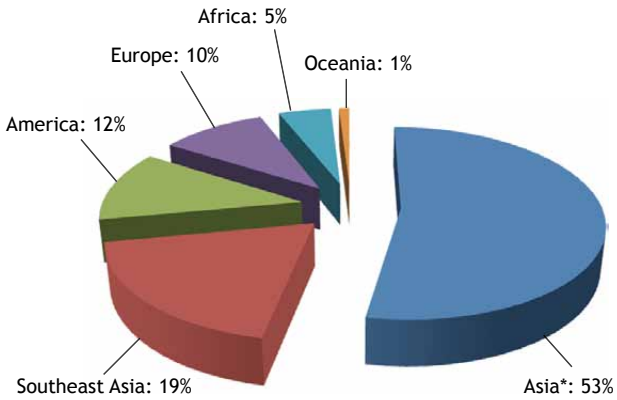

Fig. 1. Contribution of Southeast Asian fisheries to the world's total fisheries production (2010)

Sources: *Fishery Statistical Bulletin of Southeast Asia 2010; FAO FishStat Plus-Universal Software for Fishery Statistical Time Series*
(Note: Asia does not include Southeast Asia)*

Countries reaffirmed the importance of fishery statistics and information (SEAFDEC, 2011). Thus, the SEAFDEC Secretariat put more efforts in strengthening national fishery statistical systems, maximizing their usage for fisheries planning and management, and developing standard definitions and classifications to facilitate the exchange of regional and international fishery statistics and information.

The region's fishery statistics shown in **Table 1** indicate that the top producing countries in 2010 were Indonesia, Philippines, Vietnam, Myanmar, and Thailand in that order. These countries attained increasing trends in their respective annual production except Thailand, where its decreasing production could be assumed as mainly due to overfishing in the Gulf of Thailand.

The region's fisheries production comes from three main sub-sectors, namely: marine capture which accounts for a major portion of the production although the trend seemed to have declined starting in 2009; inland capture which has played a very important role as main source of protein for the poor and rural people; and aquaculture now being regarded as a very important sub-sector for economic development since large portion of its production is bound for the export market. **Fig. 2** shows the contribution of these sub-sectors to the total fisheries production of Southeast Asia in 2010.

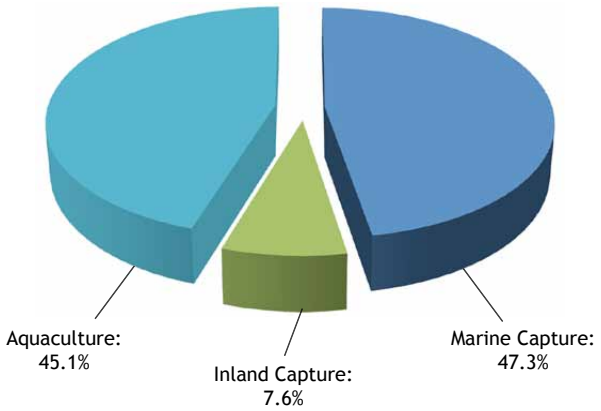

Fig. 2. Contribution of fisheries sub-sectors to the total fisheries production of Southeast Asia in 2010

Source: *Fishery Statistical Bulletin of Southeast Asia 2010 (SEAFDEC, 2010)*

Table 1. Fisheries production of the Southeast Asian countries* ('000 metric tons)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Brunei Darussalam	1.6	2.2	2.2	3.1	3.1	3.0	3.2	2.7	2.4	2.8
Cambodia	441.0	424.4	390.7	343.4	546.0	661.5	525.1	536.3	515.0	551.5
Indonesia	5,353.5	5,515.7	5,916.0	6,005.6	6,646.9	7,183.5	7,510.8	9,054.9	10,064.1	11,664.5
Lao PDR	-	-	-	94.7	107.8	107.8	91.7	93.5	105.0	113.2
Malaysia	1,411.8	1,467.5	1,484.0	1,537.9	1,402.4	1,596.1	1,654.2	1,639.0	1,729.0	1,807.6
Myanmar	1,474.5	1,606.2	1,987.0	2,148.5	2,581.8	2,818.0	2,808.0	3,147.6	3,491.1	3,904.2
Philippines	3,166.5	3,369.5	3,619.3	3,926.1	4,161.9	4,412.2	4,711.0	4,964.7	5,084.7	5,156.6
Singapore	7.8	7.8	7.1	7.6	7.9	11.7	8.0	5.2	5.7	5.2
Thailand	3,648.4	3,797.0	3,914.0	4,137.1	4,132.8	4,051.8	3,675.4	3,204.2	3,137.7	3,115.5
Vietnam	2,434.7	2,647.4	2,859.2	2,944.0	3,397.2	3,656.2	4,315.5	4,559.7	4,782.4	5,127.8
Region's Total	17,939.8	18,837.7	20,179.5	21,148.0	22,987.8	24,501.8	25,302.9	27,207.8	28,917.1	31,448.9
World's Total**	130,700.0	133,000.0	132,200.0	134,300.0	136,400.0	137,100.0	139,800.0	142,300.0	145,100.0	164,800.0
% of world's total	13.7%	14.2%	15.3%	15.7%	16.9%	17.9%	18.1%	19.1%	20.0%	19.0%

* ***Sources:*** *Fishery Statistical Bulletin for the South China Sea Area (SEAFDEC, 2001-2007)*
Fishery Statistical Bulletin of Southeast Asia (SEAFDEC, 2008-2010)
** ***Source:*** *FAO Fisheries and Aquaculture Information and Statistics Services*

Production from Marine Capture Fisheries

While the production trend of the global marine capture fisheries seems to have slightly declined, the region's production trend has been increasing by about 1.8% per year and contributed about 18% to the global marine capture fisheries production in 2009 (SEAFDEC, 2012). Indonesia has been the largest producer accounting for about one third of the region's production while the Philippines contributed 17%, Vietnam 15%, Myanmar 13%, Thailand 11%, and Malaysia 9%. The main species produced by marine capture fisheries have not been classified but reported only as miscellaneous fishes which comprised about one third of the total catch. A big portion of the production came largely from pelagic fishes such as mackerels, tunas, jacks, sardines and anchovies, and from non-fish groups, *e.g.* cuttlefish, squids, shrimps, and other crustaceans.

Production from Inland Capture Fisheries

Large numbers of the people in Southeast Asia are living near seashores and directly dependent on fisheries for food and income. Another large group of people inhabit the countryside near rivers and other inland waters, and are mainly dependent on freshwater fish and fisheries products as source of their protein requirement, and thus, a large portion of catch from inland capture fisheries is directly utilized for household consumption without proper recording. Therefore, most of the current information on inland capture fisheries is based mainly on available recorded statistics, and based on recorded information, the region's production from inland capture fisheries is said to have contributed about 8% to the total fisheries production of Southeast Asia in 2009 (SEAFDEC, 2012). Myanmar, Indonesia and Cambodia are the top producers of freshwater fish from inland capture fisheries (**Table 2**).

Currently, only eight Southeast Asian countries could provide production data from inland capture fisheries. Production of Singapore and Brunei Darussalam is negligible or non-significant, since inland fishing activities in these countries are minimal, where rivers and lakes could have been preserved as source of freshwater supply. Nevertheless, the total production from inland capture fisheries of the Southeast Asian countries in 2010, which was about 2.4 million metric tons, contributed about 8% to the region's total fisheries production. Moreover, the region's inland capture fisheries are generally characterized as multi-gear and multi-species, involving mainly the small-scale fishers, with most of the catch utilized directly for household consumption.

Production from Aquaculture

Aquaculture in Southeast Asia has been rapidly growing and its production in 2009 accounted for about 23% of the world's total aquaculture production. The regional aquaculture production has significantly increased from 4.3 million metric tons in 2001 to 14.2 million metric tons in 2010. Specifically in 2010, mariculture accounted for about 49% of the region's total production from aquaculture, followed by freshwater culture by 29% and brackishwater culture by about 22%. Aquaculture has the potentials to fill the gap in food fish supply considering the unstable fisheries production from nature, especially from marine and inland capture fisheries. However, since fish meal is still an essential component of most aquaculture feeds, such situation is expected to create some impacts on the fishing effort and incessant destruction of the natural fisheries resources until such time that other sources of protein, *i.e.* from plants, are uncovered to serve as substitutes for fish meals.

The major species cultured in the region vary in accordance with the geographical area and the preference of the countries. In Indonesia, for example, the main aquaculture commodity is seaweeds which accounts for about 62% of country's total aquaculture production, followed by freshwater fishes 20%. Similarly for the Philippines, the main commodity cultured are species of seaweeds

Table 2. Production from inland capture fisheries of Southeast Asian countries ('000 metric tons)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Cambodia	360.0	360.3	308.8	250.0	444.0	559.6	420.0	430.6	390.0	405.0
Indonesia	310.3	305.0	308.7	330.9	297.4	293.9	310.5	497.7	494.6	355.0
Lao PDR	-	-	-	-	29.8	29.8	28.4	29.2	30.0	30.9
Malaysia	3.5	3.6	3.8	4.1	4.6	4.2	4.3	4.4	4.5	4.6
Myanmar	254.9	289.9	454.3	502.6	631.1	718.0	717.6	814.7	899.4	1,002.5
Philippines	136.4	131.7	133.3	142.0	143.8	165.1	168.3	179.5	188.4	185.4
Thailand	202.5	198.7	198.4	199.6	198.8	214.0	225.6	228.6	245.5	209.8
Vietnam	243.6	227.0	208.6	-	138.8	152.3	133.6	144.8	144.8	194.2
Total	**1,511.2**	**1,516.2**	**1,615.9**	**1,429.2**	**1,888.3**	**2,136.9**	**2,008.3**	**2,329.5**	**2,397.2**	**2,387.4**

Sources: *Fishery Statistical Bulletin for the South China Sea Area (SEAFDEC, 2001-2007)*
Fishery Statistical Bulletin of Southeast Asia (SEAFDEC, 2008-2010)

(*e.g. Encheuma cottonii* and *Encheuma denticulatum*) representing about 59% and 5%, respectively of the country's total aquaculture production, the rest of which are milkfish and tilapia. Vietnam's main aquaculture commodities are the Panga catfish accounting for about 41% of the country's total aquaculture production, other freshwater fishes 36% and tiger shrimp 12%. Thailand's main commodity is the white leg shrimp representing about 38% of the country's total aquaculture production, followed by green mussel at 17%, tilapia 15%, catfish hybrid 10%, and other species. Myanmar's main commodities are rohu (*Roho labeo* or *Labeo rohita*) which contributes about 67% to the country's total production from aquaculture, other freshwater fishes 18%, *Penaeus monodon* (tiger shrimp) 6%, and tilapia 5%. Although the region's production of aquatic plants or seaweeds had been increasing during the past decade, utilization of these commodities does not directly contribute to food production. However, it could be assumed that derivatives from seaweeds of about 50% of the total quantity produced are used for human consumption which in the end, also contribute to food security.

Time Series of Existing Fisheries Production Data

The fisheries data in the Fishery Statistical Bulletin for the South China Sea Area published by SEAFDEC from 1976 to 2007 include annual total landings provided by some Southeast Asian countries, as well as those for Taiwan and Hong Kong in the South China Sea area. During such time, some countries in the region provided incomplete data, but such data had been useful in terms of time series. Nevertheless, as the region's statistical information system develops, compilation of fisheries data had been improved especially during the past decade.

The fisheries data and information compiled into the Fishery Statistical Bulletin of Southeast Asia indicate a time series of the catch which could serve as one of the indicators for determining the status of the biomass or stocks of the fisheries resources. The trend of such data could also fulfill the attempts to detect and interpret the biomass of fully assessed stocks. Hence, the Fishery Statistical Bulletin is still a major source of fisheries data and information for analyzing and interpreting fisheries production trend that could be used for national planning and management of fisheries, especially fishery stocks that are shared between and among countries in the same sub-region. Considering that the set of data in the Fishery Statistical Bulletin are secondary data provided by the countries, accuracy and veracity should be rechecked by each country taking into consideration the data provided by adjacent or neighboring countries in shared waters.

In the past, Taiwan and Hong Kong provided very good time series of their respective data which could be utilized in analyzing the status of the fisheries resources in that relevant part of the South China Sea area. In the recent issues of the Bulletin, Indonesia, Malaysia, Philippines, Singapore, and Thailand provided almost all the necessary data over the past 30 years (1977-2007) which are useful for the time series. Although Brunei Darussalam also provided data over the past 30 years, its data set in the earlier years included volumes of imported fish and fisheries products. Vietnam and Cambodia provided only rough estimates of their respective catch starting in 1977, but after harmonizing data collection systems, Vietnam now provides more reliable data and in the same manner, Cambodia also.

From the available data, provisional estimates of the potential yields based on catch data in 1977-2007 could be

Table 3. Status of Southeast Asia's marine fisheries resources based on maximum catch from 1976 to 2007

Country	Maximum Catch (A)	Estimated maximum potential yield	Estimated potential yield (B) = Ax0.8	Average catch for the last 3 years (C)	A-C	B-C
Brunei Darussalam	6,600	6,600	5,280	2,417	4,183	2,863
Cambodia	60,500	60,500	48,400	58,483	2,017	-10,083
Indonesia	4,734,280	4,729,399	3,787,424	4,557,655	176,625	-770,231
Malaysia	1,381,424	1,380,106	1,105,139	1,323,628	57,796	-218,489
Myanmar	1,525,000	1,524,751	1,219,803	1,462,137	62,863	-242,334
Philippines	2,327,815	2,352,239	1,881,791	2,201,616	126,199	-319,825
Singapore	25,042	25,042	20,034	2,848	22,194	17,186
Thailand	2,827,447	2,836,068	2,268,854	2,393,240	434,207	-124,386
Vietnam	1,987,400	1,988,532	1,590,818	1,864,818	122,582	-274,000
Total	**14,875,508**	**14,903,237**	**11,927,543**	**13,866,842**	**1,008,666**	**-1,939,299**

Source: *Calculations from the time series of the total catch of the Southeast Asian countries in 1976-2007, based on data in the SEAFDEC Fishery Statistical Bulletin*

attained, as shown in **Table 3**. The negative value implies that the resources are over-exploited while the positive value denotes under-exploitation. Most of the Southeast Asian countries have enough data for the time series over the last 30 years, but Vietnam has data available only for 1987-2007 while Myanmar has the necessary data from 1997 to 2007. Therefore, the estimated maximum potential yields for Vietnam, Myanmar and Cambodia were calculated for the period from 1997 to 2007 only, as earlier data were only estimates and not supported by landing surveys. For Singapore and Brunei Darussalam, Maximum Catch (A) was used as the Estimated Maximum Potential Yield as their fisheries structure and situation of fisheries are different from the other Southeast Asian countries while their landings had been fluctuating. Therefore, only about eighty percent of the Estimated Maximum Potential Yields could be considered as Estimated Potential Yield (B) as indicated in **Table 3**.

While the region's total means from the last three-year's catch was 13,866,542 metric tons but the estimated potential yield was 11,927,543 metric tons, this implies an over-exploitation of 1,939,299 metric tons. Moreover, the difference between the region's maximum catch of 14,875,508 metric tons and the average catch for the last three years of 13,866,842 is +1,008,666 metric tons, which means that production from the last three years was within maximum limit. However, the fisheries resources of seven countries (Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Thailand and Vietnam) appeared to be over-exploited since the differences between their respective estimated potential yields and average catch over the last three years are negative. As a result, the general situation of the region's marine fisheries resources could be seen as over-exploited, while only Brunei Darussalam and Singapore have the potential to increase their catch. Nevertheless, it should be noted that other influential factors in marine capture fisheries should be taken into consideration before any final conclusion could be made. Thus, using the estimated potential yield method, the overall picture of the status of the region's marine fisheries resources could be established as shown in the **Table 3**. However, since details of single species analysis could not be reflected from the data, the results are based only on aggregates of the entire fisheries where the total potential yields reflect all species caught in the fisheries.

Although the use of the entire fisheries potential yields could be misleading, it is also well known that tropical fisheries are multi-species with complex composition of various fish species. So that even if only few species may be severely over-exploited and/or depleted, but compensations for the fast growing under-utilized species could give high total weight of the catch. Therefore, extended periods of excess fishing pressure can greatly modify the species composition of the catch, leading to reduced abundance of more valuable large species but proliferation of lower-value small species. However, under heavy fishing pressure, even the small, usually highly productive species start to decline so the fisheries usually provide declining production data.

By major species groups, *i.e.* trash fish, miscellaneous fishes, and some other economically-important commodities, status and potential yields could be estimated following the same assumption applied to the total catch as shown in the abovementioned calculations. However, these estimations may over- or under-estimate the potential yields depending on the quality of the data provided. In the past, stock assessment models based on single species model had been derived by Beverton and Holt, Schaefer and Fox, among others, but using their models would require biological information of particular species such as growth and growth rate, length-weight relationship, lifespan, maturity, mortality, and so on. Currently however, many assumptions and methods have been applied to examine the status of stocks such as the use of catch data to indicate whether the status of the fisheries resources is considered as undeveloped, developing, fully exploited, over-exploited or collapsed. For example, Froese and Kesner-Reyes (2002) established that the maximum catch (C_{max}) is highly correlated with the maximum sustainable yield (MSY) and proposed that catches between 0.5 and 1.0 C_{max} are indicative of fully exploited stocks while also implicitly assumed that MSY would be normally found within this range. Therefore, it is justifiable to assume that in marine fisheries, catch levels of 0.5–1.0 C_{max} are indicative of fully exploited stocks. In surplus production models, catch is a predictor of two equilibrium biomasses: either above or below the biomass that can produce the maximum sustainable yield (B_{MSY}) as manifested in **Equation 1**:

$$\frac{B}{B_{MSY}} = 1 \pm \sqrt{1 - \frac{Y}{MSY}}$$

Based on Equation 1, it is assumed that stock biomass in a year before C_{max} is above B_{MSY}, and below thereafter. Consequently, over-exploited (catch between 0.1and 0.5 of C_{max}) and collapsed stocks (catch less than 0.1 C_{max}) would only occur the year after a peak catch, whereas before the C_{max} the same ranges could indicate developing and undeveloped stocks, respectively. The assumption could also be applied to major species groups, where the result from the application of this model compared with the estimation using the potential yield method shown earlier, was found to be the same. Using the data sheets (**Box 1 series**) on the status of each major species group by country (SEAFDEC, 1978-2007; SEAFDEC, 2008-2010), the relationship between C_{max} and B_{MSY} is determined using the Froese and Kesner-Reyes Model (**Table 4**).

Box 1A. Production data sheet (in metric tons): Trash Fish, Misc. Fishes Nei									
Year	Trash Fish				Misc. Fishes Nei				
	Malaysia	Philippines	Thailand	TOTAL	Indonesia	Malaysia	Philippines	Thailand	TOTAL
1978	161,889	4,789	847,421	1,014,099	182,514	33,157	13,903	95,746	325,320
1979	167,282	19,823	784,267	971,372	-	34,378	3,244	77,392	115,014
1980	159,026	15,914	786,858	961,798	259,755	10,546	2,262	80,922	353,485
1981	158,902	4,880	796,747	960,529	204,243	21,216	4,528	79,307	309,294
1982	144,805	5,229	812,789	962,823	206,575	25,256	6,581	82,048	320,460
1983	146,664	5,612	803,337	955,613	236,980	31,422	3,356	73,352	345,110
1984	111,975	4,449	757,637	874,061	492,689	24,954	2,034	92,713	612,390
1985	117,447	2,986	776,421	896,854	473,551	24,739	2,628	106,487	607,405
1986	133,407	6,948	976,236	1,116,591	323,530	22,061	2,877	120,204	468,672
1987	223,822	7,866	1,105,654	1,337,342	341,391	36,070	2,953	128,678	509,092
1988	202,481	13,367	956,113	1,171,961	334,496	39,617	3,085	132,075	509,273
1989	266,314	7,608	980,344	1,254,266	331,626	42,391	2,900	103,948	480,865
1990	314,809	6,808	978,313	1,299,930	301,997	52,443	3,845	108,524	466,809
1991	266,326	6,885	981,840	1,255,051	334,382	46,418	6,565	129,873	517,238
1992	269,892	5,274	1,001,390	1,276,556	329,587	38,956	7,357	164,551	540,451
1993	296,378	5,055	1,026,552	1,327,985	400,399	36,120	10,743	181,164	628,426
1994	314,364	10,126	172,248	496,738	-	45,954	13,857	172,248	232,059
1995	318,695	13,707	915,944	1,248,346	381,065	48,831	9,796	160,863	600,555
1996	294,739	32,709	864,130	1,191,578	433,473	58,100	8,613	175,474	675,660
1997	333,668	7,869	822,110	1,163,647	433,415	-	4,823	162,199	600,437
1998	331,702	-	764,991	1,096,693	456,546	51,100	-	191,215	698,861
1999	318,065	-	765,209	1,083,274	470,576	52,693	-	235,274	758,543
2000	348,203	8,732	775,079	1,132,014	508,966	64,796	6,595	197,877	778,234
2001	347,606	11,073	738,538	1,097,217	568,594	67,840	8,103	246,822	891,359
2002	358,345	11,811	696,641	1,066,797	528,604	87,000	8,965	241,283	865,852
2003	353,810	11,069	697,145	1,062,024	762,421	76,644	8,076	267,242	1,114,383
2004	362,519	10,660	771,723	1,144,902	-	301,396	-	754,416	1,055,812
2005	301,396	-	754,416	1,055,812	816,334	70,527	15,690	185,891	1,088,442
2006	356,875	-	672,686	1,029,561	602,864	72,595	14,848	157,272	847,579
2007	342,972	-	583,076	926,048	523,159	68,744	16,671	140,413	748,987
2008	-	-	-	0	469,361	413,932	150,467	549,230	1,582,990
2009	-	-	-	0	402,417	373,982	16,243	542,228	1,334,870
TOTAL	7,824,378	241,249	24,365,855	32,431,482	12,111,510	2,373,878	361,608	6,136,931	20,983,927

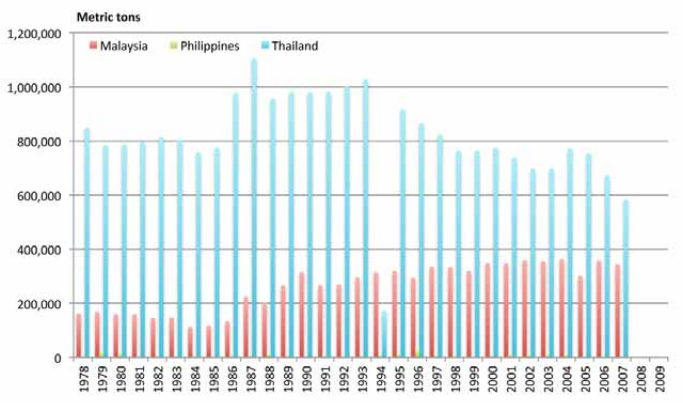

Fig. 3 Production trend: Trash Fish

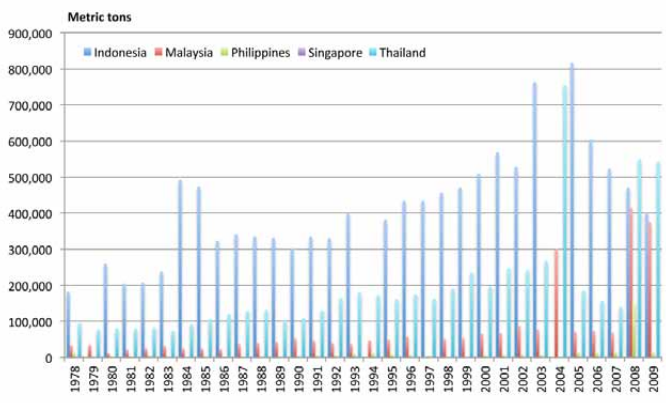

Fig. 4 Production Graph: Miscellaneous Fishes

Box 1B. Production data sheet (in metric tons): Sardines, Round Scad												
Year	Sardines						Round Scad					
	Ind.	Mal.	Phi.	Sin.	Tha.	TOTAL	Ind.	Mal.	Phi.	Sin.	Tha.	TOTAL
1978	130,411	17,500	154,029	276	145,278	447,494	40,872	88,741	18,256	1,187	22,612	171,668
1979	-	15,363	106,403	261	161,892	283,919	-	83,092	17,896	1,093	43,083	145,164
1980	132,097	15,332	117,348	224	105,413	370,414	9,027	78,365	16,824	1,086	17,631	122,933
1981	152,886	18,505	136,871	276	139,800	448,338	63,891	74,727	17,244	1,193	31,256	188,311
1982	160,995	23,801	147,746	374	116,898	449,814	66,342	76,031	18,618	1,489	26,035	188,515
1983	195,517	24,355	151,484	418	124,881	496,655	63,971	67,541	17,592	1,667	22,410	173,181
1984	-	14,849	109,027	493	117,323	241,692	54,442	55,975	15,588	2,179	22,452	150,636
1985	-	11,071	81,927	350	97,742	191,090	67,880	11,276	34,407	729	19,609	133,901
1986	186,740	10,505	73,303	481	121,242	392,271	-	-	-	-	-	0
1987	179,828	28,134	98,694	206	127,208	434,070	-	-	-	-	-	0
1988	228,720	24,129	96,405	398	123,739	473,391	59,994	70,963	13,862	-	88,962	233,781
1989	241,275	16,868	122,468	323	145,038	525,972	58,019	92,450	14,065	-	11,851	176,385
1990	248,487	16,719	156,748	357	120,546	542,857	55,894	90,540	12,359	-	12,138	170,931
1991	281,681	20,120	158,622	379	140,912	601,714	58,079	68,708	13,623	-	11,932	152,342
1992	276,374	23,585	195,879	315	163,527	659,680	63,967	19,880	18,074	-	103,495	205,416
1993	274,599	26,938	256,744	-	152,303	710,584	59,739	22,814	16,688	-	103,583	202,824
1994	313,669	34,681	259,849	-	154,624	762,823	-	-	-	-	-	0
1995	280,650	38,993	264,675	-	195,212	779,530	-	-	-	-	-	0
1996	267,597	44,525	257,804	-	214,857	784,783	76,198	17,236	14,759	-	181	108,374
1997	295,550	-	302,341	-	201,792	799,683	86,512	15,024	16,337	-	8,089	125,962
1998	210,977	46,315	-	-	185,858	443,150	-	-	-	-	-	0
1999	276,181	45,517	-	-	182,813	504,511	98,026	12,256	-	-	2,252	112,534
2000	284,724	33,613	298,466	-	164,014	780,817	105,569	31,359	16,357	-	2,273	155,558
2001	310,023	40,747	282,955	-	145,032	778,757	101,627	27,584	19,693	-	1,724	150,628
2002	332,870	40,611	254,054	-	128,877	756,412	103,078	25,769	22,800	-	1,865	153,512
2003	309,406	40,830	242,968	-	124,919	718,123	100,679	35,619	22,597	-	2,517	161,412
2004	270,484	41,657	270,484	-	119,901	702,526	110,034	41,901	22,818	-	2,648	177,401
2005	302,742	42,243	336,304	-	297,382	978,671	100,038	24,766	23,154	-	2,013	149,971
2006	371,116	54,731	303,755	-	109,508	839,110	-	-	-	-	-	0
2007	380,658	42,889	313,082	-	97,448	834,077	122,128	29,173	23,068	-	1,153	175,522
2008	-	-	369,199	-	78,859	448,058	-	-	-	-	-	0
2009	-	-	467,853	-	96,426	564,279	-	-	-	-	-	0
TOTAL	6,896,257	855,126	6,387,487	5,131	4,601,264	18,745,265	1,726,006	1,161,790	426,679	10,623	561,764	3,886,862

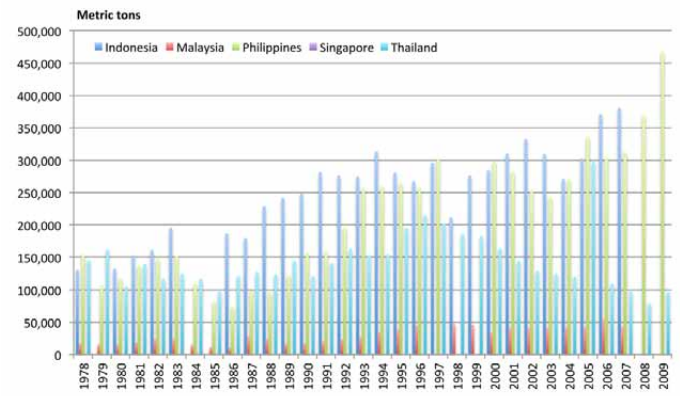

Fig. 5. Production Graph: Sardines

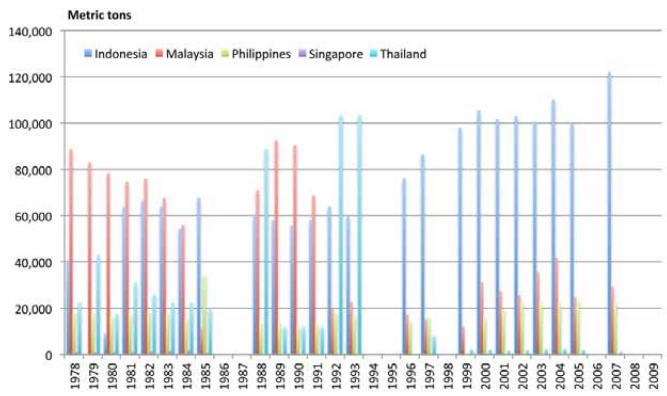

Fig. 6. Production Graph: Round Scad

Box 1C. Production data sheet (in metric tons): Anchovies, Indian Mackerel												
Year	Anchovies						Indian Mackerel					
	Ind.	Mal.	Phi.	Sin.	Tha.	TOTAL	Ind.	Mal.	Phi.	Sin.	Tha.	TOTAL
1978	105,388	18,734	96,408	166	10,308	231,004	-	40,933	45,936	102	37,005	123,976
1979	-	37,514	70,488	114	20,214	128,330	-	20,471	38,972	132	29,221	88,796
1980	96,147	30,487	80,163	108	20,299	227,204	-	-	-	-	-	0
1981	65,637	25,361	149,947	-	37,376	278,321	-	-	-	-	-	0
1982	97,072	23	25,947	-	151,623	274,665	93,593	71,303	24,229	221	21,487	210,833
1983	104,690	35,613	91,420	451	40,619	272,793	95,738	91,478	38,226	224	53,247	278,913
1984	109,299	23,500	99,545	592	90,087	323,023	114,281	87,054	33,192	475	33,436	268,438
1985	106,887	16,776	109,885	496	104,196	338,240	124,988	83,029	37,445	414	36,970	282,846
1986	111,800	18,252	99,687	761	58,987	289,487	132,000	43,993	38,942	371	41,891	257,197
1987	117,995	28,153	108,373	567	57,769	312,857	121,265	71,459	42,726	242	39,876	275,568
1988	115,601	32,065	126,373	543	69,378	343,960	127,505	57,452	51,768	146	25,808	262,679
1989	119,696	30,523	122,250	458	97,080	370,007	145,670	57,120	51,661	115	35,127	289,693
1990	127,797	30,338	107,036	421	123,958	389,550	145,377	68,920	66,278	138	32,293	313,006
1991	135,633	22,185	100,882	470	127,089	386,259	144,094	62,553	61,726	140	32,558	301,071
1992	133,910	38,270	84,652	359	159,884	417,075	177,092	77,250	62,395	110	40,124	356,971
1993	142,786	24,785	81,437	205	165,335	414,548	173,946	67,975	57,246	101	49,729	348,997
1994	150,568	22,363	67,507	170	169,359	409,967	194,882	93,646	57,445	210	64,593	410,776
1995	157,216	22,563	71,516	143	167,987	419,425	193,890	126,170	51,352	151	70,456	442,019
1996	161,779	24,361	71,456	155	161,970	419,721	188,912	95,364	46,264	12	42,099	372,651
1997	183,591	23,772	78,678	150	157,341	443,532	201,404	86,801	54,732	51	42,676	385,664
1998	166,808	25,651	-	73	157,214	349,746	204,763	102,072	-	165	43,682	350,682
1999	163,117	23,045	-	84	134,740	320,986	201,466	111,365	-	129	47,885	360,845
2000	173,944	22,516	79,630	70	143,105	419,265	207,037	98,055	53,715	97	35,203	394,107
2001	190,182	17,723	100,899	62	145,501	454,367	214,387	99,469	60,709	68	31,949	406,582
2002	168,959	23,683	74,095	54	151,731	418,522	221,634	87,910	70,279	35	32,761	412,619
2003	161,141	20,319	71,101	25	153,660	406,246	194,427	124,856	77,120	27	34,190	430,620
2004	154,811	23,449	71,498	24	163,237	413,019	201,882	141,632	75,403	44	34,889	453,850
2005	151,926	16,887	68,947	17	159,685	397,462	222,032	131,272	84,266	31	45,705	483,306
2006	165,024	19,258	70,568	36	157,784	412,670	254,960	132,605	89,089	21	40,473	517,148
2007	175,522	23,975	76,041	32	145,587	421,157	259,458	156,685	88,001	40	32,404	536,588
2008	-	-	-	-	119,964	119,964	15,432	-	91,272	-	15,214	121,918
2009	-	-	-	-	144,056	144,056	-	-	-	-	-	0
TOTAL	4,014,926	722,144	2,456,429	6,806	3,767,123	10,967,428	4,572,115	2,488,892	1,550,389	4,012	1,122,951	9,738,359

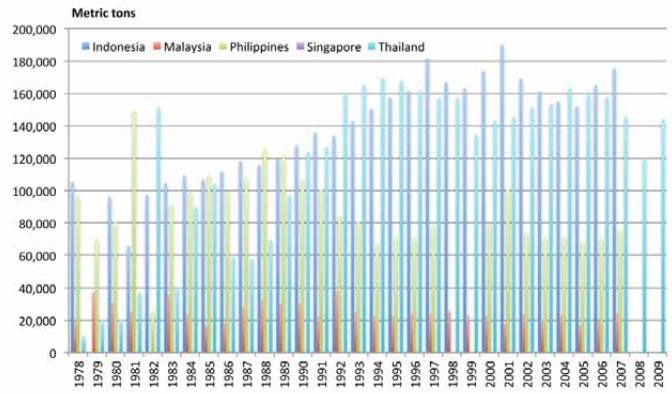

Fig. 7. Production Graph: Anchovies

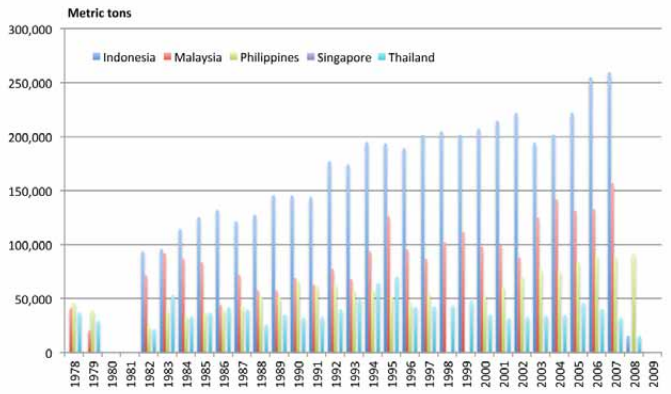

Fig. 8. Production Graph: Indian Mackerel

Box 1D. Production data sheet (in metric tons): Penaeid Shrimps, Non-Penaeid Shrimps											
Year	Penaeid Shrimps						Non-Peaneid Shrimps				
	Ind.	Mal.	Phi.	Sin.	Tha.	TOTAL	Ind.	Mal.	Phi.	Tha.	TOTAL
1978	40,872	88,741	18,256	1,187	22,612	171,668	87,294	-	10,055	98,304	195,653
1979	-	83,092	17,896	1,093	43,083	145,164	-	1,063	5,844	69,257	76,164
1980	9,027	78,365	16,824	1,086	17,631	122,933	121,890	1,612	9,327	92,646	225,475
1981	63,891	74,727	17,244	1,193	31,256	188,311	68,165	10	19,563	106,465	194,203
1982	66,342	76,031	18,618	1,489	26,035	188,515	97,072	23	25,947	151,623	274,665
1983	63,971	67,541	17,592	1,667	22,410	173,181	46,650	7,215	10,110	126,492	190,467
1984	54,442	55,975	15,588	2,179	22,452	150,636	46,513	7,535	7,792	101,097	162,937
1985	67,880	11,276	34,407	729	19,609	133,901	53,313	17,650	17,865	91,347	180,175
1986	-	-	-	-	-	0	84,440	17,000	18,197	110,488	230,125
1987	-	-	-	-	-	0	66,868	45,522	14,670	115,142	242,202
1988	59,994	70,963	13,862	-	88,962	233,781	80,192	10,601	16,350	19,030	126,173
1989	58,019	92,450	14,065	-	11,851	176,385	72,322	14,909	17,260	97,850	202,341
1990	55,894	90,540	12,359	-	12,138	170,931	76,452	8,717	18,810	93,957	197,936
1991	58,079	68,708	13,623	-	11,932	152,342	78,215	27,516	18,287	115,938	239,956
1992	63,967	19,880	18,074	-	103,495	205,416	83,461	104,421	21,351	11,969	221,202
1993	59,739	22,814	16,688	-	103,583	202,824	79,714	81,858	16,214	13,662	191,448
1994	-	-	-	-	-	0	158,753	75,400	15,809	120,962	370,924
1995	-	-	-	-	-	0	81,261	69,902	18,997	128,542	298,702
1996	76,198	17,236	14,759	-	181	108,374	89,215	82,228	18,657	128,819	318,919
1997	86,512	15,024	16,337	-	8,089	125,962	96,790	75,479	15,562	54,982	242,813
1998	-	-	-	-	-	0	87,200	67,157	-	57,272	211,629
1999	98,026	12,256	-	-	2,252	112,534	103,372	77,176	-	81,644	262,192
2000	105,569	31,359	16,357	-	2,273	155,558	98,880	63,456	20,122	83,241	265,699
2001	101,627	27,584	19,693	-	1,724	150,628	113,161	48,875	23,061	85,118	270,215
2002	103,078	25,769	22,800	-	1,865	153,512	95,561	48,507	17,131	82,120	243,319
2003	100,679	35,619	22,597	-	2,517	161,412	100,221	33,631	16,995	76,205	227,052
2004	110,034	41,901	22,818	-	2,648	177,401	95,907	35,503	15,403	107,069	253,882
2005	100,038	24,766	23,154	-	2,013	149,971	71,473	26,469	14,002	74,114	186,058
2006	-	-	-	-	-	0	93,083	31,523	15,706	68,448	208,760
2007	122,128	29,173	23,068	-	1,153	175,522	90,107	40,981	12,914	57,499	201,501
2008	-	-	-	-	-	0	-	-	-	-	
2009	-	-	-	-	-	0	-	-	-	-	
TOTAL	**1,726,006**	**1,161,790**	**426,679**	**10,623**	**561,764**	**3,886,862**	**2,517,545**	**1,121,939**	**452,001**	**2,621,302**	**6,712,787**

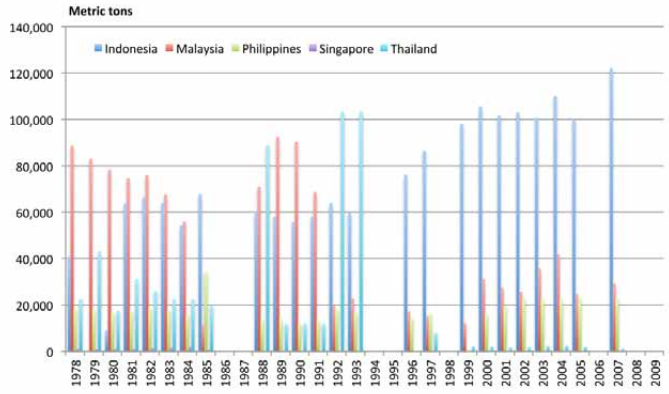

Fig. 9. Production Graph: Penaeid Shrimps

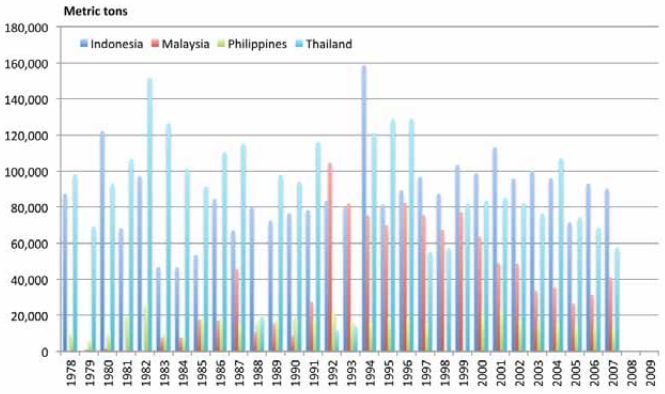

Fig. 10. Production Graph: Non-Penaeid Shrimps

Box 1E. Production data sheet (in metric tons): Eastern Little Tuna, Squids												
Year	Eastern Little Tuna						Squids					
	Ind.	Mal.	Phi.	Sin.	Tha.	TOTAL	Ind.	Mal.	Phi.	Sin.	Tha.	TOTAL
1978	55,244	3,755	26,452	-	10,353	95,804	8,691	17,996	31,416	390	52,067	110,560
1979	-	3,088	23,094	0	4,342	30,524	-	17,202	25,495	347	42,287	85,331
1980	66,582	2,716	24,730	-	5,012	99,040	12,812	8,831	27,011	303	39,854	88,811
1981	8,867	13,574	27,980	357	48,021	98,799	87,667	1,878	30,891	-	10,709	131,145
1982	78,190	3,106	45,533	-	25,891	152,720	11,626	10,028	20,989	507	70,583	113,733
1983	103,878	3,372	48,880	-	32,015	188,145	10,420	10,481	30,741	503	76,489	128,634
1984	103,179	6,871	41,899	-	32,640	184,589	8,615	10,298	20,314	694	66,340	106,261
1985	111,630	3,315	41,060	-	38,881	194,886	10,531	9,148	24,623	712	63,996	109,010
1986	116,975	2,713	42,445	-	45,473	207,606	10,000	9,704	26,632	409	71,344	118,089
1987	122,675	4,528	46,934	-	36,708	210,845	11,164	21,430	26,431	322	75,420	134,767
1988	117,898	6,322	56,266	-	53,450	233,936	14,088	20,243	28,835	270	67,176	130,612
1989	135,332	4,058	57,899	-	47,525	244,814	15,606	31,068	26,639	218	69,840	143,371
1990	139,967	3,336	43,762	-	60,759	247,824	15,262	35,069	26,574	259	64,370	141,534
1991	78,383	-	95,594	-	-	173,977	14,084	33,570	26,672	256	69,367	143,949
1992	155,661	-	31,943	-	94,627	282,231	18,365	34,402	39,402	226	64,774	157,169
1993	160,950	-	26,670	-	87,175	274,795	20,914	32,622	55,790	246	72,162	181,734
1994	186,486	-	46,221	-	84,273	316,980	26,216	35,924	49,043	1,000	72,226	184,409
1995	184,400	-	27,308	-	74,443	286,151	27,575	31,254	56,415	679	78,109	194,032
1996	208,504	-	24,345	-	68,450	301,299	29,167	36,270	52,458	546	79,235	197,676
1997	212,511	-	26,573	-	61,980	301,064	41,755	38,491	54,155	470	78,948	213,819
1998	236,673	-	-	-	61,147	297,820	31,850	38,697	-	462	92,908	163,917
1999	236,111	-	-	-	59,873	295,984	36,707	40,283	-	376	83,135	160,501
2000	250,522	-	27,963	-	53,428	331,913	39,838	54,339	46,778	348	86,203	227,506
2001	233,051	-	27,280	-	45,650	305,981	60,529	45,282	41,964	186	77,460	225,421
2002	266,955	-	34,681	-	51,489	353,125	62,133	52,483	50,612	185	89,505	254,918
2003	267,339	10,467	38,675	-	44,865	361,346	51,482	49,908	53,100	135	80,462	235,087
2004	133,000	10,137	44,875	-	54,887	242,899	69,357	52,208	56,181	181	81,267	259,194
2005	86,459	8,771	77,673	-	58,004	230,907	58,433	44,335	59,802	124	75,488	238,182
2006	118,470	18,560	78,377	-	50,458	265,865	57,821	67,606	57,584	224	76,202	259,437
2007	143,101	13,634	73,094	-	45,600	275,429	63,425	59,729	64,139	148	66,885	254,326
2008	-	-	-	-	-	0	-	-	-	-	-	0
2009	-	-	-	-	-	0	-	-	-	-	-	0
TOTAL	4,318,993	122,323	1,208,206	357	1,437,419	7,087,298	926,133	950,779	1,110,686	10,726	2,094,811	5,093,135

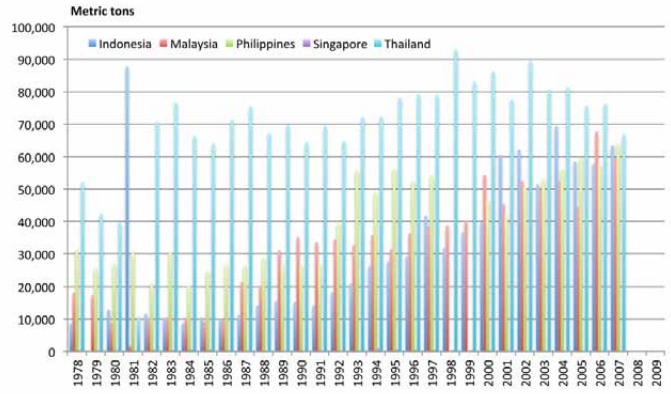

Fig. 11. Production Graph: Eastern Little Tuna

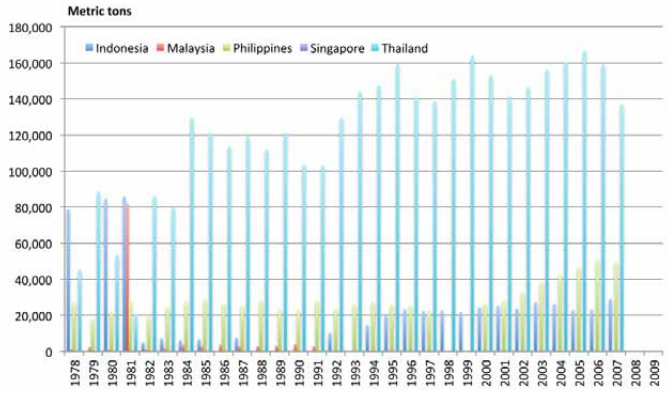

Fig. 12. Production Graph: Squids

Box 1F. Production data sheet (in metric tons): Indo-Pacific Mackerel, Selar Scad												
Year	Indo-Pacific Mackerel						Selar Scad					
	Ind	Mal.	Phi.	Sin.	Tha.	TOTAL	Ind.	Mal.	Phi.	Sin.	Tha.	TOTAL
1978	78,790	1,448	27,278	-	45,271	152,787	69,284	30,451	57,213	258	-	157,206
1979	-	2,328	17,914	-	88,720	108,962	-	26,491	47,027	301	11,129	84,948
1980	84,485	1,050	22,208	-	53,424	161,167	78,162	22,821	47,032	286	11,105	159,406
1981	85,747	81,831	28,425	194	20,542	216,739	99,681	34,852	72,745	168	14,488	221,934
1982	5,049	1,138	19,507	-	86,136	111,830	53,581	27,953	27,232	575	17,460	126,801
1983	7,122	1,765	24,672	-	79,803	113,362	64,737	35,628	22,502	534	23,342	146,743
1984	6,100	3,717	27,650	-	129,094	166,561	55,811	29,019	37,513	781	25,284	148,408
1985	6,796	3,068	28,929	-	121,107	159,900	64,430	30,224	33,481	769	18,418	147,322
1986	-	3,731	26,534	-	113,497	143,762	67,880	11,276	34,407	729	19,609	133,901
1987	7,522	2,856	25,327	-	119,182	154,887	72,977	18,861	35,461	630	25,960	153,889
1988	-	3,049	28,323	-	111,657	143,029	80,467	33,597	36,530	438	18,882	169,914
1989	-	3,218	23,301	-	121,041	147,560	88,761	37,333	38,614	359	21,408	186,475
1990	-	4,051	23,031	-	103,537	130,619	90,147	35,670	41,255	424	31,586	199,082
1991	-	2,932	28,297	-	102,977	134,206	95,989	38,402	36,264	195	22,308	193,158
1992	10,256	-	23,703	-	129,551	163,510	100,472	40,384	37,766	345	25,541	204,508
1993	-	-	26,234	-	143,982	170,216	105,946	49,979	33,438	331	22,448	212,142
1994	14,326	-	27,592	-	147,520	189,438	113,930	47,042	50,288	352	39,567	251,179
1995	19,873	-	26,200	-	159,225	205,298	116,769	42,738	43,582	285	40,223	243,597
1996	23,097	-	25,224	-	140,826	189,147	116,193	17,185	43,660	312	26,517	203,867
1997	22,250	-	22,978	-	138,621	183,849	125,504	52,309	313	-	24,092	202,218
1998	22,746	-	-	-	151,010	173,756	128,459	22,233	-	234	28,761	179,687
1999	21,674	-	-	-	164,110	185,784	128,785	23,954	-	175	-	152,914
2000	24,449	-	26,771	-	152,884	204,104	129,913	71,234	71,365	139	32,255	304,906
2001	25,056	-	28,091	-	141,315	194,462	132,998	65,037	80,858	66	32,595	311,554
2002	23,554	-	32,657	-	146,422	202,633	149,193	66,469	100,786	69	34,699	351,216
2003	27,204	-	38,294	-	156,223	221,721	154,866	61,228	103,975	56	44,588	364,713
2004	26,220	-	42,760	-	160,398	229,378	138,923	67,301	103,358	47	40,741	350,370
2005	22,903	-	46,810	-	166,766	236,479	143,105	72,571	91,534	31	41,284	348,525
2006	23,081	-	50,809	-	158,979	232,869	145,210	70,868	93,920	70	36,873	346,941
2007	28,928	-	49,494	-	136,839	215,261	142,706	70,007	95,028	62	34,732	342,535
2008	-	-	-	-	-	0	-	-	-	-	-	0
2009	-	-	-	-	-	0	-	-	-	-	-	0
TOTAL	**617,228**	**116,182**	**819,013**	**194**	**3,690,659**	**5,243,276**	**3,054,879**	**1,253,117**	**1,517,147**	**9,021**	**765,895**	**6,600,059**

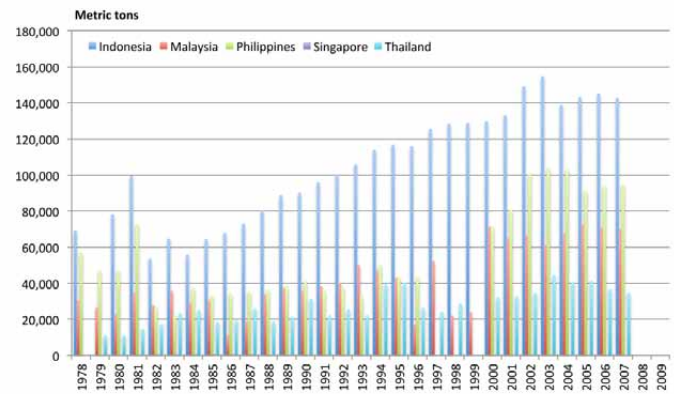

Fig. 13. Production Graph: Indo-Pacific Mackerel

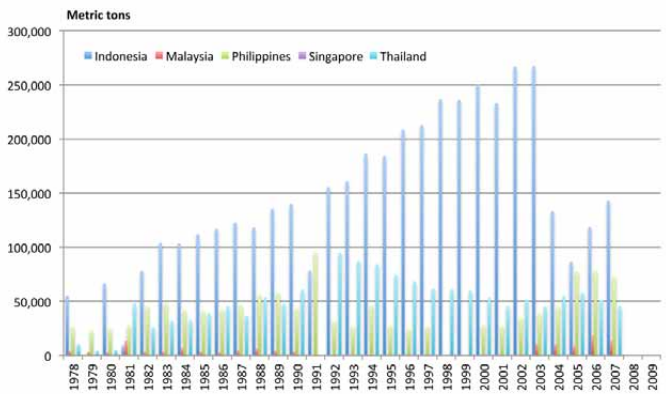

Fig. 14. Production Graph: Selar Scad

Box 1G. Production data sheet (in metric tons): Skipjack Tuna, Threadfin Breams												
Year	Skipjack Tuna						Threadfin Breams					
	Ind	Mal.	Phi.	Sin.	Tha.	TOTAL	Ind.	Mal.	Phi.	Sin.	Tha.	TOTAL
1978	33,515	-	34,597	40	-	68,152	8,778	12,601	35,129	414	23,678	80,600
1979	-	-	45,084	39	-	45,123	-	12,263	32,471	428	20,425	65,587
1980	42,834	-	31,178	35	-	74,047	9,859	10,635	37,457	381	18,016	76,348
1981	-	969	18,962	-	71,701	91,632	37,382	15,974	16,897	-	13,689	83,942
1982	47,140	-	50,795	25	-	97,960	9,869	12,588	30,883	629	17,340	71,309
1983	76,890	-	57,151	7	-	134,048	10,823	11,621	34,348	756	16,276	73,824
1984	80,658	-	44,671	81	-	125,410	10,282	11,215	41,321	938	15,052	78,808
1985	87,448	-	60,536	36	-	148,020	10,013	8,865	43,977	939	17,096	80,890
1986	98,500	-	77,031	32	-	175,563	11,000	11,217	46,476	886	26,801	96,380
1987	102,559	-	73,751	16	-	176,326	9,529	21,384	46,448	725	34,134	112,220
1988	127,543	-	55,940	-	-	183,483	-	-	-	-	-	0
1989	113,844	-	64,654	-	-	178,498	16,903	23,584	43,060	408	33,674	117,629
1990	114,168	-	99,705	130	-	214,003	17,573	26,435	44,068	325	31,139	119,540
1991	150,439	1,994	47,850	-	67,399	267,682	18,722	27,415	45,644	257	47,030	139,068
1992	152,038	-	83,179	-	-	235,217	20,248	28,999	31,196	128	65,377	145,948
1993	147,291	-	68,081	-	-	215,372	24,520	30,761	40,079	125	75,327	170,812
1994	157,663	-	84,560	6	-	242,229	25,278	29,263	34,177	305	75,110	164,133
1995	159,667	-	110,111	5	-	269,783	27,460	31,323	35,538	255	93,785	188,361
1996	182,147	-	110,004	5	-	292,156	31,593	29,534	32,884	209	89,592	183,812
1997	187,206	-	110,097	47	-	297,350	29,340	31,052	29,839	239	87,717	178,187
1998	227,068	-	-	12	-	227,080	30,937	40,327	-	158	96,595	168,017
1999	244,842	-	-	23	-	244,865	39,197	39,694	-	128	93,037	172,056
2000	34,218	32,510	29,487	96	102,282	198,593	34,218	32,510	29,487	96	102,282	198,593
2001	214,077	-	105,484	10	-	319,571	37,179	28,910	27,079	48	106,658	199,874
2002	203,102	-	109,977	6	-	313,085	39,566	30,519	49,257	33	121,376	240,751
2003	208,626	-	138,319	4	-	346,949	44,958	30,147	40,514	18	112,501	228,138
2004	233,319	-	143,143	2	-	376,464	57,853	33,502	41,161	22	105,895	238,433
2005	252,232	-	143,064	4	-	395,300	62,228	35,450	45,253	15	104,636	247,582
2006	277,388	-	164,325	1	-	441,714	65,126	35,879	51,252	29	96,583	248,869
2007	301,531	-	185,864	-	-	487,395	70,890	36,200	55,563	71	92,461	255,185
2008	243,638	-	222,010	2	6,138	471,788	36,536	26,047	51,432	38	25,024	139,077
2009	300,740	4,460	251,524	2	7,532	564,258	47,970	39,722	47,238	27	40,046	175,003
TOTAL	4,802,331	39,933	2,821,134	666	255,052	7,919,116	895,830	795,636	1,140,128	9,030	1,898,352	4,738,976

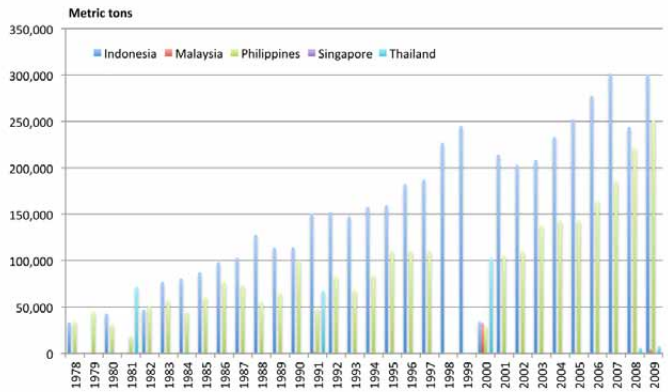

Fig. 15. Production Graph: Skipjack Tuna

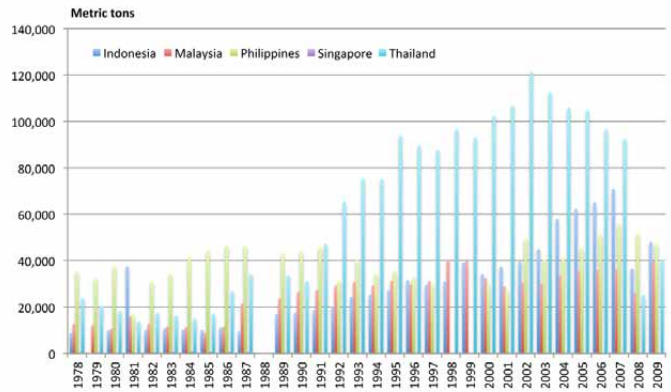

Fig. 16. Production Graph: Threadfin Breams

Box 1H. Production data sheet (in metric tons): Pony Fish; Jacks, Cavalla, Trevally												
Year	Pony Fish						Jacks, Cavalla, Trevally					
	Ind	Mal.	Phi.	Sin.	Tha.	TOTAL	Ind.	Mal.	Phi.	Sin.	Tha.	TOTAL
1978	37,751	1,736	65,762	108	-	105,357	46,191	2,436	33,183	-	35,587	117,397
1979	-	1,586	72,468	80	-	74,134	-	3,060	32,468	-	21,082	56,610
1980	41,235	1,260	60,432	109	-	103,036	47,094	3,475	30,680	-	-	81,249
1981	25,239	-	94,615	504	-	120,358	53,498	-	38,439	55	-	91,992
1982	42,119	1,393	53,738	86	-	97,336	-	-	-	-	-	0
1983	36,602	1,742	59,191	64	383	97,982	13,988	4,076	40,723	-	23,344	82,131
1984	36,940	2,502	66,784	198	184	106,608	-	-	-	-	-	0
1985	38,663	2,620	65,316	156	377	107,132	13,087	4,212	42,350	-	52,111	111,760
1986	39,000	2,214	65,415	119	-	106,748	14,670	12,625	42,150	-	42,204	111,649
1987	36,203	1,677	61,738	85	243	99,946	14,257	18,788	44,189	-	43,197	120,431
1988	40,912	1,832	65,724	85	-	108,553	18,672	8,376	45,710	-	48,918	121,676
1989	42,413	1,837	63,475	68	-	107,793	20,427	6,399	37,284	-	53,765	117,875
1990	41,768	960	69,365	78	-	112,171	19,674	5,720	37,503	197	51,954	115,048
1991	43,353	1,475	69,955	81	-	114,864	22,704	6,763	39,939	-	43,478	112,884
1992	-	-	-	-	-	0	27,213	8,281	47,066	157	45,728	128,445
1993	52,800	1,918	60,169	57	-	114,944	26,905	8,683	44,631	138	56,528	136,885
1994	57,462	1,933	59,547	141	-	119,083	26,086	6,870	47,539	249	68,796	149,540
1995	-	-	-	-	-	0	29,025	7,651	39,682	209	55,682	132,249
1996	71,401	2,539	57,867	75	-	131,882	30,045	387	37,456	227	53,028	121,143
1997	89,403	2,362	61,254	63	-	153,082	32,097	-	32,175	212	49,747	114,231
1998	-	-	-	-	-	0	39,443	575	-	222	45,994	86,234
1999	91,219	3,049	-	47	-	94,315	34,220	681	-	156	50,295	85,352
2000	-	-	-	-	-	0	36,321	12,633	34,713	163	48,010	131,840
2001	87,757	2,283	65,007	23	-	155,070	37,988	11,948	42,442	106	55,484	147,968
2002	89,936	2,340	65,816	9	-	158,101	40,235	12,806	54,019	74	57,201	164,335
2003	92,838	1,698	69,841	10	-	164,387	41,170	14,379	56,093	65	48,539	160,246
2004	90,859	2,210	68,768	5	-	161,842	54,177	15,804	52,147	61	50,867	173,056
2005	88,665	2,533	67,654	10	-	158,862	60,427	12,889	55,344	55	48,124	176,839
2006	90,034	2,301	67,573	47	-	159,955	65,582	12,181	62,629	70	36,873	177,335
2007	-	-	-	-	-	0	64,327	11,083	64,993	77	38,418	178,898
2008	-	-	-	-	-	0	-	-	-	-	-	0
2009	-	-	-	-	-	0	-	-	-	-	-	0
TOTAL	1,404,572	48,000	1,577,474	2,308	1,187	3,033,541	929,523	212,781	1,135,547	2,493	1,224,954	3,505,298

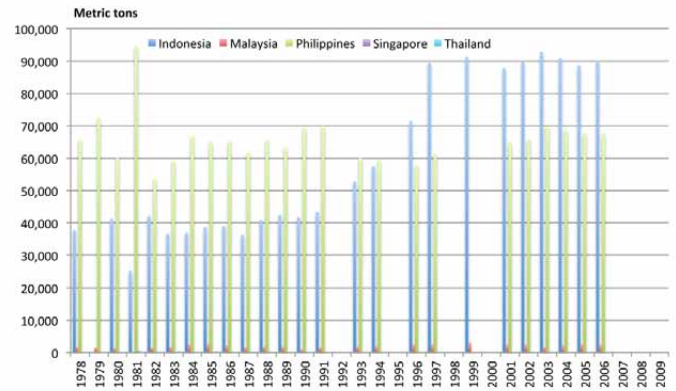

Fig. 17. Production Graph: Pony Fish

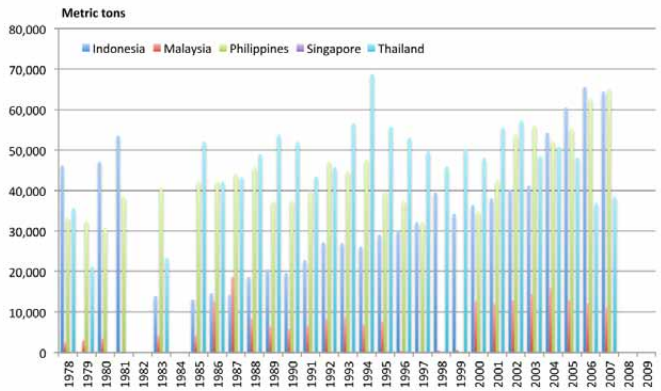

Fig. 18. Production Graph: Jack, Cavalla, Trevally

Box 1l. Production data sheet (in metric tons): Drums and Croakers						
Year	Drums and Croakers					
	Ind	Mal.	Phi.	Sin.	Tha.	TOTAL
1978	25,960	9,534	8,820	384	15,241	59,939
1979	-	8,891	5,828	438	11,036	26,193
1980	26,747	7,636	5,953	337	11,206	51,879
1981	-	-	78,248	-	-	78,248
1982	-	-	-	-	-	0
1983	-	-	-	-	-	0
1984	-	-	-	-	-	0
1985	-	-	-	-	-	0
1986	-	-	-	-	-	0
1987	-	-	-	-	-	0
1988	-	-	-	-	-	0
1989	-	-	-	-	-	0
1990	-	-	-	-	-	0
1991	-	-	-	-	-	0
1992	-	-	-	-	-	0
1993	36,360	17,314	7,795	280	20,533	82,282
1994	37,400	17,773	9,602	162	19,329	84,266
1995	-	-	-	-	-	0
1996	-	-	-	-	-	0
1997	-	-	-	-	-	0
1998	50,114	22,480	-	160	33,646	106,400
1999	56,991	22,188	-	114	36,591	115,884
2000	52,254	23,439	4,170	68	39,946	119,877
2001	49,647	28,762	4,898	45	44,932	128,284
2002	60,161	22,337	5,060	56	51,664	139,278
2003	55,896	23,242	5,844	37	48,262	133,281
2004	-	-	-	-	-	0
2005	60,177	23,911	4,249	40	49,717	138,094
2006	-	-	-	-	-	0
2007	-	-	-	-	-	0
2008	-	-	-	-	-	0
2009	-	-	-	-	-	0
TOTAL	511,707	227,507	140,467	2,121	382,103	1,263,905

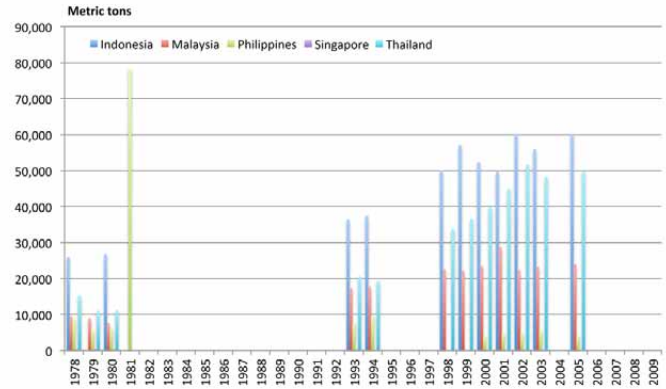

Fig. 19. Production Graph: Drum and Croakers

Based on **Table 4**, the levels of exploitation of the major groups of commodities could be determined as shown in **Box 2**, which could also be used as indicators to put into effect fisheries management measures. Since the statistical data in the Fishery Statistical Bulletin from 1976 to 2007 were collected using the same format without classifying the catch by species but instead by major groups of species, while there were no information on the fishing areas, it is quite difficult to specify the real situation of a single fish stock. This analysis could therefore be referred to as provisional detailed analysis of important fish stocks in each country of the Southeast Asian region.

The application of the potential yield method and the Froese and Kesner-Reyes Model are simple techniques for analyzing exploitation levels given poor catch data that are available. Nonetheless, attempts to develop the methodology for analyzing exploitation levels based on limited information and poor statistics have recently been introduced by the International Council for the Exploration of the Sea (ICES) of Denmark and the National Oceanic and Atmospheric Administration (NOAA) of the U.S.A.

Furthermore, Productivity and Susceptibility Assessment (PSA) is also one of the methods which can be applied to relatively poor data and is considered the best approach for determining the vulnerability of data-deficient stocks. PSA could be used to evaluate an array of productivity and susceptibility attributes for a stock, from which index scores for productivity and susceptibility could computed and displayed graphically.

The PSA has several characteristics such as: number of attribute scores could be expanded to consider direct and indirect impacts; attribute scores could be aligned with life history characteristics of fish species in tropical waters; attribute weighing system could be used to customize the analysis for a particular fishery; and data quality index and protocol for addressing stocks exploited by different sectors of a fishery could be established. After the introduction of this method by FAO in 2009, many scientists in Southeast Asia conducted trials to evaluate the status of several economically-important species. The results of such evaluation of each single species and each type of fishery by the SEAFDEC Member Countries as well as the regional evaluation using data from SEAFDEC Statistical Bulletin will help in unraveling the enigma for creating measures towards sustainable fisheries management in the region.

Another method which is also commonly used is the so-called depletion-corrected average catch (DCAC), an

Table 4. Exploitation levels based on fishery catch (C) relative to maximum catch (C_{max}), catch relative to MSY, and biomass B relative to B_{MSY} (relationship between C/MSY and B/B_{MSY} is derived from Equation 1)

Status of the fisheries	Year	C/C_{max}	C/MSY	B/B_{MSY}
Undeveloped/no information	Before C ≥ 0.5 C_{max}	<0.1	<0.2	
Developing		0.1-0.5	0.2-0.75	>1.5
Fully exploited	At/after C ≥ 0.5 C_{max}	>0.5	>0.75	≥0.5
Overexploited		0.1-0.5	0.2-0.75	<0.5
Collapsed		<0.1	<0.2	<0.1
Rebuilding	Years between collapsed and subsequent first fully exploited			
Final year rules: Developing Rebuilding	If C_{max} occurs in the final year, increase C_{max} by 50% and set its year of occurrence as final year plus one In the final year, accept C> 0.28 C/C_{max} as indicative of subsequent fully exploited status			

Source: *Adapted from the Model developed by Froese and Kesner-Reyes (2002)*

Box 2. Levels of exploitation of economically-important commodities in the Southeast Asian region

Commodities	Level of Exploitation	Remarks
Trash fish		
Malaysia, Philippines, Thailand	Over-exploited	The data set on trash fish shows that about 10-20% of the total catch make it to the top-rank in the major species group. Major portions of trash fish come from trawlers and some small purse seiners. However, some trash fishes are actually juveniles of commercially-important species, indicating that the capacity of such fishing boats and gears should be properly managed.
Miscellaneous fishes		
Cambodia, Vietnam, Myanmar	No indication	Miscellaneous fishes comprise about one-third of the total catch of Cambodia, Vietnam and Myanmar, but no conclusion could be arrived at because of the inadequate number of skilled officers capable of separating and identifying the fish species.
Indonesia, Malaysia, Philippines, Thailand	Over-exploited	Production of concerned countries had been very high which could be beyond the long-term maximum potential yield.
Sardines		
Thailand	Over-exploited	Production of concerned countries had been very high which could be beyond the long-term maximum potential yield.
Indonesia, Malaysia, Philippines	Fully exploited	Production of concerned countries could be already equal to the maximum sustainable yield.
Round scads		
Thailand, Indonesia, Malaysia, Philippines	Fully exploited	Production of concerned countries could be already equal to the maximum sustainable yield.
Anchovies		
Indonesia, Thailand	Over-exploited	Production of concerned countries had been very high which could be beyond the long-term maximum potential yield.
Malaysia, Philippines	Fully exploited	Production of concerned countries could be already equal to the maximum sustainable yield.
Indian mackerel		
Indonesia, Thailand	Over-exploited	Production of concerned countries had been very high which could be beyond the long-term maximum potential yield.
Malaysia, Philippines	Fully exploited/ harvested	Production of concerned countries could be already equal to the maximum sustainable yield.
Penaeid shrimps		
Thailand	Collapsed	Disruption of the biological mechanisms that sustain life-cycle closure of intra-population contingents, already occurred.
Indonesia, Malaysia, Philippines	Fully exploited	Production of concerned countries could be already equal to the maximum sustainable yield.
Non-penaeid shrimps		
Thailand	Over-exploited	Production of concerned countries had been very high which could be beyond the long-term maximum potential yield.
Indonesia, Malaysia, Philippines	Fully exploited	Production of concerned countries could be already equal to the maximum sustainable yield.
Eastern little tuna		
Indonesia, Malaysia, Philippines, Thailand	Fully exploited	Production of concerned countries could be already equal to the maximum sustainable yield.

Box 2. Levels of exploitation of economically-important commodities in the Southeast Asian region (Cont'd)		
Commodities	**Level of Exploitation**	**Remarks**
Squids		
Thailand, Indonesia, Philippines, Malaysia	Fully exploited	Production of concerned countries could be already equal to the maximum sustainable yield.
Indo-Pacific Mackerel		
Thailand	Over-exploited	Production of concerned countries had been very high which could be beyond the long-term maximum potential yield.
Indonesia, Philippines	Fully exploited	Production of concerned countries could be already equal to the maximum sustainable yield.
Selar scad		
Indonesia, Philippines, Malaysia, Thailand	Fully exploited	Production of concerned countries could be already equal to the maximum sustainable yield.
Skipjack Tuna		
Indonesia, Philippines	Fully exploited	Production of concerned countries could be already equal to the maximum sustainable yield.
Threadfin Breams		
Thailand, Indonesia	Over-exploited	Production of concerned countries had been very high which could be beyond the long-term maximum potential yield.
Philippines, Malaysia	Fully exploited	Production of concerned countries could be already equal to the maximum sustainable yield.
Pony Fish		
Philippines, Indonesia, Malaysia	Fully exploited	Production of concerned countries could be already equal to the maximum sustainable yield.
Jacks, Cavalla, Trevally		
Thailand	Over-exploited	Production of concerned countries had been very high which could be beyond the long-term maximum potential yield.
Philippines, Indonesia, Malaysia	Fully exploited	Production of concerned countries could be already equal to the maximum sustainable yield.
Drum and Croakers		
Philippines	Over-exploited	Production of concerned countries had been very high which could be beyond the long-term maximum potential yield.
Indonesia, Thailand, Malaysia	Fully exploited	Production of concerned countries could be already equal to the maximum sustainable yield.

extension of the potential-yield formula that could provide useful estimates of sustainable yields for data-deficient fisheries. Over an extended period (*e.g.* a decade or more), the catch is divided into sustainable yield component and unsustainable "windfall" component associated with a one-time reduction in stock biomass. The DCAC is calculated as the sum of catches divided by the sum of the number of years in the catch series and the windfall ratio is:

$$\frac{W}{Y_{pot}} = \frac{1}{M}$$

where Y_{pot} = potential yield; W = windfall harvest; and M = natural mortality rate. DCAC can be calculated as a point estimate using the most likely values of the input quantities, but this practice is not recommended unless it is meant for a quick approximation. However, a Monte Carlo exploration of the DCAC estimates could be conducted as it could provide useful information on precision and bias, including estimation of approximate confidence intervals, which are often lacking for data-deficient methods. Finally, sustainable yield can be calculated using:

$$Y_{sus} = \frac{\sum C}{n+\frac{1}{M}}$$

where Y_{sus} = sustainable yield; and M = natural mortality rate. This is one of the methods used when dealing primarily with a function of catch and is easily applied to catch data of each species which some of the countries in the region have already collected under its national statistics collection systems.

Conclusion

Fishery statistics is a tool used to facilitate development planning and management of fisheries. Fishery statistical items and data set collected by the Southeast Asian countries may differ, taking into account their respective priority needs, objectives and requirements. The use of

fishery statistics is not only for national purposes but also for regional and international actions where comparable and analysis of fisheries status and trends could be deduced and used for planning and management in a broader scope. Compilation of the region's fishery statistics has been regularly conducted by SEAFDEC over the past thirty years, initially in the form of the "Fishery Statistical Bulletin for the South China Sea Area" which later became the "Fishery Statistical Bulletin of Southeast Asia" taking into account the escalating situation in fisheries practices in the region and the new geo-political set-up of the ASEAN. This scenario has called for the need to improve the existing framework of the regional fishery statistics and usage of the Bulletin, and led to changes in the Fishery Statistical Bulletin in terms of the coverage area to cover only the Southeast Asian countries starting in 2008, as well as the data items and procedure that needed to be harmonized with those of the FAO.

Nevertheless, cognizant of the need for regional statistics, the Southeast Asian countries are still confronted with inadequate capacity to fill the gap in their respective statistical systems. The minimum requirements as the inputs for the Bulletin can only include some indicators which the Member Countries could use mainly for establishing the status and trends while scientific research on status of the stocks would need more information and statistics which may take time and effort to develop. Although it can be said that analysis of the status and trends has initially provided basis of a precautionary approach for planning, development and management of fisheries in the Southeast Asian countries, it has also facilitated cooperation for the sustainable development and management of fisheries in the region.

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Developing Market Measures to Control IUU Fishing in Southeast Asia

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The 2001 FAO International Plan of Action (IPOA) to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (FAO, 2001; FAO, 2002) provides the following composite definition of illegal, unreported and unregulated (**IUU**) fishing. **Illegal fishing** takes place when fishing is conducted by vessels of countries that are parties to a regional fisheries management organization (RFMO) but operate in violation of its rules or operate in a country's waters without permission. **Unreported fishing** comes about when catch is not reported or misreported to national relevant authorities or RFMOs. **Unregulated fishing** happens when fishing is conducted by vessels without nationality or flying the flag of States not parties of relevant fisheries organizations that consider themselves not bound by their rules. In essence, fishing that can be described as illegal, unreported and unregulated (IUU) is now commonly understood to refer to fishing activities that are inconsistent with or in contravention of the management or conservation measures in force for a particular fishery (Agnew and Barnes, 2004).

The ASEAN-SEAFDEC Member Countries have recognized the need to foster cooperation among the countries as well as with international and regional organizations in order to combat IUU fishing in the Southeast Asian region, as clearly stipulated in the ASEAN-SEAFDEC Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 (SEAFDEC, 2011). In an effort to respond to such mandate, SEAFDEC has been implementing various activities that aim to control IUU fishing in the region, one of which is the activity on **Preventing Export of IUU Fishing Products from the Southeast Asian Region**. With financial support from the Japanese Trust Fund (JTF), this activity which is being carried out by the SEAFDEC Marine Fishery Resources Development and Management Department (SEAFDEC/MFRDMD) is aimed at collecting and sharing information on the export of fisheries products from the region, and developing the regional guidelines that would set one's sight on preventing IUU fishing and its products from being traded. The said guidelines would take into consideration the relevant international trade-related measures that prohibit the marketing of fish and fisheries products derived through unsustainable means and from unsustainable sources.

It is noteworthy to mention that the effort of SEAFDEC to combat IUU fishing in the Southeast Asian region is being championed by the Government of Japan through the JTF Program on "Strengthening SEAFDEC Network for Sustainable Fisheries and IUU Fishing-related Countermeasures", as well as by the Government of Sweden through the SEAFDEC collaborative project with the Swedish International Development Cooperation Agency (Sida) which aims to promote the management of fishing capacity and effort to combat IUU fishing in the region (Awwaluddin *et al*., 2011). While also working closely with the Indonesian-based Regional Plan of Action (RPOA) to Promote Responsible Fishing including Combating IUU Fishing (Poernomo *et al*., 2011), SEAFDEC also encourages and assists the Southeast Asian countries in the development of their respective National Plans of Action on Combating IUU Fishing (NPOA-IUU). However, it should also be noted that in the course of implementing the various projects and activities on the promotion of measures to combat IUU fishing, SEAFDEC/MFRDMD in particular and SEAFDEC in general, is being confronted with concerns brought about the unclear definition of IUU fishing.

International organizations such as the FAO which reviewed the requirements of developing countries in combating IUU fishing recognized that lack of effective fisheries management and regulation in developing countries have made it difficult for these countries to implement measures to curb IUU fishing (Tokrisna, 2000). In addition, these organizations also recognized that IUU fishing should be clearly defined and concretely identifiable. As a matter of fact, the shapeless and structure-less term "IUU Fishing" should be made very precise and clearly elaborated on so that an international consensus to adopt the FAO IPOA to combat IUU fishing could be obtained. If left with unclear definition, IUU fishing which could not be controlled as problems could arise in the implementation of countermeasures in many countries, leading to discontentment and unwillingness to take on steps to combat IUU fishing. This means that there should be some forms of clear agreement concerning the range of fishing activities that are being targeted and classified as IUU fishing. Furthermore, the absence of concrete and clear definition of "IUU fishing" could also insinuate that this form of fishing is not in accordance with international consensus on the practices targeted

by trade-related measures (Chaves, 2000). In order that these issues and concerns would be addressed, the need to craft a definition of IUU fishing which would have the greatest possible precision, should be considered a priority by relevant agencies and organizations including the concerned RFMOs.

Based on FAO fishery statistics, international trading of fish and fisheries products has increased dramatically during the past decades since practically almost all countries trade significant portions of their fisheries production in the international market. However, from the volume of fish and fisheries products being internationally traded, the quantity obtained from IUU fishing could not be established. This situation has prompted the FAO to promote the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU) which includes provisions to restrict international trading of fish and fisheries products harvested through IUU fishing (FAO, 2001; FAO, 2002).

Nevertheless, despite increasing efforts worldwide, the magnitude of IUU fishing activities is still difficult to assess maybe because of the fact that by nature IUU fishing does not yield official statistics. However, all signs point towards the fact that IUU fishing is a global and widespread activity in almost all areas of the seas involving to some extent, fishing companies and fishers from many countries. FAO opined that in some important fisheries, IUU fishing accounts for up to 30% of total catches, and also evoked that in some instances IUU catches could be as high as three times the permitted catch level (Doulman, 2000). Results of some research studies carried out by major RFMOs and relevant NGOs have indicated that many commercially-important aquatic species such as tunas and swordfish are known to be targets of IUU fishers (OECD, 2003; Upton and Vangelis, 2003).

Market-related Measures Against Trading of Fish and Fisheries products Obtained from IUU Fishing

While the IPOA-IUU calls for the countries to develop internationally-agreed market-related measures to prevent, deter and eliminate IUU fishing in accordance with the principles prescribed by the World Trade Organization (WTO), "market-related measures" are not explicitly defined in the IPOA-IUU. However, it is generally understood that "market-related measures" stipulated in the IPOA-IUU encompass several types of controls on trading of fish and fisheries products derived from IUU fishing. IPOA-IUU also provides examples of such measures which include catch certification and trade documentation requirements, as well as import and export restrictions and prohibitions. Generally, however, trade measure under the WTO is a border control system that allows a State or territory to regulate, restrict or prohibit trade. Examples of trade measures include landing actions, certifications, labelling or size requirements, among others. In some high seas controls, monitoring system and boarding requirements, while not technically trade measures, are related schemes and thus can trigger the imposition of border controls. With nearly 40% of the world's fishery production traded internationally, it follows that trade measures could have certain impacts on IUU fishing activities through import controls and regulations.

Experience has indicated that trade- or market-related measures can be effective tools for promoting fisheries management while circumvention of agreed conservation goals and agreements could be prevented. More importantly, the WTO, which provides certain flexibility to use several trade measures for conservation purposes, imposes regulations with adequate safeguards against possible abuse. With a superabundance of trade measures, it is necessary to determine what type of mechanism would be most fair and transparent to curb IUU fishing, which could be the least likely to engender possible controversies. However, it is recognized that monitoring, control and surveillance (MCS) with some forms of certifications could comprise the essential features in the enforcement of conservation goals and verification of compliance with respect to measures for combating IUU fishing.

Trade-Related Measures for Combating IUU Fishing in the Perspective of Developing Countries

The relevant Articles in the General Agreement on Tariffs and Trade (GATT) 1994 that comprise the WTO-consistent Trade-related Measures to address IUU Fishing in the perspective of developing countries (**Box 1**), include **Article III** on National Treatment on Internal Taxation and Regulation (*Paragraph 4*); **Article VIII** on Fees and Formalities connected with Importation and Exportation (*Paragraph 1*); **Article X** on Publication and Administration of Trade Regulations; **Article XI** on General Elimination of Quantitative Restrictions; **Article XIII** on Non-discriminatory Administration of Quantitative Restrictions; and **Article XX** on General Exemptions. These Articles provide flexibility to use trade measures for the conservation of fisheries resources subject to certain safeguards against abuse, although it should be noted that trade measures designed to conserve resources outside of national borders are still being discussed.

Moreover, relevant Agreements should also be considered to ensure that the WTO-consistent Trade-related Measures

Box 1. Relevant Articles in GATT 1994 with respect to trade measures to combat IUU fishing

Article III *National Treatment on Internal Taxation and Regulation* (Para 4) requires that there should not be any differentiation between domestic and imported products. Any trade measure applied to products for import shall be equally applied to domestic products because trade-measure actions to curb IUU fishing should not only be implemented at the importing point. Developing countries may face difficulties in exercising the control market stage of the industry chain, as these countries would take some time in developing the control system. Therefore, the limited capacity of many developing countries taking into account their respective domestic fishery regulations at all stages from post-harvest to trans-shipment, landing, processing and export, may not allow an equal treatment.

Article VIII *Fees and Formalities connected with Importation and Exportation* (Para 1(c)) states that *"The contracting parties also recognize the need for minimizing the incidence and complexity of import and export formalities and for decreasing and simplifying import and export documentation requirements"*. And Article VIII also states *"...the production of certificates of origin should only be required to the extent that is strictly indispensable"*.

Article X *Publication and Administration of Trade Regulations* requires that *"...no measure imposing restriction on imports shall be enforced before such measure has been officially published...Each country shall administer a uniform, impartial and reasonable manner on all its laws, regulations, decisions and rulings"*. The main problem in developing countries lies in the uniform manner of implementing the trade regulations in importing IUU fishing commodities, because the existing infrastructure may impede the fulfilment of such requirement on uniformity.

Article XI *General Elimination of Quantitative Restrictions* does not allow import and export restrictions other than duties, taxes or other charges.

Article XIII *Non-discriminatory Administration of Quantitative Restrictions* prohibits discriminatory quantitative restriction. Based on Articles XI and XIII, banning the import of fish and fish products from IUU fishing may not be authorized unless there is a proof that such imports have detrimental impact on fishery resource conservation and management. Once there is a proof that the catches come from IUU fishing, the general exemption in Article XX (g) is applicable. Certificate of origin may be required, but for many developing countries, the inadequacy of effective fishery regulations makes it difficult for these countries to pursue the issuance of such certificate.

Article XX *General Exceptions of GATT 1994* states that *"Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures: ... (g) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption;..."*

Article XX allows the adoption of IPOA to take measures in combating IUU fishing for the sake of conservation on exhaustible fishery resources. Nevertheless, measures to be undertaken must be made effective for imported fish and fish products as well as those bound for domestic markets. In this case, insufficient and ineffective fishery regulations in developing countries might pose a hindrance to effectively combat IUU fishing (Tokrisna, 2000).

Note: Resource tax on fishing is an internal tax collected by coastal states to reflect the social cost of fishing, consistent with the WTO regulations. With higher fishing cost, fishing effort could be expected to become lower as the net margin could decrease. Nevertheless, without effective MCS some IUU fishing activities could succeed in avoiding the payment of resource taxes. Nonetheless, record of catches from the point of harvest, trans-shipment, landing, processing, and export must be compiled and made available for the adoption of measures in combating IUU fishing.

to address IUU Fishing in the perspective of developing countries are not disguised as trade barriers. These include: Agreement on Technical Barrier to Trade; Agreement on Pre-shipment Inspection; Agreement on Rules of Origin; Agreement on Import Licensing Procedures; and Agreement on Subsidies and Countervailing Measures (**Box 2**). These Agreements could also address the constraints encountered by developing countries in conforming to international technical regulations and standards in combating IUU fishing.

Development of Market Measures to Combat IUU Fishing in Southeast Asia: SEAFDEC Initiative

SEAFDEC through the Training Department (TD) and Marine Fishery Resources Development and Management Department (MFRDMD), has initiated a project on the promotion of fishing license, boats registration and port State measures to combat IUU fishing in the Southeast Asian region with funding support from the Japanese Trust Fund. The three main activities that encompass the project are: 1) promotion of fishing license, boats registration and port state measures; 2) promotion of Monitoring, Control and Surveillance (MCS) in Southeast Asia; and 3) preventing export of IUU fishing products. While the first two activities are carried out by TD, the last activity is under the responsibility of MFRDMD.

In October 2011, SEAFDEC convened the first Regional Core Experts Meeting on Fishing License, Boats Registration and Information Gathering on Export of Fisheries Products in Southeast Asia in Bangkok, Thailand, to review the status of fishing license, boats registration as well as trading of fisheries products in Southeast Asia; discuss the contents and information required for the regional guidelines on fishing license and boats registration in Southeast Asia; discuss the contents and information required for the regional guidelines to prevent IUU fishing and the trading of its products in Southeast Asia and beyond; and develop the way forward and project activities for future implementation, and identify responsible officials to be involved in drafting the regional guidelines. Specifically during the exchange of information and experiences on the

Box 2. Relevant Agreements that address the concerns faced by developing countries

Agreement on Technical Barrier to Trade

Article 11 Technical Assistance to Other Members. Calls for developing countries to prepare action plans to curb IUU fishing, with technical assistance to be granted as and when necessary.

Article 12 Special and Differential Treatment of Developing Country requires the contracting countries to provide differential and more favorable treatment to developing countries taking into account the special development, financial and trade needs. Actions to curb IUU fishing should not create unnecessary obstacles for developing countries to export their fish and fish products while collaboration should be enhanced including assistance in terms of capacity building to enable developing countries to adjust their fishery regulations. International body and international system should concentrate their efforts in combating IUU fishing, taking into account the special problems of developing countries. Therefore, trade-related international actions towards combating IUU fishing could not take into effect until the capability of developing countries in adjusting their fishery regulations is improved to at least "satisfactory" level.

Agreement on Pre-shipment Inspection: allows pre-shipment inspection of goods in exporting countries, and applies for the inspection of catch from IUU fishing. Such pre-shipment inspection should be non-discriminatory and transparent, and useful for recording and reporting the catch flow, while exporting country can issue Clean Report of Findings to certify that the export is free from IUU fishing. Such pre-shipment inspection would be beneficial for developing countries which could also practice HACCP and adoption of the competent authority scheme. The IPOA-IUU includes the need for cooperation among developing countries and assistance from international organizations like FAO, to build up the capability of developing countries in conducting pre-shipment inspection.

Agreement on Rules of Origin: defines the rules of origins as *"those laws, regulations and administrative determinations of general application applied by any member to determine the country of origin of goods provided such rules of origin are not related to contractual or autonomous trade regimes leading to the granting of tariff preferences going beyond the application of paragraph 1 of Article I of GATT 1994"*. The rules address the use of non-preferential commercial policy instruments including most-favoured nation (MFN) treatment, anti-dumping and countervailing duties, safeguard measures, marking origin, and discriminatory quantitative restrictions or tariff quota. Rules of Origin could also be applied in the adoption of the scheme of certificate of origin for curbing IUU fishing. Thus, IPOA-IUU should focus towards harmonizing the rules in order that the application would be fair with clear objective of combating IUU fishing. In order that the rules are not disguised as trade barriers, the certificate of origin should not be restrictive and not creating distorting or disruptive effects on international trade, provided that developing countries are capable of administering such scheme. Nevertheless, ineffective internal fishery regulation could pose some problems in such administration. The rules of origin are applied equally for imports, exports and domestic products so that with the presence of political will for better fishery conservation and management, this scheme could be useful in curbing IUU fishing not only in the national jurisdictions of the developing countries but also to greater jurisdictions of regional fisheries bodies (RFBs) and the high seas. The problem could be more complicated for the multi-species, multi-gear fishery in developing countries, so that harmonization of scheme of certificate of origin is necessary. However, insufficient capability of developing countries can bring about trade distortion and adverse impact on international trade. WTO established a Technical Committee on Rules of Origin to consult on matters relating the application of the rules of origin under the Custom Co-operation Council, and to consider the IPOA-IUU work plan on the scheme of certificate of origin. Moreover, a control market stage of the industry chain for fish and fish products could be developed in conjunction with the certificate of origin scheme. The WTO Technical Committee has been working on products basis, where products are classified into three groups: wholly obtained and minimal operations or process, substantial transformation - change in tariff classification, and substantial transformation - supplementary criteria.

Agreement on Import Licensing Procedures: in case of import ban and/or differential treatment on fish and fish products from IUU fishing, import licensing may be employed. Paragraph 4 of Article 1 in this Agreement specifies that rules and all concerning information on procedures for submission of applications, the administrative body (not more than 3) and lists of products subject to licensing requirement must be published at least 21 days prior to the effectivity date. The import licensing procedures shall be neutral, fair and equitable, although the main problem of developing countries is on the competency of license issuing body with respect to curbing IUU fishing. Nevertheless, without an acceptable internal fishery regulation, this trade measure may not be applicable for developing countries although it could be applied by developed countries. Import licensing or any similar scheme can be disguised trade barrier if it is adopted under the IPOA-IUU.

Agreement on Subsidies and Countervailing Measures: Subsidies in curbing IUU fishing are exempted based on the definition in Article 1 of this Agreement and Article XX (g) of GATT 1994. Capacity building to strengthen the capability of developing countries in fishery management is a key for the successful control of IUU fishing. Technical and financial assistance on building such capacity is a requirement while such subsidy should be made consistent. Nonetheless, positive subsidy aimed at reducing excessive capacity in fishing sector could be allowed, as this will lead to fishery resource rehabilitation, and conservation of exhaustible fishery resources. The usual subsidy in fishing sector which has been decreasing such as "negative subsidy" should not be allowed. Developing countries rarely use such subsidy knowing that in the long run it will lead to depletion in fishery resources and higher fishing cost. If abolished, fishing effort may be decreased. Therefore, together with the positive subsidy in relocating the effort in the fishing sector, fish trade can be increased due to lower supply in that country while demand for fish is still strong.

export of fish and fisheries products from the Southeast Asian countries, substantial volume of fish and fisheries products were reported to have been exported from the countries. The data as to what portion had been obtained from IUU fishing could not be established. In this regard, the 2011 Regional Core Experts Meeting came up with recommendations on this aspect (**Box 3**).

In an effort to continue addressing the issues related to export of fish and fisheries products, and the corresponding processes and procedures, MFRDMD developed a set of questionnaires to gather the relevant information from the Southeast Asian countries. Information collection visits were also conducted in Indonesia, Malaysia, Myanmar, Philippines, and Vietnam. Meanwhile, information from Brunei Darussalam, Cambodia, Lao PDR, Singapore, and Thailand were obtained through the questionnaires.

Subsequently, the Regional Core Expert Meeting on Preventing Export of IUU Fishing Products was organized

Box 3. Relevant recommendations during the 2011 Regional Core Expert Meeting on Fishing License, Boats Registration and Information Gathering on Export of Fisheries Products

1. Collaborate with customs department to improve data collection
2. Establish formal agreements with relevant transboundary countries to ensure that there is no double reporting of data and that data are properly recorded and reconciled with countries where catch had been derived
3. Upgrade licensing and registration documents as these could be accurate sources of data and information
4. Intensify human capacity building
5. Conduct R&D on value-adding to promote the trading of value-added products
6. Consider the development of measures to combat and deter IUU fishing in inland waters, taking into consideration the measures used in marine capture fisheries

by MFRDMD in November 2012 in Malaysia with the objectives of: a) reviewing the issues, processes and procedures in the export of fish and fisheries products from Southeast Asia; b) identifying and harmonizing the essential information needed for the development of the regional guidelines to prevent the export of IUU fish and fisheries products; c) formulating the draft regional guidelines to prevent export of IUU fish and fisheries products; and d) discussing the way forward and project activities for future implementation. The output of the said meeting is an outline of the draft regional guidelines for preventing the landing, export and import of the IUU fish and fisheries products (**Box 4**).

Box 4. Draft Regional Guidelines for Preventing Landing, Export and Import of IUU Fish and Fisheries Products

1.1 Introduction

Irresponsible fishing activity directly undermines efforts to manage fisheries properly and impedes progress toward the goal of sustainable fisheries. The term "illegal, unreported and unregulated fishing" – or IUU fishing has emerged to describe a wide range of such activity. As discussed more fully herein, the FAO Committee on Fisheries decided in 1999 to elaborate an International Plan of Action to Prevent, Deter and Eliminate IUU fishing (IPOA-IUU). Over the course of the following two years, a significant effort unfolded, which culminated in the adoption of the IPOA-IUU in 2001.

IUU fishing should be clearly defined and identifiable. Any trade-related measure to be employed in curbing IUU fishing has to be equally treated, for import as well as domestic products. Lack of effective fishery regulation in developing countries can impede the equal treatment.

- Duty of the flag state, Port State Measures
- Function of Competent Authority (CA); list of CA as an appendix
- Status of import and export between Member Countries to EU in reference to EC Regulations

1.2 Background and Rationale

With nearly 40% of the world's fishery production traded internationally, it follows that trade measures may have impact on IUU fishing through the regulation of trade. Experience indicates that catch certification and landing surveillance for fishery trade can be an effective tool for fisheries management officials trying to prevent circumvention of agreed conservation goals. The Regional Guidelines on Preventing Trading of IUU Fishing Products is envisaged to be used as basis by governments for formulating relevant policies and provide enabling environment to countries in the region to enable them to perceive clear direction and understanding of the promotion and implementation of catch certification and landing surveillance for fishery trade to prevent trade of IUU fishing products.

1.3 Preparation For Regional Guidelines To Preventing Landing, Export and Import of IUU Fish and Fisheries Products

- Questionnaires on Export of Fisheries Products (quantity & value) from Member Countries
  - Core Experts Meeting (CEM) 2011 in Bangkok; Outcome from the CEM 2011
- Questionnaires on Issues, Processes and Procedures
  - Country visits to gather information
  - CEM 2012 in Kuala Lumpur
  - Activities conducted by Member Countries to collect information *e.g.*; Brunei Darussalam: Consult with related agencies (Marine Department) regarding information gathering for vessels registration
- Subject to Council Director's approval for new project 2013-2017 (Combating IUU fishing in the SEA Region through Application of Catch Certification for International Trade in Fish and Fishery Products)

2.0 General Principle

2.1 Nature and scope

The scope of the guidelines is on landing, export and import of IUU fish and fisheries products from capture fisheries (freshwater & marine) for large/commercial and small-scale fisheries.

- Fish and fisheries products from capture fisheries (freshwater & marine)
- This guideline is for the region:
  - Trading within the country in the region; and trading among the countries in the region
  - International trade outside the region by Member Countries
- Large/commercial and small-scale fisheries (refer to "Regional Guideline for Responsible Fisheries Management in Southeast Asia)

2.2 Objectives of the regional guidelines

- Prevent landing, export and import of IUU fish and fisheries products
- Introducing catch certification measures and landing monitoring and surveillance

2.3 The regional guidelines show effective measures and procedures to prevent landing, export and import of IUU fish and fisheries products.

Box 4. Draft Regional Guidelines for Preventing Landing, Export and Import of IUU Fish and Fisheries Products (Cont'd)

3.0 Definition of the Terminology

- IUU fishing
  - IPOA-IUU definition
- IUU fish and fisheries products
  - Catch and derivatives from IUU fishing
- Domestic/National vessels
  - All registered/licensed fishing vessels
  - All registered/licensed carrier vessels
- Foreign vessels
  - All foreign registered/licensed fishing vessels (including factory vessel) operating in national water
  - All foreign registered/licensed fishing vessels fishing in high seas/other national waters and landing at national landing sites
  - All foreign registered/licensed carrier vessels landing at national landing sites
  - All vessel flying foreign flags operating in other national waters/high seas and land at national landing sites
- Monitoring and surveillance at landing sites
  - Information on landing amount and catch composition
  - Refer to the Guideline for Responsible Fisheries in Southeast Asia: Fisheries Management
- Large/commercial and small- scale fisheries
- Definition of Certification of Non-IUU Fish and Fisheries Products
- Definition of Catch Documentation Scheme (CDS)
- Definition of Statistical Document Scheme (SDS)
- Definition of fish (refer to EC Regulations)
- Definition of fish products (refer to EC Regulations)
- Fish and fisheries products (fish, shrimp, squids, bivalves, seaweeds, corals)
  - "Fish" means all species of living aquatic resources, whether processed or not (FAO definition)
- Positive and black list of vessels

4.0 Regional Guidelines

4.1 Certification of Non-IUU fish and fish products

- Catch documentation scheme (CDS) to comply with RFMOs (IOTC, ICCAT etc.) requirement
  - Statistical document scheme (SDS)
- Statistical document scheme (SDS) - refer to Port State Measures
- Trading license (Malaysia/Thailand)- for domestic trading
- EC Catch Certification
- RCDS (for intra regional trade)

4.2 Monitoring and surveillance at the landing sites

- Domestic/national vessels (100% monitor and validate at least 5% of total ECC, CDS)
- Foreign vessels (based on International Common Understanding: fishing vessels should be 24 meters in length and over, for cargo and carrier vessels usually more than 500 gross tonnage) (FAO Port State Measures, CDS-RFMOs)

4.3 Positive and black lists of vessels

- RFMO list (black list and positive list for tuna vessels)
- EU list (black list) (to include all vessels)

4.4 Strengthening existing law and regulations in Member Countries for preventing landing, export and import of IUU fish and fisheries products

- Implementation of CDS and SDS measures include for EC Regulation 1005/2008
  - domestic/national vessels, and foreign vessels
- Implement monitoring and surveillance at landing sites include FAO Port State Measures
  - domestic/national vessels, and foreign vessels
- Implementation of NPOA-IUU Fishing

4.5 Collaboration among SEAFDEC Member Countries

- establish networking within & among the countries
- strengthen cooperation among the countries as well as relevant regional (RPOA, ASEAN) / international organizations (FAO, EU)
- developments of regional information, education & communication programs/initiatives to compile & disseminate information

5.0 Follow-up actions to promote the implementation of the regional guidelines
(Refer to "Regional Guideline for Responsible Fisheries Management in Southeast Asia pg. 53)

- Role of Member Countries; role of regional bodies (SEAFDEC, ASEAN)

6.0 Review of the Guidelines

Conclusion and Way Forward

IUU fishing should be clearly defined and made identifiable. Any trade-related measure to be employed in curbing IUU fishing should be equally treated, *i.e.* for import as well as for domestic products. Since certification of fish and fisheries products from non-IUU fishing is difficult to promote in some developing countries due to lack of MCS programs, but the absence of this certification cannot also be considered proof of IUU fishing.

While the development of regional guidelines to prevent landings, export and import of IUU fishing products can be the first step towards creating a catch certification

scheme for non-IUU fishing products, creating a mandatory certification requirement to eliminate IUU fishing would be a bold step. Under this scheme, all imports would be considered legal if the flag State could certify that the fish has been harvested in accordance with their own fisheries management regime/requirements or from an area governed by an RFMO or other regional bodies, or in the high seas that comply with international standards. Trade measures in support of national and international conservation goals should be transparent and administered in a fair and non-discriminatory manner, with the underlying conservation goals which must be based on best available scientific evidence.

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Promoting Sustainable Tuna Fisheries Management in Southeast Asian Waters through Regional Cooperation

Somboon Siriraksophon, Achmad Poernomo and *Alma C. Dickson*

The global demand for tunas has been dramatically growing in recent years reflecting a shift of consumers' preference to food fish as protein source. The world tuna markets have substantially expanded and diversified into tuna sashimi and canned tuna. During the last several decades, Japan had been almost the only market for sashimi tuna, but nowadays, people in many countries of the world also prefer to eat tuna sashimi. The status of tuna stocks of the world depend on the regions/areas as well as on the species. Although some species are reported to be over-exploited, production of other species is continuously stable as a result of conservation and management efforts by Tuna Regional Fisheries Management Organizations (tuna RFMOs). Tunas are commercially-important fishery resources in the Southeast Asian region, providing products for export as well as for domestic consumption. As reported, the total tuna production from Southeast Asian waters increased from 0.87 million mt in 2001 to 1.94 million mt in 2008, including five oceanic tuna species, namely: bigeye, yellowfin, skipjack, albacore, and bluefin tuna, as well as from four neritic species, such as bullet tuna, frigate tuna, eastern little tuna, and longtail tuna.

Statistics have shown that in the Western Central Pacific Area (WCPA), the trend of skipjack tuna production had been increasing from 200,000 metric tons (mt) in 1970 to 1,300,000 mt in 2005, while stocks of bluefin tuna in the southern oceans decreased from 65,000 mt in 1970 to only 15,000 mt in 2005 (FAO, 2006). It has always been suggested that from the regional perspective, tuna fisheries in the Southeast Asian waters as a sub-regional area, should be placed under the guidance and management of tuna RFMOs such as the Western Central Pacific Fisheries Commission (WCPFC) and Indian Ocean Tuna Commission (IOTC). However, since the stock structure of tunas distributed in the Southeast Asian region is presently obscure and vague, it would be difficult to develop appropriate tuna management at the national and sub-regional levels, hampering the efforts of concerned RFMOs in carrying out effective regional stock assessment.

Confronted with a similar scenario, SEAFDEC with funding support from the Government of Japan Trust Fund carried out the project on "Information Collection of Highly Migratory Species in the Southeast Asian Waters" from 2008 to 2011, to examine the trend of tuna exploitation in the Southeast Asian waters. With specific objectives of clarifying and assessing the status of tuna exploitation in the Southeast Asian waters through various methods of information gathering, the project was conducted in collaboration with major tuna producing countries in the region, namely: Indonesia, Philippines, Thailand, Vietnam, and Malaysia. Analysis of the tuna exploitation focused on oceanic and neritic tunas that are exploited in the EEZs of the Southeast Asian countries. The data and information used for the analysis were sourced from national fishery statistics data, data samplings at selected landing sites, and results of consultations with national tuna focal points. Origin and species composition of tunas were examined and analyzed to warrant the status of tuna exploitation in specific sea areas, such as in the South China Sea, Sulu Sea, Celebes Sea, Andaman, Sea, Eastern Indian Ocean, Western Pacific Ocean, Banda Sea, and Gulf of Thailand. Nevertheless, since oceanic tunas are highly migratory while most of the neritic tuna stocks are shared among the Southeast Asian countries, therefore, management of tunas under the jurisdiction of a single country would not be sufficient.

In an effort to address such concern, the SEAFDEC Council at its 44th Meeting in April 2012 and the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP) at its 15th Meeting in November 2012, requested SEAFDEC to develop a concept for regional cooperation to promote the sustainable management of tuna fisheries in the Southeast Asian region. However, before proceeding with the establishment of such Regional Cooperation, it is important that the countries should develop their respective policies that would support any concerted effort for the sustainable exploitation of the oceanic and neritic tuna resources in the sub-regional and/or regional areas of the Southeast Asian waters. Moreover,

Unloading and recording of tuna catch at the Tuna Fishing Port in General Santos City, Philippines

the development of such Regional Cooperation would also take into consideration relevant provisions in the ASEAN-SEAFDEC Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 which were adopted in 2011, while the 2009 SEAFDEC Program Framework would be used as guide for the ASEAN-SEAFDEC countries in the promotion of sustainable tuna fisheries in the Southeast Asian waters. The outcomes of the Regional Cooperation would be beneficial not only to the countries in the region but also to relevant tuna RFMOs.

Status of Tuna Exploitation in Waters of Southeast Asia

The trend of tuna exploitation in the Southeast Asian countries has been well documented, especially in Indonesia and the Philippines, although this is not well organized in other countries such as Thailand, Vietnam, Malaysia, Myanmar, Brunei Darussalam, and Cambodia. As shown in the fishery statistical data, the total tuna production from Southeast Asian waters was about 1.94 million mt in 2008 increasing from 0.87 million mt in 2001 (**Fig. 1**). During its peak in 2008, the total marine capture production in the region was 13.8 million mt (SEAFDEC, 2010), and tuna represented about 14% of the total production from marine capture fisheries of the region. Comparing the catch among the Southeast Asian countries in 2010, about 56% and 36% of the total tuna production from the region were provided by Indonesia and Philippines, respectively. Subsequently, it can be gleaned that Indonesia was the biggest supplier of fresh and frozen tuna to the U.S.A. contributing about 36% (or about 9,000 mt) of the total U.S. fresh and frozen tuna imports in 2007 (Globefish, 2008), followed by the Philippines at 23%. As the number one supplier of principally yellowfin and bigeye tunas to sashimi markets in Japan, Indonesia air-ships about 15,000 mt of sashimi-grade tuna per year (Infofish, 2007). Nevertheless, the total tuna production from the region had slightly declined from 1.94 million mt in 2008 to 1.60 million mt in 2010 due to the declining trend of tuna exploitation especially by Indonesia and the Philippines while those of the other countries such as Malaysia and Vietnam also indicated certain fluctuations. However, the total tuna catch landing in Vietnam is estimated only for oceanic tuna but not including neritic tuna due to insufficient statistical data by species.

The composition of tuna stocks in the Southeast Asian waters depend on the sea areas and sub-regional areas (SEAFDEC, 2012). However, an overview of the tuna resources in the region indicated that skipjack is a dominant species representing 36% of all tuna exploitations followed by frigate tuna, yellowfin, eastern little tuna, and longtail tuna representing 18%, 17%, 14% and 9%, respectively. The other tuna species such as bigeye, bullet tuna, albacore, and southern bluefin tuna account for less than 7% of the total exploitation. Although tuna fisheries in the region could be grouped according to species, the catch composition could also be classified from the type of main fishing gears used for both oceanic and neritic tunas such as purse seine (including ringnets) associated with fish aggregating devices (FADs) called *payao* in the Philippines or *rumpons* in Indonesia, long-line, vertical hand-line, and gillnet. In the Philippines, the major catch from purse seine and ringnets is composed of skipjack tuna, roundscads, yellowfin tuna and frigate tuna. Other catches include small volumes of bigeye tuna, eastern little tuna and big-eye scad. For tuna hand-line, majority of the catch comprises adult yellowfin tuna, blue marlin and swordfish. Adult bigeye and yellowfin are also popularly caught in nearby FADs by vertical hand-line, a method which has been recently applied in Sabah State of Malaysia. This led to increased total landings of oceanic tuna especially yellowfin and bigeye in Sabah State. The yellowfin, bigeye, albacore, and southern bluefin tuna taken from the Western Pacific within the EEZs of the Philippines and Indonesia and in some sea areas such as Banda Sea and South China Sea, are also caught by long-lines. Pole-and-line fishery for skipjack is also being operated in the Sulawesi Sea by the Indonesian fishers.

Results based on this study indicated that important tuna fishing grounds which could provide yields higher than two hundred thousand metric tons are in Maluku-Papua,

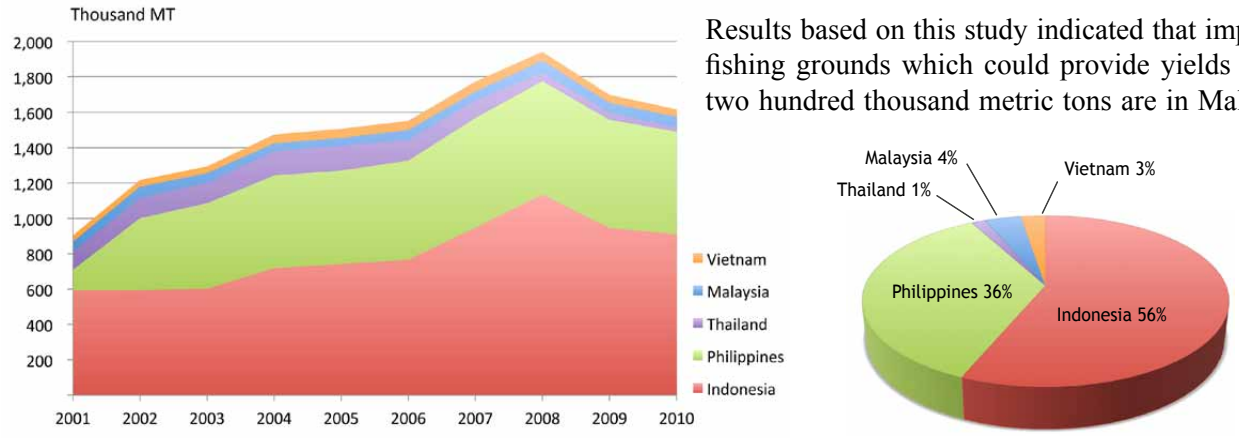

Fig. 1. Total exploitation of tunas in 2001-2010 in the Southeast Asian waters (*left*) and percentage of catch by country in 2010 (*right*)

North Sulawesi, Mindanao Sea, and Sulu Sea as shown in **Fig. 2**. As the figure clearly shows, tuna resources are very important and shared by two or three countries especially in the Sulu-Sulawesi sub-regional area (Sulu Sea and Celebes Sea). Meanwhile, the South China Sea and Andaman Sea are also other areas where tuna resources are shared. The said study also indicated that aside from oceanic tunas (*i.e.* bigeye and yellowfin tunas), neritic tunas (*i.e.* frigate tuna, longtail tuna and eastern little tuna) are also abundant and important resources in the aforementioned sub-regional sea areas.

Regional Assessment of Tuna Stocks

In principle, tuna resources in the Southeast Asian region are managed under the framework of relevant tuna RFMOs such as the WCPFC and IOTC, which also support the regular conduct of tuna stock assessment in the WCPA and the Indian Ocean, respectively. However, stock assessment conducted by these tuna RFMOs focuses mainly on oceanic tuna species such as skipjack, yellowfin, bigeye, albacore, and bluefin tunas based on an assessment model that requires time series data inputs and other relevant parameters/data. Taking into account the geographic feature of the Southeast Asian region as part of WCPA, any stock assessment that mainly uses time series data from developed countries' fishing activities in the high seas and in some EEZs of the Pacific Island countries may not reflect the real status of the tuna stocks in the waters of Southeast Asia. This is because of the complex data at the sub-regional areas such as those in the South China Sea, Sulu Sea, Celebes Sea, and Banda Sea. Furthermore, the tuna stock assessments conducted by such tuna RFMOs do not cover the neritic tuna species.

Many Southeast Asian countries have attempted to assess the tuna stocks in their respective EEZs and national waters with support from regional/international organizations such as SEAFDEC, FAO, RFMOs, among others. However, Chee (1995) pointed out that the inadequate information in most countries on the distribution and migration of the several tuna species as well as on stock structure even though biological information may be collected independently by many countries, does not merit proper assessment of the tuna stocks. Many countries in the region are known to have also conducted several workshops with the objective of assessing the stocks of tuna, for example the workshop in Indonesia (SFP, 2009) which aimed to determine the stocks of tunas in its waters. The workshop indicated that insufficient and inaccurate statistical data (that meet the data requirements for scientific stock assessments) still prevail up to now, therefore satisfactory results of scientific stock assessments relating to tunas are not available in many countries of the region. Nonetheless, tuna experts

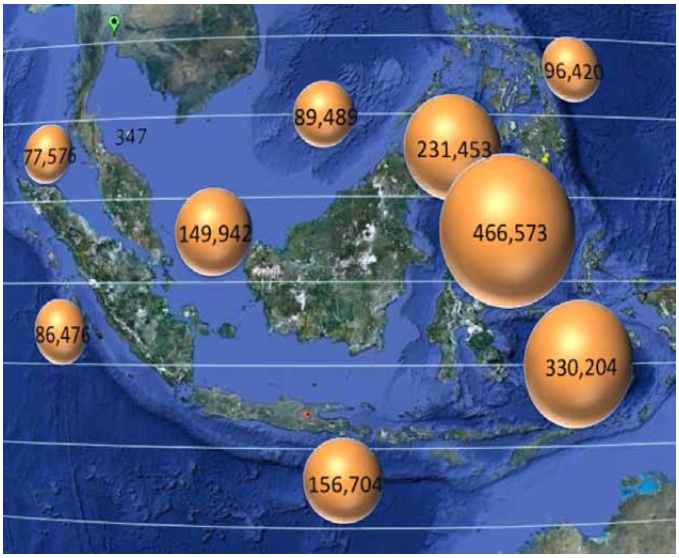

Fig. 2. Relative abundance of tuna resources in different sub-regional areas of the Southeast Asian region (2009)

at the workshop agreed that although reasonable stock size of Indonesian tunas could not be estimated to date, indicators should be established to predict the condition of Indonesian tuna fisheries, instead of coming up with the actual estimation of the tuna stock size *per se*.

Requirements for Tuna Fisheries Policy and Management

Exploitation of tuna at particular time, age, and size by one country will definitely affect the catch of other neighboring countries since tunas are migratory stocks. In order to address this concern, a concerted effort of all parties involved in tuna fisheries in the Southeast Asian region is deemed necessary. Specifically, a coordinated regional approach is necessary in order to gather the appropriate data and carry out analyses and interpretations that could lead to effective management. The important geographic features and large marine ecosystems in the region include spawning grounds of important tuna species as could be gleaned from the total tuna production of the Southeast Asian region and in the RFMO areas.

In this connection, development of sustainable management for tuna fisheries in the Southeast Asian waters should be considered at national and regional levels although this should not be isolated from that of the RFMOs, in fact, such regional management schemes should be complementary. However, since relevant data are still not sufficient for effective tuna stock assessment at national, sub-regional and regional levels, therefore a regional working group should be established to focus on the stock assessment of each tuna species. Results of the stock assessment would be used to support the development of fisheries policies and effective management for sustainable tuna fisheries in the Southeast Asian region.

Box 1. Key issues to be addressed under the proposed regional cooperation for sustainable tuna fisheries management in the Southeast Asian waters

Stock Assessment at National and Sub-regional Areas
- Establishment of working group(s) on tuna stock assessment
- Improvement of national data collection systems
  - Support routine biological and resources surveys
  - Separate high seas production from domestic tuna production
- Promote collaborative/joint research surveys in the EEZs and sub-regional areas

Impacts on Environment, Biodiversity and Tuna Stock
- Fishing Gear Selectivity
  - Reduction of the by-catch of endangered aquatic species such as marine turtles, dolphin, sharks and rays, from long-line fisheries
  - Reduction of juvenile tuna by-catch (*e.g.* yellowfin and bigeye tunas) in purse seine fishing
- Fish Aggregating Devices (fixed or drifting)
  - Proper management of FADs through control and monitoring
- R&D on the use the appropriate FADs in terms of low impact to environment
- Establishment of the fish *refugia* to protect spawning and nursery grounds
- Establishment of closed season for the conservation and management of tuna resources

Effective Fisheries Management
- Fishing Fleet Management: consider maintaining or reducing fishing capacity to strike a balance of existing tuna stocks
- Tuna fisheries management within the EEZs and sub-regional areas: consider appropriate input-output control practices

IUU Fishing
- Develop and promote an appropriate regional catch documentation schemes or RFMOs catch documentation schemes
- Strengthen MCS through sub-regional cooperation to prevent the IUU fishing practices by foreign vessels

Socio-economics
- Enhance intra-regional trade of tuna raw materials and tuna products in the region
- Promote appropriate fish-handling technology and practices at sea
- Support the proposed eco-labeling of tuna fishery products within the ASEAN

Human Resources/Capacity Building
- Identification of tuna species particularly juveniles of yellowfin and bigeye tunas
- Life history of tunas focusing on the larval stages
- Improvement of data collection systems including database at national and regional levels
- Stock assessment using appropriate assessment model(s)

Regional Cooperation to Promote Sustainable Tuna Fisheries

Thus, for the promotion of sustainable tuna fisheries in the Southeast Asian region, a regional cooperation is necessary to support tuna fisheries management in the future. In this regard, the SEAFDEC Council during its 45th Meeting in April 2013 considered the proposed development of fisheries policy framework to support tuna management at national and sub-regional areas where transboundary issues exist specifically in Sulu Sea, Celebes Sea, South China Sea, and Andaman Sea. While encouraging relevant tuna countries to pool their resources in moving towards sustainable management of tuna fisheries in the Southeast Asian region, especially in addressing the various issues and concerns (**Box 1**) and in order to attain the desired goal of the proposed Regional Cooperation, the SEAFDEC Council suggested that SEAFDEC could consider developing a draft plan of action under the Regional Cooperation to include efforts in enhancing traceability, development of tuna catch certification scheme, conduct of joint stock assessment, and combating IUU fishing in tuna fisheries.

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Community Aquaculture for Poverty Alleviation in Rural Areas of Thailand

Choltisak Chawpaknum

The role of fish as traditional source of animal protein in the Thai diet is expressed in many common Thai expressions, such as: *"Kin kao kin pla leo yang?"* (Have you eaten rice and fish yet?), and *"Nai nam mee pla nai na mee kao"* (In the water there are fish, in the field there is rice). In Thailand, an enormous amount of fish is consumed in rural households because of its relatively cheap and affordable price as well as the nutritive value that fish provides especially to the people in rural communities. Among the various types of protein available, fish is preferred by poor rural villagers to meet their main protein requirement because of availability and affordability.

Thailand is rich in natural and man-made water resources that include natural lakes, dams and reservoirs, and freshwater ponds, which could be intensively tapped to promote community fishpond development throughout the country as means of eradicating hunger and malnutrition in rural communities. The people of Thailand have always been proud of their heritage particularly their land and the natural environment. As described aptly by Prompoj (1994) "even long before the age of the now famous Golden Triangle, this fertile country was already known as the Golden Land," referring to the rich natural resources of Thailand that yield adequate quantities of products that ensure the food security of its people. Thailand has been endowed with abundant freshwater fisheries resources that led to the development of freshwater aquaculture systems especially for a number of freshwater aquatic species.

Freshwater Fisheries Production of Thailand

Based on the Fisheries Statistics of Thailand (DOF, 2011), the country's total fisheries production during the last decade had slightly decreased from 3,713,200 mt in 2000 to 3,287,300 mt in 2009 (**Table 1**) due to the declining total production from marine fisheries. Considered a critical contributor to the country's total fisheries production, marine fisheries accounted for about 78% of the total fisheries production in 2009. Production from freshwater fisheries, although still minimal in terms of volume and value, plays an important role in the country's food security as freshwater fish has been providing the much need protein for the poor segment of the population. Nevertheless, the total freshwater fish production (**Table 1**, **Fig. 1**) has been increasing over the last decade from 472,500 mt in 2000 to 728,680 mt in 2009, while the almost stable trend of production from freshwater capture fisheries (201,500 mt in 2000 to 206,800 mt in 2009) implies that production from

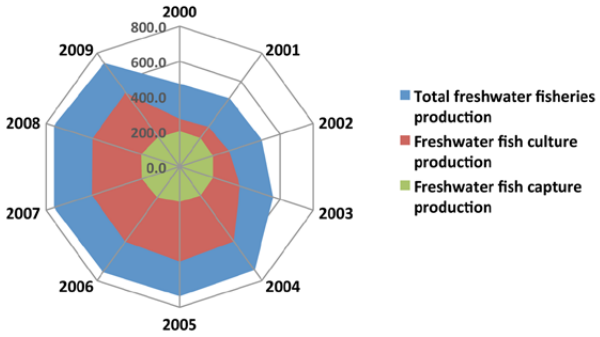

Fig. 1. Production from freshwater fisheries of Thailand in 2000-2009 ('000 mt)

Table 1. Fisheries production of Thailand in quantity (2000-2009) in metric tons (mt)

Year	Total Fisheries Production	Freshwater		Total Freshwater Production	Marine		Total Marine Production
		Culture	Capture		Culture	Capture	
2000	3,713,200	271,000	201,500	472,500	467,000	2,773,700	3,240,700
2001	3,648,400	279,700	202,500	482,200	534,500	2,631,700	3,166,200
2002	3,797,000	294,500	198,700	493,200	660,100	2,643,700	3,303,800
2003	3,914,000	361,100	198,400	559,500	703,300	2,651,200	3,354,500
2004	4,099,600	523,700	203,700	727,400	736,300	2,635,900	3,372,200
2005	4,118,500	539,400	198,800	738,200	764,700	2,615,600	3,380,300
2006	4,053,100	527,400	214,000	741,400	826,900	2,484,800	3,311,700
2007	3,675,400	525,100	225,600	750,700	845,300	2,079,400	2,924,700
2008	3,204,200	522,500	228,600	751,100	808,300	1,644,800	2,453,100
2009	3,287,280	521,880	206,800	728,680	894,800	1,663,800	2,558,600

Source: *Information Technology Center, Department of Fisheries (DOF, 2011)*

nature may not increase any more. Culture of freshwater fish is therefore an option to increase fish production that could meet the needs of the country's inland population (Choltisak, 2012).

Rural Aquaculture Development Program

Recognizing that poverty prevails in the most disadvantaged communities of the country, the Government of Thailand has been intensifying its efforts towards the improvement of the well-being of peoples in rural communities. Through the Department of Fisheries (DOF), Thailand continues to promote freshwater aquaculture for rural development to increase fish supply, create employment opportunities, and eventually eradicate poverty in rural areas.

The DOF has been promoting rural aquaculture in Thailand for decades through research and extension services. In the past, the strategy for its small-scale rural aquaculture development program included providing the fish farmers with subsidies and substantial support as well as incentives, by providing them with free advisory services for the adoption of modern aquaculture technologies, and subsidized inputs for pond construction and management, seeds and feeds. Realizing later that subsidies do not necessarily lead to sustainable aquaculture development, the DOF shifted its support to extending adequate and appropriate information on aquaculture technologies to targeted fish farmers. This metamorphosis necessitated the DOF to require additional budgetary allocation to give more focus on rural aquaculture development, from 5.94 million USD in 2001 which continued to increase annually at 9.93 million USD in 2009 (**Table 2**). With such inputs, more than 20 freshwater fish species have been promoted for culture to 304,876 fish farmers in 6850 extension project sites in the last decade. This was achieved through the rural aquaculture development program of Thailand which includes four major projects, namely: Village Fish Pond Development Project, School Fishpond Project, Training of Fish Farmers in Freshwater Fish Culture, and Culture of Indigenous Fish Species.

Table 2. Budget for freshwater aquaculture development in Thailand

Year	Budget for Aquaculture Development Program (in USD)	Number of Trainees (Farmers)	Number of Extension Project Sites
2001	5,940,669	48,487	140
2002	4,527,563	34,500	168
2003	11,084,514	58,592	168
2004	7,074,920	29,200	1,030
2005	9,701,034	30,000	1,034
2006	10,819,570	27,555	1,049
2007	12,010,483	26,000	1,056
2008	9,444,479	24,542	1,100
2009	9,930,799	26,000	1,105

Source: *Information Technology Center, Department of Fisheries (DOF, 2011)*

Village Fish Pond Development Project

One of the most important rural fisheries development approaches, the Village Fish Pond Development Project (VFPDP) has been promoted with the main objective of strengthening social cohesiveness in rural communities (Virapat and Laoprasert, 2002). As a communal activity, culture of fish in freshwater ponds is recognized as crucial for community development as it could enhance cooperation among community members. Started in the early 1980s, VFPDP is aimed at increasing fish production for local consumption, creating opportunities for local employment, and ultimately alleviating malnutrition and poverty in rural communities.

Moreover, through human capacity building, the VFPDP aims to train rural community members to be more self-governing and self-reliant. From 1982 to 2002, VFPDP had overseen more than 20,000 freshwater fishponds which are mostly located in the northeast and northern areas of Thailand (Virapat and Laoprasert, 2002). Under the VFPDP, the role of DOF comes in the form of technical advice for the rehabilitation or construction of village fishponds (reservoirs, swamps, and tanks), adoption of appropriate freshwater fish culture technologies, and increased supply of quality fish seeds or fingerlings for increased fish production. The VFPDP embraces several sub-projects that have benefited the country's rural communities, *i.e.* Sustainable Fish Production in Natural Waters, Village Fish Breeding Center, and Fish Processing.

Considering that there were thousands of freshwater fishponds ranging from 0.2 to 20.0 ha in the rural areas of the country producing fish not sufficient enough even for local consumption (3-5 kg/ha/year), the DOF was challenged to promote effective management of these ponds to enable fish farmers to increase their production (Virapat, 2007). Thus, the VFPDP was initiated and has since then been instrumental in the country's increasing numbers of freshwater fishponds from 256,082 in 2000 to 550,631 in 2009, as well as in terms of the area cultivated from 96,145 ha in 2000 165,210 ha in 2009, and average productivity of about 3.25 mt/ha/year (**Table 3**). When the Government of Thailand decided to transfer in 2001 the authority for management of natural resources including fisheries in all community waters to the local government units, locally known as Tambon Administrative Organization (TAO), which are responsible of rural development, the responsibility of implementing the VFPDP including the budgetary allocations were also gradually transferred

Table 3. Number of freshwater aquaculture farms in Thailand

Year	Total Number of Farms	Total Culture Area (ha)	Total Production (mt)	Productivity (mt/ha)
2000	256,082	96,145	271,000	2.82
2001	268,591	100,553	279,700	2.78
2002	281,199	101,952	294,500	2.89
2003	333,537	111,903	361,100	3.23
2004	423,083	143,501	523,700	3.65
2005	468,926	149,574	539,400	3.61
2006	488,167	151,138	527,400	3.49
2007	496,124	149,228	525,100	3.52
2008	500,785	153,819	522,500	3.40
2009	550,631	165,210	521,880	3.16

Source: *Information Technology Center, Department of Fisheries (DOF, 2011)*

from DOF to the TAO from 2001 until 2004. However, the DOF continues its role of providing technical inputs for the effective adoption of VFPDP in the rural areas of the country.

School Fishpond Project

Under the patronage of Her Royal Highness *Princess Maha Chakri Sirindhorn*, the School Fishpond Project which is also known as Lunch Program targets mainly the village primary and secondary schools in remote rural areas. The main objective of this project is to impart on school children the skills in fishpond preparation, fish stocking, feed preparation using locally available ingredients and low-cost methods and facilities, feeding management, and harvesting. The school children eat the fish they raised during school lunch, therefore this scheme provides the means of producing fish for daily consumption in schools through self-help initiatives in fish culture.

In addition to serving as means to teach children on the basic principles of freshwater fishpond culture and to be self-reliant, the project also provides outreach human capacity building to parents and other members of the communities. Thus, the project was later expanded to include integrated fish-poultry farming, now serving as focal point for the sustainable development of freshwater aquaculture in remote rural areas. Through the school fishpond development activities, students and the communities together take part in an experiential learning process that actively demonstrates the potential benefits of improved fishpond management to livelihoods and human nutrition. To date, the DOF continues to provide technical support to this School Fishpond Project which now covers the border areas of the country.

Training of Fish Farmers in Freshwater Fish Culture

Through the DOF, training of general fish farmers in fish culture was also conducted to increase fish production from community fishponds for local consumption. Several on-site training activities have been adopted under this project, such as the establishment of the learning centers for fish seed production. Moreover, training sessions were also conducted in DOF facilities on fish disease management, fish culture technology, fish nutrition, among others. Since its inception in early 2000s, the project has trained more than 300,000 fish farmers including their children in about 6850 project sites in remote rural areas of the country.

Culture of Indigenous Fish Species

DOF has continued to conduct research projects on the culture of indigenous fish species which has been running in the country during the last decade. The DOF researchers experimented on the culture of more than 60 indigenous fish species and came up with more than 1,000 technical research reports which provide the necessary knowledge for the aquaculture of indigenous fish species for extension to the fish farmers.

Consumption of Fish in Thailand

A study was conducted in the poorest areas of Thailand on consumption of fish and other aquatic species from inland fisheries. The results indicated that the poor is highly dependent on the aquatic resources for their subsistence. The estimated annual per capita consumption of fish of the people based on a field survey of 465 sample households in 1998-1999 was 28.8 kg/capita/year of which 92.5% was in the form of fresh fish. As a matter of fact, freshwater fish accounted for 70-90% of the total quantity of fish consumed in all regions of the country (**Fig. 2**). Tilapia is the most preferred freshwater fish (8.5 kg/capita/year or 29.6%) followed by the Thai silver barb (4.7 kg/capita/year or 16.3%) and striped snakehead (4.4 kg/capita/year or 15.4%).

In terms of household expenditures for food, fish ranked among the primary animal protein sources accounting for 15.6% of the total expenditures, together with chicken, pork, and beef which contributed around 14-17% (Piumsombun, 2001). Based on the fisheries statistical

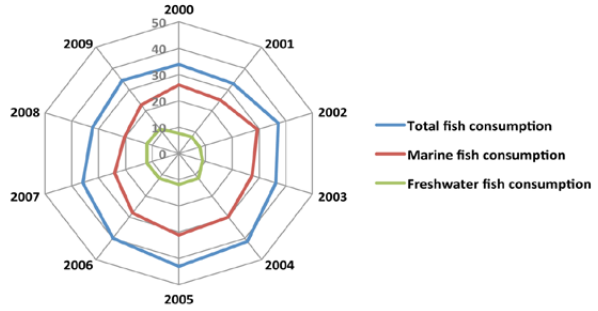

Fig. 2. Total fish consumption of Thailand in 2000-2009 (kg/capita/year)

Source: *Information Technology Center, Department of Fisheries (DOF, 2011)*

Table 4. A decade of fish consumption in Thailand

Source of Fish Consumption	Fish Consumption in 2000 (kg/capita/year)	Fish Consumption in 2009 (kg/capita/year)	Ratio
Total Fish Consumption	33.76	34.21	1.01
Marine Fish Consumption	26.13	22.74	0.87
Freshwater Fish Consumption	7.64	11.47	1.50

Source: *Information Technology Center, Department of Fisheries (DOF, 2011)*

report of Thailand (DOF, 2011), the efforts of DOF to promote community aquaculture throughout Thailand in the last ten years, had contributed positive impacts with respect to fish consumption at the national level. As can be gleaned from **Table 4**, the total fish consumption from 2000 to 2009 had increased by 1.01 times, from about 33.8 kg/capita/year to 34.2 kg/capita/year, respectively.

Meanwhile, the consumption of marine fish on the one hand had slightly decreased by 0.87 times from about 26.1 kg/capita/year to 22.7 kg/capita/year. On the other hand, the consumption of freshwater fish increased by more than 1.50 times from 7.6 kg/capita/year to 11.5 kg/capita/year, implying that freshwater fish could serve as main source of protein for rural communities. However, there is a need to promote improved freshwater community aquaculture in order to increase production and sustain its role in alleviating poverty and eradicating malnutrition in rural communities.

Conclusion and Way Forward

Over all, Thailand is not short of food fish as protein source for its people especially those who are in the rural communities. However, it is imperative that sustainable yields from natural waters and increased productivity in fish culture are ensured. The responsibility of the DOF in the past was focused in maintaining the stable status of capture fisheries production particularly in freshwater and more particularly in increasing production from community aquaculture, as it is in this aspect that the needs of the Thais for food fish can be fulfilled. The role of DOF had been successfully undertaken especially in terms of supporting the fish consumption needs of the country. However, its efforts were without challenges and difficulties, in which case Thailand would still need to continue generating advanced aquaculture techniques as part of its next step in development, in order to sustain the responsible utilization of its natural aquatic resources, and to eventually eradicate hunger and malnutrition in the rural areas of the country.

The experience of Thailand in community aquaculture development, *e.g.* the Village Fish Pond Development Project and the School Fishpond Project, demonstrates the applicability of community-based participatory approach in remote rural areas to increase fish production for food security. This approach could be adapted in the rural areas of other Southeast Asian countries, especially in the countries bordering Thailand, *i.e.* Cambodia, Lao PDR and Myanmar, where freshwater ponds could be developed to increase fish production for the daily fish consumption needs of the peoples in the rural areas, eradicate poverty and achieve food security.

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Impact of the EC Regulation No. 1005/2008 on Tuna Long-line Fisheries in Vietnam

Nguyen Quoc Khanh, Tran Duc Phu and *Nguyen Trong Luong*

The seemingly incongruities between the Economic Community Regulation No. 1005/2008 or the EC Regulation and Vietnam's fisheries regulations have challenged Vietnam to effectively combat IUU fishing in the country. Setting Vietnam's regulations against that of EC's, it would appear that as of the moment, the former would not be able to comply with the requirements of the latter especially on sustainable resource management and conservation in view of the complicated features of the fisheries sector of the country. An analysis of the challenges is spelled out in this article which focuses on tuna long-line fisheries of Vietnam.

Tuna fishery is a significant contributor to the national economy of Vietnam and is also a source of employment for the country's local people. The main markets of Vietnam's tuna products are the European Community (EC), United States, and Japan. In accordance with EC Regulation No. 1005/2008 Establishing a System to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated (IUU) Fishing also known as the Illegal, Unreported and Unregulated Fishing Regulation which came into effect on 1 January 2010, export of fish products to the EC is allowed only when accompanied by a certified catch certificate indicating that the products are not obtained through IUU fishing. While attempting to apply the said Regulation, tuna fisheries of Vietnam had been confronted with various problems and challenges, especially with respect to the process of issuing catch certificates and fishing licenses as well as in complying with the requirements on sustainable resources management and conservation.

After tuna long-line fishing was introduced in Vietnam in early 1990s, it soon became one of the major industries of the country (Phong, 2010), particularly in the central provinces of Binh Dinh, Phu Yen, Khanh Hoa, and Ba Ria Vung Tau. In 2011, there were 2,520 tuna fishing vessels in Vietnam (DECAFIREP, 2012), of which about 1,270 were long-line vessels (GDCFRP, 2011). The main tuna species targeted are the yellowfin and bigeye tunas during the peak season from September to April, and to certain extent, in the leaner season from May to October (Tri, 2002). Tuna offers another opportunity for Vietnam to excel in the seafood industry, after shrimps and *Pangasius* spp. or the tra and basa catfish. In view of its high value, tuna is highly in demand in the global market (VASEP, 2011), and Vietnam exports tuna to sixty countries in the world (VASEP and GSO, 2011), the export value of which had been increasing at an average rate of 25% per year (**Fig. 1**). The country's tuna export to its main markets, *i.e.* EC, U.S.A. and Japan, accounts for nearly 80% of the country's total tuna export value (VASEP, 2011).

Fisheries of Vietnam and the EC Regulation

Fisheries industry of Vietnam could be classified into industrial and small-scale fisheries, of which marine capture fisheries specifically practice an open access system (Tam, 2009). Although Vietnam has promulgated fisheries laws, regulations and decisions on fisheries management, the efficiency of the legal enforcement of such ordinances is rather low. This is coupled by the fact that IUU fishing which is reported to occur regularly in the

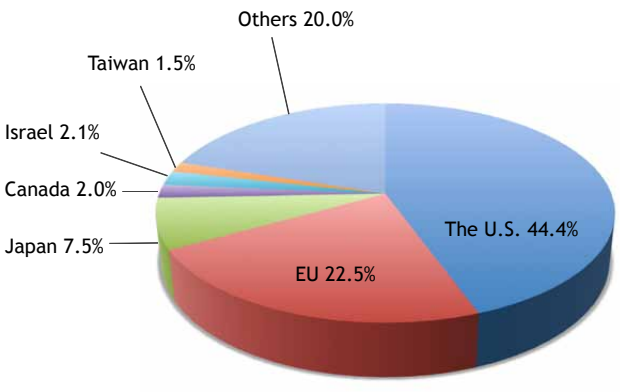

Fig. 1. Tuna export of Vietnam in volume, value and markets from 2006 to 2010

waters of Vietnam is practiced by both foreign and domestic fishing vessels. Nevertheless, in order that Vietnam would continue to have its presence felt in the world's fish market, the country's foreign trade policies must conform to international regulations and requirements.

It is widely recognized that illegal, unreported and unregulated (IUU) fishing has become a serious issue worldwide (Bray, 2001), and in order to prevent, deter and eliminate IUU fishing at the global scale, EC Regulation No. 1005/2008 was introduced to ensure that exploitation of the living aquatic resources conforms to sustainable economic, environmental and social conditions. The Regulation is a transparent and non-discriminatory instrument that applies to all vessels engaged in the commercial exploitation of fisheries resources in the high seas or in the waters under the jurisdiction of a third state. Nevertheless, IUU fishing has also been reported to be taking place not only within maritime waters of overseas countries but also in territories of the EC member states (EC, 2008). Thus, the Regulation aims to prevent IUU fishing practices in countries linked to the EC, either through trade to and from the EC or the involvement of EC nationals in IUU fishing activities of any flag states. It also provides a comprehensive legal basis for operational cooperation between third countries and the EC to efficiently combat IUU fishing.

Thus, the Regulation, which mainly aims to combat IUU fishing, imposes stringent trade measures on fishing vessels and foreign states that support IUU fishing. The control, sanctioning and conditionality elements at the heart of the Regulation includes port control over third country fishing vessels, catch certification requirements, development of an IUU vessel list, and establishment of a list of non-cooperating third countries (Tsamenyi, 2010). Considering the significance of its export of fish products to the EC for economic development, Vietnam exerts efforts to ensure that the requirements of the Regulation are complied with although the process involved had posed challenges to the country's fish trade. Therefore, a case study was conducted to assess the impacts of the implementation of the EC Regulation in Vietnam with the stakeholders of the tuna fisheries industry as respondents.

Nevertheless, in an effort to implement the EC Regulation, the Ministry of Agriculture and Rural Development of Vietnam adopted the corresponding regulations on fisheries certification of exports to European markets. Known as Decision No. 3477/QĐ-BNN and Circular No. 09/2011/TT- BNNPTNT, these regulations prescribe the processes, procedures and contents of checking, as well as the responsibilities and powers of fisheries authorities and individuals in certifying the origin of capture fisheries production. The Government of Vietnam also developed its National Action Plan to Combat IUU Fishing, which underlines the need for regional information sharing on IUU fishing activities. The objectives of the country's National Action Plan are to guarantee the sustainable development of fisheries, protection of the resources, improvement of fishing techniques, and effectively combat IUU fishing.

Implementation of EC Regulation No. 1005/2008 vs. Vietnam's Regulations in Long-line Tuna Fisheries of Vietnam: Case Study

The case study attempted to compare the impacts of the implementation of the EC Regulation No. 1005/2008 with those of the regulations of Vietnam in the country's long-line tuna fisheries. The primary data were collected through face-to-face interviews with fishers, skippers of tuna long-line vessels, and fisheries managers using questionnaires and qualitative models. Secondary data was collected from the archives of the Ministry of Agriculture and Rural Development, the General Department of Capture Fisheries and Resources Protection, and the Association of Seafood Exporters and Producers, as well as from published documents, annual fisheries reports, statistical documents, and keynote speeches. Additional information was also collected from literatures, journal articles, and newspapers. Specifically, the study was intended to seek for an answer to the question: What are the problems and challenges that arise when applying the EC Regulation in the context of Vietnam fisheries? In order to find out the problems and challenges, the case study also compared the requirements of the EC Regulation No. 1005/2008, the fisheries regulations of Vietnam, and the actual implementation of such regulations in Vietnam.

EC Regulation No. 1005/2008 and Regulations of Vietnam

After benchmarking the requirements of EC Regulation No. 1005/2008 with those of the regulations of Vietnam, the result indicated certain overlaps as well mismatches as shown in **Fig. 2**. However, a match exists in the catch certificate requirement, and fishing report and logbook keeping. The requirement of EC to enclose a valid catch certificate with the fish products imported into the EC ensures that the concerned fisheries products have been caught in compliance with the regulations on sustainable resource utilization, while the report and the fishing logbook would also prove that the fishing vessels comply with the requirements of the EC Regulation. In the regulations of Vietnam, it is prescribed that in order to export fisheries products to the EC such products should meet the catch

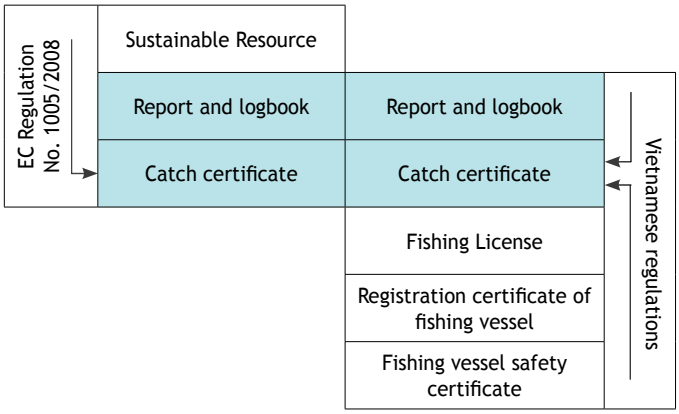

Fig. 2. Matches and mismatches between the Regulations of Vietnam and the EC Regulation No. 1005/2008

certificate requirement of EC Regulation No. 1005/2008. Therefore, there is some degree of homogeneity between the regulations of Vietnam and the EC Regulation with respect to catch certification.

Nonetheless, there are also differences between the above-mentioned sets of regulations especially on the steps in issuing the certificates. Specifically, the EC Regulation specifies that the objectives related to the promotion of sustainable resource management and conservation should be met, while efforts to promote resource management and conservation are not clearly defined in Vietnam's regulations. This weakness must have emanated from the gap of the country's regulatory systems, insufficiency of resource databases, the rapidly increasing fishing capacity, and the specific features of the country's fisheries.

In addition, issuance of fishing licenses and catch certificates from the perspective of Vietnam authorities does not need to comply with requirements on sustainable resource management but is rather focused on marine safety, which is a precondition for undertaking fishing operations. The Fisheries Administration of Vietnam therefore has different outlook especially on the requirements in the EC Regulation for catch certification. Overall, the problems occur in many aspects, such as in the process of issuing fishing licenses and catch certificates, promoting resources management and conservation, maintaining logbooks and reporting, and in complying with the EC Regulation in general due to the inadequacy of knowledge and absolute poverty on the part of the fishers.

Problems and Challenges

Issuance of and Obtaining Fishing Licenses and Catch Certificates

The regulations of Vietnam (Khai, 2005) stipulate that fishing vessels should obtain fishing licenses before undertaking fishing operations. A fishing license is issued to a fishing vessel in accordance with the certificate of safety and registration certificate, without focusing on the condition of the resources, while the EC Regulation considers resource conservation as an important aspect in the catch certificate. This scenario has resulted in a conflict between the implementation of the requirements of the EC Regulation and the process of issuing a fishing license by Vietnam authorities. Consequently, the issuance of fishing licenses based solely on technical safety and registration instead of on sustainable resource management, has led to overcapacity, and subsequently to economic losses, diminished employment opportunities and reduced household incomes, eventually exacerbating poverty among coastal and artisanal fishers. Nevertheless, it is also well recognized that fishers would try to refrain from applying for fishing licenses and certificates when they are constrained and controlled by fishery authorities, while also trying to purposely delay payment of registration fees for as long as possible. Therefore, fishing vessels operating without licenses are a common sight in the waters of Vietnam for many years.

One of the main problems encountered by fishers in complying with the EC Regulation is in filling out the catch certificate form. According to the handbook on the practical application of the EC Regulation, the skipper of a fishing vessel is responsible in providing information especially on the species caught and the corresponding yields in the said form. However, in the real scenario in Vietnam, after the partial inputs are provided by the skipper, the form is sent to the exporters to complete the remaining information, which includes the name and address of exporter and transport details. The certificate form is then submitted by exporters to fishery authorities but in order to receive a valid catch certificate from the authorities, exporters should also provide copies of logbooks together with the fishing license and a complete catch certificate form. Since a catch certificate form is accomplished by exporters after buying fish from middlemen, the information may not be as precise as that of the skipper's.

The exporters could just write any species and corresponding volume caught by a particular fishing boat, while the skipper could appropriately provide such information as features of the fishing vessel, species and yields in the catch certificate form. Thus, in Vietnam the practical application of the EC Regulation through catch certification is not in line with the requirements of the said regulation. Furthermore, trading of fish products in Vietnam is usually done through middlemen (Dung, 2010), although middlemen are not involved by the authorities during the transshipment process of fish products at sea. While middlemen serve as a bridge between fishers and exporters, transshipment at

sea also links the fishers and exporters as well. This leads to two patterns of transactions in fish products in Vietnam:

Pattern A. Fishing vessels → transshipment → exporters
Pattern B. Fishing vessels → middlemen → exporters

Based on the regulations of Vietnam (Tam, 2009 and 2011), transshipment at sea (**Pattern A**) must declare information on transshipment, *i.e.* position of transshipment, estimated weight of catch, and name of transport vessel. However, transshipment information on fisheries products that moves through middlemen (**Pattern B**) is not declared in the catch certificate. While in **Pattern A**, authorities can trace the fishing vessels from which the fish had come from because information on transshipment is declared in the catch certificate, in **Pattern B** the origin of the fish cannot be traced because information on transshipment is not declared in the catch certificate form, and thus, could come from IUU fishing. Moreover, middlemen buy fish from fishers who comply with the regulations as well as from those who do not, so the result could be a mix of IUU with non-IUU fish products in which case IUU products could be sold under the pretext of non-IUU products. Furthermore, since trading of fish products between middlemen and fishers is not recorded in the catch certificate, this makes it difficult for authorities to trace the fish products that do not comply with the EC Regulation.

In addition, Vietnam does not have regulations requiring middlemen to record information on the fishing vessels that sold the fish products as well as the yield. In reality, middlemen buy fish from many fishing vessels, including those from fish buying-vessels at sea. The middlemen in turn sell the fish to more than one exporter in different places, making the process of tracing the fish products very complicated. Middlemen also do not check the fishers' logbooks, a reason why fishers do not usually write entries in logbooks. This leads to problems in issuing the catch certificate because fishing logbook is a necessary document in obtaining a catch certificate. In addition, because of the existing patterns of trading fish products in Vietnam, inspection by concerned authorities is not effective, notwithstanding a requirement in the EC Regulation stipulating the need for authorities to carry out random inspections of at least 5% of the total average landings and transshipment transactions at fishing ports each year.

Regarding tuna landings, the concerned authorities are not able to inspect fishing vessels at ports because tunas are unloaded immediately upon landing. By the time fishery authorities receive the catch certificate application form from exporters, the fish is already in processing factories. Furthermore, many fishers in Vietnam do not land their catches at fishing ports, as these are often unloaded at landing places such as deep water areas, roadsteads and even in front of their houses. Therefore, inspection by fishery authorities is limited to checking only the validation of fishing licenses, the fishing gear used and the marine safety of vessels without having been able to inspect their fish catch.

Sustainable Resource Management

One of the greatest weaknesses in fisheries management of Vietnam in general, and in tuna fisheries in particular, is the lack of updated resource databases. Similarly, fishery scientists often conclude that large management problems occur in traditional capture fisheries due to insufficiency of catch statistics and assessment reports on major fish stocks. For example, tuna fisheries have no reliable stock assessment data that could give a comprehensive picture of the country's tuna resources (Dung, 2010). As a matter of fact, Vietnam still does not have a good system of collecting and compiling fishery statistics. The annual fisheries data shown in Statistical Reports that include total yield, number of fishing vessels and fishing capacity are general information. Vietnam needs to compile specific fisheries data, such as yield of each gear per year and yield of each species and fishing grounds, in order to facilitate planning and development of the country's national fisheries policies, more particularly those that aim to prevent and eliminate IUU fishing (MARD, 2011).

The data and information on annual tuna catches and exports have been sourced from seafood companies and the General Statistical Office based on export information, and not collected by fishing vessels. As a result, a considerable amount of tuna traded and consumed in domestic markets is not reported. Such inadequacy of resource databases often leads to difficulties on the part of fishery authorities to develop effective tuna fisheries management policies, including allocation of tuna quotas, limiting the number of long-line fishing vessels and making long-term projections on the development of tuna fisheries.

Furthermore, Vietnam has no special regulations governing marine resource management and conservation, as well as assessments of the impacts of fishing on the environment, fisheries resources and the ecosystem. Fishers fish freely and are not concerned about the negative impacts of their fishing operations on the habitat. This leads to decline and loss of the marine ecological balance. Vietnam has not participated in collecting and sharing accurate data concerning its fishing activities and information from the national and international research programs, in view of the unavailability of information on stock assessment and fishery statistics (Hanh *et al*., 2007).

Moreover, Vietnam does not have gear regulations, *i.e.* length of mainline, number and type of hooks in long-line fisheries, to protect and conserve the fisheries resources and eliminate by-catch. Therefore, long-line fishers use arbitrary types of hooks and scales of long-lines. In fact, fishers use non-selective hooks, and in the end catch all kinds of fish and organisms, resulting in negative impacts on the resources. This situation is obviously contrary to the requirements in the EC Regulation. Tuna species caught such as yellowfin and bigeye, account for 30-50% of the total catch from tuna long-line fleet, while by-catch which includes a number of prohibited species, *i.e.* sharks, turtles and porpoise, represents about 30-50%. A significant portion of the tuna catch (30-50%) is small tunas (Hanh *et al*., 2007) while the remaining catch comprises high proportion of juveniles and by-catch, a situation that is harmful to the fisheries resources and in the long-term could exhaust the resources. However, since by-catch is a significant source of revenue in Vietnam, it would not be easy for fishers to eliminate the by-catch, even if the benefit in the short-term could only be additional income to individual fishers but in the long-term this would create negative impacts on the resources.

In an open access regime, too many fishers and not enough fish lead to competition for the target catch, and destruction of fisheries resources and habitats, and eventually contributing significantly to IUU fishing as well as to problems on overcapacity and overfishing (Hanh *et al*., 2007). One of the main problems related to resource protection is that most fishing communities and fishers are not aware of the relevance of resource protection. Fishers also do not think of the future consequences of their actions thinking that fisheries resource management is a sole responsibility of fishery authorities and that the fisheries resources are infinite. Hence, fishers fish just to obtain the maximum immediate benefits and satisfy their needs without taking into account the need for sustainable resources management.

Reporting and Maintaining Fishing Logbooks

Maintaining fishing reports and logbooks is compulsory for fishers and skippers of fishing vessels, but managing and inspecting the information provided by fishers and skippers are the responsibility of fishery authorities (Tam, 2009). In reality however, these are not practiced as the procedures would require considerable amount of efforts, since each province has thousands of fishing vessels. Added to this is the fact that fisheries in Vietnam are mostly small-scale and multi-gear, making it complicated to follow the necessary management procedures. Providing inputs for the logbooks is carried out manually since an electronic logbook system in Vietnam is still non-existent. Thus, the process of providing information into the fishing reports and logbooks is impeded by a number of difficulties from the very first step. Moreover, the country's current laws and regulations do not set any criteria for accurate inputting into logbooks based on specific requirements for keeping fishing logbooks and reporting procedures nor is there a system of validating the data reported. Although fishers submit the logbooks and reports to fishery authorities, but the information which has not been validated will have no use and meaning. In other words, although the regulations require fishers to fill out the fishing logbooks and report their catches to fishery authorities, but ensuring the reliability of information is not stipulated in such regulations.

An additional challenge for fishers to maintain fishing reports and logbooks is the very nature and characteristics of the domestic fisheries market of Vietnam. Prices of IUU fishing products and non-IUU fishing products are the same, while fishers who do not maintain fishing reports and logbooks still participate in the fish trade and their catches bought by middlemen command the same prices as those of actual non-IUU fish. Therefore, fishers are not keen in maintaining fishing reports and keeping logbooks. Nonetheless, if prices of fish from fishers who comply with the regulations could be made higher than those that do not comply, it is more likely that awareness of the regulations would increase. Moreover, fishers adopting traditional fishing methods do not believe in the regulations that require accomplishing fishing reports and maintaining logbooks. Furthermore, conflict of interest and competition of fishing grounds also encourage fishers to conceal trip information or mis-state information on fishing areas and routes, especially in cases when banned species are caught or when highly productive fishing grounds are discovered which could attract the interest of other competing fishers. In fact, information in the fishing reports and logbooks has not been perceived as relevant for fishers who only think the information as private and classified. Fishers are either not eager to make the report or will report inaccurate information. Thus, a number of fishers refuse to report their yields and fill out the logbooks, considering the process inconvenient and irrational. Fishers only argue that in reality, maintaining fishing reports and keeping logbooks, only bring inconvenience to them affecting their fishing operations.

Another constraint is the distance that fishers need to travel to reach the fishery authorities' offices where most often fishers would spend one day every month to submit their fishing reports, thus, fishers consider submitting such reports not profitable at all whether these are well-accomplished or not. Sometimes when fishers have good harvests they do not dare to report the information to fishery

authorities, for fear that government might impose high taxes on them, and that they might have to pay more for their social duties, such as subscribing to charity, building houses of gratitude and constructing alleys. In fact, most fishers suggested that if their catch is low or harvest is lost, they should receive fuel subsidies such as those granted in 2008. It is for these reasons that fishers do not have the motivation to comply with the requirements to maintain fishing reports and keep logbooks.

In general, the purpose of the EC Regulation is to eliminate IUU fishing activities. However, a few gaps in the Vietnamese regulations regarding keeping fishing reports may be taken advantage of by fishers to engage in IUU fishing. Meanwhile, maintaining fishing logbooks is sometimes difficult for fishers to undertake because of the uncomfortable condition onboard fishing vessels. For example, long-line fishing vessels are usually artisanal and small-sized boats that sway when the weather at sea is severe with heavy winds and big waves. Tuna fishing boats do not have any instruments that measure the exact weight of fish, thus, fishers resort to estimating only the volume of fish caught. In addition, fishers also do not have the capability to sort the fish caught by species and to measure the exact volume by species. What is more depressing is the fact that almost all fishers have insufficient knowledge and educational background, so that recognizing and reading the words in the forms is quite difficult, let alone filling out the logbooks. Many fishers claimed that the specific writings in the fishing logbook are complex and complicated for them to follow.

Owners of fishing vessels also cited that the daily work of a skipper is really taxing and stressful. "Writing is not an interesting task for skippers who prefer fishing to holding a pen". A good skipper is difficult to find, so owners do not ask their skippers to fill out the fishing logbooks. The owners also fear that if forced to fill out logbooks, their skippers may abandon their work and move to other vessels. Nevertheless, a simple reason for the non-implementation of the requirements for logbook keeping by skippers could be merely "slothful", considering that middlemen or buying-vessels at sea buy fish from fishers without asking for fishing logbooks. This situation does not motivate the skippers to maintain fishing logbooks at all.

Inadequate Knowledge and Absolute Poverty among Fishers

Educational level in fishing communities is generally low. From the sample residents in coastal fishing communities surveyed, 68% have not completed primary school. In fact, only 20% have completed primary school while only 10% have completed secondary school, and less than 1% received certificate or diploma from vocational school or university (GSO, 2011). Therefore, the awareness of fishers on the regulations and enforcement is rather very limited. This concern had been addressed through the conduct of training courses by officers and staff of the country's Fisheries Administration. However, these training courses were attended by vessel owners, while the crew and skippers who are directly involved in complying with the regulations and laws could not attend as they are at sea almost all year round, especially for tuna long-line fisheries, where the number of fishing days is about one month (Hanh *et al*., 2007), and upon landing, fishers must prepare the gear, bait and fuel for their next trip.

Furthermore, fishers do not comply with the regulations because of the practice of traditional fishing methods. Fishers try to catch as much fish as possible without minding about any consequences of their actions in the future. Moreover, they tend to think that market price is an objective factor that fishers cannot control. They do not care where their fish will be exported to and that they are not aware of the advantages of proper enforcement of the regulations, in terms of improved price and profit. More particularly, for fish trading to the EC which is an important market for Vietnam, some fishers declared that "if their fish cannot be exported to the EU they would rather sell their fish to Japan, USA, China and other countries".

Inadequate educational attainment and minimum awareness are the main factors that make keeping logbooks and maintaining fishing reports difficult for many fishers to undertake. Filling in information in the catch certificate is a challenge while fishers are not aware of fishery regulations in general and regulation on resource management in particular. They still could not recognize the fact that proper enforcement of the regulations could bring increased profit in the future. Poor economic factor is also another main reason for the incessant occurrence of IUU fishing in Vietnam (Dung, 2010). Some fishing vessels involved in IUU fishing recruit crews coming from areas with inadequate alternative employment opportunities or are unaware of the vessels' illegal fishing operations. Fishers must look for their means of subsistence, so they do not bother to participate in any training courses or capacity improvement as called for in the fishery regulations (Hanh *et al*., 2007). Therefore, most fishers do not know what IUU fishing is and how IUU fishing is practiced.

Most fishers are generally poor, and although they might be aware that their activities are illegal, they must risk in undertaking such fishing practices for fear of losing their capital due to the high operating costs in fishing. Normally, the annual operating cost for a tuna long-line fishing vessel

could be as high as 571.6 million VND per year (Long *et al*., 2008). This is a significant investment for the fishers/ owners, which makes IUU fishing an attractive option in order to recoup their investments.

Discussion

Tuna fisheries in Vietnam have been plagued with concerns such as overfishing, excessive fishing efforts and depleting resources. The role of fisheries management is, therefore, very important to achieve sustainable development of this particular fisheries sector. Moreover, Vietnam also seeks to better conserve and manage fisheries resources not only in its Exclusive Economic Zone but also beyond, in order to comply with relevant international norms and regulations. Since Vietnam does not have enough legal documents and scientific information related to tuna resources management, the country could not come up with a comprehensive tuna stock assessment and conduct biological research.

Information on tuna catches is also not reliable, thus developing a tuna database for making long-term plans in tuna fisheries management and development as well as vessel management, is almost an impossible task. In order that Vietnam could properly implement the EC Regulation, the country should enhance the cooperation between fishery authorities and fishers. Fishers should change their traditional attitudes and learn to maintain logbooks and records. For their part, fishery authorities need to develop relevant regulations that could address the inadequacies related to IUU fishing. For example, Vietnam still lacks inspection systems for fishing vessels at sea. Therefore, prevention, deterrence and elimination of IUU fishing are impeded by many challenges and problems.

Tunas are highly migratory species and their habitats could extend many state jurisdictions, so that catching tuna in one country could affect the tuna stocks of other countries. Therefore, in order to sustain its tuna fisheries, Vietnam should explore the possibility of establishing regional or international cooperation to solve the numerous challenges, especially transboundary problems. Moreover, since the EC Regulation requires that IUU fishing activities should be immediately stopped, the corresponding regulations of Vietnam should be re-adjusted to be able to satisfy the requirements of the EC Regulation. Moreover, the national fishing management system and mode of production should also be reviewed and updated. This could be a hard task for the fishery authorities to undertake because Vietnam has not had an inspection system for its fishing activities that could meet the requirements of EC.

Way Forward

Nonetheless, Vietnamese fisheries in general have already evolved from small-scale and traditional fisheries in open access to fisheries with good management. In the process, some difficulties are encountered in the first steps in view of incomplete regulations as well as weakness in the implementation of management systems and regulations. Therefore, the problems and challenges in enforcing the EC Regulation could be addressed by embarking on an improved national fisheries regulation system, fishing infrastructure, management system, and enforcement. These problems and challenges should be mainstreamed in the fishery authorities' perspectives and fishers' foresights as well. Nevertheless, the implementation of the EC Regulation has served as an eye-opener to improve fisheries management in Vietnam.

As mentioned earlier, lack of scientific database on the country's resources had made it possible for concerned authorities to issue fishing licenses based on technical safety certificate but not on the aspects of resources conservation. Furthermore, inadequacy and weak enforcement of the country's regulations do not strictly require fishers to maintain fishing reports and logbooks. In addition, in Vietnam's fisheries being small-scale and traditional, fishers practice free fishing without giving any due concern about resources protection. Moreover, the low educational level of most fishers, lack of awareness of the implementation of regulations and poor economic capacity, make them not capable of maintaining fishing reports and logbooks. In the end, completely accomplishing the catch certificate form is still a long way to go for fishers in Vietnam.

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Unifying the Art, Science and Business of Aquaculture through the Information Resources and Services of SEAFDEC Aquaculture Department Library

Stephen B. Alayon, Daryl L. Superio, Jesserylle G. de la Peña, and *Elvi S. Nemiz*

Established in 1973 in Tigbauan, Iloilo, Philippines, the Aquaculture Department (AQD) is one of four Departments of the Southeast Asian Fisheries Development Center (SEAFDEC). AQD is mandated to conduct scientific research to generate aquaculture technologies relevant and appropriate for the region; develop human resources; and produce, disseminate and exchange information on aquaculture. AQD is committed to sustainable development and the responsible stewardship of aquaculture resources through science-based research and the promotion of appropriate technologies and information relevant to the Southeast Asian region (SEAFDEC/AQD, 2009). The need to disseminate AQD's research results is as important as the conduct of research in fisheries and aquaculture as referred to in the Code of Conduct for Responsible Fisheries (Wilkinson and Collins, 2007). In cognizance of the role that AQD should play with respect to its function of disseminating and exchanging information on aquaculture, the AQD Library was established to support the information needs of AQD scientists and staff. In addition, the Library also provides services to visiting researchers, local and international trainees and students, as well as the diverse users from AQD's partner institutions. During the strategic planning workshop conducted by AQD in 2009, one of the goals identified was for AQD to strengthen the capacities of the aquaculture sector. Matching with such goal, the Library and Data Banking Services Section of the Training and Information Division identified its information dissemination and services target for 2012. Primarily, AQD Library aims to improve accessibility to archived and updated information, and to create a digital library collection of AQD publications and documents. In keeping up its goal of providing quality, current and relevant information, the Library continues to avail of quality print and non-print information resources, to ensure that it keeps abreast of the advancements in aquaculture and fulfil the diverse information needs of users. The Library also introduces innovations in its services with the purpose of unifying the art, science and business of aquaculture, and strengthens its local and international linkages for efficient sharing of knowledge and resources.

The Art, Science and Business of Aquaculture

An old Chinese proverb which says: *Give a man a fish and you feed him for a day. Teach a man to fish and you feed him for a lifetime* could also be applied to aquaculture which is the rearing of aquatic organisms under artificial and controlled conditions. Aquaculture is often defined as the art, science and business of culturing aquatic organisms in marine and freshwater environments. As a built-in component of fisheries, aquaculture is also known as an appendage to fishing after production from the wild becomes insufficient to meet the increasing demand for food fish of the ever-growing population while aquaculture has been filling up the supply-demand gap that leads to its super grandiose advancement.

Aquaculture has been practiced in Asia for thousands of years although early on, the practice involved extensive production schemes. Later, intensive production systems have been adopted to produce yields that can routinely maximize the capacity of the culture areas with the use of top-of-the-line devices and facilities. This means that phenomenal production yields can only be achieved when all significant conditions for intensive culture systems are met. Although the advantages of adopting the intensive culture systems could be numerous, aquafarmers should be able to access information on advances in aquaculture technology that could often be sourced outside the specific culture locations. Specifically, installation of specially designed aquaculture infrastructures is an art aimed at maximizing the yields that could be derived from aquaculture systems.

While fishing can be taken as harvesting and gathering the bounties of nature, aquaculture is often considered a form of agriculture. In this connection, FAO defined aquaculture as: *the farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants, where farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, and also implies individual or corporate ownership of the stock being cultivated*. In order to be sustainable, aquaculture now emphasizes on improving the biological and technological aspects of farming commercially-important organisms and transferring the technologies developed. Thus, aquaculture advancements need to be disseminated as these have been the major main contributor to the scientific progress in fisheries. As aquaculture progresses rapidly, concerns on

its impact on the environment and habitats have been raised while adoption of the ecosystem approach to aquaculture management has become imperative.

Aquaculture is now a major industry and big business in many parts of the world. It has become an important source of revenue in many developing countries. Aquaculture production from the Southeast Asian region for example, contributed more than 22% to the world's total fish supply from aquaculture in 2009 (SEAFDEC, 2012). This came from the region's aquaculture production of more than 12 million metric tons which accounted for about 43% of the region's total fisheries production (SEAFDEC, 2011). Many developed countries are importing aquaculture products from developing countries including the Southeast Asian countries, to supply their protein requirements, a situation that led to several advancements in the farming systems for aquatic organisms with the main objective of increasing the contribution of aquaculture to the economies of producing countries. Now, aquaculture is not only practiced in ponds or submerged water areas but also in inland structures using water recirculation systems that optimize water use and minimize costs. Moreover, trading of aquaculture products is now guided by stringent requirements of importing countries which aquaculture operators and aquafarmers should comply with, although such compliance requires additional financial inputs.

To sum it up, aquaculture could be the last frontier that would answer the growing demand for food fish, especially because fish stocks from the wild have been overexploited and would need quite some time for restoration or replenishment through conservation and protection of remaining fish stocks. As research and development on aquaculture continues, the AQD Library vows to continue to amass the necessary information that would unify the art, science and business of aquaculture in order that the present and future generations could get the maximum benefits from the bounties of aquaculture systems. In this way, the Library would sustain its efforts in assisting the various information-deprived stakeholders by providing them the much needed information for progress. Specifically, the Library would continue to fulfil the information requirements of users and stakeholders, especially on the advances in aquaculture including among others, the importance of good management, improved water quality, genetic improvements, as well as fish disease and nutrition management through the use proper feeding techniques. These services are meant to respond to the instructions stipulated in the ASEAN-SEAFDEC Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 which was adopted in June 2011 (SEAFDEC, 2011a).

The SEAFDEC/AQD Library Information Resources and Services

In order to address the above-mentioned requirements, the AQD Library has been enhancing its information resources and services. Currently, bibliographic access to the AQD Library collection has been made easy as this can now be made through its online public access catalog (OPAC) at *opac.seafdec.org.ph*, while access to the physical collection and resources in Iloilo, Philippines is free for walk-in clienteles.

The AQD Library maintains a comprehensive collection of books, pamphlets, serials and other periodicals on aquaculture, fisheries, marine, aquatic sciences and allied disciplines, and as of September 2012, the Library collection stands at 41,092 titles and 62,347 volumes. It also houses various theses and dissertations, maps, posters, and microfiches and CD-ROMs (Pacino, 2009). With the integration of traditional library services and the current ICT trends and social media, the Library has taken advantage of other possible options to promote its resources and services. Document delivery and interlibrary loan services are available for remote users, while reference queries can be made through phone, chat and email (*library@seafdec.org.ph*; *seafdecaqdlibrary@gmail.com* and *seafdecaqdlibrary@yahoo.com*), Facebook page (*facebook.com/seafdecaqdlib*) or Twitter account (*twitter.com/seafdecaqdlib*). It regularly sends out Topic Alert, a bibliographic list of its current journal articles and book chapters acquisition related to fisheries and aquaculture; Books and Serials on Display, a list of its currently processed books and journals that are available for circulation; and Publication Alert, a quarterly bibliographic list of publications by AQD scientists and researchers in peer-reviewed scientific journals, book chapters or conference proceedings (Alayon, 2013). It also conducts library instruction and information literacy programs not only for AQD researchers but also to students and visiting researchers.

SEAFDEC/AQD Institutional Repository (SAIR): Responding to the Needs of Users

In order to disseminate technologies developed by AQD, the Library launched the SEAFDEC/AQD Institutional Repository (SAIR) *http://repository.seafdec.org.ph* in July 2011. SAIR is the official digital repository of scholarly and research information of AQD. The library supports the Open Access movement since it believes that information generated from publicly funded researches should be shared to the public and that the public's right to access these publications should be upheld. SAIR also enables the

Fig. 1. SEAFDEC/AQD Institutional Repository (SAIR)

effective dissemination of AQD researchers' in-house and external publications for free and online. The repository uses DSpace, an open source software, developed at Massachusetts Institute of Technology (MIT) Libraries, which is an Open Archives Initiative (OAI)-compliant.

SAIR aims to provide a reliable means for AQD researchers to store, preserve, share their research outputs, enable easy access to and increase the visibility of AQD scientific publications. It primarily aims to promote AQD publications especially those published in international peer-reviewed journals and generate more citations through increased visibility. SAIR will also provide users free access to all in-house publications of the Department. Full-text digitized copies of fish farmer-friendly materials like books, handbooks, policy guidebooks, conference proceedings, extension manuals, institutional reports, annual reports, and newsletters (*e.g.* SEAFDEC Asian Aquaculture and Aqua Farm News) will be available and downloadable. SAIR will serve as the digital archive of the Department as the deposits of electronic documents become cumulative and perpetual. Initially, the repository shall contain preprints, full-texts or abstracts of journal articles, books and conference proceedings written by AQD scientists and researchers. SAIR is envisioned to expand its collection to include images, presentations, audios, and videos, among others. The lessons learned and experiences of the AQD Library staff in digitizing institutional publications and in developing an institutional repository of value could be shared to other institutions considering similar endeavours, as described by Alayon *et al*. (in press).

The Rewards and Way Forward

The AQD Library is a member of the International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC) and has been actively participating in its resource sharing activities. IAMSLIC is an association of individuals and organizations interested in library and information science, especially as these are applied to the recording, retrieval and dissemination of knowledge and information in all aspects of aquatic and marine sciences and their allied disciplines (*www.iamslic.org*). The AQD Library has also an existing exchange program, donation of AQD publications (in print) and resource sharing agreements with various universities and institutions in the Philippines, Japan, Southeast Asia and other countries. The Library aims to build and expand its network to institutions and universities, especially in the SEAFDEC Member Countries, thus, it is open for collaboration and exchange of resources.

The Library's collection, particularly serials, is being augmented by gifts and exchanges with network libraries mostly from IAMSLIC-member institutions, considering that the Library has established agreements for gifts and exchanges with various international, regional and local institutions, such as the Food and Agricultural Organization (FAO) of the United Nations, Institut Fançais de Recherche pour l'exploitation de la Mer (IFREMER or French Research Institute for Exploitation of the Sea), Japan International Research Center for Agricultural Sciences (JIRCAS), National Shellfisheries Association (USA), the Marine Biological Association of the United Kingdom, National Oceanic and Atmospheric Administration of USA (NOAA), Commonwealth Scientific and Industrial Research Organisation of Australia (CSIRO), WorldFish Center (Malaysia), Network of Aquaculture Centres in Asia-Pacific (NACA), International Development Research Center of Canada (IDRC), University of the Philippines in the Visayas (UPV), University of San Carlos (Cebu City, Philippines), and Silliman University (Dumaguete City, Philippines) among others.

The AQD Library is also a member of Association of Special Libraries in the Philippines (ASLP) and its librarians are members of Philippine Librarians Association Inc. (PLAI) and Philippine Association of Academic and Research Librarians (PAARL), International Association of Agricultural Information Specialists (IAALD) and Special Libraries Association (SLA). The Library also facilitates the dissemination and distribution of SEAFDEC publications (in print and digital) to more than 200 fisheries schools as well as selected colleges and universities in the Philippines and to its international exchange partners. The

Library is privileged to have access to the Aquatic Sciences and Fisheries Abstracts (ASFA), an initiative of the FAO, through DVD-ROM and online by Proquest. The database provides extensive coverage of research on aquatic organisms for scientists researching the world's living aquatic resources. Currently, the Library is a collaborating partner and provides input for the ASFA databases.

The Library also subscribes to the Essential Electronic Agricultural Library (TEEAL), a digital collection of research journals for agriculture and related sciences. In 2012, the AQD Library integrated library system (ILS) migrated to the Destiny Library Manager, the ILS is Z39.50 compliant that enabled AQD Library to join the IAMSLIC Z39.50 Distributed Library (*library.csumb.edu/iamslic/ill/search.php*), which aims to facilitate international resource sharing of marine and aquatic information resources among marine and aquatic science libraries, and hosted by the California State University (CSU) Monterey Bay Library. Currently, the AQD Library is the first and only Asian institutional library to participate in the IAMSLIC Distributed Library through Z39.50 Broadcast Search of Catalogs. Through its participation, the AQD Library has made its collection visible to more than two hundred member institutions worldwide, which means greater visibility for SEAFDEC and AQD as well as the AQD Library, its collection and SEAFDEC publications. While SAIR was awarded the 2012 Outstanding Library Program, its proponent Mr. Stephen B. Alayon received the 2012 Outstanding Academic/Research Librarian Award by the Philippine Association of Academic and Research Librarians, Inc. (PAARL).

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Ten Years of Portraying Regional Movements on the Promotion of Sustainable Fisheries for Food Security for the ASEAN Region: The Special Publication *Fish for the People*

With 28 issues in 10 volumes printed as of the end of 2012, the Special Publication *Fish for the People* has completed ten years of reporting regional initiatives and movements aimed at promoting sustainable development of fisheries for food security in the Southeast Asian region. The Special Publication *Fish for the People* is therefore contemplated to have paved the way for the development of regional policies and from which, technological concepts and advances would have been derived and considered by SEAFDEC and the Southeast Asian countries in the development of programs that led to the fulfillment of the objective of achieving sustainability in fisheries for food security in the region.

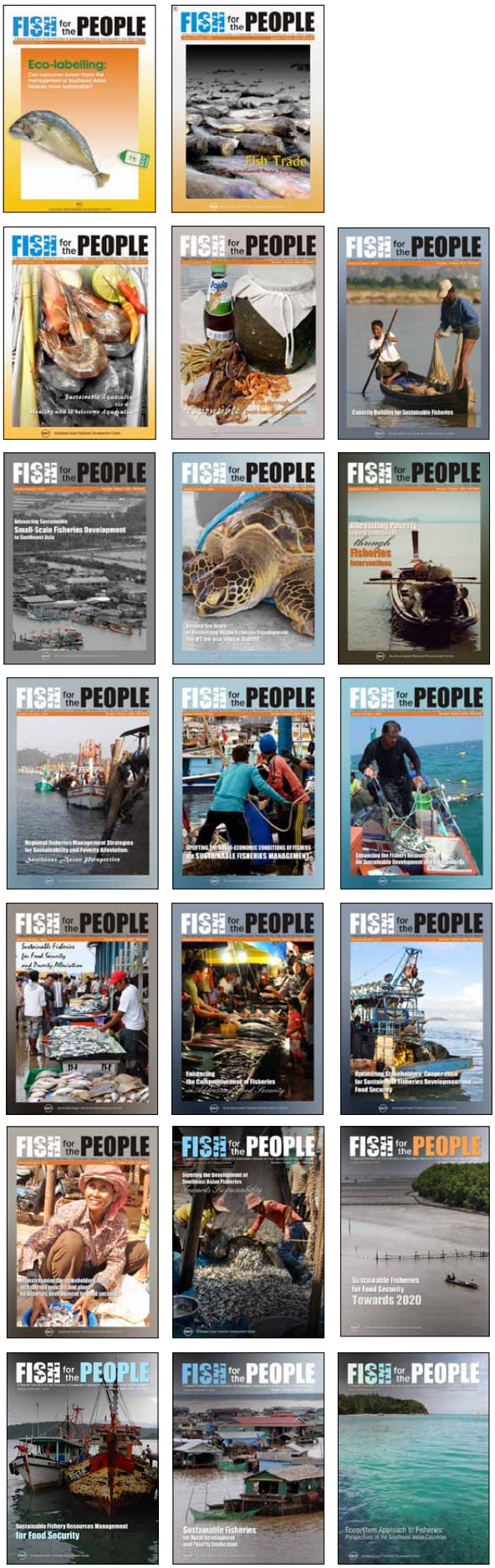
The maiden issue of the SEAFDEC Special Publication *Fish for the People* (Volume 1 Number 1: 2003) was launched in 2003 to commemorate the first anniversary of the **ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium: "Fish for the People"** which was organized in Bangkok, Thailand on 19-24 November 2001, from which the Special Publication took its title. Produced tri-annually (three issues per year), *Fish for the People* is generally aimed at supporting the endeavors of the Southeast Asian Fisheries Development Center (SEAFDEC) in "promoting sustainable fisheries for food security in the Southeast Asian region," and in raising the visibility of SEAFDEC not only to the region but also throughout the world. Specifically, *Fish for the People* also aims to provide information on the initiatives and movements of SEAFDEC and the Southeast Asian countries, to implement the **ASEAN-SEAFDEC Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region** adopted in November 2001 by the Ministers and Senior Officers of the ASEAN-SEAFDEC Member Countries responsible for fisheries, respectively, as well as the subsequent **ASEAN-SEAFDEC Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020** adopted in June 2011.

The Ministerial Session of the 2001 Conference, where the ASEAN-SEAFDEC Resolution and Plan of Action were adopted

With the printing and distribution of its 28 issues from 2003 to 2012 (**Table 1**) which was made possible through financial support provided by the Japanese Trust Fund, the Special Publication *Fish for the People* has continued to be acclaimed as an important publication by several organizations, the academe as well as by research and development institutions in the region and the world. After *Fish for the People* completed its 10 years of sustained reporting of the accomplishments of SEAFDEC and the Southeast Asian countries in addressing the sustainability of fisheries from 2003 until 2012 and as it enters into the first of its "tween" years in 2013, *Fish for the People* will also continue to intensify its role in raising the visibility of SEAFDEC as an important regional fisheries organization that provides technical support to the ASEAN as it prepares for an ultimate integration by 2015. Along with such ambitious foresight is the continued commitment of the Japanese Trust Fund to sustain its role in the production of the Special Publication *Fish for the People*.

Table 1. Published issues of *Fish for the People* (2003-2012)

Year	Vol. No	Issue No	Theme
2003	1	**1**	1st Anniversary of the ASEAN-SEAFDEC Millennium Conference
		2	Decentralization of Fisheries Management: Rights-based fisheries in the ASEAN Region
		3	Fisheries Statistics: A tool for sustainable fisheries?
2004	2	1	Country stories: Shark and ray fisheries in Cambodia; Thailand-EU's CHARM Project
		2	Regulating Access to Fisheries: Decentralization and rights-based fisheries in the Philippines; Freezing the fishing fleet?
		3	Learning from the Japanese Rights-based Fisheries System
2005	3	**1**	Assisting People Affected by the Tsunami: Rehabilitation strategies for the fishery sectors in Thailand
		2	Prized Commodity: Trash fish from marine fisheries in the Asia-Pacific Region
2006	4	1	Eco-labelling: Can consumer power make the management of Southeast Asian fisheries more sustainable?
		2	Fish trade with a Southeast Asian perspective
2007	5	1	Sustainable aquaculture vis-à-vis healthy and wholesome aquaculture
		2	Maximum utilization of fish through responsible post-harvest practices
		3	Capacity building for sustainable fisheries
2008	6	1	Advancing sustainable small-scale fisheries development in Southeast Asia
		2	Beyond Ten Years of Reinforcing ASEAN Fisheries Development: The JTF ten-year saga in SEAFDEC
		3	Alleviating poverty in rural communities through fisheries
2009	7	1	Regional Fisheries Management Strategies for Sustainability and Poverty Alleviation: Southeast Asian Perspective
		2	Uplifting the socio-economic conditions of fishers via sustainable fisheries management
		3	Enhancing the fishery resources for sustainable development and food security
2010	8	1	Sustainable fisheries for food security and poverty alleviation
		2	Enhancing the competitiveness of fisheries in addressing food security
		3	Optimizing stakeholders' cooperation for sustainable fisheries development and food security
2011	9	1	Mainstreaming the stakeholders' roles in fisheries policies and plans on fisheries development for food security
		Special issue	Steering the development of Southeast Asian fisheries towards sustainability
		3	Sustainable fisheries for food security towards 2020
2012	10	1	Sustainable fishery resources management for food security
		2	Sustainable fisheries for rural development and poverty eradication
		3	Ecosystem Approach to Fisheries: Perspectives of the Southeast Asian countries



28 issues of *Fish for the People* published over 10 years

CALENDAR OF EVENTS

Date	Venue	Title	Organizer(s)
		2013	
28-30 January	Bangkok, Thailand	Regional Workshop on Effective Fisheries Information Gathering in Coastal Small-scale and Inland Fisheries for Southeast Asian Region	TD
31 Jan - 1 Feb	Bangkok, Thailand	Intergovernmental Forum on Live Reef Food Fish Trade (LRFFT)	CTI-CFF & SEAFDEC
4-8 February	Bangkok, Thailand	Regional Training Workshop on Optimizing Energy and Safety at Sea for Small-scale Fishing Vessels	TD
24-28 February	Vietnam	24th Meeting of the NACA Governing Council	NACA
3-15 March	Bangkok, Thailand	16th Meeting of the Conference of the Parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora	CITES
17-20 March	Khon Kaen, Thailand	Workshop on Fish Passage in Southeast Asia: Principle of improved fish passage at cross-river obstacles, with relevance to Southeast Asia	FAO-SEAFDEC
1-5 April	Cebu, Philippines	45th Meeting of the SEAFDEC Council	SEAFDEC
1-5 April	Rizal, Philippines	Training on Catfish Hatchery and Grow-out Operations	AQD
10-12 April	Tamil Nadu, India	International Seminar-Workshop on Mud Crab Aquaculture	AQD
22-26 April	Rizal, Philippines	Training on Carp Hatchery and Grow-out Operations	AQD
22 April - 6 May	Iloilo, Philippines	Training on Sandfish (*Holothuria scrabra*) Seed Production, Nursery and Management	AQD
2-3 May	Bangkok, Thailand	Regional Expert Forum on Climate Change, Agriculture and Food Security in ASEAN	ASEAN, FAO, and GIZ
6-10 May	Mauritius	17th Session of the Indian Ocean Tuna Commission	IOTC
6-10 May	Samut Prakan, Thailand	2013 Annual Meeting of the Working Group on Fishing Technology and Fish Behaviour	FAO and SEAFDEC
7-27 May	Iloilo, Philippines	Training on Abalone Hatchery and Grow-out	AQD
8-9 May	Iloilo, Philippines	International Workshop on Food Safety of Aquaculture Products in Southeast Asia	AQD
8-11 May	Thailand	FAO/GEF Regional Technical Workshop on Data Collection Procedures-Mapping, Information and Data Requirement	REBYC-II CTI
13-17 May	Vietnam	On-site Training on Facilitating Fisheries Information Gathering through Introduction of Community-based Fisheries Management	TD
20 May - 7 June	Rizal, Philippines	Training on Freshwater Aquaculture	AQD
20-24 May	Rome, Italy	Technical Consultation on International Guidelines for Securing Sustainable Small-scale Fisheries	FAO
20-24 May	Siem Reap, Cambodia	Training on Practical Approach to Co-management in Inland Fisheries of Cambodia	TD
21 May - 12 June	Iloilo, Philippines	Training on Mud Crab Hatchery, Nursery and Grow-out Operations	AQD
3-7 June	Siem Reap, Cambodia	On-site Training Course on Practical Approach to Right-based Fisheries Management in Inland Fisheries of Cambodia	TD
17-21 June	Lao PDR	On-site Training on Practical Approach to Rights-based Fisheries Management	TD
18-21 June	Bali, Indonesia	Asia Conference on Oceans, Food Security and Blue Growth	Indonesia
25-27 June	Manila, Philippines	FAO/RPOA Expert Workshop on the Development of Tools to Combat IUU Fishing - The Comprehensive Global Records of Fishing Vessels	FAO, RPOA-IUU
24-28 June	Rizal, Philippines	Training on Freshwater Prawn Hatchery and Grow-out Operations	AQD
25 Jun-31 Jul	Iloilo, Philippines	Training on Marine Fish Hatchery	AQD
15-19 July	Rizal, Philippines	Training on Tilapia Hatchery and Grow-out Operations	AQD
22 Jul-13 Dec	(through Internet)	On-line/Distance Learning Course: Basic Principles of Aquaculture Nutrition	AQD

Southeast Asian Fisheries Development Center (SEAFDEC)

What is SEAFDEC?

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

Mandate

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

Objectives

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

SEAFDEC Program Thrusts

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


TD


MFRD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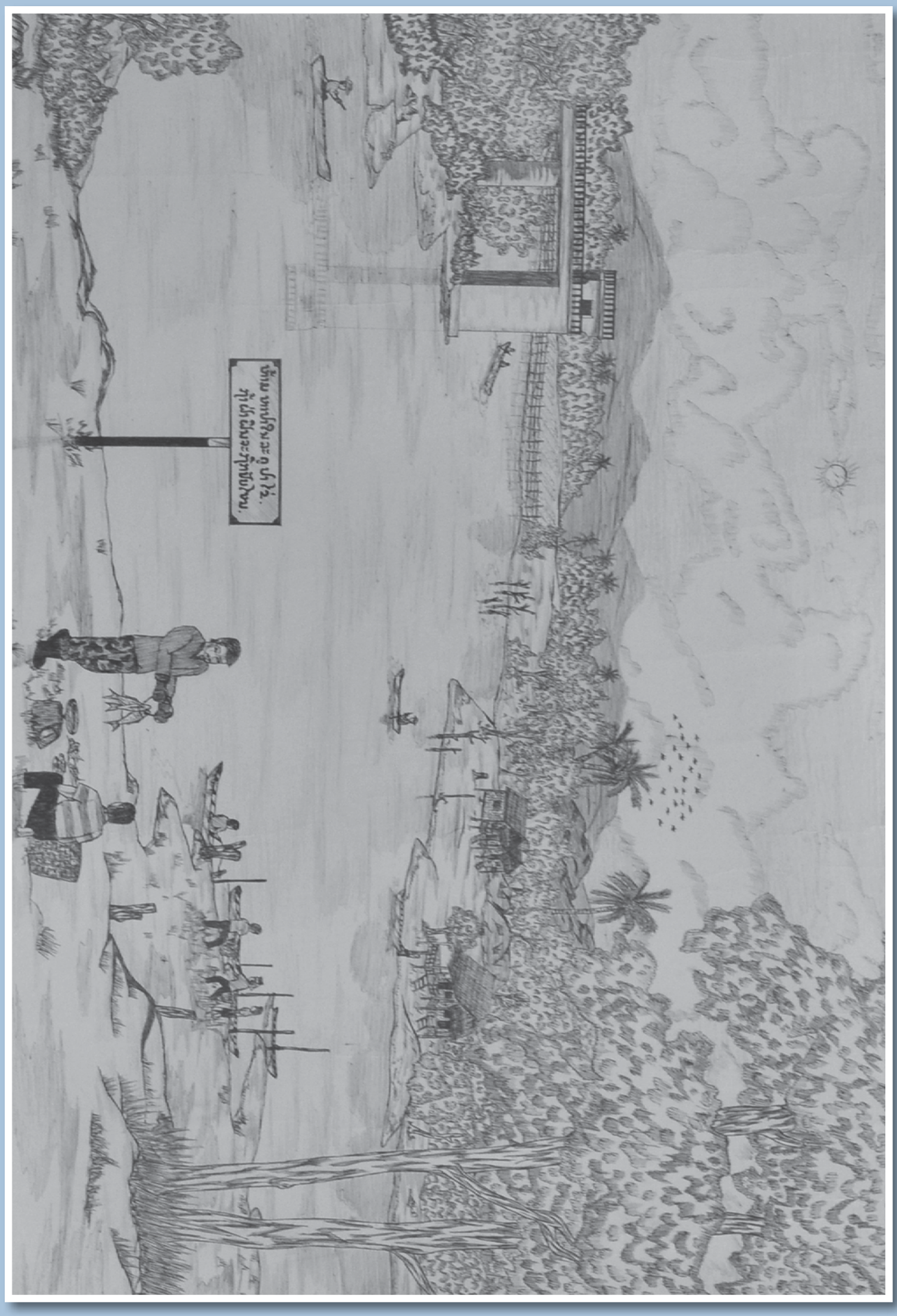

The first prize drawing winner, *Deuangpheng Chindavong*, from the national drawing contest in Lao PDR

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