PART II
Issues and Challenges in Sustainable Fisheries Development of the Southeast Asian Region

1. MARINE FISHERY RESOURCES

The Southeast Asian region abounds with marine fishery resources which could include multi-species of fishes, crustaceans, mollusks, aquatic plants, and invertebrates. The most economically important species being exploited from the region's pelagic fishery resources as well as from demersal, high sea, and deep sea resources include among others, tunas, mackerels, round scads, anchovies, and sardines. The production trend of various marine aquatic species presented in this publication is based on available data from various sources such as those from the respective country's national fishery statistical reports, the SEAFDEC Fishery Statistical Bulletin for the South China Sea Area until 2007, and the SEAFDEC Fishery Statistical Bulletin of Southeast Asia from 2008 to 2009. Information from these sources are being supplemented with data from the SEAFDEC programs on Information Collection of Some Small Pelagic Species in the South China Sea and Information Collection of the Highly Migratory Species in the Southeast Asian Region Focusing on Tunas, and other technical publications. Nevertheless, the main production data used in the foregoing sections are mostly based on the reports from the respective domestic fisheries under the jurisdiction of the countries in the Southeast Asian region.

1.1 Important Pelagic Fishery Resources

Small pelagic fishes such as scads, mackerels, anchovies, and sardines are among the most economically important commodities for many countries in the Southeast Asian region. These highly migratory fish species are commonly being thought of as moving across the Exclusive Economic Zones (EEZs) of more than one country and thus, are also known as shared stocks. The abundance of these possibly shared stocks show strong inter-annual fluctuations that are also subjected to the impacts of climatic change. The high fluctuations in stock abundance and the variability of their migratory behavior pose a great challenge in identifying not only the unit stocks but also the shared stocks (SEAFDEC/MFRDMD, 2000; SEAFDEC/MFRDMD, 2003). Accurate identification of specific shared stocks is also difficult because of inadequate quality or unavailability of relevant fishery statistical data and information. Considering the significant contribution of small pelagic species to the marine fishery production of the region, any delay in developing regional approach to manage these stocks will further expose these species to possible exploitation which at present, may probably be already at unsustainable levels.

For example, it has been reported in regional statistics that in 2008, small pelagic fish production accounts for more than 28% of the total fishery production from the South China Sea Area excluding the production of Cambodia and Vietnam, and more than 20% of the total fishery production in the Eastern Indian Ocean excluding production of Myanmar (SEAFDEC, 2010). Its contribution is even more significant in Brunei Darussalam, Malaysia and the Philippines although the respective countries' production showed fluctuating increment trends during the past ten years until 2008. Moreover, in some countries such as Indonesia and the Philippines which are the leading producers in terms of quantity followed by Malaysia and Thailand, small pelagic fish production has been considerably significant to the respective countries' economies (SEAFDEC/MFRDMD, 2003).

Considering the escalating figures in human population and the corresponding demand for fish and fishery products, there is a need to improve fishery production to supply such demand, and one option could be to develop fisheries aimed to increase production from under-exploited resources (Siriraksophon, 2006). It has been reported that under-exploited resources or those that are known to exist but have not been harvested to full potential, because of operational and economic constraints.

Moreover, it has also been known that under-exploited stocks exist in the Eastern Indian Ocean and the Western Central Pacific Ocean. These stocks mainly represent the pelagic species such as tunas, scads, mackerels, among others, although there is little scientific evidence to support the existence and extent of availability of these stocks (SEAFDEC/TD, 2006).

1.1.1 Tunas

The most exploited tuna species in the Southeast Asian region include the neritic or coastal tuna as well as oceanic tuna species which comprise the bullet tuna, frigate tuna, eastern little tuna, long-tail tuna, skipjack tuna, albacore tuna, yellowfin tuna, and bigeye tuna. The fishing gears used to exploit the tuna species vary from country to country, however the main type of gears are purse seine, long line, pole and line, trawl, hand line, and gillnet. In Southeast Asia, the main countries catching tuna include Indonesia, Philippines, Thailand, Malaysia, and Vietnam (SEAFDEC, 2010). Although Brunei Darussalam, Cambodia and Myanmar also catch tuna but their production data are minimal compared with those of the aforementioned five major tuna producing countries, but in view of inadequate statistics and landing data, tuna production of Brunei Darussalam, Cambodia and Myanmar have not been included in the foregoing analysis. The trend of the overall total tuna production of Indonesia, Philippines, Thailand and Malaysia from 1997 to 2007 had been increasing from 997,320 MT in 1997 to 1.6 million MT in 2007 representing about 5% annual increase or increasing by about 1.6 times during the last ten-year period (**Fig. 18** and **Fig. 19**).

For Indonesia, the total production increased from 515,158 MT in 1997 to 838,377 MT in 2007, but the catch dropped in 2001-2003 before increasing again. The tuna species are caught by small purse seine, long line, pole and line, and hand line from fishing grounds that cover various sea areas such as West Sumatera, South Java, Malacca Strait, East Sumatera, North Java, Bali-Nusatenggara, South/ West Kalimantan, East Kalimantan, South Sulawesi, North Sulawesi, and Maluku-Papua.

On the other hand, production of tuna from the Philippines increased from 312,506 MT in 1997 to 618,500 MT in 2007 by almost twice in 10 years. Although the trend of the country's production also dropped in 2001, such trend rapidly increased starting in 2002 until after 2007. The fishing gears used in the Philippines include mainly the purse seine, ring-net, hand line, and hook and line. Although tunas are also caught in the coastal areas of the Philippines, the country's important fishing grounds for tuna are Sulu Sea and Mindanao Sea. For Thailand and Malaysia, only the production of neritic tuna such as long-tail tuna, bullet tuna and eastern little tuna had been reported during the earlier period. The total tuna production of these two countries did not change much during the 10-year period from 1997 to 2007, where the total catch of Thailand in 2007 was about 119,032 MT and 53,021 MT for Malaysia.

The main fishing gears used in both countries are purse seine and gillnet. Specifically in 2005, the tuna production of Thailand included about 74% eastern little tuna and 84% long-tail tuna, which had been reported to have come from waters of neighboring countries as shown in **Fig. 20**.

In terms of species composition, tuna caught in each country seems to vary depending on the sea areas and fishing grounds (**Table 8, Part I**). Overall, the highest percentage of about 28% is represented by skipjack tuna and 19% each for frigate tuna and little tuna, while yellowfin tuna and long-tail tuna accounted for about 14% and 12%, respectively of the total production. On the other hand, bigeye and albacore tuna provided less than 5% (**Fig. 21**).

Specifically, the catches landed in Palawan in Western Philippines increased from 38,740 MT in 2001 to 145,832 MT in 2006, an increase of almost 4 times within a period of five years. For the Mindanao Sea in Southern Philippines, the catches also increased from 6,050 MT in 2001 to a high of 183,000 MT in 2006 increasing by about 30 times, which could be because of the expansion of both hand line fisheries targeting the bigeye and yellowfin tunas, and purse seine fisheries targeting the young bigeye, yellowfin and skipjack tunas in the Western Pacific Ocean.

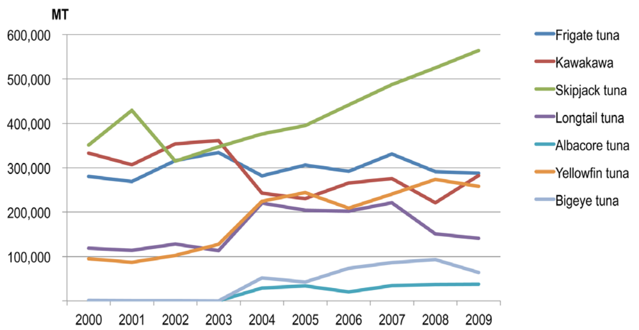

Figure 18. Production of major tuna species of the Southeast Asian region

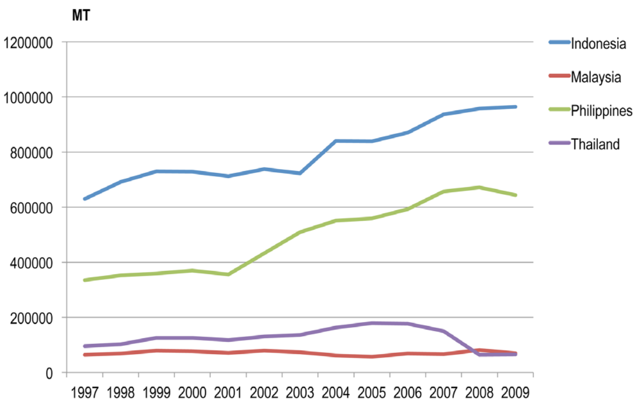

Figure 19. Trend of tuna production from four main tuna-producing countries of Southeast Asia

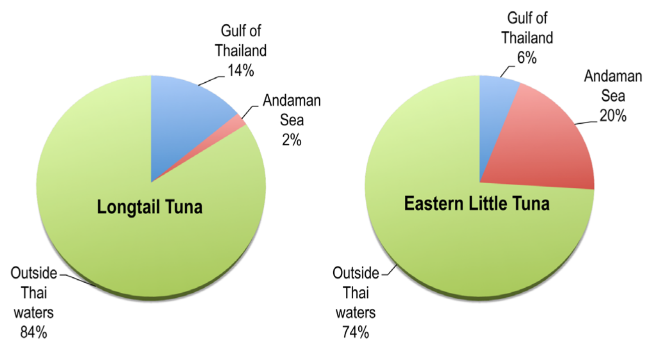

Figure 20. Tuna production of Thailand in 2005: from the Gulf of Thailand, Andaman Sea, and outside Thai waters

The results of a study conducted by SEAFDEC, especially on the catch distribution of tuna in the Southeast Asian region between 2001 and 2006 (**Fig. 22**), indicated that tuna fisheries in the Philippines had been developing very fast especially in the Sulu and Mindanao Seas in 2006 compared to that of 2001. Specifically through various surveys, SEAFDEC Training Department (TD) established the distribution characteristics and stock of transboundary tuna resources in the Eastern Indian Ocean (SEAFDEC/TD, 2002; SEAFDEC/TD, 2003; SEAFDEC/TD, 2006).

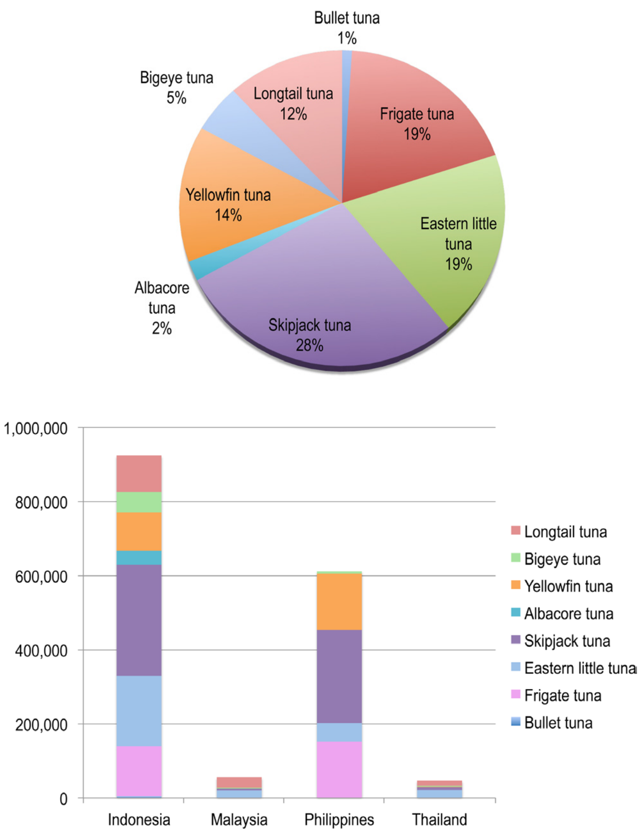

Figure 21. Species composition of tuna from four major tuna-producing countries of Southeast Asia

In 2008 and 2009, the production of tuna from Indonesia was dominated by the skipjack tuna followed by frigate tuna and yellowfin tuna. For Malaysia, the most dominant species was the long-tail tuna, and for the Philippines skipjack tuna provided the highest production followed by yellowfin, frigate and bullet tunas (**Table 44**). In terms of the value of tuna production of Indonesia in 2009 compared with that of 2008, the trend seems to indicate very drastic change which needs to be reconciled.

1.1.2 Round Scads

The three species of scads known to be found in the Southeast Asian region are the *Decapterus russselli*, *D. maruadsi*, and *D. macrosoma*. With round scads as the most common species in the region, these are mostly caught in their immature stage since mature fishes are rare in many areas as these are believed to migrate to deeper waters for spawning. Round scads have also been known to spawn in the central part of the Gulf of Thailand, and there is also an evidence of considerable migrations although no tagging activities have been conducted to confirm this presumption. Thus, stocks of *Decapterus* spp. are known to be migrating in many fishing areas and thus, are shared with possible considerable uncertainty of their limits, specifically from the Gulf of Thailand to Sunda Shelf, in Malacca Strait, Eastern South China Sea, and in the Gulf of Tonkin. However, it is also possible that one or more stocks are not shared especially those found in the waters of Indonesia.

The main fishing gear used to catch round scads is purse seine but the use of luring light techniques is common in Thailand as well as the use of payao, a type of fish aggregating device (FAD) is commonly used in the Philippines. Round scads are also caught by trawl net but it has been recorded that lift-net is used in the east coast of west Malaysia.

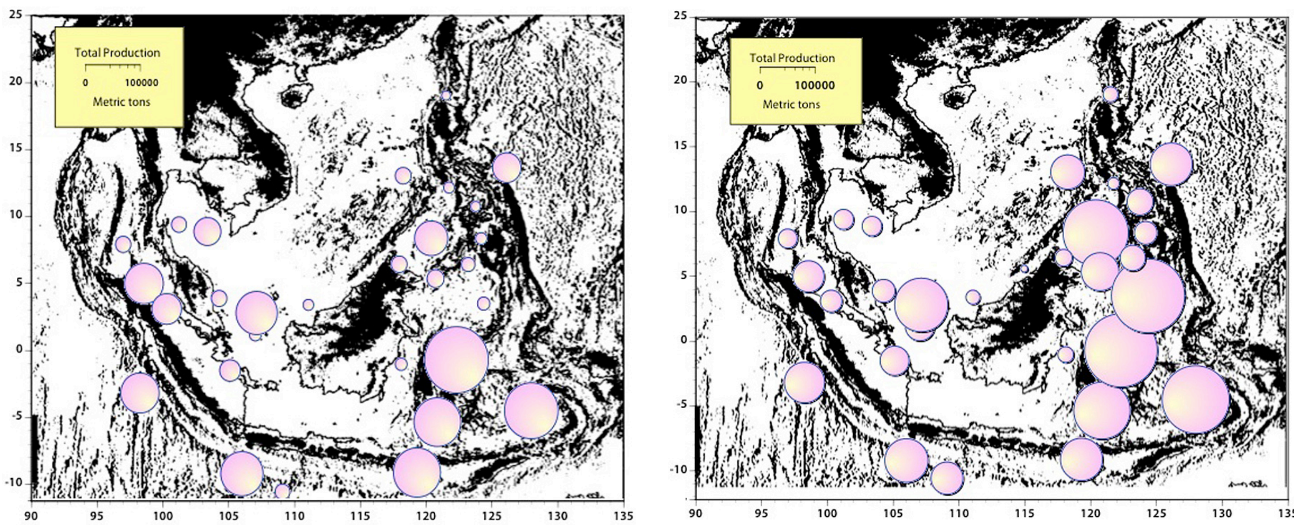

Figure 22. Relative distribution of tuna catches in Southeast Asia in 2001 (left) and 2006 (right)

Table 44. Production of major tuna species in the Southeast Asian region in 2008 and 2009

Country	FAO Common Name	Scientific Name	Quantity (MT)		Value (US$ 1,000)	
			2008	2009	2008	2009
Indonesia	Frigate tuna	*Auxis thazard*	134,744	135,200	10,835,815	51,159
	Bullet tuna	*Auxis rochei*	3,604	5,310	334,017	6,599
	Skipjack tuna	*Katsuwonus pelamis*	296,769	300,740	25,980,578	49,400
	Long-tail tuna	*Thunnus tonggol*	95,229	98,920	11,981,397	28,260
	Albacore tuna	*Thunnus alalunga*	36,538	37,380	6,133,317	19,910
	Southern bluefin tuna	*Thunnus maccoyii*	891	800	168,037	990
	Yellowfin tuna	*Thunnus albacares*	102,765	103,390	14,045,401	38,581
	Bigeye tuna	*Thunnus obesus*	53,979	54,660	6,133,188	20,110
Malaysia	Skipjack tuna	*Katsuwonus pelamis*	*329**	4,460	*390**	6,090
	Long-tail tuna	*Thunnus tonggol*	*41,493**	*27,569**	53,942	*43,209**
	Albacore tuna	*Thunnus alalunga*	359	203	*661**	297
	Yellowfin tuna	*Thunnus albacares*	1,459	1,403	3,812	2,662
	Bigeye tuna	*Thunnus obesus*	1,620	*1,837**	4,466	*3,771**
Philippines	Frigate/bullet tunas	*Auxis thazard/A. rochei*	156,341	-	188,821	-
	Skipjack tuna	*Katsuwonus pelamis*	222,010	251,524	296,506	264,186
	Yellowfin tuna	*Thunnus albacares*	168,411	152,437	292,107	249,592
	Bigeye tuna	*Thunnus obesus*	35,140	5,736	57,510	12,201

Source: *Fishery Statistical Bulletin of Southeast Asia (SEAFDEC, 2011)*
* *Updated figures provided by Fisheries Management Information Division, DoF Malaysia.*

The total production of round scads based on the national statistics provided by four countries, namely: Indonesia, Malaysia, Philippines and Thailand from 1995 to 2004 indicated gradual increases from 640,000 MT to 792,000 MT, but the trend of the total production varied from 2005 to 2008 with the total production estimated as 785,000 MT in 2008. Considering the distribution of round scads which also indicated abundance in the Gulf of Tonkin of Vietnam, certain volume of catch data should have been reported by the concerned countries but this has not been the case as shown in the statistical reports. This means that the total production of round scads in the Southeast Asian waters could be higher than what is reported elsewhere.

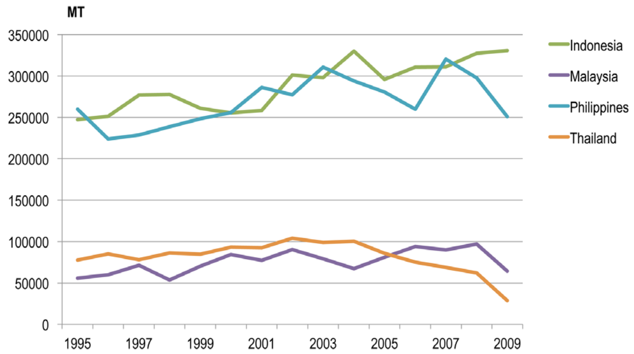

Figure 23. Round scads production in selected Southeast Asian countries (1995-2009)

Nevertheless, in the major producing countries of round scads such as Indonesia and the Philippines, their total catch varied from 250,000 MT in 1995 to about 320,000 MT in 2008 (**Fig. 23**). In the case of Thailand and Malaysia, production also varied from 55,000 MT to 100,000 MT but the catch of Thailand gradually decreased from 100,000 MT in 2004 to 60,000 MT in 2008 while that of Malaysia had been consistent at about 95,000 MT during the same period.

Based on the results of collaborative studies on round scads in the South China Sea conducted by SEAFDEC/MFRDMD from 2002 to 2006, *Decapterus macrosoma* are widely distributed in the coastal areas of the South China Sea from the Gulf of Tonkin, Gulf of Thailand and west coast of Borneo, and in Palawan and west coast of Luzon in the Philippines. The exploitation rate of *D. macrosoma* in the South China Sea varies from 0.42 to 0.90 depending on the specific fishing grounds (**Fig. 24**). For *D. maruadsi*, the exploitation rate also varied from 0.26 to 0.90 while the exploitation rate of both *D. macrosoma* and *D. maruadsi* is high especially in the Gulf of Tonkin and in the southern part of the east coast of Vietnam where the exploitation rate could be higher than 0.8.

As also reflected in the statistical data, although the production of round scads in the region had slightly increased from 2008 to 2009, the value of these species had abruptly been reduced by millions of US$ (**Table 45**).

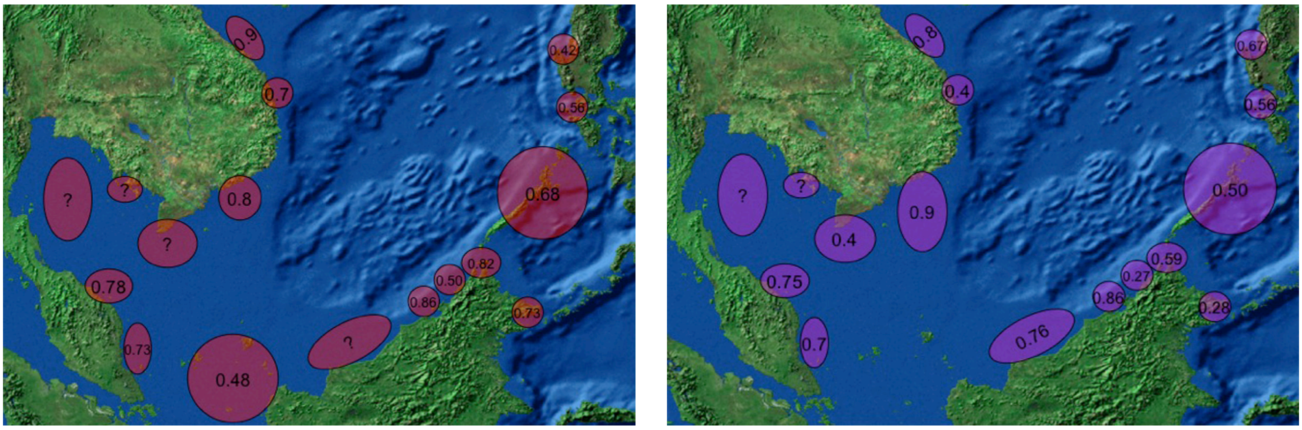

Figure 24. Exploitation rate of *D. macrosoma* (left) and *D. maruadsi* (right) in the South China Sea (2002-2005)

Table 45. Production of major scad species in the Southeast Asian region in 2008 and 2009

Country	FAO Common Name	Scientific Name	Quantity (MT)		Value (US$ 1,000)	
			2008	2009	2008	2009
Indonesia	Scads	*Decapterus* spp.	327,367	330,690	20,053,082	34,560
	Bigeye scad	*Selar crumenophthalmus*	7,927	9,270	535,519	1,290
	Yellowstripe scad	*Selaroides leptolepis*	150,830	153,490	12,102,171	43,890
Malaysia	Indian scad	*Decapterus russelli*	96,946	*92,016**	100,773	*110,850**
	Bigeye scad	*Selar crumenophthalmus*	*55,638**	*47,158**	*72,502**	*74,333**
	Yellowstripe scad	*Selaroides leptolepis*	*20,224**	*18,217**	*22,566**	*21,998**
Philippines	Scads	*Decapterus* spp.	297,892	251,072	315,179	262,969
	Bigeye scad	*Selar crumenophthalmus*	97,149	107,335	124,488	130,356
Vietnam	Indian scad	*Decapterus russelli*	-	27,829	-	33,444

Source: *Fishery Statistical Bulletin of Southeast Asia (SEAFDEC, 2011)*
* *Updated figures provided by Fisheries Management Information Division, DoF Malaysia.*

1.1.3 Mackerels

In addition to scads, mackerels are also among the most important small pelagic fishes in Southeast Asia contributing about 39% to the small pelagic production or 10% to the total capture production in 2008. Its contribution is more significant in Malaysia, Brunei Darussalam and the Philippines as shown in **Table 46**. However, the production data show fluctuating increment trends for the past ten years until 2008 especially in some countries that provided their respective production data (**Fig. 25**). Indonesia and the Philippines are the lead producers in terms of quantity followed by Malaysia and Thailand. Due to negligible figures in terms of production, the data from Brunei Darussalam and Singapore are not included in the analysis.

Distribution of Scads and Mackerels by Ecosystem

In 2008, scads were reported to be more dominant than mackerels in the South China Sea where production of scads contributed 25% to the total small pelagic production or 7% to the total production while mackerels contributed 15% to the total small pelagic production or 4% of the total production. However, in the Eastern Indian Ocean mackerels are more dominant contributing 26% to the total landings of the small pelagic species, while scads contributed only 12% (**Table 47**). A comparison of the production trends of Indonesia, Malaysia and Thailand indicates that scads are more predominantly caught in the South China Sea than in the Eastern Indian Ocean except for Thailand. However, mackerels which are less dominant in the South China Sea of Indonesia and Malaysia are more dominant in the Gulf of Thailand than in the Andaman Sea of Thailand, suggesting that the species which is dominant in the Gulf of Thailand could be different from those in other parts of the South China Sea.

Nevertheless, the stocks of scads and mackerels in the adjacent EEZs of Thailand and Malaysia in the Eastern Indian Ocean and in the South China Sea Area are most likely shared. Therefore, once the stocks in one of the EEZs are over-exploited these could be replenished through recruitment of the species that originate from the other EEZ. However, over-exploitation of the same stock in both EEZs could lead to stock decline which could possibly result in total collapse of the stocks.

Table 46. Percent contribution of scads and mackerels to total fish production of Southeast Asia in 2008

	Brunei Darussalam	Cambodia	Indonesia	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam	Average
% to total catch	17	…	12	19	…	19	3	5	…	**10**
% to small pelagic	46	…	37	58	…	43	31	18	…	**39**

Source: *Fishery Statistical Bulletin of Southeast Asia (SEAFDEC, 2011)*

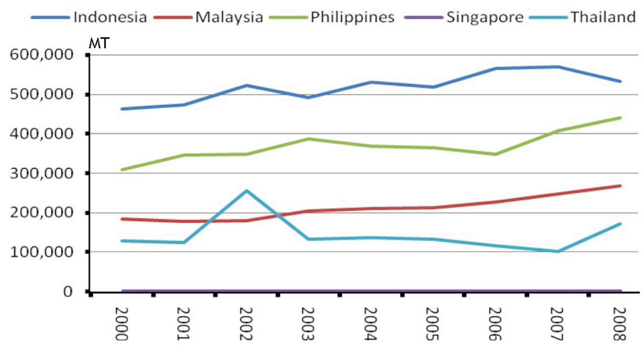

Figure 25. Production trends of scads and mackerels in selected Southeast Asian countries

Status of Scads in Malaysia and Thailand

Scads in the Gulf of Thailand are caught almost 100% by purse seine, while those from the South China Sea and landed in Malaysia are mostly caught by purse seine (89%) and 11% by trawl, drift/gill net, lift-net, and hook and line (**Fig. 26**). Although purse seine is the main fishing gear exploiting scads, the landings of scads by purse seine from these two waters clearly indicate an overall declining trend since 2002 (**Fig. 27**). For Malaysia, scads from the Straits of Malacca and the Andaman Sea are also exploited mainly by purse seine as shown in **Fig. 26**.

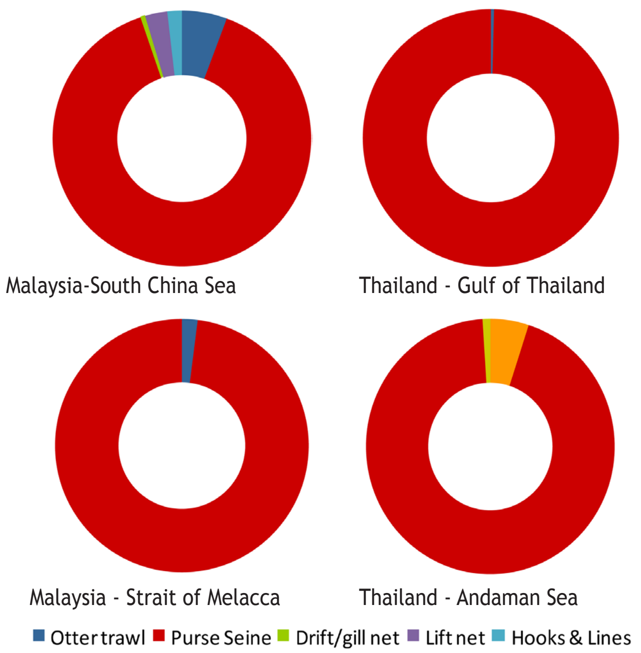

Figure 26. Landings of scads from the South China Sea (above) and Eastern Indian Ocean (below) waters of Malaysia and Thailand in 2007
(Source: Fishery Statistical Bulletin of Southeast Asia 2008 (SEAFDEC, 2010))

Table 47. Contribution of scads and mackerels to the total catch and total small pelagic fish production in the South China Sea and Eastern Indian Ocean in 2008

Ecosystem	Country	Scads		Mackerels	
		Total catch	Small pelagic catch	Total catch	Small pelagic catch
South China Sea	Brunei Darussalam	11	29	6	17
	Cambodia	?	?	?	?
	Indonesia	8	27	5	16
	Malaysia	8	26	4	13
	Philippines	13	29	6	14
	Singapore	3	38	?	?
	Thailand	0.4	1	5	16
	Vietnam	?	?	?	?
	Average	7	25	4	15
Eastern Indian Ocean	Indonesia	3	10	6	18
	Malaysia	6	16	21	59
	Myanmar	?	?	?	?
	Thailand	3	12	2	8
	Average	2	12	5	26

Source: *Fishery Statistical Bulletin of Southeast Asia (SEAFDEC, 2011)*

While the landings of scads by purse seine in the South China Sea are still increasing which is very prominent in the Straits of Malacca (**Fig. 27**), the same landing trends have also been observed in Malaysia and Thailand generally indicating that purse seines operating in the South China Sea especially in the EEZs of both countries probably exploit the same stock of scads. Since declining landing trends indicate that the stock is already over-exploited, therefore the stock of scads in the Eastern Indian Ocean may probably have already reached an over-exploitation level. As reported in 2008, there were about 2,336 units of purse seiners operating in the EEZs of these two countries. Therefore, it would be necessary to enforce suitable management measures solely for purse seine fishery operations in view of their direct impact on the stocks of scads considering that purse seine is the only gear exploiting the scads.

Status of Mackerels in Malaysia and Thailand

Mackerels are caught by various types of gears in the South China Sea although purse seine, trawl and drift/gill net are the main gears catching these species, and the contribution of mackerels to the landings in Malaysia as

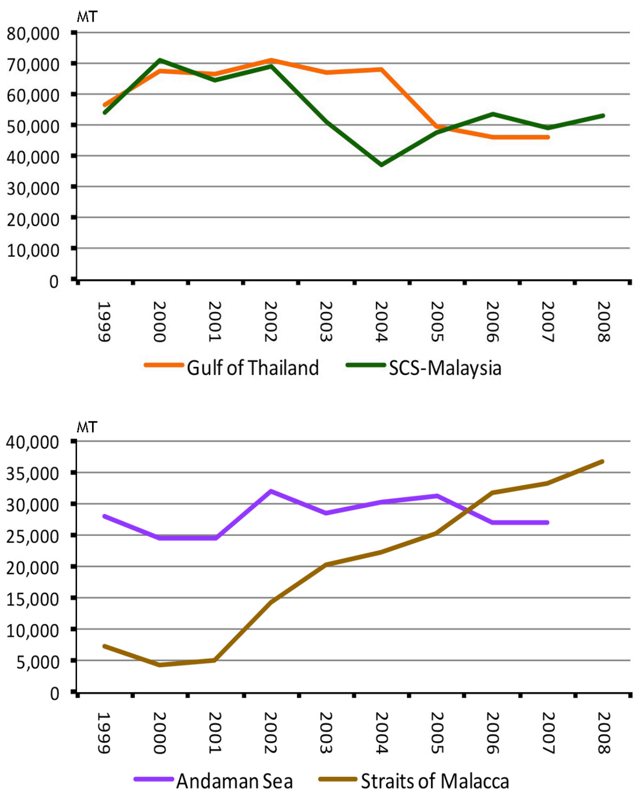

Figure 27. Landing trends of scads caught by purse seines in the South China Sea (above) and Eastern Indian Ocean (below) waters of Malaysia and Thailand in 2007
(Source: Fishery Statistical Bulletin of Southeast Asia 2008 (SEAFDEC, 2010))

well as in Thailand varies. In Malaysia, the catch from purse seines accounted for about 45% of the total catch in 2008, while that from drift/gill nets was 31% and from trawls 18% (**Fig. 28**). On the other hand, purse seine fisheries in the Gulf of Thailand contributed about 46% to the total catch in 2008, trawls contributed 51%, and drift/gill nets 3% (**Fig. 28**). In general, landings using these three main gears in Malaysia indicated fluctuating and declining trends, although a declining trend is more obvious in the Gulf of Thailand (**Fig. 28**). Such situation implies that the mackerel stocks in the South China Sea are already over exploited. Nonetheless, the question on whether these are the same stocks or whether the scads and mackerel stocks are shared among the countries in the region, still remain unanswered.

Records in 2008 indicated that mackerels in the eastern side of the Straits of Malacca are caught by purse seines (43%), drift/gill nets (37%) and trawls (20%). On the other hand, only purse seines and trawls catch substantial amounts of mackerels in the Andaman Sea in 2007, the percentage of which is almost equal to the total production, but landings from the drift/gill nets are almost not significant. Nevertheless, landings by the three main gears in the Straits of Malacca are still increasing by about three times more in terms of quantity than in the Andaman Sea (**Fig. 29**). Although, purse seine landings in the Andaman Sea indicate a continuous declining trend but the trawl landings show the opposite trend. As a whole, both landings have been declining since 2005 which suggest that exploitation could be involved in these two distinct fish stocks since the landing trends in Malaysia follows an opposite trend compared with that of Thailand.

Mackerel stocks are exploited by three main fisheries, namely: purse seine, trawl and drift/gill net. The fishing

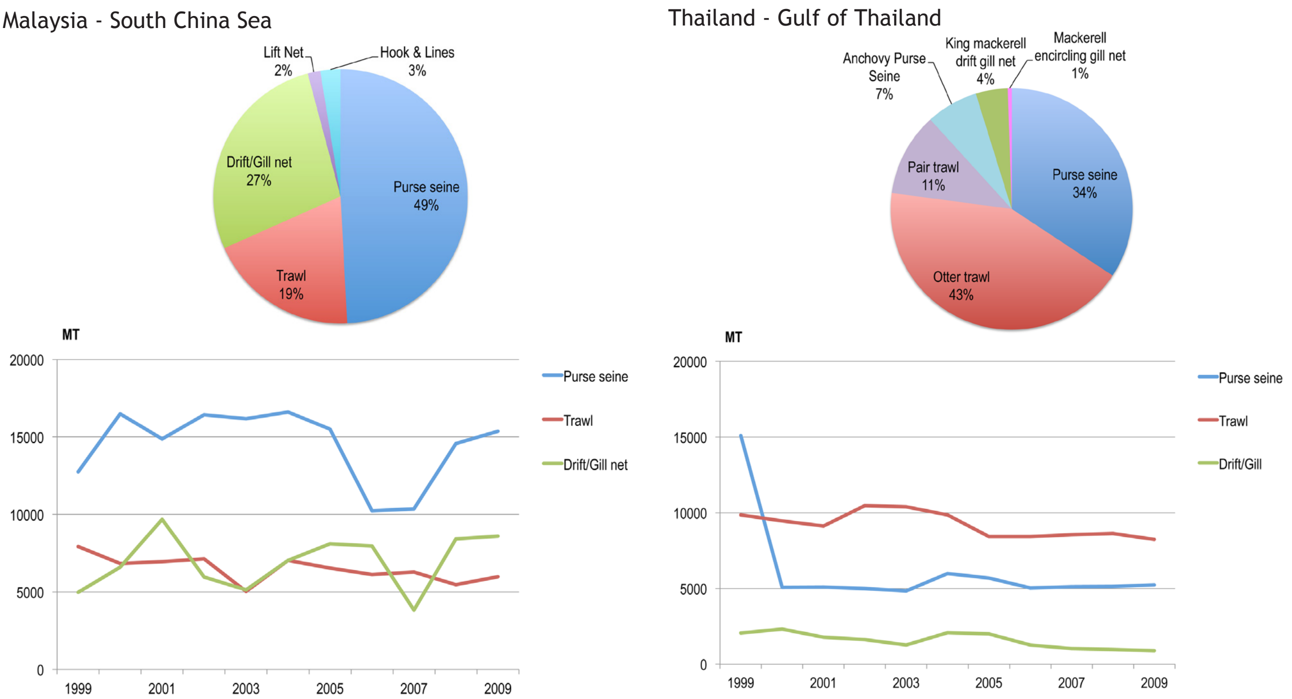

Figure 28. Landing compositions (2009) and production trends (1999-2009) of mackerels by main gear types of Malaysia and Thailand in the South China Sea areas
*(**Source:** SEAFDEC, 2010)*

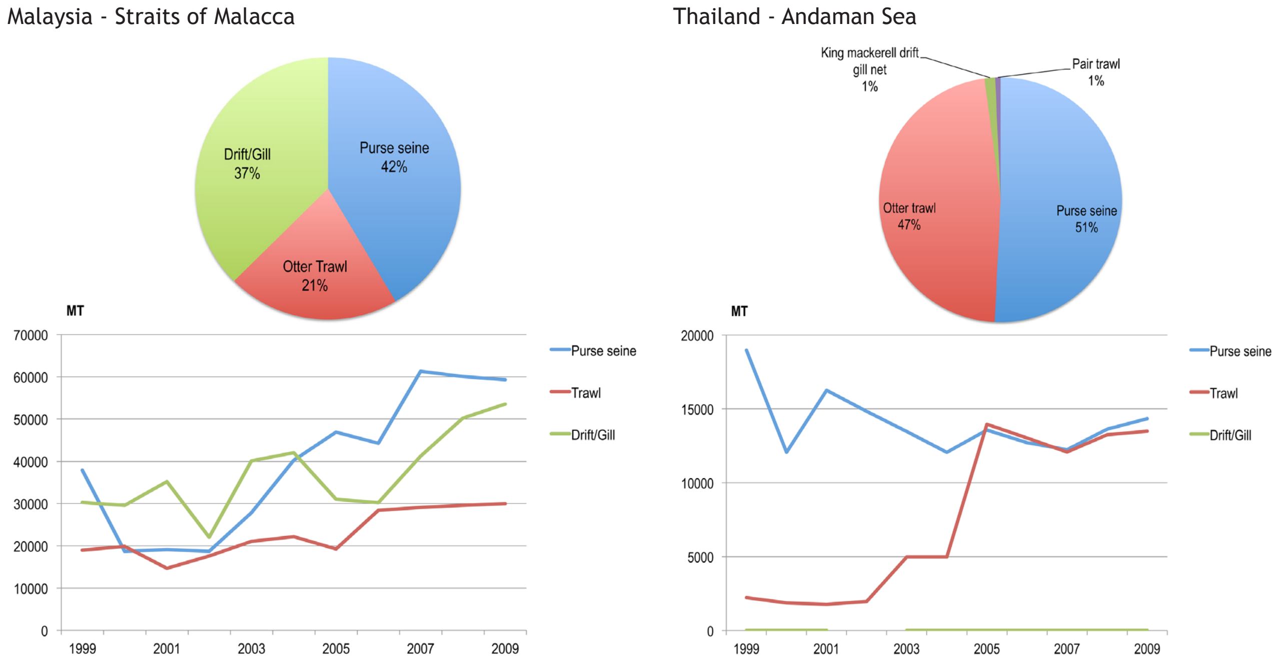

Figure 29. Landing compositions (2009) and production trends (1999-2009) of mackerels by main gear types of Malaysia and Thailand in the Andaman Sea
(Source: SEAFDEC, 2010)

grounds of purse seiners and trawlers are more offshore than those of the drift/gill netters. This requires an analysis of the landing data by species since distribution of the species could be varied. Results of a study conducted by the SEAFDEC/MFRDMD showed that the Indian mackerel (*Rastrelliger kanagurta*) comprised about 25% of the total catch of purse seines in the South China Sea off Malaysia, while the Indo-Pacific mackerel (*Rastrelliger brachysoma*) contributes only about 2% (Raja Bidin and Ku Kassim, 2007). In the Andaman Sea, purse seines using FADs and light purse seines are reported to be catching more Indian mackerels than the Indo-Pacific mackerels which are caught mainly by Thai purse seines. Likewise, trawlers using high opening trawl nets catch mainly the Indo-Pacific mackerels.

Identification of Shared Stocks of Scads and Mackerels

Based on the ten-year fishery statistical data provided and published yearly in the SEAFDEC Fishery Statistical Bulletin of Southeast Asia, the landing trends by group of fishes could be derived but not for the scads and mackerels group since production has not been reported at species level. Moreover, since fish distribution is shown by ecosystem rather than by national boundaries, analysis should also be done by ecosystem for the whole of South China Sea or Eastern Indian Ocean of the Southeast Asian region. In order to do this, countries in the region should provide the required data at certain level that could be used to describe the status of the fish stocks.

The availability of comprehensive statistical data at species level for the whole coverage area will help in the analysis and identification of the possible shared stocks in the region. This information combined with other scientific findings through tagging experiments and molecular analysis could help confirm the existence and extent of the shared stocks. This is important since effective management of shared stocks requires measures to be undertaken for the whole coverage area even if this is beyond the countries' national waters. Just like scads, the production of mackerels also increased from 2008 to 2009 but the value of the production had deeply decreased from 2008 to 2009 (**Table 48**).

1.1.4 Anchovies

Thirteen species of anchovies under the genus *Stolephorus* are found in the Southeast Asian region but only two, namely: *Stolephorus heterolobus* and *S. indicus* are the most common. Stocks of *Stolephorus* spp. are believed to typically form a number of local stocks close to the inshore waters although not always, and are also believed to have no regular migration patterns although moving about within a fairly well defined area. Nonetheless, the anchovies in the vicinity of the Southeast Asian waters are believed to form a transboundary shared stock. Although there could be several other stocks being shared in the region, very little information is available to confirm such situation.

Anchovies like other species feed mainly on planktonic crustaceans and breed throughout the year with a peak during the first part of northeast monsoon in Manila Bay (October to January), and in the Gulf of Thailand from February-April and July to December. Anchovies are

Table 48. Production of major mackerel species in the Southeast Asian region in 2008 and 2009

Country	FAO Common Name	Scientific Name	Quantity (MT)		Value (US$ 1,000)	
			2008	2009	2008	2009
Indonesia	Narrow-barred Spanish mackerel	*Scomberomorus commerson*	126,985	128,250	20,635,834	42,571
	Indo-Pacific king mackerel	*Scomberomorus guttatus*	24,505	26,360	5,029,161	34,850
	Queenfishes	*Scomberoides* spp.	13,412	14,520	1,224,639	5,150
	Blue mackerel	*Scomber australasticus*	455	510	19,285	140
	Short mackerel	*Rastrelliger brachysoma*	249,438	251,510	24,607,984	91,360
	Indian mackerel	*Rastrelliger kanagurta*	16,849	18,170	1,432,386	1,210
Malaysia	Seerfishes	*Scomberomorus* spp.	*14,630**	*12,633**	*53,826**	*46,471**
	Queenfishes	*Scomberoides* spp.	3,322	*2,772**	4,100	*3,509**
	Indian mackerels nei	*Rastrelliger* spp.	*170,321**	*185,490**	*213,153**	*295,038**
Philippines	Narrow-barred Spanish mackerel	*Scomberomorus commerson*	19,005	17,192	39,573	34,497
	Seerfishes	*Scomberomorus* spp.	7,334	-	-	-
	Queenfishes	*Scomberoides* spp.	-	6,959	-	-
	Chub mackerel	*Scomber japunicus*	1,255	1,866	-	-
	Short mackerel	*Rastrelliger brachysoma*	50,986	49,478	62,005	56,642
	Indian mackerel	*Rastrelliger kanagurta*	91,272	87,449	112,728	100,215

Source: *Fishery Statistical Bulletin of Southeast Asia (SEAFDEC, 2011)*
* *Updated figures provided by Fisheries Management Information Division, DoF Malaysia.*

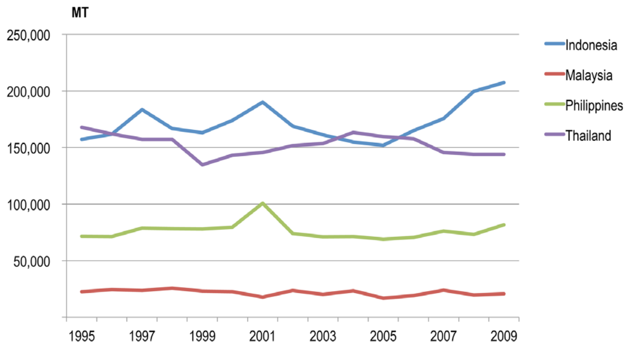

Figure 30. Production status and trends of anchovies in selected Southeast Asian countries (1995-2009)

mainly caught by anchovy purse seine operating in day time as well as in the night time with the use of luring lights, bamboo stake traps, luring light lift-net, set bag net, push net, and incidentally also by trawl fishing operations. The total production of anchovies from 1995 to 2007 based on the statistics from five countries such as Indonesia, Malaysia, the Philippines, Singapore and Thailand varied from 410,000 MT to 454,000 MT. The peak of the catch was observed in 2001 especially in Indonesia and the Philippines (**Fig. 30**).

The production of anchovies from Malaysian waters has not differed during the period from 1995 to 2007, which was around 20,000 MT (**Fig. 30**). Similar trend was also noted in the Philippines where the catch was about 70,000 MT except in 2001. In addition, the catch of anchovies in Indonesia and Thailand fluctuated where the average catch was about 170,000 MT for Indonesia and 150,000 MT for Thailand. Although the data in 2008 and 2009 were insufficient for stock assessment, the data seemed to indicate increasing trend in terms of volume but decreasing in terms of value (**Table 49**).

1.1.5 Sardines

Sardines are pelagic schooling fish species feeding on phytoplankton and zooplankton. There are six species of sardines specifically found in Thailand and in many countries of the region. However, the three common

Table 49. Production of anchovies in the Southeast Asian region in 2008 and 2009

Country	FAO Common Name	Scientific Name	Quantity (MT)		Value (US$ 1,000)	
			2008	2009	2008	2009
Indonesia	Stolephorus anchovies	*Stolephorus* spp.	199,675	207,450	21,013,687	84,201
Malaysia	Stolephorus anchovies	*Stolephorus* spp.	*19,600**	20,732	*24,433**	23,841
Philippines	Stolephorus anchovies	*Stolephorus* spp.	73,235	81,842	65,922	71,467

Source: *Fishery Statistical Bulletin of Southeast Asia (SEAFDEC, 2011)*
* *Updated figures provided by Fisheries Management Information Division, DoF Malaysia.*

Table 50. Production of sardines in the Southeast Asian region in 2008 and 2009

Country	FAO Common Name	Scientific Name	Quantity (MT)		Value (US$ 1,000)	
			2008	2009	2008	2009
Indonesia	Spotted sardinella	*Amblygaster sirm*	5,618	6,050	72,258	120
	Goldstripe sardinella	*Sardinella gibbosa*	174,356	175,800	10,645,067	22,110
	Bali sardinella	*Sardinella lemuru*	139,350	139,010	5,345,563	36,790
Malaysia	Diadromous clupeoids nei	*Clupeoidei*	850	1,025	4,382	3,657
Philippines	Sardinella nei	*Sardinella* spp.	369,199	467,853	208,562	232,967

Source: *Fishery Statistical Bulletin of Southeast Asia (SEAFDEC, 2011)*

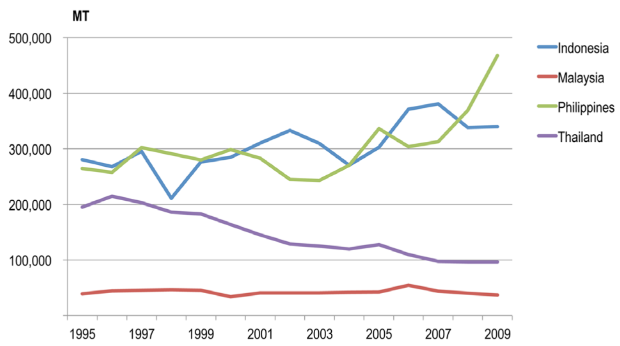

Figure 31. Production status and trends of sardines in selected Southeast Asian countries (1995-2009)

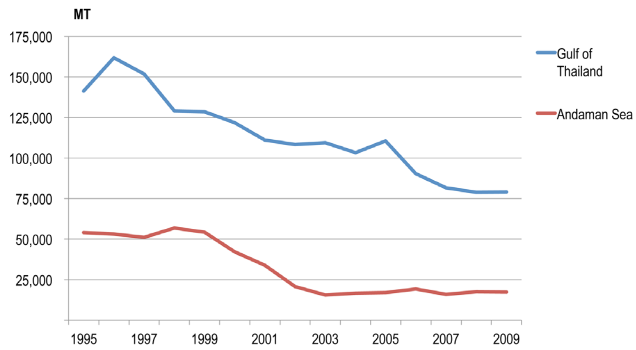

Figure 32. Decline in production trends of sardines in the Gulf of Thailand and Andaman Sea (1995-2009)

species are: *Sardinella gibbosa*, *S. frimbriata*, and *S. albella*. Sardines are normally scattering in the coastal and offshore areas at water depths ranging from 30 to 70 m. The peak of the spawning season of sardines is in March-April and July-August in the Gulf of Thailand. The main fishing gear used is purse seine with and without luring lights, encircling gill net, lift-net, set net, and bamboo stake trap. For countries like Indonesia, Philippines and Malaysia, sardines are also among the important small pelagic species and are usually utilized for several products such as canned, dried, smoked, boiled, fermented (fish sauces), cured, made into fishmeal, and also marketed fresh.

However, the total production of the main sardine producing countries in the region seemed to have fluctuated from 1995 to 2007, with the total catch varying within the range from 730,000 MT and 846,000 MT, with peaks noted in 1996 and 2006. By country, the total catch of sardines was stable at about 50,000 MT in Malaysia, while for Indonesia and the Philippines the catches fluctuated but seemed to follow slight increasing trends during the period from 1995 to 2007 with the sardine catch of the Philippines increasing from 264,000 MT in 1995 to 313,000 MT in 2007. In addition, the sardine catch of Indonesia also increased from 280,000 MT in 1995 to 380,000 MT in 2007 (**Fig. 31**).

Specifically for Thailand, sardines production gradually declined from 220,000 MT in 1996 to about 100,000 MT in 2007 (**Fig. 32**), where most of catch came from the Gulf of Thailand which was about three times more than that of the Andaman Sea. Nonetheless, the total catch also seemed to be declining in the Gulf of Thailand and Andaman Sea from 162,000 MT in 1996 to 82,000 MT in 2007, and from 53,000 MT to 16,000 MT, respectively, and the overall production of sardines in selected Southeast Asian countries from 2008 to 2009 seems to have increased as shown in **Table 50**.

1.2 Deep Sea Fishery Resources

Although almost 50% of the Southeast Asian waters comprised continental shelf but there are also continental slopes and deep basins down to nearly 1,000 to 5,000 meters deep which form the largest habitats of various fishery resources especially around Indonesia, Philippines, and some parts of Andaman Sea (Sukramongkol, 2011). Within the depth of 100 meters, the fishery resources are intensively exploited by trawl fisheries especially the shallow-water fish species which have been well documented (Siriraksophon, 2006; Yasook, 2008; SEAFDEC/TD, 2009). Attempts to assess the status of the demersal resources at the unexploited range of 200-350 meter depths have been undertaken since late 70s by the Norwegian research vessel, Dr. Fridtjof Nansen in association with FAO (Nishida and Sivasubramaniam, 1986). However, information and biological knowledge on the deep sea fauna in the EEZs of the Southeast Asian countries are still inadequate especially the demersal resources in the continental shelf and slope beyond 100-meter depth. Currently, comprehensive knowledge on deep sea fishery resources could only be made