PART II
Issues and Challenges in Sustainable Development of Fisheries 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, and invertebrates. Most of the economically important fishery resources of the Southeast Asian region that are generally exploited by pelagic fisheries include tunas, round scads, mackerels, anchovies, and sardines although some equally important species are also captured through demersal, high sea, and deep sea fisheries. The production trend of these species has been accessed from various available data such as the respective countries' national statistical data reports, SEAFDEC Fishery Statistical Bulletin for the South China Sea Area until 2007, SEAFDEC Fishery Statistical Bulletin of Southeast Asia from 2008 to 2014, reports from ASEAN-SEAFDEC programs on information collection of some small pelagic species in the South China Sea, and Information Collection of Highly Migratory Species in the Southeast Asian Region focusing on tuna, among others. Nevertheless, the production data shown in this report is based on the respective domestic fisheries in the jurisdiction of the countries in the Southeast Asian region.

1.1 Important Pelagic Fishery Resources

In Southeast Asia, small pelagic fishes such as tunas, round scads, mackerels, anchovies, and sardines are the most economically important fishery resources. Being highly migratory, these small pelagic fishes move across the Exclusive Economic Zones (EEZs) between neighboring countries depending on the oceanographic parameters and food availability. Impacts of climate change also influence the fluctuation of stock abundance as well as changes in migration routes of these species. Threats of overexploitation and decreasing recruitment due to degradation and destruction of aquatic habitats also exacerbate these serious problems. Since stocks of some pelagic species are being shared by many countries in the region, it is necessary that such transboundary stocks should be well managed to avoid overexploitation which could eventually lead to decline or even total collapse of the stocks. In the Southeast Asian region, recognition of shared stocks is fundamental for the promotion of fisheries management. However, insufficient information on stock identification and shared stocks of pelagic fishes hampers all efforts to promote sustainable management of the fisheries of these resources.

High variability in stock abundance coupled with the migratory behavior of pelagic fishes pose a great challenge in sustainable fisheries development and management. As human population and demand for fish and fish-based products continue to rise, there is a need to address these issues through the development of integrated management measures. This should be taken as a priority considering that the sustainability of the fishery resources would ensure food security in the Southeast Asian region, and one of the most dependable fisheries sub-sectors is capture fisheries, which has been playing a vital role in providing nutrition and food supply as well as improving the livelihoods of people in the region.

1.1.1 Tunas

Tunas (Family Scombridae), which include several species of oceanic and neritic tunas, are abundant throughout the Southeast Asian region. While oceanic tunas migrate over large areas, neritic tunas are commonly found within the EEZs and sub-regional seas of Southeast Asia. These tuna resources, which are of high economic importance to many Southeast Asian countries, not only generate export revenues for the countries but also provide important protein sources for people's domestic consumption. As the availability of oceanic tunas is seen to be declining, neritic tuna species are gaining more economic importance in the Southeast Asian region and have increasingly become the target for commercial and local fisheries especially that attractive prices are now being offered for these species by fish processing companies. However, there are still uncertainties about the distribution, migration, and utilization of tuna stocks in the waters of Southeast Asia, and without further clarification and dialogue, it would be difficult to develop appropriate tuna management plans at national and sub-regional levels.

While management efforts for the sustainable exploitation of oceanic tunas are guided by the recommendations from the Tuna Regional Fisheries Management Organizations, such as the Indian Ocean Tuna Commission (IOTC) and the West Central Pacific Fisheries Commission (WCPFC), for neritic tuna resources in the Southeast Asian region, it has become necessary that common approaches be promoted for the management of their utilization to ensure the sustainable use of available regional resources and maximize economic benefits for the region. Thus, the establishment of collaborative management plans for the region's neritic tuna fisheries was considered very crucial

for the sustainability of these rich and important trans-boundary resources. Recognizing the urgency of such issue, the SEAFDEC Member Countries during the Forty-fifth Meeting of the SEAFDEC Council in April 2013 called for the development of a plan of action for regional cooperation on neritic tunas in the Southeast Asian region.

Subsequently, the SEAFDEC Council of Directors during the Forty-fifth SEAFDEC Council Meeting supported the proposal to strengthen regional and sub-regional cooperation to promote the conservation and management of sustainable neritic tuna fisheries in the Southeast Asian waters, which would require cooperation of the countries' tuna producers in showing and verifying the sustainability of targeted neritic tuna fisheries. In pursuing the planned activities of the abovementioned proposal, the SEAFDEC Secretariat reviewed the development of tuna capture fisheries in the Southeast Asian region. With financial support from the Governments of Japan and Sweden, and with the technical support from relevant SEAFDEC Member Countries, the SEAFDEC Secretariat came up with the preliminary status and trends of neritic tuna fisheries in the region. Meanwhile, consultations with the Member Countries were convened to come up with the way forward for the promotion of regional or sub-regional cooperation on sustainable utilization of neritic tuna resources in the Southeast Asian region.

1.1.1.1 Neritic Tuna Fisheries

In the Southeast Asian region, neritic tunas are mainly caught commercially using three fishing gears, namely: purse seines, ring nets, and driftnets (Siriraksophon, 2013). Three types of purse seine operations are adopted, such as purse seines using searching devices, purse seines associated with fish aggregating devices (FADs), and purse seines using luring light. In Thailand, as in many neighboring countries like Brunei Darussalam, Cambodia, Indonesia, Malaysia, and Myanmar, the purse seines that are currently used evolved from the Chinese purse seine (Yingyuad and Chanrachkij, 2010), which became widely used after 1957. A unique style of purse seine has since then been developed which is appropriate to the conditions of the waters of Thailand, where purse seine fisheries started in 1982 when the country's tuna canning industry began to expand. Initially, purse seines in Thailand were used to catch small pelagic fishes, but now this fishing gear is targeting small tunas.

The purse seine fisheries operation in Thailand is labor intensive with 30-40 crews working on vessels ranging in size from 25 m to 30 m. The length of Thai purse seine nets ranges from 800 m to 1,250 m, while the depth of the nets ranges from 70 m to 120 m, and mesh sizes that range from 2.5 m to 9.7 cm. Recently, modern purse seiners are equipped with radar, depth sounder, sonar transceiver, and satellite navigational instruments. Purse seine is one of the most efficient types of fishing gears for surrounding schools of fish, *e.g.* anchovies, sardines, scads, mackerel, bonito and tuna. Purse seine was developed from two different fishing gears and methods, *i.e.*, beach seine and lampara.

A ring net is also used to catch pelagic fishes including small tunas. It is a type of surrounding net which evolved from purse seine and a lampara net. The rings at the lower edge of the net allow a purse line to close it under the fish (pursing). With a central bunt (with smaller mesh) where the catch concentrates, the two wings are hauled together forming a spoon-shape as in a lampara net. Driftnets also play very important role in neritic tuna fisheries, especially in the early period of development of small pelagic fisheries in many Southeast Asian countries. Although driftnet operations are not as popular as purse seine fisheries nowadays, the drift gillnets are still important gear for some Southeast Asian countries especially in Viet Nam where 37% of its total annual neritic tuna catch of 72,650 metric tons is caught by drift gillnets (Thong, 2013).

1.1.1.2 Stock Assessment of Neritic Tunas

While assuming that stocks of neritic tunas in the Southeast Asian waters are found in two areas, *i.e.*, Pacific Ocean and Indian Ocean aligning with FAO Fishing Areas 57 and 71, respectively (**Figure 40**), SEAFDEC in cooperation with the Member Countries has carried out stock assessment of some neritic tunas in the waters of the region. Specifically, assessment of the longtail tuna (*Thunnus tonggol*) and kawakawa (*Euthynnus affinis*) stocks in the Pacific and Indian Oceans was conducted in 2016 using the Kobe Plot (Nishida *et al*., 2016), CPUE standardization, and the software package A Stock-Production Model Incorporating Covariates (ASPIC).

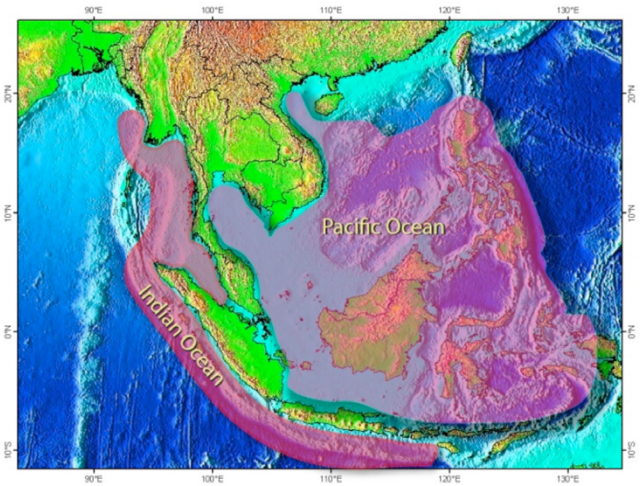

Figure 40. Pacific Ocean: FAO Fishing Area 57 (South China Sea) and Indian Ocean: FAO Fishing Area 71 (Andaman Sea-Southeast Asia) where stocks of neritic tunas are assumed to be found

Longtail Tuna

Based on the stock assessment using the Kobe Plot, the stock of longtail tuna in the Indian Ocean as of 2014 was in the red zone (unsafe) suggesting that the stock was already overfished but still fishing continues to take place. With TB/TBmsy=0.89 (TB: total biomass; TBmsy: total biomass maximum sustainable yield) and F/Fmsy=1.11 (F: fishing pressure; Fmsy: fishing pressure maximum sustainable yield), these estimates imply that TB is 11% lower than the MSY level and F is 11% lower than the MSY level (**Figure 41**). Catch was at its peak in 2011, but afterwards it decreased continually until 2014, although the stock had slightly recovered in 2014. However, the probability of uncertainties in the red, orange, and yellow zones (unsafe) of the 2014 point was very high at 78%. Therefore, catch and F should be decreased to their MSY levels, *i.e.* 37,000 metric tons and 0.51, respectively.

Meanwhile in the Pacific Ocean, the stock of longtail tuna in 2013 based on the Kobe Plot was in the green zone (safe), *i.e.* TB/TBmsy=2.22 and F/Fmsy=0.18, implying that TB is 122% higher than the MSY level and F is 92% lower than the MSY level (**Figure 42**). Catch was at its peak in 2008 and afterwards it sharply decreased in 2013 at 193,000 metric tons (the lowest level since 1980s). Nevertheless, the status of the stock is in the safe zone and the probability of uncertainties in the red, orange, and yellow zones (unsafe) around the 2013 point is 0%. Although both catch and F could be increased, these should be less than their MSY and Fmsy levels, *i.e.* at 200,000 metric tons and 1.07, respectively.

Kawakawa

As of 2014, the stock of kawakawa in the Indian Ocean was in the green zone (safe) with TB/TBmsy=1.28 and F/Fmsy=0.75 , *i.e.* TB is 29% higher than its MSY level and F is 26% lower than MSY level (**Figure 43**). Although kawakawa stock in the Indian Ocean is in the safe condition, fishing pressure and catch should not exceed the 2014 level because 53% of uncertainties around the 2014 point were in the red, orange and yellow zone (unsafe) while only 47% was in the green zone (safe).

In the Pacific Ocean, the stock of kawakawa was in the green zone (safe), *i.e.* TB/TBmsy=1.29 and F/Fmsy=0.74, implying that TB is 29% higher than the MSY level and F is 26% lower than the MSY level (**Figure 44**) due to significant catch decrease after 2002 (peak level) and the current catch level is low. In addition, the Kobe Plot shows that there is no probability that uncertainties in the 2013 estimates fall in the red, orange and yellow zone (unsafe). Although there are no problems in maintaining the current catch and F levels, these should be kept under their MSY levels at 185,000 metric tons and 0.43, respectively.

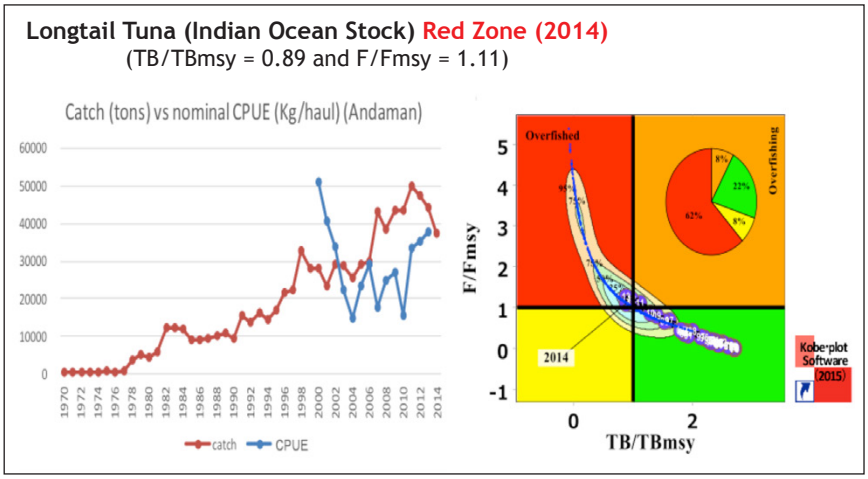

Figure 41. Stock assessment of longtail tuna in the Indian Ocean: Fishing Area 57 (Andaman Sea) in 2013 using the Kobe Plot

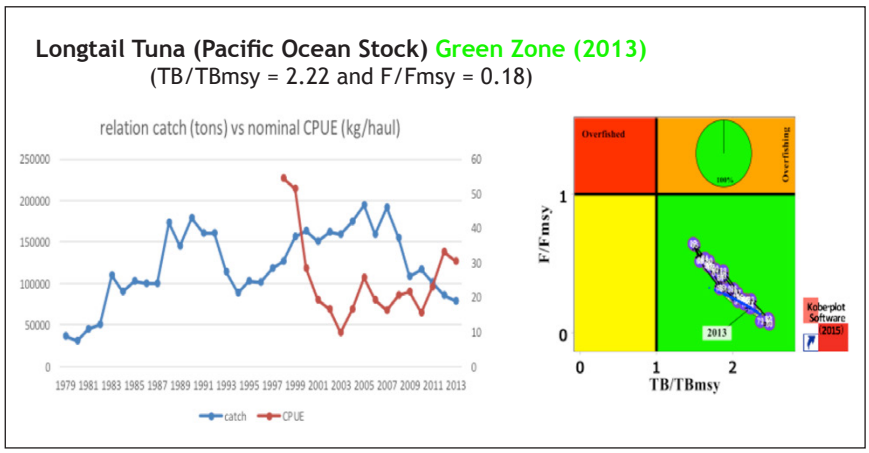

Figure 42. Stock assessment of longtail tuna in the Pacific Ocean: FAO Fishing Area 71 (South China Sea) in 2014 using the Kobe Plot

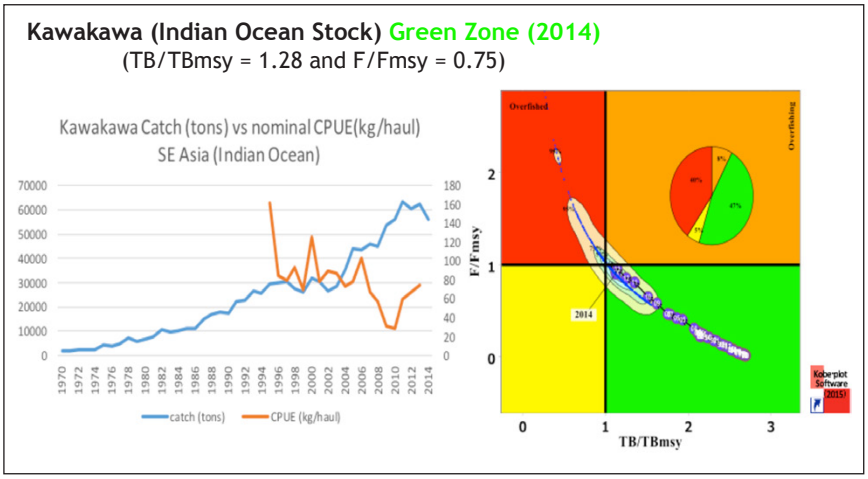

Figure 43. Stock assessment of kawakawa in the Indian Ocean: FAO Fishing Area 57 (Southeast Asia-Andaman Sea) in 2014 using Kobe Plot

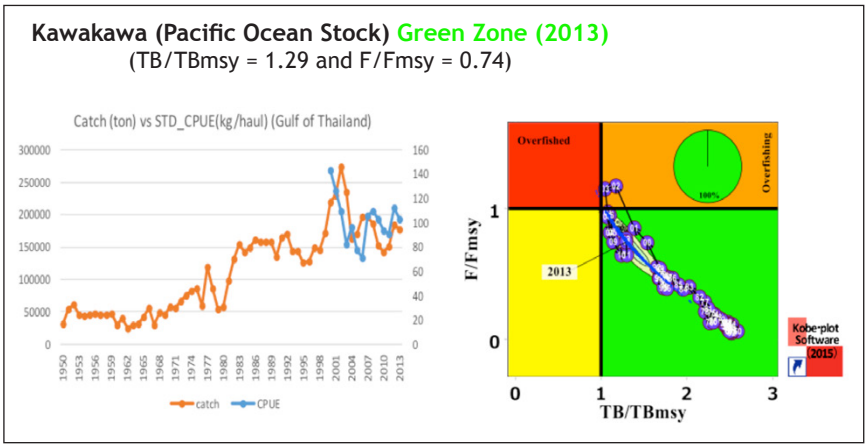

Figure 44. Stock assessment of kawakawa in the Pacific Ocean: FAO Fishing Area 71 (Gulf of Thailand) in 2013 using the Kobe Plot

The abovementioned stock assessment activities made use of catch data from FAO, IOTC, and the SEAFDEC Neritic Tuna Project, implying that almost all of the data are basically national statistics, thus there are wide ranges of uncertainties since stock structures are unknown. In addition, the CPUE data provided by the Department of Fisheries (DOF) of Thailand were also used considering that other plausible CPUE data were not available, thus there was no way of comparing the stock status with other concerned countries. Results of the stock assessment activities were therefore derived mainly from the CPUE series of DOF Thailand, which may not have covered a long historical data sufficient enough to carry out reliable stock assessments.

> *"Even though there are a number of caveats, some positive evidences emerged indicating that the results are likely realistic. First, the relationship between catch and CPUE in all four cases are negatively correlated, suggesting that the trends are likely realistic. Hence, results of stock assessments are likely credible. Second, results of stock assessments in the Indian Ocean stock are similar to those in the whole Indian Ocean based on the stock assessments conducted by IOTC" (IOTC, 2015).*

Issues and Challenges

During the series of regional technical consultations organized by SEAFDEC with the Member Countries, key issues that need to be addressed were identified for the promotion of the sustainable utilization of neritic tunas in the Southeast Asian region. These include: 1) insufficient data and information, 2) undetermined status of neritic tuna stocks, 3) open access scheme, 4) inadequate management of neritic tunas resources in some areas, 5) inadequate understanding of management and conservation measures, 6) negative impacts of climate change to changes in neritic tuna stocks, 7) negative impacts of fisheries to marine ecosystem, 8) illegal, unreported and unregulated (IUU) fishing, 9) inadequate infrastructures in fishing ports and landing sites, 10) post-harvest losses and product quality deterioration, 11) inaccessible intra-regional and international trade, 12) inadequate benefits for people involved in neritic tuna fisheries and industries, 13) working conditions and labor issues, 14) lack of sub-regional action plans for neritic tuna fisheries, 15) insufficient information on status and trends of neritic tunas at sub-regional level, and 16) limited support to intra-regional and international trade.

Regional Plan of Action for Neritic Tunas

In order to address the aforementioned issues, the Member Countries adopted the ***Regional Plan of Action on Sustainable Utilization of Neritic Tunas in the ASEAN Region (RPOA-Neritic Tunas)***. The features of the RPOA-Neritic Tunas (SEAFDEC, 2015) are summarized in **Box 1**.

Current Actions and Way Forwards

After the adoption of the **RPOA-Neritic Tunas**, SEAFDEC with support from the AMSs have implemented several action plans (**Box 2**). The Way Forward to promote and support the implementation of the RPOA-Neritic Tunas was also established as shown in **Box 3**.

Box 1. Main features of the Regional Plan of Action on Sustainable Utilization of Neritic Tunas in the ASEAN Region (RPOA-Neritic Tunas)

Objective	Issues	Action plan
Determining available data and information, improving data collection and develop-ing key indicators	1) Insufficient data and information	1) Improve data collection and analysis for neritic tunas
	2) Undetermined neritic tuna stocks status	2) Assess neritic tuna Stocks and develop resource key indicators
Improving sustainable fisheries management	3) Open access	3) Promote management of fishing capacity
	4) Inadequate management of neritic tuna resources in some areas	4) Promote sustainable utilization of neritic tuna resources
	5) Inadequate understanding of management and conservation measures	5) Enhance understanding of management and conservation measures of neritic tunas
	6) Negative impacts of climate change to changes in neritic tuna stocks	6) Mitigate the mpacts of limate change on neritic tuna stocks
Improving sustainable interaction between neritic tuna fisheries and marine ecosystem	7) Negative impacts of neritic tuna fisheries on marine ecosystem	7) Reduce negative impacts of neritic tuna fisheries on marine ecosystem
Improving compliance to rules and regulations and access to markets	8) Illegal, unreported and unregulated (IUU) fishing	8) Combat IUU fishing occurring in southeast asian region
	9) Inadequate infrastructures in fishing ports and landing sites	9) Improve infrastructures in fishing ports and landing Sites
	10) Post-harvest losses and product quality deterioration	10) Improve post-harvest techniques and product quality
	11) Intra-regional and international trade	11) Enhance intra-regional and international trade
Addressing social issues	12) Inadequate benefits for people involved in neritic tuna fisheries and industries	12) Improve the benefits for people involved in neritic tuna fisheries and industries
	13) Working conditions and labor is-sues	13) Improve working conditions of labor
Enhancing regional cooperation	14) Lack of sub-regional action plans for neritic tuna fisheries	14) Enhance and develop sub-regional action plans for neritic tuna fisheries
	15) Insufficient information on status and trends of neritic tunas at sub-regional level	15) Assessment of the status and trends of neritic tunas at sub-regional level
		16) Enhancing intra-regional and inter-national trade

Box 2. Regional Plan of Action on Sustainable Utilization of Neritic Tunas in the ASEAN Region

- Compilation and review of existing data and information on neritic tunas from all related national agencies to understand the status, trend, and biological parameters
- Review and strengthening of data collection systems on neritic tunas
- Capacity building for data enumerators, observers, port inspectors, scientists, or other key data informants on species identification and biological information
- Determination of the type of data required for stock assessment or key indicator analysis
- Utilization of the existing standard operating procedures (SOPs) for data collection to determine fisheries key indicators on status and trend of neritic tunas
- Encouraging the conduct of research on neritic tunas at national level (*e.g.* stock assessment, biological, genetics, tagging program, etc.)
- Capacity building on stock assessment (three training courses were conducted)
- Development of **Regional Plan of Action for Managing of Fishing Capacity, and promote Management of Fishing Capacity** (ongoing)

Box 2. Regional Plan of Action on Sustainable Utilization of Neritic Tunas in the ASEAN Region (Cont'd)

- Encouraging the involvement of ASEAN Member States in regional or sub-regional research on the impact, adaptation, and mitigation measures of climate change on fisheries particularly on neritic tunas (ongoing)
- Conduct of risk assessment on the effective management of neritic tunas based on the stock assessment of individual species (ongoing)
- Conduct of R&D on suitable fishing methods and practices for sustainable utilization of neritic tuna resources and promotion to ASEAN Member States
- Promotion of cooperation among ASEAN Member States and with other **RPOA-IUU** participating countries in combating IUU fishing under the **RPOA-IUU Framework** (ongoing)
- Development and promotion of the **ASEAN Guidelines for Preventing the Entry of Fish and Fishery Products from IUU Fishing Activities into the Supply Chains in the ASEAN Region**
- Provision of technical support to promote proper handling and preservation of neritic tunas onboard and at ports (ongoing)
- Development and implementation of traceability system to monitor movement of neritic tuna fish and fishery products in the supply chain for export (*i.e.* origin of catch, transport, processing, storage, and distribution)
- Development of arrangements and partnerships between fisheries authorities or related agencies and fisheries industries regarding the implementation of labor standards in fisheries in accordance with national laws, the International Labour Organization (ILO) Work in Fishing Convention of 2007 (C188/Work in Fishing Convention, 2007) No. 188 and other related ILO Conventions (on-going)
- Review of the existing action plans in sub-regions such as Sulu-Sulawesi Seas, Gulf of Thailand, South China Sea, and Andaman Sea (ongoing)
- Establishment of cooperation on R&D to support sub-regional management of neritic tuna fisheries (ongoing)
- Establishment of the SEAFDEC scientific working group on neritic tunas for regional stock assessment and provision of scientific advice for policy considerations on neritic tuna management;
- Conduct of regular meetings of SEAFDEC scientific working group at sub-regional and regional levels (ongoing)
- Promotion of the development of **ASEAN Catch Documentation Systems and Schemes**
- Enhancement of the promotion of neritic tuna fish and fishery products from small-scale operators

Box 3. Way Forward to Promote the RPOA-Neritic Tunas

- Implementation of ASEAN Catch Documentation System and Scheme by ASEAN Member States for neritic tuna fish and fishery products at national level
- Development of joint trade promotions within and outside the region through the ASEAN Tuna Working Group
- Exchange of information among ASEAN Member States on legal framework, policies and management, and trade rules and regulations at sub-regional and regional levels on neritic tuna fisheries
- Recognition of security and safety issues for all types of fishing activities by implementing skills training programs
- Conduct of assessment of post-harvest losses of neritic tunas and describe the various ways of reducing post-harvest losses
- Strengthening surveillance activities and enforcement
- Prohibition of importation, landing, or transshipment at port of neritic tunas from vessels presumed to have carried out IUU fishing activities in the ASEAN region without prior clarification from vessel owners or concerned flag States
- Development of measures to refrain from conducting business transactions with owners and vessels presumed to have carried out IUU fishing activities
- Creation of platforms and fora to facilitate cooperation among scientists and managers
- Support the development of information, education, and communication (IEC) programs on sustainable use of resources
- Development of management measures to control fishing effort and capacity at national and sub-regional levels

1.1.2 Round Scads

Round scads (Family Carangidae) are the most common pelagic fishes in the Southeast Asian region, and the three species most common in the region are the Indian scad (*Decapterus russelli*), Japanese scad (*D. maruadsi*), and shortfin scad (*D. macrosoma)*. Most of these species are caught in their immature stage since mature fishes are rare in many areas as these are believed to migrate to deeper waters for spawning. The main fishing gear used to catch round scads is purse seine, where purse seine with luring light is common in Thailand, while purse seining around payao, a type of FAD, is commonly practiced in the Philippines. Round scads are also caught by trawl net and it has also been recorded that lift-net is used to catch round scads in the east coast of West Malaysia.

Stocks of round scads are known to be migrating in several fishing areas and thus, are shared with possible considerable uncertainty of their limits, specifically from the Gulf of Thailand to Sunda Shelf, Malacca Strait, Eastern South China Sea, and the Gulf of Tonkin (**Figure 45**). However, it is also possible that one or more stocks are not shared especially those found in the waters of Indonesia. Based on the results of collaborative studies in the South China Sea conducted by SEAFDEC/MFRDMD from 2002 to 2006, *D. macrosoma* is widely distributed in the coastal areas of the South China Sea (**Figure 46**) from the Gulf of Tonkin, Gulf of Thailand and west coast of Borneo, and in Palawan and west coast of Luzon in the Philippines (SEAFDEC, 2012b).

Results of studies conducted by SEAFDEC indicated that the exploitation rate of *D. macrosoma* in the South China Sea varies from 0.42 to 0.90 depending on the specific fishing grounds (**Figure 46**). Specifically, the exploitation rate *D. maruadsi*, 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 Viet Nam where the exploitation rate could be higher than 0.8 (SEAFDEC, 2012b).