FISH for the PEOPLE

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

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SEAFDEC at 49:

Sustaining Regional Support to Combat IUU Fishing and Enhance Competitiveness of ASEAN Fish and Fishery Products

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Editorial

Illegal, unreported and unregulated (IUU) fishing is a fishing activity conducted contradictory to legal conservation and management measures that are currently in place. The FAO International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU) contains the accepted definitions of illegal, unreported and unregulated fishing activities. IUU fishing occurs because too many fishers and fishing boats race to excessively harvest more fish from their habitats to supply the demand for seafood that has soared, contributing to an "all-powerful order" to reap fish stocks from the waters curtailing their ability to reproduce. If done in the most responsible way, all forms of fishing could be highly profitable, but IUU fishing depletes the fish stocks driving them to the verge of extinction and risking the socio-economic stability of coastal communities especially in developing countries. Since IUU fishing contravenes the overall objective of sustainability in fisheries spelled out in the global Code of Conduct for Responsible Fisheries, international and regional organizations have been developing and promoting measures dovetailed towards combating IUU fishing.

The European Union (EU) launched the EC Regulation 1005/2008 to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (EC IUU Regulation) which was entered into force on 1 January 2010. Based primarily on the FAO IPOA-IUU, the EC IUU Regulation aims to crack down IUU fishing problems worldwide by making it a requirement for fisheries products to enter the EU fish markets. The USA also takes steps in combating IUU fishing through its Presidential Task Force on Combating IUU Fishing and Seafood Fraud which identifies the actions that strengthen enforcement and create a risk-based traceability program to track seafood from harvest until its entry into the U.S. markets.

At the regional level, the Southeast Asian Fisheries Development Center (SEAFDEC) has been assisting the Southeast Asian countries in their efforts to combat IUU fishing in their respective waters by initiating in 2010 the project on Promotion of Sustainable Fisheries and IUU Fishing-related Countermeasures in Southeast Asia with funding support from the Japanese Trust Fund (JTF). The Project aims to develop measures as fisheries management tools for combating IUU fishing and enhancing the competitiveness of fish and fishery products, and assist the ASEAN Member States (AMSs) in the application of such management tools.

Recognizing the magnitude of the issues and concerns on IUU fishing and safety of fishery products, the AMSs have initiated actions to address the problems through their respective fisheries agencies at the national level. From the various SEAFDEC-initiated consultations, the AMSs have come up with countermeasures and management tools to combat IUU fishing. These are compiled in this issue of the *Fish for the People* to raise the awareness of stakeholders on the sincerity of the AMSs to combat IUU fishing and enhance the competitiveness of their fish and fishery products. Parallel with such actions, SEAFDEC has been enhancing regional cooperation to support the AMSs in the implementation of such countermeasures and tools.

The continued assistance of SEAFDEC to the AMSs to implement the aforementioned countermeasures would be its legacy to the region as SEAFDEC approaches the threshold of its 50th Anniversary in 2017. SEAFDEC also expects that after such time and while another door for promoting responsible fisheries development is opened, IUU fishing in the region would have already been contained for the sustainability of the fishery resources. Furthermore, these established measures and tools for combating IUU fishing would also comprise the most significant inputs of SEAFDEC and the AMSs to the ASEAN Economic Community building where fisheries had been identified as one of the priority sectors for integration.

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Regional Initiatives

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.

Promotion of Measures to Avert Entry of Fish and Fishery Products from IUU Fishing into the Supply Chain

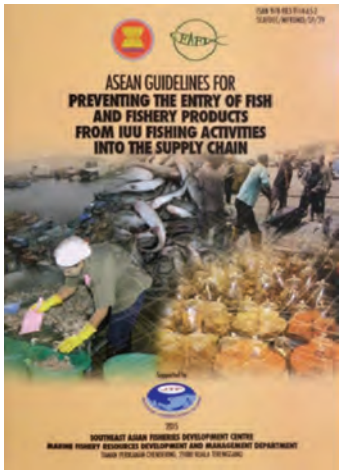
Abdul Razak Latun, Mazalina Ali, Ahmad Adnan Nuruddin, Somboon Siriraksophon, Virgilia Sulit, and *Ahmad Firdaus Siregar Abdullah*

The increasing demand for fish has driven fishers to catch more fish by all means even to the extent of practicing illegal, unreported and unregulated (IUU) fishing. It has been well reported that IUU fishing not only contributes to overexploitation of fish stocks but is also a hindrance to the recovery of fish populations and ecosystems. IUU fishing not only damages the marine environment but also distorts competition and puts those fishers who operate legally at a disadvantage, adversely affecting the economic and social well-being of fishing communities, especially in the third world countries where coastal communities rely heavily on fish resources. On the global scale, IUU fishing is a big problem and is difficult to quantify, and can occur in virtually any fisheries, *i.e.* in shallow coastal or inland waters or even in offshore areas. It is a particular issue in developing countries including the Southeast Asian countries where fisheries management strategies need to be strengthened, and where resources for landing controls and vessel inspections, and number of patrol vessels are limited to enforce the necessary regulations.

During the past decade, attempts had been made to improve fisheries management with the fundamental objective of reducing illegal and destructive fishing. The seriousness of this concern has been increasingly expressed through discussions and recommendations in various meetings and consultations such as those of the Council of Directors of the Southeast Asian Fisheries Development Center (SEAFDEC), ASEAN Fisheries Consultative Forum (AFCF), SEAFDEC Regional Advisory Committee (RAC) on Fisheries Management in Southeast Asia, Regional Plan of Action to Promote Responsible Fishing Practices including Combating IUU Fishing in Southeast Asia (RPOA-IUU), as well as those meetings of the ASEAN Heads of States including during the launching of the roadmap for ASEAN Economic Community. On the part of SEAFDEC, collaborative projects under the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP) mechanism paved the way for the conduct of consultations and discussions at the regional and sub-regional levels to find the ways and means of promoting effective fisheries management as well as managing fishing capacity in order to combat IUU

fishing in the Southeast Asian region. With such tall order, the ASEAN Member States (AMSs) requested SEAFDEC to assist them in the development of guidelines to prevent the entry of fish and fishery products from IUU fishing activities into the supply chain of the inter- and intra-regional as well as international fishery trade system.

In response, the SEAFDEC Marine Fishery Resources Development and Management Department (MFRDMD) together with the SEAFDEC Secretariat conducted a series of consultative meetings involving the ASEAN-SEAFDEC Member Countries as well as experts from national and regional organizations, to identify the issues related to IUU fishing activities that occur in the Southeast Asian waters. Through such meetings and consultations, the Guidelines were developed, reviewed and finalized for endorsement through processes under the ASEAN protocol (Mazalina *et al*., 2015). After incorporating the suggestions made during the 17th Meeting of FCG/ASSP in December 2014 and the 47th Meeting of the SEAFDEC Council in April 2015, the final draft of the Guidelines was endorsed during the 23rd Meeting of the ASEAN Sectoral Working Group on Fisheries (ASWGFi) in June 2015 for consideration at high level meetings of the ASEAN in 2015. Finally, the Guidelines were endorsed by the 37th Senior Officials Meeting of the ASEAN Ministers on Agriculture and Forestry (SOM-AMAF) in September 2015.



The ASEAN Guidelines for Preventing the Entry of Fish and Fishery Products from IUU Fishing Activities into the Supply Chain

Initiatives of AMSs to Improve Fisheries Management and Combat IUU Fishing

During the development of the Guidelines, the AMSs provided information on the status of their respective countries' initiatives to attain sustainable development of fisheries through the improvement of fisheries management, including combating IUU fishing. Based on the countries' inputs during the consultations and meetings, as well as during the Stakeholders Consultation on Regional Cooperation in Sustainable Fisheries Development towards the ASEAN Economic Community organized by SEAFDEC (SEAFDEC, 2016), and the Regional Technical Consultation on Promotion of the "ASEAN Guidelines for Preventing the Entry of Fish and Fishery Products from IUU Fishing Activities into the Supply Chain" in March 2016 (SEAFDEC/MFRDMD, 2016), the countries' initiatives in improving fisheries management and combating IUU fishing are summarized as shown in **Box 1**.

Issues and Concerns Encountered in Implementing the Guidelines

Although the AMSs recognize the importance of combating IUU fishing through trading measures and are seriously tackling the issues on IUU fishing, implementation of the "ASEAN Guidelines for Preventing the Entry of Fish and Fishery Products from IUU Fishing Activities into the Supply Chain" differs from country to country based on the circumstances surrounding the respective fishery and trading industry in the countries. To promote the Guidelines in the AMSs, appropriate strategies and measures should be introduced to ensure that effective and practical national plans are formulated and their effective implementation is in place. Nevertheless, the AMSs are still encountering various issues, concerns and difficulties that need to be addressed to be able to implement the Guidelines.

Legal Framework

Some AMSs lack the necessary legal frameworks for implementing some parts of the Guidelines, *e.g.* installation of VMS. Without any legal framework, the countries would not have any enforcement power. In some aspects, difficulties in establishing legal framework reflect the lack of technical guidance and assistance or lack of human and/or financial resources to follow the provisions stipulated in the Guidelines. Another issue is related to the evaluation and improvement of existing systems and governance which needs to be looked into by the governments.

Lack of Resources

The Guidelines covers very wide range of fishing and trading activities. Therefore, for the AMSs to follow the Guidelines in its every aspect, the countries should have certain amount of resources, which include human and financial resources, to be able to monitor their fishing/trading activities.

Awareness Building

Another challenge that confronts the AMSs in the implementation of the Guidelines is awareness building of the stakeholders. The key stakeholders in the supply chain of aquaculture products are unaware about the benefits and advantages of using a traceability system in their operations. Also, some traditional stakeholders are averse to change and are reluctant to implement any traceability system.

Way Forward

Although the Guidelines has been established and disseminated since 2015, some AMSs still require assistance to make implementation plans for adoption of the Guidelines at national

Box 1. Initiatives of AMSs in improving fisheries management and combating IUU fishing

Brunei Darussalam

Managing Fishing Activities

Under Fisheries Order 2009 of Brunei Darussalam, fishing access is controlled through the issuance of fishing gear licenses by the Department of Fisheries (DOF), Ministry of Primary Resources and Tourism. All fishing vessels and boats are compelled to register under the Merchant Shipping (Registration of Fishing Vessels and Pleasure Crafts) Regulations 2011 by the Marine Department, Ministry of Communication. The size and specification of fishing vessels for commercial fishing operations such as trawlers, long liners and purse seiners are determined by fishing areas (fishing zones) of the country's waters. Starting in 2015, fishing gear license card was introduced as fishing license documentation for better management and surveillance purposes. The implementation of moratorium to any fishing activity in Zone 1 (0-3 nm) was imposed in 2008 to reduce or ban the use of fishing gears that are not considered environment-friendly and are excessive in numbers, and to mitigate overfishing. The use of bigger mesh size at the cod ends of trawl nets from 38 mm to 51 mm was imposed in 2000 and aimed at reducing fish wastage and promoting better fish growth and stocks. All fish caught by commercial fishing vessels should be recorded in logbooks and all fish landed at the two designated fish landing complexes must be declared to the DOF. The performance of all fishing vessels in terms of production and compliance with the rules and regulations are monitored by Extension Officers of the Mobile Technical Unit of DOF as well as by Licensing Officers. At present, the use of vessel monitoring system (VMS) has not yet been implemented by DOF. Awareness building through road shows and briefings to the public continues to promote full cooperation of fishers in combating IUU fishing and the implications of destructive fishing activities in the country. Any offence related to destructive fishing (*e.g.* blasting and using cyanide) is punishable under the Fisheries Order 2009 and if found guilty, offenders could be fined and ordered to pay not exceeding B$10,000 or imprisonment for a term not exceeding one year or both. Intensification of surveillance is made through joint operations with other relevant national enforcement agencies, such as Marine Police of the Royal Brunei Police Force, Royal Navy of the Royal Brunei Armed Forces, Marine Department, and the Internal Security Department, to name a few.

Regulating Transshipment and Landing of Fish/Catch across Borders

Although no landings occur in bordering countries, the country acknowledges that some neighboring countries have similar regulations in terms of landing reports by local fishing vessels, *i.e.* licensing system and other regulations (including those for chartered fishing vessels). Fisheries Order 2009 states that no transshipment is allowed at sea and no landings allowed from foreign fishing vessels at designated landing ports in the country. Currently, no foreign fishing vessels land or transship their catch into the country's port or any other fish landing areas. However, it is a mandatory for all local fishing vessels (including chartered fishing vessels) to land and report their catch only at designated fish landing areas.

Preventing Poaching in the EEZs of ASEAN Member States

Although VMS has not yet been implemented, the country's monitoring, control and surveillance (MCS) program is getting stronger with full cooperation from other relevant enforcement agencies in the country. Being part of the RPOA-IUU, Brunei Darussalam is able to get updated information on listed illegal vessels and extend efforts hand-in-hand with other members in combating IUU fishing, especially in the areas of the South China Sea, Sulu-Sulawesi Sea and the Arafura-Timor Sea. Fishing vessel information for the Regional Fishing Vessels Record (RFVR) has been updated regularly. However, mutual bilateral/multilateral agreements on landings with any bordering or neighboring countries have not yet been established.

Controlling Illegal Fishing and Trading Practices of Live Reef Food Fish, Reef-based Ornamentals and Endangered Aquatic Species

Guided by the country's Fisheries Order 2009 and its Regulations, export, import and transit of all aquatic species are under the jurisdiction of DOF. Mutual agreement among relevant authorities (including the Royal Customs and Excise Department) is always established through regular consultations, discussions and meetings. Technical assessments and views from DOF are considered as reference information during consultations and in developing agreements. Data collection is carried out to monitor the status of live fish production and its market. Awareness programs through road shows and briefings to the public on the impacts of IUU fishing and trading of such fish and products are continuously promoted. So far, no network has been established between importing and exporting countries of Live Reef Food Fish (LRFF).

Strengthening the Management of Fishing in the High Seas and RFMO Areas

Being part of the RPOA-IUU, Brunei Darussalam is able to get updated information on RPOA-IUU fishing vessels watch list and extend efforts hand-in-hand with other members in combating IUU fishing in the South China Sea, Sulu-Sulawesi Sea, and the Arafura-Timor Sea.

Cambodia

Managing Fishing Activities

Access to fishing is controlled under the Cambodian Fisheries Law, which include proclamations on fishing vessels management, fishing vessel's logbook model, identification of marine fishing gear permitted to use in Cambodian waters, and zoning for fishing operations. The country has already adopted a vessel registration system under the Council Minister for International Fishing Vessels and under the Ministry of Public Work and Transportation for national vessels depending on the vessel's size. After vessel registration, the owner applies for two licenses from the Fisheries Administration (FiA) every year, *i.e.* use of fishing vessel and fishing gear. In order to promote responsible fishing practices and methods, capacity building is conducted for officers and fishers at provincial level and at landing sites on fishing ground (conservation areas), closed season, requirements for fishing, fishing gears, and official landing sites, although budget for awareness building is quite insufficient. As for related laws and regulations, amendments had been carried out starting in 2015, *e.g.* the Fisheries Law, sub-decree on community fishery management, and the 10-year strategic planning framework for fishery (SPF). Development of NPOA-IUU Fishing started in 2016, although fishing logbook and technical requirements of fishing vessel management have already been implemented. Reporting catch and providing appropriate logbook information are still inadequate as most fishers do not have adequate capacity to record catch appropriately and to follow the requirements for validation of catch record. Monitoring of fishing vessels are conducted by regularly checking the fishing license for fishing vessels and fishing gears, fishing logbook and technical requirements of fishing vessel management. The numbers of licensed vessels are monitored by FiA, but there is no

Box 1. Initiatives of AMSs in improving fisheries management and combating IUU fishing (Cont'd)

database that would allow analyses and sharing of data, and no VMS to track the fishing vessels. The existing mechanism for combating IUU fishing involves fisheries line offices (national, regional and local levels), sub-national administration (committees), Community Fisheries (CFI) committees, patrolling teams, legal framework and instrument for community-based fisheries management, conservation zones, National Committee on Combating IUU Fishing, FiA Task Force for Combating IUU Fishing, and development of the NPOA-IUU. Community-based patrols and community-based fisheries management staff assist in monitoring small-scale fisheries and also for detecting encroachment of trawlers into the country's restricted waters. Surveillance during fishing operations is limited because of insufficient capacity not only in terms of manpower but also facilities/devices, and limited funding in supporting such activity (only inspection boats with low capacity cover the country's fishing zones, vessels, gears, number, license, marking, season). Surveillance is conducted routinely, *i.e.* 10 days per inspection, and there is limited intervention on port State measures.

Regulating Transshipment and Landing of Fish/Catch across Borders

The country has difficulties in controlling fishing vessels that unload catches at bordering countries' landing sites, although it has been forging formal arrangements with respect to landings between bordering countries, *e.g.* MoU between Cambodia and Viet Nam (marine), MoU between Cambodia and Lao PDR (draft - inland), and MoU between Cambodia and Thailand (marine), all of which are still under development. Fishing vessels registration database will be developed and implemented in 2016. To date, port State measures are not implemented since access to landing sites is difficult. Under the Fisheries Law, all means of commercial transportation for fishery products in the country need license and are inspected by FiA to control the transport and resupply vessels.

Preventing Poaching in the EEZs of ASEAN Member States

There are no mutual bilateral agreements between neighboring countries to prevent poaching in respective countries' EEZ waters and cooperation to compile a list of illegal fishing vessels is lacking, although the country needs to strengthen its MCS to monitor fishing vessels operating illegally beyond their designated areas while promotion of the implementation of VMS is required. The country also needs to prevent foreign fishing vessels from fishing in its EEZ unless there is an overall assessment of impact and control, authorized from their own flag State and registered in Cambodia, and not using illegal fishing gears under Cambodian law. Relevant information had already been submitted to SEAFDEC for the Regional Fishing Vessels Record (RFVR) and to FAO although the country does not have fishing vessels 24 m in length and over.

Controlling Illegal Fishing and Trading Practices of Live Reef Food Fish, Reef-based Ornamentals and Endangered Aquatic Species

Various inter- and intra-national meetings among relevant authorities on harvesting practices/data reporting including stakeholders' consultations had been conducted in Cambodia. Some agreements with NGOs exist for LRFF, *e.g.* identification of coral reef species, establishment of management system for coral reef conservation areas, control of trade, and listing of endangered species. Reef-based ornamentals and endangered species are sub-decreed for identification of endangered fishery resources (58 species: 29 species from inland and another 29 marine species) and a proclamation on protection measures for endangered fishery resources has been promulgated by the Department of Conservation which monitors and compiles LRFF data. Marine network for Community Fisheries was established in the Koh Rong Archipelago but a network among LRFF importing and exporting countries has not yet been established.

Strengthening the Management of Fishing in the High Seas and RFMO Areas

The country is attempting to implement port State measures (PSM) at landing sites used by foreign vessels which include control of port entry, use of port services, requirements for pre-port entry notification, and designation of ports for fishing vessels in high seas and RFMO Areas. In the past, FiA has not authorized any fishing vessels or carrier vessels flying its flag to fish or transship in the coastal waters of another State or in the high seas. The International Ship Registry of Cambodia (ISROC) maintains a register of all Cambodian flagged vessels, including the types of vessels, *e.g.* fishing vessel, fish carrier, etc., unfortunately control from the government, *i.e.* authorization and licensing are still insufficient. There is no mechanism to de-register vessels that have committed IUU offences or to prevent an IUU fishing vessel from registering.

Indonesia

Managing Fishing Activities

Access to utilize fisheries resources is granted to eligible person or entity under Fisheries Law No. 31/2004 and amendment No. 45/2009, which is not transferable and indicates that license is attached to person and boat ≥ 5 GT; Boat ≤ 5 GT should be registered; and currently adapted to Ministerial Regulation of Marine Affairs and Fisheries No. 23 of 2013 on registration and marking of fishing vessels, and No. 30 of 2012 amended by Ministerial Regulation No. 26 of 2013 and No. 57 of 2014 on capture fisheries business. Indonesia has issued several enactments and regulations for responsible fishing practices, *i.e.* the enactment of relevant Ministerial Regulations including those on: (1) limited entry; (2) boat restriction, *e.g.* size and engine power; (3) gear restriction, *e.g.* mesh regulation; (4) area restriction, *e.g.* zonation, determined fishing ground; (5) temporary closure in some local fishing communities; the Ministerial Regulation of Marine Affairs and Fisheries No. 42/2014 Juncto 2 of 2011 on Fishing Lanes and Deployment of Fishing Gears, No. 02/2015 on Prohibition of Trawling, No. 1/2015 on Capturing of Lobster and Crab in certain sizes. NPOA-IUU fishing has been implemented and endorsed through Ministerial Decree of Marine Affairs and Fisheries No. 50/2012. The use of environment-friendly fishing gears such as pole and line has also been promoted. System of reporting catch and compiling appropriate logbook information were regulated by Ministerial Regulation No. 48/2014 on fishing logbook and No. 1/2013 on observers' onboard program. Logbook system has been implemented for all licensed fishing vessels > 5 GT. Monitoring of all fishing operations is conducted for all fishing vessels with permits to operate in all of its archipelagic waters, EEZ and high seas. A Database Sharing System for fisheries management (DSS) has been developed and used as tool for traceability and several databases had been integrated, *e.g.* Registration of Fishing Vessel, Fishing License, Logbook, Catch Certificate, VMS, Authorization of Fishing Vessel to RFMO, Center of Fishing Port Information, Port Clearance, Operation Legal Letter of Fisheries Vessel. VMS is implemented for all fishing vessels > 30 GT as enacted under Ministerial Regulation No. 10/2012 and Ministerial Decree No. 42/2015. VMS online is also integrated with DSS. Analysis and Evaluation (ANEV) has been conducted to evaluate compliance of commercial fishing vessels to national laws and regulations, especially the Ministerial Regulation No. 56, No. 57 on moratorium and prohibition of transshipments.

Box 1. Initiatives of AMSs in improving fisheries management and combating IUU fishing (Cont'd)

Intensification of surveillance is conducted from time to time through implementation of VMS System, Patrol Boat, etc. Port State control is conducted through Report of Inspection on ports, implementation of Port Clearance for every fishing vessel for conducting fishing operations, market report by destination for export (Data on Catch Certificate), etc. Indonesia also conducts promotion of community-based management approach granted under Fisheries Law No. 31 of 2014.

Regulating Transshipment and Landing of Fish/Catch across Borders

Several regulations had been implemented to oblige every fishing vessel that operate in Indonesian waters to land their catches in Indonesian fishing ports by DG Decision No. 51/DJPT/2012 on Implementation Guidelines for Fishing Vessels in Fishing Ports. Foreign flag vessels not regulated under LPPNRI (national intelligence investigation body on good governance) and blacklisted vessels in RFMOs and other international organizations, are prohibited from fishing in Indonesian waters. As a signatory country to Port State Measures Agreement (PSMA) in 2009, Indonesia promulgated Ministerial Regulation No. 46/2014 on Quality and Safety Control of Fish and Fishery Product entering Indonesia. Inspection at port is conducted by inspectors from DG Surveillance (MCS) and DG of Capture Fisheries (Quality of Fish). Indonesia supports the RFVR initiated by SEAFDEC and has established the fisheries vessel registration database. Catch Certification has been implemented in the country since 1 January 2010 and the system is integrated with the DSS.

Preventing Poaching in the EEZs of ASEAN Member States

At present, there are five (5) designated ports in the country, *i.e.* Jakarta, Bitung, Bungus, Ambon, and Pelabuhan Ratu that had been improved in terms of port infrastructures and facilities. The country enhances coordination with all national law enforcement agencies for optimizing the surveillance patrols in Indonesian waters. Several workshops and focus group discussions had been conducted including those on PSM training curriculum in cooperation with NOAA-USAID and IOTC for socialization of the PSMA to relevant stakeholders.

Indonesia also actively cooperates with RPOA-IUU participating countries and with relevant agencies at national level. Fisheries vessels data had been provided for the RFVR and VMS database, *i.e.* vessels arrested from fishing in the high seas, the action of which will be undertaken through clarification and verification of relevant data, *e.g.* investigations on FV Wuhan - Benoa in 2013, FV Perlon - Batam in 2014, which are in accordance with the current national policy on combating IUU fishing.

Controlling Illegal Fishing and Trading Practices of Live Reef Food Fish, Reef-based Ornamentals and Endangered Aquatic Species

Indonesia is actively participating at relevant fora among relevant authorities that discuss issues on harvesting practices and data reporting of LRFF, reef-based ornamentals, and endangered aquatic species. Database for coral reef fish is being established in 2016 under the Core Map Project implemented by DG of Capture Fisheries to collect and monitor data and information on LRFF and reef-based ornamentals. This database will also be integrated with the existing DSS for traceability purposes. A regulation has also been issued under International Trade in Endangered Species Act 2008 (CITES) for import and export of endangered species and the country also participates in LRFFT Network established under SEAFDEC.

Strengthening the Management of Fishing in the High Seas and RFMO Areas

Indonesia in now in the process of ratifying the PSMA and as such, is now implementing capacity building program for fisheries inspectors/fishing port officers. Observers' Onboard Program regulated under Ministerial Regulation of Marine Affairs and Fisheries No. 1 of 2013, has been implemented for fishing vessels operating in the Indonesian fisheries management areas. Indonesia is a full member of Indian Ocean Tuna Commission (IOTC), Western and Central Pacific Fisheries Commission (WCPFC) and Commission for the Conservation of Bluefin Tuna (CCSBT), and cooperates with the Inter-American Tropical Tuna Commission (IATTC) as cooperating non-member country. As a full member of CCSBT, Indonesia strictly applies catch documentation scheme (CDS) for the southern bluefin tuna in compliance with its relevant Resolutions.

Malaysia

Managing Fishing Activities

Fishing access is controlled through the registration for fishing vessels and issuance of licenses for fishing gears based on fishing zones under Fisheries Act 1985 and Regulations, placed under the purview of the Department of Fisheries Malaysia (DOFM). All fishers are also registered by DOFM and issued fishermen's identification card. Unsustainable fishing practices such as electric fishing; use of poison, cyanide, and dynamites; pair trawl; and push nets are banned under the Fisheries Regulation 1980 (Prohibition of Fishing Methods). The 38 mm cod end mesh size for trawl nets had been enforced since November 2013 to reduce trash fish landing by trawlers. Under its NPOA-IUU, a standard operation procedure (SOP) has been established allowing actions to be taken against foreign fishing vessels landing their catches at Malaysian ports. Declaration of catch is imposed under the conditions of the fishing license, and all deep sea fishing vessels (70 GRT and above) must declare their catches using the LOV (Landing of Vessels) Report and e-Declaration. Failure to do so will result in suspension of fishing license. Fishing vessel records are maintained through an e-license system. Non-compliance to the national laws and regulations are recorded in the Offences SIRIP System (Sistem SIRIP Perundangan). All fishing vessels are monitored using appropriate monitoring system, *e.g.* VMS for vessels more than 70 GRT (C2) and Automatic Identification System (AIS) for all trawlers less than 70 GRT. All deep sea fishing vessels must install VMS which is regularly monitored by DOFM. Awareness campaign on responsible fishing practices/methods, IUU fishing and destructive fishing methods to stakeholders is organized through seminars, exhibitions, pamphlets, among others. Stakeholders' consultations are held involving target groups, *e.g.* fishermen/ fishermen's associations, school children/youth, consumers, traders, NGOs, relevant government agencies, politicians. Community-based management approach has been promoted to prevent, deter and eliminate any violations with support from relevant government agencies and communities, *e.g.* establishment of Fisheries Volunteers (SUPER) consisting of local fishers to serve as extension agents; "ears and eyes" for the government; communication channel between government and fishermen; search and rescue supporting team. Fisheries Resources Management Plan Using the EAFM Approach was established in Lawas, Sarawak as pilot site. MCS especially surveillance during fishing operations, is conducted by DOFM, Malaysian Maritime Enforcement Agency (MMEA), Marine Operation Force under Royal Malaysian Police, and the Royal Malaysian Navy.

Regulating Transshipment and Landing of Fish/Catch across Borders

The country seeks cooperation from bordering countries and all RPOA-IUU Member Countries to deny Malaysian fishing vessels from entering and landing catches at their ports through a letter dated 11 March 2015. All RPOA-IUU Member Countries are requested to inspect Malaysian fishing vessels and prepare reports for transmission to Malaysia's RPOA-IUU Focal Point.

Box 1. Initiatives of AMSs in improving fisheries management and combating IUU fishing (Cont'd)

Bilateral dialogues had also been convened with neighbouring countries such as Thailand and Viet Nam, and data on registration of fishing vessels 24 meters in length and over had been submitted to the Regional Fishing Vessels Record (RFVR) Database maintained by SEAFDEC. Malaysia is strengthening PSM through the establishment of the technical committee under the Ministry of Agriculture. Nevertheless, before any foreign fishing vessel is permitted to enter and land their catches at Malaysian ports, the status of the vessels is counterchecked with relevant organizations' database, *e.g.* IOTC, Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), RPOA-IUU Secretariat so that any blacklisted vessels would not be issued permit to enter Malaysian ports. Catch certification is already adopted as required by EC Regulation 1005/2008 to prevent, deter and eliminate illegal, unreported and unregulated (IUU) fishing. Its relevant domestic legislations had been amended to facilitate the issuance of catch certificate, and the country has actively participated in various training programs/courses organized by regional and international organizations. SOP is already in place under NPOA-IUU for handling local and foreign fishing vessels that had been engaged in IUU fishing in and beyond Malaysian fisheries waters that enter any Malaysian ports.

Preventing Poaching in the EEZs of ASEAN Member States

Movement of local fishing vessels are detected using AIS or VMS. Fishing vessel owner is alerted if it has encroached bordering countries' waters. A show-cause letter will be issued to the owner of fishing vessel if VMS track shows that the vessel had been operating beyond its designated area, in which case, its license could be suspended or cancelled. The black list of IUU vessels provided by EU, IOTC and other RFMOs is utilized and updated with the list of foreign fishing vessels caught operating illegally in Malaysian waters. Information on IUU vessels are exchanged among AMSs upon request. Malaysia will inform the flag State of IUU fishing vessels through diplomatic channels. Malaysia shared information to the RFVR Database (for fishing vessels more than 24 m in length). Although there has been no bilateral agreement with any foreign country to allow fishing in Malaysian fisheries waters, Section 15 of Fisheries Act 1985 provides that it is mandatory to have a government-to-government agreement before allowing foreign fishing vessels to fish in Malaysian fisheries waters.

Controlling Illegal Fishing and Trading Practices of Live Reef Food Fish, Reef-based Ornamentals and Endangered Aquatic Species

Meetings are convened to discuss issues compiled by relevant Malaysian agencies and stakeholders with MOA as lead agency of a committee which includes representatives from the Ministry of Natural Resources and Environment, Ministry of International Trade and Industry (MITI), Ministry of Tourism, DOFM, MMEA, Malaysian Quarantine and Inspection Services (MAQIS), Royal Malaysia Customs Department, Sarawak Forestry Department, Sabah Fisheries Department, LKIM, Marine Parks, Sabah Parks, NGOs, and Stakeholders (live fish traders, aquarists, relevant importers and exporters, tour operators and fishermen associations). MAQIS manages and monitors import and export of fish, fishery products, LRFF and reef-based ornamentals at entry point. Section 40 of the Fisheries Act requires a permit to import and export live fish. Fisheries Regulation (Control of Endangered Fish Species) Amendment 2008 and International Trade in Endangered Species Act 2008 (CITES) are enforced to avoid inappropriate export of endangered aquatic species. Consultations and awareness programs for small-scale/artisanal fishers through dialogues, seminars, road shows, pamphlets, exhibitions, mass media, social media and education, are conducted from time to time accordingly. Fisheries Management Information System (FMIS) managed by Data Collection Section of DOFM is compiling the information on landing by species and fishing gears. Malaysia participates in the LRFFT Network.

Strengthening the Management of Fishing in the High Seas and RFMO Areas

Malaysia is complying with the Resolution of IOTC although it has yet to ratify the PSMA. Capacity building on PSM was conducted by IOTC to train relevant officials on port inspections including control of port entry, use of port services, requirements for pre-port entry notification, and designation of ports for fishing vessels. Observers are placed onboard Malaysian flagged carrier vessels in accordance with IOTC resolutions. Although Malaysia does not have the expertise on observers' onboard, it cooperates with RFMOs, *e.g.* IOTC, CCAMLR, by denying port entry upon receipt of notification on IUU fishing vessels, and IUU fishing vessels could be charged under the Merchant Shipping Ordinance 1952 and Fisheries Act 1985. Apart from being a member of IOTC which does not have a Catch Document Scheme yet, Malaysia is not yet a member of other RFMOs.

Myanmar

Managing Fishing Activities

Policy and legal framework for MCS measures has already been set up in Myanmar with the Department of Marine Administration (DMA) conducting vessel measurements and registrations. The Department of Fisheries (DoF) issues fishing licences based on the vessels' registration with DMA, including permitted fishing gear which is limited in number or size. Photos of vessels are included in the fishing licence together with vessel marking (hull colour, word colour and diameter) for all fishing vessels including foreign fishing vessels.

Collaboration with fisheries stakeholders has been promoted for the improvement of fisheries management and promotion of conservation measures, *e.g.* identification of closed season and closed area. Myanmar is preparing the draft of a new fisheries law in accordance with its 2008 Constitution and relevant international instruments, to include among others, licence conditions and use of logbooks for all offshore fishing vessels. VMS must be installed in all foreign fishing vessels and local fishing vessels in order not to violate the law and regulations. While all foreign fishing vessels must be installed with VMS, DoF is seeking the assistance of IGOs and NGOs for the installation of VMS in all its local offshore fishing vessels. DoF is compiling the vessels inventory for offshore fishing vessels, and is updating its vessels records for the RFVR Database maintained by SEAFDEC. Awareness of destructive fishing gears is promoted to the fishers. The Ministry of Livestock, Fisheries and Rural Development (MLFRD) of Myanmar encourages the formation of fishers groups and development of cooperatives in fisheries, to also serve as conservation teams to support the MCS measures of DoF. A total of 1148 groups have been organized involving 16,576 members from fishing, processing and aquafarming in all states and regions. DoF has implemented the project on "Sustainable Small-scale Fisheries and Aquaculture Livelihoods in Coastal Mangrove Ecosystems (GCP/MYA/010/ITA) in 13 villages in Bogale Township, Ayeyarwady Region since September 2010 which extends until 2016 as approved by FAO and the Italian Government. The Project aims to strengthen the capacity of participating communities and supporting institutions in the target areas on co-management, implementation of sustainable and mangrove-friendly small-scale aquaculture. DoF also organized the Training on Practical Approach to Community-based Fisheries Management in Coastal Areas of Myanmar in 2002 with 49 participants. Vessel control is carried out using check-in and check-out system as a one-stop inter-agencies service involving the DMA, Customs Department, Myanmar Ports Authority and DoF, among others. DoF designates the landing sites and checkpoints for local and foreign fishing vessels for inspection and port control.

Box 1. Initiatives of AMSs in improving fisheries management and combating IUU fishing (Cont'd)

Regulating Transshipment and Landing of Fish/Catch across Borders

Some arrangements already exist in the country on trading with bordering countries such as free-on-board (F.O.B) system where the seller fulfills its obligations to deliver when the goods have passed over the vessel's rail. Myanmar and Thailand cooperated for the implementation of a fishing rights program since 2010 which was terminated in 2014. Under such agreement, fishing vessels from Thailand were allowed to fish in Myanmar EEZ, provided such vessels are registered and recommended by the Authority of Thailand. In the existing Fisheries Law of Myanmar, provisions for port entry and port inspection are included. Recently, no foreign fishing vessels had been blacklisted. The country has implemented the EU Catch Certification Scheme with other documents issued for market measures, *e.g.* Country of Origin (CoO), Product Movement Document (PMD) and Health Certificate, among others.

Preventing Poaching in the EEZs of ASEAN Member States

DoF has set up the rules to install VMS system to check local fishing vessels that violate existing laws and regulations in line with the International Plan of Action-IUU. For first offence, fishing vessel must pay fines and punished by installing VMS, and for the second offence, the vessel must be confiscated by DoF. VMS system has also been initiated for local fishing vessels which are not allowed to fish in high seas and other countries' EEZs. Sharing of information on blacklisted fishing vessels has not yet been initiated, although Myanmar provides data to RFVR Database at SEAFDEC, and agrees to continue updating the information annually. There are no mutual and bilateral agreements between Myanmar and neighbouring countries for permission to fish in Myanmar's EEZ. DoF has the authority to confiscate fishing vessels that operate without licence in Myanmar's EEZ.

Controlling Illegal Fishing and Trading Practices of Live Reef Food Fish, Reef-based Ornamentals and Endangered Aquatic Species

Myanmar Fisheries Federation conducts regular inter- and intra-agency meeting every Tuesday among relevant authorities and fisheries stakeholders to address problems on fisheries-related issues. Data compilation is carried out by DoF through logbooks and data collection at landing sites, and is trying to seek the assistance of IGOs such as FAO or Italian Government for the development of data compilation system and analysis. Export or import of aquatic species needs prior permission from DoF, and such export or import must be attached with Country of Origin, Health Certificate and Catch Certificate issued by importing or exporting countries, although importing or exporting as well as trading of endangered species including CITIES-listed species is prohibited without CITES permit. The Department of Trade issues an import and export license based on the recommendations from DoF. Awareness is promoted to fishers on prohibition against use of destructive fishing gears, especially using explosives, toxic substances and electricity, and promotion of responsible fishing practices. Fisheries co-management in small-scale fisheries has been initiated in the Delta Area through the implementation of a project funded by FAO and the Italian Government.

Strengthening the Management of Fishing in the High Seas and RFMO Areas

Myanmar signed the PSMA in 2010 for instrument accession, and local fishing vessels are not allowed to fish in the high seas and RFMO areas until now. In the country's law relating to fishing rights of foreign fishing vessels (1989), the contexts on port State measures are already prescribed. DoF has set up the licence conditions with regards to ports inspection for local and foreign fishing vessels which are operating in the country's EEZ. Although observers' onboard program has not yet been initiated, this program would need employment and training of more DoF staff.

Philippines

Managing Fishing Activities

Fishing access is controlled through the issuance of fishing vessel registration, gear license and special fishing permit, and municipal fishing boat license. The two types of municipal registration system are: Municipal Fisherfolk Registration System (FishR) and Municipal Boat Registration System (BoatR). FishR was created as a national database across the country and accessed by all local government units. To date, there are 1,656,174 fisherfolks already in the registry system, and counting. BoatR is a centralized database system to guide local government in the nationwide registration of fishing boats 3 GT and below. There are now 151,550 municipal fishing vessels registered in the system. Mobile applications for BoatR are used to validate and transmit information on registered fishing vessels. Responsible fishing practices are promoted through establishment of temporal closed fishing season in certain areas, *i.e.* East Sulu Sea, Basilan Strait, Sibuguey Bay, Visayan Sea, Davao Gulf, and Palawan; regulations on mesh size; fishing closure in fish aggregating devices (FADs); and using Remote Sensing for resource protection. Under existing regulations, RA 10654 "An Act to Prevent, Deter, Eliminate Illegal, Unreported and Unregulated Fishing", all fishing vessels must declare their catch and online reporting of estimated catch could be made through Marlin Pro. The Philippines implements the National Inspection Plan FLE-QRTF for monitoring the fishing vessels, with Multi-Mission Vessels and Inspection at landing. VMS is in place for fishing vessels above 30 GT operating in HSP1/EEZs of other countries. The law that provides various stringent measures to conserve and protect fishery resources and prevent, deter and eliminate IUU fishing has been amended, in accordance with regional resolutions and international conventions, *i.e.* EO 154, s. 2013, National Plan of Action against IUU Fishing, and RA 10654 (February 2015) amended the 1998 Fisheries Code that indicates increased penalties of up to PhP45 Million (USD 1M), based on gross tonnage. The amended law expresses the serious efforts of national government in managing and rehabilitating Philippine fishery resources.

The passage of the law has largely been attributed as one of the factors leading to the lifting of the "yellow card" imposed by the European Union. The implementing rules and regulations (IRR) of the said law provides for a staggered or phased implementation of the Fisheries Observer and Vessel Monitoring Measures for a period of 6 months to 2 years and for a period of 6 months to 4 years, respectively, based on gross tonnage of the fishing vessel. Development of a fully operational, on-line VMS for all vessels above 30 GT, in particular for fishing vessels operating in the high seas, RFMO areas and EEZ of third countries regulated by RA 10654 that requires VMS for commercial vessels, on a phased approach. For intensifying surveillance during fishing operation under the existing National Inspection Plan based on FAO IPOA-IUU Fishing and using law and technology for strengthened law enforcement, a dedicated enforcement office and quick response teams had been created to serve as National Coast Watch that integrates and strengthens Philippine maritime security initiatives by creating a central inter-agency mechanism for a coordinated and coherent approach on maritime issues and maritime security operations towards enhancing governance of Philippines' maritime domain.

Box 1. Initiatives of AMSs in improving fisheries management and combating IUU fishing (Cont'd)

Regulating Transshipment and Landing of Fish/Catch across Borders

The Joint Committee on Fisheries Cooperation between the Philippine Bureau of Fisheries and Aquatic Resources (PH-BFAR) and the Papua New Guinea's National Fisheries Authority (PNG-NFA) agreed to share data or information relating to transshipment and landing of catches between bordering countries. The Philippines has also developed its Fishing Vessel Electronic Licensing System for sharing information among neighboring countries if required. The Philippines already ratify the United Nations Fish Stocks Agreement (UNFSA) and amended the Philippine Fisheries Code to strengthen measures for bilateral fisheries cooperation; traceability/fish accountancy for sharing of data/information, inspection and monitoring of landings and National Inspection Plan; and validation/issuance of Catch Origin Landing Declaration (COLD).

Preventing Poaching in the EEZs of ASEAN Member States

The Catch Certification had been implemented under Fisheries Administrative Order 238 and BFAR Administrative Circular 251 (Traceability System for Fish and Fishery Products) to prevent entry of products from IUU fishing. Bilateral agreements/MOUs had also been established with the Independent State of Papua New Guinea, Thailand, Viet Nam and Taiwan ROC. The installation of VMS, implementation of fisheries observers' program, and FLE-QRT had been carried out to prevent poaching in the EEZs of neighboring countries.

Controlling Illegal Fishing and Trading Practices of Live Reef Food Fish, Reef-based Ornamentals and Endangered Aquatic Species

The Fisheries Inspection and Quarantine Services had been implemented as well as the Regional Law Enforcement Coordinating Committee to control inappropriate export of endangered aquatic species. The Philippines also has conducted the National Stock Assessment Program for monitoring and compilation of data with expanded data collection points from 173 to 739 landing sites. Operators maintaining LRFF and ornamentals are also required to submit production data annually.

Strengthening the Management of Fishing in the High Seas and RFMO Areas

The Philippines has implemented PSM/NIP based on 2001 FAO-IPOA, FOP and has already submitted its ratification of UNFSA. Management of fishing in the high seas has been strengthened by existing Fisheries Observers Program, *i.e.* high seas pocket 1 and during FAD closure period. Cooperation with other flag States had also been enhanced through exchange of relevant data and information.

Singapore

Managing Fishing Activities

Singapore has an established system for vessel registration and licensing of fishing gears, where all fishing vessels and fishing gears used onboard fishing vessels need to be licensed by the Agri-Food and Veterinary Authority (AVA) of Singapore, and to be renewed annually. Singapore prohibits the use of poisons and explosives in fishing practices/methods. Although Singapore does not have fishing vessels more than 70 GRT, a system is in place whereby all commercial fishing vessels declare their catch landed. Singapore closely monitors all its commercial fishing vessels, and ensures that such vessels do not engage in IUU fishing activities and are fishing at designated fishing areas. All licensed commercial fishing vessels are installed with VMS. Foreign fishing vessels are not allowed to fish in Singapore waters while sites for landing fish had been designated where inspections are carried out.

Regulating Transshipment and Landing of Fish/Catch across Borders

The country's licensed commercial fishing vessels can only operate in its waters and land fish only in Singapore. Actively participating and supporting regional fisheries meetings to discuss mutual agreements on licensing system, Singapore maintains data recording and supports sharing of information on licensing system and regulations, *e.g.* to the RFVR Database, and also actively monitors RFMOs' IUU lists. Foreign fishing vessels in such IUU vessels lists are denied entry and provision of port services in Singapore as the lead country for the development of the ASEAN Catch Documentation Scheme (ACDS). Singapore is a cooperating non-contracting party to CCAMLR, IOTC and the International Commission for the Conservation of Atlantic Tunas (ICCAT) but cooperates with these RFMOs to comply with their catch documentation requirements. Singapore has designated sites for landing fish where surveillance and inspections are carried out. A comprehensive review of its fisheries legislation is being carried out to strengthen existing laws and regulations for preventing entry of fish and fishery products from IUU fishing activities into the supply chain.

Preventing Poaching in the EEZs of ASEAN Member States

All Singapore licensed commercial fishing vessels have been installed with VMS and are licensed to fish only in Singapore waters. Only licensed fishing vessels are allowed to operate in Singapore waters, and non-compliance could lead to revocation of licenses, fines and imprisonment. Singapore cooperates with the programs of the RPOA-IUU, which include setting up of a watch list for illegal vessels. Where there is a requirement to establish formal arrangements, the country would cooperate with the relevant neighboring countries to establish mutual bilateral/multilateral agreements for permission to fish in each other's fishing areas.

Controlling Illegal Fishing and Trading Practices of Live Reef Food Fish, Reef-based Ornamentals and Endangered Aquatic Species

Singapore participated in inter- and intra- agency coordination meetings on trade and data reporting of LRFF, reef-based ornamentals, and endangered aquatic species, when necessary. A system is in place whereby all commercial fishing vessels declare their catch landed, and all import and export of reef-based ornamentals should be declared. Singapore is a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and has zero tolerance on the use of Singapore as a conduit to smuggle endangered species and their parts and products. The country will continue to cooperate and collaborate with partner enforcement agencies nationally and internationally to ensure that export of endangered aquatic species is avoided, except for research and experimental purposes for which such export should be accompanied by appropriate documents. Singapore supports a network between the LRFF importing and exporting countries, to strengthen LRFF management at the regional level, where applicable.

Box 1. Initiatives of AMSs in improving fisheries management and combating IUU fishing (Cont'd)

Strengthening the Management of Fishing in the High Seas and RFMO Areas

Singapore requires all foreign fishing vessels to provide advance notification for pre-port entry. IUU vessels are denied entry into Singapore, especially at its designated fishery ports for fishing vessels. Singapore fishing carriers plying the high seas have implemented observers' onboard program, where necessary as per the requirements of relevant RFMOs. Singapore is a cooperating non-contracting party to CCAMLR, IOTC and ICCAT but work closely with these RFMOs to comply with their catch documentation requirements.

Thailand

Managing Fishing Activities

The Royal Ordinance on Fisheries 2015 prescribes that all Thai fishing vessels must have authorization to fish both in Thai waters and outside Thai waters from the Department of Fisheries (DOF). The regulation requires all important information to be submitted during application. All fishing vessels are registered and licensed by the Marine Department while fishing gears are licensed by the DOF. Thailand's marine fisheries are reformed into a limited access regime. An e-licensing system and vessel marking system had been developed. Destructive fishing gears are prohibited under the law. Port-In Port-Out (PIPO) centers had been set-up to control port in and port out of Thai fishing vessels 30 GT and over. NPOA-IUU had been established, adopted and implemented starting end of 2015, as well as Fisheries Management Plan (FMP) promoting responsible fishing practices and methods to both commercial fisheries and small-scale fisheries. The Royal Ordinance on Fisheries 2015 was entered into force on 14 November 2015, and Sub-ordinate laws following the Royal Ordinance prescribe that catch reporting information is a requirement for fishing license issuance. Fishing logbook is applied to fishing vessels 30 GT and over. Thailand has established National Plan for Control and Inspection to monitor fishing vessels through PIPO centers, inspection at port and inspection at sea. Fishing vessels of 30 GT and over are prescribed to install VMS System and there are now 5,200 vessels of 30 GT and over that have installed functioning VMS. There are 2,076 vessels 60 GT and over, and 2,000 other fishing vessels operating in Thai waters and 76 fishing vessels operate outside Thai waters. There are 3,124 fishing vessels between 30-60 GT. The newly established Royal Ordinance on Fisheries is aimed at combating IUU fishing and complies with the international conservation and management measures. Fisheries Management Plan, NPOA-IUU and MCS have been established focusing on combating IUU fishing. Destructive fishing gears have been banned while control of some fishing gears such as trawl with 4 cm cod-end mesh size must be used for trawlers. Community-based management approach has been promoted for sustainable fisheries management. For surveillance, VMS monitoring is functioning 24 hours a day and fisheries patrol is in place as sea control units by DOF for surveillance along the coastal areas. Thailand has been designated ports to IOTC and other RFMOs. In addition, PSM operations for foreign fishing vessels started in September 2015, and there are now 27 designated ports implementing PSM for foreign vessels.

Regulating Transshipment and Landing of Fish/Catch across Borders

Thailand has fishery cooperation with bordering countries in terms of MOU or implementing arrangements to exchange information of landings, *e.g.* Malaysia, Myanmar, Philippines, Cambodia, Indonesia, Viet Nam, PNG, and has regular bilateral/multi-lateral arrangements with neighboring countries via the Gulf of Thailand Project. Thailand also supports the RFVR Database. The country had implemented PSM since September 2015 based on IOTC resolutions in 27 designated ports covering 22 coastal provinces. List of foreign IUU fishing vessels had been provided to Thailand, and it had established a catch certification system for fish and fishery products implemented since 1 January 2010. A program on fish inspection at landing site and PIPO control had been implemented since 2015. The Royal Ordinance on Fisheries 2015 was established to put more focus in conservation and management measures, combating IUU fishing, sanctions and labour issues including the prevention of entry of fish and fishery products from IUU fishing activities into the supply chain.

Preventing Poaching in the EEZs of ASEAN Member States

Using VMS, Thailand has established Fishery Operational and Monitoring Center to monitor fishing vessels. All fishing vessels 30 GT and over must be equipped with functioning VMS. NPOA-IUU as well as the FMP prescribed the activities such as flag State, port State and coastal State measures. NPOA-IUU has already been adopted by the Thai Cabinet. Thailand has compiled and shared the list of foreign IUU fishing vessels from RPOA-IUU and those that had notified the IUU vessels lists. Sharing of blacklisted fishing vessels among the relevant countries is not yet done. Information on fishing vessels 24 m and over has been sent to SEAFDEC for the RFVR Database, and would updated once a year. MOU on fishing cooperation has been developed between Thailand and coastal countries, *i.e.* Cambodia, Indonesia, Malaysia, Myanmar, Philippines, PNG, and Viet Nam.

Controlling Illegal Fishing and Trading Practices of Live Reef Food Fish, Reef-based Ornamentals and Endangered Aquatic Species

MOU among agencies on sharing information (Marine Department, Maritime Enforcement Coordinating Center, Royal Thai Navy, Marine Police Division, Ministry of Labour, Ministry of Social Development and Human Security) to establish a fishing information network to be used at PIPO Center. Cooperation with Customs Department on import, export and transit of fish and fishery products is established. DOF has also set up the mechanism for monitoring and data collection on import, export and transit of fish and fishery products. Thailand complies with CITES regulation and Thai Wildlife Reservation and Protection Act 1992, *e.g.* permit system is regulated to control import and export transit of endangered aquatic species. Small-scale/artisanal fishers are involved in co-management activities. Awareness program on the impacts of IUU fishing and trading of such fish and products are being implemented. A network between the LRFFT importing and exporting countries has not yet been implemented.

Strengthening the Management of Fishing in the High Seas and RFMO Areas

Thailand started implementation of PSM since September 2015 at 27 designated ports and PSM Manual has also been developed. Thailand started its observers' onboard program with its first implementation in February 2016 and a training program for 40 observers.

Viet Nam

Managing Fishing Activities

Fishing access is controlled through legislations that require licensing for fishing vessels, vessels marking and setting up of zoning system, but quota systems are not yet in place. Registrations for trawlers had been held in abeyance since November 2015 while changing to other gears from trawlers was not allowed. The NPOA-IUU has been approved by the Minister on 5 April 2014. Logbook provision is compulsory for all fishing vessels under the Fisheries Law however compliance is still a problem. Fisheries Surveillance

Box 1. Initiatives of AMSs in improving fisheries management and combating IUU fishing (Cont'd)

Department was established recently with port sampling activities carried out especially for tuna fisheries. Initially, VMS had been installed on 3,000 offshore vessels but legislation that makes VMS installation compulsory has not yet been promulgated. Ecosystem Based Management (EBM) concepts were introduced to some provinces under a national project and some pilot sites were selected to implement the EBM approach. NPOA-IUU considers the implementation and approval of PSM but unfortunately, designated landing port regulations have not been established and Catch Certificate is only for export to EU countries and not for other destinations.

Regulating Transshipment and Landing of Fish/Catch across Borders

MoUs were signed with some countries in the region such as Cambodia, Thailand, and Philippines but the actions in these MoUs are very broad and not specific. Viet Nam participated in the RFVR Database managed by SEAFDEC, and is a Member of RPOA-IUU. The Fisheries Law provides that local authorities must furnish the Central Government with blacklisted vessels for publicity.

Preventing Poaching in the EEZs of ASEAN Member States

To date, Viet Nam has not yet approved the port State measures and flag State measures. Viet Nam is involved and participated in RPOA-IUU, and has also established regulations on national blacklisted IUU vessels.

Controlling Illegal Fishing and Trading Practices of Live Reef Food Fish, Reef-based Ornamentals and Endangered Aquatic Species

Viet Nam conducted inter- and intra- meetings annually among relevant authorities on harvesting practices and data reporting of LRFF, reef-based ornamentals, and endangered aquatic species. Data collection mechanisms are included in the MPAs regulations following the CITES regulations. The country also convenes meetings to discuss fisheries management. Trials at selected pilot sites have been conducted to implement co-management and the Ecosystem-based Approach to Fisheries Management (EAFM) approaches.

Strengthening the Management of Fishing in the High Seas and RFMO Areas

Provisions on PSM have been reflected in the country's NPOA-IUU. Viet Nam has established its national observers' program with the first implementation in February 2016 and already conducted some trials with observers' onboard fishing vessels. Viet Nam has also implemented effectively the EC Regulation but partly implements ICCAT's big-eye tuna (BET) and swordfish (SWO) catch statistics document.

levels. In order to promote the Guidelines and assist the AMSs in developing effective and practical national implementation plans, domestic circumstances in fishing and trading should be carefully examined taking into consideration each country's situation. Promotion for the implementation of the Guidelines in the AMSs also requires that strategies and recommended appropriate measures are established to prevent the entry of IUU fish and fishery products into the supply chain. As the situations surrounding fisheries and trading in the AMSs are different country by country, this should be carefully taken into consideration when establishing the strategies. Thus, countries' self-initiatives to develop appropriate national implementation plans must be esteemed for the Guidelines based on their own legal and governance frameworks. For smooth and effective implementation, active participation of all stakeholders in decision-making processes is also essential. In addition, sharing information among countries would also facilitate discussion for further consideration of the effective, practical, appropriate actions/protocols at national/domestic levels. Sharing of information would also contribute further harmonization of the commercial measures among ASEAN countries to combat IUU fishing by preventing the trade of fish and fishery products from IUU fishing.

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Regional Fishing Vessels Record:
A Management Tool for Combating IUU Fishing in Southeast Asia

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SEAFDEC has been assisting the Southeast Asian countries in their efforts to combat IUU fishing, which includes promoting the implementation of Monitoring, Control and Surveillance (MCS) considered as a catalyst in preventing IUU fishing particularly illegal fishing. Under this circumstance, the implementation of MCS could include such aspects as joint marine patrol between navy, police, departments of fisheries, and marine departments while vessels should be equipped with new engine technology and fast, increasing awareness on the use of advance technology such as coastal radar that can be installed in the vicinity of tracking illegal vessels, installation of vessel monitoring system (VMS) on fishing vessels that already have licenses whether local or foreign ships, and enhancing human resources to enable officers to carry out their duties properly and professionally in their fields to avoid a breach or things that deviate from existing laws. Recognizing the severity of IUU fishing in the Southeast Asian region, the Ministers and Senior Officials responsible for fisheries from the ASEAN-SEAFDEC Member Countries adopted the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 in June 2011 (SEAFDEC, 2011), which includes provisions declaring the need to "Foster cooperation among ASEAN Member States and with international and regional organizations in combating IUU fishing" (Resolution No. 8); as well as encouraging the ASEAN Member States to: "Strengthen regional and national policy and legislation to implement measures and activities to combat IUU fishing, including the development and implementation of national plans of action to combat IUU fishing, and promote the awareness and understanding of international and regional instruments and agreements through information dissemination campaigns" (POA No. 21); "Establish and strengthen regional and sub-regional coordination on fisheries management and efforts to combat IUU fishing including the development of regional/sub-regional Monitoring, Control and Surveillance (MCS) networks" (POA No. 22); and "Facilitate consultative dialogue among fisheries legal officers to share, at the sub-regional/regional level, perspectives of the respective legal and regulatory framework in terms of developing MCS-networks and to implement efforts to combating IUU fishing" (POA No. 23). Guided by such agreements and in support of the implementation of MCS, SEAFDEC through a series of technical/expert consultations with the ASEAN Member States (AMSs) had been tasked to initiate the establishment of a Regional Fishing Vessels Record (RFVR) as a tool to combat the IUU fishing in the Southeast Asian region and to strengthen the promotion of MCS in the region. The development of the RFVR makes use of data on fishing vessels provided by the ASEAN Member States.

Recognizing the severity of the fishery resources degradation in the Southeast Asian region brought about by uncontrolled practice of illegal, unreported and unregulated (IUU) fishing, the ASEAN Member States (AMSs) has been promoting sustainable fisheries management at the national level in accordance with a provision in the Regional Guidelines for Responsible Fisheries in Southeast Asia: Responsible Fisheries Management that: "*States should review the issues of excess fishing capacity at the national level and recommend where appropriate, measures to improve registration of fishing vessels, introduction of rights-based fisheries and reduction in the number of fishing boats and level of fishing effort using government incentives*" (SEAFDEC, 2003). Raising such argument at the regional level, SEAFDEC with support from the Japanese Trust Fund (JTF) has been developing IUU fishing-related countermeasures under the JTF-supported Project on Promotion of Sustainable Fisheries and IUU Fishing-related Countermeasures in Southeast Asia (Matsumoto *et al*., 2012).

Development of RFVR and RFVR Database for Vessels 24 m in Length and Over

Under the initial phase of aforementioned Project, SEAFDEC initiated in 2010 the activity on the Promotion of Fishing License, Boats Registration and Port State Measures in Southeast Asia which was meant to assist the AMSs in their efforts in combating IUU fishing in their respective waters. Specifically, the said activity was aimed at promoting fishing licensing, boats registration and port State measures as fisheries management tools to combat IUU fishing, promoting MCS management for sustainable fisheries in the region, preventing IUU fishing products from being exported, and assisting the countries in the application and implementation of IUU fishing-related countermeasures (Matsumoto *et al*., 2012). In order to attain the objectives of the aforementioned activity, SEAFDEC convened several regional meetings and consultations in order to compile the information and inputs from the AMSs necessary for the development of the IUU fishing-related countermeasures.

With the outset of such development, SEAFDEC/TD organized the Regional Core Experts Meeting on Fishing License, Boats Registration and Information on Export of Fisheries Products in Southeast Asia in October 2011, where the procedures for fishing licensing and boats registration in Southeast Asian countries as well as the corresponding

minimum requirements for obtaining fishing license and boats registration certificates were discussed. The results of such Meeting were compiled in a database maintained by SEAFDEC/TD. The Regional Core Experts Meeting also considered the development of regional guidelines on fishing licensing and boats registration while the ways and means of preventing the export of IUU fishing products in the region were initially identified (SEAFDEC/TD, 2011). In order to strengthen the regional networking and enhance the collaboration among the countries in the development of such guidelines as well as in future relevant activities, an electronic email group (*combat_iuu@seafdec.org*) was established which has since then, been actively used to exchange and update the necessary information. Subsequently, the Experts Group Meeting on Fishing Licensing and Boats Registration in Southeast Asia was convened by SEAFDEC/TD in June 2012, where an agreement was reached by the SEAFDEC Member Countries on the compilation of the Regional Fishing Vessels Record (RFVR) initially focusing on the information of larger fishing vessels with length from 24 meters and over (SEAFDEC/TD, 2012). Based on the results of such meetings, SEAFDEC/TD submitted the proposed establishment of the RFVR to the 45th Meeting of the SEAFDEC Council in April 2013, which the SEAFDEC Council of Directors considered and endorsed (SEAFDEC, 2013). Later, the Special Senior Officials Meeting of the Thirty-Fourth Meeting of the ASEAN Ministers on Agriculture and Forestry also supported the establishment the RFVR as a tool to combat IUU fishing in the Southeast Asian region. To continue and follow-up on such endorsements, SEAFDEC/TD organized the "Technical Workshop on Regional Fishing Vessels Record (RFVR) Database Development and Management in Southeast Asia" in August 2014 which came out with policy recommendations and the way forward for the development and implementation of the RFVR Database (SEAFDEC/TD, 2014).

Box 1. Information from the AMSs on fishing vessels 24 meters in length and over to be shared with the RFVR Database

1. Name of vessel
2. Vessel Registration Number
3. Owner Name
4. Type of fishing method/ gear
5. Fishing License number
6. Expiration date of fishing licenses
7. Port of registry
8. Gross tonnage (GRT/GT)
9. Length (L)
10. Breadth (B)
11. Depth (D)
12. Engine Power
13. Shipyard/Ship Builder
14. Date of launching/Year of built
15. International Radio Call sign
16. Engine Brand
17. Serial number of engine
18. Hull material
19. Date of registration
20. Area (country) of fishing operation
21. Nationality of vessel (flag)
22. Previous name (if any)
23. Previous flag (if any)
24. Name of captain/master
25. Nationality of captain/ master
26. Number of crew (maximum/minimum)
27. Nationality of crew
28. IMO Number (If available)

The RFVR Database, an online system, is a collaborative initiative of AMSs with the intention of sharing information among AMSs on fishing vessels identification and other relevant data and information. Through a series of Experts and Regional Technical Consultations, the AMSs agreed on the 28 elements that would comprise the basic information requirements to be shared with the RFVR Database, as shown in **Box 1**. As recommended by the SEAFDEC Council of Directors, the Initial Phase of the Database should focus on fishing vessels of 24 meters in length and over, and could be expanded later with the recording of vessels measuring less than 24 meters (Kawamura and Siriraksophon, 2014).

Access to the RFVR Database

Presently, the RFVR Database system is meant for the ASEAN Member States only. For security purposes, accessing the RFVR-24 m Database System requires Username and Password from SEAFDEC. The User's Account (Username and Password) has been provided to each AMS during the 47th Meeting of the SEAFDEC Council in Chiang Rai, Thailand in 2015 (SEAFDEC, 2015). AMSs needing additional User's Account could send a request to the Secretary-General of SEAFDEC for such purpose. Users from the AMSs can access the RFVR-24 m Database System through the web address (URL) *www.seafdec.or.th/rfvr/index.php* (**Fig. 1**)

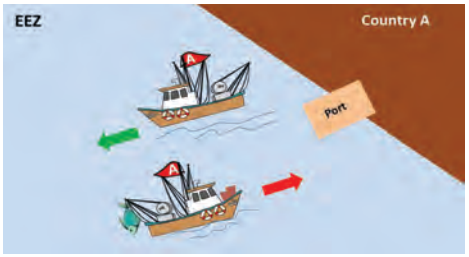
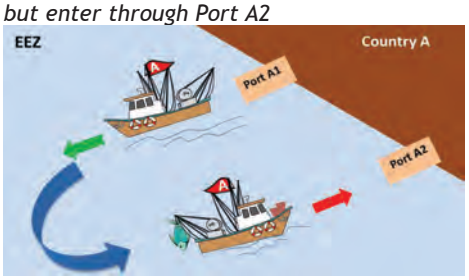
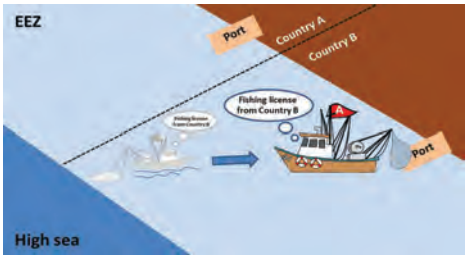
Fig. 1. Main Webpage of the RFVR Database for vessels 24 m in length and over

Usage and Application of the RFVR Database for 24 meters in Length and Over

The purpose of RFVR is to provide the AMSs with reliable and rapid tools to share information on AMS vessels engaged in "international fishing operations," *i.e.* fishing operations in foreign country's EEZ or in the high seas. It is envisioned that the RFVR would serve as a practical ways and means for related authorities of AMSs, to check and take corrective actions against inappropriate behavior of its fishing vessels,

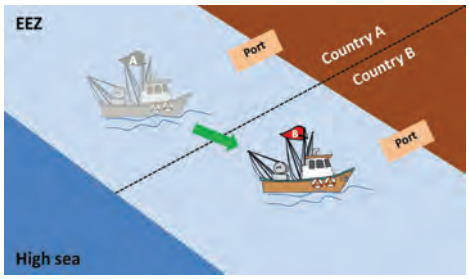
thereby supporting the elimination of IUU fishing in the Southeast Asian region (Pongsri *et al*., 2014). For example, the AMSs can take appropriate actions against "double-flagging vessels, IUU fishing vessels, port State control and poaching" by sharing information and identifying problematic vessels through the information in the RFVR Database. Therefore, the RFVR can be described as a "Shared Tool for AMSs to Reduce IUU Fishing", because RFVR could assist the AMSs

Box 2. Different scenarios in various cases where the RFVR Database could be used

Case 1: Vessel operates in the country's EEZ	
Scenario 1: Vessel goes in and out from authorized home port 	Fishing vessels that go in and go out from the same fishing port • Use RFVR Database for general checking of validated license/registration • Use RFVR Database for general checking, if found that vessels had operated in unauthorized fishing zones • Use RFVR Database during inspection of fishing vessels, when found that some data are incorrect • Refer to RFVR Database for implementing surveillance, when vessel operates in unauthorized fishing areas
Scenario 2: Vessel goes out from Port A1 but enter through Port A2 	Fishing vessels go in and go out using different fishing ports, *i.e.* fishing vessel A go out from fishing port A1 and go in at fishing port A2 • Use RFVR Database for general checking of validated license/registration • Use RFVR Database for general checking, if found that vessels had operated in unauthorized fishing zones • Use RFVR Database to inspect the fishing vessels, when found that some data are incorrect • Refer to RFVR Database for implementing surveillance, when vessel operates in unauthorized fishing areas
Case 2: Vessel operating in another coastal State using authorized license	
Scenario 1: Vessel A operates in country B and land in home port 	Vessel A originating from country A which got fishing license from country B to operate fishing in country B waters, but load the fish in the country of origin (country A) • Use RFVR Database to pre-check the vessels, compare with applied form before fishing licenses are given by country B and use RFVR Database for general checking of validated license/ registration • Use RFVR Database to check type of fishing method/gear and area of fishing operation of the vessels before landing in fishing port • Refer to RFVR Database for implementing surveillance, when vessel A operates in un-authorized fishing areas and un-authorized gears and methods
Scenario 2: Vessel A operates in country B and landing catch in country B 	Vessel A from country A which got the fishing license from country B to operate in waters of country B and lands catch in country B • Requires fishing license given to vessel A • Use RFVR Database to pre-check the vessels and compare this with application form before fishing license is given by country B and use RFVR Database for general checking of the validated license/registration • Refer to RFVR Database for implementing surveillance, when vessel A operates in unauthorized fishing areas and unauthorized gears/methods • Requires bilateral agreement between country A and country B
Scenario 3: Vessel A operates in country B and landing catch in country C 	Vessel A from country A which got the fishing license from country B to operate in country B waters, but takes the fish to land in country C • Requires fishing license given to vessel A • Use RFVR Database to pre-check the vessel, compare with application form before fishing license is given by country B and use RFVR Database for general checking of the validated license/registration • Refer to RFVR Database for implementing surveillance, when vessel A operates in unauthorized fishing areas and unauthorized gears/methods • Use RFVR Database to check type of fishing method/gear and area of fishing operation of the vessel before landing in fishing port

Box 2. Different scenarios in various cases where the RFVR Database could be used (Cont'd)

Case 3: Double-flagged vessel

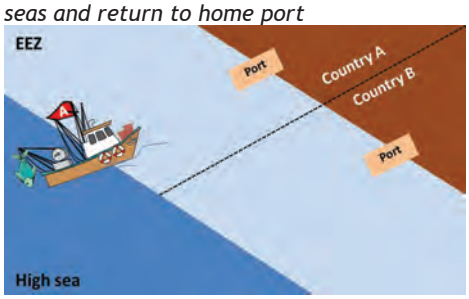


Fishing vessels register in 2 countries, they have two flag States. When they operate in country A water they show flag State A and when they operate in country B water they show flag State B. The RFVR Database could be used to:

- Check the status of vessel registration before vessel is allowed to register
- Propose for deregistration (requires deregistration document)
- Implement surveillance, when vessel is found operating in un-authorized fishing areas

Case 4: Vessels operating in the high seas

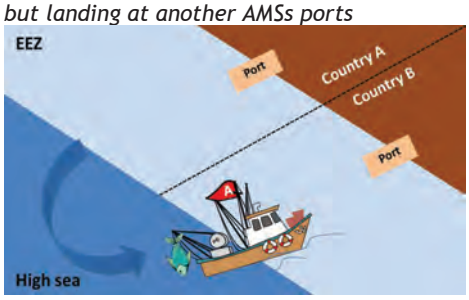
Scenario 1: Fishing in high seas and return to home port



Based on RFVR Database, Port Authority can make a list of vessels operating in the high seas

- Use RFVR Database to cross-check with catch documents to ensure that vessels operating in high seas have authorized management
- Requires fishing license and certificate of fishing registration
- Use RFVR Database to adopt appropriate surveillance

Scenario 2: Fishing in high seas but landing at another AMSs ports



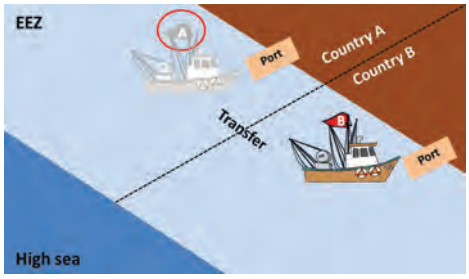
- Use RFVR Database to check the status of vessel before giving permission to enter any AMSs' ports
- Use RFVR Database to cross-check with RFMOs database and with catch documents to ensure that vessels operate in high seas with authorized management
- Use RFVR Database to adopt appropriate surveillance
- Based on RFVR Database, Port Authority can make a list of vessels operating in the high seas

Case 5: Transferring of vessel's ownership

Scenario 1: Transferring of vessel's owner within a country

- Use RFVR Database to check the historical data related to ownership of vessels
- This implies that the RFVR Database should be updated annually for effective use

Scenario 2: Transferring of vessel's ownership to another AMSs



- Use RFVR Database to check the historical data related to ownership of vessels
- This implies that the RFVR Database should be updated annually for effective use

Box 2. Different scenarios in various cases where the RFVR Database could be used (Cont'd)

Case 6: Cloned vessel

Scenario 1: One fishing license applied for more than one vessel

- Use RFVR Database for flag State to take action in case a fishing vessel is arrested or inspected at sea by navy or coastguard
- Requires fishing license

Scenario 2: One registration applied for more than one vessel

- Use RFVR Database to check the unauthorized license of vessel but if fake registration is used - check the engine number, and other relevant information
- Requires the certificate of vessel registration

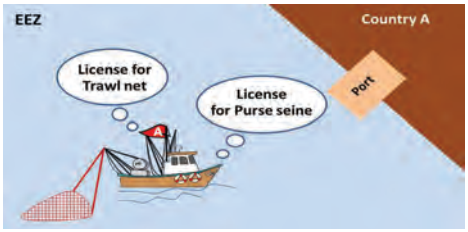
Case 7: Disregard license and more than one fishing license

Scenario 1: Disregard the fishing license

Fishing vessel has fishing license for purse seine but operates using other gear.

- Use RFVR Database to check the unauthorized license gear
- Requires fishing license
- Refer to RFVR database for surveillance/enforcement

Scenario 2: Double or more than one fishing license

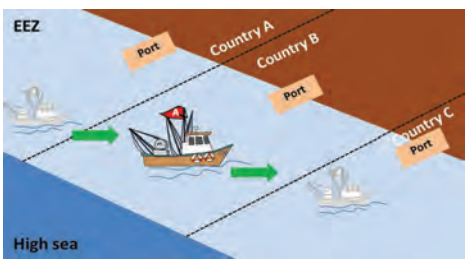


- Use RFVR Database to check for double fishing licenses to avoid double counting of number of vessels
- Requires fishing license
- Use RFVR Database to carefully check the registration and licensing documents
- Improve the electronic system used in the RFVR Database to avoid duplication of record

Case 8: Vessel uses fake flag, operates in other AMS

- Use RFVR Database to inspect the vessels, whether vessels are unauthorized or use fake licenses and fake flag
- In cases, fishing vessel A is poaching in country B waters and show fake flag State A, this would require certificate of vessel registration
- Refer to RFVR Database for implementing surveillance, when vessels operate in unauthorized fishing areas

Case 9: Vessel cruising country A to C (passing B)



- Coastal State to take action on this case
- Use RFVR Database to check data of fishing vessels when passing their country
- Requires certificate of vessel registration and fishing license

in taking coordinated countermeasures against IUU fishing. Furthermore, it is also expected that if AMSs could make full use of the RFVR Database, reduction of IUU fishing activities in the region could be achieved.

The target users of the RFVR Database are categorized into three groups, namely: coastal State, flag State, and port State, which involve many people such as enforcement officers, vessel inspectors, coastguards, marine polices, navy, vessel registration units, fishing license units, customs, immigration, quarantine units, ports authority, fisheries officers and managers, among others. SEAFDEC/TD has established that the RFVR Database for vessels 24 meters in length and over could be used and applied in monitoring fishing activities based on different scenarios and classified into eight different cases (**Box 2**).

Way Forward

In order to strengthen the monitoring and annual updating of the RFVR Database, the national focal points (NFP) in-charge of providing information from respective AMSs for the RFVR Database had been setup. The NFP meeting would be organized in an *ad hoc* basis for improvement of the Database system. Considering that RFVR is a tool to combat IUU fishing activities within the Southeast Asian region, the current RFVR Database system would be expanded to cover vessels less than 24 m, which would be carried out in 2017. In addition, the possibility of sharing the RFVR Database with other regional and/or international organizations would be discussed at the forthcoming Meeting of the SEAFDEC Council in 2017 for consideration and endorsement.

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Management of Fishing Capacity for Sustainable Fisheries: RPOA-Capacity

Taweekiet Amornpiyakrit and *Somboon Siriraksophon*

The increasing demand for fish prompts many fishers with highly-equipped fishing boats, to unceasingly chase for fish oblivious of the impacts of any irresponsible operations on the resources. The uncontrolled exploitation of the fishery resources ends up with overcapacity, which in turn lures fishers to engage in illegal fishing operations resulting in overfishing, and ultimately to resources depletion. Under such a scenario, the task of managing the fishery resources on a sustainable basis has become increasingly challenging, and the immeasurable threats of over-exploitation and degradation of aquatic habitats have become serious problems, especially in the Southeast Asian region. Recognizing that overfishing and overcapacity seriously threaten the sustainable management and conservation of fishery resources, and the severity of such problems, the Ministers of the ASEAN-SEAFDEC Member Countries responsible for fisheries through the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020, had resolved to promote better management of fishing capacity and the use of responsible fishing technologies and practices. Specifically, such agreement led to recognition and movement towards the replacement of the "open access" to fisheries resources with "limited access" through rights-based fisheries as well as to secure the rights and well-being of inland and coastal fisheries communities. As a leading regional organization working towards the promotion of sustainable fisheries management and countermeasures to combat IUU fishing in the Southeast Asian region, SEAFDEC has exerted continuous efforts to address this serious issue. Through series of consultations organized by SEAFDEC with funding support from the Japanese Trust Fund and the SEAFDEC-Sweden Project, the SEAFDEC Member Countries came up with a draft Regional Plan of Action for the Management of Fishing Capacity (RPOA-Capacity) to serve as management tool and voluntary guidelines for preventing over-exploitation of the fishery resources and consequently combating IUU fishing in the region.

Management of fishing capacity is one of key elements in fisheries management that strives to match fishing effort with available resources in order to protect important habitats as well as enforce regulations to safeguard the interest of specifically vulnerable groups of people. In general, such fisheries management scheme is aimed at regulating active fishing effort by developing schemes and management plans that would give directions as to: where, how, when and by whom to fish. These management directions could include information on total number of vessels allowed at a given time and area; the type of gear to be used (and not to be used); special restrictions on protected areas, protected species and defined seasonal restrictions; traditional rights to fish, exclusive rights and other specified rights; as well as other additional aspects that should be considered and respected when regulating the actual fishing effort.

In the development of the aforementioned RPOA-Capacity, reference has been made to the FAO Code of Conduct for Responsible Fisheries, especially the several recommendations on the need to address the concerns relevant to the improvement of fisheries management. Furthermore, the development process also referred to the subsequent FAO International Plan of Action on the Management of Fishing Capacity 1999 (IPOA-Capacity), which include a number of steps to be taken in managing capacity. These include: a) assessment and monitoring of fishing capacity; b) preparation and implementation of national plans of action (NPOA-Capacity); and c) international (regional) considerations and recommendations for immediate steps to address the management of fishing capacity. A number of countries in the Southeast Asian region have already developed or are in the process of developing their respective NPOA-Capacity, although there are some countries that still need to develop their NPOA-Capacity, their existing laws and regulations are in place that are supportive to the management of fishing capacity.

On the request of the ASEAN Member States (AMSs), SEAFDEC has been organizing experts' meetings and regional technical consultations highlighting on the critical importance of addressing the management of fishing capacity in Southeast Asia to reduce pressure on available fish stocks, mitigate conflicts of resource users over the fishery resources, and promote sustainability for people dependent on the fishery

resources. Unregulated (and/or un-enforced) fisheries and over-capacity, relative to available resources, also tend to increase incidences of illegal fishing within countries, as well as across boundaries with increased hardship facing the smaller communities as a result. To improve the levels of sustainability and equal sharing of benefits from fisheries, immediate efforts have been called for to reduce over-capacity and strengthen the implementation and/or enforcement of regulatory measures, with the overall objective of combating illegal fishing throughout the Southeast Asian region.

Development of the RPOA-Capacity

The importance of managing fishing capacity for the sustainability of fisheries and food security was one of the major concerns raised during the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 in June 2011 in Bangkok, Thailand. Specifically, "Management of Fishing Capacity" was given full focus during the Conference and subsequently, was reflected in the 2011 Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 (SEAFDEC, 2011). In a related development, Malaysia through its Department of Fisheries (DOF), as the Lead Country for the cluster on "Promoting Sustainable Fisheries Practices - Fishing Capacity and Responsible Fisheries Practices" under the ASEAN Fisheries Consultative Forum (AFCF) developed the Guidelines for Development of National Plan of Action for Management of Fishing Capacity (NPOA-Capacity) based on the country's experience in addressing the issues on fishery resources depletion due to overcapacity in fisheries (Shaupi, *et al*., 2011). This development was also meant to support the AMSs in their efforts of establishing their respective NPOAs-Capacity in accordance with the requirements of the AFCF.

The abovementioned Guidelines developed by Malaysia focuses on strategies relating to the effective management of national fishing capacity for sustainable exploitation of the fishery resources for future generation. In order to promote the Guidelines to the other AMSs and upon their request, SEAFDEC provided the platform for all ASEAN-SEAFDEC Member Countries to meet and discuss the future actions that need to be undertaken. As a result, it was agreed that the approaches to support the management of fishing capacity for the region should be identified through the development of the Regional Plan of Action for Management of Fishing Capacity (RPOA-Capacity) based on the revised Guidelines for Development of NPOA-Capacity by the AMSs (SEAFDEC, 2015a; SEAFDEC, 2015b; SEAFDEC, 2015c).

The RPOA-Capacity is meant to serve as a guidance for the management of fishing capacity in an ASEAN perspective and also to support the countries in the development and implementation of their respective NPOAs-Capacity. The RPOA-Capacity is also envisioned to be a useful tool for fisheries management and/or capacity management at the sub-

Box 1. Key issues and feasible measures identified as basic reference for development of RPOA-Capacity

Issues	Feasible Measures	Technical Assistances
Policy and Legal Framework in Managing Fishing Capacity		
1) Ineffective policies, legal framework in managing fishing capacity • Decisions inconsistent with current policies • Lack of political will and awareness towards conservation and fisheries management • Subsidies *vs.* incentives	• Strengthen good governance • Voice out in ASEAN platform • Identify gaps and issues in legal framework • Consistency in policy and implementation (both national and regional levels)	• Consultations to improve understanding by politicians/policy makers using recommendations based on scientific evidence • Capacity building
Information for Fishing Capacity Management (vessels, gears, and fishers)		
2) Insufficient information for fishing capacity management • Data on concerned fishing capacity (*e.g.* no. of fishing boat, gears, fishers) • Incomplete information of gear specification and documentation (*e.g.* length of fishing gear)	• Identify gaps • Develop common database • Economic and financial studies on the impacts of capacity management	• Review works • Organize trainings/workshops/ consultations • Develop appropriate gear specification and design for sustainability of resources • Provide guidance technology systems including VMS, Automated Identification System (AIS) databases, GRMS (mobile telephone system), etc. • Information sharing on active fishing capacity
Information for Fishing Capacity Management (fishery resources)		
3) Inadequate data and information on fisheries resources • Lack of policies/systems to deal with fisheries management in data poor situation • Lack of expertise to assess fishing capacity	• Identify gaps • Develop common SOP (feasible and effective method) for data collection • Capacity building program	• Reviews • Organize trainings/ workshops/consultations • Stock assessment, improve data collection and methodologies for both marine and inland fisheries

Box 1. Key issues and feasible measures identified as basic reference for development of RPOA-Capacity (Cont'd)		
Issues	**Feasible Measures**	**Technical Assistances**
4) Lack of research and assessment of migratory shared stocks	• Capacity building • Conduct research and assessment of migratory shared stocks • Information dissemination	• Organize the regional fora • Conduct trainings/workshops/consultations
Capacity and Capability to Manage Fishing Capacity		
5) Inadequate capacity and capability for monitoring, control and surveillance • Encroachment of local fishing vessel into prohibited area • Encroachment of foreign fishing vessels	• Strengthening MCS • Inter-agencies and inter-countries coordination • Utilization of "Fishermen eyes" (co-management) • Improve law enforcement • Information sharing on MCS • Capacity building program • Promote co-management, decentralization, EAFM • Input control (vessels, licenses, gears, days at sea) • Output control (TAC, quota, MPA, zoning, spatial and temporal measures, minimize discards) • Increase license fees (for commercial scale fisheries) • Cooperation with relevant authorities to ensure safety of fishing vessels (inspection and certification as part of fishing license requirements) • Promote alternative livelihood (other than fishing) • Reduce low cost labors on fishing fleets	• Organize trainings/workshops/consultations • Flag and Port State Measures trainings and inspections • Safety inspections • Legal and regulatory technical assistance • Development of NPOA-capacity and determination of target fishing capacity
Public Awareness		
6) Insufficient public awareness and participation of • Fishers • General public (exclude fishers *e.g.* consumers)	• Fishers/stakeholders fora (at local, national and regional levels) • Media and awareness campaign • Information, education and communication program (IEC)	• Organize the regional fora • Conduct trainings/ • workshops/consultations
7) Market-driven pressure • Demand for fish promoting unsustainable fishing practices (*e.g.* high priced fish, endangered fish, trash fish)	• Promote EAFM • Public awareness to consume fish from sustainable fisheries • Requirements for aqua feeds and raw materials for export causes pressure to the fishing capacity	• Support training courses

regional areas such as in the Andaman Sea, Gulf of Thailand, and Sulu-Sulawesi Sea. During the consultations organized for developing the RPOA-Capacity, the key issues and measures with regards to the management of fishing capacity including practical actions and useful measures to consider in the process of developing the RPOA-Capacity were identified as shown in **Box 1**.

The final draft the RPOA-Capacity was then endorsed by the SEAFDEC Council of Directors during its 48th Meeting in April 2016 (SEAFDEC, 2016). Finally, the final draft was considered by the ASEAN for publication and dissemination during the 23rd Meeting of the ASEAN Sectoral Working Group on Fisheries in May 2016. Meanwhile, for the development of NPOA-Capacity, the AMSs could refer to the experience of Japan in coping with overcapacity and overfishing (Iwata and Sulit, 2016) and for estimating the maximum sustainable yield reference could be made to a case study carried out in Viet Nam (Phuong *et al*., 2016). Nonetheless, many countries have already initiated efforts to manage their fishing capacity

The Regional Technical Consultation that came up with the final draft of the RPOA-Capacity for submission to the SEAFDEC Council.

Box 2. Initiatives of AMSs in managing their respective fishing capacity and developing the NPOA-Capacity

Cambodia

The country's legislative and institutional systems for fishing capacity management for the marine fisheries subsector are in place, *i.e.* under the Law on Fisheries 2007 (adopted in 2006 and published in 2007):

- Article 45 - All types of fishery exploitation in the marine fisheries domain, except subsistence fishing shall be allowed only upon possession of license and the exploitation shall follow the conditions and obligations in fishing logbook. The model of fishing logbook shall be determined by proclamation of the Ministry of Agriculture, Forestry and Fisheries (MAFF).
- Article 47 - Fishermen shall transship fishery products at a fishing port determined by Fisheries Administration (FiA). Foreign fishing vessels permitted to fish in the marine fisheries domain shall inform the FiA prior to port in marine fisheries domain in Cambodia. Other terms and conditions on transshipment of fishery products and anchoring of foreign fishing vessels shall be determined by FiA.
- Article 48 - Based on precise scientific information that the fishing practices have been or are being the cause of serious damage to fish stocks, FiA has the right to immediately and temporary suspend fishing activities and propose for a re-examination of the fishing agreement in order to seek for the decision of the MAFF.

For the NPOA for management of fishing capacity, the country's marine capture fisheries is classified into two (2) levels, namely: national fishing is managed by the Ministry of Agriculture, Forestry and Fisheries (MAFF) and Fisheries Administration (FiA), whereas international fishing is managed the Cabinet of the Prime Minister Office. The NPOA-Capacity had already been drafted and the Inter-Ministries Joint Working Group was formed to accelerate the approval and implementation of the NPOA.

Indonesia

The legal frameworks governing marine fisheries subsector in Indonesia include:

- Act No. 31/2004 as amended by No. 45/2009 on Fisheries.
- Act No. 27/2007 as amended by No. 1/2014 on Coastal and Small Islands Management.
- Regulation of Government No. 60/2007 on Fish Resources Conservation.
- Ministerial Decree No. 45/2011 on Estimation of Fish Resources Potential in FMA.

Activities relevant to management of the country's fishing capacity has been undertaken in terms of data collection and reporting, moratorium to imported fishing vessels, prohibition of transshipment at sea, prohibition of lobster and crab catch, prohibition of trawls and seine nets, and establishment of closing area for fishing (conservation). Its NPOA-Capacity is still in the draft stage and yet to be launched. This NPOA is referred to as technical guidelines and detailed action plan within the framework of managing fishing capacity.

Malaysia

The Fisheries Act 1985 provides the legislative framework for the conservation, management and development of the capture fisheries in Malaysia. The development of the country's fishing industry closely follows the National Agro-Food Policy 2011-2020 (NAP) on "Sustainable development of capture fisheries industry is important to ensure fisheries resources are preserved and could be sustained for the future."

Phase-2 of its NPOA-Capacity was adopted, and it is focused on 12 identified issues and challenges and 3 strategies: The strategies for such NPOA-Capacity are: 1) Review and implement effective conservation and management measures; 2) Strengthen capacity and capability for monitoring and surveillance programs; and 3) Promote public awareness education programs. For long term objective of Phase 2 of the NPOA-Capacity, Malaysia aims to achieve an efficient, equitable and transparent management of fishing capacity in marine capture fisheries by 2018.

Myanmar

The country's legal framework on management of fishing capacity is under the Myanmar Marine Fisheries Law (1990) and the 1989 law relating to fishing rights of foreign fishing vessels. In addition, the country's regulations related to management of fishing capacity are in place, *i.e.*: 1) prohibiting the building or importing of new fishing vessels; 2) prohibiting fishing operations in high seas; 3) trawls may be transformed into other fishing gears, but other fishing gears cannot be transformed to trawls; 4) flag State measures and port State measures including the installation of VMS and implementation of the Catch Certification Scheme. The challenges and future implementation for management of fishing capacity in Myanmar include: 1) Promotion of effective inspection for all fishing vessels at sea; 2) Initiating the use of VMS for effective MCS system in all fishing vessels; 3) Using TEDs and JTEDs in trawl fishing vessels; and 4) Conduct of study on the survey of fishing capacity of each fishing gear group.

Philippines

The country's relevant legal and institutional frameworks cover two classes of fishing vessels, *i.e.*: 1) Commercial Fishing – fishing with the use of fishing vessels 3.1 Gross Tons (GT) and above and operating beyond 15 km from the shoreline; and 2) Municipal Fishing – fishing with the use of fishing vessels less than 3.1 GT and operating within the area of 15 km from the shoreline. Registration of commercial fishing vessels is mandated by the Maritime Industry Authority (MARINA) while registration of municipal fishing vessels is delegated to the Local Government Units (LGUs). Meanwhile, licensing of commercial fishing vessels is the mandate of the Bureau of Fisheries and Aquatic Resources (BFAR) while licensing of municipal fishing vessels is the authority of the LGUs.

The Philippines does not have an NPOA on Fishing Capacity Management yet, however there is a plan to develop the NPOA-Capacity within 5 years. Nevertheless, Philippines has established a moratorium on the issuance of new licenses and other clearances as well as stopped building new boats and importing second hand boats. Philippines also conducted joint mobile registration and licensing with MARINA and conducted an inventory of all commercial fishing boats. These relevant issues are the challenges for the Philippines to implement in near future.

Singapore

Based on the legislative and institutional systems in Singapore, fishing capacity is monitored through catch declaration and reporting which are parts of the licensing requirements of the Agri-Food & Veterinary Authority. There are no more licenses issued for inshore fishing vessels. Related to the NPOA-Capacity, Singapore initiated inter-agency engagements to have regular discussion and coordination towards the development of its NPOA against IUU fishing activities, including the implementation of relevant measures under the Port State Measures Agreement (PSMA). In addition, Singapore plans to review of policies and amendments to its Fisheries Act to further strengthen the aspect on enforcement powers.

Box 2. Initiatives of AMSs in managing their respective fishing capacity and developing the NPOA-Capacity (Cont'd)

Thailand

The country's legal and institutional frameworks related to management of fishing capacity make reference to the Fisheries Act superceded with the Royal Ordinance on Fisheries 2015 which comprises 11 Chapters and 104 sections, and put into force in April 2015. The enactment of this law was aimed primarily at conserving the fishery resources, particularly in freshwater or inland habitats, coastal habitats and marine habitats. The Act contains a provision for the adoption of a regulation (requiring Cabinet's approval) and a notification (to be issued by responsible Ministry in pursuant to the Act). A number of regulations and notifications have been adopted and issued for the management of both freshwater and marine fisheries. The Chapters are: Fisheries Management, Fishery Zone, Promotion of Aquaculture, Standard of Fish or Fish Products, Importation and Exportation of Fish and Fish Products, Overseas Marine Fishery, Fees on License or Permit and Substitute, Transferability, Competent Official, Administrative Measure, Penalties. The Department of Fisheries (DOF) serves as the principal agency dealing with fishing, marine resources, and the management of maritime habitats. The Department of Marine and Coastal Resources (DMCR) and the Office of Natural Resources and Environmental Policy and Planning (ONEP), under the Ministry of Natural Resources and Environment (MONRE), with some legal mandates overlapping with those of the DOF, are particularly concerned with the maritime and coastal areas, and have been working closely with DOF.

Viet Nam

In Viet Nam, the NPOA-Capacity was developed and adopted in principle with reference to the country's legal documents such as Fisheries Law (2003); Viet Nam's Marine Strategy to 2020; Government's relevant decrees, resolutions and decisions; as well as to the international legal documents such as International Convention on the Law of the Sea (1982); Code of Conduct for Responsible Fisheries (FAO, 1995); and the FAO Technical Guidelines or IPOA for the Management of Fishing Capacity. The specific objectives are: (1) to reduce total trawl fishing boats by 15% in 2014-2017, and 12% in 2018-2025; (2) Fisheries co-management is applied for 8 coastal provinces in 2014-2017, and 28 provinces in 2018-2025; and (3) Fishing boats are controllable in consistence with allowable resources of each particular area in 2018-2025.

as preparation for the development of their respective NPOAs-Capacity (**Box 2**).

Way Forward

With reference to the final draft of the RPOA-Capacity developed through a series of the consultations/meetings and endorsed by the ASEAN-SEAFDEC Member Countries, SEAFDEC would consult with the relevant stakeholders to ensure that RPOA-Capacity would gain maximum support. In addition, awareness of concerned stakeholders, *i.e.* fishing vessel owners or fisheries industrial sectors of the measures/regulations included in the RPOA-Capacity would be enhanced. Considering that managing of fishing capacity is linked to fishery resources management, therefore, there is a need to strengthen and enhance the regional and/or sub-regional cooperation to ensure the effective implementation of sustainable utilization of fish stocks for some semi- or highly-migratory species. In this regard, the industrial sector and/or fisheries private sector would be tapped to play an important role in supporting the implementation of the RPOA-Capacity,

especially in: 1) implementing the Catch Documentation Scheme to support the data for stock assessment; 2) regularly providing registers for the boat and gear licensing systems; 3) conserving the early life cycle stages of fishes in spawning and nursery grounds, and protecting the migratory paths; and 4) the effective implementation of NPOA-Capacity, among others.

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Securing the Niche of ASEAN Fish and Fishery Products in the Global Market: ASEAN Catch Documentation Scheme for Marine Capture Fisheries

Somboon Siriraksophon, Hajime Kawamura, and *Namfon Imsamrarn*

It is well-recognized that the global fishery resources have declined due to overexploitation and un-controlled fishing operations whether within national jurisdictions, sub-regional/regional areas or in the high seas. Illegal, Unreported and Unregulated (IUU) fishing which has been identified as one of the causes of the declining fishery resources, can take place in all aspects of capture fisheries and in all sea areas. Initiatives to conserve and manage fish stocks have been undermined by IUU fishing, the result of which could lead to total collapse of capture fisheries, seriously hampering all attempts to rebuild the stocks that may have already been overfished. This situation could also lead to losses of both short- and long-term social and economic opportunities and thus, could have negative impacts on food security. FAO developed in 1995 the Code of Conduct for Responsible Fisheries (CCRF), an important international voluntary-based measure to serve as guide in ensuring the sustainable development of fisheries. The CCRF includes several provisions covering all aspects of fisheries, from fisheries management, fishing operations, sustainable aquaculture, to post-harvest technology, and so on. Moreover, specific sub-issues relevant to the International Plan of Action to Prevent, Deter, and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU), Port State Measures (PSM), flag State control, market driven measures, and others have also been included in the CCRF (FAO, 1995). Through the promotion of the CCRF, countries in the region recognized the issues on sustainable fishing operations and fisheries management, and to facilitate its implementation in the region, SEAFDEC in coordination with the ASEAN Member States regionalized the CCRF. Thus, a series of regionalized guidelines had been developed. Collectively known as RCCRF, the regionalized guidelines had been translated into national languages of some countries starting in early 2000s. Nevertheless, from the global and regional points of view, IUU fishing has remained active around the world, resulting in increased recognition by the international community of the need to develop a traceability system through a regional catch documentation scheme to be able to establish the route of such products and ensure that these do not come from IUU fishing operations and thus, secure the niche of the region's marine fish and fishery products in the international market.

With the objective of controlling IUU fishing activities, the European Union (EU) developed a market-driven measure known as the "EC Regulation 1005/2008" to prevent, deter and eliminate illegal, unreported and unregulated (IUU) fishing, which was made effective since January 2010. Under such arrangement, countries exporting their fish and fishery products to the EU are required to implement the EC Regulation 1005/2008. On the other hand, many Regional Fisheries Management Organizations (RFMOs) have also developed their respective Catch Documentation Schemes as means of discouraging IUU fishing operations in the RFMOs' areas and/or high seas, tracking fish catch being traded in their management areas, and minimizing opportunities for products taken by illegal, unreported or unregulated (IUU) fishing from reaching the markets. Thus, countries party to the tuna RFMOs, *e.g.* Western and Central Pacific Fisheries Commission (WCPFC), Indian Ocean Tuna Commission (IOTC), have to implement such Catch Documentation Schemes to be able to import and export tuna and tuna products.

Taking into account the abovementioned circumstances, the ASEAN Member States (AMSs) during the ASEAN-SEAFDEC Regional Technical Consultation on International Fisheries-related Issues in Bangkok, Thailand in February 2010, encouraged SEAFDEC to take a proactive role in facilitating the sharing of experiences and information among its Member Countries (*e.g.* difficulties faced by the industry, areas of negotiations with EC, possible solutions/options), in order to enhance the capacity of the AMSs in complying with the requirements of the EC Regulation. Furthermore, during the discussion of the issues pertaining to the EC Regulation 1005/2008 at the Thirteenth Meeting of the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP) in December 2010, support was expressed on the development of common catch documentation system that could facilitate intra-regional trade of fish and fishery products in the Southeast Asian region. However, the AMSs also declared that such catch documentation system should conform to and align with those of relevant Regional Fisheries Management Organizations (RFMOs) and the EU Catch Documentation, in order to comply with the requirements of the RFMOs and the EU (SEAFDEC, 2010).

Impacts of the Market-driven Measures

While AMSs had amended their laws and administrative regulations to meet the requirements relevant to the EC Regulation, many countries in the region expressed concern on the indirect exportation of fishery products (Latun *et al.*, 2016). Although some countries might not be directly exporting their products to the EU, but some may be exporting

raw materials to other AMSs to be processed into products for subsequent export to the EU. In such cases, export of such raw materials would need to be accompanied with a Catch Certificate acceptable to the EU regardless of its origin or final trade destination. Under such circumstances, the trade of fish and raw materials among the ASEAN-SEAFDEC Member Countries would still need to comply with the EC Catch Certification Scheme as the materials may be subsequently re-exported to the EU.

Considering the structure of fisheries in the Southeast Asian region where small-scale fisheries are the most important suppliers of fish, in fact more than 75% of fish consumed comes from small-scale fisheries, the impacts of the EC Regulation on small-scale fisheries and the experience of many AMSs on the implementation of the EC Catch Certification Scheme were thoroughly discussed during the Regional Workshop on Assessment of the Impacts of IUU Fishing and EC Regulation 1005/2008 on Small-scale Fisheries in the Southeast Asian Region in Nha Trang, Viet Nam in October 2012. Co-organized by the RPOA-IUU, the Agri-Food and Veterinary Authority (AVA) of Singapore, the Fisheries Administration of the Ministry of Agriculture and Rural Department (MARD) of Viet Nam, and SEAFDEC, the Meeting identified the status and the problems encountered by the AMSs on the implementation of the EC Catch Certification Scheme as shown in **Box 1**.

Thus, it has been established that the EC Regulation created considerable impacts on the AMSs that send their products to the EU through intra-regional trade of fish and fishery products. Even countries that do not export their fish directly to the EU but to neighboring countries that require catch certificates, should also comply with the catch certification system. Therefore, the required catch certificate for re-exporting products to the EU of which some AMSs are not yet ready to provide, would directly affect the importing countries that currently face shortage of raw fish materials for their processing plants.

Box 1. Status and views of ASEAN Member States on the implementation of the EC Regulation (as of 2013)

AMS	Status of implementation of the EC Regulation	Countries' Views
Cambodia	(No) At present, there is no regulation directly implementing the EC Regulation as Cambodia is not exporting fish and fishery products to EU	However, EU is indirectly requiring Catch Certificates in case of potential export of fish products to neighboring countries such as Thailand and Viet Nam
Indonesia	(Yes) MMAF Regulation No. 13/2012 supports national and international efforts to prevent, deter and eliminate IUU fishing	Agreed to simplify the certification of small-scale fishers' vessels (small-scale fisheries business), although small-scale fishing vessels are not obliged to obtain catch certificates, nevertheless, their related UPI (Fish Processing Unit)/ Exporter shall provide the notification
Lao PDR	(No) Not exporting products to EU	Development of inland fisheries and aquaculture in Lao PDR should focus on the aquaculture certification
Myanmar	(Yes) However, the requirements of the EC Regulation 1005/2008 is difficult to implement especially for inshore fisheries	Catch certification is required for exporting products to neighboring countries such as Thailand
Philippines	(Yes) Fisheries Administrative Order (FAO) 238 defines the Rules and Regulations Governing the Implementation of the EC Regulation on the Catch Certification Scheme	However, operations of municipal fishing boats are not under the purview of the national government through BFAR as their operations are under the responsibility of Local Government Units
Singapore	(Yes) Four processing plants (3 for frozen fish and 1 for processed fish) that export their fish products to EU, since the raw materials used come from Indonesia, Taiwan, India, Viet Nam, and Thailand	Shortage of raw materials for the processing plants since some suppliers of raw materials could not comply with the EC Regulation
Thailand	(Yes) Two types of catch certification are adopted, namely: (1) for fishing boats 20 GRT and over, and (2) simplified catch certification used for less than 20 GRT fishing vessels (small-scale)	Simplified catch certificate for small-scale fisheries in which vessels should submit logbooks at district/ provincial fishery offices located in any province or landing site, but issues are raised on how to effectively validate the data entered in logbook as certified by captains of fishing vessels
Viet Nam	(Yes) D-Fish issued more than 150 legal documents to guide relevant stakeholders, convened workshops and training courses for related agencies and fishers on how to comply with EC Regulations	Insufficient MCS system, insufficient logistics and infrastructures, and inadequate capacity of relevant agencies are the key issues that impede effective implementation of the EC Regulation (Khanh *et al.*, 2013)

Need for a Regional Catch Documentation System

Most of the AMSs are major producers of fish and fishery products, jointly accounting for a quarter of the global fish production. Of the world's top 15 marine capture fisheries producers, six are from the ASEAN, namely: Indonesia, Myanmar, Philippines, Viet Nam, Thailand, and Malaysia. Indonesia ranked second of the world's highest marine capture fisheries producers with production of 5.40 million metric tons (MT) in 2012 an increase of about 27.0% over the last decade. The Fisheries Statistical Bulletin of Southeast Asia 2012 (SEAFDEC, 2014) showed that in 2012, Indonesia's total production from marine capture fisheries reached 5.40 million MT followed by Myanmar at 2.33 million MT, Philippines at 2.15 million MT, Viet Nam at 2.11 million MT, Thailand at 1.61 million MT, and Malaysia at 1.47 million MT. It is worth noting that production from marine capture fisheries of Myanmar and Viet Nam increased by 121.4% and 46.8%, respectively, over the last decade.

Meanwhile, the global demand for the region's fish and fishery products has been rising as more countries depend on catches from the AMSs. For example, Australia sources nearly half of its fish demand from the AMSs, and studies showed that Australia's domestic fish requirement would reach 776,000 MT by 2020, of which 610,000 MT will be imported. One of ASEAN's major trading partners, Japan, has been the leading importer of seafood in the world. In 2011, Japan's seafood import reached 2.69 million MT amounting to 1.45 trillion Japanese Yen. Japan imports shrimps primarily from Viet Nam, Indonesia, and Thailand. Indonesia is also one of the country's major sources of tuna, third to Taiwan and Korea. This growth was driven by the increased demand from Europe and the United States. Viet Nam's seafood is also in demand as exports grew from US$ 5.0 billion in 2010 to US$ 6.2 billion in 2012. The United States is fast rising as a major importer of seafood from Viet Nam. It is the primary importer of tuna and the second largest importer of shrimps from Viet Nam. Thailand and Viet Nam are two of the world's major exporters of fish and fishery products.

From the in-depth study carried out by SEAFDEC on fish trade flow within the ASEAN Region and the requirements for catch certification by AMSs (**Box 2**), results indicated that the intra-regional trade of fish and fishery products among the AMSs is significantly high in both quantity and value. In 2007, the Ministry of Marine Affairs and Fisheries (MMAF) of Indonesia reported that a total of 216,300 MT of fisheries products valued at USD180 million, had been exported to other AMSs such as Malaysia, Singapore and Thailand. Even for the import/export of fish and fishery products within the Southeast Asian region, the AMSs still requires catch documentation in order that their fish and fishery products could be re-exported to other importing AMSs and third countries outside the region. In another case, small-scale fisheries may also be required to implement the simplified catch documentation or certification in order to comply with the requirements of importing countries. Therefore, it would be of advantage to the ASEAN-SEAFDEC Member Countries if a regional catch documentation system were developed taking into consideration the format, standard and information requirements of the existing schemes of importing countries, but simplified in order to enhance its applicability in the small-scale fisheries of the region. The development of such regional catch documentation system could be known as the

Box 2. AMSs requirements for EC Catch Certification, RFMOs CDS and ASEAN Catch Documentation Scheme

Fish Trade from ASEAN Member States	CDS Requirements		
	EC Catch Certification	RFMOs CDS	ASEAN CDS
1) Fish/fishery products for the EU	Y		
• Raw fish from commercial fisheries in EEZ	Y		
• Raw fish from small-scale fisheries in EEZ	Y		
2) Re-exporting fish products to EU	Y		
• Raw fish from other ASEAN countries	Y		
• Raw fish from foreign vessels	Y		
3) Importing raw tuna from RFMOs area		Y	
• by foreign fishing vessels		Y	
• by other ASEAN countries		Y	
4) Exporting of tuna products	Y	Y	
• To EU and other Regions	Y	Y	
5) Import-export fish among AMS			Y
6) Import fish from other AMS and Re-export to other region			Y
7) Export fish from AMS to other region except EU			Y
8) Import from outside region and re-export within the AMS region			Y

"ASEAN Catch Documentation System", depending on the requirements of the AMSs (Kawamura and Siriraksophon, 2014).

Nonetheless, the development of the ASEAN Catch Documentation System would require harmonization of all relevant schemes, including the EC Catch Certification, the RFMOs Catch Documentation Systems (CDS) that are being adopted by their respective parties, as well as the existing schemes of the respective AMSs. Along this process, it has become necessary for the AMSs to work together with importing countries in developing the ASEAN Catch Documentation System that could facilitate not only intra-regional trade in fish and fishery products, but also enhance the cooperation among the AMSs for the realization of the ASEAN Economic Community starting in 2015, where fisheries had been identified as a priority sector for the said integration.

Development of the ASEAN Catch Documentation Scheme

At the onset, SEAFDEC conducted several workshops and meetings to carry out an impact assessment of the EC Regulation to the region's fisheries sector including small-scale fisheries, and determine the ways and means of improving the implementation process to meet the requirements of the measures. Based on the inputs from the Member Countries and the outputs from the workshops and meetings, the Concept Note on the Development of "ASEAN Catch Documentation Scheme (ACDS)" was endorsed at the 45th Meeting of the SEAFDEC Council in April 2013, considering that the ACDS could facilitate intra-regional trade of fisheries products in the ASEAN region. Later, the Concept Note was also endorsed and supported by the 21st ASEAN Sectoral Working Group on Fisheries in June 2013 and subsequently, by the ASEAN Special Senior Officials Meeting in August 2013.

After such endorsements, the SEAFDEC Secretariat in collaboration with MFRDMD conducted an experts' group meeting in October 2014 and came up with the first draft ASEAN Catch Documentation System/Scheme. This was followed by the Regional Technical Consultation organized by SEAFDEC in December 2014 to come up with the 2nd draft of the ASEAN CDS. This draft was discussed at the 47th Meeting of the Council of SEAFDEC in April 2015 after which their comments were accommodated into the 3rd draft of the ACDS which was discussed during an Experts Meeting in May 2015. This resulted in the final Draft of the ACDS as well as the Info-graphic on the Usage of the ACDS in Various Scenarios of Catch Flows of Fish and Fishery Products into the ASEAN Region (SEAFDEC/MFRDMD, 2013).

The ASEAN Catch Documentation Scheme

The ACDS is intended to provide a unified framework that will enhance traceability of fish and fishery products for effective marine fisheries management in the AMSs; enhance the credibility of fish and fishery products for intra-regional and international trade; and prevent entry of fish and fishery products from IUU fishing activities into the supply chain of the AMSs. It is envisioned that at the initial stage, the ACDS shall be voluntary for all AMSs but could be made mandatory later.

Scope of the ACDS

As mentioned above, the ACDS is being established to improve the traceability of marine capture fisheries in the AMSs and enhance intra-regional and international trade of fish and fishery products in the AMSs. However, while the ACDS shall apply to most fishery products, it would not be applied for products shown in **Box 3**. Generally, the ACDS applies to trade of marine fish and fishery products, processed or not, originating from AMSs flagged fishing vessels. For transshipment, landings of domestic products, exports, imports, and re-exports, under jurisdiction of AMS, a catch certificate and details of transshipment shall accompany all catches. There is no waiver of this requirement. The ACDS will cover catch from small fishing vessels (which meet the criteria) that can contribute to trade among the AMSs, although a simplified catch document would be applied accordingly. The ACDS does not cover the export/import of fish parts other than the meat, including head, eyes, roe, gut, fin, skin, and tail, with the exception of sharks' fin. This ACDS is meant for intra-regional trade demonstrating AMSs' commitment to combat IUU fishing. A subsequent phase could be developed later for all fish and fishery products coming from outside the region.

Box 3. Products not subjected to the ACDS

- Freshwater fish and fishery products
- Aquaculture products obtained from fry or larvae
- Ornamental fish
- Oysters, live
- Scallops including queen scallops, of the genus Pecten, Chlamys or Placopecten, live, fresh or chilled
- Coquilles St. Jacques (*Pecten maximus*), frozen
- Other scallops, fresh or chilled
- Mussels
- Snails, others than those obtained from the sea
- Prepared and preserved mollusks
- Corals
- CITES-listed species

Main Provisions of the ACDS

The ACDS covers the export of fish and fishery products from AMSs' flagged fishing vessels operating within their EEZs or that of other AMSs, and re-exportation of imported fish and fishery products from AMSs as well as non-AMSs. The catch flow and movement of ACDS is shown in **Fig. 1**.

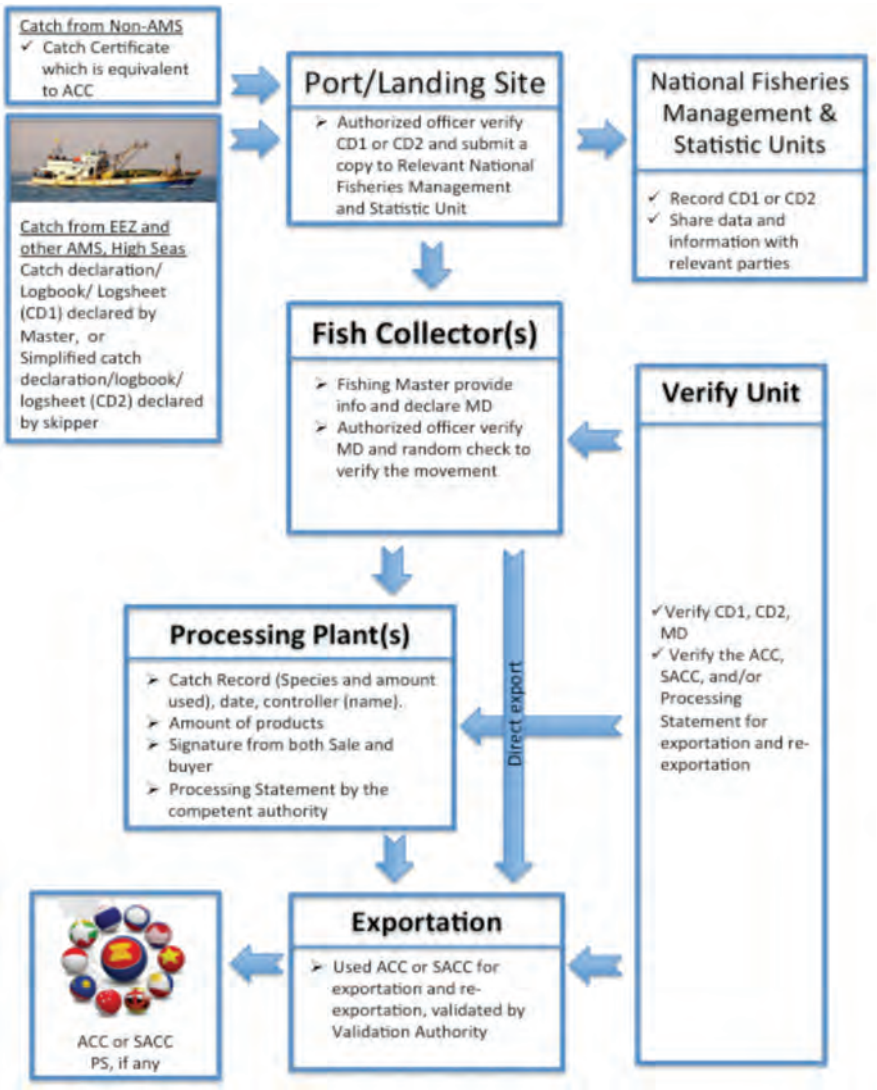

Fig. 1. Catch flow and movement of the ACDS

The documentation required for the ACDS of commercial marine capture fisheries and small-scale fisheries whose fish and fishery products are involved in the international market, is similar but the documents had been simplified for implementation by small-scale fishers before landing. To support not only intra-regional but also international trade of fish and fishery products in the future, the ACDS documents had therefore been designed considering the documents under the EC Regulation 1005/2008. Thus, the ACDS documentation consists of four key documents as shown in **Box 4**.

Some provisions on ACDS documents suggest that all exportation and re-exportation of fish and fishery products, processed or not, caught by AMSs' flagged fishing vessels within their EEZs or that of other AMSs, shall be accompanied by relevant ACDS documents. In addition, the relevant ACDS documents shall be validated by competent authorities of the flag State from which the fish and fishery products have been obtained. The ACDS shall be used to certify that such catches have been made in accordance with applicable national laws and regulations.

Usage of ACDS in Various Scenarios of Fish Trade

To support the implementation of the ACDS, and for better understanding of the usage of ACDS documents, trade of fish and fishery products within the ASEAN region are defined into 18 patterns/scenarios as shown in **Fig. 6-23** and summarized in **Box 5**.

Recommendations from Stakeholders

The Stakeholders Consultation on Regional Cooperation in Sustainable Fisheries Development Towards the ASEAN Economic Community: Combating IUU Fishing and Enhancing the Competitiveness of ASEAN Fish and Fishery Products organized by SEAFDEC in Bangkok, Thailand in March 2016 (SEAFDEC, 2016) considered the requirements of major markets, *e.g.* EU and US, as well as intra-regional markets, for traceability of products from capture fisheries and preventing entry of products from IUU fishing into the supply chain. Stakeholders attending the Consultation suggested that SEAFDEC could consider undertaking some actions with regards to the ACDS (**Box 6**).

CATCH DECLARATION/LOGBOOK/LOGSHEET (CD1)

1. Unique Serial Number		2. Reference Number		
3. Validation Authority: (Agency Name)				
(a) Address	(b) E-mail Address		(c)Tel.	(d) Fax
4. Fishing Vessel Name:	5. Flag-Home Port	6. Registration Number	7. Call Sign:	8. IMO/Lloyd's Number: (If issued
9. Fishing License No. Valid to:	10. Vessel Contract No. Inmarsat No., Fax No., Telephone No., E-mail address (if issued):			
11. Type of Processing On Board:				
12.Description of Product				
(a) Species	(b) Product Code	(c) Catch Area(s) & Dates	(d) Estimated Live Weight (kg)	(e) Verified Weight Landed (kg) where appropriate
13. Name of Master of Fishing Vessel – Signature – Seal:				
14. Declaration of Transshipment At Sea				
(a) Name of Master of Fishing Vessel/ Captain/Representative:		(b) Signature and Date	(c) Transshipment Date/Area/Position	(d). Estimated Weight (kg)
(e) Name of Master of Receiving Vessel/Carrier	(f) Signature	(g) Vessel Name	(h) Registration Number	(j) IMO/Lloyd's Number (If issued)
15. Flag State Authority Validation:				
(a) Name/Title		(b) Signature	(c)Date	(d) Seal (stamp)

Fig. 2. Catch Declaration/logbook/logsheet (CD1)

MOVEMENT DOCUMENT (MD1)

(OPTIONAL DOCUMENT)

1. Unique Serial Number	2. Reference Number: CD1/XXXXX		
3. Validation Authority: (Agency name)			
(a) Address	(b) E-mail address	(c) Tel.	(d) Fax
4. Fishing Vessel Name	5. Registration Number	6. Fishing License No. Valid Until:	
7. Date of Landing/unloading:	8. Landing Place/Name:		
9. Description of Product			
(a) Product by species	(b) Product Code	(c) Estimated Live Weight (kg/MT)	(d) Total Weight (kg/MT)
10. Purchasing documents			
(a) Name of Buyer:	(b) Registration No. :	(c) Address:	(d) Phone No. :
(e) Catch by Species	(f) Total Weight (kg/MT)	(g) Sold by:	(h) Buyer's signature:
11. Processing Plant			
(a) Processing Plant Name:	(b) Registration No. :	(c) Address:	(d) Phone No. :
(e) Catch by Species:	(f) Date of Processing:	(g) Total Weight Used:	(h) Remaining Fish:	(j) Name of Controller:
12. Flag State Authority Verification:			
(a) Name/Title	(b) Signature	(c) Date	(d) Seal (stamp)

Fig. 3. Movement Document (MD1)

ASEAN CATCH CERTIFICATE (ACC)

FOR EXPORTATION

1. Unique Serial Number:		2. Reference Number: MD1/XXXXX or CD1/XXXX			
3. Validating Authority: (Agency Name)					
(a) Address:	(b) E-mail Address		(c) Tel.		(d) Fax
4. Fishing Vessel Name	5. Flag-Home Port	6. Registration Number	7. Call Sign		8. IMO/Lloyd's Number (If Issued)
9. Fishing License No. Valid to:	10. Vessel contract no. Inmarsat No., Fax No., telephone No., E-mail address (if issued)				
11. Type of Processing On Board					
12. Description of Exported Product					
(a) Species	(b) Product Code	(c) Catch Area(s) and Dates	(d) Estimated Live Weight (kg)	(e) Verified Weight Landed (kg) where appropriate	
13. Name and Address of Exporter:			Signature	Date	Seal
14. Name/Title of Competent Authority Validation:			Signature	Date	Seal
15. Transport Details (**Appendix 1**)					
16. Importer Declaration					
Name and Address of Importer		Signature	Date	Seal	Product Code
17. Import Control - Authority	Place	Importation Authorized (*)	Importation Suspended(*)	Verification Requested – Date	
18. Customs Declaration (If issued)		Number	Date	Place	
(*) Tick as appropriate					

Fig. 4. ASEAN Catch Certificate (ACC)

Processing Statement (PS)

(for imported fish through processing before re-exportation)

I confirm that the processed fishery products: (product description and Combined Nomenclature code) have been obtained from catches accompanied by the following information:

ACC Unique Serial Number	Vessel name(s) and flag(s)	Validation date(s)	Catch description	Total landed weight (kg)	Catch processed (kg)	Processed fishery product (kg)

Name and address of the processing plant_____

Name and address of the exporter (if different from the processing plant)

_____

_____

Approval number of the processing plant _____

Health certificate number and date_____

Responsible person of the processing plant:	Signature:	Date:	Place:

Endorsement by the competent authority:_____

Official:	Signature and seal:	Date:	Place:

Fig. 5. Processing Statement (PS)

Box 4. Four key documents in the ACDS

1. **Catch Declaration/Logbook/Logsheet (CD1)**
   - Catch and information in the catch declaration or logbook/logsheet (**Fig. 2**) shall be declared by captain/fishing master/skipper and reported to the competent authority at fishing ports/landing sites
   - Competent authorities shall verify the catch declaration/logbook/logsheet submitted by captain/fishing master/skipper
   - Competent authorities shall submit a copy of catch declaration/logbook/logsheet to the relevant national fisheries management and statistics units
2. **Movement Document (MD1)**
   - Captain/fishing master/skipper/owner of fishing vessel and/or representative shall provide inputs in MD1 (**Fig. 3**)
   - Competent authorities shall verify information in the MD1
   - Any transfer of ownership of the fish and fishery products must be verified
   - Competent authorities shall conduct random check to verify information in the movement document
   - Fish processing units shall maintain proper stock records keeping for verification by competent authorities
3. **ASEAN Catch Certificate for Exportation and Re-exportation of Fish and Fishery Products from AMS (ACC)**
   - Export and re-export of fish and fishery products under ACDS shall be authorized through the issuance of ASEAN Catch Certificate (ACC) for Exportation of Fish and Fishery Products (**Fig. 4**) by the competent authorities of the AMSs from which the exportation or re-exportation takes place
4. **Processing Statement (PS)**
   - Competent authorities shall issue Processing Statement (**Fig. 5**) for exporting of processed fish and fishery products.

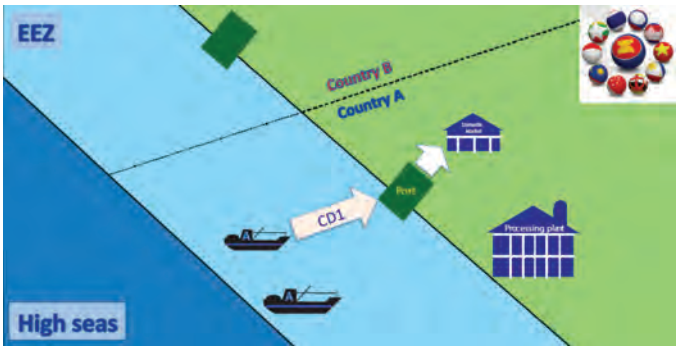

Fig. 6. Catch from flag State vessel-operated in the EEZ for the domestic market

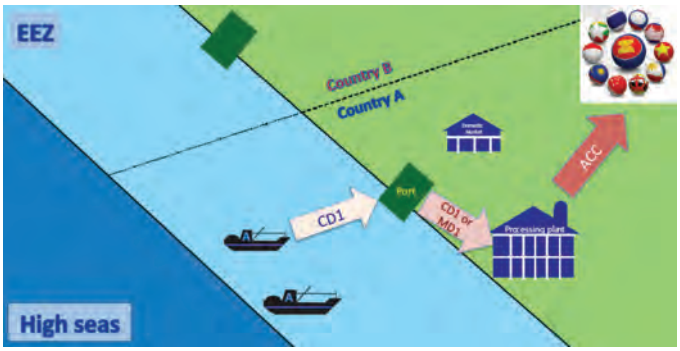

Fig. 7. Catch from flag State vessel-operated in the EEZ - are processed for export to other AMSs

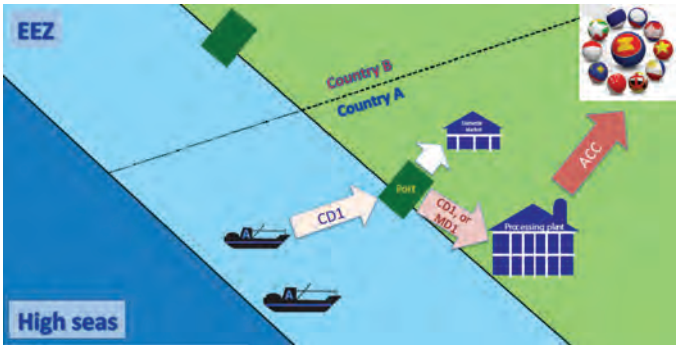

Fig. 8. Catch from flag State vessel-operated in the EEZ, are sent to domestic market, and some are processed for export to other AMSs

Fig. 9. Catch from flag State vessels-operated in the EEZ, are sent to domestic market and some are processed for export to other AMSs

Fig. 10. Catch from flag State vessels-operated in the EEZ, send to more than one processing plants separately, for export to other AMSs

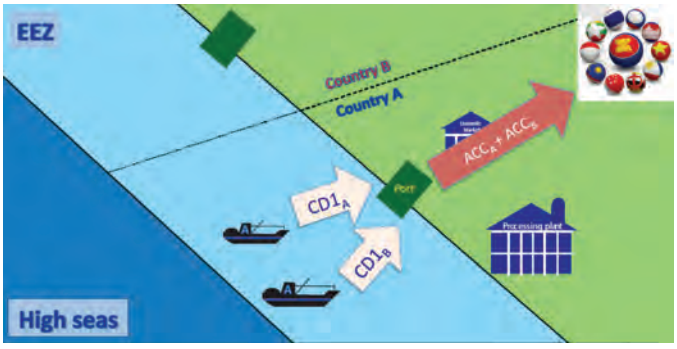

Fig. 11. Catch from flag State vessels-operated in the EEZ, are directly exported to other AMSs or non-AMS

Fig. 12. Catch from flag State B vessels-operated in their EEZ, are landed at port State A for direct re-exportation

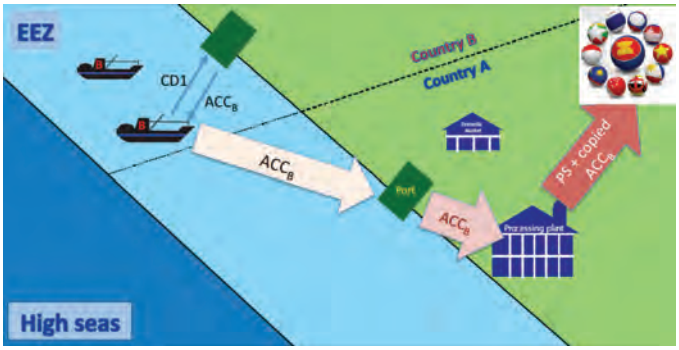

Fig. 13. Catch from AMS flag State B vessels-operated in their EEZ, are landed at port State A for processing and exportation to other AMS

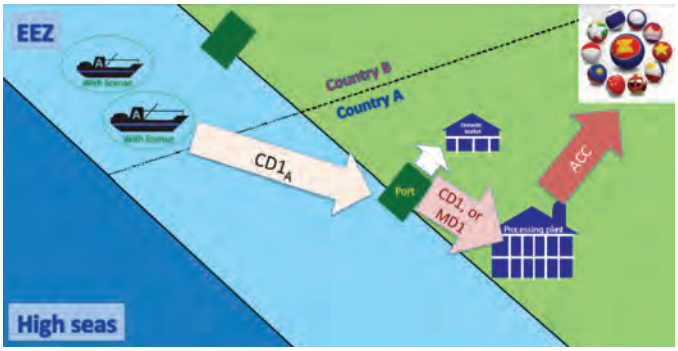

Fig. 14. Catch from flag State A vessels-operated in other AMS B with licenses/agreement, landed in home port

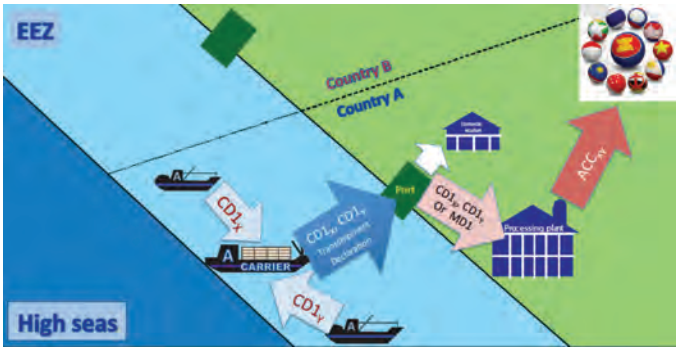

Fig. 15. Catch from flag State are transshipped at sea to carrier and landed in home port for processing before exportation

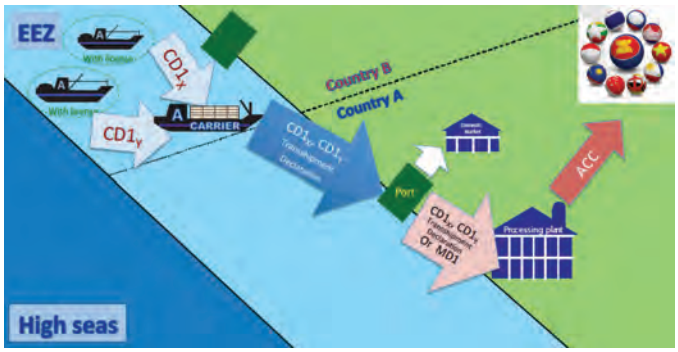

Fig. 16. Transship by flag State carrier-operated in other ASEAN coastal state under the licenses/agreement and landed in home port

Fig. 17. Catch from AMS B send by land or across the border of AMS A to processing plant(s) before re-export to AMSs or non-AMSs

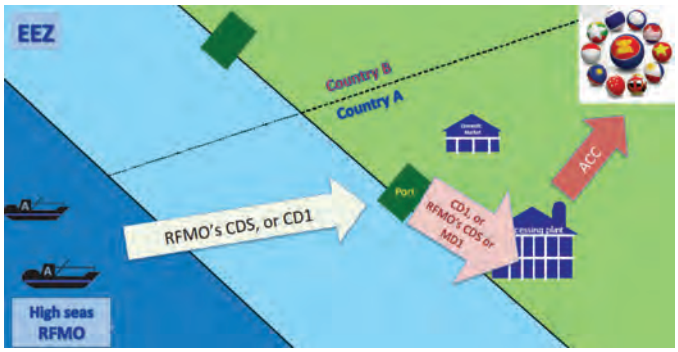

Fig. 18. Catch from flag State vessels-operated in the RFMOs area of competent or high seas are processed before exportation

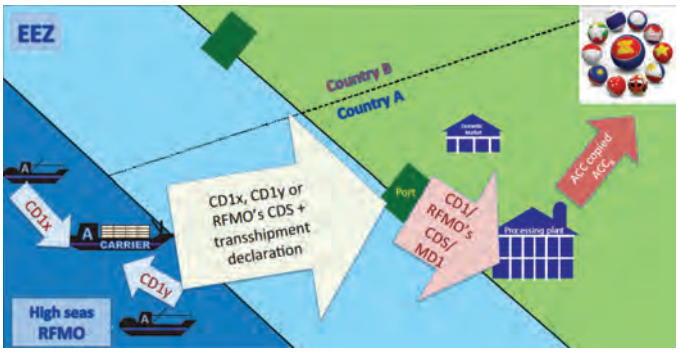

Fig. 19. Catch from flag State vessels-operated in the RFMOs area or high seas are transshipped to land at home port for processing before exportation to other AMSs

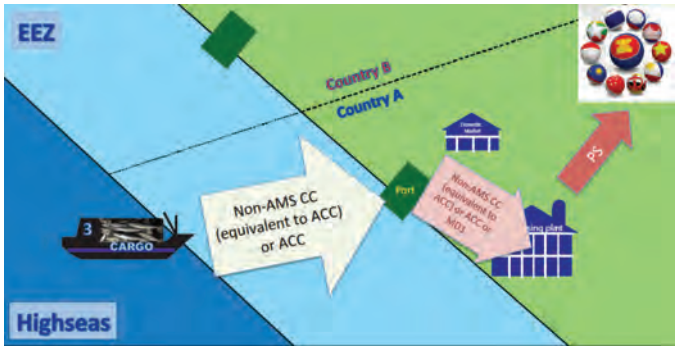

Fig. 20. Imported catch from non-AMS are sent to processing plant before re-exporting to other AMSs or non-AMS

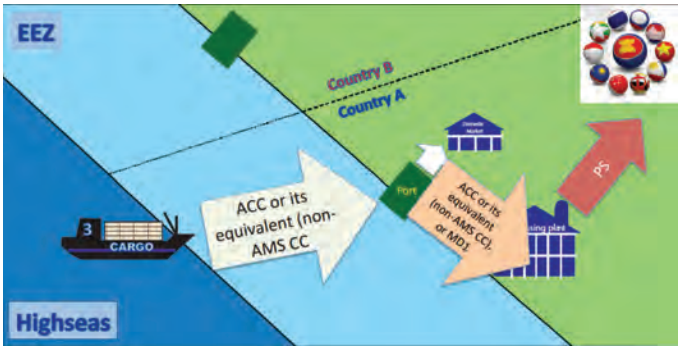

Fig. 21. Fish from non-AMS processed through the domestic market and processing plant before re-exporting to other AMSs or non-AMS

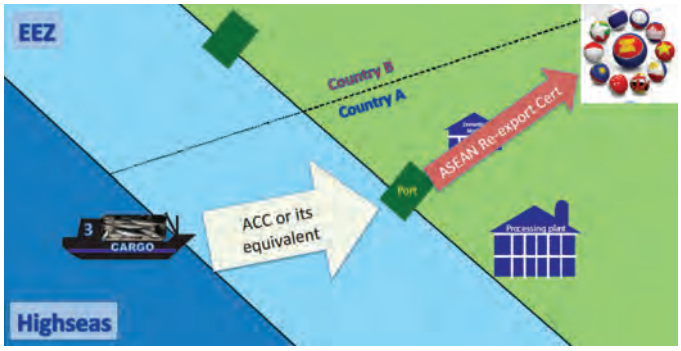

Fig. 22. Import of processed fish from AMS or non-AMS through processing plant before re-exporting to other AMSs or non-AMS

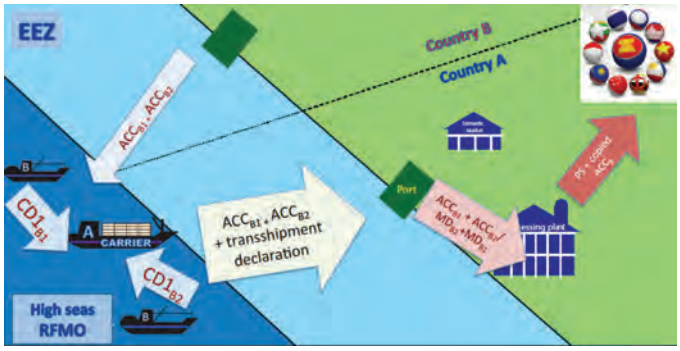

Fig. 23. Catch from AMS flag State B vessels, transshipped to carrier A in high seas then carrier A lands catch in the country for processing before re-exportation to other AMS or non-AMS

Box 5. Patterns/scenarios of trade of fish and fishery products within the ASEAN region

1. Catch from flag State vessel-operated in the EEZ for the domestic market
2. Catch from flag State vessel-operated in the EEZ - are processed for export to other AMSs
3. Catch from flag State vessel-operated in the EEZ, are sent to domestic market, and some are processed for export to other AMSs
4. Catch from flag State vessels-operated in the EEZ, are sent to domestic market and some are processed for export to other AMSs
5. Catch from flag State vessels-operated in the EEZ, send to more than one processing plants separately, for export to other AMSs
6. Catch from flag State vessels-operated in the EEZ, are directly exported to other AMSs or non-AMS
7. Catch from flag State B vessels-operated in their EEZ, are landed at port State A for direct re-exportation
8. Catch from AMS flag State B vessels-operated in their EEZ, are landed at port State A for processing and exportation to other AMS
9. Catch from flag State A vessels-operated in other AMS B with licenses/agreement, landed in home port
10. Catch from flag State are transshipped at sea to carrier and landed in home port for processing before exportation
11. Transship by flag State carrier-operated in other ASEAN coastal state under the licenses/agreement and landed in home port
12. Catch from AMS B send by land or across the border of AMS A to processing plant(s) before re-export to AMSs or non-AMSs
13. Catch from flag State vessels-operated in the RFMOs area of competent or high seas are processed before exportation
14. Catch from flag State vessels-operated in the RFMOs area or high seas are transshipped to land at home port for processing before exportation to other AMSs
15. Imported catch from non-AMS are sent to processing plant before re-exporting to other AMSs or non-AMS
16. Fish from non-AMS processed through the domestic market and processing plant before re-exporting to other AMSs or non-AMS
17. Import of processed fish from AMS or non-AMS through processing plant before re-exporting to other AMSs or non-AMS
18. Catch from AMS flag State B vessels, transshipped to carrier A in high seas then carrier A lands catch in the country for processing before re-exportation to other AMS or non-AMS

Box 6. Suggestions made during the March 2016 Stakeholders Consultation on Regional Cooperation in Sustainable Fisheries Development Towards the ASEAN Economic Community: Combating IUU Fishing and Enhancing the Competitiveness of ASEAN Fish and Fishery Products

- Developing comprehensive measures by AMSs to prevent the entry of products from IUU fishing into the supply chain
- Promoting the adoption and implementation of "ASEAN Catch Documentation Scheme (ACDS)" to enhance traceability of fish and fishery products, enhancing understanding and capacity of stakeholders on the implementation of the system (especially small-scale fishers), and development of electronic system to support the implementation of ACDS; and enhancing the acceptability of ACDS by major importing markets.
- Ensuring that ACDS once endorsed by AMSs would not create unnecessary burden, cost or lengthy process for importers/exporters, *e.g.* combined forms, harmonize international requirements with market requirement of respective countries
- Undertaking information, education and communication campaign, and capacity building programs to enhance the implementation of required actions

Way Forward

Considering that the ACDS would be used as basis for promoting intra-regional trade by the AMSs, the SEAFDEC Council of Directors during its 48th Meeting in Viet Nam in April 2016 (SEAFDEC, 2016) suggested that the ACDS should be in line with the systems that are already being implemented by the AMSs since the ACDS would also be used to improve national traceability of fish and fishery products. As a part of ACDS, an electronic catch documentation system would be developed to reduce the burden of the AMSs in the implementation of the ACDS. In this connection, SEAFDEC with support from Government of Japan and Government of Sweden would continue working with its partners, *e.g.* USAID-Oceans and Fisheries Partnerships, and the Swedish Agency for Marine and Water Management (SwAM), from 2016 onwards. The SEAFDEC Council also agreed to pilot-test the ACDS as well as the e-system in Brunei Darussalam. Pilot testing would be expanded to specific fisheries such as neritic tuna fisheries, blue-swimming crab fisheries, among others, to cover not only commercial-scale but also small-scale fisheries involved in international trade. Results from pilot testing experiments would be disseminated regional-wide to improve the traceability of all marine capture fisheries in the Southeast Asian region.

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Securing the Niche of ASEAN Fishery Products in the Global Market: Traceability System for ASEAN Aquaculture Products

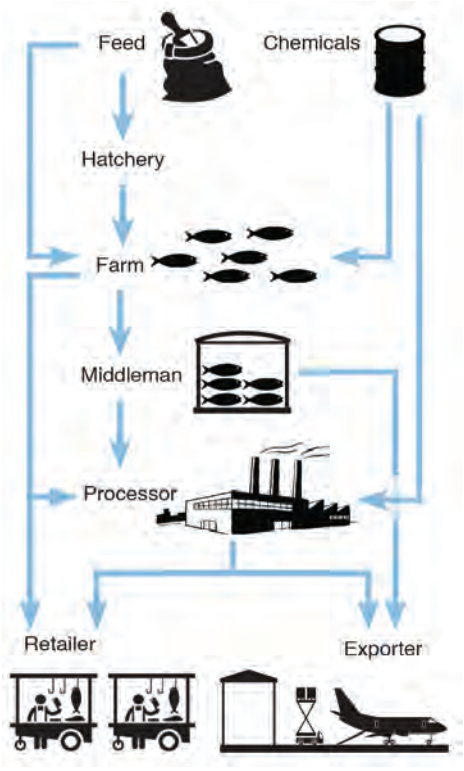
Yeap Soon Eong

The Codex Alimentarius Commission defines traceability or product tracing as "the ability to follow the movement of a food through specified stage(s) of production, processing and distribution". In an increasingly complex food system, traceability has become the major tool to deal with issues/problems associated with food safety and quality assurance, thus allowing business to prevent risk and gain consumer trust. Meanwhile, the strengthened ties between countries across the globe encourage and facilitate bilateral trade, and it is not uncommon for food to travel thousands of miles to reach a market. In food trade, records of traceability are used as proof of compliance to food safety, bio-security and regulatory requirements, and ensure that quality and other contractual requirements are fulfilled. Thus, it is imperative that traceability of food products should be strengthened to support food safety worldwide. In a situation of a food recall, robust traceability systems allow efficient tracing of affected products throughout the supply chain. Traceability has also been used in the aquaculture supply chain to ensure the safety and quality of aquatic organisms, and to verify that such organisms are farmed in compliance with national or international management requirements or meet national security and public safety objectives. In order to enhance the competitiveness of the Southeast Asian region's fish and fishery products, as well as facilitate trade with major importing countries, *e.g.* the United States of America, the European Union as well as Japan, traceability has become a vital tool and requirement for necessary market penetration and securing the niche of the region's fish and fishery products in the world market.

Many ASEAN Member States (AMSs) export significant volumes of aquaculture fish and fishery products to regional and global markets annually. As traceability becomes a trade requirement for eligibility to export aquaculture products to major markets, such as Japan, the European Union (EU) and the United States of America (USA), establishing reliable traceability system is crucial for the sustainable development of the aquaculture industry in the AMSs. Tapping the demand for aquaculture fish in the global market requires that aquaculture companies in the AMSs comply with the stringent export requirements imposed by the international market. Thus, governments and organizations around the world have developed various systems of seafood traceability, *e.g.* TraceFish (EU), TraceShrimp (Thailand).

Meanwhile, the USA through a Presidential Memorandum in June 2014 established the Presidential Task Force on Combating Illegal, Unreported, and Unregulated (IUU) Fishing and Seafood Fraud (Task Force) which includes recommendations for combating IUU fishing and seafood fraud throughout the seafood supply chain. The Task Force also promoted the actions to address the issues through additional traceability requirements that include establishing an integrated risk-based traceability program that tracks the path of seafood products from harvest or production to entry into the US market (NOAA Fisheries, 2016). In an effort to address such requirements, many countries in the ASEAN region which are major seafood exporters, *e.g.* Malaysia (shrimp), Thailand (shrimps), Viet Nam (catfish and shrimp), have developed and implemented their respective traceability systems for their aquaculture products.

In addition to the stringent regulatory requirements imposed by international markets, the greatest pressure for businesses to implement traceability systems for aquaculture products comes from the general public. A new generation of educated consumers with high level of awareness drives a growing market demand for food safety, security and sustainability for aquaculture products. Consumers are getting more and more cautious over what they eat – whether the food comes from a safe and sustainable source, and whether production, transportation, and storage conditions can ensure food safety and quality.



Supply chain flowchart of aquaculture products

Recognizing such concerns, the ASEAN-SEAFDEC Member Countries adopted in 2011 the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 (SEAFDEC, 2011). Specifically, Resolution No. 19 stipulates that the ASEAN-SEAFDEC Member Countries should "*Support the competitiveness of the ASEAN fish trade through the development of procedures and programs that would certify, validate or otherwise indicate the origin of fish to reflect the need for traceability, sustainable fishing practices and food safety, in accordance with international and national requirements*."

Moreover, Plan of Action No. 40 specifies that the concerned countries should "*Develop and implement ASEAN guidelines for environment-friendly and responsible aquaculture and good aquaculture practices that cover: (i) the integration of quality and safety management systems for products with significant trade potential; (ii) the harmonization for chemical use and food safety in aquaculture; (iii) the development of product traceability systems from farm to market; and (iv) harmonization of the quarantine and inspection/sampling procedure and Sanitary and Phytosanitary (SPS) measures for aquaculture products to secure food safety*;" Plan of Action No. 60 indicates that the countries should "*Develop traceability systems, with mechanisms as needed to certify or validate the information, for the whole supply chain, and establish regulations and enforcement schemes in line with international standards. Align Member Countries' inspection systems and incorporate strengthened port inspections in the process as a means to improve inspection systems*;" and Plan of Action No. 68 encourages the countries to "*Establish regional/ASEAN standards applicable for fishery and aquaculture products that are in line with international requirements and applicable to the region. Harmonize standards, technical regulations and conformity assessment procedures as inputs for the establishment of the ASEAN Policy Guidelines on Standards and Conformance, to increase the competitiveness of fishery products on regional and international markets*."

Guided by such stipulations, the AMSs had initiated their respective quality, safety and control management systems to be able to expand their fish trade and enhance competitiveness of fish and fishery products for regional and international trade. More particularly, the AMSs also heeded the recommendation on the need to improve traceability methodology and capacity to deal with new emerging export requirements (SEAFDEC/MFRD, 2011). As a result, government agencies and industries in the AMSs have to ensure food safety and quality of their fish products (including aquaculture products) by providing additional information, *i.e.* source, harvest/production including processing, and distribution to the supply chain up to the consumers (Wongchinda, 2011).

In an effort to assist the AMSs in developing and implementing traceability systems in aquaculture production and the supply chain, SEAFDEC through its Singapore-based Marine Fisheries Research Department (MFRD) implemented the Project on Traceability Systems for Aquaculture Products in the ASEAN region from 2010 to 2014. Supported by the Japanese Trust Fund and carried out by the Post-Harvest Technology Centre of the Agri-Food and Veterinary Authority of Singapore as the Collaborating Center of MFRD programmes, the Project aimed to provide a platform for sharing of information and experiences among the AMSs on implementation of traceability systems for aquaculture products in the region; and to enhance regional capability on implementation of traceability systems for aquaculture products and promote their implementation in the region.

Throughout its duration, the Project was able to collate and compile information that were used as inputs for the Technical Compilation on Traceability Systems for Aquaculture

The Technical Compilation and Regional Guidelines on Traceability System for Aquaculture Products in the ASEAN Region

Products in the ASEAN Region, and the Regional Guidelines on Traceability Systems for Aquaculture Products in Southeast Asia published in 2016 (SEAFDEC, 2016). The Technical Compilation includes the AMSs country reports on the status of implementation of traceability for aquaculture products, the difficulties encountered by the AMSs in the implementation of traceability systems, and the benefits of implementing such systems. Developed through consensus of and in accordance with the collective inputs and efforts of the AMSs, the Regional Guidelines would serve as useful resource and common reference for the AMSs in the implementation of traceability systems for aquaculture products and in the future formulation and development of national programs and activities promoting traceability.

National Initiatives

The status of traceability system development and implementation for aquaculture products differs among the AMSs. Countries which are major exporters of fish and fishery products have implemented traceability systems for their aquaculture products, such as Malaysia (shrimp), Thailand (shrimps) and Viet Nam (catfish and shrimp). However, with increasing requirements for traceability in the international markets, it has become necessary for all AMSs to implement traceability systems in their aquaculture industry to comply with the regulations and requirements of importing countries. Moreover, countries that have already put to practice traceability systems that allow their aquaculture products to be exported to the EU or USA, also established certain degree of legal frameworks as well as computerized/ electronic traceability systems to track aquaculture products from farm to fork. Other countries that are still in the process of implementing traceability systems have been enhancing their capabilities by building up their respective legal frameworks for traceability implementation and introducing such traceability systems to the aquaculture industry through government support such as regulatory requirements, education and training.

Brunei Darussalam

The three private companies in Brunei Darussalam engaged in blue shrimp (*Litopenaeus stylirostris*) aquaculture have implemented traceability in their operations. Under the guidance of these companies, shrimp farmers maintain records of their aquaculture operations, *i.e.* date of stocking, feeding and harvest. The country has been a sole supplier of blue shrimp fry for culture by shrimp farmers of the private companies. The harvest is sold to local shrimp buyers for the domestic market or to a processing company. One of the country's private companies, Golden Corp is the first to breed organic blue shrimp in the country (Business Times, November 2014). Its total production contributed to the country's total blue shrimp production of 6,000 metric tons in 2014 and the company's aquaculture of the blue shrimp has been accredited by ECOCERT, an organic inspection and certification body of France (Borneo Bulletin, January 2015) and a leading certifier of fair trade food based on its Fair Trade Standards. Currently, the country's blue shrimps are exported to Australia, China, Japan, and USA.

Cambodia

Although aquaculture production of Cambodia is only for domestic consumption, the Fisheries Administration (FiA) ensures that the country's aquaculture products comply with safety and quality requirements. Such requirements had been established by FiA through the issuance of the Aquaculture Technical Guidelines and a technical manual on Good Aquaculture Practices (GAqP) which include elements of product traceability. In order that the requirements are understood by stakeholders, FiA provided training sessions on GAqP to fish farmers and model farms have been selected for GAqP certification. However, FiA also noted that the implementation of GAqP entails a high cost for the fish farmers to comply with and that some farmers are having difficulties in obtaining better price for their products.

Indonesia

The traceability system for aquaculture products in Indonesia is being piloted in three provinces, namely: Lampung, East Java and South Sulawesi, and is expected to be gradually implemented in 2016. Indonesia recognizes the need to encourage stakeholders to be involved in the implementation of the established traceability system. The Directorate General of Aquaculture (DGA) of the Ministry of Marine Affairs and Fisheries as the competent authority for aquaculture had conducted a number of training workshops, socialization programs and activities to build the stakeholders' awareness on traceability to support the implementation of the traceability system in Indonesia. In the process, the DGA has initiated data/information gathering systems for internal record keeping of hatcheries, fish farms, processing plants, and feed mills as well as establishing farmers' identification to support the traceability implementation. The DGA however, suggested that a strong legislation is needed to ensure the system could be carried out successfully. Currently, Indonesia is developing such a government regulation to ensure the implementation of the traceability system that can help improve aquaculture products' traceability.

Lao PDR

Presently, traceability for aquaculture products had yet to be implemented in Lao PDR. Nevertheless, the country has developed document inspection for import, export and transit of commodities, as well as inspection of seafood at the International Checkpoint before this enters into Lao PDR.

Malaysia

Malaysia's Aquaculture Product Traceability System has been developed to support the aquaculture shrimp industry and enable the country to export shrimps to the USA and EU. Developed in 2011 and fully established in 2012, the

system is mainly aimed at ensuring the origin and food safety of aquaculture products. Currently, the country's traceability system for aquaculture products is paper-based but an electronic system is being developed. Malaysia has also implemented another Live Fish Traceability System for ornamental fish to make sure that its ornamental fishes are healthy and spread of fish diseases is minimized or prevented.

Myanmar

Myanmar is in the process of implementing traceability systems in all supply chains for aquaculture products. The Department of Fisheries (DOF) of Myanmar has already initiated Good Aquaculture Practices (GAqP) for fish and shrimp farming since 2011. Recently, the DOF has issued GAqP certificates for about 1550 ha of fish, shrimp and soft-shelled crab farming. DOF also conducts training on GAqP for fish inspectors, extension aquaculture officers, fish farmers, and other stakeholders in the aquaculture supply chain.

Philippines

Traceability for aquaculture products in the Philippines is being implemented under the purview of the Bureau of Fisheries and Aquatic Resources (BFAR) as the competent authority for aquaculture and fishery products. As such, BFAR has been implementing programs and activities that aim to enhance and strengthen the implementation of the country's traceability systems. Specifically, BFAR Administrative Circular Order No. 251 of 2014 on traceability system for fish and fishery products provides the requirements on documentation for traceability for wild caught, farmed fish and other aquatic products. The Circular applies to all fishery and aquaculture business operators directly or indirectly involved in production and processing of fishery and aquatic products for export. As indicated in such Circular, the aquaculture supply chain is divided into three main sections, namely: i) pre-production (hatchery/nursery, feed mill/ aquatic veterinary products); ii) production (grow-out farm); and iii) post-harvest (auction market, transport, processing establishment, cold storage, shipment). Each stage in these main sections of the supply chain requires documentation system for traceability. For large operators, there is an internal traceability system for the stages of the supply chain, such as within hatcheries, farms, processing plants, and feed mills. However, external traceability linking all parts of the supply chain has yet to be strengthened, considering that small-scale aquaculture operators and the auction markets mostly have minimal records for traceability. Furthermore, the Code of Good Aquaculture Practice (GAqP) developed by BFAR that focuses on food safety, animal health and traceability, has also been approved and adopted as a Philippine National Standard by the Bureau of Agriculture and Fisheries Standard (BAFS, 2014). As prescribed in RA 10654, ammendment to the Philippine Fisheries Code of 1988, aquafarmers are required to implement the GAqP to minimize the risks associated with aquaculture production.

Singapore

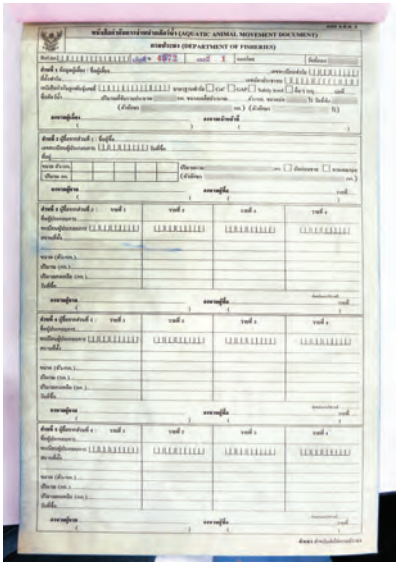
The Agri-Food & Veterinary Authority of Singapore (AVA) is the national authority responsible for aquaculture development in Singapore and licensing of all marine food fish farms and land-based farms in Singapore. At farm level, AVA leverages on the Good Aquaculture Practice for Fish Farming (GAP-FF) scheme for the traceability of aquaculture products. The GAP-FF scheme which was launched in August 2014 is a voluntary scheme which consists of a set of consolidated practices or Code of Practices (COP) formulated by AVA for on-farm safe and quality fish farming. The COP, which is based on the concept of Hazard Analysis of Critical Control Points (HACCP) and quality management principles, focuses on 6 key aspects, namely: farm structure and maintenance; farm management; farming and packaging practices; fish health management; farm environment; and human health and safety. The objective of GAP-FF scheme is to promote responsible management practices in food fish farming and at the same time the guidelines for GAP-FF provide the basis and framework for farms to implement some elements of traceability in their farm products. Under the GAP-FF's COP guidelines, farms are required to document all farming activities such as fish species, culture/stocking period, stocking size and density, source of stock, feeding regime, and seasonal stocking trends. Farms certified under this scheme must stock fish from known origin *i.e.* from hatchery source for traceability purposes. Records and invoices of incoming fish stocks are to be kept for verification and audit purposes. There must be proper documentation of fish stocks in the various net cages and records of fish movement between net cages must be tracked and updated. GAP-FF certified farms are encouraged to use dry formulated pellet feeds which can be traced to source.

Other than farm feeding records, the farms are also expected to have in place records for farm environment monitoring, health and disease treatment and fish mortality. Prophylactic measures and disease treatment regime must be documented as part of health management records. In addition, certified farms are required to maintain and update farm Standard Operating Procedures (SOPs), instruction manuals, laboratory tests, log records and other information required under GAP-FF certification. GAP-FF is a positive step forward in the implementation of traceability in the Singapore aquaculture industry. Only GAP-FF certified farms are allowed to use the GAP-FF logo when marketing their farm products. AVA conducts yearly audit checks on the GAP-FF certified farms and certification is renewed annually after the audit checks. Currently, 4 farms have been certified with the GAP-FF scheme and more farms have expressed interest in joining the scheme. Moreover, in response to changes in consumers' preference, some local farms are value-adding their aquaculture products. Harvested fish are sent to AVA-licensed fish establishments/processors for further processing into fillets before being sold to retailers such as supermarkets.

AVA-licensed fish establishments/processors are GMP/HACCP certified and under the licensing conditions, these establishments are required to keep proper documented records of all their incoming raw materials as well as all outgoing finished products. This traceability system enables the manufacturer or distributor to promptly remove any unsafe products along the food supply chain in order to safeguard public health.

Thailand

Thailand has implemented traceability system for its aquaculture shrimp since 2002 as one of the main export products of the country's fisheries industry. From a manual paper-based system known as Fry Movement Document (FMD) and Movement Document (MD), the Department of Fisheries (DOF) of Thailand with assistance from the French Government developed a computerized traceability system in 2005 known as TraceShrimp. This system aims to provide a reliable traceability management tool not only for the country's stakeholders in the aquaculture shrimp production and supply chain but also for their local and foreign buyers. TraceShrimp is a voluntary scheme managed by the DOF and requires membership by the Thai stakeholders. TraceShrimp member can give access to its local and foreign buyers all information/data on a given lot or consignment of shrimps identified by means of lot number, invoice number, delivery bill number, client/buyer name or operation date through the TraceShrimp website. Any consignment or lot of shrimps can be traced back all the way to the origin of broodstocks.



Aquatic Animal Movement Document Form applied by the DOF Thailand

Viet Nam

In Viet Nam the aquaculture product supply chain is managed by three agencies. The stage from stocking to harvest is managed by the Directorate of Fisheries (DoF) under the Ministry of Agriculture and Rural Development (MARD). The stage from harvest to processing is managed by the National Agro-Forestry-Fisheries Quality Control Department (NAFIQAD) also under MARD. The retail stage (sale in the market to consumers) is managed by the Ministry of Industry and Trade. Ministerial

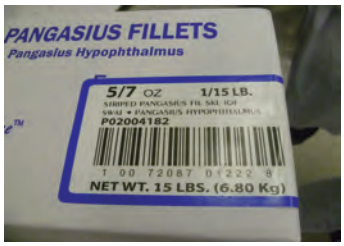
Circular No. 03/2011/TT-BNNPTNT dated 21/01/2011 – Regulation on tracing and recall of fishery products failing to meet food quality and safety requirements (also known as Circular No. 03) is the legal basis for MARD to regulate traceability for aquaculture products from farming to processing. Circular No. 03 applies to organizations and individuals involved in fisheries production and business in fisheries such as feed, chemicals, products for treatment and improvement of the environment, as well as seed nursery and rearing.

However, Circular No. 03 does not apply to households and individuals producing fisheries products for their own consumption without sale in the market, and producers of products of aquatic origin which are not used as food. Specifically, Article 5 of Circular No. 03 requires that organizations and individuals involved in fisheries production and business in fisheries shall establish traceability system meeting the following requirements:

- The system shall be under the one step back-one step forward principle to enable the identification and tracking of a product unit in specific steps of production, processing and distribution;
- The system shall be able to trace product origin through information, including the system of product identification codes (coding), stored throughout production process of the establishment;
- Information shall be stored and provided to enable identification of production lots: lots of receipt, suppliers and lots of delivery and recipients; and
- Measures should be taken up to clearly separate lots of receipt, production lots and lots of delivery to ensure accuracy of information.

Ministerial Decision No. 1503/QD-BNN-TCTS of 5 July 2011 on the National Standard on Good Aquaculture Practices in Viet Nam, which was subsequently replaced by Decision No. 3824/QD-BNN-TCTS issued on 6 September 2014, makes it compulsory for fish farmers to adopt the Vietnamese Good Agriculture Practice (VietGAP) standards in their farming process. Based on the FAO Code of Conduct for Responsible Fisheries, VietGAP for Aquaculture includes: General Principle, Technical Guideline on Aquaculture Certification (FAO, 2011), AseanGAP and other international standards (GlobalGAP and ASC, GFSI, ISO, Codex). The scope of VietGAP covers general requirements, food safety, animal health and welfare, environmental integrity, and socio-economic aspects. From 2015 onwards, *Pangasius* spp. (catfish/Tra) farming and processing are obliged to apply the VietGAP standard. Subsequently, VietGAP certification will be applied for other aquaculture species such as shrimps and tilapia.

Processing of *Pangasius* fillets and product labelling for traceability



Under the VietGAP standard, aquaculture farms shall record adequate information of the production process until harvest of each culture pond. All records must be kept for 24 months from harvest date. Therefore, all farms certified by VietGAP have adequate records that are easy to trace when required. The records related to traceability shall include:

- receipt/delivery, use, storage of products, inputs;
- handling of expired products/hazardous waste;
- movement of farmed aquatic animals and identification of locations, products with/without VietGAP application;
- seeds used;
- diary of each culture pond;
- information related to control and handling of diseases; and
- harvest, transportation including details of buyers.

As of 1 August 2015, Viet Nam catfish farmers obtained VietGAP certification for nearly 2500 ha of aquaculture water surface area. DoF/MARD has set up a website (*http://vietgap.tongcucthuysan.gov.vn/*) for VietGAP certified producers.

Issues and Concerns Confronting the Implementation of Traceability Systems

Despite the progress made by the AMSs in initiating the development and implementation as well as promote wider implementation of traceability system for aquaculture products, the industry (especially small-scale stakeholders) in the AMSs still continue to be confronted with issues and difficulties, which are summarized below.

Inadequate resources

In the AMSs, the supply chain of aquaculture products largely comprises individual small-scale stakeholders, *i.e.* hatcheries, feed mills, farmers, and middlemen, among others. These stakeholders, unlike bigger operators, usually face challenges in maintaining their product quality. Due to insufficiency of resources, it has become difficult for them to maintain relevant records of their products. The small size and limited income of small-scale stakeholders, lead to tightly run operations with limited manpower and funds. Record keeping, a key component of a traceability system, usually entails the need to hire more manpower to establish and maintain the traceability system. Hiring of manpower requires additional funds which could be insufficient for the small-scale stakeholders.

Insufficient awareness

Another issue that confronts the AMSs during the implementation of traceability system for aquaculture products is the lack of awareness and insufficient knowledge about the traceability system. The key stakeholders in the supply chain of aquaculture products are unaware about the benefits and advantages of having traceability system in their operations. Also some traditional stakeholders are averse to change and are reluctant to implement any traceability system.

Complexity of the supply chain

The supply chain of aquaculture products in the AMSs is characterized by the presence of numerous small-scale aquaculture farms with limited production capacity. This results in the need for central buying stations/collection centers or middlemen to collect aquaculture produce from various small farms. In addition, some stakeholders such as middlemen may be reluctant to share information, *e.g.* source of their raw materials, as such information oftentimes considered classified and confidential.

The presence of diverse stakeholders at each stage of the supply chain results in the mixing of raw materials and end products. The absence of cooperatives to manage these stakeholders accentuates the problem. This forms a complex supply chain framework that makes it more difficult to implement traceability system.

Weak enforcement of regulations

Some AMSs lack the necessary legal framework for enforcing regulations on traceability in their respective aquaculture industries. Without the legal framework, various stakeholders lack the motivation and incentive to implement traceability system in their operations. For those who are keen, lack of technical guidance and assistance hinder the successful implementation of traceability system. In addition, the format of documents to track and record details of aquaculture products has not been established, making it more difficult for the small stakeholders to adopt traceability system.

Way Forward

Implementation of traceability systems could be mandatory or voluntary depending on the governmental or private sector initiatives or obligations. Nonetheless, whether or not traceability is a regulatory requirement, it is now a common feature in international trade of fish and fishery products. According to the FAO Expert Panel Review 5.2 on "Servicing the aquaculture sector: role of state and private sectors", in order to encourage application/implementation of traceability, governments should provide training and promote capability building on traceability requirements and system (FAO/NACA, 2012). Other roles of the government could include provision of infrastructure facilities and financial incentives to enhance the implementation of traceability system and improve safety and productivity.

The governments of AMSs should stipulate the pre-requisites of traceability application in their respective aquaculture industries through the issuance of national standards, circulars, laws and regulations. In addition, governments should promote or impose the adoption of best practices, *e.g.* Good Aquaculture Practice (GAqP) in the industry. For their part, the private sector should comply with regulatory provisions to support governments' initiatives and programs and to ensure product traceability. The private sector should also ensure that proper information and records pertaining to the various stakeholders in the aquaculture supply chain provided to the governments are accurately documented and maintained throughout the supply chain.

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Supporting Southeast Asian Countries in Implementing Port State Measures

Kongpathai Saraphaivanich, Yanida Suthipol, Namfon Imsamrarn, and *Somboon Siriraksophon*

The importance of port State measures (PSM) is highlighted in the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU) adopted by the FAO Committee on Fisheries (COFI) in 2001. PSM has been identified as an effective means of combatting illegal, unreported and unregulated fishing, and the need to build capacity and develop human resources to implement port State measures had been emphasized. Later, the FAO Conference in 2009 adopted Resolution 12/2009 approving the FAO Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (PSM Agreement), as a legally binding instrument. The PSM Agreement aims to "prevent illegally-caught fish from entering international markets through ports". To do so, port State needs to take actions on restriction of entry into port, use of port, access to port services, among others. In addition, inspection and other enforcement activities are also included in the PSM Agreement. At the regional scene, the importance of PSM in combating IUU fishing in the Southeast Asian region has been well recognized by the Senior Officials responsible for fisheries from the ASEAN-SEAFDEC Member Countries. Given such target, the Senior Officials adopted the Plan of Operation on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 in June 2011, which includes a provision on the need to "*build up capacity among Member Countries, including functions for regional and sub-regional cooperation, to effectively meet the requirements of Port State measures and Flag State responsibilities.*" SEAFDEC together with its collaborating partners, is therefore building up the capacity of the ASEAN countries to enable them to implement port State measures, and ultimately combat IUU fishing in their respective waters.

Southeast Asia is not only a major fish producing region but is also a leading trader of seafood supporting a big bulk of the fish requirements of peoples around the world. With such a scenario, it has become imperative that the Southeast Asian countries should avoid creating any negative repercussions on their international and intra-regional seafood trade to make sure that the niche of their fish and fishery products in the global market is secured. Implementation of port State measures is one of the requirements that the ASEAN Member States (AMSs) should consider to sustain fair seafood trading in the world market, together with other regional management measures developed under the ASEAN-SEAFDEC Collaborative Framework, *i.e.* ASEAN Catch Documentation Scheme (ACDS), Regional Fishing Vessels Record (RFVR), ASEAN Guidelines for Preventing the Entry of Fish and Fishery Products from IUU Fishing into the Supply Chain, among others.

At the outset, FAO developed a Model for Port State Measures (PSM) to Combat Illegal, Unreported and Unregulated (IUU) Fishing which was meant to be implemented on a voluntary basis. The PSM Model includes international minimum standards for PSM and the requirements for implementation of PSM at regional or national levels (Saikliang *et al*., 2012). Later, when FAO developed the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU) which was adopted by the FAO Committee on Fisheries (COFI) in 2001 (FAO, 2001), provisions on PSM were given emphasis, specifically encouraging the use of PSM to combat IUU fishing.

Implementation of PSM requires that relevant countries' laws and regulations are consistent with international laws and qualified inspectors are capable of examining all relevant areas

Box 1. Status of implementation of PSM by AMSs	
Cambodia	• Laws and regulations to support PSM implementation • In the process of developing NPOA-IUU which will also include PSM • PSM has not really been applied since no foreign vessels unloading in the country • No designated port for PSM
Indonesia	• Signed the PSM Agreement and preparing to ratify the FAO PSM Agreement • Following the IOTC resolution on PSM to prevent, deter and eliminate IUU fishing • 5 designated ports for PSM implementation • At present, no foreign or joint venture fishing vessels operating in the country's EEZ • Requirement of foreign fishing vessels information prior to entering into port • Implementation of the EC-Catch Certification, the CCSBT CDS, and IOTC resolution on CDS for big-eye tuna • Decree laws and regulations to support PSM implementation • NPOA-IUU linked to the implementation of PSM • Conduct of capacity building on PSM and relevant activities for staff concerned
Malaysia	• Only one designated of port in Penang under IOTC requirement • Domestic law supports the implementation of PSM • Foreign fishing vessel is required to get written approval prior to land fish • Continuous capacity building on PSM for officials from relevant agencies • NPOA-IUU developed in 2013
Myanmar	• Signed for accession the FAO PSM Agreement in 2010 • Decree laws and regulations to support PSM implementation • Local and foreign fishing vessels should be inspected in check points before entering landing sites • Designated five ports for foreign fishing vessels which operate in Myanmar EEZ • Implement check point as one stop service to inspect fishing vessels when they go to fishing ground and come back to the port • Implementation of catch certification scheme under EC regulation • Preparing NPOA-IUU linked to the PSM Agreement
Philippines	• One designated port for foreign vessel in Davao and is planning to designate one more port in General Santos • Fishing vessel must submit prior notification information to the one-stop action center • Enacted law and regulation to support PSM implementation • Foreign fishing vessel is required to submit catch documentation in support to PSM implementation • Developed the NPOA-IUU in 2013 which include PSM • Signed the instrument of accession to the 2009 FAO PSM Agreement in 2016 and is currently in the process of ratification • Conducted capacity building training for PSM implementation for local inspectors
Singapore	• 3 ports designated for fishing vessels to import, export and transship fish: Jurong Fishery Port, Jurong Port and Senoko Fishery Port • Advanced notification of arrival of foreign fishing vessels • Compliance with CCAMLR's Catch Documentation • Collaboration with ICCAT in issuance of re-export certificates for Big-eye Tuna and Swordfish
Thailand	• 27 ports have been designated for PSM and on-going for revision • Implemented pilot project on PSM at Phuket in 2012-2014 • Signed Instrument of Accession to the 2009 FAO PSM Agreement on 10 May 2016 • Significant enforcement activities • Requirements prior to port entry • Relevant activities to PSM (Traceability System, MCS, Processing Statement Validation) • Decree laws and regulations to support PSM implementation • Development of NPOA-IUU with support to PSM implementation • Developing "Processing Statement and PSM Linked System" (PPS) • Updated inspection manual based on information provided by MoU and NPCI
Viet Nam	• No designated port for foreign fishing vessels • Required information prior to port entry • Law, decree and regulation to support PSM implementation • Development of NPOA-IUU with support to PSM implementation

Box 2. Summary of constraints/problems encountered by AMSs hindering the implementation of PSM									
Constraints/Problems	**CM**	**ID**	**MY**	**MM**	**PH**	**SG**	**TH**	**VN**	**Challenges**
Operational									
• Lack of standard operating procedure (SOP) in implementing PSM with any scale of vessel	X	X			X		X	X	1. Revision and reorganization of fishing port operational procedures to support PSM 2. Development of harmonized SOP on vessel inspection at port for guidance of all AMSs 3. Identification of the needs and capacity building required for staff concerned on relevant aspects for PSM implementation 4. Difficulties in verification of vessel documentation and inspection
• Port management under different agencies leads to insufficient inter-agency cooperation for PSM implementation	X	X		X				X	
Legal									
• Challenges with regards to implementation of laws and regulations	X	X	X				X	X	1. Inconsistent interpretation of laws
• Challenges in interpretation of the PSM Agreement	X	X			X	X	X	X	
Human Resources									
• Limited capacity of implementation due to inadequate facilities and officers concerned	X	X		X		X	X	X	<none>
Infrastructure									
• Insufficient infrastructure and lack of budget for upgrading infrastructures to support PSM	X	X		X			X		<none>
Information									
• Lack of fish landing data collection system and management, *e.g.* list of IUU fishing vessels from RFMOs is not updated	X		X*						1. Encouraging "traders" to cooperate with AMSs through information and education campaigns 2. Sharing of information such as catch, fishing vessels, fishing gear through sharing of experience in PSM implementation among the AMSs 3. Information sharing on rules and regulations for inter-agencies collaboration and implementation • Creation of a "rapid alert system" for ASEAN (through Mobile Application if available) • Establishment of the ACDS
• Lack of regional network, MCS and information sharing in concerned agencies, among the AMSs	X	X	X**	X	X		X	X	
• Lack of awareness among stakeholders about PSM	X	X							
• Limited traceability of some imports of fish and fishery products						X			
• Control of ports fall under different port authorities			X						
Measures related to PSM implementation									
• Inadequate vessels registration and fishing license system management	X								<none>

* *Malaysia's experience shows that RFMO's IUU vessel list may not be up-to-date*

** *Malaysia sees information sharing with regards to PSM implementation,* e.g. *inspection report, as a challenge rather than an issue for the region*

of the vessels, the fish onboard, the nets and any other gear, equipment, and any document or record onboard. In addition, international, regional and inter-agencies cooperation is necessary for exchanging of necessary information. However, due to the high volumes of seafood trade in the Southeast Asian region, certain constraints hinder the effective implementation of port State controls for all foreign fishing vessels, such as human resources, institutional and infrastructures. SEAFDEC therefore proposed to establish a Regional Cooperation to support the effective implementation of the PSM. In addition to the standard approach, a harmonized approach would be developed in which PSM are integrated, aligned with international and regional agreement/measures, and applied for all foreign-flagged vessels of the AMSs. Such approach should be agreed by all the AMSs and linked to existing management tools such as the ACDS, the ASEAN Guidelines for Preventing the Entry of Fish and Fishery Products from IUU Fishing into the Supply Chain, and the RFVR. Although the main responsibility of enforcing these IUU fishing countermeasures lies with the flag States, the role and functions of port States should also be strengthened through the enforcement of relevant regulations to enhance the promotion of measures to combat IUU fishing.

Initiatives of AMSs and Current Status of Implementation of PSM in Southeast Asia

Under the ASEAN-SEAFDEC Strategic Partnership Mechanism, SEAFDEC convened the Experts Meeting on Regional Cooperation for Supporting the Implementation of Port State Measures in Southeast Asian Region in Bangkok, Thailand in February 2016. Results of the preliminary assessment of the current status (**Box 1**), and constraints/ problems on the implementation of the PSM (**Box 2**) were discussed during the Experts Meeting, which came up with recommendations for development of the regional cooperation for supporting PSM implementation in the Southeast Asian region.

The Port State Measures Agreement

Considering that implementation of PSM was made voluntary while IUU fishing operations continue to become a major global concern, COFI endorsed the initiative of FAO to develop a binding agreement on PSM based on the PSM Model and the IPOA-IUU (FAO, 2009). The Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (PSM Agreement), which is binding to all parties, is aimed at preventing illegally-caught fish from entering international markets through ports and addressing the role of a port State to prevent IUU fishing at landing sites, in ports and on transshipment vessels (considered as "first port"). The PSM Agreement also defines the roles of port States and flag States, especially the measures to be considered in connection with landings of catches by fishing vessels. As shown in **Box 1**, only four AMSs signed the instrument of accession to the PSM Agreement, namely: Indonesia, Myanmar, Philippines, and Thailand. During the February 2016 Experts Meeting on Regional Cooperation for Supporting the Implementation of Port State Measures in Southeast Asia, some countries expressed concerns on the implementation of PSM, especially with respect to the provisions in the PSM Agreement, as shown in **Box 3**.

Moreover, in order to strengthen the implementation of PSM in the region, capacity building by imparting knowledge and understanding on PSM is important for staff concerned, which could be categorized as general audience, inspectors, fishery managers, and policy markers. Capacity building on PSM should take into consideration **Annex E** of the PSM

Box 3. Recommendations for regional cooperation to support the implementation of PSM

Refers to the PSM Agreement		Recommendations of Regional Cooperation on PSM implementation
PART	Article No.	
Entry to Port	Article 7: Designated port	• Encourage AMSs to identify designated ports for foreign fishing vessels and discourage foreign fishing vessels from unloading fish and fishery products in non-designated ports • Include in the list of designed ports information on the name of the port, address of location, contact person and his/her designation as well as official website in English version • Publicize information on AMSs designated ports through SEAFDEC mechanism
	Article 8: Advance request for port entry	• AMS shall provide, as a minimum standard, the information requested in Annex A of the PSM Agreement or relevant document to be adopted by AMS to be provided before granting entry to a vessel to its port (Note: SEAFDEC to provide a simplified document for small fishing vessel for adoption by AMSs) • Support the implementation by port State of the database on fishing vessels record which shall be expanded based on the existing Regional Fishing Vessels Record (RFVR) Database
	Article 9: Port entry, authorization or denial	• Share information on the countries' laws and regulations among the AMSs taking into account the situation where some AMSs (*e.g.* Malaysia and Indonesia) do not allow its fishing vessels excluding carriers to unload catch at other ports in the respective countries • Encourage AMSs to require foreign fishing vessels and carriers to submit pre-arrival information (such as approval to land catch, origin of catch or certificate of catch) so that port State can decide whether to authorize or deny the entry of such vessel into their port. Decision to deny shall be communicated to the flag State • Provide awareness building to relevant stakeholders (*e.g.* fishing boat owners, importers, port authority officials and staff, etc.) at national level to enhance better understanding of the countries' laws and regulations, and other procedures on inspections

Box 3. Recommendations for regional cooperation to support the implementation of PSM (Cont'd)		
Refers to the PSM Agreement		Recommendations of Regional Cooperation on PSM implementation
PART	Article No.	
Inspections and Follow-Up Action	Article 12: Levels and priorities for inspection	• Adopt the Standard Operating Procedures (SOPs) on risk assessment and inspection of vessels through harmonization during consultations or workshops • AMSs to consider minimum levels for inspection of vessels through, as appropriate, agreement among all AMSs • Support inspection of the vessels, based on historical data/information of vessels, should be required in the database module of vessels
	Article 15: Transmittal of inspection results	• AMS to transmit the results of each inspection to the flag State of inspected vessels • AMS to submit to SEAFDEC the total number of inspections conducted annually • Port State to share the summary report of inspection to SEAFDEC, when AMS flagged vessel has been denied entry, denied the use of port or denied the landing of fish
	Article 16: Electronic exchange of information	• Facilitate implementation of this Regional Cooperation, where possible, each AMS should establish a communication mechanism that allows for direct electronic exchange of information with due regard to appropriate confidentiality requirements • AMSs to cooperate for the establishment of an information-sharing mechanism by SEAFDEC to facilitate the exchange of information with existing database for this cooperation
	Article 17: Training of inspectors	• AMSs to request FAO, RFMOs, ASEAN, SEAFDEC and relevant agencies for the conduct of training of trainers (TOT) for port inspections including legal and operational aspects with emphasis on practical hands-on component • Develop a network/team among AMSs on training of trainers for port inspections • Consider an existing training module developed by RPOA-IUU in collaboration with the Australian Maritime on port inspections to support the TOT programs
	Article 18: Port State actions following inspection	• Publicize and create awareness building on standard inspection procedures

Box 4. Capacity needs identified by AMSs to support the implementation of PSM	
Target Group	Capacity building modules
General audience	• Fisheries situation and management scheme o Fisheries region and global situation o Form of IUU fishing in Southeast Asian Region o Initiative activities to combat IUU fishing o Management scheme such as RPOA, NPOA, RFMO • Applicable international law and national laws and regulation measures • Introduction of Port State Measures Agreement • Importance of implement on PSM • Advanced request to enter port
Inspectors	• Fisheries situation and management scheme o Fisheries region and global situation o Form of IUU fishing in Southeast Asian Region o Initiative activities to combat IUU fishing o Management scheme such as RPOA, NPOA, RFMO • Applicable international law and national laws and regulation measures • Introduction of Port State Measures Agreement and especially focus on; o Overview inspection and Follow action (Article 12-19) o Vessel inspection (Article 13 and Annex A and B) • Ethics of PSM inspector • Health Safety & Security of PSM inspector • Authority & Powers (Fisheries enforcement) of PSM inspector including the owned domestic laws and regulation (if applicable) • Standard Operating Procedure (SOP)/decision criteria • Advanced request to enter port • Prioritizing inspection based on the risk assessment • Inspection of vessel (intensive) o Prior boarding inspection o Boarding and inspection procedures - Identification the VMS devices and VMS record o Freezer and cold store inspections guidelines o Bridge observations and equipment o Calculating product weight by hold measurements o Calculating gross fish hold volume • Commercial fishing gear, equipment and techniques • Fish and product identification • Monitoring offloading and transshipment operation • Follow-up procedures information sharing including requesting for additional information from flag State and deny port entry and IUU vessels list • Legal process, rule of evidence and interviews • Field practical training

Box 4. Capacity needs identified by AMSs to support the implementation of PSM (Cont'd)	
Target Group	**Capacity building modules**
Fishery managers	• Fisheries situation and management scheme o Fisheries region and global situation o Form of IUU fishing in Southeast Asian Region o Initiative activities to combat IUU fishing o Management scheme such as RPOA, NPOA, RFMO • Applicable international law and national laws and regulation measures • Introduction of Port State Measures Agreement • Ethics, Health Safety & Security, Authority & Powers (Fisheries enforcement) of PSM inspector • Advanced request to enter port • Prioritizing inspection based on the risk assessment • Inspection of vessel o Prior boarding inspection o Boarding and inspection procedures - Identification the VMS devices and VMS record o Freezer and cold store inspections guidelines o Bridge observations and equipment o Calculating product weight by hold measurements o Calculating gross fish hold volume • Commercial fishing gear, equipment and techniques • Fish and product identification • Monitoring offloading and transshipment operations • Follow-up procedures, information sharing including requesting for additional information from flag State on denial at port entry and IUU list • Legal process, rule of evidence and interviews • Capacity needs assessments towards implementation of Port State Measures • Observation on fishing port and inspection activities
Policy markers	• Fisheries situation and management scheme o Fisheries region and global situation o Form of IUU fishing in Southeast Asian Region o Initiative activities to combat IUU fishing o Management scheme such as RPOA, NPOA, RFMO • Applicable international law and national laws and regulation measures (Intensive) • Understanding on Port State Measures Agreement for apply in the region • Advanced request to enter port • Prioritizing inspection based on the risk assessment • Inspection of vessel (in general) • Monitoring of loading and transshipment operation • Follow-up procedures information sharing including requesting for additional information from flag State and deny port entry and IUU list • Legal process, rule of evidence and interviews • Capacity needs assessments towards implementation of Port State Measures • Observation on fishing port and inspection activities

Agreement. During the February 2016 Experts Meeting on Regional Cooperation for Supporting the Implementation of Port State Measures in Southeast Asia, the AMSs identified the capacity needs to support the implementation of PSM based on the target group, as shown in **Box 4**.

Way Forward

Adopted in 2009, the Port State Measures Agreement requires all parties to exert greater port controls on foreign-flagged vessels, in order to keep IUU fish out of the supply chain in the world's markets by removing the incentives for dishonest fishing operators to stop them from doing illegal activities. This implies that the implementation of port State measures is necessary for the AMSs that allow foreign-flagged vessels to enter into their ports. Concerned stakeholders such as fishing boat operators, boat owners, exporters, importers, and others need to understand the situation while supporting the port authorities to effectively implement the PSM. They should also

take into consideration the condition that port States enforcing the treaty, would refuse port entry or access to port services including landing and transshipment of fish, to foreign-flagged vessels known to have been engaged in IUU fishing.

Box 5. Work Plan for the development of Regional Cooperation for the Implementation of PSM in Southeast Asia

Activity	2016		2017		2018	
Enhancement of RFVR database to support implementation of PSM	Q4					
Development of SOPs on vessel inspections		Q1				
Capacity building to support implementation of PSM		Q1	Q2	Q3		
Pilot site(s) demonstration					Q4	
Report of results of implementation at pilot site(s)						Q1

In support therefore of the development of the Regional Cooperation for the Implementation of PSM in the ASEAN, SEAFDEC will continue to work closely with its Member Countries under the supervision of the SEAFDEC Council of Directors. In this connection, the Work Plan for the development of the Regional Cooperation (**Box 5**) would focus on the harmonization and enhancement of database systems, development of SOPs for port inspections, capacity building, and sharing of information to support its effective implementation at the regional level.

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Addressing Trans-boundary Issues and Consolidating Bilateral Arrangements to Combat IUU Fishing

Worawit Wanchana, Magnus Torell, Somboon Siriraksophon, and *Virgilia T. Sulit*

In Southeast Asia, illegal and destructive fishing activities are recognized as among the most crucial problems that threaten the sustainability of the region's fisheries affecting the livelihoods of millions of people dependent on the fishery resources. In addressing such concern, SEAFDEC has been promoting regional activities to improve management of fisheries including fishing capacity, which are envisioned to be achieved through the establishment of sub-regional fisheries management mechanism considering the specific profiles and challenges of the sub-regions in Southeast Asia. This effort had been sustained by SEAFDEC with support from the Government of Sweden through the SEAFDEC-Sida Project which ran from 2006 to 2012, and the next phase under the SEAFDEC-Sweden Project from 2013 to 2017. Over the years, SEAFDEC has facilitated bilateral dialogues through such sub-regional approach to discuss and look for effective ways to improve management of fisheries for the sustainability of the fishery resources in each sub-region. Focus was given on the importance of trans-boundary coastal/marine species, and integration of fisheries and habitats managements as well as control of illegal and destructive fishing activities. Since 2008, a series of technical meetings had been convened on effective fisheries management for the Gulf of Thailand Sub-region, and bilateral dialogues had been forged between Thailand-Cambodia and Cambodia-Viet Nam and Malaysia-Thailand, as well as Myanmar-Thailand and Indonesia-Malaysia-Thailand for the Andaman Sea sub-region. From such dialogues, it has become obvious that bilateral and sub-regional dialogues and arrangements facilitate the development and implementation of fisheries programs and activities including those that address the issues on IUU fishing. The agreements between neighboring countries through bilateral/sub-regional cooperative arrangements have been so-designed so as to improve fisheries management, specifically on the sustainable utilization of trans-boundary fishery resources.

For the effective management of fisheries in the Southeast Asian region, it is necessary to take into consideration the features of the region's fisheries, *i.e.* the migratory nature of tropical marine fish stocks; as generally practiced, fishing licenses are provided to foreign fishing vessels; the unregulated nature of domestic fisheries resulting to a great extent in IUU fishing; high concentration of small-scale fisheries that continues to provide significant contribution to the national economies; and high mobility of fishing crew (Ekmaharaj, *et al*. (2009)). Generally, the sub-regional areas of Southeast Asia had been identified (Ekmaharaj, *et al*. (2009)), namely: Gulf of Thailand (shared by Cambodia, Malaysia, Thailand, and Viet Nam); Andaman Sea (shared by India, Indonesia, Malaysia, Myanmar and Thailand but India is not a member of the ASEAN); Eastern and Southern South China Sea and Sulu-Sulawesi Sea (bordered by Brunei Darussalam, Indonesia, Malaysia, Philippines, and Viet Nam); Timor-Arafura Sea (bordered by Australia, Indonesia, Papua New Guinea, and Timor Leste but Australia and Papua New Guinea are not members of the ASEAN); Northern South China Sea and the Gulf of Tonkin (shared by China, Philippines and Viet Nam but China is not a member of the ASEAN); and the Lower Mekong Basin (shared by Cambodia, Lao PDR, Thailand, and Viet Nam). For the efforts being undertaken by SEAFDEC, concentration has been made on four modified sub-regions, *i.e.* Gulf of Thailand (GOT), Andaman Sea, Sulu-Sulawesi Sea (SSS), and Lower Mekong Basin (LMB) taking into consideration the common elements that could be worked out for sub-regional fisheries management including the need to combat IUU fishing for the sustainability of fisheries in the Southeast Asian region.

Collaborative Arrangements between SEAFDEC and the Government of Sweden

For the first phase of the collaboration, SEAFDEC entered into an agreement with the Swedish International Development Cooperation Agency (Sida) for the development of sustainable fisheries in Southeast Asia focusing on human resource development for fisheries management. At the initial stage, the collaboration was aimed at promoting and supporting the implementation of the FAO Code of Conduct for Responsible Fisheries that had been regionalized by SEAFDEC in coordination with the ASEAN Member States (AMSs). This was carried out through a process-oriented approach that paved the way for forging regional cooperation for the promotion of improved fisheries management and management of fishing capacity (Wanchana, 2007). Specifically, the Project also exerted efforts to manage the fishing potentials of the region for food security through sub-regional cooperation initially focusing on the Gulf of Thailand and the Andaman Sea (Leng, 2013). Through the series of consultations, the sub-regional coordination for sustainable fisheries management had been strengthened to include the establishment of regional and sub-regional monitoring, control and surveillance (MCS) networks for combating IUU fishing (Yleaña and Velasco, 2012).

Upon completion of the SEAFDEC-Sida Project, SEAFDEC again entered into an agreement with the Government of Sweden to extend the project activities beyond fisheries and putting certain emphasis on biodiversity and habitat

Fig. 1. Map of Southeast Asia showing the four sub-regions focused in the SEAFDEC-Sweden Project

management as well as incorporating social and governance aspects. Thus, building upon the outcomes of the SEAFDEC-Sida Collaborative Project, the SEAFDEC-Sweden Project (2013-2017) includes the other two sub-regions, *i.e.* Sulu-Sulawesi Sea and Lower Mekong Basin (**Fig. 1**) with the poor coastal and inland communities in Southeast Asia as the main stakeholders. The approach is to establish collaborative arrangements on fisheries and habitat management for the Gulf of Thailand and Andaman Sea and support the processes for the cooperation among countries in the Sulu-Sulawesi Sea and the Lower Mekong Basin.

Bilateral and sub-regional dialogues among countries in Southeast Asia

Bilateral and sub-regional dialogues had been useful for developing key indicators for assessment of the activities implemented that support the efforts towards improved management of fisheries and habitats including combating IUU fishing. Such bilateral and sub-regional dialogues had been arranged to strengthen collaborative and cooperative arrangements within and among countries through relevant agencies as main proponents, *e.g.* agencies responsible for fisheries, enforcement, environment, etc. Proponents of the bilateral and sub-regional dialogues are crucially important for sharing of information especially with respect to capacity building requirements, development of effective means of addressing problems on illegal and destructive fishing as well as strengthening the system of monitoring transfer/landing of fisheries products across borders. Moreover, regional and sub-regional cooperation has been enhanced by strengthening institutional responsibility within countries and among neighboring countries.

Box 1. Bilateral dialogues convened in the Southeast Asian region through SEAFDEC and Sweden arrangements

Gulf of Thailand Sub-region

In order to address critical issues related to fishing capacity including combating illegal and destructive fishing, the integration of fisheries and habitat management and promotion of sub-regional cooperation, SEAFDEC organized a series of the sub-region meetings involving the Gulf of Thailand Sub-region (GoT) since 2008. Under the GoT arrangement, the common objectives are to review baseline information, discuss and come up with recommendations on matters relevant to fisheries and habitat management in the GoT as defined by the 2008 RPOA-IUU Meeting in Bali and by the UNEP/GEF/SCS project on fisheries *refugia*. The participating countries have agreed to move towards a process of improving cooperation on fisheries/habitat management, development of MCS network, and sharing of information on vessel registration and fishing licensing. Specific attention has to be given to cooperation on port monitoring to address the common practice of landing fishes across national boundaries in the perspective of fisheries management in the GoT.

A consensus was reached on the importance of creating sub-regional cooperation among countries in the GoT in the aspect of integrating fisheries and habitat management, and of managing fishing capacity, *i.e.* reducing over-capacity and combating illegal and destructive fishing. Working towards sustainability, attempts have been made by fisheries and environmental agencies to improve fisheries and habitat management. An important step undertaken towards this direction is controlling the active fishing effort, both commercial-scale and small-scale, and reducing IUU fishing, especially destructive fishing. The very nature of the region's fisheries where there is migration of fish stocks and mobility of people and vessels involved in fishing, implies that there is a need for regional, sub-regional and/or bilateral dialogues on measures to improve fisheries management and safeguard important habitats.

The participating countries in the GoT have highlighted on the importance of initiating the development of MCS Network by initially focusing on the "Monitoring" component through sharing of information on fishing vessels and licenses as well as conducting surveys and monitoring of fishes landed at ports and landing sites - recognizing the difficulties of such tasks due to insufficient man-power and financial resources, and the political will of key stakeholders, *i.e.* government sector, fisheries and the private sector. GoT participating countries also recognized the need to raise awareness and understanding on the important roles and functions of ports and landing places while recognizing the large numbers of institutions involved in managing the activities related to ports and landing sites. These sites should be recognized as the point of "entry" (and control) of goods being transported by sea and for landing of resources harvested at sea, and being on the "threshold" of the sea and land. Thus, it had been suggested that support should be provided to facilitate cooperation and strengthen the role of concerned authorities, *e.g.* customs office, immigration office, and fishing port authorities. Furthermore, port monitoring, inspections onboard fishing vessel, and collection of data/information were also highlighted by the GoT countries. Landings of catch in neighboring ports also require special consideration in the process of validation of the legal status of the landed catches, especially with regards to artisanal fisheries as stipulated in the FAO Port State Measures Agreement. The existence of a whole range of local level initiatives aiming to monitor and policing illegal fishing activities suggested that it would be useful to collect information on local initiatives, both traditional and project-based, in order to formulate and promote best/good practices that work at a given local area, to the countries in the sub-region.

Box 1. Bilateral dialogues convened in the Southeast Asian region through SEAFDEC and Sweden arrangements (Cont'd)

Between Cambodia and Viet Nam

Dialogues between Cambodia and Viet Nam have been convened to promote cooperation for working towards development and implementation of sustainable and responsible fisheries management, habitat conservation, and utilization of marine living resources. To underline the importance of cooperation, the two countries signed in 2011 the Memorandum of Understanding (MOU) between the Fisheries Administration (FiA) of the Ministry of Agriculture, Forestry and Fisheries of the Kingdom of Cambodia and the Directorate of Fisheries (DFISH) of the Ministry of Agriculture and Rural Development of the Social Republic of Viet Nam, for Bilateral Cooperation in Fisheries Sector. Under such MOU, several actions have been carried out to strengthen the cooperation between Cambodia and Viet Nam. The fishery authorities of the two countries have continued their dialogues by conducting bi-annual meetings to review the implementation of activities under the MOU. Since collaboration with other relevant agencies in fishery resources and habitat management still needs to be strengthened, the two countries developed a collaborative arrangement which provides directions for continued cooperation and have expressed their willingness to activate and strengthen collaboration in order to enhance common approaches for trans-boundary fishery resources management. Under the framework of the 2011 MOU, such arrangement was signed by the two countries in 2014 which specifically focused on supporting the fisheries sector through the implementation of joint actions in the areas of common interest in and around Kien Giang Province of Viet Nam and Kampot of Cambodia. The three main components of such arrangement are: (i) legal framework; (ii) management measures on trans-boundary species; and (iii) marine capture fisheries and combating illegal and destructive fishing practices.

During the First Technical Meeting of the Joint Working Team for Fisheries Management between Cambodia and Viet Nam organized in Viet Nam in May 2014, focus was made on the implementation of joint activities on legal matters, namely: (i) review of existing laws and regulations of the two countries relevant to fisheries and habitat management; and (ii) exploring the ways of improving trans-boundary fishery resources management. To facilitate implementation of such activities, the two countries agreed to appoint their respective members for joint working teams for each priority area. Subsequently, the Technical Workshop of the Joint Committee for Fisheries Management between Cambodia and Viet Nam organized through the SEAFDEC-Sweden Project in 2014, developed the Terms of Reference for the Joint Committee and the Working Groups for Fisheries Management between Cambodia and Viet Nam for the promotion of the cooperation within their respective areas of common concern.

Between Cambodia and Thailand

Dialogues between Cambodia and Thailand have been convened since 2008, where information and updates on measures implemented for the management of fishing capacity and efforts to reduce illegal and destructive fishing (including efforts to combat IUU fishing) have been shared. During the "sub-regional technical meetings on effective fisheries management between Cambodia and Thailand," information on regulations, procedures and requirements for registration of fishing vessels in both countries, systems and processes to issue fishing licenses, the license to fish (in case of Cambodia) for foreign fishing vessels, systems and procedures for landing and recording of catches by foreign fishing vessels or by domestic vessels with catches from neighboring countries, have been shared.

During the recent meeting between Cambodia and Thailand in 2015, the joint efforts to reduce illegal and destructive fishing gears/practices (combat IUU fishing) were discussed. The issues included poor control of fishing/carrier vessels, unclear catch reporting, conflict between small- and commercial-scale fishers, and insufficient communication and coordination between Cambodia and Thailand. A number of activities have been proposed for implementation under the bilateral arrangement between Cambodia and Thailand both at national and bilateral levels with clarification on the responsible agencies and timeframe for implementation. The 2015 Meeting also highlighted on the need to gather information on the actual situation such as status of fisheries and habitats, degree of the conflicts between small- and commercial-scale fishers, and socio-economic of small-scale fishers. This is due to the fact that the livelihoods and social well-being of small-scale fishers are often affected by illegal fishing activities mainly by commercial-scale fishers. The 2015 Meeting acknowledged the efforts of the SEAFDEC-Sweden Project in providing support for the establishment of arrangements on the improvement of fisheries management between Cambodia and Thailand with the ultimate objective of mitigating the impacts of illegal and destructive fishing practices in the GoT.

Between Malaysia and Thailand

The dialogues between Malaysia and Thailand were discussed during the Fourth Meeting of the GoT Sub-region in 2013. During such Meeting, it was suggested that roundtable discussion between sets of two neighboring countries in the GoT should be conducted to discuss the issues revolving around the effective management of fishing capacity and reducing illegal and destructive fishing activities in the GoT. Subsequently, the "Sub-regional Technical Meeting on Effective Fisheries Management between Malaysia and Thailand" was organized in 2014, to identify possible working areas that could be established between these countries for the promotion of effective management of fishing capacity, combating IUU fishing and management of trans-boundary stocks in the GoT waters that cover both Malaysia and Thailand in the GoTas well as in the Andaman Sea.

The 2014 Meeting between Malaysia and Thailand identified three major issues with regards to IUU fishing, *e.g.* dual flagging/registration/deregistration, landing of catches in the neighboring countries' ports, and encroachment by foreign (and national) fishing vessels in the coastal waters. It was then agreed that an MOU between Malaysia and Thailand should be developed as a priority long-term activity. This would become the official mechanism for strengthening future cooperation between both countries. Furthermore, a Joint Working Group should also be defined in the MOU. The 2014 Meeting also agreed that a proper mechanism for data recording should be established for monitoring the landing of catches in the neighboring countries' port. In addition, fishing vessels under the IUU lists should be denied to enter into fishing ports of the participating countries in the GoT and Andaman Sea Sub-region. In this connection, both countries agreed to nominate focal points to coordinate the data exchange and establishing of a network for such purpose.

Box 1. Bilateral dialogues convened in the Southeast Asian region through SEAFDEC and Sweden arrangements (Cont'd)

Between Cambodia and Lao PDR

Concerns on the importance of inland fisheries, especially in the Mekong River Basin particularly in Cambodia and Lao PDR have promoted the development of dialogues between Cambodia and Lao PDR for achieving their parallel objectives in fisheries management and development in accordance with the 1995 Mekong River Commission Agreement. The two countries signed the MOU by the FiA of the Kingdom of Cambodia and the Department of Livestock and Fisheries of the Ministry of Agriculture and Forestry of Lao PDR in July 2010. The 5-year MOU was aimed at encouraging direct communication and cooperation between their respective staff; promoting cooperation within areas of common concern that are mutually agreed upon including activities intended to exchange information related to fisheries management, research and development; identifying and implementing strategies and schemes for joint management of shared trans-boundary fisheries resources, aquaculture development and prevention of fish disease and spread of aquatic diseases, joint meeting and workshop; and together looking for third parties to support human resource development in the fisheries sector of both countries.

With support from the SEAFDEC-Sweden project, the Joint Fisheries Management between Cambodia and Lao PDR would be implemented based on the provisions of the MOU signed in 2010. Currently, the two countries agreed to review the laws, regulations, and policy statements, as well as existing data and information with regards to the management of trans-boundary species, conservation areas and important habitats, information collection on capture fisheries including measures to combat illegal and destructive fishing and trade of aquatic species/products. Under such bilateral arrangement, the Terms of Reference (TOR) of the "Joint Committee and the Working Group for Fisheries Management in Trans-boundary Areas between Cambodia and Lao PDR" was developed to promote cooperation within areas of common concern that are mutually agreed upon, especially on the issues mentioned above. Meanwhile, issues on combating IUU fishing would be discussed after the results of the review/data collection are already analyzed and reported.

Through the SEAFDEC-Sida Project and the subsequent SEAFDEC-Sweden Project, a number of bilateral and sub-regional dialogues had already been convened in the region. **Box 1** shows the summary of such dialogues including the outputs and achievements in terms of fisheries management improvement including the trans-boundary issues and development of relevant measures to combat IUU fishing.

Common Areas for Bi-lateral Cooperation to Combat Illegal and Destructive Fishing Activities

Based on the series of bilateral and sub-regional initiatives, a number of priority issues could be addressed leading to the development of measures to address illegal and destructive fishing practices. The common areas and topics for the bi-lateral cooperation include the following:

- Joint framework and work plan of activities
- Effective management of fishing capacity (fishing vessels and fishers)
- Agreement on a joint approach to manage/integrate fisheries and habitat management
- Management system for trans-boundary species resources
- Human and institutional capacity program
- Fishing ports monitoring program
- Catch document and traceability system
- Bi-lateral mechanism to share experience from traditional knowledge local capacity/communities for improvement of fisheries/habitat management
- Building up of working relations for institutions and entities responsible for management of fishing ports and landing sites, including records of catches landed by foreign vessels
- Improving vessels registration and fishing licensing systems
- Efficient MCS system for effective control of fishing capacity and to combat IUU fishing, destructive fishing, and encroachment by larger fishing vessels to coastal waters
- Awareness raising program for fishers and concerned authorities to minimize IUU and destructive fishing activities

Local Institutional Capacity Building

Among the most notable aspects of the SEAFDEC-Sweden Project is on building up of the capacity of local organizations to enable them to pursue at the local level, the improvement of livelihoods in rural communities, promotion of poverty alleviation measures, and the restoration of important fishery resources and habitats. It is envisioned that such approaches would dovetail to luring the fishers away from illegal and destructive fishing practices.

For such purpose, the SEAFDEC-Sweden Project established sub-agreements with local organizations/institutions with specific activities (**Box 2**), the lessons of which could be learned by the other Southeast Asian countries through information exchange and dissemination. The establishment of such linkages would also support the sustainability of the Project, especially at the local communities.

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Box 2. Sub-agreements established by the SEAFDEC-Sweden Project for implementation of activities at local level	
Local institutions/ organizations	**Activities**
Learning Institute of Cambodia	Strengthening Community Fisheries Management and Livelihoods Diversification in Cambodia
Asian Coastal Resources Institute Foundation (Corin-Asia) Cambodia	Strengthening relevant local institutions' capacity to enable them to address natural resources degradation and climate change vulnerability of target coastal communities Improvement of local people's capacity to effectively cope with the challenges of climate change and other changes brought about by development through enhanced family livelihoods, sustainable use of natural resources and understanding of risks Strengthening of the existing approaches at the local level developed through the Wetlands Alliance Programme (WAP) for sustainable resource management of target coastal communities
Corin-Asia Myanmar	Building the capacity of local government agencies and local authorities towards sustainable management of fishery resources and important coastal habitat to protect coastal resources
Prince of Songkla University, Hat Yai, Thailand	Study on local ecological knowledge and benefit sharing approaches for small-island fishery/ tourism management in Lipe Island, Andaman Sea, Thailand

Way Forward

The Plan of Action (POA) on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 adopted by Senior Officials from Fisheries Agencies of the ASEAN-SEAFDEC Member Countries in June 2011, encouraged the AMSs to: "*establish and strengthen regional and sub-regional coordination on fisheries management and efforts to combat IUU fishing including the development of regional/ sub-regional Monitoring, Control and Surveillance (MCS) networks*" (POA No. 22); and "*facilitate consultative dialogue among fisheries legal officers to share, at the sub-regional/ regional level, perspectives of the respective legal and regulatory framework in terms of developing MCS-networks and to implement efforts to combating IUU fishing*" (POA No. 23). These provisions have guided SEAFDEC and the AMSs to sustain efforts towards strengthening regional cooperation by giving more focus on improving the management of fisheries, maintaining and conserving critical habitats, as well as building up the well-being of coastal communities.

Thus, with added emphasis in combating illegal and destructive fishing, the SEAFDEC-Sweden Project would continue to build up the capacity of the AMSs in many areas, especially in improving and strengthening systems for the management of fishing capacity, *i.e.* monitoring, recording and control, as well as enhancing the social well-being of fisherfolks who had been undermined by illegal and destructive fishing practices. The Promotion of Sub-regional Cooperation in Southeast Asia and Strengthening Regional and Sub-regional Programs would be continued to strengthen cooperation between neighboring countries to join hand-in-hand in addressing issues and concerns in fisheries management and ultimately for the neighboring countries to work together in combating illegal (IUU) and destructive fishing in their areas of jurisdictions and eventually in the whole Southeast Asian region.

The Project would also continue to work with national and local institutions and organizations to provide them with more focus and capacity to address issues at the local levels, especially in managing important habitats for fisheries and regulating fishing capacity, while taking due considerations of socio-cultural aspects. This is expected to facilitate and support local capacity building in fisheries management, including the capacity to more effectively engage the local communities of the AMSs.

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Forging Regional Cooperation to Address Fishery Labor Issues

Pattaratjit Kaewnuratchadasorn and *Virgilia T. Sulit*

The rapid development of the world's fisheries sector together with increasing demand for fish and fishery products for human consumption, result in a growing global demand of labor in fishing and aquaculture related activities. Meanwhile, illegal, unreported, and unregulated (IUU) fishing activities continue to proliferate to fill the ever-enlarging gap in the supply of fish and fishery products. However, illegal fishing activities leads to increasing incidence of labor abuses, forced labor, child labor, and human trafficking. The ASEAN Member States, as major producers of fish and fishery products, are making considerable efforts to develop and implement management measures that aim to ensure the sustainability of fish stocks, combat IUU fishing and promote fair labor standards throughout the Southeast Asian region. Recognizing that labor concerns continue to loom in the region's fisheries sector necessitating the need to address such concerns for sustainable development, labor issues in the fisheries sector including the situation of migrant workers, working conditions and safety at sea had been given priority in the ASEAN-SEAFDEC Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 adopted in 2011.

The importance of addressing labor issues in the fisheries sector, including improvement of fishery labor working conditions and safety at sea had been given priority in the ***2011 ASEAN-SEAFDEC Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020***, which were adopted by the Ministers of ASEAN-SEAFDEC Member Countries in June 2011 (SEAFDEC, 2011). As stipulated in the ASEAN-SEAFDEC Resolution and Plan of Action, the ASEAN Member States (AMSs) have been bound to "*improve the working conditions of people engaged in fisheries activities, and strengthen measures for safety at fishing vessels taking into account the regional specificity*" (Resolution No. 13). Moreover, the Plan of Action (POA) also implies that the AMSs are impelled to adopt measures that endeavor to "*encourage good and appropriate employment practices in accordance with domestic laws and regulations*" (POA No. 5); *"strengthen efforts to address safety at sea, including considerations of working conditions and socio-economic development, and ensure that these considerations are addressed by all concerned authorities while improving monitoring and control of the status of conditions, especially on small fishing boats*" (POA No. 30); and "*encourage good and appropriate employment practices in accordance with domestic laws and regulations*" (POA No. 65). Furthermore, the need to address the status of migrant workers is also highlighted in the ***ASEAN Socio-Cultural Community Blueprint 2025*** (ASEAN, 2016) and the ***ASEAN Declaration on the Protection and Promotion of the Rights of Migrant Workers*** (ASEAN, 2007).

At the global level, several conventions and agreements relevant to the fishing sector have guided the AMSs in pursuing the path towards the ASEAN Community building, especially those that aim to address the need to improve working conditions in the fisheries sector, including the importance of migrant workers, *e.g.* ILO Convention 188 on Work in Fishing (ILO, 2007). Meanwhile, FAO (2015) also expressed the increasing concern on securing "decent work," which should be addressed to ensure that the development of fisheries and aquaculture translates into enhancement of livelihoods of fishers, fisher-folk, fish farmers, and workers at various stages of the fish value chains. As recommended in relevant fora, *e.g.* Resolution (70/1) dated 25 September 2015 of the ***Sustainable Development Goals (SDG),*** referred to as labor, child labor and human trafficking (United Nations, 2015), the countries' role in addressing the decent work deficits and in promoting the effective implementation of the ILO decent work agenda in the fisheries and aquaculture sectors, should be made clear. Guided therefore by the ASEAN-SEAFDEC Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020, the AMSs have been exerting efforts to promote sustainable fisheries in the Southeast Asian region and to achieve rapid economic development to be able to move towards an integrated ASEAN Community.

Considering that fisheries had been identified as one of the priority sectors for such regional integration, various sectors in the fishing industry had been developed. As a consequence however, such efforts have been shadowed by the increasing demand for workers which has been largely met by employing large numbers of workers from within and outside the AMSs. Meanwhile, some unscrupulous fishers continue to embark on IUU fishing activities and their demand for fishery labor had been met by engaging illegal migrants as well as child labor to the extent that human trafficking became widespread.

The AMSs with support from SEAFDEC had been boosting their efforts to combat Illegal, Unreported and Unregulated (IUU) fishing in the Southeast Asian region. In so-doing, the AMSs have also attained a growing understanding of the need to seriously address labor-related issues, especially with regards to migrant workers. Thus, the AMSs have been

working towards improving the working conditions of their fishery workers while SEAFDEC had been strengthening the institutional cooperation on this aspect in collaboration with relevant agencies and organizations as well as with the AMSs.

Fisheries and the Fishing Industry of the Southeast Asian Region

The regional and sub-regional nature of fisheries in Southeast Asia is underlined by seasonal migration of important species and encroachment of unlicensed fishing vessels into neighboring countries (SEAFDEC, 2016). Thus, focus has been made by the AMSs on combating the irregularities within the fishing sector with increased attention being given to the working conditions and status of people engaged in fishing and its ancillary activities. In the industry's large-scale fisheries, attention is focused on the very large number of migrant workers – with more people getting onboard to seek work opportunities in the countries as well as the large groups of workforce moving from one country to another.

The AMSs recognize the importance of soliciting broad institutional responses and obtaining international recognition of their efforts to address labor issues, and seek the coordination of all concerned for the implementation of necessary actions to improve labor working conditions and strengthen the status of workers employed in the fishing sector in the region. In their effort to combat illegal practices and to improve regulations and recording of vessels, catches and people engaged in the fisheries sector, many AMSs have been seriously revising their respective national legal frameworks including those that are relevant to labor aspects for immediate implementation (SEAFDEC, 2016). Individual countries had also taken their own significant steps to regulate and improve the ways in which good labor practices could be ensured within the fisheries sector. For example, in the Philippines a vessel owner/skipper is required to provide a guarantee that all crew members are to be treated in accordance with Philippine labor laws, before a fishing license is issued for a vessel; while in Indonesia a special Sub Directorate of Fisheries Labour and Manning a Fishing Vessel is established within the Directorate of Fishing Vessel and Fishing Gears under the Directorate General of Capture Fisheries of the Ministry of Marine Affairs and Fisheries. In Thailand, the Royal Ordinance on Fisheries of 2015 includes labor aspects (Art 11), and the Department of Fisheries (DOF) in cooperation with the Department of Labour Protection and Welfare (DLPW) and the International Labour Organization (ILO) had developed a set of four Good Labour Practices (GLP) Guidelines for endorsement by the Government.

Furthermore, countries like the Philippines, Indonesia and Viet Nam are actively promoting and providing opportunities to fishery labor, including enhancing the capacity of their national fishing crew before they go abroad to work in the fisheries sector. Although meant to ensure that crew members receive decent working conditions abroad, such schemes have been confronted with difficulties in covering all migrant workers. Nationals in large numbers from Myanmar, Cambodia and Lao PDR are being engaged to work onboard fishing vessels and in processing facilities of neighboring countries. Since there is lack of "specific policies, regulations and measures," recruitments and movements are largely unregulated in spite of the efforts being made by the governments.

Given such a scenario, SEAFDEC has strengthened cooperation with the AMSs to address labor concerns in the fisheries sector taking into consideration the importance of highlighting the points indicated in the ASEAN Socio-Cultural Community Blueprint that actions should be "in accordance with the laws, regulations and policies of respective ASEAN Member States". The expressed interest of the AMSs to address fishery labor issues was apparent during the Forty-seventh Meeting of the SEAFDEC Council in April 2015, when SEAFDEC was requested to ensure

that *"in addition to addressing issues related to IUU fishing, labor issues should also be attended to as this is crucial for enhancing the competitiveness of the ASEAN fish and fishery products"* (SEAFDEC, 2015). The commitment of the AMSs to work towards increased human well-being and enhance "the competitiveness of the ASEAN fish and fishery products" has been well documented and emphasized at the highest possible level. The Declaration on the ASEAN Economic Community Blueprint signed by ASEAN Heads of States in November 2007, highlighted clearly that among the trade priority measures, fish and fishery products which are among the priority commodities, should be given more focus (ASEAN, 2007). Following the signing of the Economic Community Blueprint, the ASEAN Socio-Cultural Community Blueprint was adopted by the ASEAN Leaders at the 14th ASEAN Summit on 1 March 2009 in Cha Am, Hua Hin, Thailand.

The ASEAN Socio-Cultural Community Blueprint focuses on nurturing "the human, cultural and natural resources for sustained development in a harmonious and people-oriented ASEAN," and the well-being of workforces in all sectors and migratory workers are the key factors under such Blueprint. In response to the request of the SEAFDEC Council of Directors and to the increased recognition being given on the need to address labor issues and to improve working conditions within the fisheries sector, SEAFDEC with support from the SEAFDEC-Sweden Project organized the First Regional Technical Consultation (RTC) on Labor Aspects within Fishing Industry in the ASEAN Region on 25-27 February 2016 in Bangkok, Thailand. The RTC was meant to provide a venue for ASEAN-SEAFDEC Member Countries and relevant organizations to discuss and recommend the ways and means of improving the working conditions of labor in fisheries, including that of migratory workers, in the spirit of the ASEAN Community building. The RTC was participated by representatives from government agencies responsible for fisheries and labor from the ASEAN-SEAFDEC Member Countries, as well as from independent organizations and representatives from international and regional organizations such as the International Labour Organization (ILO), FAO Asia-Pacific Fishery Commission (APFIC), USAID-Oceans and Fisheries Partnership, International Collective in Support of Fisheries (ICSF), United Nations Action for Cooperation Against Trafficking of Persons (UNACT), EU delegation to Thailand, Swedish Embassy, Sustainable Development Foundation, SEAFish for Justice, among others. Representatives from Trade Unions, the private sector and Civil Society Organizations also attended the RTC which highlighted and discussed the key international agreements including the requirements of those agreements in relation to labor engaged in fisheries. During the RTC, the participating AMSs provided an update on their respective national legal provisions and implementation guidelines for securing the rights and well-being of labor engaged in the fisheries sector, including recruitment and treatment of migrant workers.

Issues and Concerns: Securing the rights and well-being of labor engaged in the fisheries sector

A summary update of the current legal instruments and guidelines adopted by the respective AMSs that are of relevance to the improvement of working conditions of fishery labor including recruitment and treatment of migratory labor is given below (SEAFDEC, 2016). It should be noted that the information gives due recognition of the rights of people engaged in various segment of the fishing industry, as expressed in their respective national regulations and the ASEAN Community Blueprints.

Cambodia

In 2014, the population of Cambodia was reported to be about 14,320,000 with about 60% under 25 years old, and the country's effort to create employment could not keep up with the increasing population. The benefits from the country's economic growth are generally urban-centered and captured by only a few, exacerbating the country's poverty rate which remains the highest in Southeast Asia. Such "push factor" on one hand leads to labor migration and on the other hand, wages in destination countries, *e.g.* South Korea, Malaysia, Thailand, are generally higher than those in Cambodia while employment is available all year round in these destination countries, especially in Thailand contributing to the "pull factor" that also results in labor migration. Given such push and pull factors, migration of labor as one of the few options available for rural people, becomes inevitable. In general, migrant workers benefit from working overseas not only in terms of financial remittances but also acquisition of properties and assets including houses, making migration a pathway towards getting out of dire poverty (Chandalin, 2016).

The fisheries sector of Cambodia has recently seen rapid development, and the fisheries GDP in 2008 was US$ 720 million benefiting about 50% of the country's population. Nevertheless, the country's fishery workers had been continuously challenged by many domestic factors that push them to labor migration, including the need for higher wages to provide for the basic needs of their families in spite of the risks that confront the migrant workers. In an effort to address the concerns on labor migration, the Government of Cambodia had issued regulations beneficial to migrant workers, *e.g.* Sub-decree 190 dated August 2011 on "Management of Sending Khmer Migrants to Work Abroad through Private Recruitment Agency," Sub-Decree 195 dated November 2008 on "Passport Issuance to Cambodian Workers to Work Legally Abroad," Sub-decree 70 dated July 2006 on "The Creation of the Manpower Training and Overseas Sending On-board." These sub-decrees came with various guidelines for recruitment and sending of migrant labor abroad. Under such regulations and guidelines, the Government of Cambodia signed MOU with

various labor-receiving countries, such as South Korea in 2006, Thailand in 2003, and Malaysia in 2015 (Panha, 2016). Nonetheless, for the sustainability of labor migration, Cambodia has been exerting efforts to: mainstream labor migration issues within its national development agenda, especially in the national employment policy, national development plan, and the country's decent work program. The country has also established a system of recognition for skills gained from labor migration; promoted the productive use of migrant workers' remittances for community development; provided workers' return and reintegration services; and established support linkages with the diaspora. Moreover, Cambodia also provides financial literacy training to migrants and their families at the pre-departure stage; supports the opening of bank accounts by migrant workers in Cambodia and in their destination countries to facilitate remittances; facilitates migrant-worker transfer of capital, skills, and technology by providing them with incentives; promotes the acquisition of new skills abroad to minimize brain drain in key economic sectors; and ensures that while recognizing the contribution of migrant workers to the economy, the Government of Cambodia does not promote foreign employment as the sole means of economic development and poverty reduction (Chandalin, 2016; Panha, 2016).

Indonesia

Indonesia's marine waters had been divided into 11 Fisheries Management Areas, and in 2014, the country's production from marine capture fisheries was reported to be more than 6.0 million metric tons. Some statistics in the same year showed that there were 643,105 fishing vessels, more than 2.0 million fishers engaged in marine capture fisheries, and about 4,800 Indonesian migrant fishers. Labor in the country is regulated by the Ministry of Manpower (for manpower standards), Ministry of Transportation (for seafarers standards), and Ministry of Marine Affairs and Fisheries (for fishers' competency standards). The country's mechanism for recruitment of fishery labor is classified into: work in Indonesia or onboard fishing vessels, and work overseas or foreign fishing vessels. Specifically, Indonesia's Law No. 45/2009 stipulates that all fishing vessels flying Indonesian flag must use 100% Indonesian citizens. For work overseas in foreign fishing vessels, BNP2TK1 or the National Board of Placement and Protection of Indonesian Overseas Workers is responsible for issuing clearance for all labor including fishery workforce to work overseas upon getting the certificates of competency. Recently, Ministerial Decree No. 35/PERMEN-KP/2015 on System and Certification of Human Rights in Fisheries Business issued on 10 December 2015 provides the role of the Government in protecting the human rights of fishers and communities, and ensuring that fishery business respects human rights related to fisheries activities in accordance with the Ruggie Principles (Endroyono, 2016).

Records have also shown that at one time, about 2,000 foreign fishers (coming from Thailand, Myanmar, Lao PDR, Cambodia, Viet Nam, and Philippines) have been stranded in Indonesia. Most of the stranded fishers do not have identity documents as these had been kept by their employers and thus had become victims of extortion by corrupt persons. Having been hired without individual work contracts, they were not paid properly and were often subjected to inhumane treatment. Meanwhile, about 10,000 Indonesian seafarers are working on foreign fishing vessels from Spain, South Korea, Taiwan, and Japan, about 20% of whom are members of the Kesatuan Pelaut Indonesia (KPI) or the Indonesian Seafarers' Union. KPI ensures the protection of seafarers through bi-partite or tri-partite collective agreements approved by the Government. Specifically, the KPI Seafarers Employment Contract for Fishing Vessels include provisions on contract period, working hours, monthly income, medical treatment, insurance compensation, among others, making sure that seafarers receive their remunerations and other benefits from their employers. There had been many incidents of seafarers (non-KPI members) being stranded in foreign countries as they had been employed by companies without valid agreements and had not been paid of their salaries (KPI, 2016).

Lao PDR

The Fishery Law of Lao PDR which was officially enforced on 20 July 2009 through Presidential Decree No. 074 includes among others the National Policy concerning the development of the country's fisheries sub-sector, especially in supporting rural development for poverty alleviation and income generation. On the other hand, the country's Labor Law includes Article 67 specifying the Rights and Duties of Lao Labor Administrators Abroad, ensuring the protection of the rights and interests of Lao labor working abroad. In Lao PDR, the data on labor including fishery workers are compiled by the Ministry of Labor and Social Welfare (Tammajedy, 2016).

Malaysia

Malaysia has been adopting fisheries management tools that aim to promote sustainable fisheries, *e.g.* regulating the issuance of fishing gear and fishing vessel license to limit fishing effort; zoning system; conservation and rehabilitation of marine ecosystems through establishment of MPA and deployment of artificial reefs; prohibition of destructive fishing methods; vessel monitoring system (VMS); and fishermen registration. The country's zoning system (**Fig. 1**) is also used as basis for its Fishermen Registration Policy so that traditional gears in Zone A and commercial gears <40 GRT in Zone B must be owner-operated and only for local fishers. Commercial gears >40 GRT in Zone C should be operated by 80% foreign crew while Zone C2 and Zone C3 by 100% foreign crew.

Photo credits: DOF Malaysia (2016)

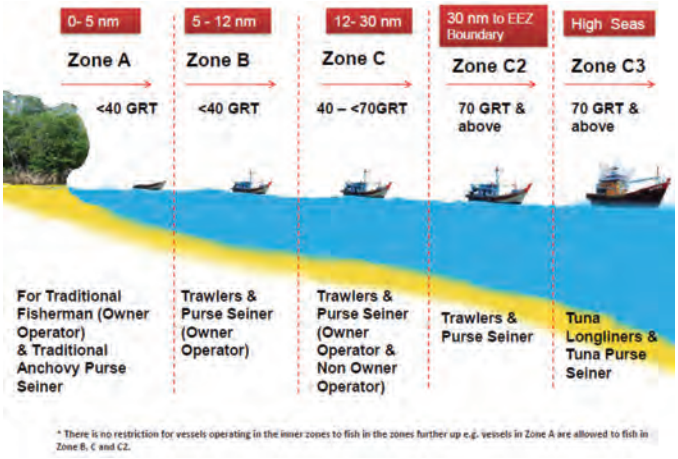

Fig. 1 Zoning of Malaysian Waters
(Photo credits: DOF Malaysia (2016))

The country's Fisheries Act of 1985 includes Section 10 (1) (c) which indicates that any person who is not a Malaysian citizen shall not engage in fishing activity in fishing vessels without written approval of the Director-General of Fisheries. Malaysia has also imposed the Procedures for Hiring Foreign Crew on Malaysian Fishing Vessels, and on Registration of Foreign Workers on Fishing Vessels, as well as standards for manning fishing vessels in Zone C, Zone C2 and Zone C3 (DOF Malaysia, 2016).

Myanmar

When it comes to migrant workers, Myanmar could be considered a sending State. As such, the country has established and promoted legal practices to regulate recruitment of migrant workers; instituted elimination of recruitment malpractices; established accreditation of recruitment agencies and employers; and blacklisted negligent and unlawful agencies. The country has also enhanced its measures to assist migrant workers including the setting up of Migrants Resource Centre; employment contracts now written in both Burmese and English languages; copies of employment contracts provided to migrant workers; well-trained Labour Attaches designated in Myanmar Embassies abroad. Nevertheless, undocumented or irregular workers have been increasing due to attractive job opportunities abroad which are disseminated through intensive social networking and enhanced black market channels. The country is therefore exerting efforts to protect the rights of Myanmar migrant workers through on-site protection and reaching out to migrant workers in remote areas through the Labour Inspectors. Therefore, in order to intensify support to migrant workers, it has become necessary that occupational safety and health of migrant workers should be improved, workers filing complaints should be given proper attention while fair and appropriate wages should be promoted (Lwin, 2016).

Meanwhile, the Myanmar Maritime Trade Unions Federation (MMTUF) had been assisting Myanmar migrant fishers and fisheries workers with their concerns, *e.g.* exploitations and abuses by unscrupulous fishing vessels' owners as well as in some dishonest fisheries and seafood processing plants or factories. MMTUF has also been conducting trade union awareness through trainings, workshops and seminars in many areas in Thailand and Myanmar as well as on occupational safety and health, and rights of workers, among others. Considering the many incidences of unfair treatment of Myanmar migrant workers, MMTUF recommends that the provisions on minimum standards for all fishers and fishery workers regarding standards for minimum wage, overtime, working hours and rest hours, breaks, benefits, compensations etc., should be improved. Moreover, it has also become necessary for the country to ratify and implement the ILO Conventions Nr (87) and Nr (98) as well as the ILO Work in Fishing Convention Nr (188). In addition, MMTUF suggested that tripartite representation in the sector should be established to oversee labor standards. MMTUF also proposed additional measures, *i.e.* giving workers the possibility of working with other labor organizations such as Thai or Myanmar or international offices, and removing the restrictions against forming migrant trade unions in Thailand in accordance with the democratic principle of freedom to organize as long as the workers follow the Thai laws; and giving the workers access to training programs on health, safety, basic labor union education freedom in the employees' languages to enable them to obtain strong bargaining capacity (MMTUF, 2016).

Philippines

Fisheries is an important sector in the Philippine economy, providing direct employment to about 1.6 million fishing operators from municipal fisheries, commercial fisheries and aquaculture. Domestic and migrant fishers in the Philippines are covered by various legal frameworks and are governed by different institutions. Protection and prosecution policies had been instituted to protect the welfare of fishery workers, *e.g.* Labor Laws Compliance System; Presidential Task Force Against Illegal Recruiters; and Inter-agency Council Against Trafficking jointly chaired by the Department of Justice and the Department of Social Welfare and Development. Recently, the Joint Department Order Prescribing Rules and

Regulations Governing the Working and Living Conditions of Fishers on Board Fishing Vessels Engaged in Commercial Fishing Operation has been issued to secure the rights of fishery workers. The provisions under the said Joint Order include minimum wage and other wage-related benefits and social security contributions; rights to security of tenure, self-organization and collective bargaining; repatriation provision; livelihood assistance during closed and off-season to increase household income opportunities; skills and capability upgrading to enhance employment opportunities; occupational safety and health standards; requirements for Certificate of Compliance in the regulatory functions of the Bureau of Fisheries and Aquatic Resources (BFAR), Maritime Industry Authority (MARINA) and the Philippine Fisheries Development Authority of PFDA (Curada, 2016). With regard to forced and child labor, the Philippines had already addressed this concern by banning the operation of "muro-ami" fishing or reef hunting since the mid 2000s, since aside from being an unsustainable utilization of aquatic resources it has also served as an example of severe child exploitation. Furthermore, the Labor Code of the Philippines provides that 18 years old should be the minimum age for fishers since fishing is a hazardous job. Thus, the fishing companies in the Philippines do not employ fishers younger than 20 years of age.

Thailand

Thailand's Department of Labour Protection and Welfare (DLPW) in collaboration with its Department of Fisheries (DOF) and supported by the International Labour Organization (ILO) and its International Programme on the Elimination of Child Labour (IPEC) had been working together to promote better working conditions in Thai shrimp and seafood industry through the development of Good Labour Practice (GLP) Guidelines. Anchored on ILO's Fundamental Conventions, the GLP Guidelines have been based on Thailand's national laws and regulations, *e.g.* Labour Protection Act. B.E. 2541 (1998); Labour Relations Act B.E. 2518 (1975); Alien Employment Act; Anti-Trafficking Act; Occupational Safety, Health and Environment Act, B.E. 2554 (A.D. 2011); Ministerial Regulation of the MOL on the absolute prohibition of children under the age of 18 working in the seafood or fishery sectors effective on January 18, 2016; Thai Labour Standards Corporate Social Responsibility of Thai Business TLS 8001-2010. The GLP Guidelines are a combination of existing standards derived from Thai labor laws and regulations as well as from international labor standards.

These Guidelines comprise industry-specific labor compliance (customized for each sector of the industry) and good practices for farms, primary processing, factories and fishing boats. Good practices are based on international experiences and Thai factories' own initiatives and experiences. Issued by the Government as Notifications, *i.e.* based on National Labour Law and Regulations, the GLP Guidelines are promoted in the country through training programs (CCCIF, 2016).

Photo credits: CCCIF (2016)

The four GLP Guidelines developed by Thailand are: GLP for Primary Processing Workplaces (so called "peeling sheds" but also covers other primary seafood processing) which has already been adopted and used in a pilot training; GLP for Shrimp Farms which is being developed through consultations with farmers associations and workers, the draft of which has already been pilot-tested; GLP for Seafood Factories still being developed while the draft would be used in a pilot training; and the GLP for Fishing Vessels which is still being drafted. The areas covered in the GLP Guidelines include fundamental labor rights (*e.g.* forced and child labor, discrimination) and working conditions (*e.g.* compensation, benefits and welfare; contract and human resources; workplace cooperation and communications; occupational safety and health, and workplace hygiene; maternal health; general workers' welfare). Thailand has also developed its National Plan of Action (NPOA) on Countering Forced Labor (CFL) and Anti-Human Trafficking (AHT) in the Fisheries Sector which was endorsed in October 2015. Furthermore, the *ad hoc* Command Center for Combating Illegal Fishing (CCCIF) had been established to provide a decision making avenue for inter-departmental issues and fishery-related complex issues including those on fishery labor.

Recently, Thailand has already ratified the ILO Occupational Safety and Health Convention No. 187 which entered into force in March 2016 and that the process of ratifying the ILO Work in Fishing Convention, 2007 (No. 188) or C188 is still being reviewed by the Cabinet. In addition, Thailand would enhance its cooperation with neighboring countries such as Myanmar, Cambodia, Lao PDR, and Viet Nam to address through ongoing dialogues, the issues related to migrant fishery workers.

Viet Nam

The fishery sector of Viet Nam is generally small-scale and mainly family-based. Recent reports indicate that a total of 106,717 fishing vessels are in operation and more than 4.0 million workers are engaged in fishing with more than 400,000 working onboard fishing vessels. The country issued Decree No 66/2005-NĐ-CP; Circular 02/2007/TT/BTS on guaranteeing fishermen and fishing vessels safety; 77/2008/QD/BNN - Regulations for training and giving certificate/license for Captain, Chief Engineer, fisherman, and oiler on fishing vessels; Guarantee for fishing vessels: Fishing vessels must be registered; Guarantee for fishermen: Boat captain, Chief Engineer must be trained and possess certificates, while crews must be registered; Responsibility of the State and individuals (Ship owner, Captain, Chief Engineer, and Crew). Viet Nam had been sending fishers to work abroad since 1992 and up to now, about 30,000 Vietnamese fishers are working in off-shore and near-shore vessels, mainly in Korea, Japan, Taiwan and other countries like the Republic of Cyprus and USA.

Currently, there are about 50 service enterprises operating Viet Nam and responsible for sending Vietnamese fishers abroad. Viet Nam started to send fishers to Taiwan since 1999, on both off-shore and near-shore vessels but in 2005, Viet Nam and Taiwan stopped sending and receiving fishers on near-shore vessels but renewed the cooperation in April 2015. The country's regulations on ensuring working and living conditions for Vietnamese fishers working on overseas fishing vessels include: Regulation on labor supplying contract (signed between Viet Nam's service enterprises and overseas partners) and labor sending contract (signed between Viet Nam's service enterprises and Vietnamese workers); Regulation on registering labor supplying contract; Regulation on labor recruiting; Regulation on training; Regulation on managing workers sent abroad by the service enterprises (Viet Nam, 2016).

Summary of the Issues and Challenges on Labor Aspects in the Southeast Region

The rapid development of the fisheries sector and demand of more workers in the fisheries sector has been filled up by fishery workers from within and outside the AMSs seeking for better job opportunities and incomes. However, issues have frequently been surfacing with regards to the plight of fishery workers throughout the region, as expressed by the AMSs (SEAFDEC, 2016). These include: low wages, absence of or inadequate social security; workers are unskilled in relation to fishing operations, lack of training before working onboard in fishing vessels, unaware of the requirements for safety at sea; possessing fake or no legal documents, subjecting to forced labor, child labor, human trafficking; poor working conditions, unfair treatment by employers; and limited capacity for inspection of fishing vessels at sea for compliance with sea safety.

In the analysis of such concerns, four key points had been identified during the RTC which should be addressed in order to secure good and fair working conditions of fishery workers in the Southeast Asian region (**Box 1**). Based on such issues and concerns, recommendations were formulated and directed towards the rights and working conditions of people engaged in the fisheries sector, including migrant workers (domestic and foreign), and securing their decent working conditions in the spirit of the ASEAN Community (**Box 2**).

Box 1. Summary of issues and concerns on securing good and fair working conditions in the Southeast Asian region

- **Employment practices and working conditions (living conditions) at sea and in processing plants should secure and build upon:**
  - Standards/ Instruments/ (ILO-C188, IMO/FAO/ILO Guidelines, COC, etc)
  - National GLP
  - Appropriate legal framework
  - Minimum wage, working hours, food, safety, health
  - Awareness building
  - Provide skills training/capacity building, pre-departure training program before working onboard fishing vessels, safety at sea
  - Labor unions/associations: at national and regional levels
- **Combating IUU fishing and improving registration/licensing of vessels, gear and people and improving records of catches. Improve records throughout the supply chain (on vessels/at factories)**
  - Registration and licenses of vessels, gear and people
  - Surveillance of fishing activities and recruitment procedures (coastal State/port State/flag State, sea port, landing site, base)
- **Migration policy (sending/receiving side)**
  - Rules and practices to be established between states (establish MOUs)
  - Improve ability to implement MOUs (issue passport, visa, work permit, seaman's book)
  - Easy and regulated/registered access
  - Surveillance at borders of people and goods crossing
  - Unregulated should be regulated (private agents, broker's recruiting agencies)
  - Illegal should be legalized (registration)
  - Monitoring, surveillance, and penalty should be strengthened
- **Combat Human Trafficking**
  - Reinforce policy matters
  - Strengthen inter-ministerial coordination (Ministries, Embassies, etc.)
  - Strengthen surveillance (police, coast guard, etc.)
  - Involve private sector, NGOs, CSOs

Box 2. Recommendations to secure good and fair working conditions in the Southeast Asian region		
Inputs	**Interventions/Recommendations**	
	National agencies	**Regional cooperation**
International instruments (ILO, FAO, IMO)	• Strengthen inter-ministerial cooperation and apply an integrated and comprehensive approach in implementing international instruments • Competent authorities to be defined and with focal point identified to enhance cooperation and dialogue • Seek "high level" support on measures to ensure good working conditions • Raise the application of standards of labor/ working conditions in the fisheries sector based on the C188 and other relevant and applicable ILO conventions and international instruments • Build upon/relate to the ILO and FAO initiative on **"Decent Work"**, recognizing the four pillars: 1) Employment; 2) Social security; 3) Status and Rights of workers; and 4) Governance and Social dialogue	• Promote the application of standards of labor/ working conditions in the fisheries sector based on the C188 and other relevant and applicable ILO conventions and international instruments • Increase awareness on the relevance (and implications) of international instruments (ILO, IMO, etc.) as reference to standards applicable to the improvement of working conditions (including contracts, wages, etc.) for domestic and migrant workers • AMSs to adopt an inclusive approach to decent work (employment, working conditions, social protection, social dialogue of men and women fishers and fish workers, and of migrant fishers and fish workers)
Regional instruments (ASEAN Declaration on the Protection and Promotion of the Rights of Migrant Workers)	• AMSs to develop regulations or policies on labor in the fisheries sector based on the ASEAN Declaration • Consider and strengthen the roles and obligations of the "receiving" countries, the "sending" countries and commitments by "ASEAN" as indicated in the "ASEAN Declaration"	• Coordinate dialogue or consultations to develop the **ASEAN Guidelines on Implementation of Labor Standards for the Fisheries Sector**
NGOs/CSOs	• Build awareness of agencies on the importance and context of labor related laws and measures - aim for a "broader social dialogue" while building upon a "human rights based approach"	• Involve NGOs/CSOs in the development of the **ASEAN Guidelines on Implementation of Labor Standards for the Fisheries Sector**
Best practices (national regulations)	• Maintain close collaboration between fisheries-related agencies, labor departments and other responsible agencies to ensure that the rights of fisheries labor are protected under respective countries' national labor laws • Ensure the development, enhancement and implementation of national laws and regulations • Support the implementation and maintenance of good working conditions including steps to secure rights of workers (in accordance with national laws) • Support the formulation of labor unions/ associations at national and regional levels (in accordance with national laws) • For domestic fishers, adopt labor standards including occupational safety and health standards (OSHS) • For migrant workers, develop standards for recruitment, good working conditions, re-integration approach	• Establish MOU or multi-lateral or bilateral labor agreement to address the concerns of migrant workers • For domestic fishers, promote the adoption of labor standards including occupational safety and health standards (OSHS) • Support the formulation of labor unions/ associations at national and regional levels (in accordance with national laws)

Way Forward

To assist the AMSs in dealing with issues and concerns on fishery labor, a set of ASEAN Guidelines on Implementation of Labor Standards for the Fisheries Sector will be developed in line with international standards. The development of such Guidelines will build upon the intentions of the ASEAN Socio-Cultural Community Blueprint, the provisions of the "ASEAN Declaration on the Protection and Promotion of the Rights of Migrant Workers 2007," and other relevant ASEAN declarations. SEAFDEC for its part, would collaborate with the AMSs and continue to work on these aspects, following the endorsement of the recommendations of the RTC by the SEAFDEC Council of Directors and the ASEAN Sectoral Working Group on Fisheries (ASWGFi). The process of addressing labor issues in the fisheries sector of the Southeast Asian region would therefore be a continuing activity of SEAFDEC and the AMSs.

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Strengthening Fishery Resource Rehabilitation Measures to Mitigate the Impacts of IUU Fishing

Yuttana Theparoonrat, Hajime Kawamura, Virgilia T. Sulit, and *Nopporn Manajit*

The coastal waters of Southeast Asia are blessed with fishery resources with high level of productivity because of rich ecosystems such as dense mangrove forests and sea grass beds sustained by rich effluence of nutrients from land, as well as extensive coral reefs with clean tropical sea environment. These areas are critical to a broad range of aquatic organisms during their life cycle from breeding, spawning, nursing and growing; host the feeding zones of aquatic species that are economically important; and serve as important source of recruitment of a wide diversity of aquatic resources. It is widely recognized that healthy aquatic environment is a prerequisite for sustainable fisheries production. Therefore, fisheries management in the Southeast Asian region should be directed towards realizing a good balance and relationship between human activities and coastal environment in order that aquatic resources could be utilized in a sustainable manner. Specifically, fisheries management should aim to safeguard the health and reproductive capacity of fish stocks through sustainable protection and conservation of the aquatic resources that provide the foundations for profitable fishing industry and promote equitable sharing of benefits for the resource users. However, most of the important fishery resources in the region are believed to have declined due to many factors that include overfishing, illegal fishing, use of destructive fishing practices, and environmental degradation. Inshore, the massive clearance of mangrove forests for aquaculture, urbanization, industrialization, wood fuel, timber and the like, has brought about large destruction of the breeding, nursery and feeding areas of many aquatic species that might have been already destroyed and lost. Meanwhile, illegal, unreported and unregulated (IUU) fishing activities that continue to occur in many Southeast Asian waters result in overfishing ultimately leading to severe exploitation of fish stocks without allowing the stocks to reproduce, reduced catch and consequently deteriorating national economies. Recognizing such a scenario, the June 2011 ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 "Fish for the People 2020: Adaptation to a Changing Environment" adopted the ASEAN Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 that include provisions encouraging the ASEAN Member States (AMSs) to "*Optimize the use of inshore waters through resources enhancement programs such as promoting the installation of artificial reefs and structures, encouraging coordinated and effective planning for coastal fisheries management programs, undertaking environmental impact assessment studies, restocking of commercially important fish species, as appropriate, and give priority to human resources development for the implementation of such programs*" (**Plan of Operation No. 27**); and "*Recognizing the different management approaches that are required, sustainably manage major critical coastal habitats, such as mangroves, coral reefs and sea grasses; and develop and disseminate information and guidance on appropriate tools and interventions*" (**Plan of Operation No. 29**).

Impacts of IUU Fishing on the Fishery Resources

Based on the definition of IUU fishing (FAO, 2001), a fishing activity is illegal when "operated in contravention of the conservation and management measures adopted by relevant regional fisheries management organizations (RFMOs) by which States are bound;" and is unregulated when "operated in areas or for fish stocks in relation to which there are no applicable conservation or management measures and where such fishing activities are conducted in a manner inconsistent with State responsibilities for the conservation of living marine resources under international law." Report of a study carried out by MRAG (2005) adopted the concept that a "fishing activity could be classified as IUU if it constitutes action that is, under the definitions, either illegal, unreported or unregulated." MRAG (2005) also considered that IUU fishing activities could include "illegal and unlicensed fishing in EEZs, incursions into EEZs by vessels fishing in adjacent high seas waters or licensed to fish in adjacent country waters; and unregulated fishing in high seas waters undertaken both in areas of RFMOs by non-parties or in contravention of the conservation efforts of those RFMOs, or any fishing in areas not covered by RFMOs."

The AMSs have been exerting efforts to counter illegal fishing operations as these have become contributory factors to the over-exploitation and destruction of fish stocks, through the promotion of effective fisheries management. Illegal fishing in this context includes poaching by foreign fishing vessels and fishing using destructive practices such as the use of dynamite and cyanide that completely devastate the fishery resources and fish habitats (Torell, *et al*., 2010). However, it has also been recognized that the increasing demand for seafood worldwide pushes fishers to illegally fish and poach on seas of neighboring countries outside of their jurisdictions.

If uncontrolled, illegal and unregulated fishing activities could therefore impede the recovery of fish stocks that had been over-fished eventually ending up with degraded resources even at the verge of stock collapse, inducing increased competition among resource users and severely affecting the economic and social well-being of fishing communities (Kawamura and Siriraksophon, 2014).

Community-based stock enhancement demonstration site (a 4,000 m^2 coral patch (*Porites* sp.)) in Brgy. Molocaboc, Sagay City, Philippines (Salayo *et al.*, 2016)

Hence, fisheries management should aim for safeguarding the health of fish stocks to sustain an equitable, viable and profitable fishing industry. Within such objective, there is a need to strengthen fishery resource conservation, protection and rehabilitation to mitigate the impacts of illegal and unregulated fishing activities on the fishery resources.

Initiatives of SEAFDEC and AMSs to Mitigate the Impacts of IUU Fishing on the Fishery Resources

Considering that most of the fishery resources in the Southeast Asian waters are already in various levels of decline mainly due to illegal and unregulated fishing activities, and in an effort to address the concerns on resources degradation, SEAFDEC with funding support from the Japanese Trust Fund (JTF), carried out a five-year program on the "Promotion of Sustainable Aquaculture and Resource Enhancement in Southeast Asia" starting in 2010. Implemented in the Southeast Asian countries, the program was conceptualized based on two approaches, namely: improvement of critical habitats/nursing grounds of fishery resources; and direct enhancement of fisheries resources through artificial propagation techniques. Thus, under such program, the project on "Rehabilitation of Fisheries Resources and Habitats/Fishing Grounds through Resources Enhancement" was implemented by the SEAFDEC Training Department (SEAFDEC/TD) based in Thailand to serve as immediate response to the concerns on the deteriorating coastal and inland ecosystems, and preventing further loss of habitats and eventual damage to the aquatic organisms. Simultaneously, the Philippine-based SEAFDEC Aquaculture Department (SEAFDEC/AQD) carried out the project on "Resource Enhancement of Internationally Threatened and Over-exploited Species in Southeast Asia through Stock Release" including the establishment of strategies of stock enhancement through sustainable, responsible and environment-friendly approaches.

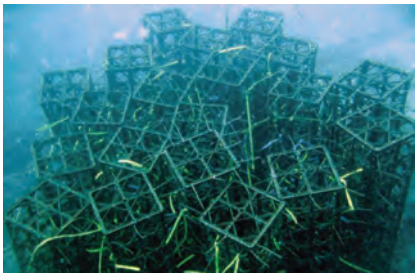
As the abovementioned projects involved identification of appropriate resource enhancement strategies that could serve as guide for the countries in the region in their efforts towards rehabilitating their respective fishery resources, SEAFDEC with support from the JTF organized the "Symposium on Strategy for Fisheries Resources Enhancement in the Southeast Asian Region" in Thailand in July 2015. Organized with two-pronged themes, *i.e.* Fishery Resources Enhancement through Habitat Improvement and Management; and Fishery Resources Enhancement through Artificial Propagation and Stock Release, the Symposium compiled, consolidated and exchanged necessary information and technologies based on

the countries' initiatives to enhance the fishery resources that might have already been degraded and destroyed due to illegal and unregulated fishing practices (Kawamura, *et al*., 2016).

In order to promote fishery resources enhancement measures in critical habitats and fishing grounds, the AMSs have been carrying out R&D activities on various enhancement measures, *e.g.* installation and management of artificial reefs (ARs), management of fisheries *refugia* and marine protected area (MPAs), habitat diagnosis and rehabilitation, restocking and stock restoration. The experiences and lessons learned by the ASEAN-SEAFDEC Member Countries and the initiatives of SEAFDEC (**Box 1**) were shared during the abovementioned Symposium (Kawamura, *et al*., 2016). Based on the inputs from the SEAFDEC Member Countries and outputs of relevant SEAFDEC projects, the Symposium also came up with Policy Recommendations and Strategic Plans for Fisheries Resources Enhancement in the Southeast Asian Region (**Box 2**).

Abalone juveniles rearing and releasing to the sea for conservation in Bach Long Vi National Marine Protected Area, Viet Nam (Chieu *et al*., 2016)

Fish stocks aggregating in cuboid ARs installed in Malaysia (Zainudin, 2016) *(above)*



Fish apartments installed in Indonesian waters serve as refuge for fish stocks and prevent encroachment of the fishing areas by illegal fishers (Anjaresta and Agung, 2016) *(left)*

Way Forward

The Policy Recommendations and Strategic Plans for Fisheries Resources Enhancement in the Southeast Asian Region adopted during the July 2015 Symposium on Strategy for Fisheries Resources Enhancement in the Southeast Asian Region, were used as basis for the development of activities under the Project on Rehabilitation of Fisheries Resources and Habitat/Fishing Grounds for Resources Enhancement in Southeast Asia from 2015 to 2019, also supported by the JTF.

The Project aims to identify the appropriate resource enhancement tools appropriate for the region as well as habitat conservation measures based on analysis and diagnosis of the effectiveness of the measures, and formulate strategies and guidelines for implementation in the Southeast Asian region. Capacity building on fisheries resource enhancement and habitat conservation measures would also be promoted in the ASEAN countries. The specific activities were formulated during the Regional Inception Workshop for JTF-6 Program on Promotion of Sustainable Fisheries Resources Enhancement Measures in Critical Habitats/Fishing Grounds in Southeast Asia organized in Thailand on 31 July 2015 by SEAFDEC with funding support from JTF. Moreover, the Project also aims to strengthen collaboration and cooperation among the SEAFDEC Member Countries for the promotion of sustainable fisheries resources enhancement in the Southeast Asian region to ensure the sustainability of such measures.

Box 1. Initiatives of the ASEAN-SEAFDEC Member Countries on fishery resources enhancement

Cambodia

- **Management of fisheries *refugia***
  - Blood Cockle *Refugia* was established in Preah Sihanouk, Cambodia to enhance and protect the habitats of blood cockles as mangroves and sea grass in natural sea beds
  - management approach for the blood cockle *refugia* takes into consideration various factors such as regulating blood cockle size to be harvested, taking into consideration the socio-economic viability of this resource
  - country's Community Fisheries established the self-regulatory measures, *i.e.* fishing rights and entry, fishing seasons and fishing hours, and harvestable size of blood cockle through consultations with the stakeholders, *e.g.* local fishers, local officers, government staff, researchers, and relevant organizations/agencies
  - in spite of such regulations, illegal fishing operations still prevail in the *refugia* area, especially by fishers from outside areas who collect the blood cockle using dragger with engine, a rampant practice which could easily deplete the blood cockle resources
- **Habitat rehabilitation and artificial reefs installation**
  - the country considers fishery resources as very important for food security and source of income for its rural fishers
  - decline in resources led to fishing competition and conflicts in fishing while the use of modern fishing techniques resulted in the gradual degradation of the fish habitats
  - fluctuating depths and temperature of the waters create impacts on the fishery resources as refuges are lost and eventually causing mass fish kills while in some cases, the capacity of fish to reproduce is reduced
  - Fisheries Administration (FiA) of Cambodia divided the responsibilities of managing the fishing grounds and conservation areas within the Community Fisheries (CF) domain to be managed by community fishers
  - more than 350 conservation areas had been rehabilitated by the community fishers resulting in enhanced fish stocks and increased fish production
  - community participation in the rehabilitation activities has been enhanced through volunteerism, and to raise funds for such activities, interested persons are encouraged to pay certain amount of funds while financial assistance are also sourced from donors
  - mangrove reforestation is a routine activity in the conservation areas where community fishers follow the rules and regulations on mangrove reforestation as prescribed by FiA
  - while conservation areas had been rehabilitated, community fishers also engage in alternative livelihoods, *e.g.* tourism in the Tonle Sap Great Lake, upon thorough consultations among the members of the CF
  - installation of ARs in lakes as means of protecting the fishing grounds from encroachment had been successfully carried out making use of tree trunks

Indonesia

- **Habitat rehabilitation**
  - the country rehabilitates and conserves the habitats by undertaking mangrove reforestation, coral transplantation, installation of fish apartments, and the like
  - engagement of the communities at the beginning of such activities is important to support the maintenance, monitoring, and nursery of rehabilitated habitats
  - fish apartments made of durable plastic materials that could last for more than 25 years, are used to support the aggregation of fish and serve as fish shelters
  - installed near fishing communities, fish apartments serve as refuge for fish stocks and prevent encroachment of the fishing areas by illegal fishers
  - concrete management actions is necessary to monitor the effectiveness of the fishery resources conservation and habitat rehabilitation activities
- **Restocking and stock restoration**
  - country's stock enhancement activities include determining the bio-limnological characteristics of the release sites, development of fisheries co-management approach, and making use of local wisdom or knowledge for the management of the sites
  - stock enhancement and culture-based fisheries are options to optimize the utilization of inland waters for producing fish, ensuring food security, creating additional income, and promoting human welfare
  - concerned government agencies also support and take active part in the activities, as well as providing local fish seeds for restocking purposes, *i.e.* Research Institute for Inland Fisheries in Palembang; Research Institute for Stock Enhancement in Java; and the SEAFDEC Inland Fishery Resources Development and Management Department in Palembang
  - parameters on nutrition of fish feeds should be considered to support the promotion of food security while policy support on stock enhancement should be sought
  - the numerous research activities on stock enhancement in inland waters have been undertaken the results of which could address the various technical concerns on and management of the released stocks

Japan

- **Management of artificial reefs**
  - country carries out two aspects of artificial reef activities: (1) artificial reef fishing ground for marine resources enhancement; and (2) measurement method on the effects of fish-gathering and fish-propagation around artificial reefs
  - in the past, artificial reefs had been constructed as auxiliary fishing gear to gather fish, and now artificial reefs have been constructed as fishing grounds to gather, propagate and protect fish from their larval/juvenile stages to adult stage, considering that in many cases, juvenile fish resources are extremely diminished
  - construction and installation of artificial reefs aim to expand natural reefs and create new fishing grounds with the same conditions as those of natural reefs
  - to date, a new type of ARs, known as "**upwelling reef**" is being promoted in Japan following the concept that when "rich nutrient salts near the bottom layer rise to the euphotic zone, primary productivity would be enhanced in the surrounding sea areas" leading to increased fishery production
  - constructed using concrete blocks and stones at sea bottom with depths of about 82 meters, "upwelling reef" is beneficial in terms of enhancing the primary productivity and fisheries production capacity of the surrounding sea areas

Box 1. Initiatives of the ASEAN-SEAFDEC Member Countries on fishery resources enhancement (Cont'd)

- **Habitat diagnosis and restoration**
  - drastic decrease of eelgrass in Hinase City from 590 ha in 1945 to 12 ha in 1985, prompted the local fishers to undertake eelgrass bed restoration since 1985
  - area of eelgrass beds recovered is now 200 ha or 1/3 of the area in 1945, and fish production using set net had also recovered starting 2011
  - oyster culture was started in 1985 in the same fishery ground so that together with the expansion of the eelgrass beds, harvest of oysters would be improved because eelgrass beds and oyster culture have a win-win relationship: oyster culture helps the expansion of eelgrass beds by the assimilation of detritus and increase sunlight transmittance depths (transparency), while eelgrass beds tend to decrease the mortality of cultured oysters in summer by decreasing water temperature in the water column
  - Hinase Fishermen Union would establish fish farms by integrating eelgrass bed, oyster culture rafts and artificial reefs in an arrangement where locally spawned fish grows in the designated farming area using the eelgrass beds, oyster rafts and artificial reefs as shelters
  - newly developed concept known as 'Sato-Umi' developed in Japan could be promoted as a fisheries management measure in coastal seas with high biodiversity and productivity as adapted in Hinase, as this could provide the means of increasing the abundance of eelgrass
  - 'Sato-Umi' concept is a form of unified management system for land and sea, where management mechanisms for coastal waters move inland, one step away from integrated coastal management so that land and sea are brought under a unified management policy
  - 'Sato-Umi' concept is meant for environmental conservation of coastal areas in harmony with human interaction on land
- **Restocking and stock restoration**
  - several stock enhancement programs had been carried out in Japan during the last fifty years aiming for cost-effectiveness and stocking efficiency
  - seeds of about 85 species of fish, mollusks, crustaceans and other aquatic organisms have been released in the country's waters for stock enhancement, *e.g.* chum salmon (*Oncorhynchus keta*) and barfin flounder (*Verasper moseri*) in northern Japan, red sea bream (*Pagrus major*) in central and western Japan, and Spanish mackerel or 'sawara' (*Scomberomorus niphonius*) in Seto Inland Sea, the largest inland sea in country
  - protocols to be considered in stock release: (1) **diagnosis** for stock assessment includes investigation of the ecology of target species considering that there is no need to release seeds if the natural stock is abundant, and investigations of the environment of nursery grounds as a prerequisite for effective seed release; (2) **planning** of the stock strategy (when, where, how, how many) and checking the quality of seeds for stocking (size, shape); (3) **establishing cooperation** with concerned fisherfolk for the fisheries management, habitat improvement and/or rehabilitation; (4) **monitoring** the market of target species through market survey taking into consideration the yield per release (YPR), and **evaluating** the impacts of stocking; (5) **implementing** the most efficient stocking strategy based on the results of the protocols considered
  - the carrying capacity of the nursery grounds should be assessed as it restricts the allowable number of released seeds, as in the case of *hirame* or the Japanese flounder (*Paralichthys olivaceus*), the number of release seeds was higher in northern Japan than in the south-western areas of the country
  - to evaluate stocking efficiency, the YPR which is equal to the weight of landed "recaptured fish" divided by the number of released seeds, should be determined, and the YPR for successful cases should be more than 50 metric tons per 1.0 million seeds stocked
  - on stock enhancement of Portunid crabs as the most important fishery resources in the coastal waters of Japan, *e.g.* swimming crab (*Portunus trituberculatus*), blue swimming crab (*P. pelagicus*) and mud crab species (*Scylla paramamosain* and *S. serrata*), about 30 million hatchery-produced juveniles have been released annually since the late 1980s since the annual catch of the Portunid crabs have fluctuated and in order to sustain and/or increase the Portunid crabs stock
  - estimating recapture rates of stocked crabs is indispensable to evaluate the effectiveness of stock enhancement programs, therefore marking methods should be developed to distinguish between wild and hatchery-released individuals
  - stocking effectiveness of Portunid crabs could be determined if appropriate methods to mark small body sized juveniles which frequently molt in their life cycle, are put in place
  - a technique has recently been developed to mark crab juveniles which could eventually estimate the contribution rates of released crabs to the total catch of mud crabs and swimming crabs
  - mixed rate of released juveniles in the total catch of mud crab could be estimated using genetic stock identification, which could be 5.0-19.7%, and the contribution of released juveniles to the total catch could be about 0.5-1.0 metric tons
  - recapture rate of released juveniles of the swimming crabs is estimated through a marking technique by clipping the swimming leg (dactylus), resulting in an estimated contribution rate of marked crabs to the landings of about 3.0%

Lao PDR

- **Habitat rehabilitation and artificial reefs installation**
  - pilot project in country's Nam Houm Reservoir has various activities, *e.g.* compilation of fisheries information and data, promotion of sustainable fisheries and the concepts of community-based and co-management in inland fisheries, strengthening the critical habitats by installing 50 pieces of high effective fish shelters as protective measures of broodstocks from illegal fishers, prohibition of certain fishing gears in conservation areas, transfer of technology on mobile hatcheries to fishers' groups in Nam Houm Reservoir for the breeding the common silver barb using hormones, and promotion of juvenile fish releasing techniques, among others
  - with water serving capacity 60 million m^3 in wet season, Nam Houm Reservoir also supports agriculture activities
  - of the 36 species of economically important fishes in the Reservoir, the most valuable are tilapia (*Oreochromis niloticus*), featherback (*Notopterus notopterus*), and common silver barb (*Barbonymus gonionotus*)
  - since illegal fishing operations still take place even in the conservation zones, ARs had been installed in these zones by the Reservoir Fisheries Management Committee (ARs are made of concrete and other materials that would not drift with the strong flow of water current)

Box 1. Initiatives of the ASEAN-SEAFDEC Member Countries on fishery resources enhancement (Cont'd)

Malaysia

- **Artificial reefs installation**
  - The country has been implementing R&D activities on artificial reefs, *i.e.* construction and designs, materials used, site selection
  - artificial reefs installations serve as natural resources habitat, *e.g.* management of artificial reefs in Sabah by local fishermen's community established for the purpose of developing and protecting the artificial reef sites, as local communities should be involved especially the fishers to make sure that the construction plans and installation are beneficial to them, especially in terms of socio-economic returns
  - artificial reefs installation could minimize conflicts between traditional and commercial fishers by curbing possible encroachment of commercial fishers in traditional fishers' fishing areas
  - Malaysian Fisheries Act 1985 prohibits any fishing activities within the 0.5 nautical miles radius of artificial reef areas
- **Management of fisheries *refugia***
  - special *refugia* for two commodities *i.e.* shrimp and lobster had been established in Sarawak and Johor, respectively, following the concept of *refugia* similar to that in Sarawak, Malaysia known as the "tagal system" for the seasonal conservation of the freshwater fish Malaysian red mahseer (*Tor tombroides*)
  - to address the country's production of penaeid shrimps and lobsters that had been declining, activities had been initiated aiming to safeguard spawning aggregations, nursery grounds, and migration routes; protect and revive fish populations from being overfished; and increase and sustain catch and incomes of fishers and relevant stakeholders
  - in developing the aforementioned new concept of *refugia*, science-based information had been taken into consideration while agro-tourism aspects were explored so that local communities could generate additional incomes
  - such established *refugia* systems had been constrained by various factors, *e.g.* inadequate support from local communities; pollution from terrestrial activities especially the sludge coming from crude palm oil milling factory that flows into the *refugia* area; local communities not empowered to stop encroachment by illegal fishers in *refugia* areas; migratory characteristics of target commodities makes it difficult to manage the fisheries; and target fish species in the "tagal system" have become dependent on artificial diets provided by tourists instead of finding food by themselves from the natural environment
- **Restocking and stock restoration**
  - coral reef restoration activities had been carried out in the waters off Pahang and in Perhentian Island of Terengganu Province from 2010 to 2014
  - Malaysia is reported to have about 1,687 km^2 of coral reef areas with more than 540 species of hard corals, but only about 9% of the coral reef areas are protected under the country's MPA systems, while some of the coral reefs have been threatened by climate change, pollution, and illegal fishing among others, leading to massive coral bleaching and habitat loss
  - in an effort to rehabilitate the coral reefs, a pilot coral reef restoration project was launched through coral re-plantation, in the waters off Pahang and Terengganu starting in 2010
  - based on country's experience, site selection is a crucial aspect as the site should have moderate water current with unobtrusive sunlight, and should not be too near to adjacent natural reefs
  - coral fragments used for transplantation must be larger than 10 cm, and the site should be maintained immediately after the corals had been transplanted
  - some benefits of coral restoration include increased live coral cover, recovery of targeted coral reefs, increased biodiversity, re-establishment of ecological balance, and stabilizing the surrounding environment

Myanmar

- **Habitat rehabilitation**
  - the country's system of inland fisheries management includes dividing inland fisheries into two categories, *i.e.* leasable fisheries and open fisheries
  - in leasable fisheries, fishing rights are granted to lease holders under a lease agreement subject to stipulations relating to the area, species, fishing implements, period and fishing methods used
  - lease holders must take the responsibility of carrying out stock enhancement and conservation of fisheries habitats
  - there are 3,729 leasable fisheries in Myanmar and culture-based system is applied in most of these leasable fisheries
  - inland fisheries and habitats have gradually degraded due to siltation, extension of agriculture, and road construction, among others
  - to conserve the fisheries habitats and fish stocks, several activities had been carried out in leasable fisheries rehabilitate and maintain the fisheries habitats and fish production in inland fisheries, including selective harvesting of stocks and protecting the inland fishery resources from illegal fishing activities

Philippines

- **Management of fisheries *refugia***
  - fisheries *refugia* has been established in the Philippines, *e.g.* in Busuanga, Palawan and in Zamboanga Peninsula
  - success of fisheries *refugia* depends on the actions at the local level with level of community support dependent on the involvement of local stakeholders in any relevant actions undertaken
  - while science-based management measures are most crucial, it is also necessary to harness local knowledge as this is critical for site selection and establishment of management measures
  - information and communication also help in enhancing communities' acceptance of the fisheries *refugia* approaches
  - the case in Busuanga, Palawan has led to the development of a model of fish egg dispersal and larval settling in Philippine waters, where the source and sink of fish eggs and larvae had been used in identifying the spawning and nursery *refugia*
  - the case in Zamboanga Peninsula meant to address the decreasing catch of sardines, led to the establishment of a management measure through the enforcement of 'closed fishing season' in the Peninsula's fishing ground, leading to increased catch of the sardines

Box 1. Initiatives of the ASEAN-SEAFDEC Member Countries on fishery resources enhancement (Cont'd)

- **Habitat diagnosis and restoration**
  - sea urchins (*Tripneustes gratilla*) and sea cucumber (*Holothuria scabra*) are invertebrates with important ecological functions in tropical near shore ecosystems, and function as reproductive reserves and source of larval supply to adjacent suitable habitats
  - culture and release of sea urchins and sea cucumber has been conducted to rebuild depleted populations and provide income to fishers
  - an integrated socio-ecological approach is necessary with active participation of local partners in site management and regular monitoring
  - although culture-based resource management is imperative, relevant factors should also be taken into consideration, *e.g.* investment and high associated risks, related science-based information, regular monitoring and evaluation, involvement of local stakeholders and decision makers
  - culture-based resource management should demonstrate the ecological and economic benefits, and identify where appropriate governance that is necessary as critical considerations for sustainability
- **Habitat rehabilitation**
  - inland fisheries resources in the Philippines comprise swamplands, lakes, rivers, and reservoirs, and host some 340 species of freshwater fishes
  - for increasing the country's fisheries production from inland fisheries, a National Program on the Fisheries Enhancement of Inland Waters was launched covering 36 minor lakes and 320 small reservoirs in 16 regions of the country
  - this program intends to rehabilitate and/or restore the physical conditions of the country's minor lakes and reservoirs, enhance fisheries, and repopulate indigenous species in support of biodiversity conservation, poverty alleviation and food sufficiency
  - Dagatan Lake in Quezon Province is a small lake with a surface area of about 7.0 ha but almost totally covered by thick aquatic vegetation and thus requires rehabilitation
  - the importance of mobilizing local communities is necessary, especially in resource rehabilitation activities, *i.e.* removal of aquatic plants that pose serious problems on the conservation of indigenous fish species, and promotion of economic activities
  - for successful implementation of rehabilitation activities, there is a need to harmonize legal and juridical mandate, enhance the management skills of fisherfolk, ensure sufficient supply of fingerlings, make rehabilitation sites accessible, and conserve indigenous species

Thailand

- **Artificial reefs installation**
  - installation of artificial reefs in Pattani and Narathiwat Provinces from 2002 to 2015 under the Royal Initiative Project, made use of five (5) types of materials, namely: concrete pipes, concrete blocks, abandoned train cars, used military tanks, and used cars
  - results from monitoring the artificial reefs and fishing gear operations, and income of fishers from fishing around the artificial reefs indicated that most artificial reefs are still in good condition although some are observed to be sinking, while a total of 188 fish species inhabit the artificial reef areas
  - hook and line, threadfin bream fish trap, fish trap, and short-bodied mackerel gill net have been used by small-scale fishers in their fishing operations around the artificial reefs
  - income survey suggested that the total income of fishers ranged from 14,275.38 to 110,064.71 Baht/month and catch rate of about 31.045 kg/boat while the average income was 47,371.20 Baht/month
  - the project has succeeded in raising the standards of living of fishers and in restoring the natural wealth of the fishery resources
- **Management of fisheries *refugia***
  - fisheries *refugia* has been established in the Gulf of Thailand for Indo-Pacific mackerel (*Rastrelliger brachysoma*) and other economically important species that face major stock reduction due to various factors, *i.e.* increasing demand for protein sources together with rapid development and improvement of fishing gear and fishing techniques, and illegal fishing, among others
  - enforcement of closed seasons and areas in some parts of the Gulf of Thailand for Indo-Pacific mackerel (*Rastrelliger brachysoma*) and other economically important species has been carried out
  - measures involve prohibiting the operation of some fishing gears and practices as well as monitoring changes in the status of the target species and evaluating the fishing methods to determine the appropriate measures that could be promoted from time to time for the sustainable utilization of such pelagic species
  - measures developed for conserving the Indo-Pacific mackerel had been used as basis for the formulation and development of conservation measures for other economically-important aquatic commodities
  - cancellations and revisions of the measures are effected from time to time based on the changes in the status of the fishery resources and effective management of the aquatic resources
- **Restocking and stock restoration**
  - restocking programs had been implemented in the country through the Department of Fisheries (DOF), local administration organizations, provincial agencies, the Electricity Generating Authority of Thailand and other private sector, and government agencies
  - in aquatic animal stocking, achievements depend on participation of local communities
  - new Management Strategies of Thailand adopted starting in 2015 is an important tool that could be used to attain sustainable production from fisheries and maintain fish diversity, as well as means to enforce relevant laws and regulations to combat illegal fishing in the country
  - the Strategy effective in enforcing control measures as determined from the catch although production could vary depending on the environments
  - the natural stock of giant clam species *Tridacna squamosa* has been declining in their natural distribution area, therefore hatchery breeding and seed production of the giant clam had been carried out in Thai waters since 1993 mainly for conservation purposes
  - results of the trial restoration of giant clam attained a survival rate of 40% mainly influenced by various factors that affect the environment
  - restoration of giant clam made use of metal netted cages to protect the stocks from predators and illegal collection

Box 1. Initiatives of the ASEAN-SEAFDEC Member Countries on fishery resources enhancement (Cont'd)

Viet Nam

- **Management of fisheries *refugia* and MPA systems**
  - country promotes closed seasons and areas as useful measures for promoting stock enhancement, especially for endemic, rare and important economic aquatic species, *e.g.* tiger shrimp (*Penaeus monodon*), featherback (*Notopterus notopterus*), ray-finned carp (*Semilabeo notabilis*), spiny barb (*Spinibarbichthys denticulatus*), redtail catfish (*Hamibagrus elongatus*), common carp (*Cyprinus carpio*), barbel chub (*Squaliobarbus curriculus*)
  - country's MPAs system has been playing an important role in stock enhancement, serving as potential successful approach in addressing barriers in fish stock and habitat management
  - results of activities could serve as important measure for enhancing the fishery stocks allowing them to continue providing animal protein, employment and household income for rural people
  - monitoring of the country's MPAs systems is done once a year, the results of which are used as basis in formulating policies and regulations on the protection and development of the aquatic resources
  - engagement of stakeholders during the process of establishment the conservation zones should be ensured considering the knowledge and experience of local stakeholders, *e.g.* officers, fishers, scientists, and government authorities
  - consultations with stakeholders should be regularly conducted to make them understand the MPA systems and the benefits that could be gained from the systems
- **Restocking and stock restoration**
  - artificial breeding of abalone (*Haliotis diversicolor*) has been carried out in Bach Long Vi (2012 – 2015), since the many-colored species of abalone (*Haliotis diversicolor*) is of high commercial value but the abalone stocks in the natural habitat had decreased due to over-exploitation
  - to restore the natural abalone resources, artificial breeding had been carried out producing 1,250,000-2,000,000 larvae and 137,960 juveniles (6.4-17.3 mm length) with survival rate of 6.9-11.0%
  - about 6,000 juveniles (1 cm length) were released in Bach Long Vi National Marine Protected Area in 2014 for conservation, and after one year, the abalones were found to have attained an average shell length of 3.4 cm

SEAFDEC

- **Management of artificial reefs**
  - pilot project was conducted by SEAFDEC/TD to evaluate the impacts of enhancement practices including ARs, on the fishery resources and the environment in Rayong Province of Thailand in 2009-2014 in collaboration with the Eastern Marine Fisheries Research and Development Center (EMDEC) of Rayong
  - activities included identification of fishing gear used as well as species composition and abundance, and underwater observation to assess the condition of the ARs
  - in the case of Rayong ARs, fishery resources around ARs appeared to be less enhanced due to certain environmental problems, such as the accidental crude oil leak from the PTT Global Chemical pipelines off the coast of Rayong Bay which could have created a massive impact to the environmental condition
  - as a result, in the ARs area in adjoining Ban Phe Bay, there was massive reduction of the fishery resources around the Bay
  - a study on the water circulation in the Bay suggested insufficient water exchange in the ARs areas due to a blockage of the shore tidal current flow
  - future studies on the impacts of artificial reefs installation on the environmental conditions would consider primary productivity, suspended solids, water turbulence, characteristics of bottom sediments, and marine benthos
  - monitoring of the ARs areas should be carried out four (4) times in a year, *i.e.* before and after monsoon seasons, to compare the results obtained considering the different sea conditions of the ARs areas
- **Management of fisheries *refugia* and MPA systems**
  - the ASEAN-SEAFDEC Ministers responsible for fisheries support the promotion of the fisheries *refugia* approach in the Southeast Asian region by endorsing the ASEAN-SEAFDEC Regional Guidelines on the Use of Fisheries *Refugia* for Capture Fisheries Management in Southeast Asia in 2006, and adopting the 2011 ASEAN-SEAFDEC Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 which serves as guide in formulating and implementing programs and activities that promote the adoption and use of the *refugia* concept in line with the aforesaid ASEAN-SEAFDEC Regional Guidelines
- **Habitat diagnosis and restoration**
  - Studies had been carried out by SEAFDEC/TD on selection of critical fishing grounds in marine habitats, and promotion of conservation and rehabilitation measures
  - a deteriorated seagrass bed area in Sriboya Island, Krabi Province, Thailand was selected as one of the pilot sites to mitigate the area's depleted stocks of an edible sea snail, the dog conch (*Strombus canarium*)
  - dog conch is commonly harvested by fishers and local communities by hand and/or labor-saving equipment using motorized boats, dredges, and diving with self-contained underwater breathing apparatus but such massive collection methods of harvesting easily led to the drastic degradation of the seagrass bed habitats as well as deterioration of the dog conch population
  - SEAFDEC/TD, therefore promoted the conservation and optimum utilization of dog conch through public awareness activities
  - the Andaman Sea Province Dog Conch Shell Resource Management Measures had been formulated through consultations with local stakeholders in Krabi Province and nearby provinces
  - a consensus and subsequent implementation of several management schemes, such as restriction on dog conch harvestable size (less than 6 cm) and allowable type of fishing gear (dredges), as well as banning the use of motorized boats
  - several types of media that support awareness building, such as posters, stickers, brochures and banners were produced and distributed to several provinces along the Andaman Sea coast
  - permanent dog conch conservation areas were established by the local fishing communities at Sriboya Island in Krabi Province, and Muk Island in Trang Province
  - for the replantation of seagrass beds, collaboration is necessary with experts/researchers on seagrass to support such activities, especially on the evaluation of seagrass bed resources

Box 1. Initiatives of the ASEAN-SEAFDEC Member Countries on fishery resources enhancement (Cont'd)

- **Restocking and stock restoration**
  - stock enhancement activities had been carried out by SEAFDEC/AQD since 2001 with the first stock enhancement of mud crab (*Scylla* spp.) funded by the European Commission, and followed by another stock enhancement activities for seahorses (*Hippocampus* spp.), giant clam (*Tridacna* spp.), abalone (*Haliotis asinina*), and sea cucumber (*Holothuria* spp.) as priority species with support from the Japanese Trust Fund
  - release strategies had been established for the giant clam, abalone, and mud crab
  - giant clams should be released in ocean nurseries until they reach escape size of 20 cm shell length (SL) for better survival before transferring seeds to shallow reefs with warm temperature for better growth
  - community-based stock enhancement of abalone *Haliotis asinina* in Sagay Marine Reserve in Negros Occidental (central Philippines) included social baseline surveys and establishment of a community-based stock enhancement demo-site accessible to and replicable by the fishers
  - involvement with strong engagement of the stakeholders led to communities' agreement in 2010 to regulate the catch size of abalone at 6 cm
  - involvement of the communities helped in the successful implementation of activities that deal with stock enhancing and restocking
  - appropriate release size of 2.5-3.5 cm based on research results was recommended since stocking bigger juveniles would entail higher investments in hatchery rearing
  - sincere collaboration is necessary to enhance the participation of stakeholders which could lead to successful project implementation
  - maintaining camaraderie with the stakeholders, establishing a good working team, conducting regular consultations with stakeholders and occasional meetings with concerned local government units, and intensifying information, education and communication (IEC) activities, among others are important factors in undertaking restocking activities
  - giving the stakeholders thorough independence is important, especially in carrying out the management responsibilities to make them recognize and take up ownership of any restocking activity
  - equal sharing of proceeds from the activities is also important for the livelihoods of the stakeholders, *e.g.* in the community-based stock enhancement of abalone, the fisherfolk organization developed their own sharing scheme, so that 30% of the proceeds go to the fisherfolk organization; 30% to the fisherfolk (to be equally shared); 30% to the administration of Sagay Marine Reserve; and the remaining 10% to fund other operating expenses
  - for abalone, seeds should be released at ≥ 3 ml SL and should be transported from the hatcheries using PVC transportation modules to minimize mortalities caused by transport stress
  - for mud crab there is a need to check the conditions of release areas at least one month prior to release to increase the chances of survival in the wild
  - regular monitoring the released stocks is crucial as observed in releasing the mud crab, where the crablets appeared lost in the wild
  - tagging the stocks is also necessary to separate the released stocks from wild conspecifics, and that appropriate tags should be chosen, *e.g.* diet tags have been used in the case of abalone, numbered dymatapes for giant clams, and coded microwires for mud crabs
  - stock enhancement of the tiger shrimp (*Penaeus monodon*) in New Washington Estuary (NWE) in the Province of Aklan in central Philippines was carried out with support from the Research Institute for Humanity and Nature (RIHN) of Japan
  - impacts of the tiger shrimp stock enhancement included increased income of fishers, reduced number of fishing gear, mangroves rehabilitation promoted, and methods for implementation the tiger shrimps stock enhancement established considering the biological, technical and socio-economic aspects
  - results after the stock enhancement activity in that area indicated increased incomes by 300%

Box 2. Policy Recommendations and Strategic Plans for Fisheries Resources Enhancement in the Southeast Asian Region adopted during the July 2015 Symposium on Strategy for Fisheries Resources Enhancement in the Southeast Asian Region

I. Fishery Resources Enhancement through Habitat Improvement and Management

Issues/Challenges	Recommendations	Strategic Plans
Artificial Reefs Management	• Best practices on installation of artificial reefs (ARs) should be promoted to ensure the protection of aquatic species during their life cycle and allowing them to reach optimum size. • Planning and deployment of ARs should be undertaken, taking into consideration the following: - Clear purpose of ARs, *e.g.* resources enhancement; - Results from relevant feasibility studies, including cost-benefit analysis, socio-economic analysis, financial analysis, among others; - Involvement of researchers, policy makers, fishing communities, local government units and other stakeholders in the planning process; - Results of site suitability evaluation, *e.g.* existing corals/fishes, seabed conditions, oceanographic conditions, water circulation patterns; - Choice of AR design(s) that should suit seabed conditions and purpose; and - Certainty that installed ARs does not create pollution to the marine environment.	• Developing Regional Guidelines on Best Practices for Installation of the Artificial Reefs (ARs)

Box 2. Policy Recommendations and Strategic Plans for Fisheries Resources Enhancement in the Southeast Asian Region adopted during the July 2015 Symposium on Strategy for Fisheries Resources Enhancement in the Southeast Asian Region (Cont'd)		
Issues/Challenges	**Recommendations**	**Strategic Plans**
	• ARs should be regularly monitored (over time, and seasonally) using appropriate parameters, *e.g.* conditions of ARs, primary productivity, abundance and diversity of aquatic species (fish, macro benthos, etc.). The impacts of ARs on environmental conditions, *e.g.* water current, turbidity, and sedimentation, among others, should also be monitored. • Regular monitoring and evaluation of the effectiveness of AR programs should be conducted (for short-, medium- and long-term) by comparing various indicators before/after or within/outside ARs. Correlation of the abundance of species inhibiting the ARs and other environmental factors, *e.g.* bottom condition, water current/condition, should also be established. • Cost-benefit analysis of AR deployment program(s) should be conducted, taking into consideration the resources, environmental and socio-economic benefits that could be gained from the program(s). Data to be collected could include investment costs (ARs construction and deployment), fisheries production by fishing gear and fishers' incomes before and after ARs deployment, and other ecosystem services. • Implementation of AR program(s) should be integrated with other fisheries management measures, *e.g.* fishing regulations that include among others, prohibition of encroachment of commercial fishing activities, establishment of conservation/fishing zones, to ensure that resources are utilized in sustainable manner. Stakeholders' consultations on the management of ARs should be conducted to elaborate responsibility of stakeholders and fishers in the management plan. • AR programs could be implemented in the coastal and offshore (if necessary) areas to ensure that the life cycle of both of demersal and pelagic species is sustained. • A list of expertise on ARs and available resources should be compiled for reference and usage by the countries.	• Integrating fisheries management measures/principles in AR management programs • Integrating ARs in policies and plans for coastal and offshore fisheries resources conservation, management and development
Integrating Fisheries and Habitat Management	• Fisheries *refugia* could be implemented to complement the existing conservation/management measures, by integrating it with the fisheries objectives of protecting critical life cycle, *e.g.* spawning, nursing, broodstock aggregation, and migratory routes of species targeted for management. • Selection of site(s) for fisheries *refugia* should be based on scientific information and local knowledge especially in identifying the areas that are natural habitats for critical stages of the life cycle of species targeted for management, *e.g.* spawning, nursery grounds, broodstock aggregation, migratory routes. The area of the Fisheries *Refugia* should be manageable by concerned stakeholders. • Regulations on fishing activities in the *refugia* (*e.g.* restriction of harvestable size, fishing seasons, fishing gears/methods) should be enforced taking into account up-to-date scientific data (*e.g.* spawning season, size at maturity, larval study), which should be relevant and correspond to the activities of host communities. • Community participation should be optimized for the establishment and management of fisheries *refugia* (*e.g.* identification of suitable sites, establishment/implementation of management measures including MCS) and collaboration with relevant government agencies at local/national levels should be strengthened so that the fisheries *refugia* could be as self-sustaining as possible. • Sub-regional cooperation should be strengthened for the establishment of fisheries *refugia* for management of trans-boundary species (*e.g.* Indo-pacific mackerels) that move across the EEZs of more than one country.	• Promoting the establishment of fisheries *refugia* as a tool for integrating fisheries and habitat management • Conducting scientific research programs and stakeholders consultation to support the identification of suitable sites and establishment of fisheries *refugia* for target species, and coming up with scientific evidence that harmonize with local knowledge to serve as basis for developing appropriate management measures • Ensuring the sustained participation of key stakeholders in the planning, sites selection and development of management measures for fisheries *refugia*. • Enhancing regional and sub-regional collaboration for the establishment of fisheries *refugia* system for transboundary fish stocks management

Box 2. Policy Recommendations and Strategic Plans for Fisheries Resources Enhancement in the Southeast Asian Region adopted during the July 2015 Symposium on Strategy for Fisheries Resources Enhancement in the Southeast Asian Region (Cont'd)

Issues/Challenges	Recommendations	Strategic Plans
Degradation of (fish) habitats in the Southeast Asian region	• Fish habitat restoration priorities in different water resources in the region should be reviewed. • Effectiveness of habitat restorations and resources enhancement in inland water resources such as lakes should be determined through the following methodologies: - Conduct of baseline studies; - Harmonization of legal and juridical mandates of authorized agencies, including local governments responsible for water resources; - Pooling of government funds and resources; - Mobilization of local communities and/or other stakeholders; - Application of technical tools to reconstruct the fisheries; and - Improvement of buffer zones. • Habitat restoration should be implemented through suitable co-management arrangements taking into consideration the importance of the ecosystem. • The "Satoumi Concept" could be considered as one of the Integrated Coastal Management approaches for habitat restoration. **Remarks:** Developed by Japan, the "Satoumi Concept" is a form of unified management system for land and sea, where management mechanisms for coastal waters move inland, one step away from integrated coastal management so that land and sea are brought under a unified management policy. In short, the "Satoumi Concept" is meant for environmental conservation of coastal areas in harmony with human interaction on land.	• Making habitat restoration a priority at national levels • Developing the best practice guidelines on habitat restoration for different water resources such as inland and marine, in conjunction with fisheries resources enhancement programs.
	• Enhancement of fish populations in restored habitats could be carried out by applying appropriate techniques such as installation of ARs, establishment of fisheries *refugia*, restocking, and/or mangrove reforestation, etc. • Since indigenous knowledge is crucial for habitat restorations, applicable only in most cases for specific areas and the culture of local communities, science and indigenous knowledge should be combined to ensure the effectiveness of habitat restorations. • Impact assessment of lost natural habitats (*i.e.* coral reefs, sea grass and sea beds) due to human activities (irresponsible fishing or pollution) should be conducted as well as raising the awareness of stakeholders on the importance of habitats to humans and fishes.	• Rebuilding sustainable fish populations in restored habitats • Undertaking baseline studies based on indigenous and scientific knowledge • Conducting impact assessment of lost natural habitats, and raising the awareness of stakeholders on conservation and protection of the natural habitats
II. Fishery Resources Enhancement through Artificial Propagation and Stock Release		
Potentials and Limitations of Stock Enhancement and Restocking		
• Selection of species and release area considerations - Lack of species and site specific protocols/guidelines for successful stock enhancement/ restocking - Techniques (specific to stock enhancement) for ex-ante impact assessment and monitoring (biological, environmental, social and economic) are not available	• Stock enhancement and restocking activities should take into consideration the following: - Development of species- and site-specific strategies to ensure success of activity; - Give high importance to availability of scientific information/ biology of the target species; - Ensure appropriate choice of species – benthic over pelagic and migratory species; - Provide adequate preparation/rehabilitation of receiving habitats to ensure likelihood of success; and - Give preference to marine reserves as release sites for managed monitoring and harvesting.	• Developing Regional Guidelines or criteria for feasibility assessment and improvement and disseminating the Guidelines to Member Countries [**Note**: the Guidelines will take into considerations the elements for higher success of restocking and stock enhancement covering the technical (choice of species, biology/life cycle of species, sustainable supply of quality seeds/stocks), environmental (suitability of site), social/ institutional (involvement and strong support of local communities, local government agencies and research institutions), and economic aspects (funds)]. • Formulating a 'Strategy or Framework for Sustainability of Stock Enhancement Initiatives' and disseminating this Framework to Member Countries

Box 2. Policy Recommendations and Strategic Plans for Fisheries Resources Enhancement in the Southeast Asian Region adopted during the July 2015 Symposium on Strategy for Fisheries Resources Enhancement in the Southeast Asian Region (Cont'd)		
Issues/Challenges	**Recommendations**	**Strategic Plans**
• Strategy to ensure sustainability of activities and gains/benefits achieved from stock enhancement is not yet developed • Although benefits from stock enhancement and restocking are urgently needed and appreciated, the technical capabilities and financial resources of most Member Countries could be limited	• Active involvement of the local people (especially the fisherfolks) in the planning, implementation and monitoring activities, with understanding that the objectives of the activity and its long-term sustainability will largely depend on their continuous active involvement and participation; • Well-defined governance arrangements, and access and harvest rights through consultations with various stakeholders in enhancement/restocking activities; • Conduct of cost-benefit analysis of release and stock enhancement activities; • Implementation of long-term planning with all stakeholders to ensure availability of sufficient funds and manpower resources; • Participation of the local government units and their assured commitment to adopt and sustain stock enhancement initiatives (with donor funds) beyond project completion date; • Creation of supplemental and alternative livelihood strategies to encourage fisherfolks' participation and compliance to regulations; • Promotion of multi-stakeholder involvement and embedding conflict management in all phases of stock enhancement activity (including planning for and prioritizing a bottom-up approach in policy & regulation formulation); • Implementation of regulations and networking with enforcement agencies for protection of released stocks and management of recaptures; and • Implementation of activities, in conjunction with other management and conservation measures, to ensure that resources are utilized in sustainable manner.	
Release Strategies and Ecological Interaction with Natural Stocks		
• Lack of release protocols/guidelines (specific to stock enhancement) • Capacity of Member Countries on ecological risk assessment and effective monitoring needs to be assessed and strengthened	• Assess the initial status of the community structure of the release site and monitor over time to determine the effects of interaction with the released stocks. • Determine the appropriate size of release of stocks to ensure high survival, avoidance of predators and economic efficiency. • Conduct proper behavioral conditioning of stocks prior to release. • Promote regular and long-term continuous monitoring to determine effectiveness. • Develop effective marking techniques for stock enhancement - Determine appropriate tags for proper identification of released stocks and for effective long-term monitoring. • Based on needs of Member Countries, enhance their capacity on the application of decision-making tools for stock release (*e.g.* ecological risk assessment tool).	• Establishing release protocols/guidelines based on scientific findings and in accordance with existing policy instruments/regulations • Implementing effective institutional frameworks, policy instruments for the release of stocks, monitoring and enforcement mechanisms at national and local levels • Developing and implementing capacity building programs on the application of decision-making tools for stock release
Aquaculture-based Enhancement and Restoration		
• Genetic, health and biodiversity considerations - Indiscriminate stocking or translocation of non-indigenous species/stocks poses adverse genetic and health risks	• Importance of the genetic and health information of species should be well recognized to minimize genetic effects, transfer of diseases and protect biodiversity.	• Formulating mechanism that will ensure that stocks for release are healthy/disease-free (for instance, thru health certification) and will not pose genetic risks • Strengthening IEC (information, education and communication) activities to enhance public awareness on genetic and health risks related to stock release and the need for precautionary measures following relevant Guidelines developed and promoted by FAO

Box 2. Policy Recommendations and Strategic Plans for Fisheries Resources Enhancement in the Southeast Asian Region adopted during the July 2015 Symposium on Strategy for Fisheries Resources Enhancement in the Southeast Asian Region (Cont'd)

Issues/Challenges	Recommendations	Strategic Plans
• Lack of seed production techniques and facilities intended for enhancement and restocking activities	• Increase government investments and solicit donor contributions for aquaculture R&D and related facilities to support wide-scale and high-impact stock enhancement and restocking initiatives	• Fostering strong collaboration among R&D institutions, national and local government, and local communities on initiatives that will support wide-scale and high-impact stock enhancement and restocking initiatives

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Supporting ASEAN Good Aquaculture Practices:
Preventing the Spread of Trans-boundary Aquatic Animal Diseases

Rolando V. Pakingking Jr. and *Evelyn Grace de Jesus-Ayson*

The FAO Fishery Statistics had indicated that Asia is the top producer of fish and fishery products from both capture fisheries and aquaculture. Specifically, Southeast Asia had contributed 9-31% of the total aquaculture production in Asia from 1950 to 2014 with Indonesia and the Philippines accounting for the most at 23-63% and 10-45% of the total, respectively. Aquaculture has been viewed as a solution to the growing concern on food security issues as well as for the socio-economic stability of many countries in Southeast Asia. For such reason, aquaculture operations are being intensified to compensate for the declining production from capture fisheries and in order to nail the gap between supply and demand for fish and fishery products in the world. With intensification, aquaculture production has already overtaken the contribution of capture fisheries to the world's total fisheries production. However, concerns on the safety and quality of aquaculture products have been raised as result of intensified fish farming operations. Added to such concern is the irresponsible introduction of aquatic species for aquaculture that serve as carriers of pathogens. As a result, a large number of infectious aquatic diseases have emerged threatening the sustainability of aquaculture in the Southeast Asian region. In an effort to address the emergence of transboundary diseases in the region, the Aquaculture Department of SEAFDEC (SEAFDEC/AQD) launched a program on Healthy and Wholesome Aquaculture which includes as one of its main objectives, the need to continue improving aquaculture production through innovations in fish health management.

There is no doubt that the recent rapid development of aquaculture has led to improved production. In fact in 2013, aquaculture production had already surpassed that from capture fisheries by 51% (FAO, 2016a; FAO, 2016b). However, it should be recalled that irresponsible aquaculture practices as well as over-development of aquaculture, especially in the Southeast Asian region, had brought about the occurrence of infectious aquatic diseases damaging the region's aquaculture production by hundreds of million USD. It was at this point that the ASEAN Member States (AMSs) recognized the need to promote responsible aquaculture in the region. Thus, with technical assistance from SEAFDEC and with funding support from the Japanese Trust Fund, the AMSs cooperated in the regionalization of the Code of Conduct for Responsible Fisheries (CCRF) and came up an agreement that "States should take necessary actions to appropriately manage aquaculture within their jurisdictions based on the Regional Guidelines" (SEAFDEC, 2001a).

Such declaration was enhanced when the ASEAN-SEAFDEC Member Countries through the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region adopted in November 2001, resolved to "*increase aquaculture production in a sustainable and environment-friendly manner by ensuring a stable supply of quality seeds and feeds, effectively controlling disease, promoting good farm management and transferring appropriate technology*" (SEAFDEC, 2001b). This proclamation was backed up by specific provisions in the Plan of Action that indicated the need to "*improve capabilities in the diagnosis and control of fish diseases within the region by developing technology and techniques for disease identification, reliable field-side diagnosis and harmonized diagnostic procedures, and establishing regional and inter-regional referral systems, including designation of reference laboratories and timely access to disease control experts within the region*" (SEAFDEC, 2001b). Moreover, considering that the uncontrolled introduction of aquatic species had led to occurrence and transfer of aquatic diseases, the ASEAN-SEAFDEC Member Countries also emphasized to "*reduce risks of negative environmental impacts, loss of biodiversity and disease transfer by regulating the introduction and transfer of aquatic organisms…*"

As aquaculture continues to develop and being concerned about the industry's sustainability, the ASEAN-SEAFDEC Member Countries declared in the subsequent Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 adopted in June 2011, to "*mitigate the potential impacts of aquaculture on the environment and biodiversity including the spread of aquatic animal diseases caused by the uncontrolled introduction and transfer of exotic aquatic species and over-development of aquaculture*" (SEAFDEC, 2011). The countries also affirmed the need to "*continue the national efforts to control serious disease outbreaks by providing support to: (i) R&D to improve the ability to handle new and emerging diseases and surveillance of transmission of diseases to wild populations; and (ii) regional initiatives on harmonization of regional disease control standards, disease reporting and implementation of contingency plans to handle new and emerging diseases*;" and to "*develop regional warning systems on aquatic animal health and diseases to inform other Member Countries of relevant epidemiological events and to raise awareness of new diseases that may pose risks. Build emergency preparedness capacity through rapid and timely*

responses to reduce potential catastrophic consequences of diseases" (SEAFDEC, 2011).

Along with the agreements and declarations made by the ASEAN-SEAFDEC Member Countries, SEAFDEC for its part intensified the implementation of its activities on fish disease management under the holistic program on Healthy and Wholesome Aquaculture. Early on and with funding support from the Japanese Trust Fund (JTF), SEAFDEC/AQD embarked on a five-year Regional Fish Disease Project in 2000 which focused on the development of fish disease inspection methodologies for artificially-bred seeds. In 2004, the Project was extended for another five years to give more emphasis on developing fish disease surveillance system that could assist the AMSs in their efforts towards preventing and managing fish diseases (Ogata, 2009). As a result, a well-coordinated network was established for the timely and efficient reporting of any outbreak of aquatic diseases in the region, while the AMSs now have its own regionally-recognized reference laboratory for specific aquatic diseases.

Meanwhile, as aquaculture continues to develop, problems keep on emerging as a consequence of the translocation or introduction of exotic species that brought about diseases in different areas or territories (Iwama, 1991). These transboundary diseases, known for their significant economic, trade and/or food security importance for a considerable number of countries, are easily spread to other countries. When their incidence reaches epidemic proportions, control and management including exclusion would require cooperation between and among several countries (FAO, 2007). Being highly transmissible, transboundary diseases could wipe out stocks, threaten food security, and potentially disrupt trade relations. Once introduced, these diseases put to risk wild fish populations when infected stocks find their way into the natural environment as well as pose a permanent threat to farmers because of their capability of contaminating hatchery-reared stocks or new species for aquaculture (Lavilla-Pitogo *et al*., 2011). Some examples of transboundary diseases that affected the aquaculture industry of the Southeast Asian region are shown in **Table 1**.

Table 1. Some transboundary diseases that impacted aquaculture production in Southeast Asia

Diseases	Affected Organisms
Epizootic ulcerative syndrome (EUS)	Freshwater fish
Koi herpes virus disease (KHVD)	Koi, carps
White spot disease (WSD)	Shrimps
Taura syndrome (TS)	Shrimps
Infectious myonecrosis virus (IMNV)	Shrimps
Viral nervous necrosis (VNN)	Marine fish
Acute hepatopancreatic necrosis disease (AHPND)	Shrimps

Over the years, outbreaks of diseases have affected cultured and wild fish populations resulting in decreased production and economic losses (de la Pena, 2004). Particularly, the shrimp industry has been beset with disease issues, starting with the white spot disease (WSD) epizootic which probably began in China in 1992 and subsequently spread to Taiwan, Japan and the rest of Asia. The white spot syndrome virus (WSSV), the causative agent of white spot disease (WSD), was first described in Japan where an initial outbreak occurred in cultures of *Penaeus japonicus* in 1993 and was thought to have originated from imported stocks from China.

Taura syndrome, caused by the Taura syndrome virus (TSV), was first recognized in shrimp farms in Ecuador in 1992. TSV spread rapidly to virtually all the shrimp-growing regions of the Americas and was introduced to Asia through shipments of infected shrimp postlarvae and broodstock. TSV outbreaks were first reported in Taiwan and later in Thailand and Indonesia. The most recent disease affecting cultured shrimp in Southeast Asia is acute hepatopancreatic necrosis disease (AHPND). Known earlier as early mortality syndrome or EMS, this disease was first reported in Viet Nam and later in Thailand, Malaysia, and the Philippines.

Issues and Concerns

Effective disease prevention and control require rapid and reliable detection of pathogens and exclusion of potential carriers, diagnosis, surveillance, reporting and an early warning system. Diagnostic procedures are classified according to levels of complexity and harmonized to become effective tools in aquatic animal health management. Farmer-friendly diagnostic methods have also been developed for pond-side application. Understanding disease and their recognition needs to be heightened among small-scale fish farm operators in rural communities (Lavilla-Pitogo *et al*., 2011).

Disease surveillance and reporting have been enhanced in most countries and the awareness about transboundary diseases has been heightened. The Asia-Pacific Quarterly Aquatic Animal Disease Reporting System (QAAD) established in 1998 by FAO/NACA/OIE-Tokyo covers both the OIE-listed and other diseases deemed important to the Asia-Pacific region. The QAAD includes reports of the occurrence of specified diseases of fishes, mollusks and crustaceans from 21 countries and areas (Australia, Bangladesh, Cambodia, China, Hong Kong, India, Indonesia, Iran, Japan, DPR Korea, Republic of Korea, Lao PDR, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, and Viet Nam). This transparent reporting system allows countries to know the status of diseases that pose threats to the aquaculture industry in the region.

Nevertheless, the Southeast Asian region still has a lot to learn about bringing in new and exotic species and their accompanying threat of disease introduction. Controlling the spread of important pathogens through the introduction of exotic species remains a major concern and outbreaks of introduced diseases continue to spread to new areas, causing serious socio-economic impacts and concerns on their effect on the wild populations. On the other hand, the effect of diseases in carrier wild populations should be considered, especially when sourcing broodstock for hatcheries. Surveillance of wildlife based on the protocols recommended by the Import Risk Analysis framework of the Office International des Epizooties (OIE) could be developed and evaluated for prioritizing pathogens for surveillance in wildlife species (McKenzie *et al*., 2007).

Quarantine is important in preventing the spread of serious pathogens of aquatic animals. In the strictest sense, quarantine is the confinement of aquatic animals of unknown or questionable health status in secure facilities such that neither they nor any pathogens they may be carrying can escape into the external environment. During this period, the animals are observed, tested and treatment may be applied, and a decision would be made as to whether or not they should be released to the external environment. The purpose of quarantine is to minimize the risk of introducing infectious agents (pathogens) into the national territory of the importing country and their escape and spread to susceptible species. The secondary objective is to prevent the entry of aquatic organisms that have not been approved for introduction.

The AMSs have established quarantine and/or health certification procedures for aquatic animals and have invested in training quarantine/aquatic animal health officers, establishing quarantine holding facilities and supporting diagnostics laboratories. However, implementing quarantine has not been totally successful and has not prevented the entry of serious exotic aquatic animal diseases due to a number of reasons including: the lag time between emergence of a new disease and its recognition as a serious pathogen of international importance, and when accurate and reliable diagnostic tools are developed and become generally available; the sheer volume of commodity traded and the diversity of forms of trade; and the lack of capital and human resources that governments are able to invest to this undertaking. It is to be noted that the levels of capacity among countries in the region for disease diagnosis, surveillance, quarantine and control of transboundary movement of aquatic animals vary significantly (Arthur, 2004) as shown in **Table 2**.

Strategies under the national aquatic animal health programs of Southeast Asian countries (**Box 1**) are embodied in the Asian Regional Technical Guidelines on Health Management for the Responsible Movement of Live Aquatic Animals and the Beijing Consensus and Implementation Strategy (FAO/NACA, 2001a). The Manual on Procedures for the Implementation of the Asia-Pacific Technical Guidelines on

Box 1. Components of a National Strategy for Aquatic Animal Health (FAO/NACA, 2000)

- National pathogen list
- Disease diagnosis
- Health certification and quarantine measures
- Disease zoning
- Disease surveillance and reporting
- Contingency planning
- Import risk analysis
- National strategies and policy frameworks
- National and regional capacity building

Table 2. Capacity of AMSs for disease diagnosis, surveillance and health certification to control movement of aquatic animals

Country	AHPND Outbreak	Diagnostic Laboratories	Surveillance	Movement Control	Capacity Building
Brunei Darussalam	No	Yes	Yes	No, health certificate from country of origin is required	Yes
Cambodia	Yes, unconfirmed	Yes		Yes	Yes
Indonesia	No	Yes	Yes	Yes	Yes
Japan	No	Yes	Yes	Yes	Yes
Lao PDR	No			Yes	Yes
Malaysia	Yes	Yes	Yes	Yes	Yes
Myanmar	No	Yes		Yes	Yes
Philippines	Yes	Yes	Yes	Yes	Yes
Singapore	No	Yes	Yes	Yes	Yes
Thailand	Yes	Yes	Yes	Yes	Yes
Viet Nam	Yes	Yes	Yes	Yes	Yes

Sources: Country Reports presented during the Meeting on Current Status of Transboundary Fish Diseases in Southeast Asia: Occurrence, Surveillance, Research and Training (Arthur, 2004)

Box 2. Examples of risk management measures for importation of live aquatic animals (Arthur *et al.*, 2004)

- Sourcing from stocks of known disease status, including the use of specific pathogen-free (SPF) stocks
- Importing eggs only
- Requiring quarantine in the country of origin
- Requiring quarantine and testing within the receiving country
- Using the International Council for the Exploration of the Sea (ICES) protocols
- Requiring the use of specific diagnostic tests and standards
- Requiring pre-shipment and/or post-shipment treatments

Health Management for the Responsible Movement of Live Aquatic Animals (FAO/NACA, 2001b) is also available. Examples of risk management measures for importation of live aquatic animals are shown in **Box 2**.

Role of AMSs and SEAFDEC in Addressing the Issues and Concerns

While aquaculture activities of the region have remarkably been intensified, monitoring and surveillance of aquatic diseases have become very important. During the Thirty-fifth Meeting of the SEAFDEC Program Committee in 2012 and Thirty-sixth Meeting in 2013, the Member Counties raised the concern regarding the outbreaks of AHPND and other transboundary diseases in the region, and acknowledged the need for concerted regional effort to address this issue (SEAFDEC, 2013; SEAFDEC, 2014a). In this connection, the SEAFDEC Council during its Forty-sixth Meeting in 2014 asked SEAFDEC/AQD to consider intensifying its activities related to aquatic animal health management as this could have impacts on the trade of fish and fishery products from the region (SEAFDEC, 2014b). Specifically, the SEAFDEC Council recommended that aquatic animal health management, including control and prevention of transboundary aquatic animal diseases, be included in the formulation of future programs of SEAFDEC and its partners in the region since addressing this issue would require collaborative effort.

In responding to the requirements of the Member Countries, SEAFDEC/AQD with funding support from the Japanese Trust Fund embarked on a new five-year project in 2015, on Reinforcement and Optimization of Fish Health Management and their Effective Dissemination. The Project is aimed at: developing and accelerating rapid and effective fish and shrimp health management; enhancing the efficacy of vaccine treatment in tropical cultured species; establishing protective measures against persistent and emerging parasitic diseases of tropical fish; identifying risk factors and developing protective measures against Early Mortality Syndrome (EMS); and extending and demonstrating technology to practitioners, officers, among others of the Member Countries. This Project would therefore address the concerns of the AMSs on the need to address occurrence of emerging aquaculture diseases, the most recent of which is the shrimp disease known as Enterocytozoon hepatopenaei (EHP) caused by a microsporidian parasite (SEAFDEC, 2016a).

In an effort to share the results of the Project's activities to the Member Countries, SEAFDEC/AQD in collaboration with the Government of the Philippines through the Department of Agriculture's Bureau of Fisheries and Aquatic Resources (DA-BFAR), organized the ASEAN Regional Technical Consultation on EMS/AHPND and other Transboundary Diseases for Improved Aquatic Animal Health in Southeast Asia on 22-24 February 2016 in Makati, Philippines. The Consultation was made possible through the Government of Japan's strong commitment in supporting the initiatives related to enhancing food security and safety in the AMSs, through the Japan-ASEAN Integration Fund (JAIF). The country reports presented during the Consultation focused on the occurrence of EMS/AHPND and other transboundary diseases in AMSs and their capacities for disease diagnosis, surveillance, health certification and control of live aquatic animals (SEAFDEC/AQD, 2016).

During the Technical Consultation, it was noted that the outbreaks and incidence of EMS/AHPND has so far been limited to Viet Nam, Thailand, Malaysia and the Philippines. On the other hand, most countries have in place a system for reporting, monitoring, and surveillance for diseases as well as health certification systems for importation and exportation of live aquatic organisms to prevent entry or spread of pathogens (**Table 2**). The Technical Consultation mainly focused on EMS/AHPND since AHPND is a relatively new disease, and several gaps in understanding this health concern still need to be elucidated. Various issues were identified for R&D on AHPND. These include the use of live feeds (specifically polychaetes) as these are potential carriers of pathogens; genetic considerations, *e.g.* the effect of inbreeding on the shrimps' susceptibility to AHPND and other diseases; vertical transmission of AHPND-causing bacteria; transfer of plasmid carrying the toxin gene to other *Vibrio* species and possibly other bacterial pathogens; environmental risk factors for spreads and outbreaks of AHPND; use of green water technology as well as probiotics in the prevention of AHPND; mixed infection with other shrimp pathogens; development of antibiotic resistance; and development of other strategies for prevention and control of the disease. The outputs of Consultation are expected to address Strategic Objectives 38 and 39 under A.7 (Food, Agriculture and Forestry) of the ASEAN Economic Community Blueprint, as well as Strategic Objective 21 under B.3 (Enhancing Food Security and Safety) of the ASEAN Socio-cultural Community Blueprint.

Conclusion and Way Forward

The aforementioned Regional Technical Consultation established the Policy Recommendations to address the issues (**Box 3**) and agreed that such policies should be adopted or strengthened (SEAFDEC/AQD, 2016). These include the need for Member Countries to harmonize legislation(s) and regulation(s) related to aquatic animal health management including the legislation for transboundary movement of live aquatic animals; compliance with good aquaculture practices to maintain optimal environmental conditions during the culture period; develop and implement the guidelines on health management and good practices to prevent EMS/AHPND and other trans-boundary diseases; adopt capacity building programs that would ensure availability and capacity of public or private laboratory services; strictly implement a monitoring, surveillance and reporting system to relevant authorities and/or Competent Authority at country, regional and international levels; put in place an early warning system and develop emergency preparedness and contingency plans; strengthen cooperation and collaborative arrangements among the AMSs and with other regional and international organizations such as OIE, FAO, NACA and SEAFDEC as well as the ASEAN Network of Aquatic Animal Health Centres (ANAAHC); promote and fund public-private partnerships at the national levels as well as cooperation among shrimp industries in the ASEAN Region; promote region-wide capacity building/education and information dissemination programs including technology transfer from an AMS to another AMS to enhance awareness of farmers and relevant stakeholders on R&D developments in transboundary diseases especially on management and control.

During the Forty-eighth Meeting of the SEAFDEC Council in April 2016, the Council recommended that cooperation among the AMSs should be strengthened in order to immediately address problems on aquatic diseases in a collaborative manner, and that a regional early warning system should be established through the leadership of SEAFDEC/AQD in collaboration with the ANAAHC, to keep other countries informed when disease outbreak occurs in one country (SEAFDEC, 2016b). After the endorsement by the SEAFDEC Council of the Policy Recommendations (**Box 4**), actions would be undertaken by SEAFDEC through the SEAFDEC/AQD and the AMSs, as appropriate.

Box 3. Issues on AHPND and HPM-EHP that should be included in future actions/studies on aquatic diseases management

Acute hepatopancreatic necrosis disease (AHPND)

- Use of live feeds for broodstock, especifically polychaetes which have been proven to be carriers of the pathogen
- Copying SPF (*Penaeus vannamei*) hatchery - effect on inbreeding/genetic erosion on susceptibility to AHPND; these breeding programs are long-term, usually highly expensive and need sufficient resources, therefore, should be carefully planned and efficiently implemented and sustained
- Misconception about SPF shrimps and its use; banning of SPF broodstock and live shrimp products from AHPND-affected countries
- Vertical transmission of AHPND bacteria (broodstock to post-larvae)
- Toxin plasmid transfer to other *Vibrio* species and possibly other bacterial pathogens that are common in the aquatic/rearing environment; *V. harveyi* and *V. owensii* have already been reported to carry the AHPND toxin plasmid
- Environmental risk factors for spread and outbreak of AHPND
- Mixed infection with other shrimp pathogens (Covert Mortality Disease or CMD, EHP, White Spot Syndrome Virus or WSSV)
- Efficacy of green water technology in prevention of AHPND infection; currently being practiced in Viet Nam and the Philippines with some degree of success
- Issue on extensive/non-registered farms: risk that they may pose to the spread and occurrence of the disease
- Probiotics: locally produced *vs*. imported; issue on banning probiotics for use in prevention of AHPND
- Biosecurity capacities of countries to prevent the entry of the pathogen
- Emergency preparedness and contingency planning
- Sharing of information and experiences among countries affected and not affected by the disease
- Lack of disease surveillance in processing plants and the wild population of Antimicrobial resistance
- Certification of Aquatic Animal Health (AAH) Professionals (other than veterinarians)
- Cooperation of government and producers in prevention and management of AHPND; Strengthen government and private sector partnership. Learn from the farmer experience and understand science behind and disseminate

Hepatopancreatic microsporidiosis caused by Enterocytozoon hepatopenaei (HPM-EHP)

(Possible research areas for better understanding of the pathogen and disease mechanisms, as well as preventive and control measures)

- Identification of the reservoir of the pathogen to include live feeds other crustaceans that are common in the aquatic environment
- Detailed study on the effect of the pathogen on growth and survival of infected shrimps
- Preventive and control measures
- Co-infection with other important pathogens of shrimps (viral and bacterial), and its association to other shrimps diseases (*e.g.* White Feces Syndrome, AHPND)

Box 4. Policy recommendations and priority areas for R&D to address aquatic diseases	
Issues/Gaps	**Regional Policy Recommendations**
Legislative and policy frameworks	• Development of a national Strategy and Policy Framework • Member Countries should work to harmonize legislation and regulation related to aquatic animal health management including the legislation for transboundary movement of live aquatic animals
Strategy for prevention, control, and biosecurity	• Compliance with good aquaculture practices to maintain optimal environmental conditions during the culture period • Establishment of effective prevention system on EMS/AHPND and other diseases • Marker-assisted selective breeding • Development of vaccine against AHPND • IgY as feed additive (based on experiments, high concentration of IgY in egg yolk can reduce the mortality of shrimp due to presence of antibody to toxin) • Nano-bubble technology: ozone nano-bubble can prevent AHPND • Pond bottom management: use of central drain system • Phage therapy • Development and implementation of the Guidelines on Health Management and Good Practices to Prevent EMS/AHPND and other trans-boundary diseases • Strict implementation of the reporting system to relevant authorities and/or Competent Authority at country, regional and international levels - Early warning system - Monitoring system - Information for the regular report, annual report • Emergency preparedness and contingency plan: should be the responsibility of Competent Authority • Funds should be made available as joint endeavor by private and public sectors
Detecting the EMS/AHPND disease	• Diagnostic methods: should follow the OIE guidelines • Development of tool kit • Ensure availability and capacity of laboratory services, either public or private
Research and Development program at regional and national levels	• Refer to **Box 3**
Cooperation among relevant stakeholders	• Strengthen cooperation arrangements of the following: • ASEAN Member States (AMSs) and international/regional organizations such as OIE, FAO, NACA and SEAFDEC • ASEAN Network of Aquatic Animal Health Centres (ANAAHC); in addition to cooperation arrangements, ANAAHC should also: - assess the status and find ways on how the network could be assisted in implementing its activities - identify what centers should be involved in ANAAHC per country - mobilize all aquatic animal health centers • Public-private cooperation at national levels • Cooperation among shrimp industries in the ASEAN Region
Capacity building program	This should also include technology transfer from an AMS to another AMS
Awareness building	• Enhance awareness of farmers and relevant stakeholders on R&D developments in transboundary diseases (especially on management and control)

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Supporting ASEAN Good Aquaculture Practices:
Utilization of Alternative Protein Sources for Aquafeed to Minimize Pressure on Fishery Resources

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Aquaculture industry of Southeast Asia has been expanding steadily as a result of an increasing demand of food fish in the region as well as in the global scale. Aside from its contribution to the world's fisheries, the aquaculture industry creates employment opportunities and provides income for the region's fish farmers, as well as produces fish which is a major component in the diets of peoples in Southeast Asia. However, the fast development of aquaculture had been viewed as threat to sustainable capture fisheries production as the widespread use of fish by-catch in aquaculture feeds results in over-exploitation of the fishery resources and to certain extent degradation of the resources. Recognizing the importance and urgency of addressing such concern, the Senior Officials of the ASEAN Member States responsible for fisheries adopted in June 2011, the Plan of Action on Sustainable Fisheries for Food security for the ASEAN Region Towards 2020 which includes provision on the need to "improve the efficient use of aquatic feeds by strictly regulating the quality of manufactured feed and feed ingredients and support continued research for developing suitable alternative protein sources that will reduce dependence on fishmeal and other fish-based products." Along with such declaration, the SEAFDEC Aquaculture Department has been enhancing its R&D activities aimed at finding alternatives to fishmeal as feed ingredients in aquaculture feed formulations.

Many ASEAN Member States (AMSs) are top producers of aquatic products from aquaculture, *e.g.* Indonesia, Viet Nam, Myanmar, Thailand, and the Philippines altogether contribute about 16% of the total finfish (inland aquaculture) and 19% of the total finfish (mariculture) production in the world (**Table 1 & 2**). Given the land resource and access to improved technology, Cambodia, Lao PDR and Singapore would be fast catching up in terms of aquaculture production and can become major players in the coming decades. Supporting this upward direction entails the reliance of aquaculture on efficient and sustainable aquafeed production.

Issues and Concerns

Reducing aquafeed dependency on fishmeal is a key for a sustainable development of aquaculture. Towards this end and guided by the various agreements and declarations of the ASEAN-SEAFDEC Member Countries, the Aquaculture Department (AQD) of SEAFDEC launched a program on Healthy and Wholesome Aquaculture since the late 1990s, which is a holistic approach to address issues on fish nutrition and aquatic disease management for food security and sustainability of the aquaculture industry. Going along the direction towards sustainability, the AMSs took notice of the need to source aquafeed ingredients from other sources aside from wild-caught fish in order to minimize pressure on the fishery resources which had undergone severe deterioration. Thus, the AMSs heeded the call for States to "*support research and development on potential feed ingredients and alternative protein sources to minimize the use of fishmeal and food fish in aquaculture*" (SEAFDEC, 2001a). Such objective had been

Table 1 & 2. World's top 10 producers by selected measurements of aquatic production, 2013 (FAO, 2015)

1. Finfish - Inland Aquaculture

Country	Production (metric tons)	%
China	24,817,311	60.1
India	4,148,407	10.0
Indonesia	2,459,418	6.0
Viet Nam	2,369,903	5.7
Bangladesh	1,647,827	4.0
Egypt	1,091,688	2.6
Myanmar	869,384	2.1
Thailand	467,249	1.1
Brazil	388,700	0.9
Philippines	318,798	0.8
Others	*2,713,481*	*6.6*
World	**41,292,167**	**100.0**

2. Finfish - Mariculture

Country	Production (metric tons)	%
Norway	1,245,399	21.6
China	1,123,576	19.4
Chile	736,310	12.7
Indonesia	720,545	12.5
Philippines	375,735	6.5
Japan	242,905	4.2
United Kingdom	156,220	2.7
Greece	124,740	2.2
Canada	122,024	2.1
Turkey	110,845	1.9
Others	*820,088*	*14.2*
World	**5,778,387**	**100.0**

intensified when the ASEAN-SEAFDEC Member Countries again agreed to "*improve the efficient use of aquatic feeds by supporting research into developing suitable alternative protein sources to reduce dependence on fishmeal and other fish-based products*" (SEAFDEC, 2001b).

Recognizing the urgency and severity of the aforesaid concern, the ASEAN-SEAFDEC Member Countries reiterated their declaration to "*consider aquafeed ingredients not derived from wild-caught fish, encourage the culture of species requiring no or low fishmeal content in their feed and apply effective feeding management practices, taking into consideration the need for cultural and social acceptance of alternative feed ingredients*" (SEAFDEC, 2011). Therefore, it has also become imperative for SEAFDEC to support the objective of achieving sustainable aquaculture by doing its part in searching for suitable and cost-effective substitutes for fishmeal and fishery products in aquaculture feeds or aquafeeds. Platon *et al*. (2007) suggested that in order to support R&D initiatives to reduce dependence on fishmeal for aquafeeds, it is necessary to intensify research on the use of low-cost agricultural products or plant-based ingredients for aquafeeds. Through SEAFDEC's Philippine-based AQD, R&D on fish nutrition has been sustained focusing on alternative protein sources that could be used as fishmeal substitutes in the formulation of aquafeeds for various aquaculture species.

Fishmeal Substitutes

Although most omnivorous fish species feeds are now devoid of fishmeal such as tilapia, carp, catfish, and milkfish, reduction of fisheries-based products in the diets of carnivorous aquaculture species still poses a huge challenge. Feed accounts for 50% of the total operational costs in

Box 1. Locally-available ingredients as fishmeal substitutes

Plant protein

Feed ingredients derived from plants are the most abundant substitutes for fishmeal. However, their characteristics of having high variability of nutrient profile, inadequacy of essential amino acids (EAA), and the presence of anti-nutritional factors are aspects that still need thorough examination and research.

Oil seeds such as soybean meal, cotton seed meal, rapeseed (**Fig. 1**) meal, and sunflower meal have competitive prices and protein content ranging from 38 to 52%. Soybean meal is the most available and commonly-used plant ingredient in aquaculture. Fishmeal replacement by oil seeds is only limited to 20-40% and mean incorporation of 10-20% for carnivorous fish species. Oil seeds are characterized to be deficient in EAA, particularly methionine and lysine, and could also contain several anti-nutritional factors that can be inactivated by heat processing or solvent extraction. Palatability is compromised when plant ingredients are incorporated in the diets of the fish, thus the addition of feed stimulants is needed.

Fig. 1. Rapeseed
www.bdtdc.com

Pea seed meal *Pisum sativum* and lupin *Lupinus*, and other beans could contribute to the research on substitution of fishmeal. However, due to their minimal protein content (22-30%), its incorporation has become limited due to the presence of anti-nutritional factors. It can replace fishmeal at a level of 10-30% of the ingredient. Its incorporation has become limited due to the presence of anti-nutritional factors, poor EAA profile, presence of non-starch polysaccharides and a high content of starch which should be taken into consideration when formulating the diet.

Cereals which include maize, rice and wheat could be incorporated in the diets to be used as an energy source (carbohydrates). It is low in protein (8-12%) but is a rich source of carbohydrates in the form of starch (about 60%). Cereal incorporation in the diets of carnivorous fish is limited at 10-20% which provides 5% of the dietary protein. It is also deficient in EAA especially lysine.

Leucaena leaf ("ipil-ipil" leaf meal) with an analyzed crude protein of 34.38% could be a supplement in the diets of tilapia. However, this plant protein source contains mimosine and tannin which are toxic that can affect the digestive process of the fish and eventually leads to poor fish growth.

Groundnut cake, *Arachis hypogaea* which contains 31.6% crude protein, is an alternative protein source which is highly palatable and have acceptable odor. It has better binding properties compared to soybean. In spite of its positive characteristics, it is deficient in some EAA (methionine and lysine) and can be exposed to aflatoxin which is toxic. Results from previous studies suggested that groundnut cake can replace 10% of fishmeal in the diets of catfish *Heterobranchus longifilis*.

The sweet potato, *Ipomoea batatas* is an important food crop in the tropical areas. The leaves of this plant have been used as a cheap protein source as ruminant feeds. The leaf meal has protein content between 26 to 33%, good amino acid, minerals and vitamin profile. However, it contains anti-nutritional factors that can significantly affect fish growth. Tilapia growth trials have suggested an up to 15% inclusion level of sweet potato leaves in tilapia diets.

The identification and removal of anti-nutritional factors through heat treatment has improved the potential of taro, *Colocasia esculenta* as a protein ingredient in fish feeds. Taro leaves have a high amount of protein (31.5%) and high level of vitamins and minerals which are needed in fish feed formulation. Growth experiment has indicated that a complete replacement of fishmeal with taro can be achieved in the diets of tilapia cultured in ponds with high natural productivity.

Harvested duckweed, *Lemna* spp. (**Fig. 2**) plants contain up to 43% protein on a dry weight basis and may be utilized without further processing as a complete food for fish. The amino acid profile of duckweed is relatively better than most of the plant protein sources and it contains high concentration of trace minerals. Studies have indicated that tilapia fed with duckweed at a feeding rate of up to 30 g dry matter/kg resulted in a higher survival rate and weight gain.

Fig. 2. Duckweed
www.duckweedbioponica.com

Box 1. Locally-available ingredients as fishmeal substitutes (Cont'd)

Coconut meal (copra), *Cocos nucifera* is made from the processed by-product of coconut oil extraction. It contains approximately 22% crude protein. Copra contains no known anti-nutritional factors and has a high protein digestibility. But relative to fishmeal and soybean meal it is deficient in all the essential amino acids required by fishes. Nevertheless, copra is a useful diet ingredient in areas where it is locally available in quantity.

The leaves of water hyacinth, *Eichhrornia crassipes* (**Fig. 3**) contain 20% protein and relative to other plant, its essential amino acid profile is relatively balanced. However, it has a high fiber content which limits the utilization of this ingredient. Reports have suggested that processing the water hyacinth as concentrates can improve its nutrient profile and can be fed to white shrimp, *Litopenaeus vannamei* at 25% level.

Fig. 3. water hyacinth

Terrestrial animal protein

Rendered protein or animal by-product, which comprises meat meal, poultry meal (**Fig. 4**), meat and bone meal, feather meal, blood meal, has high potential as alternative to fishmeal. However, these types of ingredients are heterogenous in nutrient profile, limited EAA and prone to bacterial contamination. The protein content of these animal by-products ranges from 50 to 80% and can replace fishmeal at a level of 20-40%. These types of ingredients have good palatability and do not contain anti-nutritional factors similar to plants. However, it contains high levels of ash and saturated lipid. High inclusion level of animal by-product meal in fish feed can cause excess dietary phosphorus which is harmful to the environment and could have deleterious effect on the nutritional health of the fish.

Fig. 4. Chicken by-product meal
www.saragingerich.com

Fisheries co-products

Shrimp by-products, *e.g.* heads and shells (**Fig. 5**) are produced in large quantities from processing plants and are commonly used as ingredients in shrimp diets. Head meal, processed residue and waste of shrimp by-products has an average crude protein of 40%. Studies have indicated that *L. vannamei* growth and survival was significantly improved when shrimp by-product was included in the feeds of up to 18% level. Fish, *e.g.* humpback grouper growth experiments suggested that with increased level of shrimp head meal (SHM) inclusion in the diets, growth and feed efficiency were adversely affected. High chitin and ash content of SHM pose as main constraints in the performance parameters of the fish fed the experimental diets. Studies also suggest that a maximum of 10% SHM inclusion could be included in the diet of the fish.

Fig. 5. Shrimp head meal
www.hxcorp.com

By-products from the fish processing industry, *i.e.* milkfish and tuna (**Fig. 6**), could be utilized as ingredient in fish feeds. On average, derivatives from fish processing has crude protein of 60% and several essential amino acids are not limiting. Research trials have shown that these ingredients have performed well when fed to grouper, *Epinephelus coioides* and red sea bream, *Pagrus major* at an inclusion level of up to 25%. However, products obtained from the processing plants do not ensure the homogeneity and freshness of the ingredients.

Fig.6. Fish processing by-product
www.addcon.com

Microbes

Single cell proteins (SCP), such as yeast are rich in protein source (>50%), high levels of nucleotides, palatable and devoid of anti-nutritional factors commonly found in plants. Studies have indicated that these ingredients can replace protein from fishmeal by as much as 50% (corresponding to a dietary incorporation of 30-55%). These types of ingredients are mostly incorporated in the diets as potential probiotics which can improve the health condition, health resistance, microbiota balance, and gut physiology of the fish.

Unconventional sources

Earthworm (**Fig. 7**) can also be used as protein source in fish feed. It has amino acid profile similar to that of fishmeal and can be easily propagated in culture conditions. Replacement of up to 20-30% earthworm (*Eisenia foetida*) has improved the growth performance of several fish such as tilapia, rainbow trout and common carp which could be attributed to its palatability and high protein content of 60% crude protein.

Considered as pest, the golden snail (*Pomacea* sp.) is easy to cultivate and has a huge potential to become a source of protein in fish diets. It is characterized with high protein content however it has low levels of specific essential amino acid (methionine + cystine) relative to fishmeal values. Results from experiments have suggested maximum inclusion level of 30% GSM to replace fishmeal in the diets of tiger grouper (*Epinephelus* spp.).

Frog meal contains 58% of crude protein and amino acids close to the ideal profile of an animal feed. It contains a high proportion of essential fatty acid as good source of vitamins and minerals. However, scientific studies on its utilization as ingredient in fish feeds had been very limited.

Tilapia fed with maggot meal of up to 30% substitution level resulted in good overall growth performance and health status of the fish. Based on cost effectiveness, availability and nutrient profile, the housefly larvae grown on animal waste seem to have an immensed potential as an alternative source of protein in the diets of the fish. Maggot meal has a range of protein content of 39-55%, a rich source of phosphorus, trace elements, B complex vitamins and an excellent essential amino acid profile.

Fig.7. Worm meal
www.mazuri.com

Table 3. Protein and limiting amino acid profile of selected alternative protein ingredients (A. Oliva-Teles *et al.*, 2015)

Feedstuffs	% Protein	Limiting amino acids		
		1°	2°	3°
Maize distillers wet grains and solubles	44.0	Lys	Tyr	Arg
Maize distillers dried grains and solubles	29.5	Lys	Tyr	-
Brewer's yeast, dehydrated	48.6	M+C	His	-
Earthworm, dehydrated	61.0	Lys	-	-
Feather meal	87.5	Lys	His	Trp
Blood meal	94.1	Ile	Trp	His
Poultry offal meal	60.2	Lys	Trp	His
Meat and bone meal, low fat	62.0	Lys	M+C	Trp
Meat and bone meal, high fat	54.9	Trp	M+C	Lys
Fishmeal, 60-68% protein as fed	70.6	-	-	-
Fishmeal, high protein	75.4	-	-	-
Maize gluten meal	67.3	Lys	Trp	Arg
Maize grain, Europe	9.4	Lys	Tre	-
Wheat grain	12.6	Lys	Tre	-
Faba bean (*Vicia faba*)	29.0	M+C	Trp	-
Lupin (*Lupinus angustifolius*), blue seeds	33.8	M+C	Lys	Trp
Pea seeds	23.9	M+C	-	-
Linseed meal, expeller-extracted	34.2	Lys	-	-
Cottonseed meal, low fiber, low oil	45.0	Lys	M+C	Tre
Sunflower meal, solvent extracted, dehulled, partially dehulled	37.7	Lys	-	-
Canola meal, solvent extracted	39.0	Lys	-	-
Rapeseed meal, solvent extracted, low erucic, low glucosinolates	38.3	Lys	-	-
Soybean meal, high oil (expeller)	49.3	M+C	-	-
Soybean meal, high protein (dehulled)	53.5	M+C	-	-

Note: 1° - First limiting amino acid; 2° -Second limiting amino acid; 3° -Third limiting amino acid
Arg - Arginine; His - Histidine; Ile - Isoleucine; Lys -Lysine; M+C -Methionine + Cysteine; Tre - Threonine; Trp - Tryptophan; Tyr - Tyrosine

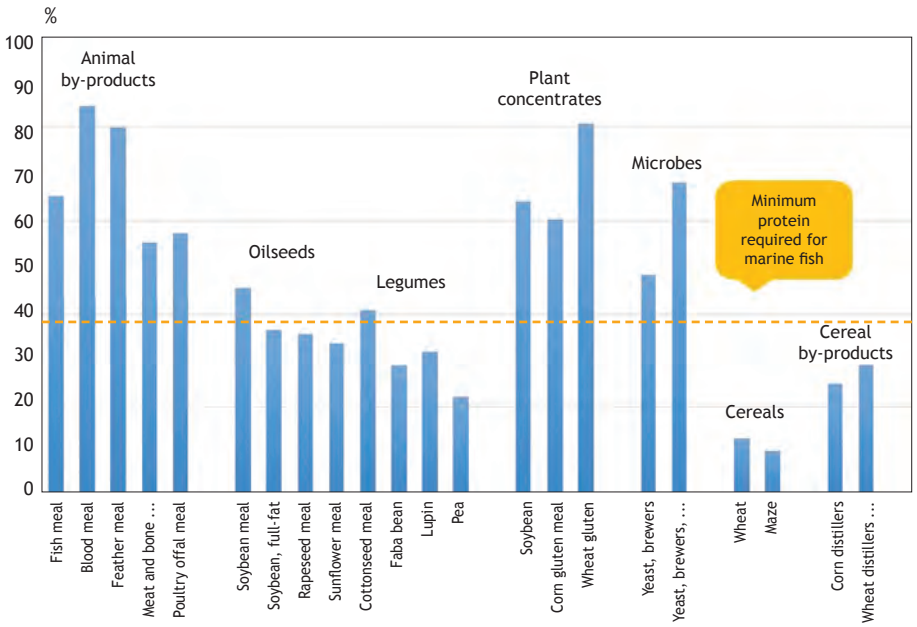

Fig.8. Protein composition of alternative protein sources (A. Oliva-Teles *et al.*, 2015)

aquaculture with fishmeal as the main protein source (average inclusion level of 24% in the diets). The supply of wild-caught fish in the Southeast Asian region including by-catch or trash fish had been dwindling while the same fishery resource also serves as protein source for peoples in the region. Thus, the aquaculture industry is beset with increasing operational costs in feed formulations, shortage of fish-based ingredients, and increasing conflict with human consumption. This has driven the AMSs to seek the assistance of SEAFDEC/AQD in exploring the use of unconventional ingredients in aquafeeds. Therefore, SEAFDEC/AQD with inputs from the AMSs, has been examining the utilization of locally available ingredients as fishmeal substitutes, *e.g.* plant protein, protein from terrestrial animals, fisheries co-products, microbes, unconventional sources (**Box 1**).

Processing of the Ingredients

Although indigenous and alternative protein sources are encouraging, high levels of inclusion has been hampered by various constraints as mentioned above, which could include: deficiencies in nutrient composition (protein and essential amino acids) as shown in **Fig. 8** and **Table 3**, complex carbohydrates, high fiber, anti-nutritional factors and even contamination. Advances in feed processing which comprise extrusion cooking, pre-enzyme treatment, use of protein concentrates, hydrolysis and solvent extraction have been undertaken to improve the nutrient profile of the ingredients.

For AMSs that produce palm oil, lessons could also be learned from Indonesia's research on "converting waste to wealth" through the natural process of bioconversion to produce aquafeeds from oil palm kernel (Hem *et al*., 2008).

Recommendations and Way Forward

Acceptability of these alternative protein ingredients mainly depends on its nutrient and phytochemical profile. Previous growth experiment resulted in poor performance parameters when using these crude alternative ingredients. With the advent of new feed processing technology, these protein substitute ingredients could be incorporated in the fish diets at a higher level without significantly affecting growth. Blending two or more processed alternative ingredients in fish diet formulations has been currently pursued in experimental growth trials.

SEAFDEC/AQD has embarked on nutritional studies which involve applying fish protein substitutes (plant, terrestrial animals and fish by-products) in fish diets. Over the past decade, several results have shown prospects that some ingredients could be applied in a commercial scale without affecting fish growth and revenue from the farmed fish. At present, laboratory results from the evaluation of recently introduced ingredients (Distiller's dried grains with soluble (DDGS), hydrolyzed milkfish offal, mungbean as well as new variety of soybean meal) in the region had shown positive

Box 2. Regional Policy Recommendations for the Development and Use of Alternative Dietary Ingredients or Fishmeal Substitutes in Aquaculture Feed Formulations

Issues/Gaps	Regional Policy Recommendations
Knowledge & Technology Nutritional profiles of feed ingredients (amino acid/fatty acid profile)	• Create a network/regional forum for exchanging and sharing of information on R&D on feed formulation and improving feed efficiency • Technical support to improve farmer knowledge on feed and feeding management, hygiene and sanitation • Information exchange and cooperation with other regions
Status of the aquafeeds	• Assess the capacity of feed milling companies, status of import - export of the raw materials for feed ingredients
Raw materials from IUU fishing activity/GMO	• Traceability system of raw materials • Apply the Catch Documentation system
Efficiency of Feed Formulation	• R&D on aquafeeds quality, formulation and use of alternative dietary ingredients
Sustainability of supply of alternative dietary ingredients to replace fishmeals	• Need government program to increase production and centralized supply of feed ingredients in each local government • Develop techniques for mass production of high quality alternative ingredients • Establish the local ingredients supplier networks
Creation of regulations/fishery acts to manage the development of Aquafeeds	• Establish the national Aquafeeds Quality Standards (control) to ensure that feed milling companies comply with the regulation/fishery acts
Center of ASEAN Program	• SEAFDEC/AQD to work closely with ASEAN Member States, R&D institutions, the academe, Industry and inter-regional organizations as a center of ASEAN programs on Development and Use of Alternative Dietary Ingredients in Aquaculture Feed Development • Establishment of the ASEAN Network on Development and Use of Alternative Dietary Ingredients in Aquaculture Feed Development
Regional Cooperation	• Develop the National Action Plan on Development and Use of Alternative Dietary Ingredients in Aquaculture Feed Development • Increase the awareness of importance of reducing dependence of aquaculture on marine animal origin feed and ingredients

Agricultural wastes and by-products currently being converted into valuable protein sources in tilapia diets (Photos: F. Aya)

results as well. Information that could be gathered from this article could serve as basis to further improve the utilization of these ingredients by other fish species as well as the search for new ingredients to lessen the dependence of fishmeal in the formulation of aquaculture feeds.

Along with such foresights, SEAFDEC in collaboration with the Department of Fisheries of Myanmar with funding support from the Government of Japan through the Japan-ASEAN Solidarity Fund, convened the ASEAN Regional Technical Consultation on Development and Use of Alternative Dietary Ingredients or Fishmeal Substitutes in Aquaculture Feed Formulations in Myanmar in December 2014. The Consultation came up with Regional Policy Recommendations for the Development and Use of Alternative Dietary Ingredients in Aquaculture Feed Formulations (**Box 2**) which had been endorsed by the SEAFDEC Council during its Forty-seventh Meeting in Thailand in April 2015 (Catacutan *et al*., 2015). Therefore, SEAFDEC/AQD would continue to pursue its technical works as well as information compilation on the aforementioned aspects as these could serve as basis for countries in the region to develop strategies to reduce dependence of fish-based materials as ingredients in aquaculture feeds, as recommended by the SEAFDEC Council of Directors (SEAFDEC, 2015).

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CALENDAR OF EVENTS

Date	Venue	Title	Organizer(s)
		2016	
1-3 June	Makati, Philippines	24th Meeting of the ASEAN Sectoral Working Group on Fisheries (ASWGFi)	ASEAN Sec
7-9 June	Bangkok, Thailand	Regional Technical Consultation on Development of Regional Guidelines for Small-scale Fisheries in the Southeast Asian Region	Secretariat
8 June	Bangkok, Thailand	4th REBYC-II CTI Project Steering Committee Meeting 2016	REBYC-II CTI
9-10 June	Bangkok, Thailand	REBYC-II CTI Project Lesson Learnt Workshop	REBYC-II CTI
13-22 June	TMS-Philippines	Training Course on Mud Crab Nursery & Grow-out Operations	AQD
13 Jun-19 Jul	TMS-Philippines	Training Course on Marine Fish Hatchery	AQD
20-25 June	Cambodia	Training Course on Essential Ecosystem Approach to Fisheries Management (E-EAFM) for Cambodia	SEAFDEC-Sweden Project
21-23 June	Chonburi Province, Thailand	Mid-term Shark Data Collection Project Meeting	Secretariat
24-26 June	Bac Lieu, Viet Nam	VietShrimp International Fair 2016	Viet Nam
27-29 June	Chonburi Province, Thailand	3rd Meeting of the Scientific Working Group on Stock Assessment of Neritic Tunas	Secretariat
27 Jun-1Jul	Myanmar	Training of Trainers on Essential Ecosystem Approach to Fisheries Management (E-EAFM) for Myanmar	SEAFDEC-Sweden Project
4-14 July	Samut Prakan, Thailand	Regional Training Workshop on Larval Fish Identification and Fish Early-life History Science (Advanced course: Key to Species)	SEAFDEC-Sweden Project
11-15 July	Rome, Italy	32nd Session of FAO Committee on Fisheries	FAO
18-22 July	Singapore	Regional Training Course on Identification of Biotoxin-producing HAB Species in the ASEAN Region	MFRD
3 August	Bangkok, Thailand	High-level Consultation on Regional Cooperation in Sustainable Fisheries Development Towards the ASEAN Economic Community	Secretariat
4-6 August	Bangkok, Thailand	ASEAN Fisheries Conference and ASEAN Seafood Exposition	Thai DOF & NACA
8-10 August	Palembang, Indonesia	1st Workshop to Review Activities and Methodologies for Promotion on Inland Fishery	IFRDMD
9-11 August	Kuala Lumpur, Malaysia	Core Experts Meeting for Comparative Study on Purse Seine Fishery in the Southeast Asian Region	MFRDMD
16-18 August	(To be decided)	Final Project Meeting on Sharks Data Collection in Southeast Asia	Secretariat, TD & MFRDMD
Aug.-Oct. (Tentative)	TMS-Philippines	Distance Learning Course on Principles of Aquaculture Nutrition (ANOL)	AQD
12-16 September	BFS-Philippines	Training Course on Freshwater Prawn Hatchery & Grow-out Operations	AQD
12-23 September	TMS-Philippines	Training Course on Seaweed Farming	AQD
12 Sep 2016 -26 Feb 2017 (Tentative)	TMS-Philippines	Distance Learning Course on Principles of Health Management in Aquaculture (AHOL)	AQD
20-22 September	Preah Sihanouk, Cambodia	On-site Training on Energy Saving and Safety at Sea for Small Fishing Vessels in Cambodia	TD
24 Sep-5 Oct	South Africa	17th Conference of the Parties of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	CITES
21-23 November	Hokkaido, Japan	10th Meeting and Conference of Asian Fisheries Acoustic Society (AFAS) 2016	AFAS
22 Nov-1 Dec	BFS-Philippines	Training Course on Community-based Freshwater Aquaculture for Remote Rural Areas of Southeast Asia	AQD
28-30 November	Yogyakarta, Indonesia	39th SEAFDEC Program Committee Meeting (PCM)	Secretariat & IFRDMD
1-2 December	Yogyakarta, Indonesia	19th Meeting of the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP)	SEAFDEC & ASEAN

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


Secretariat


TD


MFRD


AQD


MFRDMD


IFRDMD

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The second prize drawing winner, *Musashi Uemoto*, from the national drawing contest in Japan

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