

# Exploring the Sustainable Development of Demersal Fishery Resources in the High Seas

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The Southeast Asian Fisheries Development Center (SEAFDEC) is an autonomous inter-governmental body established as a regional treaty organization in 1967, to promote sustainable fisheries development in Southeast Asia. Currently, SEAFDEC has 11 Member Countries: Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam. In order to fulfill its mandate, SEAFDEC established five Technical Departments: Training Department (TD) in Thailand which focuses on R&D on marine capture fisheries, Marine Fisheries Research Department (MFRD) in Singapore for the development of fisheries post-harvest technology, Aquaculture Department (AQD) in the Philippines focusing on aquaculture R&D, Marine Fishery Resources Development and Management Department (MFRDMD) supports the sustainable development and management of marine fishery resources in the region's EEZs; and the Inland Fishery Resources Development and Management Department (IFRDMD) focusing on the sustainable development and management of inland capture fisheries. Specifically and in accordance with their respective mandates, TD and MFRDMD have been conducting R&D with respect to the sustainable development and management of the region's marine fishery resources. While the former undertakes R&D on fishing grounds, fishing gear improvement, and socio-economic aspects, among others, to facilitate sustainable utilization of the region's marine fishery resources; the latter gives priority to fish stocks management that support the sustainable development and management of such fishery resources. Basically, TD in collaboration with the SEAFDEC Member Countries and concerned international and regional organizations has been conducting fisheries research surveys in the South China Sea, Gulf of Thailand, and the Andaman Sea, using the SEAFDEC research and training vessels: the M.V. SEAFDEC and the M.V. SEAFDEC 2. While the M.V. SEAFDEC, a 1178-GT purse seine research vessel, is used to provide services towards the conduct of marine fishery resources surveys, the M.V. SEAFDEC 2, a 211-GT vessel, is mainly used to explore the fishery resource potentials in the Southeast Asian region. Both vessels were provided to SEAFDEC by the Government of Japan.

Many countries in the Southeast Asian region have increasingly attempted to expand their fishing activities to the offshore areas in their respective Exclusive Economic Zones (EEZs) and also in the high sea areas, where the fishery resources appear to be still under-utilized. These efforts are meant not only to reduce the pressure of over-exploiting the fishery resources in near shore areas and find alternative sources of fishery resources, but also to respond to the Resolution

and Plan of Action No. 18, which encouraged SEAFDEC and the ASEAN Member States (AMSS) to “investigate the potential of under-utilized fisheries resources and promote their exploitation in a precautionary manner based upon analysis of the best scientific information” (SEAFDEC, 2011). In this connection, SEAFDEC has therefore been providing technical support to the AMSS in their efforts to explore such under-utilized fishery resources through technical consultations as well as collaborative research surveys that have been undertaken under the current five-year project “Offshore Fisheries Resources Exploration in Southeast Asia.” Implemented by TD from 2014 to 2019, this project receives funding assistance from the Japanese Trust Fund (JTF) and technical support from collaborating partners at national, sub-regional, and regional levels, and makes use of the SEAFDEC research and training vessels: the M.V. SEAFDEC and the M.V. SEAFDEC 2.

Anchored at the TD Pier in Samut Prakan, Thailand, these two research and training vessels have been utilized mainly to support three specific R&D aspects: fisheries resource and oceanographic research surveys; human resource development on fishery resources development and management, development of sustainable fishing technology, navigation, marine engineering, and fish handling onboard fishing vessels; and assessment of national fishery resources in the respective EEZs of the AMSS. From the time it started its operations in 1993 up to the present, the M.V. SEAFDEC has been utilized for the conduct of regional collaborative research survey activities in several waters of the Southeast Asian countries, e.g. Gulf of Thailand, Andaman Sea, eastern Indian Ocean, as well as regional research activities in collaboration with relevant agencies. The M.V. SEAFDEC is also being tapped by the Government of Thailand to deploy and maintain a tsunami warning system in the Andaman Sea and Indian Ocean under the technical arrangement with the National Disaster Warning Center (NDWC) of Thailand.

The M.V. SEAFDEC 2, on the other hand, which started its operations in 2004 focuses mainly on the assessment of fishery resources through extensive scientific surveys of the coastal and offshore fishery resources of the AMSS. The vessel is also used during the implementation of the various fishery training courses arranged by TD, especially those that deal with the utilization of fishery resources in offshore and deep sea areas, and on the exploration of un-trawlable grounds in the waters of the AMSS.

## Role of SEAFDEC in exploring the fishery resources in offshore and deep sea areas

Through the utilization of the M.V. SEAFDEC from 1993 to date, TD has been able to conduct marine fishery resources surveys in the waters of the Southeast Asian countries in collaboration with concerned countries, as well as short-term training courses on responsible fishing technology, and sustainable fishing techniques and practices. From the resources surveys, oceanographic data on the Southeast Asian waters and information on the region's marine fishery resources have been compiled. Moreover, a number of technical persons from the Southeast Asian countries have been trained on fishing gear technology, techniques, and practices. The collaborative fishery resources surveys carried out by TD had therefore been enhanced with the arrival of the M.V. SEAFDEC 2 at TD, especially the activities on coastal and marine resources surveys in the waters of the Southeast Asian region, e.g. South China Sea, Gulf of Thailand, Sulu-Sulawesi Seas. From those surveys, substantial data had been compiled, especially from the activity "Assessing the Demersal Fishery Resources in Southeast Asian Waters" carried out from 2004 to 2007, and the TD Project "Development of Demersal Fishery Resources Living in Un-trawlable Fishing Grounds in Southeast Asian Waters: Deep-sea Fisheries Exploration in Southeast Asia," which was implemented during 2007-2010. The results from such activities had been compiled and disseminated in the region through sets of guidelines and standard operating procedures for scientific surveys and fishing operations. All samples collected from the surveys using the M.V. SEAFDEC and the M.V. SEAFDEC 2 had been catalogued and maintained by TD. Through the years, the utilization of these research and training vessels has helped in strengthening the technical cooperation in effective fisheries and environmental management in the region through enhanced research and training capabilities.

## Abundance of demersal fishery resources in Southeast Asian waters

Using the M.V. SEAFDEC 2, surveys were conducted by TD with the collaboration of concerned Member Countries from 2004 to 2007 to collect data on the relative abundance of demersal resources in the un-trawlable areas of Southeast Asia (Yasook, 2008). Covering the un-trawlable areas of the Andaman Sea of Thailand; West Coast of Borneo in the waters of Brunei Darussalam, and Sabah and Sarawak of East Malaysia; West Coast of Luzon and Sulu Sea of the Philippines; and East Coast of Viet Nam, and using the bottom vertical longline, the distribution and abundance of demersal fish species in these areas were determined. From the results, Yasook (2008) concluded that high-value demersal fishery resources, such as groupers and snappers, are found in these un-trawlable waters. Specifically, 20 species of groupers and 15 species of snappers were found but only the grouper *Epinephelus areolatus* was distributed in the sampling areas. He added that the highest CPUE was in the Andaman Sea, followed by the West Coast of Borneo and East Coast of Viet Nam, and the lowest CPUE was in the West Coast of Luzon in the Philippines. These results could imply that such fishery resources have the potentials for the development and management of deep sea fisheries in the Southeast Asian region.

Many reports have indicated that several surveys of the deep sea areas of the Southeast Asian waters had been conducted in the past years (Sukramongkol, 2011), specifically covering the South China Sea as well as the Andaman Sea. Although the compilation shown in the **Table** might not be very extensive, the results showed high diversity of species found in these waters. SEAFDEC also reported that during the survey cruises carried out by TD using the M.V. SEAFDEC 2, the waters off the Philippines and Indonesia with depths that range from

**Table.** Historical surveys of deep sea areas in the Southeast Asian region (adapted from Sukramongkol, 2011)

The survey	Year of survey	Research vessel used	Area of coverage	Important findings
US Bureau of Fisheries deep sea sampling expeditions	1908-1910	The ALBATROSS	Pacific and Hawaiian Islands (including Philippines and Indonesia)	New crustacean species of were found in Philippine waters (185 m deep) including the living fossil of the glypheoid, <i>Neoglyphea inopinata</i>
Fifth Thai-Danish Expedition (FTDE)	1966	R.V. THANARAT	Andaman Sea at depths 16 and 85 m	Recorded 80 species of fishes from 41 families
Deep sea explorations by the French National Museum of Natural History	1976, 1981, 1985	R.V. VAUBAN, R.V. CORIOLIS	Southwest waters off Luzon, Mindoro, Marinduque	Recapture of <i>Neoglyphea</i> sp. (glypheod lobster specimens)
Deep sea demersal resources survey	1975	Fisheries No. 2 or FR.V. Thanarat	Andaman Sea: in waters with depths from 100 to 450 m. off Myeik Coast (Myanmar), and off southwest of Phuket to Adang Island (Thailand)	With the main objective of exploring the deep sea for spiny lobster ( <i>Puerulus sewellii</i> ) and deep sea shrimp <i>Linuparus trigonus</i> at depths ranging from 100 to 450 m, results revealed high abundance of the species and the possibility of developing deep sea trawl fisheries at sea depths ranging from 130 to 350 m

**Table.** Historical surveys of deep sea areas in the Southeast Asian region (adapted from Sukramongkol, 2011) (Cont'd)

The survey	Year of survey	Research vessel used	Area of coverage	Important findings
Viet-Xo Joint Otter Trawl Survey	1978-1988		Viet Nam waters with depths more than 200 m	Catch rate fluctuated from 30 kg/hr to 460 kg/hr
FAO-assisted deep sea fishery resources survey (using bottom trawl)	1979-1980	Norwegian research vessel, the R.V. FRIDTJOF NANSEN	Countries bordering the Indian Ocean (waters of Indonesia, Malaysia, Myanmar, Thailand)	Substantial resources of deep sea shrimps and lobsters in the unexploited zone that with depths that range from 200 m to 300 m of the EEZs of Myanmar and Thailand
Bottom trawl survey	1980	R.V. FRIDTJOF NANSEN	West Coast of Sumatra	Standing stock was estimated to 65,000 metric tons
Joint Thai-Japanese-SEAFDEC survey	1981	R.V. NAGASAKI MARU	Continental slope off Myanmar and Thai waters in Andaman Sea in depths 200 to 400 m	Deep sea shrimps and lobsters, cephalopods, Nemipteridae, Synodontidae, Elasmobranchii
Deep sea survey (SEAFDEC)	1987	M.V. PAKNAM	Southwestern waters off Phuket Island, with depths between 400 and 421 m	Max CPUE was 181.8 kg/hr of which CPUE of useful fishes was 20.3 kg/hr, 11.5 kg/hr for crustaceans, and 150 kg/hr of trash fish
Survey of un-trawlable waters between Myanmar and Thailand	1990	R.V. CHULABHORN	Areas between Myanmar and Thailand	Commercial species comprise yellow snapper at 1.7 kg/100 hooks, banded grouper at 0.9 kg/100 hooks
Survey under "Biodiversity of the Andaman Sea Shelf" of Denmark and Phuket Marine Biological Center	1996-2000	R.V. CHAKRATONG TONGYAI	Areas bordering Myanmar in the north to the Malaysian border in the south of the waters of Thailand	More than 1,000 deep-sea fish specimens were collected during this expedition at water depths that were deeper than 200 m
Fishery research survey of Brunei Darussalam	2004	M.V. SEAFDEC 2	Continental shelves and slopes off Brunei Darussalam waters (depths: 100 and 400 m)	Fish density along the continental slope: 0.63 to 1.53 mt/km <sup>2</sup> , species composition from demersal trawl on continental shelf and upper slope (100-200 m) dominated by lizardfish ( <i>Saurida tumbil</i> ) and nemipterids ( <i>Nemipterus</i> sp.)
Survey of fishery resources of Indonesia	2004-2005	R.V. BARUNA JAYA IV	West Coast of Sumatra and Java	High diversity: 456 fish species, 52 crustacean species, 42 cephalopod species; the area also serves as habitat of red roughy ( <i>Hoplostethus crassispinus</i> ), black roughy ( <i>H. rubelloterus</i> ), Alfonsino ( <i>Beryx splendens</i> ) and blackthroat seaperch ( <i>Doederleinia berycoides</i> )
Survey of Malaysian EEZ	2004-2005	K.K. MANCHONG	Off Sarawak waters, with depths 92 and 185 m	Dominant species in deep sea; <i>Priacanthus macrocanthus</i> , <i>Saurida tumbil</i> , <i>S. longimanus</i> , <i>Decapterus kurroides</i> ; <i>Lophiomus</i> spp., <i>Malakichthys elegans</i> ; In un-trawlable waters (using bottom vertical longline): Ariidae, Lutjanidae, Squalidae, Lethrinidae, Nemipteridae, Portunidae, Muraenidae
Deep sea resource surveys in Philippine waters: Census of Marine Life	2005-2008		Panglao Island, Western Pacific off Luzon Island, Lubang and Mindoro: sea depths from 100 to 2,250 m	Compilation of taxonomic and morphological; significant catches of pandalid shrimps ( <i>Heterocarpus woodmasoni</i> , <i>H. hayashii</i> , <i>H. dorsalis</i> ) at depths of 200 and 600 m
Bottom trawl survey	2007	M.V. SEAFDEC 2	Continental shelf at the eastern central part off Myanmar waters up to 100 m deep	Highest catch: lizardfish ( <i>Saurida undosquamis</i> ) about 20% of total catch at 91 kg/hr
Deep sea fishery resources survey (SEAFDEC-BFAR survey using beam trawl)	2008	M.V. SEAFDEC 2	Lingayen Gulf (northwest of Luzon, Philippines)	50% of catch belong to family Macrouridae, Colocongridae, Sternoptychidae

200 m to 1,000 m, have highly-diverse fishery resources that are still less exploited (SEAFDEC, 2012). Nonetheless, these resources are also highly vulnerable to human demand for seafood, especially the low-productivity species and the sensitive deep-sea habitats. Commercial deep-sea fishing practices, e.g. gill-net, trawl, bottom longline, multiple hook and line, and trap, had been tried in Indonesia and the Philippines but their impacts have not yet been assessed. Concerns have therefore been raised on the absence of specific regulations related to deep-sea fishing practices in the region including the sustainable utilization of the deep-sea resources and the management requirements for deep-sea fisheries in the EEZs. Moreover, the FAO International Guidelines for the Management of Deep-sea Fisheries in the High Seas that were adopted in 2008 might not have been considered and adopted by the countries' national jurisdictions.

## Opportunities for Southeast Asian countries to explore the demersal fishery resources in the high seas

As adopted by the United Nations in the 1982 United Nations Convention on the Law of the Sea (UNCLOS), high seas in international and maritime law, refer to the open ocean that are not part of the Exclusive Economic Zone, territorial sea or internal waters of any State. Therefore, oceans, seas and waters outside national jurisdictions are referred to as the high seas. In the Convention on the High Seas signed in 1958 and used as the foundation of the 1982 UNCLOS, high seas had been defined as “*all parts of the sea that are not included in the territorial sea of in the internal waters of a State*” and where “*no State may validly purport to subject any part of them to its sovereignty.*”

During the Fifth Meeting of the Parties to the Southern Indian Ocean Fisheries Agreement (SIOFA) on 25-29 June 2018 in Phuket, Thailand, it was noted that there are positive opportunities for SEAFDEC Member Countries to explore the

demersal fishery resources in the high seas, especially in the area of competence of SIOFA (**Figure 1**). However, this could mean applying as one of the SIOFA Contracting Parties to be able to understand the Agreement and related Resolutions complied by all Contracting Parties, e.g. Resolution on Interim Arrangement Concerning the High Seas in the Southern Indian Ocean, Resolution on Data Collection Concerning the High Seas in the Southern Indian Ocean.

SIOFA was established as a Regional Fisheries Management Organization (RFMO) to manage the fisheries of non-tuna species and to combat illegal fishing in the southern Indian Ocean. Signed on 7 July 2006 and entered into force in June 2012, SIOFA aims to ensure the long-term conservation and sustainable use of the fishery resources in its area of competence through cooperation among the Contracting Parties, and promote the sustainable development of fisheries, taking into account the needs of developing States bordering its competence area, and in particular the least-developed among them and small island developing States (FAO, 2018). SIOFA has nine (9) Contracting Parties: Australia, The Cook Islands, The European Union, France on behalf of its Indian Ocean Territories, Japan, The Republic of Korea, Mauritius, The Seychelles, and Thailand. Five (5) States around the Indian Ocean: Comoros, Kenya, Madagascar, Mozambique and New Zealand are also signatories to this SIOFA but have not yet ratified it, so they only the meetings of the Parties as observers. There are few organizations that technically coordinate with SIOFA, e.g. International Union for Conservation of Nature IUCN, Convention for the Conservation of Antarctic Marine Living Resources (CCALMR), Deep Sea Conservation Coalition (DSSC), Agreement on the Conservation of Albatrosses and Petrels (ACAP), Steinmetz Archive & the Dutch Social Science Information and Documentation Centre (SWIDCO).

Considering that the SEAFDEC Member Countries have already acquired the sufficient technology to conduct fishing operations, these countries could also explore the fishery resources in the SIOFA fishing grounds (**Figure 2**), like Thailand and Japan that are already Parties to SIOFA and have been fishing in such fishing grounds. Trawl, trap or pot, and bottom longline which are the general fishing gears and practices operated in SIOFA fishing grounds could also be used by the Southeast Asian countries in exploring the high seas under the competence of SIOFA because these countries have already developed the skills and experiences in the operations of such fishing practices.

However, there are still certain aspects that the Southeast Asian countries need to enhance, e.g. suitable fishing techniques in deeper fishing grounds, efficient safety at sea procedures and communication systems as the fishing grounds are far from ports. Another concern is the development of fish handling techniques onboard since in offshore areas, fishing vessels must be able to adopt efficient techniques for fish preservation.



Figure 1. Area of Competence of SIOFA  
(Source: <https://www.apsoi.org>)

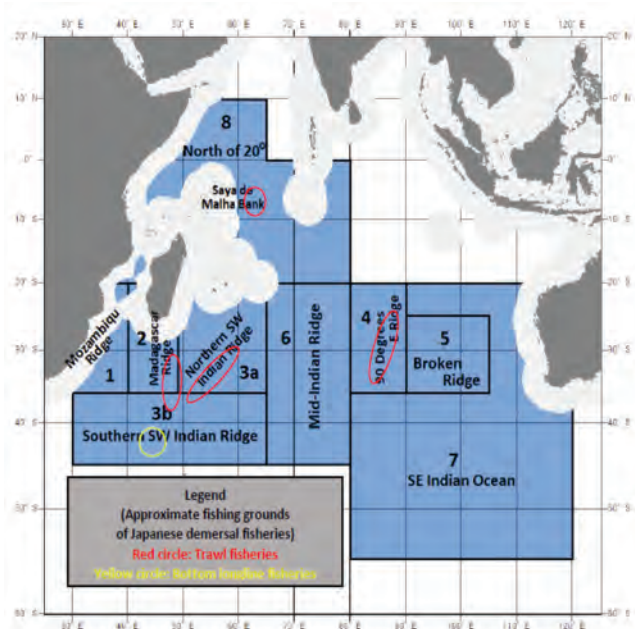


Figure 2. Major fishing grounds in SIOFA area used by Japanese fishing operations in 2017  
(Source: Modified from Annual National Report of Japan on the 3<sup>rd</sup> Meeting of the Southern Indian Ocean Fisheries Agreement (SIOFA) Scientific Committee)

Other concerns include monitoring control and surveillance system that must be installed onboard fishing vessels, and following the regulations of SIOFA, Vessel Monitoring System (VMS), Logbook system and observers onboard must also be complete. Nonetheless, the other SEAFDEC

Member Countries could learn from the experience of Japan and Thailand on fishing practices and fisheries management being part of the Contracting Parties SIOFA.

The major fishing practices operated in the area of competence of SIOFA are trawl fishing (midwater and bottom trawl), line fishing (longline, dropline) gillnets fishing, and pot fishing. These are the same gears that the Southeast Asian countries used in operating demersal fisheries in the waters of Southeast Asia. In the case of Japan and Thailand, which are Member Countries of SEAFDEC and also Contracting Parties to SIOFA, their fisheries activities in SIOFA fishing grounds (SIOFA, 2018) are summarized in the **Box**.

### Important fishery resources in the area of competence of SIOFA

The major fishery resources that are being utilized by the Contracting Parties to SIOFA are shown below. These are the same resources that are considered commercially-important to the Southeast Asian countries.



Splendid alfonsino (*Beryx splendens* Lowe, 1834)  
Photo source: <http://www.fishbase.org/summary/1320>



Orange roughy (*Hoplostethus atlanticus* Collett, 1889)  
Photo source: <http://www.fishbase.org/summary/334>



Patagonian toothfish (*Dissostichus eleginoides* Smitt, 1898)  
Photo source: <http://www.fishbase.org/summary/467>



Wreckfish (*Polyprion* spp.): In photo is *Polyprion americanus* (Bloch & Schneider, 1801)  
Photo Source: <https://www.fishbase.de/summary/Polyprion-americanus.html>



Portuguese dogfish (*Centroscymnus coelolepis* Barbosa du Bocage & de Brito Capello, 1864)  
Photo source: <https://www.fishbase.de/summary/Centroscymnus-coelolepis.html>

#### Box: Fishing experience of Japan and Thailand in the fishing grounds under the area of competence of SIOFA

Japan used two different types of fisheries discontinuously for 41 years (1977-2017), i.e. trawl fisheries targeting splendid Alfonsino (*Beryx splendens*), and bottom longline fisheries targeting the Patagonian toothfish (*Dissostichus eleginoides*). Based on accumulated information in the 12 years of trawl fisheries operations in three periods: 1977-1978, 2001-2002 and 2009-2017, the total catch (without 2017) of trawl fisheries ranged from 352 to 4,416 metric tons (1,340 tons on the average) with 1-2 vessels. Bottom longliners operated by the same vessel for nine (9) years 2004-2010, 2013 and 2017, the total catch (without 2017) ranged from 5 to 87 metric tons (28 tons on the average).

Thailand reported its fisheries operations during 2015-2017 using 62 vessels with 58 available logbooks. The fishing gears were trawling nets and portable traps with total effort of 9,455 fishing sets. The highest input fishing effort was in 2016 from the total of 4,560 sets. The total catch during 2015-2017 was 35,916.67 metric tons. The dominant catch species comprised the round scad (*Decapterus* spp.) - 29.78%, lizard fish (*Saurida* spp.) - 25.66%, threadfin bream (*Nemipterus* spp.) - 11.62%, goat fish (*Parupeneus* spp.) - 5.59%, bigeye scad (*Selar* spp.) - 4.79%, and Indian mackerel (*Rastrelliger* spp.) - 4.29%. The highest catch of 23,118.05 metric tons was recorded in 2015. Based on the observers' data and report, the average sizes of two dominant species of fish including the lizardfish (*Saurida undosquamis*) and round scad (*Decapterus russelli*) are larger than their sizes at maturity. They found no ETP species, coral or sponge. For latest fishing period in 2017 (January to February 2017), there were 14 vessels operated in the above mentioned area.



Southern boarfish  
(*Pseudopentaceros richardsoni* Smith, 1844)  
Photo Source: <https://www.fishbase.de/summary/Pseudopentaceros-richardsoni.html>



Rat tails grenadiers  
(*Macrourus* sp.): In photo is *Macrourus berglax* Lacepède, 1801  
Photo source: <http://fishbase.org/summary/331>



Blue antimore (*Antimora rostrata* (Günther, 1878))  
Photo source: <https://www.fishbase.de/summary/2005>



Round scad (*Decapterus russelli*)  
Photo source: <https://www.fishbase.de/summary/374>



Lizard fish (*Saurida undosquamis*)  
Photo source: <http://www.fishbase.de/summary/1055>



Threadfin bream  
(*Nemipterus* spp.): In photo is *Nemipterus japonicus*  
Photo source: <http://www.fishbase.org/summary/4559>



Bluenose warehou  
(*Hyperoglyphe antarctica* (Carmichael, 1819))  
Photo source: <http://www.fishbase.org/summary/496>

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