

Managing Purse Seine Fisheries in the Southeast Asian Region: a joint effort among ASEAN Member States

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Production from marine capture fisheries of the Southeast Asian region is derived from the fishing grounds in the South China Sea and Andaman Sea of the Indian Ocean (Fig. 1), comprising FAO Fishing Area 57 (Indian Ocean, Eastern), Area 61 (Pacific, Northwest), and Area 71 (Pacific, Western Central). In the Southeast Asian region, small pelagic fishes such as round scads, mackerels, sardines, and anchovies are considered as important components of the marine ecosystem and pelagic fishery resources. The migratory behavior of small pelagic fishes had made them known as “shared stocks” since they migrate across the exclusive economic zones (EEZs) of neighboring countries. Considering the likelihood that such stocks are shared by the bordering countries within the same ecosystem, *i.e.* in the South China Sea and the Andaman Sea, effective management of the shared stocks would require appropriate measures at the regional level. Nevertheless, delaying the regional approach in managing these stocks will further expose the small pelagic fishes to overexploitation that are now probably at unsustainable level (SEAFDEC, 2012).

Purse seine is one of the major fishing gears used to exploit small pelagic fishes in the region. Many types of purse seines are used to catch small pelagic fishes, among them are fish purse seine, anchovy purse seine, Thai purse seine, luring purse seine, tuna purse seine, and others. Commonly, purse seine operations are associated with fish aggregating devices (FADs), luring lights, and other devices. Nowadays, modern purse seines are equipped with radar, depth sounder, sonar transceiver, and satellite navigational instruments (SEAFDEC, 2017). However, management of purse seine fisheries has not been considerably pursued because of inadequate information on the stocks of the small pelagic fishes (Raja Bidin and Latun, 2016).

In an effort to establish a management plan for commercially important small pelagic fishes, the Marine Fishery Resources Development and Management Department (MFRDMD) of SEAFDEC was given the mandate to embark on the seven-year project “Comparative Studies for Management of Purse Seine Fisheries in the Southeast Asian Region” starting 2013. Funded by the Japanese Trust Fund VI (JTF-6), the project involves eight ASEAN Member States (AMSs) that border the South China Sea (SCS), an important fishing area of these coastal states, namely: Brunei Darussalam, Cambodia, Indonesia, Malaysia, Myanmar, Thailand, Philippines, and Viet Nam. As this point in time, the project has compiled the catch-effort statistics and reviewed the appropriate measures for management of small pelagic fisheries in the Southeast Asian region. In addition, a genetic study is being conducted to verify the extent of connectivity among the commercially important small pelagic fishes targeted by purse seine fisheries.

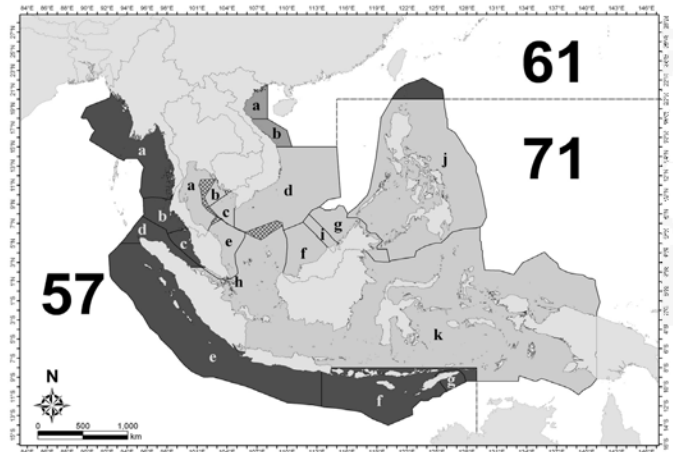


Fig. 1. Fishing areas 57, 71 and 67, with respective sub-areas (SEAFDEC, 2008; adapted from FAO)

The results would provide scientific background for concerted actions of the AMSs for the management of shared stocks of small pelagic fishes as well as development of appropriate management strategy for purse seine fisheries in the region.

Compilation of Catch-effort Statistics for Purse Seine Fisheries

Considering that fisheries catch-effort statistics are available in some AMSs and catch per unit effort (CPUE) is an indirect measurement of abundance of a target species, MFRDMD has examined the trend of resource level using the CPUE. At the same time, MFRDMD also reviewed the purse seine fisheries management systems including total allowable catch (TAC) and other measures to analyze the most appropriate system or measure that is applicable for the management of small pelagic fisheries in the Southeast Asian region (Raja Bidin and Latun, 2016). Taking place from 2013 until now, MFRDMD had continuously collected the updated information on purse seine fisheries from the AMSs as well as assessed the data for regional synthesis to recommend stock indicators and management systems that are suitable in the region. Every AMS has therefore been requested to provide updated and detailed information on their respective purse seine fisheries by complying with the parameters established by MFRDMD as shown in **Table 1**.

Nevertheless, there are some issues on the reliability of the compiled data because some countries are not able to fulfil all of the parameters, especially on the number of vessels for fish purse seine and anchovy purse seine. If this constraint continues to occur, it may affect the final analysis because the fishing efforts will be used in calculation of CPUE which is the key component of the project. The CPUE that will be analyzed from the catch and

Table 1. Parameters necessary for the management of purse seine fisheries in the Southeast Asian region

Parameters	Details
Landing of purse seine fisheries	<ul style="list-style-type: none"> • Trend of landing • Species composition • Biological information <ul style="list-style-type: none"> - length at maturity (Lm) - spawning season
Fishing effort for purse seine fisheries	<ul style="list-style-type: none"> • No. of vessels (fish purse seine, anchovy purse seine) • Weight of vessels (GRT) • No. of days/trip • No. of trips/month • No. of hauls/day • Trend of CPUE <ul style="list-style-type: none"> - by vessel - by trip - by days
Status of pelagic fish stock	<ul style="list-style-type: none"> • Biomass • Maximum sustainable yield (MSY)
Existing management strategies	<ul style="list-style-type: none"> • Closed Season • Closed Area • Survey-explorations • Joint venture program

effort statistics (*i.e.* number of vessels) will be used to calculate the allowable biological catch (ABC). The calculated ABC shall then serve as a scientific guide to set the annual TAC for the management of purse seine fisheries in this region.

The most recent information based on the parameters indicated in **Table 1** was presented by each AMS and discussed during the Third Core Expert Meeting on “*Comparative Studies for Management of Purse Seine Fisheries in the Southeast Asian Region*” in September 2017 in Kuala Lumpur, Malaysia. Based on the issues and challenges raised during the meeting, all of the AMSs were aware of the importance of reliable statistics to develop an appropriate management of purse seine fisheries. Thus, a detailed catch-effort statistics in the region should be prioritized to uphold accurate information.

Genetic Study

The spotted sardinella, *Amblygaster sirm* (**Fig. 2**) was chosen for genetic study because of its recognizable morphological features. *A. sirm* can be distinguished easily from other species of sardines by the presence of a series of 10 to 20 gold spots (in live or fresh specimens) or black spots (in preserved specimens) along the lateral line, but sometimes the spots are missing. This species is widespread in tropical Indo-West Pacific from the Red Sea and Madagascar, eastward to Indonesia, Gulf of Thailand, New Guinea, and the Philippines; north to Taiwan Province of China, and Okinawa (Japan); southward to northern coasts of Australia and New Caledonia; eastward to Kiribati and Fiji (Carpenter and Niem, 1999) as shown in **Fig. 3**.

In carrying out the genetic study of *A. sirm*, sampling locations were established in the South China Sea (Zambales and Palawan in the Philippines; Kudat, Kuching, and Kuantan in Malaysia; Muara in Brunei; and Songkhla in Thailand), and in the Andaman



Fig. 2. Spotted sardinella (*Amblygaster sirm*)

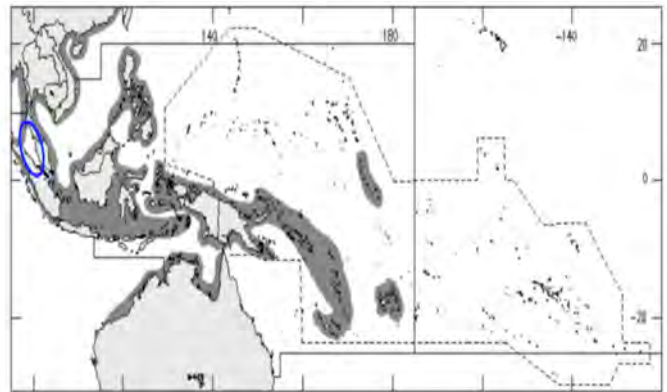


Fig. 3. Distribution of spotted sardinella, *Amblygaster sirm* (highlighted in dark gray). *A. sirm* could not be found in the Strait of Malacca, in blue circle (Carpenter and Niem, 1999)

Sea (Ranong in Thailand) as shown in **Fig. 4**. The samples were collected from the South China Sea ($n = 217$) and the Andaman Sea ($n = 35$) from January to September 2015. *A. sirm* specimens were analyzed using DNA mitochondrial cytochrome *b* marker.

Based on the 1016 bp inferred by mitochondrial DNA cytochrome *b*, the stocks of *A. sirm* between the South China Sea and the Andaman Sea are separate genetic units. This indicates that the populations in the South China Sea are not associated with the populations in the Andaman Sea. It should be noted that this species could not be found in the Strait of Malacca (Carpenter and Niem, 1999) which could be the main reason of separation of the stock structure.

As for the management of sustainable fisheries, *A. sirm* in the South China Sea and the Andaman Sea should be regarded as a separate fishery resource that can be managed separately. Therefore, factors that affect the population in the South China Sea, such as fishing pressure, will not affect the population in the Andaman Sea, and vice versa. However, this is only a preliminary result due to limited number of samples. Therefore,



Fig. 4. Sampling locations of spotted sardinella (*Amblygaster sirm*) in the South China Sea and the Andaman Sea for genetic study (in blue dots)

it is recommended that additional specimens are needed especially from the Andaman Sea that would be sourced from the waters of Indonesia and Myanmar. Hence, the use of other methodologies using different DNA markers could be applied to confirm the initial findings.

Recommendations and Way Forward

The migratory behavior of small pelagic fishes poses a great challenge in the development and management of sustainable fisheries. Even though the preliminary result of genetic study found that populations of one of the target species, *A. Sirm*, in the South China Sea and the Andaman Sea are separate stocks, majority of the pelagic fishes are being shared by many countries in the region. Since purse seine is the main fishing gear used to exploit the small pelagic fishes, it is possible that purse seines operating in both ecosystems (the South China Sea and the Andaman Sea) might exploit the same stocks of small pelagic fishes. Hence, it is necessary that such shared stocks should be well managed to prevent overexploitation that could probably lead to the decline of the stocks.

In order to promote the fisheries management in the region, acknowledging the shared stocks is vital (SEAFDEC, 2017). Thus, in view of direct impact of purse seine fishery on the shared stocks of small pelagic fishes, it is essential to implement suitable management measures exclusively for purse seine fisheries in the region (SEAFDEC, 2012). In the early stages of the project, MFRDMD and AMSs reviewed the TAC as a possible measure to manage purse seine fisheries in the Southeast Asian region. However, it was found that TAC is not applicable due to the multispecies catch composition of the purse seine fisheries, thus other management measures must be considered. Among other management measures are the total allowable effort (TAE), allowable biological catch (ABC), and allowable biological effort (ABE).

Upon consultation with *Dr. Takashi Matsuishi* from Hokkaido University, Japan, the Resource Person for the Project, it was agreed that either ABC or ABE would be the most appropriate management measure for multispecies catch composition of purse seine fisheries in the Southeast Asian region. It was based on the feedback control that was introduced by *Dr. Matsuishi* which refers to cause-effect relationship. In fisheries, feedback control exemplifies the actions taken by managers according to the current state of the fisheries, management objectives, and a decision algorithm in a feedback control loop, typically aiming to stabilize annual catches and population abundances at desired levels (Holt and de la Mare, 2009). In the project's feedback control, Rule 2-1 and Rule 2-2 were constructed based on two assumptions, namely: (1) CPUE is proportional to the population; and (2) catch trend will correspond to short term population trend, respectively. These rules are being considered as the most applicable and appropriate for the management of purse seine fisheries utilizing the available data.

Since MFRDMD plans to publish a regional synthesis of purse seine fisheries in Southeast Asia, an internal workshop will be

organized during the first quarter of 2018 for the preparation of the said regional synthesis. Besides, MFRDMD will also convene a Core Expert Meeting in late 2017 year or early 2018 to report on the information gathered during the project period and discuss about purse seine fisheries management in the Southeast Asian region. As for the genetic study, the analysis of specimens from other locations will be continued.

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