Issues

Globally, due to the pandemic COVID-19, the impacts on fish catches have varied with many countries seeing sharp drops in production during the first weeks of the crisis followed by improvements as the sector adapted (FAO, 2020c). Although many vessels are not going out for fishing during pandemic COVID-19, overfished fish stocks need as much as 10–15 years of reduced fishing to permit depleted stocks to recover. So, in the absence of governance and management reforms that sustain reduced pressure, such recoveries seem unlikely to date (UNDP, 2020).

According to FAO (2020c), most surveys to collect data for fisheries stock assessment processes have been postponed or canceled in some countries. The situation during this pandemic, with restrictions of movement and number of persons that can work near each other, with working from home policies in many countries and even some crew members or researchers becoming infected, suggest that canceling stock assessment activities is the only possible solution. In these circumstances, estimating the stock sizes for long-lived fish species may be possible for some species by using trends or the same results as the year(s) before. However, this situation could be challenging for some short-living species (one to three years) and result in highly uncertain total allowable catches (TACs) for fish stocks. The results for stock status may be affected where a TAC is overestimated, or a decrease in potential production where a TAC is underestimated.

There are some issues concerning fisheries in Viet Nam, such as the decreasing marine fishery resources in all waters of Viet Nam, underdeveloped fishing techniques, insufficient funds for research of fish stocks, while biological information for target species and implementation of fisheries management regulations are limited at fishermen's communities, and the ineffective fisheries management tools for purse seine fisheries (Tuyen & Tam, 2018). Meanwhile, in Thailand there have been some issues, such as those on IUU fishing, catching large quantities of juvenile fish of larger commercial species which could grow bigger, conflicts between artisanal and commercial fishers, degraded critical habitats, and inadequate fisheries data and information.

Way Forward

The status of the anchovy resources is important for management purposes. Therefore, continuous studies should be conducted for 5–10 years and the strong support of governments would be necessary such as allocation of sufficient budget, especially for collaborative and comprehensive studies. Biological information of anchovies such as species composition, density, biomass, population dynamic parameters should be obtained from the conducted surveys. Information on the early life history of anchovies including their habitats, gonad maturity, spawning season, and their route should also be studied to enable to establish closed areas or closed seasons (**Table 59**). Public awareness campaigns for fishers and other stakeholders should be frequently undertaken to educate them on the need to sustain the resource through an ecosystem approach. Capacity building is necessary to achieve the above targets and raise knowledge, especially for coastal fishermen's communities, which should be undertaken continuously. Strengthening the capacity for various stakeholders (scientists, managers, policymakers, fishers, etc.), the conduct of stock assessment courses for the anchovy resources as well as biosocioeconomics should be introduced at the university level. The pool of knowledgeable graduates would ensure the continuity of expertise capable of estimating the status and trends of anchovies in the region.

Table 59. Way forward for anchovies

1. Long-term research activities • Resource status through anchovy resource survey for each three years • Biological study to determine species and distribution pattern • Fishery biosocioeconomics
2. Capacity Building • Training on stock assessment of anchovies for research staff • Establishment of programs on anchovy stock assessments at local university
3. Fishing Capacity • Standardization of vessel parameters • Review of the number of vessels operating in each fishing area
4. Establishment of closed seasons • Closed season or closed area during the peak spawning months every year • No fishing activities in the conservation zones (0-1 nm), which are the nursery grounds for larvae and juveniles
5. Public awareness on EAFM • Raising the stakeholders and fishers' awareness in sustaining anchovy resources
6. Fisheries Management Plan for Anchovies (FMP for Anchovies) • This management body should be supported and implemented • FMP will set the management indicators such as stock status, catch per unit effort (CPUE), economic indicators • FMP would be reviewed and action is taken based on stock assessment and assessment of ecosystem impacts

1.1.5 Sardines

Sardines are under the Family Clupeidae, subfamily Clupeinae, and are small pelagic fishes feeding on phytoplankton and zooplankton. The species are distinguishable from other small pelagics through their rounded upper lip and two pronounced supra-maxillae at the proximal end of the mouth (Whitehead, 1985). Clupeids have short life spans generally ranging 1–4 years, typically reaching maturity by 12 months, occupying low trophic levels, and occurring in continental shelf waters, and each species differ in maximum size, size at maturity, habitat preferences, seasonal or life-cycle migration patterns and response to climate ocean variation (Hunnam *et al.*, 2021).

The production of sardines including the goldstripe sardinella (*Sardinella gibbosa*), Bali sardinella (*S. lemuru*), sardinellas *nei* (*Sardinella* spp.), spotted sardinella (*Amblygaster sirm*), rainbow sardinella (*Dussumieria acuta*) of the Southeast Asian region from Fishing Area 57, and Fishing Area 71 during 2008–2019 is shown in **Figure 60**. In Fishing Area 57, the average production was 106,577 mt per year with the highest at 206,967 mt in 2008 and the lowest at 46,098 mt in 2016. In Fishing Area 71, the average production was 669,346 mt per year with the highest at 968,597 mt in 2018 and 491,253 mt in 2017.

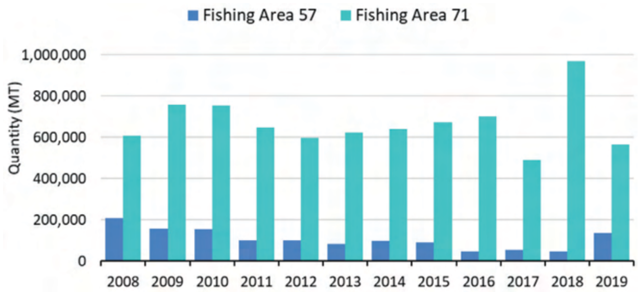

Figure 60. Production of sardines of the Southeast Asian region between 2008 and 2019 from Fishing Area 57 and Fishing Area 71 by quantity (mt)

Source: *SEAFDEC, 2022*

Exploitation Rate

Table 60 shows the exploitation rates of sardines in selected fishing grounds of the Philippines and Thailand. The high exploitation rates of 0.76 and 0.78 for *S. gibbosa* were recorded in the Gulf of Thailand and Manila Bay, respectively. Meanwhile, *S. fimbriata* had an exploitation rate value of 0.66 in Manila Bay. In general, the stock of sardines is overfished (E = 0.66 - 0.78) in the western side of the South China Sea and moderately fished or underfished (E = 0.44) in the northern and central Philippines.

Genetic Stock Structure

SEAFDEC/MFRDMD, with support from the Japanese Trust Fund VI, conducted the genetic population study of *Amblygaster sirm* by using mitochondrial DNA (mtDNA) markers to ascertain its genetic structure in the South China Sea and Andaman Sea, and to confirm whether there is a single stock or more for management purposes. *A. sirm* is one of the economically important sardine species in the region. A total of 498 samples of *A. sirm* were collected during 2014–2018 from the different sampling sites in the region (**Figure 61**). It was found that this species does not occur in the Strait of Malacca. Based on the genetic analysis, both mtDNA markers, Cytochrome B (*Cyt b*) (**Figure 62A**) and Cytochrome C Oxidase Sub-unit I (COI) (**Figure 62B**), it has been established that there are two highly divergent genetic stocks. One stock is in the northern Andaman Sea (*i.e.* Ranong in Thailand) while the rest of the populations could be found in the South China Sea (*i.e.* Muara in Brunei Darussalam; Kuantan, Kuching, and Kudat in Malaysia; Palawan and Zambales in the Philippines; and Songkhla in Thailand), southern Andaman Sea (Banda Aceh in Indonesia), and Java Sea (Pekalongan in Indonesia). As *A. sirm* could not be found in the Strait of Malacca, this suggests that each stock should be managed independently. Nonetheless, further studies should be carried out to confirm the genetic stock structure of the spotted sardinella being a cryptic species in Ranong (Wahidah *et al.*, 2020).

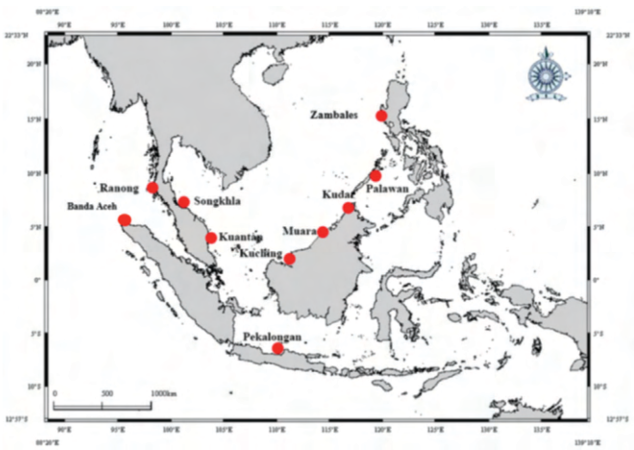

Figure 61. Sampling sites for the genetic population study of *Amblygaster sirm* in the Southeast Asian region

Issues and Concerns

- Failure to control overfishing
- Variation in local names of one species of sardines in one country across the region
- Limited knowledge and understanding of fishers relevant to managing the sardine fishery including seasonality, habitat, interannual variation in landings, movements as well as post-harvest characteristics in relation to perishability

Table 60. Exploitation rate of sardines in the Philippines and Thailand waters

Country	Fishing ground	Species	Year	Exploitation rate (E=F/Z)	Reference
Philippines	Manila Bay	*Sardinella fimbriata*	2012-2015	0.66	Santos *et al.*, 2017
	Tayabas Bay	*S. gibbosa*	2018	0.44	Ramos *et al.*, 2018
	Manila Bay	*S. gibbosa*	2012-2015	0.76	Santos *et al.*, 2017
Thailand	Gulf of Thailand	*S. gibbosa*	2012	0.78	Boonjorn *et al.*, 2012

A.
B.

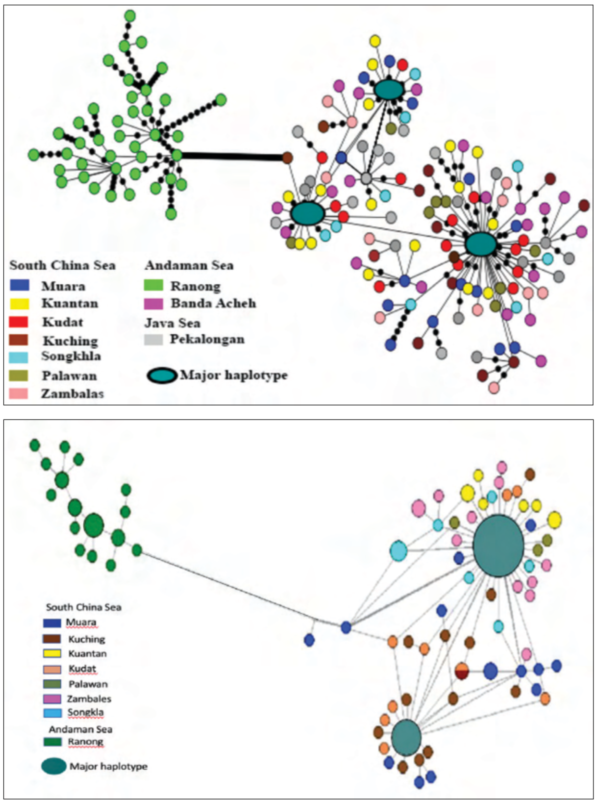

Figure 62. Minimum Spanning Network (MSN) inferred from mtDNA *Cyt b* (A) and *COI* (B) genes

- Misidentification of most common sardine species; thus, there is a need for morphologic, meristic, and molecular genetic tools to identify at the species level

Way Forward

The ongoing project of SEAFDEC/MFRDMD "Fisheries Management Strategy for Pelagic Fish Resources in the Southeast Asian Region" (2020–2024) under the JTF VI Phase II is developing the sustainable management strategy for pelagic fisheries including the fishery of sardines. For the AMSs, the Philippines as the leading sardine producer in the region through its Bureau of Fisheries and Aquatic Resources (BFAR), has initiated the National Sardines Management Plan (NSMP) 2020–2025 which envisions "A sustainable and equitably-shared sardine fishery that contributes to food security and increased income through responsible management." To contribute to this vision, the Plan aims to: 1) establish (reference points) and monitor progress with respect to biomass-based and fishing mortality-based reference points for the top three sardine species by 2023; 2) reduce juvenile catch by 10 % by 2025 in five priority sardine fishing areas by 2022; and 3) reduce poverty incidence of sardines fishers by 5 % (BFAR, 2020).

1.1.6 Marine Shrimps

In the Southeast Asian region, the economically important marine shrimps from capture fisheries include the tropical spiny lobsters *nei*, flathead lobster, slipper lobsters *nei*, banana prawn, giant tiger prawn, western king prawn, green tiger prawn, *Penaeus* shrimps *nei*, endeavour shrimp, *Metapenaeus* shrimps *nei*, and sergestid shrimps *nei*. Shrimps are mainly caught by beam trawls with relatively small mesh size, while in Brunei Darussalam and Singapore, *Penaeus* spp. are mainly caught by gill nets and trawls, respectively (SEAFDEC, 2020a).

The average production of marine shrimps from capture fisheries of the region during 2008–2019 was around 288,057 mt per year (**Figure 63**). In Fishing Area 57, the average production between 2008 and 2019 was around 95,815 mt with the highest at 118,445 mt in 2011 and lowest at 74,307 mt in 2019. On the other hand, in Fishing Area 71 production between 2008 and 2019 reached an average of 192,242 mt per year, with the highest in 2018 at 248,170 mt, and the lowest was in 2017 (157,786 mt).

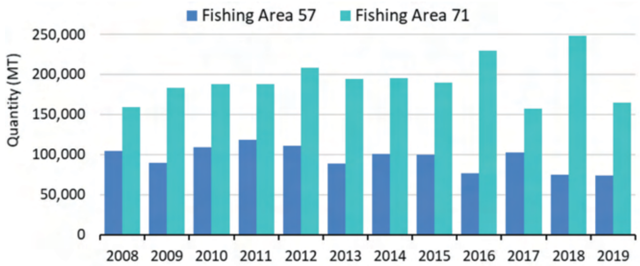

Figure 63. Production of marine shrimps from capture fishery of Southeast Asia from 2008 to 2019 by quantity (mt) (SEAFDEC, 2022)

1.1.7 Seaweeds

Seaweeds are aquatic plants that could be commonly differentiated by the predominant color of its pigments, *i.e.* red (*Rhodophyta*), green (*Chlorophyta*), and brown (*Ochrophyta*). Seaweeds have been traditionally exploited for centuries and generally collected from the wild as a source of food particularly in Asia. However, in the last 50 years, the increased demand for seaweeds and its by-products has led to the commercial exploitation and expansion of farming areas in tropical and temperate countries. The exponential increase in production of the eucheumatoid seaweeds in the Southeast Asian region has been attributed to the increased demand for carrageenan, an extract valued for its hydrocolloid polysaccharides. Carrageen-producing red algal seaweeds of the genera *Kappaphycus* and *Eucheuma* are the leading seaweeds being cultured in the region. Carrageenan is classified into three types, namely: kappa, iota, and lambda carrageenan. Kappa carrageenan is the hard-gelling type and comes from *Kappaphycus* spp; iota-carrageenan is a soft-gelling carrageenan sourced from *E. denticulatum*; and lambda is a non-gelling carrageenan usually used as a thickener in dairy products. Moreover, the red alga *Gracilaria* is known as an important source of agar. The discovery of other uses of seaweeds and its by-products other than food applications, including nutraceuticals, pharmaceuticals, and biofuels, contributed to the high demand for seaweeds.