

**Box 2. Actions for the RAP for Management of Indo-Pacific Mackerel (Cont'd)**

5. Climate Change Dimension		
Objectives	Knowledge Gaps/Issues	Actions
Adaptive management measures <b>in place</b> in response to the impact of climate change and disaster on short mackerel fisheries and habitats	Impact of climate change to fish migration route	Assess the impact of climate change/disaster/ anthropogenic activities to fish migration route, habitat and behavior
		Study effect of environmental changes on the migratory pattern and spawning patterns based on climate change
	Sensitivity of species on critical habitats and environment impact to ecosystem (pollution, climate change, etc.)	Conduct study on sensitivity of species on environment change (pollution, climate change, etc.) to support the management response
		Study on the critical habitats (spawning and grounds)
		Study effect of environmental changes on the migratory pattern and spawning patterns
Capacity building and experts exchange	Data sharing (assign focal person to share information)	
Mitigation and precautionary measures <b>adopted</b> to compensate for the effects of climate change	Impact of climate change to fish migration route	Training, workshop, conference and experts exchange on CC impacts
	Capacity building and experts exchange	Share information from the findings of scientific research to both fisheries managers and fishers
		Training, workshop, conference and experts exchange on CC impacts

**Issues and Challenges**

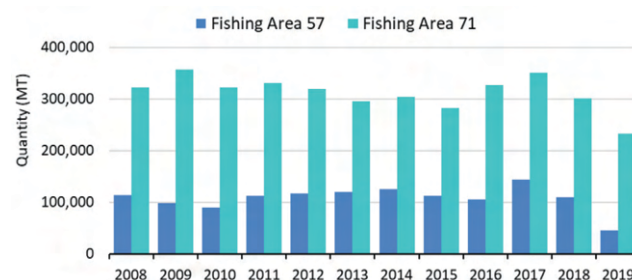
- Inadequate regular collection of data on capture fishery production
- Insufficient data and information on fishery characteristics including catch and effort and biology
- Inadequate information on stock status and population dynamics including distribution and abundance
- Changing of fishing gear used to catch pelagic fishes especially mackerel
- Absence of fisheries management plan including fishery regulations, co-management, traceability system, among others
- Need for strengthened regional cooperation on standardized and integrity of data collection for regional stock assessment, data sharing, management body to develop the transboundary management plan

**1.1.4 Anchovies**

Anchovies are small pelagic fishes that belong to the family of Engraulidae, under the order of Clupeiformes which has 151 species and 17 genera (Eschmeyer *et al.*, 2017). Like other small pelagic fishes, anchovies are widely distributed in the Southeast Asian region. Anchovies are found in the neritic zone or shallow coastal waters where the shorthead anchovy (*Encrasicholina heteroloba*) and Indian anchovy (*Stolephorus indicus*) are the two dominant species found in the Southeast Asian region. Fishing grounds are located in the South China Sea and the Andaman Sea. The South China Sea had higher production compared to the Andaman Sea. Indonesia, Malaysia, Philippines, Singapore, and Thailand are the countries that catch anchovies in the South China Sea. Meanwhile, the countries that fish for anchovies in

the Andaman Sea are Indonesia, Malaysia, Myanmar, and Thailand. Anchovies have ecological importance due to the large biomass in the food web in coastal areas and the transfer of energy from plankton and small organisms to large-sized fish (Ganias, 2014). Most species of anchovies are commonly found in coastal areas (Young *et al.*, 1995) and are usually present in shallow waters from 5 m to 35 m depths with the highest densities around island areas (Fricke *et al.*, 2011).

The production of anchovies including the *Stolephorus* anchovies (*Stolephorus* spp.) and anchovies *nei* (Engraulidae) of the Southeast Asian region during 2008–2019 is shown in **Figure 59**. In Fishing Area 57 (Indian Ocean, Eastern), the production trend was constant with an average of 107,561 mt/year ranging from 44,492 mt in 2019 to 143,626 mt in 2017. In Fishing Area 71 (Pacific, Western Central), the production had an average of 312,088 mt per year with the range between 232,636 mt in 2019 and 356,446 mt in 2009.



**Figure 59.** Production of anchovies of the Southeast Asian region between 2008 and 2019 from Fishing Area 57 and Fishing Area 71 by quantity (mt)  
Source: SEAFDEC, 2022

## 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

<b>1. Long-term research activities</b>
<ul style="list-style-type: none"> <li>• Resource status through anchovy resource survey for each three years</li> <li>• Biological study to determine species and distribution pattern</li> <li>• Fishery biosocioeconomics</li> </ul>
<b>2. Capacity Building</b>
<ul style="list-style-type: none"> <li>• Training on stock assessment of anchovies for research staff</li> <li>• Establishment of programs on anchovy stock assessments at local university</li> </ul>
<b>3. Fishing Capacity</b>
<ul style="list-style-type: none"> <li>• Standardization of vessel parameters</li> <li>• Review of the number of vessels operating in each fishing area</li> </ul>
<b>4. Establishment of closed seasons</b>
<ul style="list-style-type: none"> <li>• Closed season or closed area during the peak spawning months every year</li> <li>• No fishing activities in the conservation zones (0-1 nm), which are the nursery grounds for larvae and juveniles</li> </ul>
<b>5. Public awareness on EAFM</b>
<ul style="list-style-type: none"> <li>• Raising the stakeholders and fishers' awareness in sustaining anchovy resources</li> </ul>
<b>6. Fisheries Management Plan for Anchovies (FMP for Anchovies)</b>
<ul style="list-style-type: none"> <li>• This management body should be supported and implemented</li> <li>• FMP will set the management indicators such as stock status, catch per unit effort (CPUE), economic indicators</li> <li>• FMP would be reviewed and action is taken based on stock assessment and assessment of ecosystem impacts</li> </ul>

### 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