

Fish and Fisheries Situation in Fisheries Management Area (FMA) 5 and 6: Philippine Fishing Grounds in the Philippine Waters of the South China Sea-Large Marine Ecosystem (SCS-LME)

Len R. Garces*

UNEP/GEF Implementing the Strategic Action Programme for the South China Sea, Bangkok, Thailand.
18 M. Gonzaga St., Mandaluyong City, 1550 Philippines

*corresponding author: leng@unops.org; garces.lenregidor@gmail.com

Abstract

The Philippine fisheries sector plays an important role in the national economy, contributing to food security, nutrition, employment, and livelihoods. The SCS-LME is critical for marine biodiversity and fisheries. Effective management of these resources is essential for the sustainability of the fisheries sector and food security. Fisheries management areas (FMAs) covering all Philippine waters was established based on stock ranges, administrative subdivisions, and distribution of fisheries, with FMA 5 and 6 situated in the SCS waters. This report examines the status of fisheries and ecosystem health in the SCS and identify key fisheries issues and threats i.e.: (i) overfishing and depletion of fish stock in coastal waters; (ii) illegal unreported and unregulated (IUU) fishing; (iii) environmental degradation (pollution and coastal habitat destruction); and (iv) climate related impacts on fisheries. The report also provides opportunities for regional capacity building needs for improving fisheries management in SCS including regional data and information sharing. Regular conduct of resource surveys and stock assessments, scientific studies on impacts of climate change on major fish stocks, and establishment and monitoring of fisheries refugia are recommended for national priority actions.

Keywords: Fisheries status, fisheries management area, South China Sea

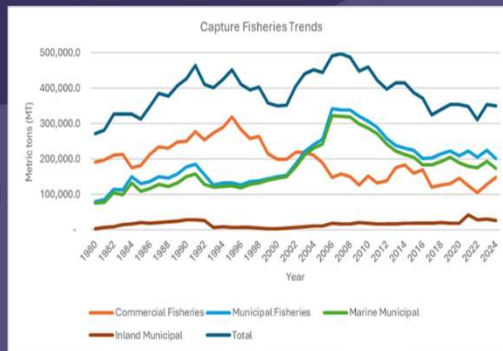
Fish and Fisheries Situation in FMA 5 and 6:

Philippine Fishing Grounds in the South China Sea-Large Marine Ecosystem (SCS-LME)

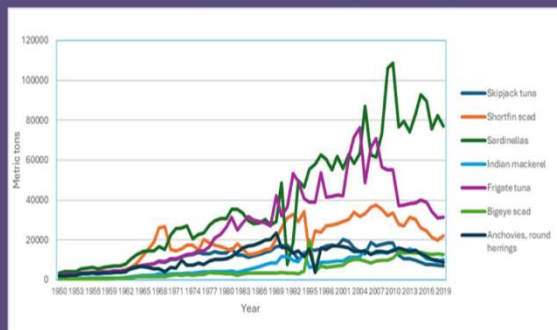


20%
Estimated contribution of capture fisheries in SCS waters to Philippine domestic

Capture Fisheries Production Trends (1980-2024)



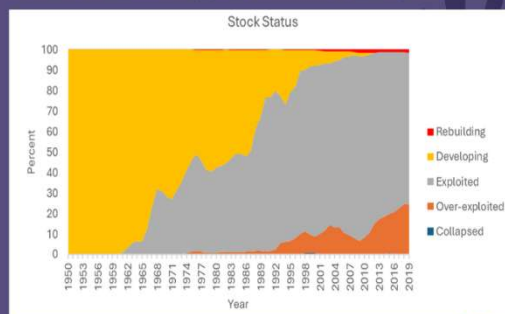
Catch Composition Trends (1950-2019)



Dominant
fish species from capture fisheries in SCS are small pelagics and tuna

Stock Status of Philippines Fisheries Catch (1950-2019)

Majority
of fish stocks may be experiencing excessive or heavy fishing pressure



5. Fish and Fisheries

The Philippine fisheries sector plays an important role in the national economy, contributing to food security, nutrition, employment, and livelihoods. The fisheries sector of the Philippines is categorized into commercial fisheries, municipal fisheries, and aquaculture. Commercial fisheries refer to capture fishing operations using fishery vessels of over 3 gross tons (GT) outside the municipal waters (beyond 15 km from the shoreline), and are classified into: a) small scale using passive or active gear and utilizing fishing vessels of 3.1–20 GT; b) medium scale utilizing active gears and vessels of 20.1–150 GT; and c) large scale utilizing active gears and vessels of more than 150 GT. On the other hand, municipal fisheries refer to capture fishing operations along coastal and inland waters with the use of fishing vessels of 3 GT or less including other forms of fishing not involving the use of watercraft. Aquaculture involves fish culture activities in inland and marine waters. The Bureau of Fisheries and Aquatic Resources (BFAR) under the Department of Agriculture is the government agency responsible for the development, improvement, management, and conservation of the fisheries and aquatic resources of the Philippines. Local Government Units (LGUs) have the mandate to manage municipal waters in coordination with the local Fisheries and Aquatic Resources Management Councils (FARMCs) in collaboration with BFAR.

In 2023, the Philippines produced about 4.26 million metric tons (MT) of fishery products and valued at PhP 328.74 billion (BFAR 2024). Aquaculture production including seaweeds contributed 2.38 million MT (or 56% of the total fisheries production), with an approximate value of PhP 124.02 billion. The combined production from the inland municipal and marine municipal fisheries sub-sectors amounted to a total municipal production volume of 1.05 million MT and valued at PhP 20.30 billion. For commercial fisheries, the total volume production amounted to 822,427.50 MT, valued at PhP 77.18 billion. Municipal fisheries contributed to 24.7% while commercial fisheries 19.3% of the total production. In addition, fishing and aquaculture activities recorded a value of PhP 274 billion or 12.0% share, following agricultural crops with 47.8%, and livestock with 13.3% (BFAR, 2024).

The Fisheries Code (Republic Act (RA) No. 8550 in 1998, as amended by RA No. 10654 in 2015) recognizes the ecosystem approach to fisheries (EAF) as the foundation for managing fisheries resources in natural fisheries management areas. In 2019, the Bureau of Fisheries and Aquatic Resources (BFAR) and the Fisheries Administrative Order (FAO) No. 263 formally established 12 fisheries management areas (FMAs) covering all Philippine waters based on stock ranges, administrative subdivisions, and distribution of fisheries (Figure 5.1). FMA 5 and 6 are situated in the South China Sea (SCS) large marine ecosystem (LME).

The delineation, establishment, and operationalization of FMAs involve two critical components. First, there is a deliberate effort to integrate the best available science into the process. And second, multi-sectoral collaboration and active engagement with stakeholders play a pivotal role. These features are essential for the success of FMAs in contributing to the national goal of achieving fish food security and fisheries sustainability (Ramiscal, et al., 2024).

The large marine ecosystems of the South China Sea and the Gulf of Thailand are critical for marine biodiversity and fisheries. Effective management of these resources is essential for the sustainability of the fisheries sector, which supports millions of livelihoods. However, without updating and reanalyzing the region's transboundary diagnostic problems, it isn't easy to take further actions to ensure the health of these ecosystems. National Transboundary Diagnostic Analysis (TDA) is only a fundamental process for assessing and managing aquatic ecosystems within and between neighboring states.

In the preparation of the national TDA report for the Philippines, the regions and provinces in the waters of national jurisdiction within the large marine ecosystems of the South China Sea are listed in Table 5.1. Fisheries production data for the period 1950-2019 compiled by the Sea Around Us project (<https://www.seaaroundus.org/>) for Philippine waters in the SCS LME was used and complemented with the fisheries statistics data obtained from the

Philippine Statistics Authority. The goal of this TDA report is to identify and develop a strategic action plan or program at the national level as well support the regional transboundary management initiatives in the SCS LME.

Table 5.1. FMAs, regions and provinces covered by the national TDA for the Philippines with in in the SCS LME.

FMA	Area	Regions/Provinces	Regions/Provinces covered by national TDA report
FMA 6	293,930 km ²	Region 1: Ilocos Norte, Ilocos Sur, La Union, Pangasinan Region 3: Bataan, Bulacan, Pampanga, Zambales Region 4A: Batangas, Cavite Region 4B: Occidental Mindoro CAR: Abra	Region 1: Ilocos Norte, Ilocos Sur, La Union, Pangasinan, Region 3: Bataan, Bulacan, Pampanga, Zambales Region 4A: Batangas, Cavite Region 4B: Occidental Mindoro
FMA 5	485,415 km ²	Region 4B: Aklan, Antique, Occidental Mindoro, Palawan ARMM: Tawi-tawi	Region 4B: Occidental Mindoro, Palawan

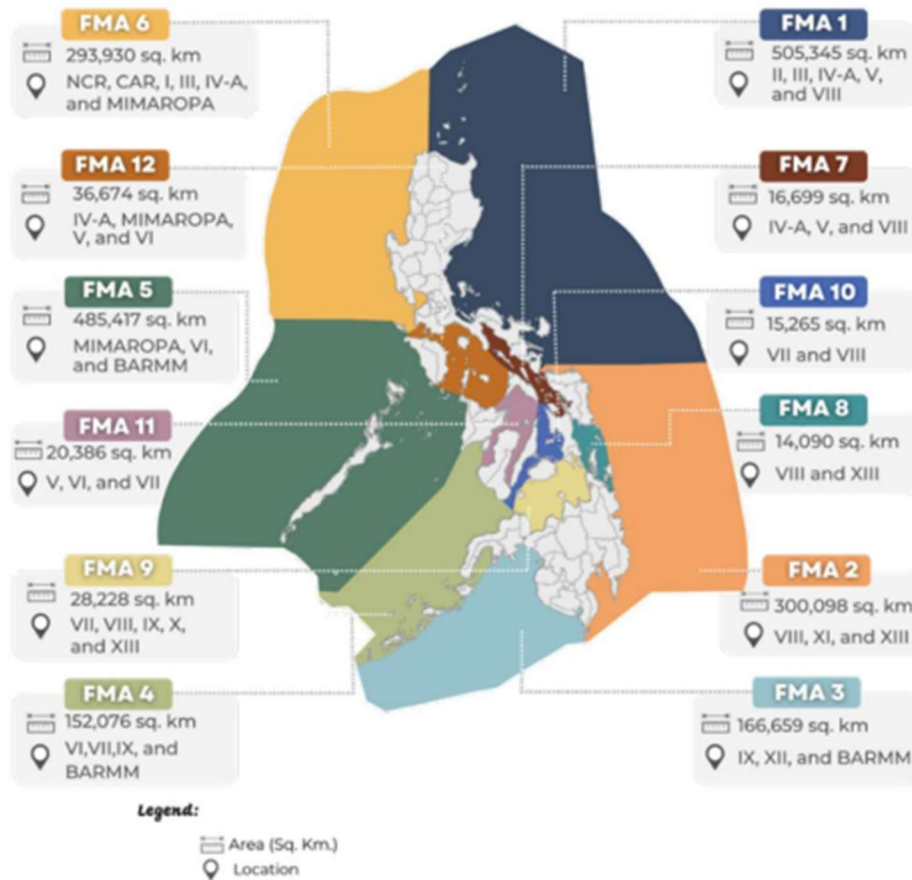


Figure 5.1. Area and Location of the Fisheries Management Areas in the Philippines (BFAR, 2024).

5.1 Key Findings

The Philippine waters of the SCS LME support rich marine biodiversity and productive fisheries resources. In 2024, total capture fisheries production from domestic catches in the SCS LME was estimated at 350 thousand MT. Of this, 201 thousand MT from municipal fisheries sub-sector and 149 thousand MT from commercial fisheries. Catch trends continue to show decreasing trends since 2008, specially from marine municipal fisheries.

The *Comprehensive National Fisheries Industry Development Plan (CNFIDP), 2016-2020* reports that the Philippine fisheries sector is confronted with nine key and interlinked problems/issues, namely (BFAR, 2016): (i) depleted fishery resources largely brought about by excessive fishing effort and the open access regime in Philippine fisheries; (ii) degraded fishery habitats due to destructive fishing methods, conversion of fishery habitats into economic uses, and negative impacts from land-based activities; (iii) intensified resource use competition and conflicts among fisher groups and other economic sectors; (iv) unrealized full potential of aquaculture and commercial fisheries in view of the still underutilized areas for industry development; (v) uncompetitive products due to inferior quality and safety standards; (vi) postharvest losses in terms of physical, nutritional and value losses; (vii) limited institutional capabilities, from the local up to the national level of governance; (viii) inadequate/inconsistent fisheries policies for promoting a conducive environment for sustainable development; and (ix) weak institutional partnerships among government agencies both at the national and local levels, civil society organizations (CSOs), and the private sector.

Based on the FMA Framework Plans, the following issues and threats to be addressed in FMA 5: (i) Overfishing; (ii) Habitat degradation; (iii) weak compliance with existing fishery laws rules and regulations/ IUU Fishing; (iv) weak governance; (v) low capacity for fisheries management; and (vi) decreasing income due to low fish catch, and lack of livelihood support and diversification (BFAR – FMA 5, 2023). On the other hand, the focus of the framework plan for FMA 6 include: (i) declining fish catch; (ii) IUU Fishing (in municipal waters and beyond); (iii) resource use conflicts; (iv) inadequate income; and (v) poor market linkages (BFAR – FMA 6, 2023).

This TDA Fisheries component report identified the following key fisheries issues and threats within Philippines waters in SCS LME:

- **Overfishing and depletion of fish stock in coastal waters** – this situation is mainly attributed to unsustainable fishing practices leading to declining fish catch trends and mean trophic level or catches, as well as biodiversity loss.
- **IUU fishing** – based on reports there are encroachments of commercial fishing boats in municipal waters as well as presence of foreign flagged fishing vessels in fishing grounds and areas within Philippine territory. The lack of compliance to fisheries regulations such as operation of unlicensed commercial fishing vessels and use of destructive fishing gears also contribute to unsustainable fisheries situation.
- **Environmental degradation** (pollution and coastal habitat destruction) - resource use conflicts including coastal developments in coastal areas have resulted in environmental degradation from water pollution and habitat destruction (coral reefs, seagrass beds, mangroves). The destruction of critical fisheries habitats contributes to the challenges to maintaining productive fisheries habitats and healthy fish stocks.
- **Climate related impacts on fisheries** – there are limited studies on climate change impacts on fisheries. Reductions or shifts in suitable habitats and changes in primary productivity can affect the fish stocks. Occurrence of frequent typhoons can result to reductions of effective fishing days and loss of income.

The report also outlines regional capacity building needs for improving fisheries management in SCS including regional data and information sharing, as well as regular conduct of resource surveys and stock assessments. Scientific studies on impacts of climate change on major fish stocks must be carried out due to limited data and information on this topic. The establishment and monitoring of fisheries refugia, building on previous SCS projects in the region is also proposed.

5.2. Current Status of Fisheries and Ecosystem Health

5.2.1 Based on Fisheries Indicators

Capture Fisheries Status and Trends

The Philippine waters of the SCS LME support rich marine biodiversity – from species to ecosystems, and the fisheries production they provide (Arceo et al., 2024). Based on the Philippine Statistics Authority (PSA) data, in 1980 the capture fisheries production from Philippine waters in the SCS LME was about 271 thousand MT and increased to about 498 thousand MT in 2007. From 2008 the capture fisheries production showed a declining trend until 2024 (i.e., from 487.5 thousand MT in 2008 to 353.8 thousand MT).

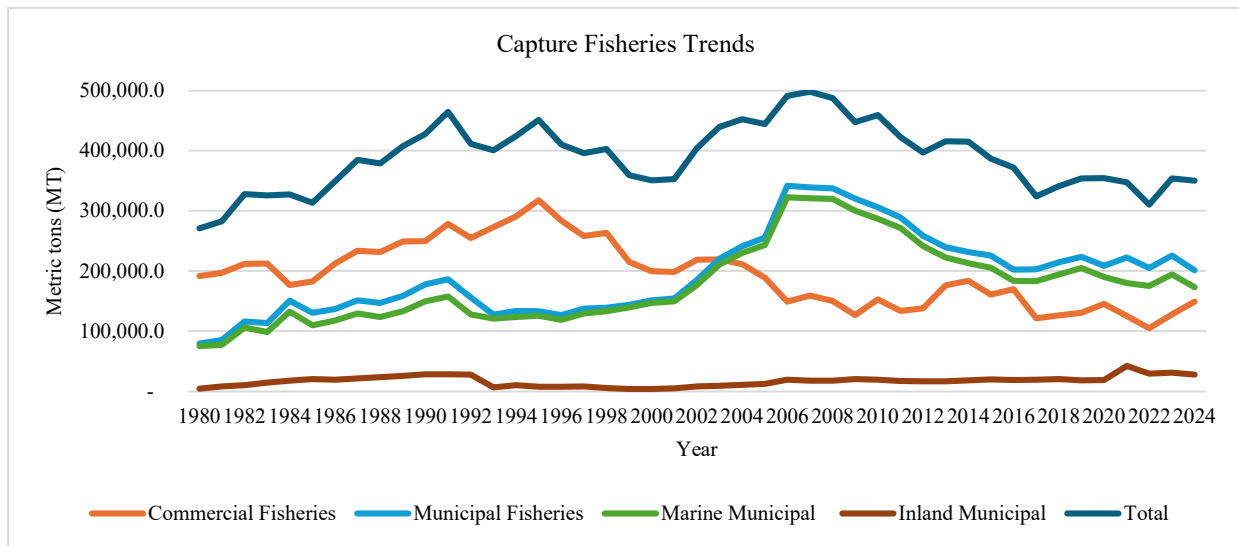


Figure 5.2. Capture fisheries production trends (1980 – 2024) from commercial and municipal subsector in Philippine waters in the SCS LME (PSA data)

Based on the compiled and reconstructed fisheries data from the Sea Around Us project, the trend shows an increasing trend in capture fisheries production from 1960s to 2009, then in 2010 catch from industrial i.e., defined as ‘commercial’ and include boats of 3 GT deploying dragged gears such as trawls either within or outside of municipal waters (Palomares and Pauly 2014) recorded 427 thousand MT and showed a declining trend until 2019. On the other hand, artisanal fisheries also showed decreasing trend from 2010 (188 thousand MT) to 2019 (135 thousand MT). Also referred to as ‘municipal’. The Sea Around Us definition of artisanal fishing in the Philippines is of the fleet of boats weighing 3 GT and less, and does not account for the fact that boats of 3 GT can deploy gears (such as bottom trawls) similar to those deployed by industrial vessels (Palomares and Pauly, 2014).

The catches reported from the SCS by the bordering countries were observed that artisanal fisheries contributed to 25% while 75% from industrial (commercial) sector, and the estimated contribution of Philippines domestic catch to SCS is about 27% of the total capture fisheries production (Pauly and Liang, 2020). In addition, the reported 10 million MT total catch level was achieved by “fishing down the food web” or catching smaller fish in the lower trophic level of the food web as bigger (and thus, more valuable) fish in the higher trophic level of the food web are depleted due to over-exploitation.

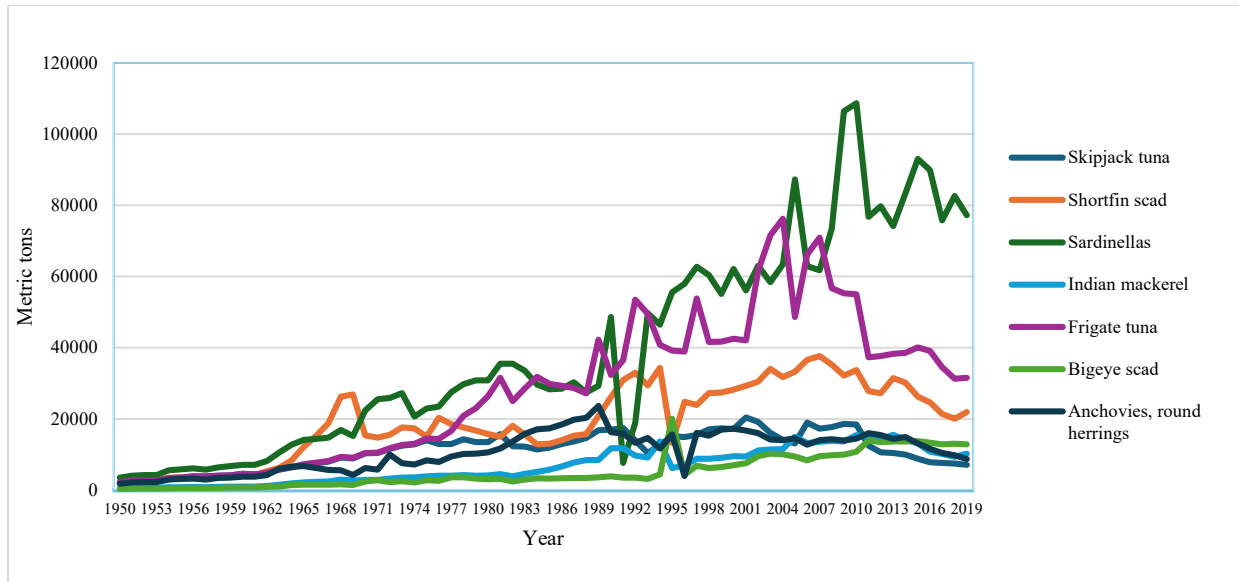


Figure 5.3. Catch composition trends (1950 – 2019) (Sea Around Us project data <https://www.seaaroundus.org/>)

Status of stocks

Major Philippine fisheries have been considered overfished since 1990s (Barut et al., 2003, Green et al., 2003), and fish catch has been declining (Mualill et al., 2014). A report on status of small pelagic fish resources in the Lingayen Gulf (2009-2013) showed that almost 50% of the total fish harvest in are small pelagics and the commercial fisheries sector contributed the largest catch (Gaerlan et al., 2018). The commercial fishing gears that mostly catch small pelagic fish are the Danish seine and Trawl with a catch per unit of effort ranging from 899 to 1,186 kg/day and 65.98 to 119.77 kg/day, respectively. The dominant small pelagic species are *Decapterus maruadsi*, *Decapterus macrosoma*, *Selar crumenophthalmus*, *Rastrelliger brachysoma*, and *Rastrelliger kanagurta*. The estimated mortality parameters and exploitation values obtained from stock assessments for dominant small pelagic fish species are presented in Table 5.2. Results of stock assessment (1998 – 2002 for *D. macrosoma*, *Selaroides leptolepis* and *R. kanagurta*) from northern Zambales waters are also included in Table 5.2. The assessments have indicated some levels of overfishing among the dominant small pelagic species. The exploitation values are way above the “optimum” values of 0.3 - 0.5 suggested by conventional fisheries theory and imply very heavy fishing pressure from the mix of gear used.

The Atlas of Capture Fisheries published by the National Fisheries Research and Development Institute (NFRDI) (Santos et al., 2017) showed that the majority of fish stocks are experiencing excessive or heavy fishing pressure. The National Stock Assessment Program (NSAP) also generated reference points for 42 fish species (47 stocks) and proposed HCRs that can inform policymaking even by relevant management bodies such as those in FMA 5 and 6. 6 and 9. Table 5.2 provides a list of fish species in FMA 5 and 6 that were reported to be exploited. The exploitation values are way above the “optimum” values of 0.3 - 0.5 suggested by conventional fisheries theory and imply very heavy fishing pressure from the mix of gear used.

Table 5.2. Estimates of mortality parameters and exploitation values for dominant small pelagic fish species from Lingayen Gulf (Gaerlan et al., 2018) and Northern Zambales waters (Rueca, et al. 2009).

Species	Total Mortality (Z)	Natural Mortality (M)	Fishing Mortality (F)	Exploitation value (E =)	Source
<i>Decapterus maruadsi</i>	4.18	1.97	2.21	0.51	Gaerlan et al. 2018
<i>Decapterus macrosoma</i>	3.97	2.06	2.53	0.57	Gaerlan et al. 2018
	12.90	2.90	10.0	0.78	Rueca. et al. 2009

<i>Selar crumenophthalmus</i>	8.40	1.91	6.49	0.75	Gaerlan et al. 2018
<i>Selaroides leptolepis</i>	19.36	5.87	13.49	0.70	Rueca. et al. 2009
<i>Rastrelliger brachysoma</i>	6.17	1.91	4.26	0.68	Gaerlan et al. 2018
<i>Rastrelliger kanagurta</i>	3.76	1.98	1.77	0.50	Gaerlan et al. 2018
	4.15	1.84	2.31	0.56	Rueca. et al. 2009

Fish stock assessment data collation for roundskad *Decapaterus macrosoma* (Gonzales et al., in press.) and lizardfish *Saurida tumbil* (NSAP Region 1 and 3, in press) indicated relatively high fishing pressure for these species in FMA 5 and FMA 6, respectively. Annex 5.A.1 also provides the growth, mortality parameters and exploitation values of different species caught in FMA 5 and 6 fishing grounds of the Philippines that was obtained from Silvestre et al. (2003). Based on 2019 data of the Sea Around Us project, the status of fish stocks that were categorized “exploited” with about 73.6% of fisheries catch, while 24.5% were considered “over-exploited” (Figure 5.4). The Atlas of Capture Fisheries published by the National Fisheries Research and Development Institute (NFRDI) (Santos et al., 2017) also indicated that the majority of fish stocks maybe experiencing excessive or heavy fishing pressure.

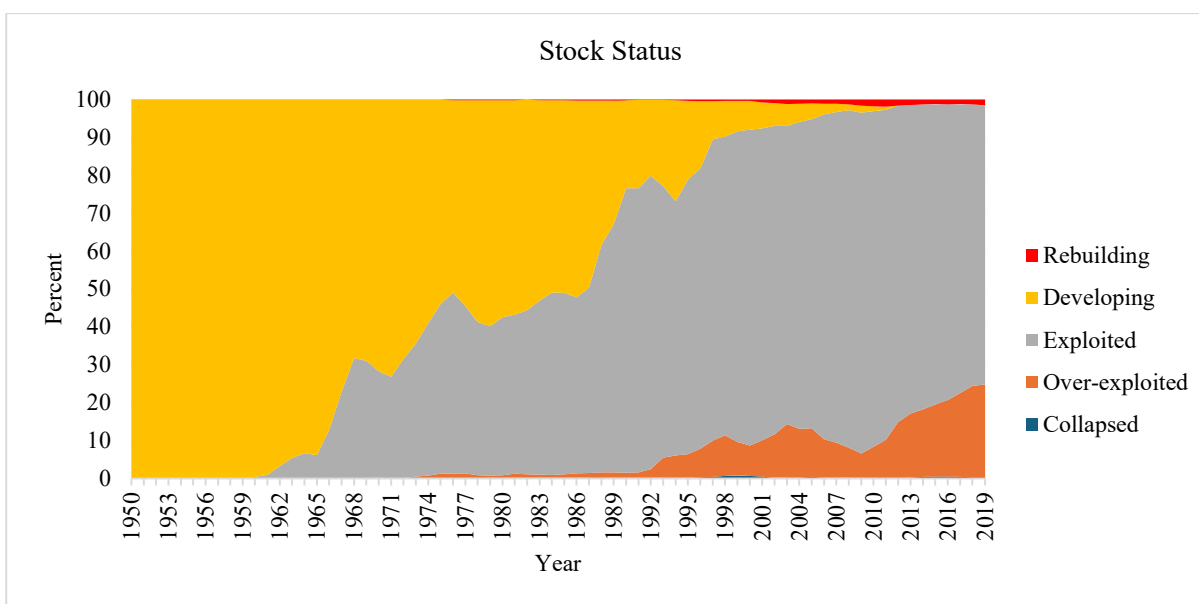


Figure 5.4. Stock status of Philippines fisheries catch (1950 – 2019). (Sea Around Us project data <https://www.seararoundus.org/>)

In 1998 – 2000 (during March to May) an exploration of purpleback flying squid (*Sthenoteuthis oualaniensis*) resources in the SCS and its fishing ground were conducted by using MV SEAFDEC of the Southeast Asia Fisheries Development Center (SEAFDEC). The survey area in the South China Sea was divided into three areas, namely: Area I: Western Philippines waters; Area II: Vietnamese waters; and Area III: Sabah – Sarawak (Malaysia) and Brunei Darussalam waters. The survey results showed that in the Western Philippines waters, the catch per unit of effort (CPUE) of the oceanic squid averaged about 5.7 individual/line/hour, with the CPUEs of the squid ranging from 1.6 and 18.5 individual/line/hour (Siriraksophon, et al., 2001).

Figure 5.5 shows the CPUE distribution and sex composition of the squid caught at each sampling station, and it is apparent that females formed the majority of the catch, accounting for 1,383 squid or 81% of the 1,701 total catch. The resource survey estimated biomass of *S. oualaniensis* in the waters of western Philippines to be 283 thousand MT; the density averaged about 7.2 t/km², whereas the abundant area was as high as 26.4 t/km² during summer of 1998 (Labe 1999 cited by Siriraksophon, et al., 2001). The oceanic squid resources in western Philippine waters were considered under-utilized.

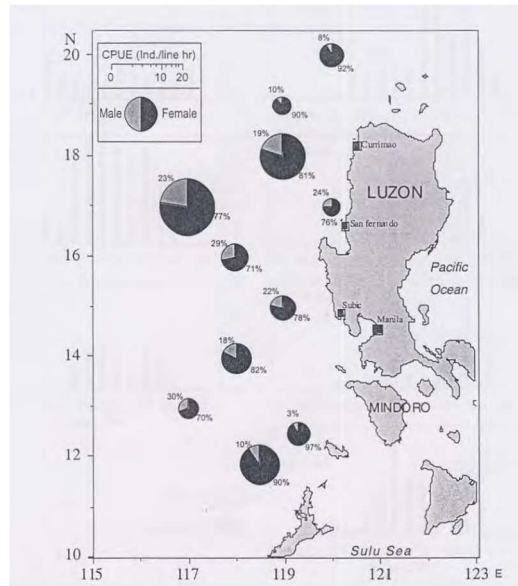


Figure 5.5. Sex composition and CPUE distribution of purpleback flying squid in the South China Sea, Western Philippines waters during April - May 1998 (Siriraksophon, et al., 2001)

Catch from Bottom-impacting gear

Table 5.3 shows the historical stock density and biomass in selected traditional trawl fishing areas in the Philippines noting that Manila Bay and San Miguel Bay are situated in the western seaboard facing the SCS LME. In addition, the E value confirms heavy fishing pressure of the fishery resources in the study areas and is consistent with the declines in demersal biomass. Annex 5.A provides a compilation of growth, mortality parameters and exploitation rates of different species caught in FMA 5 and 6 fishing grounds of the Philippines.

Table 5.3. Estimates of stock density and biomass in Manila Bay and Lingayen Gulf in the Philippines (Adopted from Garces and Silvestre 2003, Stobutzki et al., 2006).

Area	Year	Stock density (t km ²)	Relative density (%)	Stock biomass (t)	Source
Manila Bay	1949-52	4.61	100.0	8,240	Warfel and Manacop (1950)
	1992-93	0.47	10.2	840	UPV & MADECOR (1995)
	2014	0.32	6.9	618	Bendaño, et al. (2017)
	2015	0.48	10.4	928	Bendaño, et al. (2017)
Lingayen Gulf	1978-79	1.33			Villoso and Aprieto 1983
	1987-88	0.57			Ochavillo et al 1989

Silvestre and Hilomen (2004) suggested that trends in the species composition changes from trawl surveys in Lingayen Gulf from late 1940s to the late 1980s is reflective of overfishing which threatens the sustainability of fisheries in the gulf, for example: (1) relative increase in squids (cephalopods), triggerfish and “trash fish” components; (2) virtual disappearance of large species such as rays and lactarids (3) relative decrease of slipmouths, lutjanids (snappers) and flatfishes. In Manila Bay, comparison of the catch composition between the 1947's and the REA study (1990s) showed significant changes that are reflective of recruitment and ecosystem overfishing (MADECOR & National Museum 1995; Pura et al., 1996). The biomass of fished stocks declined in the mid-1980s to about 30% of levels in the late 1940s, resulting in an annual rent dissipation of about US\$130 million per year, due to over-fishing of demersal stocks (Silvestre et al., 1986).

Negative aspects from trawl fisheries also include overcapacity, excess fishing effort and, because trawls are poorly selective (usually by design), they can lead to the suboptimal harvest of juveniles of many species (FAO 2014). In addition, bottom trawling can adversely affect populations of commercially and biologically important target fish and impact species which are endangered, threatened or protected species (ETPs), do damage to benthic habitats and disrupt normal ecosystem functions.

In accordance with Section 95 of Republic Act (R.A.) No. 10654 otherwise known as the Act to Prevent, Deter, and Eliminate Illegal, Unreported and Unregulated (IUU) Fishing, amending Republic Act No. 8550, active gear such as bottom trawl is banned from operating within 15 kilometers from the coastline which, by law and as a matter of equity, is reserved for municipal fishers (Sec. 95 in relation to Sec. 4(44), Fisheries Code of the Philippines). Despite the prohibition, however, there is still a proliferation of bottom trawlers within municipal waters in various parts of the country, highlighting the need to strengthen the implementation of the ban of bottom trawl operations within municipal waters. Hence on 28 November 2018, a Joint Memorandum Circular (JMC) No.: 2018-03 was issued by Department of Interior and Local Government (DILG) and DA-BFAR re. Guidelines on Strengthening the Implementation of the “Ban on Bottom Trawl Operations within Municipal Waters”. The purpose of this policy issuance is to clarify roles and responsibilities of the LGUs, DILG and BFAR to conserve, and protect municipal waters from the adverse ecological, and socioeconomic impacts of bottom trawl operations for the benefit of municipal fisherfolk.

Catch trends of major fishing gears

The major fishing gears used by commercial sector include purse seine for catching pelagic fishes while bottom trawl for demersal species. Figure 5.6a and 5.6b shows the catch trends of major commercial and municipal fishing gears in the SCS waters within the Philippines. It should be noted that bottom trawl and purse seine showed catch in declining trends in 2010, while small scale lines indicated steep catch declined from 2009-2011. The percentage contribution trends of small-scale and commercial fishing gears in the SCS (1950 – 2022) is also shown in Figure 5.6c indicating that purse seines contribute to about 40% of the fisheries catches in the SCS mostly comprised of small pelagic species (see Figure 5.3).

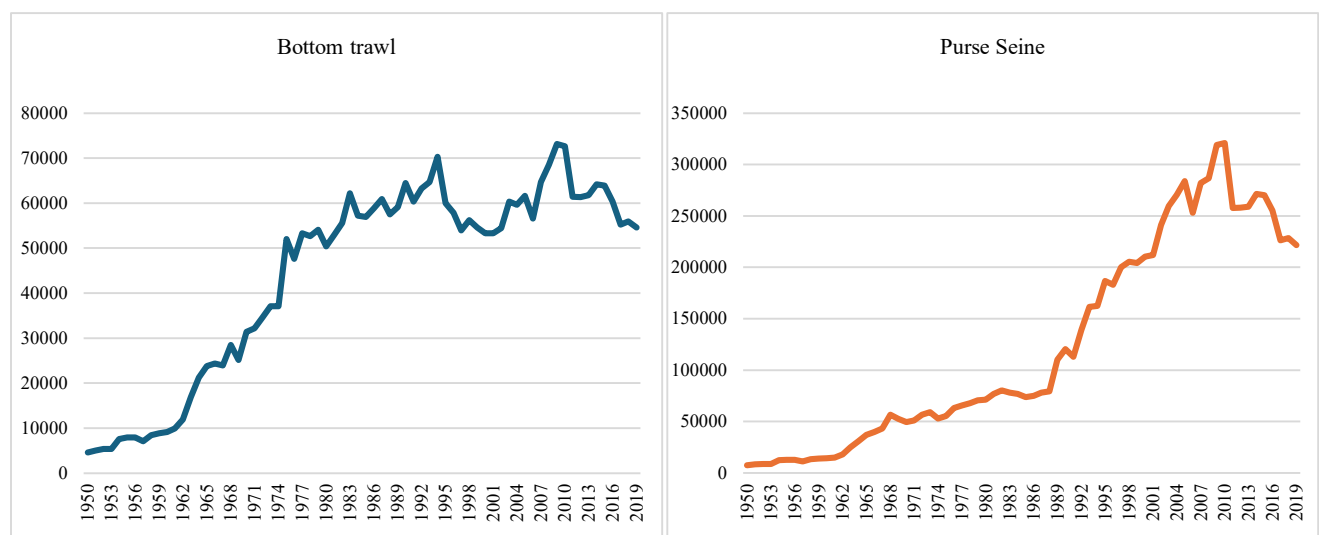


Figure 5.6a. Catch trends of commercial fishing gears in the SCS (1950 – 2019). (Sea Around Us project data <https://www.searoundus.org/>)

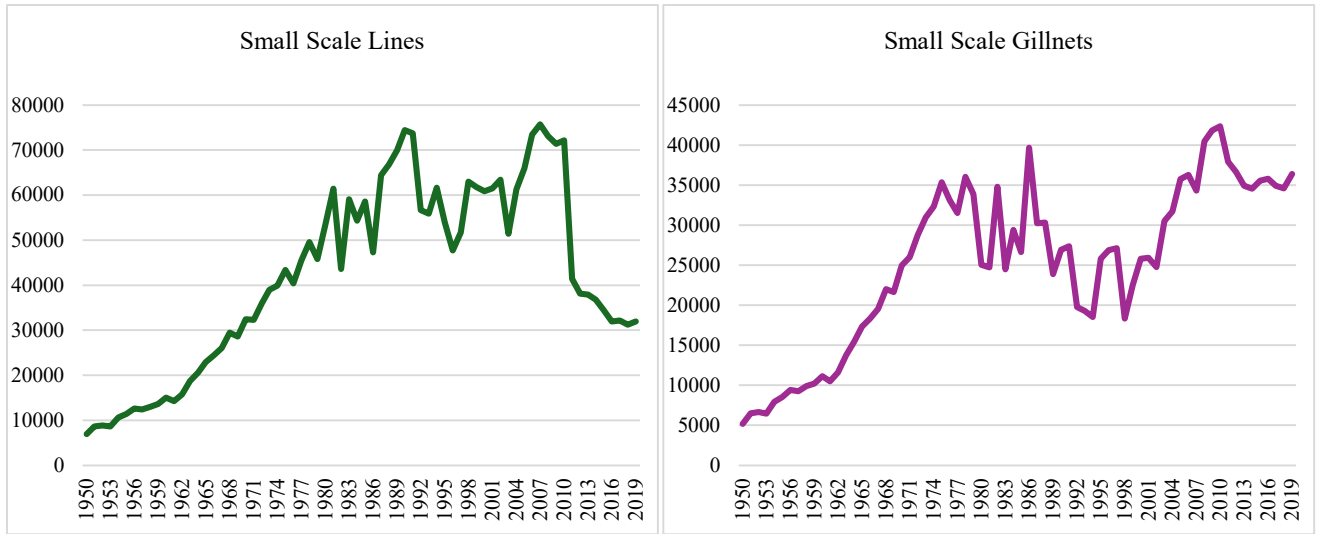


Figure 5.6b. Catch trends of municipal fishing gears in the SCS (1950 – 2019). (Sea Around Us project data <https://www.seaaroundus.org/>)

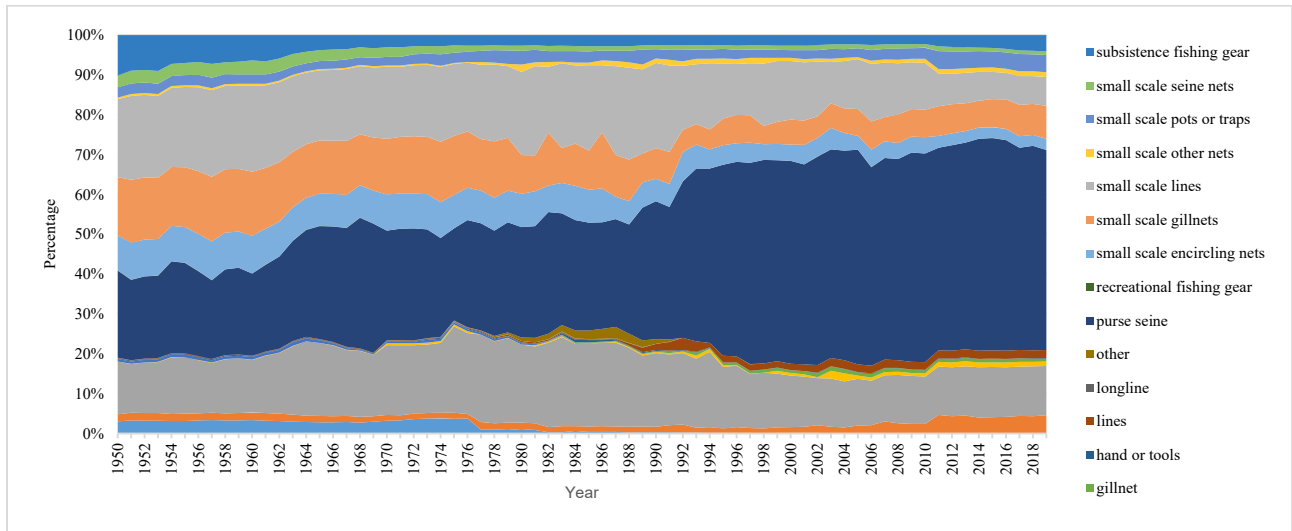


Figure 5.6c. Percentage contribution trends of small-scale and commercial fishing gears in the SCS (1950-2019) (Sea Around Us project data <https://www.seaaroundus.org/>)

Fishing effort

In 2023, BFAR reported that approximately 2.30 million registered fisherfolk engaging in various types of fishery-related livelihoods across the different municipalities in the country (FishR, 2023 cited in BFAR, 2024). Capture fishing constitutes approximately 50.9% of the overall livelihood distribution, indicating that it is the prevailing source of income among fisherfolk, followed by aquaculture at 11.4%, gleaning at 11.1%, fish vending at 7.0%, fish processing at 2.0%, and others composing 17.6%. Table 5.4 provides the number of registered fisherfolks and Table 5.5 shows the number of fishing vessels/boat by regions that are with the SCS LME, and Table 5.6 provides the number of boats by region and GT category based on PSA 2023 data.

Table 5.4. Number of fisherfolks that are engaged in capture fisheries by region (BFAR, 2024)

Region	Male	Female	Total
NCR	8,663	544	9,207
Region 1	53,346	4,016	57,362

Region 2	52,940	4,436	57,376
Region 3	69,700	4,553	74,253
Region 4A	91,144	7,786	98,930
Region 4B	92,985	12,984	105,969
SCS	368,778	29,766	403,097
PH Total	1,061,180	109,682	1,170,862

Table 5.5. Number of registered fishing vessels/boats by region facing the SCS LME (BFAR Fisheries Profile 2024; 2020; 2010; 2000).

Region	2023		2010		2000		1990	
	Municipal	Commercial	Municipal	Commercial	Municipal	Commercial	Municipal	Commercial
NCR	2,744	646	-	758	-	1,351	3,553	323
1	17,964	112	17,678	74	17,678	113	12,720	3
2	12,700	64	3,304	111	3,304	64	3,085	-
3	17,815	212	27,038	137	27,038	40	21,433	27
4A	32,567	160	69,927	226	69,927	221	54,657	1,102
4B	41,280	443	-	455	-	-	-	-
SCS	112,370	1,637	114,643	1,195	114,643	1,725	92,363	1,455
PH Total	407,215	4,560	469,807	6,365	469,807	3,603	464,415	3,278
				*2000		**1999	1985 data	1989 data

Table 5.6. Number of registered fishing vessels/boats by region and by GT category in 2023 (BFAR Fisheries Profile 2024).

Region	Municipal (3 GT or less)	Commercial	3.1-20 GT	20.1-150 GT	>150 GT
NCR	2,744	646	142	367	137
1	17,964	112	100	12	0
2	12,700	64	62	2	0
3	17,815	212	126	86	0
4A	32,567	160	122	38	0
4B	41,280	443	339	100	4
SCS	112,370	1,637	891	605	141
PH Total	407,215	4,560	1,981	2,224	355

5.2.2 Based on Ecosystem Health Indicators

Marine Trophic Index (MTI) and Fishing-in-Balance Index (FiB)

The marine trophic index (MTI) measures the change in mean trophic level of fisheries catches from an ecosystem, adequately tracks changes in mean trophic level of an ensemble of exploited species in response to fishing pressure. The Fishing-in-Balance (FiB) index aim to account for the expansion and contraction of fishing fleets over time as reflected by the trophic level of the catches. Harvesting lower trophic level species has been happening in the Philippines has been observed and indicates the declining trend in the mean trophic level of the Philippines fishery catches, as reported by (Cabral et al., 2023).

An analysis of the mean trophic level of the reconstructed industrial (commercial fisheries) catch for which landings data were disaggregated to the species-level also implied the presence of the ‘fishing down the food web’ phenomenon (Palomares and Pauly 2014), i.e., catching smaller fish lower in the food web, and through a demand-

and subsidy-driven offshore expansion (Pauly and Liang, 2020). Figure 5.7 shows the MTI and FiB indices based on capture fisheries data from SAUP in the waters of Philippines (1950 – 2019).

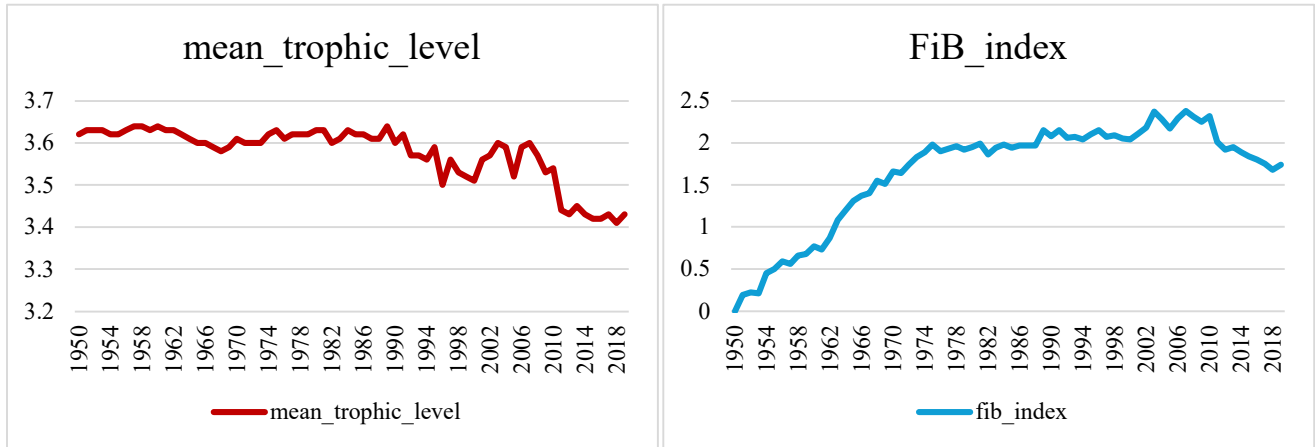


Figure 5.7. Marine Trophic Index (MTI) and Fishing-in-Balance Index (FiB) for catches in the waters of Philippines (1950 – 2019) (Sea Around Us project data <https://www.seararoundus.org/>).

Primary Production Required (PPR)

The Primary Production Required (PPR) index is a crucial tool for evaluating the ecological footprint of fisheries. It provides a comprehensive understanding of the impacts of fishing activities on marine ecosystems and facilitates sustainable fishery management. By using rigorous assessment methodologies, stakeholders can ensure the preservation of marine biodiversity and the long-term viability of fishery resources. As the demand for marine resources increases, the importance of PPR as an ecological metric will remain vital in guiding responsible and sustainable fishing practices. Figure 5.8 presents the PPR for fisheries catches in the waters of Philippines.

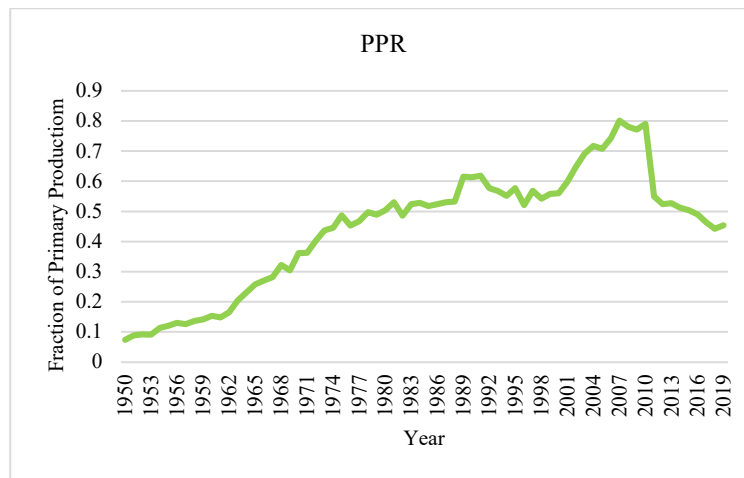


Figure 5.8. Primary Production Required for catches in the waters of Philippines (1950 – 2019) (Sea Around Us project data <https://www.seararoundus.org/>).

In addition, a study was conducted to estimate primary productivity in the South China Sea off the coast of Western Philippines indicated that the net primary production estimated from ten sampling stations ranged from 0.10 to 1.53 g C m⁻² d⁻¹ during April 15 to May 11, 1998 (Furio and Borja, 2000). The result of the study showed relatively low primary production in that area and suggests some parts of the ecosystem may be vulnerable. It must be noted that an area with low primary production has less energy entering the food web, and it can naturally support a lower

total biomass of fish than a highly productive area (i.e., coastal upwelling zones). Moreover, in a low-productivity ecosystem, even a modest fishery can represent a large fraction of the total available energy (a high PRR%). And catching the same tonnage of fish in the Philippines might have a much larger ecological footprint (higher PRR) than catching it in a highly productive area. Based on a remote sensing study in the Luzon strait in the SCS, the area was identified as typical oligotrophic region where primary productivity is limited by nutrient availability (Tang et al., 1999).

5.3 Discussion and Conclusions

5.3.1 Transboundary Problems and Issues and Risk Assessment

The following issues were identified in the Philippines national TDA report that contribute to the problem on overexploitation of marine living resources in the SCS LME (UNEP undated): (i) reduced fish stock and declining fish biomass; (ii) reduced biodiversity; (iii) degradation of coastal habitats; (iv) reduced coastal productivity; (v) increased resource use conflicts and competition between commercial and municipal fishing sectors; and (vi) declining catch rates and income of fishers, among others. Regionally significant threats to coral reefs in the SCS were overfishing, use of destructive fishing techniques, pollution (mainly eutrophication) and increased sedimentation (Vo et al., 2013).

In south and southeast Asia including the Philippines, the key issues impacting coastal fisheries include (Silvestre and Pauly 1997): (i) overfishing, (ii) inappropriate exploitation patterns, (iii) post-harvest losses, (iv) conflict between large- and small-scale fisheries, (v) habitat degradation, (vi) inadequacy of management information and research, and (vii) institutional weakness and constraints.

Illegal fishing is also prevalent, and commercial fishing intrusion into municipal waters has been identified as a top threat (Green et al. 2003, DA-BFAR 2024). Poaching by foreign entities is also considered the most challenging threat to Philippine fisheries, especially in SCS LME and access to several reef areas have become restricted due to the presence and encroachment of foreign flagged (Arceo et al., 2024).

As part of the national continuing commitment to address IUU fishing and its strategic vision of reducing destructive practice, DA-BFAR has been seeking solutions to the still significant knowledge gaps that remain in the current understanding of IUU fishing in the Philippines. Based on the DA-BFAR IUU report (DA-BFAR 2024), the top three violations of commercial fishing vessels (CFV) based on the number of incidents in 2022 for both FMAs 5 and 6 were (DA-BFAR 2024): (1) unauthorized fishing (fishing without registration); (2) CFV intrusion in municipal waters; and (3) CFV operators employing unlicensed fishworkers (Table 5.7). Other violations reported were: use of unlicensed gear; fishing using explosives; and use of prohibited gear (ban on muro-ami).

Table 5.7. Violations by CFVs involved in IUU fishing in FMA 5 and FMA 6 (DA-BFAR, 2024)

Commercial Vessel IUU Violation	FMA 5	FMA 6
Unauthorized fishing	50%	29%
CFV intrusion in municipal waters	38%	22%
CFV operators employing unlicensed fish workers	6%	15%

Based on data from apprehension reports and IUU fishing reports from BFAR, CFVs engaged in IUU fishing in FMA 5 were estimated to catch about 558 MT of fish per year valued at nearly Php56 million while in FMA 6 the estimate was 756 MT, and valued about Php75 million (DA-BFAR 2024). In addition, Philippines coastal waters within the SCS LME accounted for the highest number of suspected IUU fishing activities by foreign-flagged vessels in 2020 (OceanMind, 2022 cited in DA-BFAR, 2024). IUU fishing constitutes a persistent and pressing problem,

estimated to account for up to \$23 billion annually in the Asia Pacific region (Wilcox et al., 2021). Hotspot areas of illegal fishing activities are included in the regions encompassing the border of Vietnam's EEZ and the SCS, and the region between the Philippines and Indonesia in the Celebes Sea.

With regards to the intrusion of commercial fishing vessels in municipal waters. On August 19, 2024, the Supreme Court (SC) First Division upheld a Malabon Regional Trial Court (RTC)'s ruling that allows the Mercidar Fishing Corporation, a commercial fishing operator, to operate in municipal waters. The RTC's ruling allows Mercidar to operate in all territorial waters of the Philippines, including within the 15-kilometer municipal water zone, so long as such bodies of water are seven fathoms or more deep and so long as it is duly licensed to operate as a large commercial fishing operator pursuant to Section 26 of RA 8550, as amended. In January 2025, the Department of Agriculture (DA), through the Office of the Solicitor General, filed a motion for reconsideration with the Supreme Court to overturn a decision allowing commercial fishing vessels access to municipal waters, previously reserved for small-scale fishers under the Fisheries Code. Allowing commercial vessels to operate within municipal waters jeopardizes the livelihoods of thousands of subsistence fishers and accelerates the depletion of already fragile fish stocks. The potential impacts on small-scale fishers and municipal waters may include: (i) shrinking fishing grounds of municipal fisherfolk; (ii) further depletion of fish stocks in coastal areas; (iii) exploitation or destruction of marine protected areas (MPAs) and fish sanctuaries; and (v) intensify competition over the fisheries resources between municipal fishers and commercial fishers.

Considering the emphasis on addressing the three (3) interlinked planetary crises in the preparation of the national TDA (i.e., climate change, nutrient and plastic pollution, and biodiversity). For this fisheries report we considered the following transboundary problems/issues (see also **Risk Assessment**):

- Overfishing and depletion of fish stock in coastal waters (15-km municipal water and commercial fishing operations) (this issue was mentioned in the FMA 5 and 6 Framework Plans)
- IUU fishing (encroachment of commercial fishing boats in municipal waters and operation of foreign flagged fishing vessels within Philippines waters (this issue was mentioned in the FMA 5 and 6 Framework Plans)
- Habitat Destruction and Environmental Degradation (refer to **Chapter 4 – Ecosystems** (Wetlands, Mangroves, Seagrasses, and Coral Reefs) and **Chapter 3 - Pollution** chapters)
- Climate change impacts (see section 5.3.2 below)

It must be noted that overfishing and declining fish catch, IUU fishing in municipal waters and habitat destruction were identified as key issues and threats in the FMA Framework Plans for FMA 5 and FMA 6. These issues contribute to enhancing loss of biodiversity in productive fishing areas in the SCS.

5.3.2. Climate Change Impacts on Fisheries and Aquaculture

Barange et al. (2018) suggest that in marine region the climate model projections will result to decreases in maximum catch potential in the world's exclusive economic zones of between 2.8% and 5.3% by 2050 according to greenhouse gas emission scenario RCP2.6, and between 7.0% and 12.1% according to greenhouse gas emission scenario RCP8.5, also by 2050. The estimated projected changes in catch potential (%) in the Philippines by 2050 and 2100 relative to 2000 under RCP2.6 and RCP8.5 will be between -8.2% and -59.2% (Cheung et al., 2018).

Projections reveal that the Philippines shall experience increases in sea surface temperature more intense storms, locally prolonged droughts, and intense episodic rainfalls (David et al., 2016). The country is also likely to experience effects of ocean acidification, and sea level rise is projected to be higher than the global estimates for the Philippines. These impacts are additional pressure on top of the many, and mostly anthropogenic pressures which the marine ecosystem is already experiencing.

Fisheries and fisherfolk may be impacted in a wide range of ways due to climate change (Daw et al, 2009). These include biophysical impacts on the distribution or productivity of marine and freshwater fish stocks through processes such as ocean acidification, habitat damage, changes in oceanography, disruption to precipitation and freshwater availability. Fisheries will also be exposed to a diverse range of direct and indirect climate impacts, including displacement and migration of human populations; impacts on coastal communities and infrastructure due to sea level rise; and changes in the frequency, distribution or intensity of tropical storms. In aquaculture, climate change impacts include (i) damage to farming facilities and loss of stocks due to extreme weather events, (ii) changing salinity due to sea-level rise, (iii) production impacts from rising temperatures, water shortages during droughts, (v) loss of stocks due to flooding and overflowing of ponds, and (vi) eutrophication or upwelling and harmful algal blooms resulting in fish kills, among others.

Geronimo (2018) identified potential effects of climate change on the populations of the top commercially exploited marine species in the country and projected that: (i) marine species will experience reductions in habitat suitability within the Philippine exclusive economic zone (EEZ) with continued climate change, with the magnitude of change varying across species; and (ii) climate change will also substantially reduce the total area within the Philippine EEZ that is suitable for growth of other species. This study also compared the potential changes in the distribution of 59 top commercial marine species by 2050s under two climate change scenarios. All 59 species will experience reductions in suitability of existing habitats and extent of suitable areas for growth and survival while eight of these species will encounter conditions beyond their current known occurrence range.

Campos and Bagarinao (2021) reported that climate stressors and risks to the sardine fishery will likely vary among the six major sardine fishing grounds in the country including southern Palawan and Zamboanga waters in the Sulu Sea, considering the differences in the drivers of primary production and vulnerability of communities. These include an intensification of upwelling, stronger stratification of the water column, a decrease in drying capacity, the relocation of fishers along the coast, increasing vessel safety concerns and a reduction in effective fishing days. All these challenges are further exacerbated by the overfished status of sardine stocks.

A study on the potential distribution of mackerel scad (*Decapterus macarellus*) in the South China Sea under future climate scenarios has indicate a reduction in suitable habitats, particularly under high-emission scenarios, with more gradual reductions under low-emission scenarios (Shen et al., 2025). Habitat loss is most pronounced in the northern South China Sea, while the central region is projected to see an expansion of suitable habitats.

Increasing concern about the potential impacts of climate change on Philippine fisheries have been documented (Santos et al. 2011; Muallil et al. 2014; Macusi et al. 2020), and the projected economic impact of climate change on marine capture fisheries in the Philippines (Suh and Pomeroy 2020). Macusi et al. (2020) indicated that the top five exposure factors for small pelagic fisheries were: coastal development (leading to habitat destruction), water quality, temperature changes, typhoons, and declining fish catch.

5.3.3. Current Governance to Address Fisheries Problems

The following is a list of national laws and policies on fisheries management, conservation and protection:

- **Republic Act 7160:** The Local Government Code of 1991 outlines the powers and functions of local government units in the Philippines which includes jurisdiction over the municipal waters, among others.
- **Republic Act 7586:** The National Integrated Protected Areas System Act of 1992 and Republic Act 11038 or the Expanded National Integrated Protected Areas System (E-NIPAS) Act of 2018 for the establishment and management of protected areas.
- **Executive Order 240 (1995):** Creating the Fisheries and Aquatic Resources Management Councils (FARMCs) in Barangays, Cities and Municipalities, their Composition and Functions.

- **Republic Act 8435:** The Agriculture and Fisheries Modernization Act of 1997 – which prescribes measures to modernize the agriculture and fisheries sectors in order to enhance their profitability.
- **Republic Act 8550:** An act providing for the development, management and conservation of fisheries and aquatic resources, integrating all laws pertinent thereto, and for other purposes. Otherwise known as the Philippine Fisheries Code of 1998 (signed into law on 25 February 1998).
- **Republic Act 9147:** Wildlife Resources Conservation and Protection Act of 2001 – to conserve and protect wildlife species and their habitats and to regulate the collection and trade of wildlife.
- **Executive Order 305 (2004):** Devolving to Municipal and City Government the Registration of Fishing Vessels below three (3) Gross Tonnage (GT).
- **Executive Order 154 (2013):** A National Plan of Action to Prevent, Deter and Eliminate IUU Fishing – the plan outlines priority actions that will address the ecological, biological and socioeconomic challenges posed by IUU fishing in a coordinated and integrated manner with collaboration between Philippine government departments and agencies.
- **Republic Act 10654 (2015):** An act to prevent, deter, and eliminate Illegal, Unreported and Unregulated (IUU) fishing, amending RA 8550, otherwise known as “The Philippine Fisheries Code of 1998”.

Philippine Fisheries Code of 1998 (RA 8550) provides a comprehensive legal framework that governs the development, management and conservation of the country’s fisheries and aquatic resources. The Fisheries Code focuses on the sustainability of the fishery resources and maintenance of ecological balance as well as achieving food security through a regulatory regime that operates through Local Government Units (LGUs) and FARMCs for municipal waters in collaboration with DA-BFAR for all fisheries and aquatic resources other than municipal waters. The Code enumerates the following objectives of the fishery sector: (1) conservation, protection and sustained management of the country's fishery and aquatic resources; (2) poverty alleviation and the provision of supplementary livelihood among municipal fishers; (3) improvement of productivity of aquaculture within ecological limits; (4) optimal utilization of offshore and deep-sea resources; and (5) upgrading of post-harvest technology.

The Amended Fisheries Code (RA 10654) put emphasis on the act to prevent, deter and eliminate IUU fishing. Accordingly, Section 2 of the Fisheries Code specifies that it is the policy of the state to achieve food security as the overriding consideration in the utilization, management, development, conservation and protection of fishery resources, in order to meet the nutritional needs of the population. A flexible policy towards the attainment of food security will be adopted in response to changes in demographic trends for fish, emerging trends in the trade of fish and other aquatic products in domestic and international markets, and the law of supply and demand.

The Fisheries Code (RA No. 8550 in 1998, as amended by RA No. 10654 in 2015) also recognizes the concept of integrated coastal area management in managing fishery and aquatic resources in natural fisheries management areas (Section 2f). Hence, BFAR Fisheries Office Order No. 164 (s. 2016) promotes EAF as the foundation for managing fisheries resources and provides guidelines to operationalize the EAF concept in the development and implementation of BFAR programs and activities.

The adoption of EAF in FMAs is an attempt to provide a framework to integrate national and local management roles, based on a common science-based platform and consistent with international best practices. The Fisheries Code gave BFAR a mandate to establish FMAs and adopt measures following an ecosystem-based approach. In 2019, BFAR formally delineated 12 FMAs under FAO 263 in order to “provide a science-based, participatory and transparent governance framework and mechanism to sustainably manage fisheries in such areas, consistent with the principles of EAF and anchored on food security and supplementary livelihood for poverty alleviation.”

The Local Government Code (LGC) of 1991 (RA 7160), is a landmark legislation wherein the government of the Philippines undertook policy and institutional reform to facilitate increased participation in management and to

devolve control over resource access to local levels of government. The resulting jurisdictional divisions designate authority to village, municipal or city governments for management of ‘municipal waters’ up to 15 km from the shoreline and resources within the territorial boundaries of these municipalities or cities. This law promotes local autonomy and government decentralization that devolved much authority to local government units (LGUs), specifically the municipal level. As such, the LGUs have become the key managers of natural resources within their territorial boundaries. This national law has provided for the devolution of the responsibilities in the provision of a number of basic services from National Government Agencies to the Local Government Units (LGUs). Among the responsibilities devolved to the LGUs are the enforcement of environment and natural resources laws within the territory of the LGUs, water and soil resources utilization and conservation projects. Specifically, the devolved responsibilities concerning the fisheries sector are the enforcement of fishery laws in municipal waters (i.e., within 15-km from shoreline) and the provision of extension and on-site research services and facilities related to agriculture and fishery activities.

The 2015 Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (The SSF Guidelines) (FAO 2015) is the first international instrument dedicated entirely to the small-scale fisheries sector. These are aimed at all actors striving to secure sustainable small-scale fisheries, to end hunger and poverty and strengthen human rights. In October 2024, the NPOA-SSF was officially launched by the Department of Agriculture – Bureau of Fisheries and Aquatic Resources (DA-BFAR) in partnership with FAO, local fisherfolk and various government, NGO and research partners. It was a result of a participatory and inclusive process that engaged stakeholders across the country in various Fisheries Management Areas (FMAs), including representatives from municipal and artisanal capture fisheries, Indigenous Peoples and vulnerable workers across the value chain, NGOs, national government authorities, research partners, among others.

5.3.3.1 Management and Conservation Efforts

The Comprehensive National Fisheries Industry Development Plan (CNFIDP) 2006–2025 was developed to provide a framework for promoting the optimal development and long-term sustainability of benefits derived by the nation from its fisheries. To attain the vision of a sustainable and competitive fisheries industry, the CNFIDP 2021–2025 identified the following important elements: (1) sufficient contribution to national food security; (2) inclusive growth within the industry; (3) sustainable, science-based fisheries and aquatic resource management practices; (4) compliance with international laws, policies and standards, and enforcement of local laws and regulations; (5) strengthened capacities in infrastructure, technologies, human resources and information-sharing; and (6) resilience to environmental hazards. BFAR in close collaboration with key stakeholders (including Fisheries and Aquatic Resources Management Councils) has also developed National Plan of Action (NPOA) for sardines, tuna, IUU Fishing, among others.

The Philippines has several programs to improve fisheries management using an EAFM and integrated coastal management approach that are conducted in collaboration with Local Government Units (LGUs) and non-government organizations (NGOs). Key strategies for fisheries management and conservation that are being implemented by BFAR, and are consistent with the CNFIDP include (BFAR 2021): (i) restoring fishery habitats (mangroves, seagrasses, coral reefs, wetlands and inland bodies of water) through protection and rehabilitation; (ii) protecting spawning grounds and spawning cycles based on research and participatory processes; (iii) delineating and zoning of coastal lands and water uses to resolve conflicting uses with the Comprehensive Land Use Plans (CLUPs); and (iv) developing and harmonizing inter-LGU coastal resources management plans based on participatory coastal resources appraisals, among others. BFAR has also undertaken fisher registration and boat registration, and improvements in management, monitoring and enforcement have been included in the Integrated Maritime Environmental Monitoring System (IMEMS) including deployment of BFAR Vessels to conduct MCS activities, as well as Vessel Monitoring System, and Catch Reporting/Documentation.

In early 2000, the National Fisheries Research and Development Institute (NFRDI), in collaboration with BFAR Regional Offices were mandated to monitor the status of fish stocks in major fishing grounds through the National Stock Assessment program (NSAP). Recently, NFRDI-NSAP started collating data at the FMA-level to provide science support to the development and implementation of FMA-based fisheries management plans for priority fish stocks.

The delineation of Philippine waters into 12 FMAs represents a significant shift for the country in the management of straddling and shared stocks (Ramiscal et al., 2024). And the FMAs provides a framework and mechanism for fisheries managers and resource users to move from an open access regime to nuanced management that takes into account the status of the stocks. The establishment of FMAs aims to facilitate a transition from geographic and production-based fisheries management to EAF, with the long-term goal of managing fish stocks in a more sustainable manner, while gaining greater economic benefits. The main features of the FMA concept are: (i) spatial delineation of Philippine waters as a means to manage resources at an appropriate scale; (ii) approximation of an ecosystem scale of management; (iii) approximation of stocks and fisheries distribution based on the best available science; and (iv) building on previous resource management interventions such as seasonal fishing bans or closed seasons, species-level management plans, and bay-wide management.

In 2024, BFAR initiated the implementation of the Fisheries and Coastal Resiliency (FishCoRe) Project. The development objective of FishCoRe is to improve the management of targeted fisheries resources and enhance the value of fisheries production to coastal communities in selected FMAs (i.e. FMAs 6 and 9). Specifically, key targets include fisheries management plans (FMPs) implemented in the FMAs; and the share of major fish stocks covered in FMPs including harvest control rules and measures moving towards target reference points, among others. Annex 5.B. provides the summary of the goals and objectives of the FMA 5 and 6 Framework Plans in support to sustainable fisheries management in the SCS LME.

In addition, BFAR in collaboration with local government units and fishing industry and has introduced temporal (seasonal) area-based closed fishing seasons for conservation sardines in the Zamboanga peninsula (including portions of FMA 5 in eastern Palawan) and Visayan Sea from November 15 to February 15; and round scad in northern Palawan waters within FMA 5 from November 1 to January 31 (BFAR, 2024). Similar policy interventions are encouraged to be implemented in FMA 5 and 6. While the policy's continuous implementation will conserve the fisheries resources and sustain the sardine industry, it should be complemented with regular and continuous monitoring of socioeconomic impact to provide information for feedback to reframe and revise for a more effective policy (Rola et al. 2020). For closed season to be effective it has to be applied along with other management strategies such as mesh size regulation, establishment of Marine Protected Areas, and provision of alternative sources of livelihood (Napata et al. 2020).

As part of the SCS Refugia project, a national plan of action (NPOA) for the establishment of "fisheries refugia" in the coastal areas of Masinloc in Zambales, Coron in Palawan and Bolinao in Pangasinan was developed (Garcia et al., 2022). The concept of fisheries refugia was developed as a novel approach to the identification and designation of priority areas in which to integrate fisheries and habitat management in the context of high and increasing levels of small-scale fishing pressure in the South China Sea (Paterson et al. 2013). In addition, the refugia concept also appears to be a successful approach in addressing a significant barrier to the integration of fisheries and habitat management, namely the adverse reaction to the Marine Protected Area concept that is elicited from fishing communities and fisheries officers at the local and provincial levels. And it is anticipated that the experiences gained from this novel approach to the use of spatial management tools in fisheries management will be suitable for scaling-up in the SCS region and replication in other aquatic habitats.

Building on from the SCS Refugia project (Paterson et al., 2013), the establishment and monitoring of the fisheries refugia in the coastal areas of Masinloc, Zambales, Coron, Palawan and Bolinao, Pangasinan must be pursued

and replicated (see Table 5.8 and Figure 5.9 below). BFAR through Fisheries Office Order No. 335 (FOO), approved the Implementation of the Guidelines on the Establishment and Operation of Fisheries Refugia in the Philippines”, and management plans for each refugia site has been developed by BFAR in collaboration with the LGUs.

Table 5.8. Description of Fisheries Refugia Sites in the Philippines (Borja et al., 2022).

Fisheries Refugia Sites	No. of Hectares (ha)	Priority Species	Type of Habitat	Habitat in Hectares (ha)
Bolinao, Pangasinan	99.8	<i>Siganids spp.</i>	Seagrass	1,084.58
Coron, Palawan	163.20	<i>Caesio cuning</i> <i>Decapterus muroadsi</i>	Mangrove	229.56
Masinloc, Zambales	120.69	<i>Pterocaesio tessellata</i> <i>Sadinella fimbriata</i>	Coral reef	1,602.20

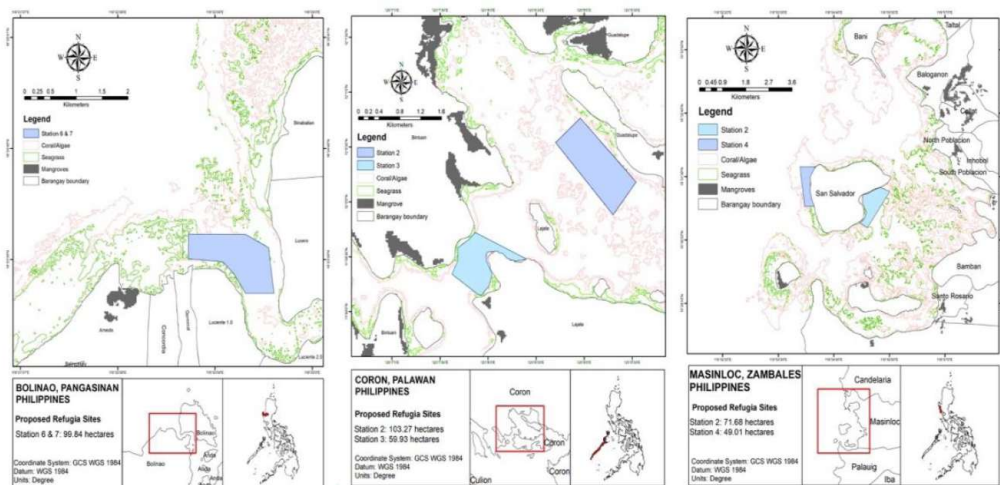


Figure 5.9. Map of Fisheries Refugia Sites in the Philippines (Borja et al., 2022)

5.3.3.2 Regional Cooperation

Table 5.9 below provides a list of regional fisheries cooperation mechanisms in the Asia Pacific region and the government of the Philippine are associated or member-country.

Table 5.9. List of regional fisheries collaboration and cooperation mechanisms for the Asia Pacific region (Adopted from USAID SuFiA TS 2024).

Institution / Organization	Primary Mandate
1. Association of South East Asian Nations (ASEAN)	Regional geo-political and economic organization of 10 countries that aims acceleration of economic growth, social progress, and cultural development among its members as well as the promotion of the region’s peace and stability. The ASEAN Network for Combating IUU Fishing (AN-IUU) was establish to: (i) enhance regional cooperation on information sharing through an online interactive platform; as well as on the use of Monitoring, control and Surveillance (MCS) information; and (ii) enhance capacities and capabilities of ASEAN Member States (AMS) in the fight against IUU fishing through the dissemination of best practices, especially on MCS and investigation activities and experiences.
2. Asia-Pacific Fishery Commission (APFIC)	APFIC was established under the APFIC agreement as the Indo-Pacific Fisheries Council in 1948 by the Food and Agriculture Organization of the United Nations (FAO). APFIC works to improve understanding, awareness and cooperation in fisheries issues in the Asia-Pacific region.

3. ASEAN Centre for Biodiversity	Intergovernmental organization in response to the challenge of biodiversity loss that facilitates cooperation and coordination among 10 ASEAN Member States and with regional and international organizations on the conservation and sustainable use of biological diversity and the fair and equitable sharing of benefits arising from the use of such natural treasures
4. Coordinating Body on the Seas of East Asia (COBSEA)	As a regional coordinating body under UNEP, it promotes the development and protection of the marine environment and coastal areas of East Asian Seas to support human well-being and livelihoods and contribute to sustainable development for the long-term benefit of present and future generations
5. Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF)	A multilateral partnership of the six Coral Triangle countries formed to sustain the marine and coastal resources by addressing crucial issues such as food security, climate change and marine biodiversity; also mandated to promote regional cooperation, sharing of lessons, and facilitate learning across the six countries.
6. Partnerships in Environmental Management for the Seas of East Asia (PEMSEA)	A regional coordinating mechanism for the sustainable development seas and coasts in East Asia that works together with countries, non-governmental organizations, local governments, academic institutions, and other development partners to foster and sustain healthy and resilient ocean, people, and economies across the region.
7. Regional Plan of Action to Promote Responsible Fishing Practices including to Combatting Illegal, Unreported, and Unregulated Fishing Practices in the Region (RPOA-IUU)	A high-level decision-making body providing strategic advice and direction to RPOA member countries about conservation of the marine environment, sustainable management of fisheries resources, managing fishing capacity, building competency in fisheries management, and combating IUU fishing in the region.
8. Southeast Asian Regional for Graduate Study and Research in Agriculture (SEARCA)	A non-profit R&D organization with a mandate to build capacities in agricultural and rural development in Southeast Asia; with current fisheries works related to climate change, impact assessments and vulnerabilities
9. Southeast Asian Fisheries Development Center (SEAFDEC)	An autonomous inter-governmental body with mission “To promote and facilitate concerted actions among the Member Countries to ensure the sustainability of fisheries and aquaculture in Southeast Asia”; primarily R&D mandate with learning and demonstration sites related to capture fisheries and aquaculture
10. WorldFish Center Penang Office	A global research and innovation institution in aquatic food systems that support sustainable development and food systems transformation for healthy and resilient diets with R&D works in the fisheries sector embedded in the larger aquatic food systems; FAO/UN on Southeast Asian/Indo-Pacific fisheries management and food security.

5.3.4 Recommended Priority Actions including those for Regional Cooperation

Zhang (2018) proposed three primary objectives for fisheries cooperation in SCS, namely, 1) achieving food security and economic development, 2) ensuring sustainable fishery and protecting marine environment, and 3) preventing fishing conflicts and disputes. Additionally, using these three objectives as evaluation criteria, three prevailing options for regional cooperation can be pursued, including (i) Marine Protected Areas (MPA)/Marine Peace Park, (ii) Regional Fishery Management Organizations (RFMO), and (iii) aquaculture.

On 16-18 January 20204, BFAR in partnership with the U.S. Agency for International Development (USAID) Sustainable Fish Asia Technical Support (SuFiA-TS) conducted a Regional Technical Exchange to: collaboratively strengthen sub-regional information exchange and policies; share relevant information from recent assessments and research in the sub-region; and identify priority needs for improving sub-regional information sharing and strengthening regional technical capacity and collaborative fisheries management mechanisms (USAID SuFiA TS 2024). Based on the technical report, the identified regional capacity building in support for improved fisheries

management in the SCS, as well as needs for regional fisheries data and information sharing include the following thematic areas (see Table 5.10): (1) fisheries management (FM), (2) Combined FM / Research and Development, (3) Research and Development, and (4) Data and Information Sharing (DIS), along with proposed initiatives to address the perceived gaps in regional capacity.

Table 5.10. List of regional capacity building needs for improving fisheries management in SCS including regional data and information sharing (USAID SuFiA TS, 2024).

Capacity	Perceived gaps in regional capacity	Proposed capacity building initiatives	Proposed lead
Fisheries Management (FM)	MCS: Fisheries surveillance and enforcement; community-based surveillance group	Collaborative enforcement; PSMA; training based on success stories in the region, i.e., Bantay-dagat (fish warden); fisheries intelligence training	ASEAN, CTI, RPOA-IUU
	Small-scale fishing operations		
	Disaster relief and response		
	Stock assessment and population dynamics for vulnerable species (e.g., marine mammals) Assessment models (translating Stock Assessment to management (advise)	ToT for Regional trainers (intensive online courses), for scientist; training program for fisherfolks/stakeholders;	SEAFDEC, CTI-CFF University partnership, ASEAN, Academe, and other RFMOs to be mainly supported by NOAA, Australian
	Destructive fishing gears		
FM/ Research and Development	Harvest Strategy; Management indicators and Reference Points, Assessment of fishing capacity		
	Capacity for Catch documentation		
	Managing compatibility and conflict between capture fisheries and aquaculture; stateless fishers		
Research and Development	Community engagement (communication and cooperation); incorporate traditional knowledge		
Data and information sharing (DIS)	Habitat assessment		
	Technology literacy (updated IEC)	Technology training/ demonstration; Training of Trainers; Language translation materials	CTI-CFF, ASEAN
	Data standardization and sharing;	It's complicated	

Significant data and knowledge gaps include: policy and governance, socioeconomics, information and data management infrastructure, capacity of small-scale fishers, and stock status. An enhancement of regional capacity is needed in monitoring, control and surveillance of small-scale operations, stock assessments and population dynamics, technology literacy, and harmonizing data standards to improve policy. Strengthening regional and international cooperation is paramount in marine capture fisheries management in South East Asia (DAFF, 2011). Such initiative may include strengthening capacity for complementary management of transboundary stocks, joint (and common) stock assessment, cooperative MCS and international engagement.

In 2018, the Centre for Humanitarian Dialogue (HD), a private diplomacy organization founded to prevent, mitigate and resolve armed conflicts and crises through dialogue and mediation, began facilitating a multilateral dialogue amongst scientists and policymakers from China, Indonesia, Malaysia, the Philippines and Vietnam, aimed at reducing regional tensions (Prince et al., 2022). By establishing an informal Fisheries Science Working Group

(FSWG), the FSWG) has convened eight times between 2018 and 2022, and benefiting from a wide range of independent expertise, the participating fisheries managers, diplomats, and national security officials discussed cooperatively managing SCS fisheries resources, and decided to begin by building the basis of regional scientific consensus around the status and management of some key fisheries. The FSWG agreed to a process involving multi-lateral scientific cooperation through a series of Common Fisheries Resource Analyses (CFRA) adhering to agreed principles of: (i) Voluntary participation, (ii) Focus on issues relevant to policymakers across the region, (iii) Allowing all participating countries to contribute meaningfully and on an equal footing, (iv) Avoiding territorial disputes and other political sensitivities, and (v) Not requiring the sharing of raw data or other sensitive information. The CFRA processes was facilitated by HD which provided secretariat support, access to independent technical expertise, meeting facilitation and modest funding for new data collection where necessary. The conclusion of the study indicated that fishing targeted at adult stocks would probably be sustainable, but for the continuing intensification of fishing for juveniles skipjack tuna stocks, and fishing pressure is apparently eroding SCS food webs and serially depleting local stocks” (Prince et al., 2023).

Marine scientific research (MSR) is essential in addressing these challenges by providing the scientific evidence needed to develop sustainable conservation strategies, guide policy decisions, and foster regional cooperation (Mallari et al. 2025). In the Philippines, the lack of a national MSR agenda limits the promotion of the conduct of MSR and provides a plan of action on ensuring its translation into policies. As the region moves toward policy solutions, the challenge lies in leveraging MSR for effective and cooperative management within the Philippine waters in the SCS LME and in the larger South China Sea, ensuring long-term ecological health and socioeconomic stability.

Additionally, Ablan-Lagman (2017) suggested the following actions for the Philippines to advance our own fisheries management policy, in connection with our neighbors in the SCS: (i) establish transboundary marine parks or areas of joint protection (e.g., marine areas that serve as refuge, sources or sinks of fish juveniles and larvae); (ii) bring into discussions other international policy instruments (e.g., FAO Code of Conduct for Responsible Fisheries of (1995); Agreement Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (1995); and (iii) develop regional-level policies targeted toward small-scale fisheries (noting the Philippines has already developed its NPOA SSF in 2024 following the FAO SSF guidelines).

5.4 Methodology and Analysis

The guidelines to support the drafting of the national TDA using identified fish and fisheries indicators was followed. Fisheries production data for the period 1950-2016 compiled by the Sea Around Us project (<https://www.seaaroundus.org/>) for Philippine waters in the SCS LME was provided by the Regional Fisheries Consultant. This was complemented with the fisheries statistics data obtained from the Philippine Statistics Authority. Data and reports from NFRDI - NSAP was used for assessing stock status and number of fishing boats were derived from BFAR annual fisheries profiles. Marine trophic index (MTI), Fishing-in-Balance (FIB) index and primary production required (ecological footprint of fisheries) were obtained from SAUP data for the Philippines. In the preparation of this report online and published sources of information were also used and these sources are listed in the references (Table 5.11). Below are the fisheries indicators and data sources.

Table 5.11. Fisheries indicators and data sources.

Indicator	Data sources
Fisheries Production Potential	PSA data 1980-2024 by subsector, by province, and SAUP data (fish catch, fishing gear, species composition; Sea Around Us project data https://www.seaaroundus.org/)
Stock Status, Biomass	NSAP reports/data (selected key pelagic species); other reports and publications
Fishing Effort	BFAR annual Fisheries Profiles

PPR, MTI, FIB	SAUP data complemented by Sea Around Us report for Philippines (Palomares et al. 2014)
Catch from bottom impacting gear types	Reports for Manila Bay and Lingayen Gulf other reports and publications
Change in catch potential under climate change	Limited information; used report on “Projected Climate Change Impacts on Philippine Marine Fish Distributions” complemented by published reports

This report was initially validated with BFAR on 3 November 2025 and presented during the National Validation Workshop on 12-14 November 2025. Comments and suggestions by key stakeholder on the draft Fisheries report were considered and included in the finalization of this report. Table 5.12 provides proposed interventions to improve fisheries data collection and analysis, as well as strengthening fisheries law enforcement.

Table 5.12. List of proposed interventions to improve fisheries data collection and analysis, and fisheries law enforcement.

Proposed Interventions	Indicative Lead Agencies
Unified data collection form for fish catch monitoring Data Consolidation/Reconciliation Data Analytics and Data sharing	DA-BFAR/PSA/DA-NFRDI
Catch documentation and reporting systems	DA-BFAR/LGUs
Study on the impacts of IUU fishing activities within Philippines fishing areas including coastal habitat assessments	DA-BFAR/DENR, Academe/NGOs
Enhanced Stock Assessments by FMA/fishing areas	DA-NFRDI/DA-BFAR, Academe/NGOs
Unified and centralized database for enforcement reports (apprehensions/violations) and list of registered and licensed fishing boats/vessels	DA-BFAR, PNP Maritime (within 12 nm)/Coast Guard (beyond 15 km), LGUs (within 15 km)

Glossary

- **Ecosystem Approach to Fisheries Management** – An approach to fisheries management and development that strives to balance diverse societal objectives by considering the knowledge and uncertainties about biotic, abiotic, and human components of ecosystems and their interactions, applying an integrated approach to fisheries within ecologically meaningful boundaries. An EAFM is a practical way to implement sustainable development for the management of fisheries by finding a balance between ecological and human well-being through good governance. The purpose of EAFM is to plan, develop, and manage fisheries in a manner that addresses the multiple needs and desires of societies, without jeopardizing the options for future generations to benefit from the full range of goods and services provided by marine ecosystems (Garcia et al. 2003; Food and Agriculture Organization 2003, 2011).
- **Fishing-in-Balance (FiB) index** - aim to account for the expansion and contraction of fishing fleets over time as reflected by the trophic level of the catches.
- **Fisheries Management Area** - delineated bodies of water in the Philippines based on approximation of fish stocks and their boundary, range and distribution and other considerations for the purpose of fisheries management or governance that is science-based, participatory and transparent, applying the ecosystem approach to fisheries management (EAFM). FMA provides a framework to integrate national and local management roles, based on a common science-based platform and consistent with international best practices.
- **Fisheries Management**– An integrated process to improve the benefits that society receives from harvesting fish consisting of (i) information gathering, (ii) analysis, (iii) planning, (iv) consultation, (v) decision making, (vi) allocation of resources, and (vi) formulation and implementation—with enforcement as necessary—of

regulations or rules which govern fisheries activities in order to ensure the continued productivity of the resources and accomplishment of other fisheries objectives.

- **Fisheries Refugia** – concept as a fisheries management tool has been introduced in the Southeast Asian region with the objective of enhancing fisheries resources through the integration of fisheries and habitat management. The concept is defined as “spatially and geographically defined, marine or coastal areas in which specific management measures are applied to sustain important species [fisheries resources] during critical stages of their life cycle.” (Siriraksophon, 2016)
- **Marine Trophic Index (MTI)** - measures the change in mean trophic level of fisheries catches from an ecosystem, adequately tracks changes in mean trophic level of an ensemble of exploited species in response to fishing pressure.
- **Primary Production Required (PPR)** index - is a crucial tool for evaluating the ecological footprint of fisheries. It provides a comprehensive understanding of the impacts of fishing activities on marine ecosystems and facilitates sustainable fishery management.

Acknowledgments

This report produced under the UNEP/GEF SCS-SAP Project with the United Nations Office for Project Services (UNOPS) as the executing agency. Thanks are due to our national partners, namely: DA – BFAR and DA-NFRDI who provided additional data and information for the TDA report and their guidance and suggestions in the finalization of the Fisheries report. We would also like to thank Dr. Somboon Siriraksophon, Fisheries Specialist, UNEP/GEF SCS SAP project and Mr. Romeo Trono, National Coordinator, Fisheries Specialist, UNEP/GEF SCS SAP project for their technical guidance and critical comments on the earlier draft of the report. Mr. Daniel Trono, Mr. Yuijiro Centeno, and Society for the Conservation of Philippine Wetlands (SCPW), Inc. Secretariat who assisted in the preparation and validation of the report. And Assistant Director Isidro Velayo of DA-BFAR for supporting the validation and finalization of the report.

Author Contributions

The Author was responsible in the conceptualization, literature review, data collection, collation and analysis, writing the report, review and editing based on the guidelines to support the drafting of the national TDA using identified fish and fisheries indicators.

Chapter 5 References

- Ablan – Lagman, Converging on the Fisheries in the South China Sea. Albert Del Rosario Institute for Strategic and International Studies, Makati City, Philippines. 24p.
- Arceo, H.O., Velos, M.J.P., Nuñez, M.A.C. and Aliño, P.M. (Eds.). (2024). *The West Philippine Sea: State of the Coasts*. University of the Philippines Marine Science Institute, Diliman, Quezon City, Philippines. 208pp.
- Barange, M., Bahri, T., Beveridge, M.C.M., Cochrane, K.L., Funge-Smith, S. and Poulain, F., eds. 2018. *Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options*. FAO Fisheries and Aquaculture Technical Paper No. 627. Rome, FAO. 628 pp.
- Barut, N.C., M.D. Santos, L.L. Mijares, R. Subade, N.B. Armada and L.R. Garces. 2003. Philippine coastal fisheries situation, p. 885 - 914. In G. Silvestre, L. Garces, I. Stobutzki, M. Ahmed, R.A. Valmonte-Santos, C. Luna, L. Lachica-Aliño, P. Munro, V. Christensen and D. Pauly (eds.) *Assessment, Management and Future Directions for Coastal Fisheries in Asian Countries*. WorldFish Center Conference Proceedings 67, 1 120 p.
- Bendaño, A.P., G.V. Lopez, M.A. Perez, M.D Santos and F.B. Torres Jr. 2017. “Species composition, distribution, biomass trends and exploitation of dominant fish species in Manila Bay using experimental trawl survey”. *The Philippine Journal of Fisheries*. 24(1): 31-46
- BFAR. 2016. *Comprehensive National Fisheries Industry Development Plan (CNFIDP) 206-2025*. Bureau of Fisheries and Aquatic Resources. Quezon City, Philippines. 68p.
- BFAR. 2021. *Comprehensive National Fisheries Industry Development Plan (CNFIDP) 2021-2025*. Bureau of Fisheries and Aquatic Resources. Quezon City, Philippines. 301p.
- BFAR. 2024. *2023 Philippine Fisheries Profile*. Bureau of Fisheries and Aquatic Resources. Quezon City, Philippines. 204p.
- BFAR – FMA 5. 2023. *Fisheries Management Area 5 – Framework Plan (2023 – 2027)*. Fisheries Management Area 5 Secretariat BFAR Regional Fisheries Office, MIMAROPA. 50p.
- BFAR – FMA 6. 2023. *Fisheries Management Area 6 – Framework Plan (2023 – 2030)*. Fisheries Management Area 6 Office, BFAR Regional Fisheries Office, Region 3. 56p.
- Borja, V.M., R.V. Ares-Cayme, J.S. Yleana. 2022. *Community Acceptance of Fisheries Refugia in the Philippines*. International Waters Experience Notes, SEAFDEC/UNEP/GEF/FISHERIES REFUGIA-2022-04. 5p.
- Cabral, R.B., R.C. Geronimo, A.S.S. Mamauag, J.A. Silva, R.H. Mancao, M.P. Atrigenio. 2023. *Ensuring Aquatic Food Security in the Philippines*. *The Philippine Journal of Fisheries* 30(2): 298-313.
- Campos, W.L. and A. Bagarinao-Regalado. 2021. *Climate change and the Philippine sardine fisheries: status of stocks, stressors, threats and measures for sustainability*. In: Bahri, T., Vasconcellos, M., Welch, D.J., Johnson, J., Perry, R.I., Ma, X. & Sharma, R., eds. *Adaptive management of fisheries in response to climate change*. FAO Fisheries and Aquaculture Technical Paper No. 667. Rome, FAO.
- Cheung, W., J. Bruggeman and M. Butenschön. 2018. Chapter 4: *Projected changes in global and national potential marine fisheries catch under climate change scenarios in the twenty-first century*. In. Barange, M., Bahri, T., Beveridge, M.C.M., Cochrane, K.L., Funge-Smith, S. and Poulain, F., eds. 2018. *Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options*. FAO Fisheries and Aquaculture Technical Paper No. 627. Rome, FAO. 628 pp.
- DA-BFAR. 2024. *Philippine IUU Fishing Assessment and Report 2023*. Department of Agriculture - Bureau of Fisheries and Aquatic Resources (DA-BFAR). Quezon City, Philippines. 84p.
- DAFF (Department of Agriculture, Fisheries and Forestry). 2011. *Net Returns – A Human Development Capacity Building Framework for Marine Capture Fisheries Management in South East Asia*. Department of Agriculture, Fisheries and Forestry, Canberra.
- David, L.T., T.L.P. dela Cruz, R.V. Azanza. 2016. *Climate Change Impacts on Food Security from Marine Resources*. *Transactions National Academy of Science & Technology Philippines*, 38(2) doi.org/10.57043/transnastphl.2016.757
- Daw, T., Adger, W.N., Brown, K., Badjeck, M.-C. 2009. *Climate change and capture fisheries: potential impacts, adaptation and mitigation*. In K. Cochrane, C. De Young, D. Soto and T. Bahri (eds). *Climate change*

- implications for fisheries and aquaculture: overview of current scientific knowledge. FAO Fisheries and Aquaculture Technical Paper. No. 530. Rome, FAO. pp.107-150.
- FAO 2014. APFIC/FAO Regional Expert Workshop on “Regional guidelines for the management of tropical trawl fisheries in Asia”. Phuket, Thailand, 30 September–4 October 2013. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand. RAP Publication 2014/01, 91 pp.
- FAO 2015. Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries (VGSSF) in the Context of Food Security and Poverty Eradication (The SSF Guidelines). Food and Agriculture Organization of the United Nation, Rome. <https://www.fao.org/3/i4356en/I4356EN.pdf>
- Furio, E. F., Borja, V. M. 2000. The primary productivity in the South China Sea, Area III: Western Philippines. In Proceedings of the Third Technical Seminar on Marine Fishery Resources Survey in the South China Sea, Area III: Western Philippines, 13-15 July 1999 (pp. 235-250). Bangkok, Thailand: Secretariat, Southeast Asian Fisheries Development Center (SEAFDEC).
- Gaerlan, R.S. P., Buccat, F.G.A., Ragutero, F.C. 2018. A Review on the Status of Small Pelagic Fish Resources in the Lingayen Gulf for the Year 2009-2013. *The Philippine Journal of Fisheries* 25 (1): 1-141.
- Garces, L.R. and Silvestre, G.T. 2003. Exploitation Status of Demersal in four Fishing Areas in the Philippines. *University of the Philippines in the Visayas (UPV) Journal Natural Science*, 8: 235-246.
- Garcia, L. C., Yleana, J. and Borja, V.M., 2022. Establishment and Operation of a Regional System of Fisheries Refugia in the South China Sea and Gulf of Thailand, National Plan of Action for Establishment and Operation of Fisheries *Refugia* in Philippine. Southeast Asian Fisheries Development Center, Training Department, Samut Prakan, Thailand; FR/REP/PH81, 10 p.
- Geronimo, R.C. 2018. Projected Climate Change Impacts on Philippine Marine Fish Distributions. Department of Agriculture – Bureau of Fisheries and Aquatic Resources. 76 pages.
- Gonzales, L. M., Candelario, M. B., & Villaflores, E. M. (n.d.). Baseline Information on the Reproductive Biology Indicators of Shortfin Scad *Decapterus macrosoma* (Bleeker, 1851) from Southwest Sulu Sea, Philippines. National Fisheries Research and Development Institute (NFRDI). In Press
- Green, S.J., White, A.T., Flores, J.O., Carreon, M.F. III & Sia, A.E. 2003. Philippine fisheries in crisis: A framework for management. Coastal Resource Management Project of the Department of Environment and Natural Resources, Cebu City, Philippines. 77 p.
- Labe, L. L., 1999: Catch rate of oceanic squid by jigging method in the Western Philippines, In the Proceedings of the 3rd Technical Seminar on Marine Fisheries Resources Survey in the South China Sea Area III: Western Philippines Special Paper No. SEC/SPI41. SEAFDEC, Bangkok, p.19-31.
- MADECOR (Mandala Agricultural Development Corporation) and National Museum. 1995. Fisheries Sector Program - Resource and ecological assessment of the Manila Bay. Final Report.
- Mallari, R.M.M. D.J.L. Ortiz, D.F.L. Onda. 2025. Developing Strategies for Marine Environmental Protection in the West Philippine Sea and Adjacent Seas. University of the Philippines Center for Integrative and Development Studies (UP CIDS) Policy Brief 2025-14, 6p.
- Muallil RN, Mamauag SS, Cababaro JT, Arceo HO, Aliño PM. 2014. Catch trends in Philippine small-scale fisheries over the last five decades: The fishers' perspectives. *Marine Policy*. 47:110–117. <https://doi.org/10.1016/j.marpol.2014.02.008>
- Napata, R.P., L.N. Espectato and G.D. Serofia. 2020. Closed season policy in Visayan Sea, Philippines: A second look. *Ocean and Coastal Management*, 187: 105115. <https://doi.org/10.1016/j.ocecoaman.2020.105115>
- NSAP Region 3, NSAP Region 1. (n.d.). FMA 6 Data on *Saurida tumbil* from 2014-2023. National Stock Assessment Program, National Fisheries Research and development Institute (NFRDI). In Press.
- Ochavdo, D., H. Hernandez, S. Resma and G. Silvestre. 1989. Preliminary results of a study of the commercial trawl fisheries in Lmgayen Gulf, p. 31-42. h G. Silvestre, E. Mielat and T.-E. Chua (eds.) Towards sustainable development of the coastal resources of Lingayen Gulf, Philippines. ICLARM Conference Proceedings 17, 200 p. Philippine Council for Aquatic and Marine Research and Development, Los Bafios, Laguna, and International Center for Living Aquatic Resources Management, Makati. Metro Manila. Philippines.

- Palomares, M.L.D., Parducho, V.A. 2014. Marine artisanal fisheries of the Philippines, Subzone B – southern Luzon (Regions IV, V and NCR). In: Palomares, M.L.D., Pauly, D. (eds.), *Philippine Marine Fisheries Catches: A Bottom-up Reconstruction, 1950 to 2010*, p. 45-61. Fisheries Centre Research Report 22(1). Fisheries Centre, University of British Columbia, Vancouver, Canada.
- Palomares, M.L.D., Pauly, D. 2014. Reconstructing Philippine marine fisheries catches: a rationale and a methodology. In: Palomares, M.L.D., Pauly, D. (eds.), *Philippine Marine Fisheries Catches: A Bottom-up Reconstruction, 1950 to 2010*, p. 14-28. Fisheries Centre Research Report 22(1). Fisheries Centre, University of British Columbia, Vancouver, Canada.
- Parducho, V.A., Palomares, M.L.D. (2014) Marine artisanal fisheries of the Philippines, Subzone A – northern Luzon (Regions I, II and III). In: Palomares, M.L.D., Pauly, D. (eds.), *Philippine Marine Fisheries Catches: A Bottom-up Reconstruction, 1950 to 2010*, p. 29-44. Fisheries Centre Research Report 22(1). Fisheries Centre, University of British Columbia, Vancouver, Canada.
- Paterson, C.J., Pernetta, J.C., Sirarakophon, S., Kato, Y., Barut, N.C., Saikliang, P., Vibol, O., Chee, P.E., Nhung Nguyen, T.T., Perbowo, N., Yunanda, T., Armada, N.B. 2013. Fisheries refugia: a novel approach to integrating fisheries and habitat management in the context of small-scale fishing pressure. *Ocean & Coastal Management* 85: 214-229.
- Pauly, D. and C. Liang. 2020. The fisheries of the South China Sea: Major trends since 1950. *Marine Policy* 121: 1-3584. <https://doi.org/10.1016/j.marpol.2019.103584>
- Prince J., Xuefeng, W., Kun, L., Suryanti, A., Jamon, S., Santos, M.D., Torres, F.S.B. Jr., Flores, A.L., Ha, V.V. and Anh, T.T.N. 2022. The CFRA: A Joint Assessment of South China Sea Skipjack Tuna Stocks. <https://www.hdcentre.org/wp-content/uploads/2022/09/CFRA-Scientific-Paper.pdf>
- Pura, L.R., E. A. Cinco, Q.P. Sia III, F.L. Gonzales, A.P. Luistro and L.M. Rueca. 1996a. Chapter 1, Assessment of fishery resources of Manila Bay. In G. Silvestre, L.R. Garces and A. Cruz-Trinidad. (eds) Resource and ecological assessment of Manila Bay, Philippines: Results of the Monitoring Activities (1995-1996). ICLARM Tech. Rep.
- Ramiscal, R., Torres Jr. F., Cedo, K.K., Catibog, N., de la Torre, A., Yutuc, R., Candelario, M., Armada, N., Uychiaoco, A., Nuñez, A. 2024. Pivoting toward Multisectoral and Science-Based Fisheries Management, p. 85-91. In Arceo, H.O., Velos, M.J.P., Nuñez, M.A.C. and Aliño, P.M. (Eds.). *The West Philippine Sea: State of the Coasts*. University of the Philippines Marine Science Institute, Diliman, Quezon City, Philippines. 208pp.
- Rola, Agnes R.; Narcaez, Teresita A.; Naguit, Maria Rio A.; Elazegui, Dulce D.; Brillo, Bing Baltazar C.; Paunlagui, Merlyn M.; Jalotjot, Hadji C.; and Cervantes, Catherine P., "Zamboanga Peninsula's Seasonal Fishing Closure for Sardines: Opening the Sustainability Frontier" (2020). CSPPS Policy Brief. 6. https://www.ukdr.uplb.edu.ph/cspps_policy_brief/6
- Rueca, L.L., Bien, N.B., Bathan, R.M., Yuzon, J.I., Salamat, G.B. 2009. Fish Stock Assessment in Northern Zambales Coast. National Stock Assessment program, Technical Paper Series Vol.12, No. 3. Bureau of Fisheries and Aquatic Resources – National Fisheries Research and Development Institute. 20 p.,
- Santos, M.D., Dickson JO, Velasco PL. 2011. Mitigating the impacts of climate change: Philippine fisheries in focus. Secretariat, Southeast Asian Fisheries Development Center. *Fish for the People*. 9(2):101–110.
- Santos, M.D., N.C Barut, and A.D Bayate. 2017. National Stock Assessment Program (NSAP): The Philippine Capture Fisheries Atlas. BFAR-NFRDI. Quezon City, Philippines.
- Sharma, R., Barange, M., Agostini, V., Barros, P., Gutierrez, N.L., Vasconcellos, M., Fernandez Reguera, D., Tiffay, C., & Levontin, P., eds. 2025. Review of the state of world marine fishery resources – 2025. *FAO Fisheries and Aquaculture Technical Paper*, No. 721. Rome. FAO. <https://doi.org/10.4060/cd5538en>
- Shen, Q., Zhang, P.; Yu, W.; Xiong, P.; Cai, Y.; Li, J.; Chen, Z.; Fan, J. 2025. Impact of Climate Change on the Habitat Distribution of *Decapterus macarellus* in the South China Sea. *J. Mar. Sci. Eng.* **2025**, 13, 156. <https://doi.org/10.3390/jmse13010156>

- Silvestre, G., E. Cinco, R. Gatchalian and J. Diaz. 1995. Catch and effort in the San Miguel Bay fisheries. In G. Silvestre, C. Luna and J. Padilla (eds) *Multidisciplinary assessment of the fisheries in San Miguel Bay (12992-1993)*. ICLARM Tech. Rep. 47 (CD-ROM).
- Silvestre, G., Garces, L., Stobutzki, I., Ahmed, M., Valmonte-Santos, R.A., Luna, C., Lachica-Aliño, L., Munro, P., Christensen V., & Pauly, D. (eds.) *Assessment, Management and Future Directions for Coastal Fisheries in Asian Countries*. WorldFish Center Conference Proceedings 67, 1 120 p.
- Siriraksophon, S., Y. Nakamura, N. Sukramonskoll. 2001. Exploration of Purpleback Flying Squid, *Sthenotaihis oualanimsi* Resources in the South China Sea. Southeast Asia Development Center (SEAFDEC) Training Department, Thailand. TD/RES/48. 81.
- Siriraksophon, S. (2016). Fisheries refugia: A regional initiative to improve the integration of fisheries and habitat management. In H. Kawamura, T. Iwata, T. Theparoonrat Yuttana, N. Manajit, & V. T. Sulit (Eds.), *Consolidating the Strategies for Fishery Resources Enhancement in Southeast Asia*. Proceedings of the Symposium on Strategy for Fisheries Resources Enhancement in the Southeast Asian Region, Pattaya, Thailand, 27-30 July 2015 (pp. 80-92). Samutprakan, Thailand: Training Department, Southeast Asian Fisheries Development Center. <https://repository.seafdec.or.th/handle/20.500.12067/697>
- Suh D, Pomeroy R. 2020. Projected economic impact of climate change on marine capture fisheries in the Philippines. *Frontiers in Marine Science*. 7:232. <https://doi.org/10.3389/fmars.2020.00232>
- Torell, M., Ekmaharaj, S., Siriraksophon, S., & Wanchana, W. (2010). Strategies to Combat Illegal Fishing and Manage Fishing Capacity: Southeast Asian Perspective. *Fish for the People* 8:1, pp10-19.
- UNEP (nd). National Report of the Philippines on the Formulation of Transboundary Diagnostic Analysis and Preliminary Framework of a Strategic Action Programme for the South China Sea. United Nations Environment Programme (UNEP), East Asian Seas Coordinating Unit. Bangkok, Thailand. 95p.
- USAID SuFiA TS. 2024. Regional Fisheries Collaborative Management in South China Sea: 2024 South China Sea Regional Technical Exchange on Fisheries Governance (SCS REX). Technical Report prepared by Tetra Tech Inc. for the USAID/RDMA Sustainable Fish Asia Task Order No. 72048622N00001 ARD. Bangkok, Thailand. 40p.
- Vo, S.T., J.C. Pernetta, C.J. Paterson. 2013. Status and trends in coastal habitats of the South China Sea. *Ocean & Coastal Management*, 85:153-163
- Wilcox, C., Mann, V., Cannard, T., Ford, J., Hoshino, E. and Pascoe, S. 2021. A review of illegal, unreported and unregulated fishing issues and progress in the Asia-Pacific Fishery Commission region. Bangkok, FAO and Hobart, CSIRO. <https://doi.org/10.4060/cb2640en>
- Zhang, H. 2018. Fisheries cooperation in the South China Sea: Evaluating the options. *Marine Policy*, (89): 67-76. <https://doi.org/10.1016/j.marpol.2017.12.014>

Chapter 5 Annexes

Annex 5.A. Key Biological Parameters of Major Fish Species in FMA 5 and 6

Table 5.A.1. Growth, mortality parameters and exploitation rates of different species caught in FMA 5 and 6 fishing grounds of the Philippines (Adopted from Silvestre et al., 2003).

Species	Fishing Ground	FMA	Year	L_{inf}	k	L_c	Z	M	F	E	Source
<i>Ambassis gymnocephalus</i>	Manila Bay	6	1978-79	19.5	1.2	10.6	5.24	2.27	2.97	0.57	Ingles & Pauly, 1984
<i>Atule mate</i>	Manila Bay	6	1992-93	27	0.7		5.3		3.82		Armada, 1994
<i>Atule mate</i>	Lingayen Gulf	6	1987-88	24.9		10.05		.48		.72	Ochavillo et al. 1989
<i>Cynoglossus puncticeps</i>	Manila Bay	6	1978-79	24.5	.65	7.8	3.29	1.43	1.86	0.57	Ingles & Pauly, 1984
<i>Decapterus macrostoma</i>	Manila Bay	6	1957-58	1.5	0.65	19.2	3.74	1.33	2.41	0.64	Ingles & Pauly, 1984
<i>Decapterus macrostoma</i>	Manila Bay	6	1958	1.5	0.71	16.5	3.8	1.41	2.39	0.63	Ingles & Pauly, 1984
<i>Decapterus macrostoma</i>	Palawan	5	1957	27	0.9	15.3	4.01	1.72	2.29	0.57	Ingles & Pauly, 1984
<i>Decapterus macrostoma</i>	Palawan	5	1957-58	26.8	0.71	16.7	4.71	1.47	3.24	0.69	Ingles & Pauly, 1984
<i>Decapterus macrostoma</i>	Palawan	5	1958	26.5	1	19.2	6.86	1.85	5.01	0.73	Ingles & Pauly, 1984
<i>Decapterus macrostoma</i>	Palawan	5	1958-59	27.8	0.83	19.5	6.46	1.61	4.85	0.75	Ingles & Pauly, 1984
<i>Decapterus macrostoma</i>	Palawan	5	1960	33	0.5	17.7	4.8	1.1	3.7	0.77	Ingles & Pauly, 1984
<i>Decapterus macrostoma</i>	Palawan	5	1960	27.5	1.25	16.6	10.5	2.12	8.38	0.8	Ingles & Pauly, 1984
<i>Decapterus macrostoma</i>	Palawan	5	1965	25	1.2	13.9	11.57	2.12	9.45	0.82	Ingles & Pauly, 1984
<i>Decapterus macrostoma</i>	Palawan	5	1965-66	25.5	0.85	16.6	4.14	1.68	2.46	0.59	Ingles & Pauly, 1984
<i>Decapterus macrostoma</i>	Palawan	5	1966	25.5	0.8	13.3	5.26	1.62	3.64	0.69	Ingles & Pauly, 1984
<i>Decapterus macrostoma</i>	Palawan	5	1968	33	0.65	17.5	3.38	1.31	2.07	0.61	Ingles & Pauly, 1984
<i>Decapterus macrostoma</i>	Palawan	5	1968b	30	0.74	19.5	5.79	1.47	4.32	0.75	Ingles & Pauly, 1984
<i>Decapterus russelli</i>	Manila Bay	6	1958-59	27	0.8	16.8	6.89	1.59	5.3	0.77	Ingles & Pauly, 1984
<i>Decapterus russelli</i>	Manila Bay	6	1959	30	0.54	15.4	2.06	1.19	0.87	0.42	Ingles & Pauly, 1984
<i>Decapterus russelli</i>	Palawan	5	1958	26.9	0.69	15.6	4.34	1.44	2.9	0.67	Ingles & Pauly, 1984
<i>Decapterus russelli</i>	Palawan	5	1959	26	0.73	18.2	3.69	1.51	2.18	0.59	Ingles & Pauly, 1984
<i>Decapterus russelli</i>	Palawan	5	1968	33	0.45	15.4	2.62	1.03	1.59	0.61	Ingles & Pauly, 1984
<i>Dussumiera acuta</i>	Lingayen Gulf	6	1987-88	18	1.3	12.92	6.72	2.44	4.28	0.64	Ochavillo et al. 1989
<i>Gazza acclamys</i>	Lingayen Gulf	6	1987-88	12.8	1.17	6.71	5.91	2.51	3.4	0.58	Ochavillo et al. 1989
<i>Gazza minuta</i>	Honda Bay	5	1977-78	17.5	0.97	8.6	6.62	2.03	4.59	0.69	Ingles & Pauly, 1984
<i>Gazza minuta</i>	Lingayen Gulf	6	1987-88	11.8	1.17	8.95	3.64	2.57	1.07	0.29	Ochavillo et al. 1989
<i>Gerres filamentosus</i>	Manila Bay	6	1992-93	18.3	0.9		5.34	1.95	3.39	0.63	Armada, 1994
<i>Hemirhamphus georgii</i>	Manila Bay	6	1978-79	34.5	0.6	15.3	2.32	1.23	1.09	1.47	Ingles & Pauly, 1984
<i>Katsuwonus pelamis</i>	Sulu Sea	5	1975-76	83	0.78	54.7	6.57	1.14	5.43	0.83	Ingles & Pauly, 1984
<i>Leiognathus bindus</i>	Manila Bay	6	1958	10.3	1.25	4.5	6.7	2.79	3.91	0.58	Ingles & Pauly, 1984
<i>Leiognathus bindus</i>	Manila Bay	6	1959	8.2	1.25	4.1	4	2.97	1.03	0.26	Ingles & Pauly, 1984
<i>Leiognathus bindus</i>	Manila Bay	6	1960	8.2	1.3	3.4	4.58	3.05	1.53	0.34	Ingles & Pauly, 1984
<i>Leiognathus bindus</i>	Manila Bay	6	1992-93	10.5	1.1		4.97	2.59	2.38	0.48	Armada, 1994
<i>Leiognathus bindus</i>	Lingayen Gulf	6	1987-88	12.3	1.05	4.69	6.87	2.37	4.5	0.66	Ochavillo et al. 1989

<i>Leiognathus blochii</i>	Manila Bay	6	1957	13.2	1.2	5.2	5.05	2.53	2.52	0.5	Ingles & Pauly, 1984
<i>Leiognathus blochii</i>	Manila Bay	6	1958	12.5	1.16	6.1	4.32	2.51	1.81	0.42	Ingles & Pauly, 1984
<i>Leiognathus blochii</i>	Manila Bay	6	1959	12.5	1.25	6.4	4.51	2.64	1.87	0.41	Ingles & Pauly, 1984
<i>Leiognathus blochii</i>	Manila Bay	6	1959-60	12.5	1.25	6.4	5.6	2.64	2.96	0.53	Ingles & Pauly, 1984
<i>Leiognathus daura</i>	Manila Bay	6	1957	9.4	2.1	6.6	9.53	4.01	5.52	0.58	Ingles & Pauly, 1984
<i>Leiognathus daura</i>	Manila Bay	6	1959	9.6	1.27	6.3	6.73	2.87	3.86	0.57	Ingles & Pauly, 1984
<i>Leiognathus daura</i>	Manila Bay	6	1959-60	9.6	1.25	6.6	7.91	2.84	5.07	0.64	Ingles & Pauly, 1984
<i>Leiognathus equulus</i>	Manila Bay	6	1992-93	12	1.1		4.01	2.5	1.51	0.38	Armada, 1994
<i>Leiognathus equulus</i>	Lingayen Gulf	6	1987-88	19	1.3	7.68	4.05	2.41	1.64	0.4	Ochavillo et al. 1989
<i>Leiognathus leuciscus</i>	Manila Bay	6	1957	11.8	1.3	8.2	7.17	2.72	4.45	0.62	Ingles & Pauly, 1984
<i>Leiognathus leuciscus</i>	Manila Bay	6	1958	10.8	1.3	8.2	7.42	2.79	4.63	0.62	Ingles & Pauly, 1984
<i>Leiognathus lineolatus</i>	Manila Bay	6	1957	11.5	1.05	7.1	9.53	2.41	7.12	0.75	Ingles & Pauly, 1984
<i>Leiognathus lineolatus</i>	Manila Bay	6	1958	11.5	1.3	7.1	9.23	2.77	6.46	0.7	Ingles & Pauly, 1984
<i>Leiognathus lineolatus</i>	Manila Bay	6	1959	10	1.3	7.1	3.48	2.88	0.6	0.17	Ingles & Pauly, 1984
<i>Leiognathus splendens</i>	Manila Bay	6	1957-58	12.4	0.75	3.8	3.85	1.89	1.96	0.51	Ingles & Pauly, 1984
<i>Leiognathus splendens</i>	Manila Bay	6	1958	13.2	0.76	6.2	7.52	1.88	5.64	0.75	Ingles & Pauly, 1984
<i>Leiognathus splendens</i>	Manila Bay	6	1959-60	12.3	0.7	4.9	4.46	1.81	2.65	0.59	Ingles & Pauly, 1984
<i>Leiognathus splendens</i>	Manila Bay	6	1979-80	15	0.72	8.7	3.77	1.76	2.01	0.53	Ingles & Pauly, 1984
<i>Leiognathus splendens</i>	Lingayen Gulf	6	1987-88	11.6	0.79	7.17	2.59	2	0.59	0.23	Ochavillo et al. 1989
<i>Liza subviridis</i>	Manila Bay	6	1978-79	36.5	0.63	11.2	3.19	1.25	1.94	0.61	Ingles & Pauly, 1984
<i>Mene maculata</i>	Manila Bay	6	1978	22.5	1.22	15	3.85	2.2	1.65	0.43	Ingles & Pauly, 1984
<i>Mugil cephalus</i>	Manila Bay	6	1992-93	30	1.35		6.49	2.21	4.28	0.66	Armada, 1994
<i>Nematolosa nasus</i>	Manila Bay	6	1992-93	25	1.15		3.47	2.09	1.38	0.4	Armada, 1994
<i>Nemipterus japonicus</i>	Manila Bay	6	1978-79	30	0.7	14.8	3.31	1.41	1.9	0.57	Ingles & Pauly, 1984
<i>Nemipterus japonicus</i>	Manila Bay	6	1992-93	25.5	0.9		3.49	1.77	1.72	0.4	Armada, 1994
<i>Nemipterus japonicus</i>	Lingayen Gulf	6	1987-88	26.7	0.46	8.26	3.99	1.11	2.88	0.72	Ochavillo et al. 1989
<i>Nemipterus nematophorus</i>	Lingayen Gulf	6	1980-81	22	0.43	11.7	1.48	1.12	0.36	0.24	Ingles & Pauly, 1984
<i>Nemipterus nematophorus</i>	Lingayen Gulf	6	1987-88	27	0.62	8.28	7.15	1.35	5.8	0.81	Ochavillo et al. 1989
<i>Pelates quadrilineatus</i>	Manila Bay	6	1992-93	21	0.45		3.83	1.19	2.64	0.69	Armada, 1994
<i>Pennahia macrophthalmus</i>	Manila Bay	6	1978-79	26.5	1.4	13.1	5.55	2.3	3.25	0.58	Ingles & Pauly, 1984
<i>Pentaprion longimanus</i>	Lingayen Gulf	6	1987-88	13.7	1.05	6.26	5.34	2.29	3.05	0.57	Ochavillo et al. 1989
<i>Pomadasys argyreus</i>	Manila Bay	6	1958	13.6	0.78	8	3.9	1.88	2.02	0.52	Ingles & Pauly, 1984
<i>Pomadasys argyreus</i>	Manila Bay	6	1959	14.2	0.83	7.4	5.08	1.93	3.15	0.62	Ingles & Pauly, 1984
<i>Pomadasys argyreus</i>	Manila Bay	6	1960	15.1	0.62	8.1	4.5	1.57	2.93	0.65	Ingles & Pauly, 1984
<i>Pomadasys argyreus</i>	Manila Bay	6	1961	12.9	0.81	7.5	3.94	1.94	2	0.51	Ingles & Pauly, 1984
<i>Rastrelliger brachysoma</i>	Manila Bay	6	1978-79	34	1.1	15.2	4.27	1.84	2.43	0.57	Ingles & Pauly, 1984
<i>Rastrelliger brachysoma</i>	Manila Bay	6	1992-93	25.5	1		3.83	1.9	1.93	0.5	Armada, 1994
<i>Rastrelliger brachysoma</i>	Lingayen Gulf	6	1987-88	25		14.27	5.23	1.88	3.35	0.64	Ochavillo et al. 1989
<i>Rastrelliger kanagurta</i>	Palawan	5	1965	28	1.55	19.3	8.27	2.43	5.84	0.71	Ingles & Pauly, 1984
<i>Rastrelliger kanagurta</i>	Manila Bay	6	1992-93	24.5	0.85		4.96	1.73	3.23	0.65	Armada, 1994

<i>Sardinella fimbriata</i>	Manila Bay	6	1959	18	0.7	10.4	3.38	1.63	1.75	0.52	Ingles & Pauly, 1984
<i>Sardinella fimbriata</i>	Palawan	5	1965	22	1.15	14.7	6.56	2.12	4.44	6.56	Ingles & Pauly, 1984
<i>Sardinella fimbriata</i>	Manila Bay	6	1992-93	16.5	0.8		3.6	1.85	1.75	0.49	Armada, 1994
<i>Sardinella longiceps</i>	Manila Bay	6	1979	21	1.1	13.5	7.37	2.1	5.27	0.72	Ingles & Pauly, 1984
<i>Sardinella longiceps</i>	Palawan	5	1965	23	1.1	16.8	7.26	2.05	5.21	0.72	Ingles & Pauly, 1984
<i>Sardinella melanura</i>	Honda Bay	5	1978	22.5	0.7	18.8	3.36	1.53	1.83	0.54	Ingles & Pauly, 1984
<i>Sardinella sirm</i>	Palawan	5	1959	27.3	0.86	17.9	5.36	1.66	3.7	0.69	Ingles & Pauly, 1984
<i>Saurida tumbil</i>	Manila Bay	6	1978-79	37.5	1.03	18.1	4.83	1.71	3.12	0.65	Ingles & Pauly, 1984
<i>Saurida tumbil</i>	Lingayen Gulf	6	1987-88	39	0.52	7.97	3.33	1.08	2.25	0.68	Ochavillo et al. 1989
<i>Scatophagus argus</i>	Manila Bay	6	1978-79	25	1.2	14	4.12	2.12	2	0.49	Ingles & Pauly, 1984
<i>Secutor insidiator</i>	Manila Bay	6	1957	10.2	1.5	6	10.7	3.13	7.57	0.71	Ingles & Pauly, 1984
<i>Secutor insidiator</i>	Manila Bay	6	1959	11	1.35	6.5	5.31	2.88	2.43	0.46	Ingles & Pauly, 1984
<i>Secutor insidiator</i>	Manila Bay	6	1960	9.1	1.4	7.5	5.04	3.1	1.94	0.38	Ingles & Pauly, 1984
<i>Secutor insidiator</i>	Manila Bay	6	1992-93	12.5			5.01	2.32	2.69	0.54	Armada, 1994
<i>Secutor ruconius</i>	Manila Bay	6	1957	8.4	1.55	4.7	9.57	3.39	6.18	0.65	Ingles & Pauly, 1984
<i>Secutor ruconius</i>	Manila Bay	6	1959	9.2	1.15	4.8	8.69	2.72	5.97	0.69	Ingles & Pauly, 1984
<i>Secutor ruconius</i>	Manila Bay	6	1960	7.6	1.6	5.5	10.35	3.56	6.79	0.66	Ingles & Pauly, 1984
<i>Selar crumenophthalmus</i>	Manila Bay	6	1978-79	36.5	0.89	17.9	2.91	1.57	1.34	0.46	Ingles & Pauly, 1984
<i>Selaroides leptolepis</i>	Manila Bay	6	1978-79	29	0.8	11	2.76	1.56	1.2	0.44	Ingles & Pauly, 1984
<i>Selaroides leptolepis</i>	Manila Bay	6	1976-77	23	1.15	13.8	8.64	2.11	6.53	0.76	Ingles & Pauly, 1984
<i>Selaroides leptolepis</i>	Manila Bay	6	1992-93	25.5	0.95		3.26	1.84	1.42	0.44	Armada, 1994
<i>Sillago sihama</i>	Manila Bay	6	1978-79	23.5	0.7	11.9	2.7	1.51	1.19	0.44	Ingles & Pauly, 1984
<i>Sillago sihama</i>	Manila Bay	6	1992-93	25.5	0.75		4.68	1.57	3.11	0.66	Armada, 1994
<i>Stolephorus bataviensis</i>	Manila Bay	6	1992-93	13	1.05		6.68	2.37	4.31	0.65	Armada, 1994
<i>Stolephorus commersoni</i>	Manila Bay	6	1992-93	13	0.95		4.04	2.22	1.82	0.45	Armada, 1994
<i>Stolephorus commersonii</i>	Manila Bay	6	1961	11.3	0.96	8.07	4.94	2.28	2.66	0.54	Ingles & Pauly, 1984
<i>Stolephorus heterolobus</i>	Manila Bay	6	1961	11.4	0.95	7.58	10.69	2.29	8.4	0.79	Ingles & Pauly, 1984
<i>Stolephorus indicus</i>	Manila Bay	6	1957-58	16.3	1.42	11.7	5.81	2.67	3.14	0.54	Ingles & Pauly, 1984
<i>Stolephorus indicus</i>	Manila Bay	6	1958	15.7	1.08	12.2	4.53	2.23	2.3	0.51	Ingles & Pauly, 1984
<i>Stolephorus indicus</i>	Manila Bay	6	1992-93	14	0.8		4.7	1.94	2.76	0.59	Armada, 1994
<i>Stolephorus zollingeri</i>	Manila Bay	6	1957	10.1	1.1	7.48	8.41	2.55	5.86	0.7	Ingles & Pauly, 1984
<i>Stolephorus zollingeri</i>	Manila Bay	6	1958	10.6	1.85	7.2	12	3.53	8.47	0.71	Ingles & Pauly, 1984
<i>Stolephorus zollingeri</i>	Manila Bay	6	1961	9.2	1.15	6.8	4.22	2.69	1.53	0.36	Ingles & Pauly, 1984
<i>Therapon jarbua</i>	Manila Bay	6	1992-93	26	1		4.89	1.89	3	0.61	Armada, 1994
<i>Therapon theraps</i>	Manila Bay	6	1978-79	34	0.61	9.6	3.49	1.25	2.24	0.64	Ingles & Pauly, 1984
<i>Thyrssa setirostris</i>	Manila Bay	6	1992-93	17.5	1.1		6.14	2.25	3.89	0.63	Armada, 1994
<i>Thunnus albacares</i>	Sulu Sea	5	1975-76		0.42	52	2.06	0.65	1.41	0.68	Ingles & Pauly, 1984
<i>Trichiurus haumela</i>	Manila Bay	6	1992-93	90	0.7		3.52	1.06	2.46	0.7	Armada, 1994
<i>Trichiurus haumela</i>	Lingayen Gulf	6	1987-88	68.1	0.38	22.52	2.62	0.75	1.87	0.71	Ochavillo et al. 1989
<i>Trichiurus lepturus</i>	Manila Bay	6	1978-79	78	0.7	38.2	2.97	1.08	1.89	0.64	Ingles & Pauly, 1984

<i>Trichiurus lepturus (f)</i>	Manila Bay	6	1960-61	66	0.46	32.3	3.46	0.86	2.6	0.75	Ingles & Pauly, 1984
<i>Trichiurus lepturus (m)</i>	Manila Bay	6	1960-61	64.5	0.41	32.1	2.29	0.8	1.49	0.65	Ingles & Pauly, 1984
<i>Upeneus sulphureus</i>	Manila Bay	6	1992-93	17			6.5	2.13	4.37	0.67	Armada, 1994
<i>Upeneus sulphureus</i>	Lingayen Gulf	6	1987-88	19.9	1.32	8.88	8.72	2.4	6.32	0.72	Ochavillo et al. 1989
<i>Upeneus vittatus</i>	Manila Bay	6	1978-79	24.5	0.71	12.5	5.18	1.51	3.67	0.71	Ingles & Pauly, 1984
<i>Valamugil seheli</i>	Manila Bay	6	1992-93	23	1		6.83	1.96	4.87	0.71	Armada, 1994

Annex 5.B. Summary of Goals and Objectives of FMA 5 and 6

Table 5.B.1. Summary of Goals and Objectives of approved FMA Framework Plans for FMA 5 and 6. Adopted from BFAR FMA 5 (2023) and BFAR FMA 6 (2023).

Goals	Objectives
Fisheries Management Area 5	
1) Improved catch rate within sustainable limits	<ul style="list-style-type: none"> a) Catch of round scads (<i>Decapterus spp</i>) and tuna trending towards within target reference points by 2027, consistent with approved management plan; b) Establish reference points and stock status of other priority species by 2023; c) Adopt management measures for grouper and lobster by 2024; d) Reduce catching of immature fish sizes by 10% in 5 years; and e) Boost aquaculture production by 20% for 5 years to augment the demand for food fish and lessen pressure in capture fisheries.
2) Systematically conserve coastal habitats	<ul style="list-style-type: none"> a) Assist LGUs/ Alliances to establish MPA Networks covering 15% of coastal municipal waters based on systematic conservation planning by 2027; b) Improved coordinated protection of critical habitat by year 2024; c) By 2023, Database of critical habitat in FMA 5 is established, well-maintained and updated.
3) Improved economic security, resilience and welfare of coastal communities	<ul style="list-style-type: none"> a) 25% increased income of at least 25% registered fisherfolk living below poverty threshold in FMA 5 by 2027; b) Increase awareness & advocacy of stakeholders by year 2027,
4) Mainstream equitable access to economic opportunities	<ul style="list-style-type: none"> a) By 2027, a financial literacy program for fisherfolk will be established and sustained; b) By 2027 at least 25% of registered fisherfolk will receive livelihood support; c) By 2027 at least 5 types of fishing livelihood support will be provided to 25% of registered fisherfolk.
5) Reduced FMA-wide reported and/or actual occurrence of IUU Fishing Activities	<ul style="list-style-type: none"> a) To strengthen collaboration of national government agencies and all LGUs concerned on fishery law enforcement by 2023; b) Strengthen functionality and effectiveness of <i>bantay-dagats</i> through IATF-IUU fishing by 2024; c) Increase the number of LGUs with reviewed & updated MFO (based on R.A 10654) by 80% by year 2025 and 100% by 2027; d) Consult and adopt voluntary compliance principles and plans for CFVs by 2024. e) Establish coordination mechanisms with national agencies to address poaching by foreign fishing fleets.
6) Establish effective institutions for fisheries management	<ul style="list-style-type: none"> a) By 2025, establish and/or strengthen LGU alliances as platforms for cooperation in implementation of management actions; b) Prepare a Joint Administrative Order between BFAR, DENR, and DILG for Local Government Units to adopt FMA Framework Plan for all coastal communities/cities within FMA 5; c) Allocate 100% increase of the LGUs budget for fisheries management by 2024;

- d) Enhance fisheries program, activities, and project assessment and monitoring system by 2024;
- e) Strengthening of Fisheries Management Area 5 - Bodies (Management Board, Technical Working Group, Scientific Advisory Group, and Secretariat by 2023;
- f) Create and maintain fisheries database system for FMA 5 by year 2025.

Goals	Objectives
Fisheries Management Area 6	
1. Restored fish stocks at sustainable level	<ul style="list-style-type: none"> a) By 2023, reference points are established and harvest control rules (HCR) are agreed; b) By 2024 and succeeding years, management actions are based on science or recommendations of stock assessments and/or species specific EAFM plans developed and implemented; c) By 2027, priority fish stocks identified in West Philippine Sea and Manila Bay managed towards target reference points and agreed HCRs; d) By 2027, restored fishery habitats (coral reefs, seagrass, mangroves and inland bodies of water) through marine protected areas and fish sanctuary and their continuing conservation/rehabilitation with at least one network/cluster per province.
2. Compliant fishers and harmonious fishing communities	<ul style="list-style-type: none"> a) By 2027, deter, prevent/eliminate/reduce by at least 5% IUU Fishing by promoting compliance to fishery rules and regulations
b) Knowledgeable fisherfolks provided with enabling environment for sustainable livelihood and improved benefits from fisheries	<ul style="list-style-type: none"> a) By 2027, 70-80% of the fisherfolk are knowledgeable on various fishery programs b) By 2027, each region has supported and capacitated at least 20-30% of all fisherfolk organization including women-led enterprises in aspects of financial literacy, sustainable fisheries, etc. c) By 2027, developed and demonstrated the full potential of top aquaculture fishery commodities contributing to enhanced food security d) By 2027, established at least two network in FMA 6 with infrastructures for priority aquaculture commodities as livelihood support/option for fisherfolks e) By 2027, fisherfolks are engaged in sustainable fisheries with 3% increase in household income
c) Improved markets of fisheries and aquatic commodities established	<ul style="list-style-type: none"> a) By 2026, fair market price along the supply chain established b) By 2030, 80% increase in market accessibility and enable smallholders negotiate with larger business or market development c) By 2030, post-harvest losses reduced by 3% by creating an enabling environment d) By 2030, elevated value and quality of products
d) Mechanisms in place to address resource use conflicts towards equitable access and use of fisheries resources	<ul style="list-style-type: none"> a) By 2023 and succeeding years, strengthen and institutionalize linkages and networks among stakeholders through collaborative meetings and events

	<ul style="list-style-type: none"> b) By 2025, functional communication platform for the whole FMA 6 to strengthen the linkages among stakeholders and support FMA implementation, monitoring and evaluation c) By 2027, strengthen fisheries / coastal resource management (CRM) with at least 20% of LGUs adopting the FMA Framework Plan d) By 2027, harmonize zonation on municipal waters with roll-out to concerned LGUs e) By 2027, 50% of municipal waters of coastal and inland municipalities/cities are assisted
e) Adequate and capacitated institutions and stakeholders in fisheries governance	<ul style="list-style-type: none"> a) By 2023 and continuous thereafter, increase human technical capabilities of LGUs, NGAs, stakeholders and local civic society organization relevant to fisheries management b) By 2027, capacitated 50% of identified LGUs/ stakeholder groups that need training or capacity building
f) Adequate and capacitated institutions and stakeholders in fisheries governance	<ul style="list-style-type: none"> a) By 2023 and continuous thereafter, increase human technical capabilities of LGUs, NGAs, stakeholders and local civic society organization relevant to fisheries management b) By 2027, capacitated 50% of identified LGUs/stakeholder groups that need training or capacity building