Fisheries Management Areas in the West Philippine Sea and Their Heritage Values

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Fisheries Management Areas in the West Philippine Sea and Their Heritage Values
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ABSTRACT

Geopolitical issues pose a challenge to the holistic management of fisheries and associated ecosystems in two Philippine fisheries management areas (FMAs 5&6) encompassing the West Philippine Sea. One way to allay these issues is through a common values approach based on heritage. This paper presents evidence of the heritage value of FMAs 5&6 that could be integrated into an ecosystem approach to fisheries management to manage conflicts. This presupposes a common understanding of their heritage value and the fundamental principle that sustaining this value is good—in fact, essential—for everyone and our planet. Heritage value is assessed as a composite and dynamic unity of human gains and investments in the ecological value, economic value, and value to society of ecosystem services, which create cultural significance and socioeconomic worth for communities and peoples. Ecological value is assessed by way of selected indications of the ecosystem services of the two FMAs; economic value is assessed using published estimates of the monetizable and nonmonetizable value of these services; and value to society is evaluated based on influences on cultural identities, ways of life, and amenities in surrounding lands and contiguous waters. The values are highly significant and beneficial not only to Filipinos but also to others around the South China Sea and beyond. However, the ecosystem services underlying these values—and users' access to them—are at risk. They need to be protected from climatic and anthropogenic threats, including illegal, unreported, and unregulated fishing, pollution, coastline modifications, island building, and violations of the United Nations Convention on the Law of the Sea provisions on safeguarding the marine environment and fishers' safety.

Keywords: FMA, heritage value, ecological value, economic value, value to society, ecosystem services, natural resource, conservation, international resource policy, international environmental policy, protected area, oceans, common pool, resource security, fisheries, maritime, fishing, overfishing, West Philippine Sea

JEL codes: Q22, Q25, Q26, Q28, Q30, Q51, Q57

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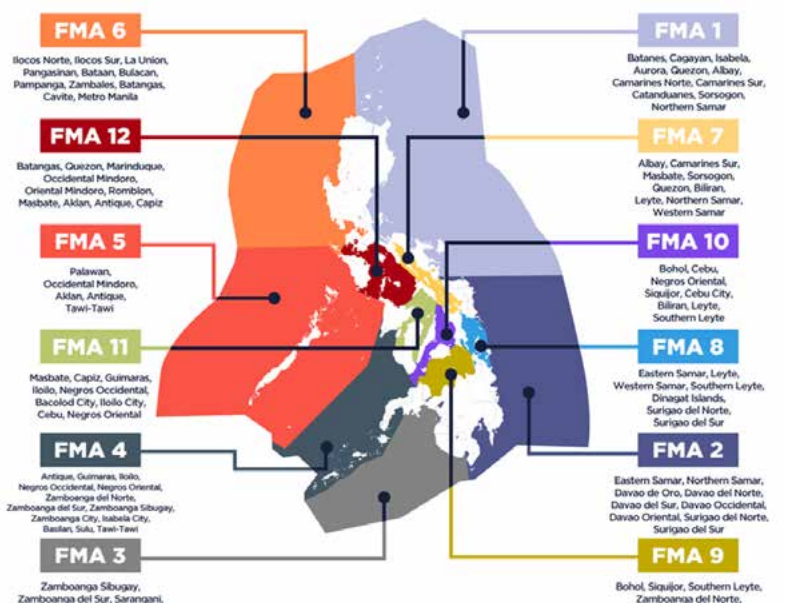
INTRODUCTION

In 2019, in a move it describes as "a new era of fisheries governance," the Philippines' Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR) issued Fisheries Administrative Order (FAO) 263, delineating Philippine waters into 12 fisheries management areas (FMAs) (Figure 1). The delineation considered stock distribution, fisheries structure, and administrative divisions to define geographical regions where fisheries management policies and decisions are made based on ecological and economic indicators of fish stock status and capacity, as well as the resource users' economic well-being (DA-BFAR 2020).

The FMAs are DA-BFAR's response to the challenge of assessing fish populations, fishery impacts, and overall intervention efficacy in a decentralized system, where fisheries are managed by different jurisdictions. In the Philippines, inland waters and marine waters from the coastline up to 15 km offshore are, with exceptions, "municipal waters" under the jurisdiction of municipal and city governments; all other waters fall under national government jurisdiction. Without a broader framework, fisheries tend to be managed according to and within the limits of political and administrative, rather than ecological, boundaries, making it difficult to assess resources that are shared by two or more jurisdictions, which fishery resources typically are. The FMAs are designed to provide a broad framework based on an ecosystem approach to fisheries management (EAFM) that addresses some of the difficulties. However, in FMAs 5&6, fisheries management continues to run into territorial and jurisdictional issues, which exacerbate climatic and anthropogenic threats to their ecosystem services (Baviera and Batongbacal 2013; Gavilan 2021;Yano 2020).

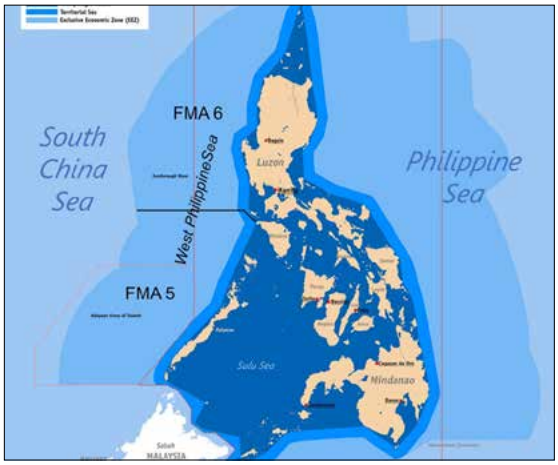
Together, FMAs 5&6 form an important biogeographic region, one of the country's most productive fisheries areas. FMA 5, with an area of 483,417 km^2, is the second largest of the 12 FMAs; and FMA 6, with 293,930 km^2, is fourth largest (Figure 1). FMAs 5&6 cover the entirety

Figure 1. Fisheries management areas (FMAs) in the Philippines



Source: Abad (2021)

Figure 2. The West Philippine Sea



Source: Yano (2020)

of the West Philippine Sea (WPS) (Figure 2) and a large part of the eastern region of the South China Sea (SCS) basin, an area of 740,000 km^2, about a third of the Philippines' 2.2 million km^2 maritime domain[1] and 20 percent of the 3.8 million km^2 area of the SCS (Gavilan 2021; Yano 2020; DENR-BMB 2021; Baviera and Batongbacal 2013).

Geopolitical issues in the region make fisheries issues extremely complex to solve, highlighting the need for new solutions. A common values approach based on heritage can be explored to mitigate this challenge. By "heritage", we mean "what we have inherited from the past to value and enjoy in the present, and to preserve and pass on to future generations" (Heritage Council, The n.d.), including the natural ecosystems on which humanity depends. Azzopardi et al. (2021) point out that "there are strong links between heritage and the environment, yet heritage is not fully included in existing ecosystem-based frameworks" (1). The authors suggest that in certain conflict situations, "explicit recognition of heritage value should be seen as a starting point for mutually respectful discussions toward sustainability or mutually beneficial processes rather than a perspective that is used to shut discussion down" (378). They have proposed a framework that "provides opportunities for more effective, integrated and participatory management through bridging (environmental management and heritage management) by promoting a common language and understanding of values" (380).

Valuation is an important tool to inform the policymaking and decision-making process, especially in fisheries management where choices must often be made among competing uses. Important work has been done that describes the economic values of Philippine marine resources (White and Cruz-Trinidad 1998; Azanza et al. 2017; Mendoza and Valenzuela 2017; PEMSEA and DENR 2019). Also, the Philippine Statistics Authority (PSA) maintains satellite accounts that track key indicators of the ocean economy. This paper aims to add a heritage value lens to the discourse. It presents evidence of the heritage value of FMAs 5&6 that could be used to begin the discussion on integrating heritage values in the Philippines' EAFM framework, not only to manage territorial and jurisdictional disputes in these two FMAs but also to help ensure that all FMAs are managed in a manner that truly represents their rich diversity and full potential.

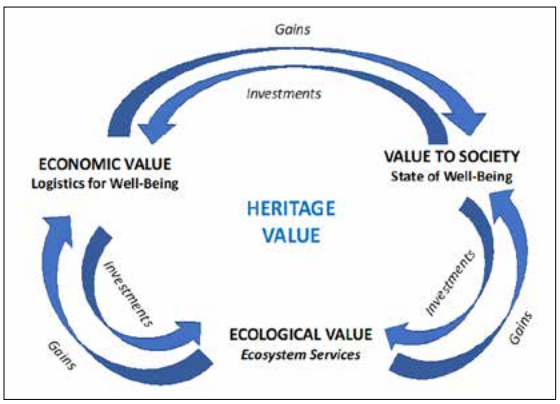
What is Heritage Value?

As used in this paper, heritage value refers to the irreplaceable importance of a thing or place to people, "the meanings and values that individuals or groups of people bestow on heritage (including collections, buildings, archaeological sites, landscapes, and intangible expressions of culture, such as traditions)" (Diaz-Andreu 2017). This study is based on a framework that defines heritage value as a composite and dynamic unity of human investments in, and gains from, the ecological, economic, and social values of ecosystem services in a place and time that creates cultural meaning and socioeconomic worth for communities and individuals (Figure 3).

In the case of FMAs 5&6, we use heritage value to refer to their unique natural and cultural features that have high psychosocial significance and socioeconomic worth for people and the

[1] The country's territorial waters, exclusive economic zone (EEZ), and extended continental shelf (ECS)

Figure 3. Heritage value is derived from ecological, economic, and social values, and their investment and returns dynamics



Source: Malayang et al. (2023)

communities around them.[2] These features create social, ecological, and economic dynamics that shape and support the sustenance of people, their cultures, and their sense of individual and collective identity (Díaz-Andreu 2017). In these FMAs, we look at ecosystem services as generators of (a) ecological value (their worth as producers and sustainers of life and life systems); (b) economic value (their worth as sources of logistics for human well-being); and (c) their value to society (their unique worth to the collective state and well-being of communities and people as social organizations). "Value to society" includes the ability of ecosystem services to contribute to food security, nutrition and health security, security of livelihoods, security of cultures and amenities, and environmental security. People residing around FMAs 5&6 gain from the ecosystem services, hence, they invest assets to sustain the services.

Ecological value, economic value, and value to society encompass a range of monetizable and nonmonetizable indications of human worth. To determine the heritage value of FMAs 5&6, we assessed a composite of selected indicators and measures of worth (Table 1).

[2] See definitions of "cultural" and "natural" heritage sites in Articles 1 and 2 of the *1972 Convention Concerning the Protection of the World Cultural and Natural Heritage* (UN Treaty Collection 1972).

THE HERITAGE VALUE OF FMAS 5 AND 6

The Philippines's territorial and EEZ waters combined are seven times larger than its land area of about 300,000 km^2. As an archipelagic nation with more than 7,600 islands and a total coastline of 36,298 km (WEPA 2021), its citizens directly bear the benefits and risks emanating from the ecosystem services of FMAs 5&6 and how these interact with those of nearby seas and lands. People living around the SCS and beyond also bear the same risks and benefits to the extent that their own maritime domains interact with the ecosystem services of FMAs 5&6.

Ecological Value

Provisioning services. FMAs 5&6 host fisheries and other biota, have hydrocarbon reserves and minerals, and offer physical spaces for commerce and industries.

Fisheries. Twenty-seven percent of marine fish caught in the Philippines is from FMAs 5&6, mostly from the Kalayaan Island Group (KIG) in FMA 5. KIG has around 600–1,000 km^2 of diverse reefs that account for 3–5 percent of the country's total reef fisheries harvests. In FMA 6, the Bajo de Masinloc is an important fishing ground, having a reef area of 56.6 km^2 that produces 1.30–1.92 metric tons (MT) of fisheries products per year (Baviera and Batongbacal 2013; Arceo 2021; Arceo et al. 2020).

Biotic diversity. Coral formations in the two FMAs cover an estimated combined area of 4,640 km^2 (about 21% of the country's total reef area); diversity is comparable with that of the Coral Triangle and higher than that of the rest of the SCS (DENR-BMB 2020; Quimpo et al. 2019 citing Dorman et al. 2015; Juinio-Meñez 2015; Licuanan et al. 2021; Quimpo et al. 2019 citing Huang et al. 2015). A recent report identified 1,056 marine fishes in FMA 5, comprising 32 elasmobranchs and 1,024 bony fishes in two classes, 42 orders, 115 families, and 366 genera (Balisco et al. 2023).

Table 1. Selected indications and measures of value

Values	Indicators	Measures
Ecological *(Ecosystem Services)*	Provisioning	Important items of marine biodiversity Extent of hydrocarbon reserves Available spaces for industries and commerce
	Supporting	Presence of important habitats Extensiveness of ecological connectivity
	Regulating	Climatic and oceanographic processes Biological and ecological features
	Cultural	Important indigenous and other cultural identities, lifestyles, and moral, aesthetic, and recreational aspirations
Economic	Fisheries for food	Fisheries production
	Genetic resources	Biota with potential for biotechnology applications
	Hydrocarbon reserves	Estimates of volume and monetary value of reserves
	Commerce and Industry	Estimates of monetary value of transiting commerce Estimates of infrastructure and industrial investments
Value to society	Marine-based tourism	Important destinations Extent of available facilities Important cultural items or artifacts from the sea
	Health and nutrition	Health and nutrition from fisheries
	Human security	Risks to ecosystem services Threats to human access to ecosystem services

A variety of seaweed and seagrass species have also been reported—a 2019 expedition to the KIG recorded 95 seaweed species, including 33 new species (Santiañez 2021), and at least 10 of the 19 seagrass species found in the Philippines have been observed in both FMAs 5&6 (Fortes et al. 2018; UNEP 2004; Seagrass-Watch 2020). Mangrove diversity includes *R. apiculata* (the most dominant) and the less dominant *R. mucronata, A. marina, S. alba,* and *C. tagal* (Barangan n.d.; FAO 2005; Samson and Rollon 2011). This biotic diversity provides a genetic backbone for living systems in and around FMAs 5&6; in addition, the various biological communities each generate ecological, economic, and social benefits. For example, plankton and phytoplankton communities produce O_2 (e.g., see Gruber et al. 2019), and seaweeds and seagrasses provide food and high-value products used as feed, biofuel feedstock, fertilizer, and bioactive compounds for medical and pharmaceutical applications (Santiañez 2021; De Vera-Ruiz 2020).

Hydrocarbons. Significant hydrocarbon deposits have been found in the SCS. Most of the "proven and probable" deposits are in Recto Bank, northeast of the KIG in FMA 5. In 2013, the United States Geological Survey (USGS) estimated these deposits to be about 11 billion (1.75 m^3) of oil and over 190 trillion ft^3 (5.38 trillion m^3) of natural gas (Gavilan 2021 citing USGS 2013; Saiidi 2018). More recent estimates put the figures closer to 125 billion bbl[3] (19.87 billion m^3) of oil and 500 trillion ft^3 (14.16 trillion m^3) of natural gas in undiscovered areas (Saiidi 2018). Furthermore, it has been reported that "unexplored hydrocarbon stores" in the area could be more (Gavilan 2021 citing US EIA 2020). Deposits in the Malampaya structure, west of Palawan in FMA 5, have proven reserves of about 2.7 trillion ft^3 (76.46 billion m^3) of natural gas and 85 million bbl (13.5 million m^3) of condensate. Just 80 km west of Palawan, the Malampaya Gas Field produces 146 billion ft^3 (4.13 billion m^3) of gas per year, fueling power plants that generate 2,700 MW[4] of electricity for the Philippine Grid (DOE n.d.).

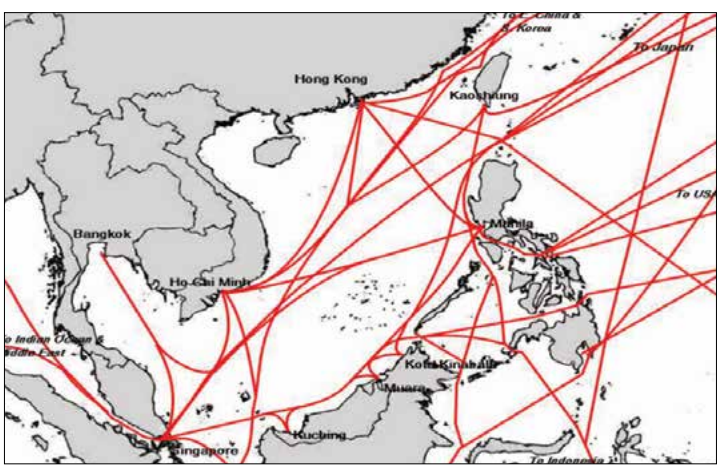
[3] Oil barrels

[4] megawatts

Metallic and nonmetallic minerals. Metallic and nonmetallic minerals in FMAs 5&6 include phosphates and guano; manganese nodules that yield magnesium, cobalt, nickel, and molybdenum; and beach to shallow shelf placers of gold, tin, titaniferous magnetite, zircon, monazite, phosphate, quartz sand, chromite sands, polymetallic sulfide deposits, and rare earth-bearing monazite placers (Baviera and Batongbacal 2013 citing Balce 2012).

Spaces for commerce and industry. The surface waters of FMAs 5&6 provide space for commerce and industry. Shipping transitioning between the two FMAs conveys goods consumed and exchanged in the world, and the sea lines of communication in FMAs 5&6 connect with those in the SCS (Figure 4), which "are absolutely essential to international trade" (Baviera and Batongbacal 2013; MTI-CSIS 2016). The four major industries in FMAs 5&6 are fisheries, energy development, port operations, and tourism. The two FMAs have the largest seaports in the country—the ports of Manila, Batangas, Subic, San Fernando (La Union), and Limay in FMA 6, and Zamboanga in FMA 5. Many of the Philippines' major tourist destinations can be found in their coastal areas (Alampay 2022), and petroleum contracts are operating in FMA 5 (Baviera and Batongbacal 2013 citing DOE n.d.).

Figure 4. Sea lines of communication (SLOCs) in the WPS and SCS



Supporting services. Habitats and ecological connectivity help maintain the life cycles in FMAs 5&6, and in their contiguous and surrounding lands and seas in the SCS.

Habitats. Mesophotic coral ecosystems at depths of 30–150 meters in FMAs 5&6 provide refugia for organisms under stress and reseed degraded shallow water reefs (e.g., Quimpo et al. 2019 citing Bongaerts et al. 2010; Bridge et al. 2011; Lindfield et al. 2016; Bongaerts et al. 2017); shallower reefs serve as a habitat for diverse species and protect coastal ecosystems from the impact of waves, storms, and floods (DENR-BMB 2014; NOAA 2021). The seaweeds and seagrass meadows are habitats for a wide variety of marine invertebrates and fish, including turtles and dugongs; they contribute to reef formation, enrich the substrates on which corals settle and form, sequester carbon, clean water pollutants, and provide breeding grounds for marine plants and animals (UNEP 2004). Their mangroves are habitats and breeding grounds for the coastal biota, with nearshore yields of certain fish and shrimp positively correlating with nearby mangrove areas, which provide detritus that enriches the organic content of nearshore marine habitats (Primavera 2000; Barangan n.d.; Fleming, Guanghui, and L. Sternberg 1990). The most extensive mangrove formations in the WPS are in Palawan in FMA 5 (Barangan n.d.; FAO 2005).

Connectivity. Coral reefs in the KIG in FMA 5 are sources of coral and fish larvae spread by tides and currents across the SCS. There is evidence that marine species found in the KIG and Sulu Sea are genetically linked, and there is a "clear connection" between the marine biota in the KIG waters and those in the Philippine archipelagic waters. These waters exchange and replenish each other's living marine resources on account of the constant

and seasonal interchange of seawater between them through currents driven by winds and tides (Baviera and Batongbacal 2013 citing Aliño and Quibilan 2003; Quimpo et al. 2019 citing Dorman et al. 2019 and Juinio-Meñez 2015). Such exchange reaches the coast of Vietnam on the other side of the SCS (Pata and Yñiguez 2019; Juinio-Meñez 2015; Dorman et al. 2015; Melbourne-Thomas et al. 2011; Kininmonth 2011) (figures 5 and 6). Detritus and debris, including plastics and chemicals, are conveyed by currents across FMAs 5&6 and the SCS. These affect life systems in the surrounding seas and lands through different forms of transport (Jacinto 2022).

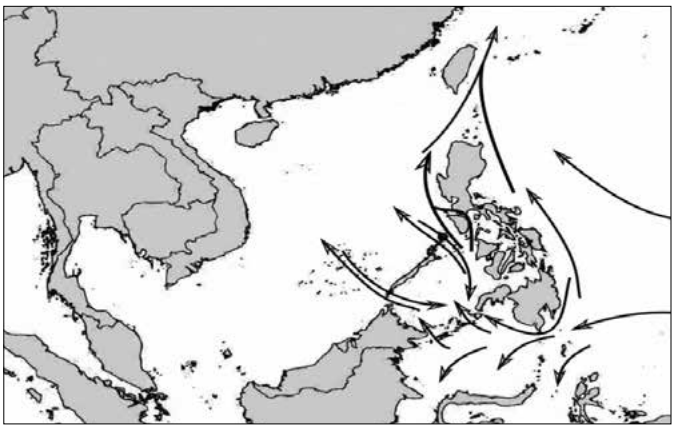
Regulating services. Climate-ocean dynamics, nutrient and chemical flows, hydrologic features, and chlorophyll production influence the viability of life systems in FMAs 5&6.

Climatic-oceanographic dynamics. Sea surface heat and currents in FMAs 5&6 significantly influence the climatic and oceanographic conditions in the SCS, a monsoonal sea with prevailing southwest and northeast winds and currents that reverse each year. In summer, the Annam Cordillera (elevation 1,000 m) accelerates southwest monsoon winds, cooling the waters on the coast of Vietnam and spreading westward toward FMAs 5&6, lowering the sea surface temperature (SST) in these areas and the SCS. This cooling effect is moderated by warmer winds and sea currents from the western Pacific through the Luzon Strait in FMA 6. In winter, the northeast monsoon warms the SCS passing over FMAs 5&6. The El Niño-Southern Oscillation (ENSO) in the western Pacific warms the SCS by the flow of Pacific waters through the Luzon Strait into FMAs 5&6. Evidence suggests that the SST in FMAs 5&6 and the SCS are linked to the Pacific ENSO, and the Kuroshio Current in the western Pacific influences large-scale ocean-atmosphere phenomena from the western Pacific to the SCS (Jacinto 2022; IPRC 2004 as cited from Liu et al. 2004, Qu et al. 2004, Xie et al. 2003, and Yaremchuk and Qu 2004). FMAs 5&6 form part of the wider Indo-Pacific Warm Pool, which regulates global climate (Figure 7). No data are available on the amount of carbon absorbed by FMAs 5&6, but sediments and sedimentary rocks in oceans, seagrasses, plankton, and phytoplankton are known to lock up more carbon than land (Gruber et al. 2019; National Geographic Society n.d.). Increasing SST can lead to acidification,

Figure 5. Connectivity of *L. laegiata* and *T. crocea* in offshore and nearshore ecosystems in the WPS

Sources: Onda n.d. as cited in Ravago et al. (2001); Juinio-Meñez et al. (2003); Juinio-Meñez et al. (2004)

Figure 6. Migratory routes of some tuna species passing through the Philippines

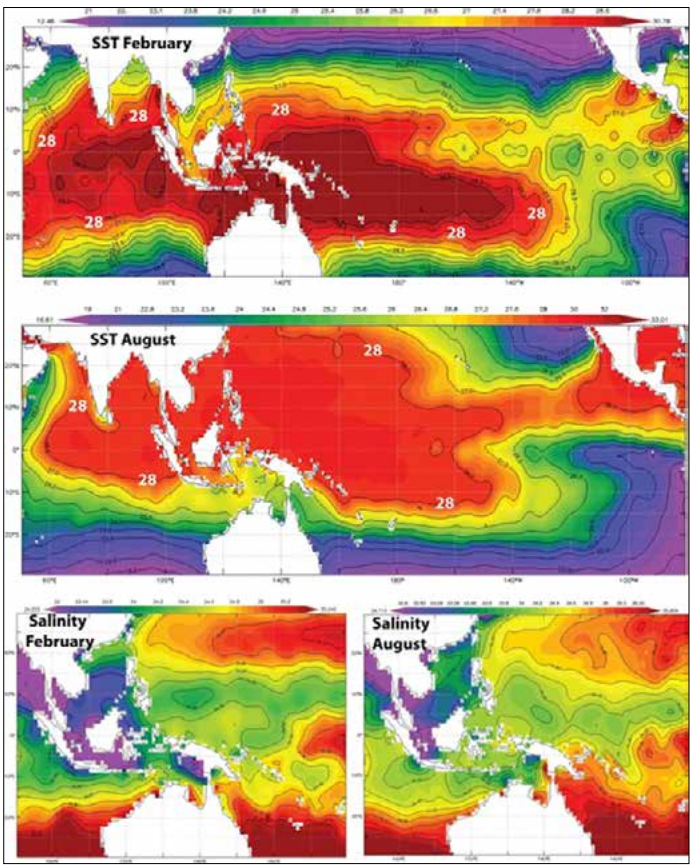


Source: Baviera and Batongbacal (2013) citing Morgan and Valencia (1983)

affecting plant growth, calcitic biota and formation, and atmospheric carbon sequestration.

Nutrient and upwelling features. Upwelling is a hydrological feature that brings cold, nutrient-rich deep water to the surface. The SCS is one of the world's largest marginal seas, and yet its nutrient distribution processes are poorly understood; understanding these processes is important for managing its fisheries and marine ecosystems. The western Indo-Pacific has 12 major upwelling regions (Figure 8), including that of FMA 6 off northwest Luzon from October to January, which provides nutrients to the interior SCS in spring (Shaw et al. 1996). Studies have shown an intermediate water outflow into FMA 6 via the Bashi Channel during both the wet and dry seasons, carrying more nutrients during the dry season (Chen et al. 2001; Wong et al. 2007). Another upwelling feature is observed off the Zamboanga Peninsula in FMA 5, driven by offshore Ekman transport during the

Figure 7. The Indo-Pacific warm pool climate system

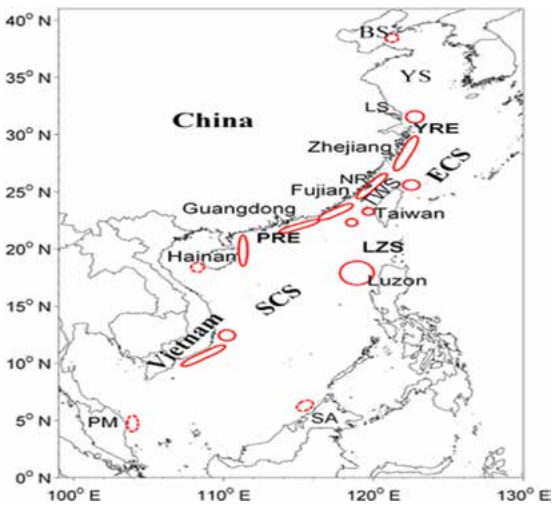


Source: De Deckker (2016)

northeast monsoon and impacted by interannual ENSO variations (Villanoy et al. 2011). These nutrient sources fertilize the surface water and promote productivity in the SCS.The carbon cycle, nutrient dynamics, and biological community structure show distinct seasonal patterns in the northern SCS (Chen et al. 2001; Wong et al. 2007). Significant chlorophyll concentrations exist across the coasts of FMAs 5&6 and around the SCS (Figure 9) that influence nutrient levels and levels of coastal primary and secondary productivity in both FMAs and the wider SCS (IPRC 2004 as cited from Xie et al. 2003). Seaweeds, seagrasses, mangroves, and other photosynthetic organisms, such as certain types of algae and phytoplankton, are major producers of chlorophyll in FMAs 5&6 (see De Vera-Ruiz 2022; Primavera 2022 citing Hamilton and Snedaker 1984).

Cultural services. The ecosystem services of FMAs 5&6 influence and shape the diversity of indigenous and other cultural identities and traditions of people in the western seaboard of the Philippines. They provide opportunities and conditions for moral, aesthetic, and recreational experiences, as well as local knowledge systems that sustain livelihoods and ways of life (e.g., see Dapar and Alejandro 2020). Of the more than 130 languages and dialects in the Philippines, 110 represent ethnolinguistic groups who are identified by law (Indigenous Peoples' Rights Act of 1997) as indigenous peoples (Figure 10). Seasonally moving across upland and coastal landscapes to meet their needs, these groups are known for ecological, economic, and social practices that are highly linked to the features and conditions of the lands and seas around them. Their way of life and daily sourcing of needs (food, medicine, fuel, construction materials, and materials for rituals) are intricately interwoven with local ecological systems, such as the terrain, climate, physical features of the environment, and local biota (Padilla 2013; Boissière and Liswanti 2004; Cadeliña 1982).

Figure 8. Map of the WPS, SCS, Taiwan Strait, East China Sea, Yellow Sea, and Bohai Sea

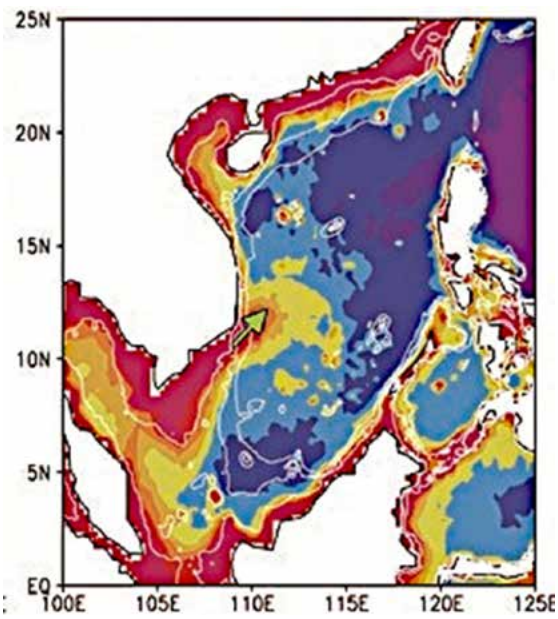


Source: Hu and Wang (2016)

Economic Value

The marine ecosystems of FMAs 5&6 generate goods and services that people exchange and value for the utility and satisfaction these provide.

Figure 9. Chlorophyll concentrations around the SCS



Source: IPRC (2005)
Notes: high values: red; low values: blue and purple

Fisheries. Based on preliminary estimates from the PSA, the Philippines produced 2 million MT from capture fisheries and 2.3 million MT from aquaculture in the four quarters of 2022 (DA-BFAR 2023). The value of production for the first three quarters was estimated at USD 3.5 billion based on 2018 constant prices. Of these, 66 percent was from regions that intersected FMAs 5&6 (Table 2). The Philippines' 10 major fishery products in 2022 included frigate tuna, yellowfin tuna, roundscad, big-eyed scad, skipjack, Bali sardinella, tilapia, milkfish, squid, and seaweed (PSA 2022). As earlier cited, if 27 percent of marine fish catch in the country is from the WPS, then about 1.16 million MT of the fish captured in the country in 2022 were from FMAs 5&6, which would be worth around USD 950 million at 2018 prices.

Seaweeds and seagrasses. Globally, seaweeds are estimated to value USD 10 billion/year (Krishnan and Narayanakumar 2013; Bixler and Porse 2011). In 2022, the Philippines produced 1.5 million MT of seaweeds valued at USD 137 million at 2018 prices (PSA 2022). There are no estimates of seaweed and seagrass production and value in FMAs 5&6 specifically, but seagrass values could be high, given that UNEP (2004) has valued seagrasses at USD 8.3 trillion globally, mainly for their nutrient cycling function (Stankovic et al. 2021).

Coral reefs. Coral reefs have been estimated to have a global value of USD 352,249/ha/year at 2007 prices (Onda n.d. citing de Groot et al. 2012), of which regulating services account for almost 50 percent (USD 171,478/ha/year), provisioning services for USD 55,724/ha/year, supporting services for USD 16,210/ha/year, and cultural services for USD 108,837/ha/year. In 2004, the value of coral reefs in FMAs 5&6 was estimated at about USD 45 million inclusive of their fisheries, tourism, research, carbon sequestration, coastal protection, biodiversity, and other services with nonmarket value, with fisheries, tourism, and research accounting for 27 percent of the total value. Calculated over 20 years at a discount rate of 10 percent, this translates to a net present value, at 2004 prices, of USD 440 million, or USD 4,745/km^2/year on an annualized basis, assuming

Figure 10. Distribution of ethnolinguistic group communities in the Philippines

Source: Dapar and Alejandro (2020) citing ECIP (1993)

Table 2. Culture and capture fisheries production in selected regions of the Philippines (preliminary estimates), January-September 2022

Regions	Volume ('000 MT)
BARMM	1,319.83
SOCKSARGEN	299.78
Zamboanga Peninsula	529.07
Western Visayas	334.85
MIMAROPA	380.87
CALABARZON	194.36
Central Luzon	364.08
Ilocos Region	194.11
NCR	75.57
Total	**3,692.52**

Source: PSA (2022)

a total reef area of 4,640.4 km^2 (Samonte-Tan and Armedilla 2004). Damage to a reef in Tubbataha in FMA 5 was estimated at USD 300/m^2 (Onda n.d.), but no estimation of this kind has been performed elsewhere in FMA 5 nor in FMA 6.

Mangroves. Mangrove values are likely high, but the conventional valuation of mangroves is based mainly on the goods they produce and hardly on their nonmarketable ecosystem services (see Primavera 2000 citing Hamilton and Snedaker 1984). There are no estimates of the current value of mangroves in FMAs 5&6 but nationally, they range from USD 10-4,000/ha/year for wood products (Primavera 2000 citing Radstrom 1998) and USD 775-11,282/ha/year for fishery products (Primavera 2000 citing Ronnback 1999). Barangan (n.d.) reports that "complete mangrove ecosystems" would have a value of USD 500–1,500/ha/year (citing Melana et al. 2000); Philippine mangroves range in annual value from USD 580/ha/year for unmanaged and understock stands, USD 628/ha/year for naturally regenerated stands, and USD 694/ha/year for managed plantations (see also Azanza et al. 2017).

Genetic diversity. Marine genetic diversity offers potentially immense economic value as sources of natural products for applications in genetic engineering, the development of transgenics, and creating circular economies (Cruz 2022). Peptides and other compounds can be assayed from organisms to develop pharmaceuticals, such as antibacterial, anti-inflammatory, antiparasitic, neuroprotective, antiviral, and anti-cancer agents, bioremediation technologies, and energy sources (Cruz 2022; Malayang 2021 citing ISAAA 2021, Malve 2016, Marine Biotechnology ERA-NET n.d., and Nikolaivits et al. 2017). Marine cones, sponges, and macroalgae are potentially rich sources of valuable gene products (Cruz 2022) and can be safely and sustainably tapped in the global biotechnology market. It is a large market estimated to be worth USD 447.92 billion in 2019, USD 833.34 billion by 2027 (Malayang 2021 citing Fior Markets 2020), and USD 244 trillion by 2028 (Malayang 2021 citing Grand View Research 2021). Of the over 400,000 natural products from plants identified so far, only 10 percent are marine (Sigwart et al. 2021). This reflects the longer history of terrestrial natural product research from the 1700s (Dias, Urban, and Roessner 2012) versus marine natural products research, which started only in the 1950s (Molinski et al. 2009) and indicates that many more marine species remain undiscovered.

Hydrocarbons and minerals. The hydrocarbon reserves in FMAs 5&6 may not be much compared with other reserves in the world. However, in 2012, they were estimated to meet the total fuel demand of the Philippines for 20 years up to 2032. In 2013, the Malampaya field in FMA 5 was estimated to contribute "about USD 1 billion/year at current (2012) gas prices to the national coffers" and generate "foreign exchange savings from foregone energy importation estimated at USD 500 million/year." It "led to the emergence of a local natural gas industry" in the country (Baviera and Batongbacal 2013 citing Balce 2012). They also reported occurrence in FMAs 5&6 of metallic and nonmetallic minerals but cited no monetized values.

Tourism and port operations. There are no published estimates of the economic value of tourism across the two FMAs, but nationally tourism was reported to have generated USD 9.39

billion in 2019 and accounted for 5.4 percent of GDP in 2020; it averaged 7.4 percent of GDP from 2000–2018 (Alampay 2022). Estimates of the value of port operations specifically for FMAs 5&6 are also unavailable, but seaports either in or facing the waters of FMAs 5&6 serve the bulk of Philippine domestic and international trade. The largest, Manila, handles 39 percent of entering and exiting domestic and international cargo.

Commerce. In 2021, transiting commerce in the SCS was valued at USD 3.4 trillion/year, about 21 percent of global trade in 2016 (China Power Team 2021). Among the products transiting the SCS are oil, gas, and raw and processed materials, which are crucial to the economies of East and Southeast Asian countries. In 2020, Philippine exports were valued at USD 65.21 billion, and imports at USD 89.81 billion. Disaggregated data specifically for FMAs 5&6 are unavailable, but given that these two FMAs have some of the busiest ports in the country, it can be assumed that most of this trade transits through them. The top Philippine trade commodities and trading partners in 2021 are shown in Table 3.

Value to Society

Tourism, health, and nutrition are the major sectors that derive value to society from the ecosystem services of FMAs 5&6. Non-use values also account for substantial economic values that people hold for coral reefs, as in the case of the Tubbataha Reefs UNESCO World Heritage Site located in the vicinity of the WPS (Subade 2007; Subade and Francisco 2014).

Tourism. Coastal nature and cultural experiences are the backbone and principal allure of Philippine tourism. It is viewed internationally as largely coastal and aquatic, with sun-and-beach tourism and sea-based activities as the main attractions (Arellano 2019; DOT 2011). With their abundance of popular coastal and marine tourist sites (Table 4), FMAs 5&6 are a favorite among both domestic and foreign tourists, accounting for approximately 18 percent of the country's overnight arrivals (Alampay 2022 citing DOT 2019). Reef-associated visits generate an estimated USD 250 million/year (Alampay 2022 using estimation methods in Spalding et al. 2017), but visitor experience in these locations is not limited to the sun, sea, and sand. Local culture and history add value to the coastal tourism experience. There are large concentrations of people on the coasts of FMAs 5&6 and around the wider SCS whose economic and social lives, cultural identities, and personal and collective aspirations are influenced or put at risk by the quality, processes, and rhythms of the ecosystem services in their immediate environment, and how these services influence those beyond their waters. Their influences are revealed in local sea-based cultural artifacts that create distinctive features and contents for local tourism, which generates

Table 3. Major Philippine export and import commodities, values, and top trading partners in 2021

Commodities and Partners	Exports	Value (Billion USD)	Imports	Value (Billion USD)
Commodities	Integrated circuits	22.60	Integrated circuits	12.3
	Office machine parts	9.32	Refined petroleum	5.61
	Electrical transformers	2.36	Broadcasting equipment	2.89
	Insulated wires	2.32	Office machine parts	2.45
	Semiconductors	2.18	Cars	2.16
Countries	China	12.90	China	34.5
	US	10.70	Japan	8.21
	Japan	10.30	South Korea	7.31
	Hongkong	10.00	US	6.84
	Singapore	6.28	Indonesia	6.34

Sources: PSA (2020); OEC (n.d.)

Table 4. Marine tourism zones in FMAs 5 and 6

Marine Tourism Zones	Popular Coastal and Marine Tourism Sites
Batanes	Mt. Iraya, Vayang Rolling Hills, Morong Beach (Sabtang Island)
Ilocos Norte and Ilocos Sur	Saud Beach (Pagudpud), Bangui Wind Farms, Kapurpurawan Rock Formations (Burgos), Davila Coast (Pasuquin), La Paz Sand Dunes (Laoag), Currimao resorts, Badoc Island surfing, Ambucao, Gabao and Candon beaches, Santiago Cove
La Union and Pangasinan	Poro Point (San Fernando), San Juan surfing beaches (also Bacnotan and Urbiztondo), Hundred Islands National Park (Alaminos), Lingayen Gulf, Patar Beach and UP MSI marine laboratory (Bolinao), Santiago Island giant clam nursery in Masamirey Cove (Sual)
Zambales and Bataan	Santo Niño Beach (San Felipe), Anawangin Cove, Pundaquit Beach & Capones Island (San Antonio), San Salvador Island marine conservation project (Masinloc), Hermana Menor island (Santa Cruz), Subic Bay Freeport & Anvaya Cove development (Subic-Olongapo), Mariveles-Bagac-Morong coastal/beach resorts
Batangas and Occidental Mindoro	Hamilo Coast and Punta Fuego integrated beach resorts (Calatagan), Fortune Island-Tali Beach (Nasugbu), Matabungkay Beach (Lian), Anilao (Mabini-Tingloy), Verde Island, Abra de Ilog (Mamburao), Tayaman Bay, Apo Reef Natural Park (Sablayan), North Pandan Island), White Island and Ilin Island (San Jose)
Palawan	Calauit Island and North Busuanga, Coron, Bacuit Bay and Archipelago (El Nido), Long Beach, San Vicente wetlands, and Port Barton (San Vicente) Balabac Island

value from the "people-land-sea dynamics" that residents and nonresidents seek to experience (e.g., see Artal-Tur 2018; Stronza 2008; Robinson and Picard 2006). Tangible cultural heritage, such as historic churches, picturesque lighthouses, and similarly identifiable legacy structures, have direct tourism use values, providing opportunities for visitors to engage in sightseeing, photography, group tours, and other activities that Spalding et al. (2017) described as reef-adjacent (or marine-adjacent) tourism. There is an associated intangible cultural heritage in these destinations that has experiential and intellectual value, comprising elements of culture that are nonmaterial—"practices, representations, expressions, knowledge, and skills that belong to communities and are held by specific members" (Alampay 2022, citing Cominelli and Greffe 2012), including indigenous fishing practices and gear, gleaning traditions, fishery processing, food products, designs, and art forms (Alampay 2022 citing Arnold 2015; Arcalas 2022; Porter and Orams 2014; Mangahas 2009).

Health and nutrition. Health and nutrition are important values for FMAs 5&6 although contingent on their ecosystem services being free of threats and on people being able to readily access and invest in the services (e.g., see Cabalza 2017). Filipinos consume an average of 101 g/day (or 37 kg/year) of fish and fish products; this is 11.9 percent of their daily food intake, 18.3 percent of their total protein intake, and 42.2 percent of their total animal protein intake (Castro 2022; DA-BFAR 2021). With their productive fisheries, FMAs 5&6 are—or should be—a major contributor to the diet, nutrition, and health of Filipinos. Both FMAs have five of the country's most common and nutritious finfish species: skipjack tuna, yellowfin tuna, Bali sardinella, leopard coral grouper, and roundscad (Abad 2021; FishBase 2019). Fish are known to contain vitamin B12, omega-3 fatty acids, vitamin D, niacin (B3), Ca, Se, P, K, Cu, Fe, Mn, Mg, Zn, lysine, and isoleucine. They improve brain health, body growth, weight control, and joint support, and are reported to reduce inflammation and the risk of diseases and defend against mood disorders (anxiety and depression), insulin resistance, age-related bone degeneration, heart diseases, immune disorders, and clots (Plowe 2020; CheckYourFood.com, n.d.; myfitnesspal.com n.d.; WebMD Editorial Contributors 2022). Seaweeds contain vitamins K, C, and E and folate, which are good for brain and skin health, have anti-cancer benefits,

and reduce the risk of muscular degeneration; they also contain high levels of iodine, which improves thyroid function, gut health, and heart health; reduces cancer risks; and stabilizes blood sugar (Stibich 2022; Health Benefits Times n.d.). Yet, more than 50 percent of Filipinos are said to be food insecure, contributing to cases of malnutrition even in fish-producing areas, such as Zambales in FMA 6 and Palawan in FMA 5 (Castro 2022). This underscores the need to protect fisheries resources and to ensure that these healthy food sources are adequately available, accessible, and affordable to local communities.

Security of ecosystem services. There are no definitive assessments of the security of ecosystem services in FMAs 5&6, except for the enumeration of endangerment of living and nonliving resources in some of the sites described in the Submissions and Discussions on Record in the July 12, 2016 ruling (Award) by the Permanent Court of Arbitration (PCA) of the International Tribunal for the Law of the Sea on the Philippines' case against China's claim to a vast expanse of the SCS (Case No. 2013-19) (PCA 2016).

Security of access. There are no definitive assessments of the breadth and scope of the impedance of fishers' and other resource users' access to ecosystem services in FMAs 5&6, other than media reports on harassment of fishers in some of their sites (e.g., see Baroña 2023; Cabalza 2023), and the narration of fishers being hindered from entering certain fishing grounds determined by the PCA in its 2016 Award as within the Philippine EEZ.

THREATS TO THE HERITAGE VALUE OF FMAS 5 AND 6

The high heritage value of the ecosystem services in FMAs 5&6 needs to be urgently protected, conserved, and sustained irrespective of political and territorial disputes. These services are national, regional, and global commons, and vital to populations in the Philippines and beyond (Zhang 2018). Notwithstanding the geopolitical issues in their immediate region, FMAs 5&6 provide valuable ecosystem services that contribute to the social, economic, cultural, and political life of people living around the SCS. However, threats—including human behaviors exacerbating the climate crisis and contravening provisions of the United Nations Convention on the Law of the Sea (UNCLOS) Part XII (on safeguarding the marine environment) and Article 98 (on fishers' safety)—diminish their heritage value.

Poaching by foreign distant-water fishing fleets is most concerning (Syverson 2022). Their unreported catch levels and unregulated fishing methods pose severe challenges to sustainably managing the fisheries in FMAs 5&6. The breadth of this threat is serious: DA-BFAR apprehension data from 2016–2019 and nighttime Visible Infrared Imaging Radiometer Suite (VIIRS) satellite images reveal a concerning trend of foreign-fleet poaching across FMAs 5&6. From 2016 to 2019, half of the apprehended vessels had unknown flag states, indicating illegal and unregulated fishing activities that endanger coral reefs and other marine habitats. VIIRS images from April 2012–July 2021 show increasing presence of potential fishing vessels using bright lights in the SCS and in FMAs 5&6. Although fishing effort appears to have declined slightly in 2019, it remained higher compared to earlier years. West Palawan, Panatag Shoal, and North Luzon had the highest number of boat detections, with an increasing trend in fishing from the west observed in the Philippine EEZ in North Luzon and West Palawan (DA-BFAR 2022).

Addressing foreign-fleet poaching is crucial to preserve and sustain the heritage value of FMAs 5&6 because the collapse of fisheries and biodiversity in these seascapes could threaten total fisheries harvests in the Philippines and the sustainability of interconnected living resource systems in the wider SCS.

RECOMMENDATIONS

We recommend that stakeholders of FMAs 5&6 and the broader SCS basin adopt individual and collective measures to mitigate threats based on a common understanding of their heritage value, and the fundamental principle that sustaining this value is not only in everyone's interest, but is essential to our planet's sustainability, and therefore everyone's responsibility. Among others, these measures may include:

- Collaborative and coordinated policies, programs, and activities designed to incentivize public and private investments and ensure safe access to ecosystem services for qualified resource users. This approach should be applied regardless of ongoing disputes like the Antarctic Treaty of 1959 (Antarctic Treaty System 2021), where territorial claims are suspended while collaborating on preservation.
- Investments and incentives to establish coastal and littoral marine protected areas (MPAs) and MPA networks in at least 30 percent[5] of the seas around the KIG and Bajo de Masinloc, where most of the fisheries and coral reefs in FMAs 5&6 are found. Instituting reference points, catch ceilings, and harvest control rules in the KIG and Bajo de Masinloc is necessary to sustain stocks and biodiversity. The promotion of appropriate technologies and gear for proper fishing and resource extraction activities is essential to protect and sustain the provisioning and other ecosystem services across the two FMAs.
- Ensuring protection for the livelihoods of registered fishers, resource users, and communities with cultural and economic ties to the ecosystem services of FMAs 5&6, alongside regulations for qualifying fishers and other resource users. Measures against material and chemical pollution, including oil spills and plastics, must be in place. Rules governing energy exploration and development, foreign participation in mineral exploration and extraction, and renewable energy development should be established.
- Research and Development (R&D) programs focusing on marine biodiversity conservation, improving the resilience of marine living resources to climate change-related risks and vulnerabilities, and the sustainable use of genetic resources, organisms, and minerals in FMAs 5&6. These would be necessary to sustain and support additional value adding to the ecosystem services of the two FMAs.

These policy, investment, protection, and R&D measures will strengthen and sustain the heritage value of FMAs 5&6 for Filipinos and others across the WPS and the SCS community and beyond.

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[5] See Blue Prosperity Coalition (n.d.)

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