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# On the Archipelagic Ecology and the Economy of the Philippines

Seeing the sea for its value as a vaster ecosystem platform (than land) for the country's pandemic recovery and post-pandemic national development and security interests

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## INTRODUCTION

The Greek Admiral Themistocles, who defeated the Persians in the Battle of Salamis in 480 BCE, ([World History Encyclopedia 2021](#)) once said: "He who has command of the sea, has command of everything ([AZ Quotes 2021](#))." This resonates prominently today when oceans are increasingly appreciated for their strategic value to human survival and security.

Oceans cool the earth, and this is important as global surface temperature climbs to about 50 percent more than the mid-1800 levels. They sequester almost 30 percent of global carbon (C) emissions. Marine sediments and sedimentary rocks lock up 66–100 million billion metric tons (BMT) of C. Ocean ecosystems store another 38–40 thousand BMT. Of these, seagrasses store 10–18 percent or twice per square miles than terrestrial forests. Plankters combine calcium (Ca), C, and oxygen (O) into  $\text{CaCO}_3$  that form the shells and exoskeletons of many marine organisms. The C-sequestration and storage capacities of oceans are much higher than land. Terrestrial plants sequester and store only 540–610 BMT while soil organic matter does about 1.5–1.6 thousand BMT. Fossil fuel deposits store 4,000 BMT and the atmosphere does a mere 7 BMT. Furthermore, oceans produce 70 percent of the earth's oxygen, much more than tropical forests and other biomes: 50 percent by phytoplankters and 20 percent by seagrasses and other plankters ([Gruber et al. 2019](#); [IUCN 2017](#); [National Geographic Society 2021](#); [NOAA Office of Ocean Exploration and Research 2021](#); [The Nature Conservancy 2020](#)).

Themistocles was correct. Controlling the sea means controlling everything—in this case, global human survival, security, and sustainability.

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## ARCHIPELAGIC ECOLOGY OF THE PHILIPPINES

The Philippine archipelagic landscape accentuates the closely intertwined dynamics of land-sea interactions. Land and sea ecosystems closely and immediately affect each other. In the case of the Philippines, it has over seven times more sea (2.2 million km<sup>2</sup> including exclusive economic zone [EEZ]) than land (0.30 million km<sup>2</sup>) (The World Bank 2018; WEPA 2021). Of its total seas, 266,000 km<sup>2</sup> are coastal (littoral) stretched across 36,298 km of coastlines; most of Philippine seas (1,934,000 km<sup>2</sup>) are oceanic (WEPA 2021).

The country is tropical with a total territory and EEZ of almost 2.5 million km<sup>2</sup> and a population of about 109 million (2020).<sup>1</sup> The Philippines is among the world's ecologically "megadiverse" countries (CBD 2021; Carpenter and Springer 2005), hosting almost 53,000 species. About 15,000 are plant species (5% of the earth's flower species) and 38,000 are fauna (with > 50% of them endemic). In total, about 75 percent of the world's flora and fauna species are found in the Philippines. These numbers translate to  $2.1 \times 10^{-4}$  macroscopic species per area and  $2.0 \times 10^{-3}$  macroscopic species per capita.<sup>2</sup> (In comparison, with 1.5 million known macroscopic species and a 2020 population of around 8 billion, the global species per capita is only  $1.8 \times 10^{-4}$ ).

Of the Philippines' 53,000 macroscopic species, 11,237 species are terrestrial. These include ~8,000 species of flowering plants, ~1,000 species of ferns, and ~800 species of orchids; it has 1,437 species of animal wildlife. In comparison, the country has 14,989 species of marine organisms (3rd globally) or ~27 percent of its total macroscopic biodiversity (which is about twice the global ratio of 15%). These translate to 1.3

$\times 10^{-4}$  marine species per capita, which is much higher than the global  $2.8 \times 10^{-5}$  per capita (CBD 2021; DENR-BMB 2014; FishBase 2019; Labatos 2020).

Philippine seas host marine-based industries. These include capture fisheries and aquaculture, coastal and marine tourism, manufacturing, education and research and development (R&D), shipping and transportation, construction, mining and quarrying, energy, real estate, financial intermediation (insurance), and public administration and defense (Ebarvia 2020; see also an earlier work on ocean valuation by Constanza et al. 2014).

With their high biodiversity and numerous industries, Philippine seas offer significant economic value.

But while being archipelagic offers the country considerable value from marine natural capital, it has inherent vulnerabilities. It faces high risks of sea level rise, higher frequency and intensities of severe weather events, and longer and more extreme seasonal variations of heat-moisture regimes. Sea levels in the country are on average rising faster than the global average and this poses increased hazards of storm surges that threaten low-lying coasts. The 19–20 typhoons that enter the country's area of responsibility each year, of which seven to nine make landfall, pose recurring risks to economic and social productivity and stability. Reducing these risks exacts high costs to society and the economy. Moreover, longer and more severe El Niño and La Niña episodes threaten agriculture, biodiversity, and freshwater stocks (USAID climatelinks 2017).

Its location in the western Pacific, terrain, and population densities in the face of its fragmented and generally small land masses, makes it widely vulnerable to the destructive effects of typhoons, flooding, landslides, shortages in freshwater stocks, and the spread of diseases. A continually rising population in a land-starved archipelago likewise poses threats to land-based agriculture and to both terrestrial and marine biodiversity (Cruz et al. 1992). As more of the country's limited lands are inevitably converted to spaces for human habitats and infrastructure, the land areas for farming,

1 Reportedly 109,035,343 as of 1 May 2020 (PSA 2021)

2 Species count changes fast because new species are constantly being identified; this is especially true in the Philippines. The numbers here are mostly as indicated in the cited sources; the species per area and per capita are the author's calculations based only on the indicated count of macroscopic species (CBD 2021; DENR-BMB 2014; FishBase 2019; Labatos 2020).

grazing, and wildlife shrink (Moya et al. 1997). This translates to increased pressures to overfish or to derive food and protein from the sea and widening disturbance of the quality and functions of marine ecosystems (USAID Fish Right 2021).

Risks and vulnerabilities in the land areas of the Philippine archipelago are systemically linked to the risks and vulnerabilities of its maritime domains, forming one singularity.<sup>3</sup>

In brief, the archipelagic landscape of the Philippines is both valuable and vulnerable. These are its features as an ecological platform of the country's economy. Managing and harnessing the land-sea continuum of the archipelago backdrops its archipelagic power to drive the overall socioeconomic productivity in the country.

This paper focuses on how the seas of the Philippines possess potentials to advance the country's CoViD recovery and its post-CoViD economy.

## ECONOMY OF THE PHILIPPINES

"The year 2020 began with the Philippine economy in a position of strength," said Dr. Benjamin Diokno, the Governor of the Bangko Sentral ng Pilipinas (Central Bank of the Philippines) in a speech to the Rotary Club of Manila on 6 January 2021.<sup>4</sup> "After exhibiting 84 consecutive quarters of growth," Governor Diokno added, "the Philippine economy contracted in the first three quarters of 2020, amounting to an average real GDP decline of 10 percent."

But there are now early signs of recovery,<sup>5</sup>

according to Governor Diokno, indicating some resilience of the economy. This optimism is reflected by the June 2021 Philippine Economic Update of the World Bank, which found that after a period of 4.2 percent year-on-year contraction of the economy by Q1 2021, the government's acceleration of public spending from 19.1 percent of GDP in Q1 2020 to 23.4 percent in Q1 2021 makes the economy to likely recover and reach around six percent growth by 2023 (The World Bank Group 2021).

This begs the question: could the Philippines have done better in the rapidity and expanse of its CoViD-19 recovery? Recovery funding was first estimated in May 2020 at PHP 1.7 trillion (or 9.1% of GDP).<sup>6</sup> This was in the early stages of the pandemic (Malayang 2020a). It has since worsened so that the entire 2021 national budget of 4.5 trillion now focuses on three pillars of recovery: reset (addressing the pandemic as it happens); rebound (reviving infrastructure development to stimulate the economy); and recover (an all-of-government effort to adapt to the "new normal") (DBM 2021).

The country could have allocated more resources for recovery now if it had been able to mobilize much earlier the full socioeconomic value and potentials of its ocean economy as component of its total national economy (OECD 2016). That is, the country could have been in a much stronger position now if it had much earlier restored, improved, and maintained the quality and productivity of its marine resource systems and

3 The risks are also interrelated and are linked (e.g., see BTI 2020).

4 Governor Diokno cites the following indications of strength: real GDP growth of 6.4 percent over a 10-year period from 2010 to 2019; stable inflation within the same period; robust external payments position; record-high international reserves; improved external debt metrics; healthy public finances; the soundness and stability of banks; and a sufficient "monetary and fiscal space to navigate the first few months of this [CoViD] crisis" (BIS 2021).

5 Governor Diokno cited the following indications of rebound: rising business confidence; rebounds

in manufacturing; rising consumer confidence; expanding retail, recreation, and other economic activities; more people going out of homes after the long lockdowns; moderating unemployment rates; price pressures are manageable with inflation averaging 2.6 in 2020; the banking system remaining to be resilient and stable and having ample liquidity; domestic liquidity continues to grow at a double-digit pace; easing of outstanding loans of universal and commercial banks; and the appreciation of the peso (BIS 2021).

6 Philippine peso; PHP 1.00 = USD 50.23 (23 July 2021) (<https://www.bsp.gov.ph/statistics/external/day99.aspx>)

ecosystem services in significant and sustainable ways,<sup>7</sup> consistent with the country's constitutional prescription of a "balanced and healthful" interaction of biotic and abiotic components "in accord with the rhythm and harmony of nature" ([Official Gazette of the Republic of the Philippines 2021](#)).

## VALUE FROM PHILIPPINE SEAS

The ocean economy of the Philippines includes two principal components: marine biodiversity and sea-based industries. These are the major generators of socioeconomic value to the people and economy of the country consistent with the blue economy development framework of the World Bank (n.d.) and the 2012 Changwon Declaration Toward an Ocean-Based Blue Economy ([PEMSEA 2012](#)).

### Marine Biodiversity

Fisheries have high socioeconomic value to the people and economy of the Philippines ([USAID FishRight Program 2021](#)). The country is one of the top fisheries producers in the world ([Lamarca 2017](#)), a big producer of capture and culture fisheries in both volume and species diversity.<sup>8</sup> In 2018, it produced 2 million metric tons of capture fisheries and 2.3 million metric tons of culture fisheries. Much of the capture fisheries was from municipal fishing (1.1 million metric tons) and only 946,437.62 MT from commercial fishing ([Malayang et al. 2020](#); [Cudis 2021](#); [FAO 2021a](#); [Trono and Largo 2019](#)). The Philippines also produces substantial marine

botanicals like seaweeds ([Trono and Largo 2019](#)). Large populations of Filipinos depend on fisheries for income (1.9 million in 2019) ([Ebarvia 2020](#)) and for protein and nutrition security (~60% of the population consume an average of 40 kg/year or 109 g /day) ([Lamarca 2017](#)). It was estimated that in value terms, fisheries harvests in the country was PHP 244 billion in 2017 and increased to PHP 282 billion in 2019 ([PSA 2020](#)).

In addition to fisheries, Philippine seas hold a vast treasury of genetic information. While their full extent are yet to be known, current inventories indicate a high diversity of both macro- and micro-biotic species ([Carpenter and Springer 2005](#); [DENR-BMB 2014](#); [Nemenzo 1981](#); [Silva, Meñez, and Moe 1987](#); [Springsteen et al. 1986](#); [Trono and Largo 2019](#); [Unico Conservation Foundation 2021](#)). The inventory is likely to keep growing as more surveys are done.

This rich marine genetic library poses potentially high value in the biotechnology industry, particularly in genetic engineering and the development of transgenics ([FAO 2021b](#)). Marine biodiversity has been surveyed, prospected, and assayed for genetic information that provide the basis for developing pharmaceuticals (antibacterial; anti-inflammatory; neuroprotective; antiparasitic; antiviral agents; and anticancer), bioremediation compounds, and even energy (e.g., [ISAAA 2021](#); [Malve 2016](#); [Marine Biotechnology ERA-NET 2021](#); [Nikolaivits et al. 2017](#)). It might be noted that the global biotechnology market is large: it was estimated to be USD 447.92 billion in 2019 and is expected to reach USD 833.34 billion by 2027 ([Intrado GlobeNewswire 2020](#)) and USD 244 trillion the following year 2028 ([Grand View Research 2021](#)).

[Ebarvia \(2020\)](#) (citing [Azanza et al. 2017](#)) estimates that in 2016, the value of coastal and marine resources in the Philippines was about PHP 75 trillion (USD 1,500 billion). It exceeded the country's GDP that year (USD 318.6 billion) ([PSA 2017](#)). And this did not include two ecosystem services of coastal biodiversity: "blue carbon" (USD 8.4 billion) and coastal protection (USD 1.8 billion) ([Ebarvia 2020](#)) (a similar

7 This is optimizing benefits from oceans and the sustainability of the oceans and of their ecological components and ecosystem services. Here, "sustainable" is used in the sense of "sustainable development" as defined by the [United Nations Educational Scientific and Cultural Organization \(2021\)](#).

8 Haribon reports that as of 2016, the Philippines hosts 3,212 fish species (731 of which are commercially important); it was second only to Australia in seagrass diversity in the world ([The Haribon Foundation 2016](#)).

valuation exercise [not on the Philippines] was done by [Constanza et. al. 2014](#)). The PHP 75 trillion, however, is a stock variable while GDP is a flow variable and so the two are not entirely or directly comparable. But if coastal and marine resources were better and sustainably harnessed, they would likely contribute to GDP much higher than they are presently pegged at about two percent ([Habito 2021a](#)).

The Philippine Biodiversity Strategy and Action Plan (PBSAP) 2015 to 2028 estimates the value of coastal and marine resources of the Philippines at PHP 2.3 trillion, much lower than Ebarvia's cited estimate of PHP 75 trillion. This could be because of differences in estimation methods, how data were synthesized, the purpose of the estimates, and categorization and clumping of ecosystem services ([Ebarvia 2021](#)).

When amply backstopped by a robust biosafety regulatory environment that ensures their sustainability and the nation's sovereign rights to them, the high genetic diversity of Philippine seas could give Filipinos a potentially high equity per capita in global gene-based industries.

## Sea-Based Industries

Industries are other generators of value from Philippine seas. Tourism contributed 13 percent to GDP in 2019 ([DOT 2020](#)). Much of Philippine tourism is coastal as indicated by the regions with the highest number of tourism establishments, which are the country's most archipelagic regions: Region 7 (2,210 establishments) and Region 6 (1,451) ([DOT 2019](#)). Pre-pandemic arrivals and receipts peaked in 2019. That year, arrivals totaled 8,260,913 (15.24% rise from 2018 and 54% from 2015) and receipts totaled PHP 482.15 billion (18.80% higher than 2018 and 111% from 2015) ([DOT 2019](#)).<sup>9</sup> Arrivals plunged 83 percent in 2020 (the first year of the pandemic) ([Rey 2021](#)) but are widely expected to rebound quickly as both international and domestic travel restrictions ease.

9 These are 2019 numbers. Regions 4 and 4-B have each less than 1,400 and the rest of the regions only have three-digit counts.

Other than tourism and fishing, Ebarvia (2021) lists nine other major industries in Philippine seas. These are education; public administration and defense; real estate renting and business activities; financial intermediation services (maritime insurance); electricity, gas, and water supply; ports and shipping; construction; manufacturing; and mining and quarrying (offshore and gas). Excluding fisheries (which was placed under the category of "coastal and marine resources"), Ebarvia placed the value of tourism and the other nine industries in 2016 prices at PHP 566 billion (USD 11.9 billion) or seven percent of GDP that year ([Ebarvia 2020](#); see also [PSA 2017](#) and [2019](#)).

Many Filipinos derive incomes from sea-based livelihoods within the country and outside the country. It was 2.75 million in 2018 (or 6.7% of total employments in the country that year). A greater number (1.90 million) was in fishing, but this increased to 1.95 million by 2019. Sea-based overseas workers totaled 378,072 in 2017 and remitted to the country USD 6.5 billion in 2019 ([Ebarvia 2021](#)).

[Ebarvia \(2020\)](#) suggests that between biodiversity and industries, biodiversity offers the Filipino people and its economy a significantly much higher value (PHP 75 trillion) than all non-fisheries sea-based economic activities (PHP 566 billion).<sup>10</sup>

The total biodiversity and industrial value of Philippine seas could be tapped to harness higher economic and financial capacities to recover from the CoViD-19 pandemic and improved long-term growth prospects for the Filipino people.

## Legacy Values to the World

Philippine biodiversity has inherent legacy value to the world because genetic information has global benefits. Species richness in Philippine

10 Two cautions, however, when comparing the biodiversity and industry values are that (a) biodiversity is a stock variable and industry includes generated incomes that are flow variables ([Habito 2021a](#)) and (b) there could be double counting in the two industries could involve biodiversity stocks ([Ebarvia 2021](#)).



seas affect the productivity of the oceans around the country's maritime domain (Malayang 2021a; 2021b).

Ecosystem services in Philippine islands and wetlands include supporting the life cycles of migratory birds and marine mammals and other fauna (BMB 2014). Evapotranspiration from the country's seas could have impacts on regional and global water cycles (Lagerloef et al. 2015).

Thus, it would be the world's interests—not just the Philippines'—that the country's archipelagic landscape be kept well and to ensure that the integrity of its marine ecosystems is high.

### THREATS TO PHILIPPINE SEAS, BIOTA, AND ECOSYSTEMS

Ironically, while among the world's richest in life forms and having high socioeconomic importance to Filipinos, Philippine marine ecosystems are highly threatened (Alexandra Cousteau 2017).

Among the clear and most serious threats are the combinations of overfishing; illegal, unreported, and unregulated (IUU) fishing; habitat destruction; increased demand for fisheries; and climate change (Elliot 2015; One Ocean 2021; USAID Fish Right Program 2021). Seventy-five percent of fishing grounds in the country are overfished (Elliot 2015). Meanwhile, IUU fishing involved PHP 63 worth of fisheries in 2019, or ~40 percent of capture fishery harvests that year (Habito 2021b). Degraded coral reefs, mangrove cover, seagrass meadows, and coastal waters are associated with precipitous losses of fisheries stocks and biodiversity (USAID Fish Right Program South Negros Team 2021).

On the other hand, increased demand for fisheries is associated with continuing population growth, declining harvests, inefficient marketing and supply chains, spikes in the prices of pork and meats, and a high rate of post-catch wastes and losses (about 40%) (Cudis 2021; WorldFish Center 2008; Malayang et al. 2020). Climate change, now at crisis level, is, of course, an upending systemic game changer: hotter sea surfaces; acidification;

coral bleaching; higher pollution pressures resulting from intensifying effort to produce food and subsequent increased runoffs of farming inputs and of eutrophication from aquaculture; and increased sedimentation of coastal waters due to increased soil erosion from drier soils and from more frequent and high volume flooding due to increased frequencies and intensities of extreme weather events (BTI 2020; Dahlman and Lindsey 2020; Frontiers Media 2021; NOAA 2020; Yi Guan et al. 2020).

But probably the most serious threat to the socio-economy of Philippine seas is the “policy blindness” of the country to its vast and rich ecosystem services. These seas and their wealth of ecosystem services are yet to be proportionately appreciated and more fully harnessed for their value in the government's national development plans and fiscal programs and priorities.

### Two cases in point:

**1. The Philippine Bureau of Fisheries and Aquatic Resources' (BFAR's) budgets in 2016 to 2020 have been averaging only 15.4 percent of the Philippine Department of Agriculture's (DA's) annual disbursements.** DA disbursements averaged only 81 percent of its total budget and so the actual percentage of BFAR's budget—if compared to the total DA budgets in those years—would have been even lower. This year (2021), BFAR's budget has been reduced from PHP 6.1 billion in 2020 to only PHP 4.4 billion in the current National Expenditure Program (or NEP). The total budgets for both BFAR and other fisheries-related offices in the DA (e.g., for R&D) averaged only 16.3 percent of annual DA disbursements in the same period. The Department of Environment and Natural Resources (DENR), the Philippines' principal environmental governance authority, puts reforestation and watershed management (terrestrial programs) as top budget priorities; their budgets averaged about PHP 8.0 billion per year in 2016 to 2021. Its next highest allocations are for natural resource

enforcement and regulation (an average of about PHP 4.5 billion per year in the same period, or only slightly half of those for forests and watersheds). In contrast, its budget for “coastal and marine environment” averages just about half a billion a year. Even taking into account absorptive capacities in budget disbursements, which are persistent issues across government agencies, these comparably low and declining budgets for BFAR indicate a focus on land development investments and fiscal prioritization and scarcely on the country’s blue economy (Malayang 2020b; 2021a).

2. ***Ambisyon 2040, the Philippine Government’s summation of the “collective long-term vision and aspirations of the Filipino people for the country in the next 25 years,” stipulates a focusing of development investments on eight sectoral concerns.***<sup>11</sup> Fisheries- and ocean economy-related interests are embedded as elements of only some of the concerns (i.e., mainly in agriculture and tourism) (NEDA 2016).

The low visibility in national development plans and low priority in fiscal programs for ocean economy indicate a “policy blindness” to the socioeconomic potentials of the “life-rich” maritime domain of the Philippines, and of its high industrial potentials. In turn, the marine ecosystems of the country are not fully harnessed for their potentials as economic powerhouses for urgent pandemic recovery and long-term post-pandemic growth and development, in tandem with development investments on land. Additionally, their protection is not deemed a political and policy priority and the resulting low public investments on protecting the seas multiplies

the severity of the threats to them; in this case, “policy blindness” translates to being actually a principal threat in itself.

## POLICY RECOMMENDATIONS

In light of the indicated high ecological and socioeconomic value of Philippine marine biodiversity and sea-based ecosystem services, it appears necessary that it be appropriately embedded in the country’s pandemic recovery strategies, development planning policy, and expenditure programs.

Three policy actions seem strategic and necessary. These three are recommended for further and more detailed discussion by policymakers and economic and planning managers of the Philippine Government and the Congress of the Philippines:

**Recommendation 1: The Philippine Government shall declare as national policy that all terrestrial and aquatic life forms and their genetic information are national treasures of utmost national importance and subject to heightened protection by the state; that any unauthorized activity to survey, prospect, and extract genetic information from any and all life forms in the country are high national security concerns.**

In the immediate term, the indicated value of the country’s marine biodiversity and ecosystem services could be validated and used as additional basis for revenue assumptions and projections of the annual National Expenditure Program (or NEP) in the target years for recovery. This would allow for expanding budgetary commitments for CoViD-19 pandemic recovery.

In the longer term, the indicated value could be harnessed to expand national capacities to secure and sustain future growth of the economy.

Toward these two ends, the following action points are recommended to be taken by the Philippine Government:

11 housing and urban development; manufacturing; connectivity; education services; tourism and allied services; agriculture; health and wellness services; and financial services.



1. ***Mobilize the National Economic and Development Authority (NEDA) and the Philippine Statistics Authority (PSA) to validate recent estimates of the value of Philippine marine biodiversity and ecosystem services.*** This will be used as basis for estimating revenue potentials in the next three to five years, or whatever would be the anticipated period of recovery from the CoViD-19 pandemic.<sup>12</sup>
2. ***Adopt six measures on protecting the biodiversity treasures of the Philippines (terrestrial and marine) throughout its territory and jurisdictions:***

- a. Mainstream learnings on the unity of land and sea ecosystems as the fundamental ecological platform for social and economic life of Filipinos, the country, and of peoples and places outside of the Philippines. Instilling concepts of the country's archipelagic environment as being a complex land-sea continuum of ecosystem services and socioeconomic costs and benefits would be foundational to making biodiversity protection a whole-of-nation and all-of-landscape concern. It could lead to animating multiple aspects of governance from planning, budgeting, and regulations (Hoffman and Muttarak 2020).
- b. Biological assets in the country's terrestrial and maritime domains shall be physically and intellectually protected from biopiracy (to include

unauthorized surveys, bioprospecting, and gene collection and mapping), and from unnatural, unauthorized, and unsafe genetic modifications.

- c. All property and intellectual rights to the country's gene pool (both terrestrial and marine) found within its territory and EEZ shall be fully reserved and secured.
- d. Industrial potentials of the country's aquatic regimes shall be properly and effectively buffered from being weakened and compromised by landscape modifications, unsafe and illegal coastal land uses, and pollution.
- e. The maritime domain of the country (including its EEZ and all life forms and parts that are found within it in whatever state and presentation) shall be secured by the government of the Philippines consistent with the constitution, body of relevant national and international laws, and the best available science. They shall be governed entirely and exclusively by the Philippine Government to ensure that their physical, chemical, and biological features and processes and the ecosystem services that sustain them and their habitats are "balanced and healthful in accord with the rhythm and harmony of nature" (Official Gazette of the Republic of the Philippines 2021).
- f. The protection of maritime domains including EEZs shall be among the top three program and budget priorities of the departments of Foreign Affairs, National Defense, and Interior and Local Government. Likewise, the sustainable development and mobilization of their natural capital for the country's food security and socioeconomic growth and well-being shall be among the top three program and budget priorities of NEDA, and the departments of Science and Technology, Agriculture, Environment and Natural Resources, Education, and Finance, including the Commission on

12 NEDA and PSA might use principles and methods such as those described in the United Nations System of Environmental Economic Accounting (<https://seea.un.org>) and as has been correspondingly proposed in House Bill 9181 (An Act Institutionalizing the Philippine Ecosystem and Natural Capital Accounting System [PENCAS]) introduced by Deputy Speaker Loren Legarda of the House of Representatives, and the corresponding Senate Bill 2184 introduced by Senator Ramon Revilla, Jr., Congress of the Philippines.

Higher Education, and the Technical Skills and Development Authority.

**Recommendation 2. The Philippine Government shall set up a national authorization, licensing, and genetic information control and security protocol on surveying, prospecting, and extraction of genetic information in the country.**

While needing to secure the country's seas and maritime wealth, the Philippines, as a responsible part of the global community of nations, shall need to also ensure that this wealth serves not only national interests, but also the shared interests of all humankind and the global commons. The value of the Philippine maritime biodiversity and industrial potentials, while reserved nationally, would be much expanded when shared globally. Toward this end, the following action points are recommended to be done by the Philippine Government in collaboration with pertinent international science bodies and institutions:

1. ***Develop and adopt a National Genetic Access Authorization and Licensing System*** (e.g., [Dyke et al. 2018](#); [Greiber et al. 2012](#)) that shall ensure Philippine control of the production, storage, and legitimate international access to the genetic information found and immanent from within the country's domain, including EEZs. The system shall reflect different levels and modes of control over the genetic information of endemic and non-endemic biota found across the landscape-seascape continuum of the country.
2. ***Establish a legal protocol for ensuring the country's continuing equity rights*** to the utilization of the genetic information found within the national land and maritime domains and to ensure the Filipino peoples' share of the benefits gained from their application or use.

**Recommendation 3. The Philippine Government shall adopt a national planning and budgeting framework that makes the restoration, protection, conservation, and sustainable utilization of marine biodiversity, ecosystems, and ecosystem services a development planning and budgeting priority.** This is to harness their full potentials to support national food and nutritional interests and to increase the country's equity in global bio-based industries and economies.

Development planning and fiscal programs must aim to enhance national capacities to harness modern biotechnology scientifically, safely, and sustainably to backstop and elevate levels of national food, nutrition, health, industrial, environmental, economic, and human security. Planning and public investments to harness ocean socioeconomic productivity would be crucial to expanding the value of the country's marine biodiversity and ecosystem services. Toward this end, the following are recommended to the Philippine Government:

1. ***Develop and adopt a national planning policy anchored on an archipelagic framework of national development, which highlights the unity and continuity of land and sea ecosystems, social and cultural systems, and economies.*** The policy could be based on the ArcDev Framework for Sustainable Philippine Archipelagic Development earlier drafted by the DENR and the Marine Environment and Resources Foundation, Inc. (MERF), with support from the United Nations Development Programme ([DENR](#), [UNDP](#), and [MERF 2004](#)). The framework might be updated and sharpened in light of the upending effects of the CoViD-19 pandemic and the worsening climate crisis, and shall be made the basis for stressing archipelagic perspectives and assumptions in the country's current national planning paradigm.

2. **Enact a National Maritime Domain Awareness Policy, Plans, and Programs (MDA PPP)**, encompassing: (a) continuing monitoring and evaluation of physical, biological, chemical, and other threats to Philippine seas and EEZ and to their biodiversity and ecosystem services; (b) measures and actions to reduce and control the threats; and (c) zoning areas for industrial, fisheries, and conservational and habitat restoration activities. The MDA PPP integrates multiple concerns relating to the rightful and sustainable uses of the sea, its ecological integrity, its economic productivity, and its governance and security (AXYS Technologies Inc. 2021; US Dept. of Defense n.d.).
3. **Set national marine living resource stock monitoring baselines and methodological standards for multi-method triangulated assessment of increases and declines of the stocks.** Baselines and standards of monitoring and assessment strengthen national capacities to undertake a continuing and consistent surveillance of the state of the country's marine genetic treasury, which would be critical for their effective governance, management, and sustainable use. Certain past surveys like the Albatross expedition in 1907–1910 (Smith and Williams 1999) or recent ones conducted by the government (PSA 2019b)<sup>13</sup> may be used as basis for developing a national marine biodiversity index to serve as an “immovable milestone” against which to track stock increases and declines in subsequent years. A combination of assessment methods may be prescribed to achieve robustness of results in light of inherent limitations of specific methods (see Nuijten 2011; also, Timans, Wouters, and Heilbron 2019).
4. **Integrate fisheries in farming systems.** Intercropping fisheries in the country's limited agricultural lands would, *caeteris paribus*, achieve three results: (1) animal protein would be produced in comparatively shorter regeneration cycles (i.e., than pork, beef, or poultry) (Armada 2021); (2) the carbon footprint of animal-based protein production would be lower (Boyd 2013); and (3) pressures on stressed capture fisheries would be reduced (Willmann, Halwart, and Barg 1998; Malayang et al. 2020). In this farming system, fish culture is ecologically possible, or appropriate, and is economically viable (Gerard and Gros 2011).
5. **Set a national fiscal and public financing policy for ocean economy protection, development, and for R&D** on harnessing marine biodiversity and ecosystem services that support national food, health, industrial, environmental, economic, and human security aspirations of the Filipino people. Fiscal support and financing would be crucial. But in light of the Mandanas-Garcia Ruling<sup>14</sup> and its implementation in 2022 (Executive Order No. 138 s. 2021), the configuration of fiscal support would probably be split between the local government units (LGUs) and the national government. The protection, development, and governance of municipal waters<sup>15</sup> would likely be fully devolved to and

13 Kent Carpenter refers to the issue of shifting baselines in his presentation in the first session of “Oceans of Opportunity: Southeast Asia's Shared Maritime Challenges” (a Webinar organized by the Center for Strategic and International Studies [CSIS]) 7 June 2021. He cited Daniel Pauly's earlier works on the topic (see Pauly 2010 and 2019).

14 In the Mandanas et. al. vs. Executive Secretary, et al. (G.R. No. 199802, G.R. No. 208488), the Supreme Court ruled that “all collections of national taxes, except those accruing to special purpose funds and special allotments for the utilization and development of the national wealth, should be included in the computation of the base of the just share of LGUs...the just share of LGUs from national taxes is not limited to the national internal revenue taxes collected by the Bureau of Internal Revenue but includes collections (customs duties) by the Bureau of Customs” (Republic of the Philippines Supreme Court 2018).

15 Defined in Republic Act 8550 (Fisheries Code of the Philippines, 1998) to “include not only streams, lakes, inland bodies of water and tidal waters within the municipality which are not included within the protected areas as defined under Republic Act No. 7586 (The NIPAS Law), public forest, timber lands, forest

be under the responsibilities and mandates of LGUs, whose share of national revenues in 2022 would soar to PHP 1.083 trillion (4.75% of GDP) because of Mandanas-Garcia. It would have been only PHP 848.44 billion (3.72% of GDP) without Mandanas-Garcia (The World Bank Group 2021). Waters and oceans outside municipal waters would probably remain under the fiscal responsibility of the national government (e.g., the Philippine Navy, Philippine Coast Guard, and the DA, DENR, and the Department of Science and Technology) (Republic of the Philippines Supreme Court 2018; Executive Order No. 138 2021).

If adopted and executed, these recommendations may expand the profile of the Philippines' "archipelagic advantage" in the country's build-up of national capacities to respond to and recover from disruptions on its development and growth; and to secure and future-proof its economy and people.

Themistocles might as well have added, relating to the Philippines: losing the sea risks losing everything.

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reserves or fishery reserves, but also marine waters included between two lines drawn perpendicular to the general coastline from points where the boundary lines of the municipality touch the sea at low tide and a third line parallel with the general coastline including offshore islands and 15 km from such coastline. Where two municipalities are so situated on opposite shores that there is less than 30 km of marine waters between them, the third line shall be equally distant from opposite shore of the respective municipalities" (Section 4, para. 56, Republic of the Philippines Tenth Congress 1998).

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