



National State of Oceans and Coasts 2018:  
**Blue Economy Growth**

# PHILIPPINES



Empowered lives.  
Resilient nations.







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## **National State of Oceans and Coasts 2018: Blue Economy Growth of Philippines**

December 2019

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# Acronyms and Abbreviations

4Ps	– Pantawid Pamilyang Pilipino Program	CITES	– Convention on International Trade in Endangered Species of Wild Fauna and Flora
ACB	– ASEAN Centre for Biodiversity	CLUP	– Comprehensive Land Use Plan
ADB	– Asian Development Bank	CMEMP	– Coastal and Marine Ecosystem Management Program
AFMA	– Agriculture and Fisheries Modernization Act of 1997	CMS	– International Convention on Conservation of Migratory Species of Wild Animals
AFS	– International Convention on the Control of Harmful Anti-fouling Systems in Ships	CO <sub>2</sub>	– carbon dioxide
AIS	– Automatic Identification System	COBSEA	– Coordinating Body on the Seas of East Asia
APEC	– Asia-Pacific Economic Cooperation	CPA	– Cebu Ports Authority
APFIC	– Asia-Pacific Fishery Commission	CRED	– Centre for Research and Epidemiology of Disasters
APSN	– APEC Port Services Network	CRM	– coastal resource management
ARMM	– Autonomous Region in Muslim Mindanao	CS	– Celebes Sea
ASEAN	– Association of Southeast Asian Nations	CSR	– corporate social responsibility
BBL	– barrel	CTI-CFF	– Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security
BFAR	– Bureau of Fisheries and Aquatic Resources	DA	– Department of Agriculture
BGFTEZ	– Bucas Grande Flagship Tourism Economic Zone	DAO	– DENR Administrative Order
BIMP-EAGA	– Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area	DAP	– Development Academy of the Philippines
BINU	– Biodiversity Indicators for National Use	DENR-EMB	– Department of Environment and Natural Resources – Environmental Management Bureau
BOC	– Bureau of Customs	DENR-BMB	– Department of Environment and Natural Resources – Biodiversity Management Bureau – Coastal and Marine Division
BOD	– Biochemical oxygen demand	CMD	
BOI	– Board of Investments	DENR-ERDB	– Department of Environment and Natural Resources – Ecosystems Research and Development Bureau
BWM	– International Convention for the Control and Management of Ships' Ballast Water and Sediments	DENR-FASPS	– Department of Environment and Natural Resources – Foreign-Assisted and Special Projects Services
CALABARZON	– Cavite-Laguna-Batangas-Rizal-Quezon	DENR-FMB	– Department of Environment and Natural Resources – Forest Management Bureau
CBD	– Convention on Biological Diversity	DENR-MBCO	– Department of Environment and Natural Resources – Manila Bay Coordinating Office
CBMSH	– community-based multi-species hatcheries	DENR-MGB	– Department of Environment and Natural Resources – Mines and Geosciences Bureau
CCA	– climate change adaptation		
CCC	– Climate Change Commission		
CCTV	– closed-circuit television units		
CDF	– Countrywide Development Fund		
CDP	– Comprehensive Development Plan		
CFP	– Camaligan Fish Port		
CHED	– Commission on Higher Education of the Philippines		
CI	– Conservation International – Philippines		

DENR-PPS	– Department of Environment and Natural Resources – Policy and Planning Services	FFA	– Pacific Islands Forum Fisheries Agency
DENR-RBCO	– Department of Environment and Natural Resources – River Basin Control Office	FFWS	– Flood Forecasting and Warning System
DFA	– Department of Foreign Affairs	FIES	– Family Income and Expenditure Survey
DFPC	– Davao Fish Port Complex	FiT	– Feed-in-Tariff
DILG	– Department of Interior and Local Government	FLEMMS	– Functional Literacy, Education and Mass Media Survey
DND	– Department of National Defense	FSP	– Fisheries Sector Program
DO	– dissolved oxygen	GAA	– General Appropriations Act
DOE	– Department of Energy	GATT	– General Agreement on Tariffs and Trade
DOF	– Department of Finance	GDP	– gross domestic product
DOH	– Department of Health	GEF	– Global Environment Facility
DOST	– Department of Science and Technology	GHG	– greenhouse gas
DOT	– Department of Tourism	GIWA	– Global International Waters Assessment
DOTC	– Department of Transportation and Communication	GIZ	– Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
DOTR	– Department of Transportation	GMA	– Ginintuang Masaganang Ani
DPSIR	– Drivers-Pressures-State-Impact-Response	GMS	– Greater Mekong Sub-region
DPWH	– Department of Public Works and Highways	GNI	– gross national income
DRRM	– disaster risk reduction and management	GOCC	– Government owned- and controlled corporations
DSWM	– Department of Social Welfare and Development	GPAS	– Green Port Award System
DTI-BOI	– Department of Trade and Industry-Board of Investments	GrAT	– Gruppe zur Förderung der Angepassten Technologie or Center for Appropriate Technology
EAFM	– Ecosystem approach to fisheries management	GRDP	– gross regional domestic product
EAS	– East Asian Seas	GRT	– Gross Registered Tonnage
ECC	– Environmental Compliance Certificate	GSFPC	– General Santos Fish Port Complex
eCDTS	– Electronic Catch Documentation and Traceability System	GT	– gross tonnage
EEZ	– Exclusive Economic Zone	GVA	– gross value added
EIS	– Environmental Impact Statement	ha	– hectare
EMB SWMD	– Environmental Management Bureau – Solid Waste Management Division	HABs	– harmful algal blooms
EMP	– Environmental Management Plan	HDI	– Human Development Index
ENSO	– El Niño Southern Oscillation	IBAMO	– Iligan Bay Alliance in Misamis Occidental
EO	– Executive Order	ICD	– Integrated Conservation and Development Zone
est.	– estimate	ICM	– Integrated coastal management
EU	– European Union	ICRMP	– Integrated Coastal Resource Management Project
FAO	– Food and Agriculture Organisation	ICTSI	– International Container Terminal Services, Inc.
		IEC	– information, education and communication
		IFPC	– Iloilo Fish Port Complex

IMO	– International Maritime Organization	MIMAROPA	– Mindoro-Marinduque-Romblon-Palawan
IMS	– Integrated Management System	mL	– milli-liter
IMT-GT	– Indonesia–Malaysia–Thailand Growth Triangle	mm	– millimeter
I-O	– Input-Output	MMB	– million barrels
IOSEA	– Indian Ocean and Southeast Asia (Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia)	MMSCF	– million standard cubic feet
IPCC	– Intergovernmental Panel on Climate Change	MOU	– Memorandum of Understanding
iPORTS	– Internet-based Port Operations Receipting for Terminal Systems	MPA	– marine protected area
ISO	– International Organization for Standardization	MPN	– Most Probable Number
ITH	– Income tax holiday	MRA-TP	– ASEAN Mutual Recognition Arrangement on Tourism Professionals
IUCN	– International Union for Conservation of Nature	MRB	– major river basin
IUU	– Illegal, Unreported, and Unregulated	MRF	– material recovery facility
kg	– kilogram	MSU	– Mindanao State University
km	– kilometer	MTOE	– millions of tonnes of oil equivalent
km <sup>2</sup>	– square kilometer	MW	– megawatt
km <sup>3</sup>	– cubic kilometer	MWh	– megawatt-hour
kTOE	– kilotonnes of oil equivalent	MWSS	– Metropolitan Waterworks and Sewerage System
Lao PDR	– Lao People’s Democratic Republic	NACRE	– National Assessment of Coral Reef Environments
LCCAP	– Local Climate Change Action Plan	NAMRIA	– National Mapping and Resource Information Authority
LED	– light-emitting diode	NCCAP	– National Climate Change Action Plan
LFPC	– Lucena Fish Port Complex	NCR	– National Capital Region
LFS	– Labor Force Survey	NDHS	– National Demographic and Health Survey
LGU	– Local Government Unit	NDRRMC	– National Disaster Risk Reduction and Management Council
LLDA	– Laguna Lake Development Authority	NEDA	– National Economic and Development Authority
LNG	– liquefied natural gas	NESAP	– National Ecotourism Strategy and Action Plan
M&E	– monitoring and evaluation	NFPC	– Navotas Fish Port Complex
m <sup>2</sup>	– square meter	NFRDI	– National Fisheries Research and Development Institute
m <sup>3</sup>	– cubic meter	NGO	– nongovernmental organization
MARINA	– Maritime Industry Authority	NGP	– National Greening Program
MARPOL	– International Convention for the Prevention of Pollution from Ships	NIPAS	– National Integrated Protected Areas System
MC	– Memorandum Circular	NOx	– nitrogen oxides
mcm	– million cubic meters	NP	– Northeastern Philippine Sea
MCS	– Monitoring, Control and Surveillance system	NREP	– National Renewable Energy Program
mg	– milligram	NSOC	– National State of Oceans and Coasts
MICT	– Manila International Container Terminal	NSSMP	– National Sewerage and Septage Management Program

NSWMC	– National Solid Waste Management Commission	PHIVOLCS	– Philippine Institute of Volcanology and Seismology
NTDP	– National Tourism Development Plan	PhP	– Philippine peso
NWAPP	– National Wetland Action Plan of the Philippines	PIDS	– Philippine Institute for Development Studies
OCD	– Office of Civil Defense	PMO	– Port Management Office
OECD	– Organisation for Economic Co-operation and Development	PNAP	– Philippine National Aquasilviculture Program
OECF	– Overseas Economic Cooperation Fund	PNOC-EC	– Philippine National Oil Company - Exploration Corporation
OHI	– Ocean Health Index	POPs	– persistent organic pollutants
ORE	– Ocean renewable energy	PPA	– Philippine Ports Authority
PAMANA	– PAyapa at MASaganang PamayaNAn Program	PPP	– purchasing power parity
PAGASA	– Philippine Atmospheric, Geophysical and Astronomical Services Administration	PPP	– public-private partnership
PAWB-PCP	– Parks and Wildlife Bureau – Pawikan Conservation Project	PRB	– Principal river basin
PBSAP	– Philippine Biodiversity Strategy and Action Plan	PRRC	– Pasig River Rehabilitation Commission
PCAARRD	– Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development	PSA	– Philippine Statistics Authority
PCG	– Philippine Coast Guard	PSF	– People’s Survival Fund
PCHRD	– Philippine Council for Health Research and Development	PSHEMS	– Ports Safety, Health, and Environment Management System
PCIEERD	– Philippine Council for Industry, Energy, and Emerging Technology Research and Development	PSIC	– Philippine Standards for Industrial Classification
PD	– Presidential Decree	PSMA	– Port State Measures to Address Illegal, Unreported and Unregulated Fishing
PDNGR	– Philippine Downstream Natural Gas Regulation	PTSA	– Philippine Tourism Satellite Accounts
PDO	– Pacific Decadal Oscillations	R&D	– research and development
PDP	– Philippine Development Plan	RA	– Republic Act
PEMSEA	– Partnerships in Environmental Management for the Seas of East Asia	RE	– renewable energy
PENRO	– Provincial Environment and Natural Resources Officer	RORO	– Roll On - Roll Off
PES	– payment for ecosystem services	RSAP	– Regional Strategic Action Plan (for Sulu-Sulawesi Seascape)
PEZA	– Philippine Economic Zone Authority	RTG	– rubber tyred gantry
PFDA	– Philippine Fisheries Development Authority	SAP	– Strategic Action Programme
PG-ENRO	– Provincial Government-Environment and Natural Resources Office	SBSR	– Ship-building and Ship Repair
PHARMASEAS	– Philippine Marine Drug Discovery and Resources Facility	SC	– service contract
		SCS	– South China Sea
		SCTR	– State of the Coral Triangle Report
		SDGs	– Sustainable Development Goals
		SDS-SEA	– Sustainable Development Strategy for the Seas of East Asia
		SEAFDEC	– Southeast Asian Fisheries Development Center
		SFP	– Sual Fish Port



SIPLAS	– Siargao Island Protected Landscape and Seascape	UNCSD	– United Nations Convention on Sustainable Development
SOC	– State of Coasts (local)	UNCTAD	– United Nations Conference on Trade and Development
SOC	– State of Oceans and Coasts (national)	UNDP	– United Nations Development Programme
SOCCSKSARGEN	– South Cotabato, Cotabato, Sultan Kudarat, Sarangani and General Santos City	UNEP	– United Nations Environment Programme
SOLAS	– International Convention for Safety of Life at Sea	UNESCO	– United Nations Educational, Scientific and Cultural Organization
SP	– Southeastern Philippine Sea	UNFCCC	– United Nations Framework Convention on Climate Change
SpTP	– septage treatment plant	UNOPS	– United Nations Office for Project Services
SRF	– shore reception facility	UNU-EHS	– United Nations University - Institute of Environment and Human Security
SRS	– Shipyards Regulation Service	UP-MSI	– University of the Philippines – Marine Science Institute
SS	– Sulu Sea	USAID	– United States Agency for International Development
SSME	– Sulu-Sulawesi Marine Ecoregion	VIP	– Verde Island Passage
SST	– sea surface temperature	VIPMC	– Verde Island Passage Marine Corridor
STP	– sewage treatment plant	VMS	– Vessel monitoring system
SUCs	– state universities and colleges	VR	– Visayas Region
SWM	– solid waste management	VTMS	– Vessel Traffic Management System
SWMP	– Solid Waste Management Plan	WAVES	– Wealth Accounting and Valuation of Ecosystem Services
TCF	– trillion cubic feet	WCPCF	– Western and Central Pacific Fisheries Commission
TDA	– Transboundary Diagnostic Analysis	WPS	– West Philippine Sea
TDGVA	– tourism direct gross value added	WQMA	– Water Quality Management Area
TESDA	– Technical Education and Skills Development Authority	WTO	– World Tourism Organization
TEU	– twenty-foot unit equivalent	WWF	– World Wide Fund for Nature
TEWS	– Tsunami Early Warning System	WWTP	– Wastewater treatment plant
TIHPA	– Turtle Islands Heritage Protected Area	ZCR	– Zero-Carbon Resort
TIWS	– Turtle Islands Wildlife Sanctuary	ZFPC	– Zamboanga Fish Port Complex
TMO	– Terminal Management Office		
TNC	– The Nature Conservancy		
tonne	– metric ton		
TWAP	– Transboundary Waters Assessment Program		
UN	– United Nations		
UNCLOS	– United Nations Convention on the Law of the Sea		

# FOREWORD

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REPUBLIC OF THE PHILIPPINES  
DEPARTMENT OF ENVIRONMENT AND  
NATURAL RESOURCES



Oceans protect biodiversity, provide food and livelihoods, drive economic growth, keep the planet cool, and absorb about 30% of global CO<sub>2</sub> emissions. However, the oceans are under stress – from nutrient loading, plastic and toxic waste, habitat destruction, overfishing, rising temperatures and ocean acidification among others. These challenges have serious repercussions on the sustainability of the planet, and health and well-being of people. Thus, more countries are developing national ocean policies to protect their coastal and marine ecosystems, while, at the same time, viewing oceans as a source of economic growth. “Blue economy” has become a paradigm for this emerging focus on coasts and oceans as a driver of sustainable, resilient and inclusive economic growth.

We are pleased to publish the **National State of Oceans and Coasts 2018: Blue Economy Growth** report. This is a collaborative effort among various government agencies, academe, non-government organizations, development partners, and private individuals to assess the state and benefits of the oceans and the pressures and threats affecting our rich marine biodiversity. This report is a compilation of peer-reviewed papers and national and local data and reports provided by various agencies and organizations, giving us a closer look at the **value** of the oceans in terms of the ocean economy, health and status of our coastal and marine resources, and the socioeconomic importance of these resources, as well as supporting government policies and plans, and blue economy initiatives.

The country's initiative to develop this National State of Oceans and Coasts (NSOC) Report reinforces its commitment to regional and global partnerships on sustainable oceans and blue economy development, and shift from the “business-as-usual” thinking to a more sustainable way of using natural resources for the nation's benefit. This NSOC Report aims to contribute to the over-all assessment and monitoring, not only of the implementation of the *Sustainable Development Strategy for the Seas of East Asia (SDS-SEA)*, but also the *2030 Agenda for Sustainable Development* and other related international agreements and national policies. With the impending climate change impacts, intensified by destructive human activities, the need to reassess and develop new strategies is truly undeniable. However, we should keep in mind that “taking action” will never be enough, rather action grounded on scientific evidence and data should always be our choice of endeavor.

The year 2030 is just around the corner. To reach the Sustainable Development Goals (SDGs), planners, managers, and decision-makers need quality data. Reliable systems for monitoring, data collection and management, and accessing research studies can help planners and managers formulate plans with feasible targets, and support the processes that are essential to achieving those plans and targets. Reliable information on coasts and seas of the Philippines—which can be further refined, expanded and updated—is now available through this NSOC Report to help the government prioritize investments and reforms that support integrated coastal and ocean management and blue economy development. The NSOC Report is not just about the state of the coastal and marine environment, but it also focuses on the ocean-based and marine-related economic activities, and shows potential areas for further growth, and opportunities for more sustainable growth path. Despite being an archipelagic country, perhaps, for too long, the discussion of economic development has ignored the ocean dimension.

Blue Economy can only be sustainable when we also succeed in creating **a sustainable economy on land and at sea** – that is, an economy that provides incomes, food, jobs and amenities while sustainably uses natural resources, utilizes clean technologies and energy, reduces wastes, adopts circular material flows, and restores, protects and maintains the diverse, productive and resilient ecosystems from the watershed to the marine areas. Balancing these different demands is indeed a tall order, but there are already examples of best practices and innovative blue economy initiatives that can be replicated and scaled up.

This is a matter of not just creating clean environment and economic progress, but a personal issue. Each one of us is called to contribute to ensuring healthy and resilient ecosystems, economy and communities. While a challenging process that will require time, the foundation for blue economy must be laid today. We hope that this NSOC Report will encourage discussions and help in the development of policies on oceans and coastal management. We join the people and agencies involved in developing the NSOC Report of the Philippines in the conviction that our country and the East Asian Seas Region are indeed transforming toward a blue economy, and sustainable oceans for all.



**ROY A. CIMATU**

Secretary

Department of Environment and Natural Resources

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- DENR-Environmental Management Bureau (EMB)
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- DENR-Forest Management Bureau (FMB)
- DENR-Manila Bay Coordinating Office (MBCO)
- DENR-Mines and Geosciences Bureau (MGB)
- DENR-Policy and Planning Services (PPS)
- DENR-River Basin Control Office (RBCO)
- Department of Agriculture (DA) - Bureau of Fisheries and Aquatic Resources (BFAR)
- Department of Energy (DOE)
- Department of Interior and Local Government (DILG)
- Department of Public Works and Highways (DPWH)
- Department of Tourism (DOT)
- Department of Trade and Industry-Board of Investments (DTI-BOI)
- Department of Transportation (DOTR)
- Laguna Lake Development Authority (LLDA)

- Maritime Industry Authority (MARINA)
- Metropolitan Waterworks and Sewerage System (MWSS)
- National Economic and Development Authority (NEDA)
- National Mapping and Resource Information Authority (NAMRIA)
- PEMSEA
- Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)
- Philippine Coast Guard (PCG)
- Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD)
- Philippine Council for Health Research and Development (PCHRD)
- Philippine Council for Industry, Energy, and Emerging Technology Research and Development (PCIEERD)
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Magrove Sanctuary in Calatagan, Batangas. (Photo by PEMSEA/J. Castillo)



Wildbirds in Las Piñas-Parañaque Critical Habitat and Ecotourism Area (LPPCHEA). (Photo by DENR)

# EXECUTIVE SUMMARY

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## 1. Background

### 1.1 Setting the Scene

In July 2012, Ministers from ten PEMSEA Partner Countries of the East Asian Seas (EAS) region signed the *Changwon Declaration towards an Ocean-Based Blue Economy: Moving Ahead with the Sustainable Development Strategy for the Seas of East Asia*. The Declaration paved the way for embracing the blue economy paradigm, which employs an alternative economic growth strategy in the coasts and oceans with low environmental impacts. The blue economy as defined in the Changwon Declaration<sup>a</sup> is in line with the *2030 Agenda for Sustainable Development* and the Sustainable Development Goals (SDGs).

The signing of the *Da Nang Compact* in November 2015 by Ministers and Senior Government Officials from 11 PEMSEA Partner Countries saw the adoption of the *Five-Year Regional Implementation Plan for the Sustainable Development Strategy for the Seas of East Asia* (SDS-SEA) and four post-2015 Strategic Targets. Target 2 of the four strategic time-bound targets outlined the requirement that “by 2018, a regional State of Oceans and Coasts reporting system to monitor progress, impacts and benefits, and to continually improve planning and management of SDS-SEA implementation”. The first set of Regional and National State of Oceans and Coasts Reports will focus on blue economy development in the EAS region.

### 1.2 Purpose of the SOC Report

This *National State of the Oceans and Coasts (NSOC) 2018: Blue Economy Growth Report* of the Philippines aims to contribute to the over-all assessment and monitoring, not only of the SDS-SEA implementation, but also the SDGs and other related international agreements and national policies. As expressed in the Changwon Declaration 2012, PEMSEA and the EAS countries believe that blue economy offers a useful framework and organizing principle for the sustainable development of coastal and marine areas. With a growing global population, mounting pressures on the environment and existing resource base, and increasing access to coastal and marine areas through technological advances, the accelerated development and exploitation of coasts and oceans is a certainty. Hence, a developmental framework that will put a premium on balancing economic development with environmental protection, habitat and biodiversity conservation, and social welfare is of utmost importance.

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<sup>a</sup> “We understand the Blue Economy to be a practical ocean-based economic model using green infrastructure and technologies, innovative financing mechanisms, and proactive institutional arrangements for meeting the twin goals of protecting our oceans and coasts and enhancing its potential contribution to sustainable development, including improving human well-being, and reducing environmental risks and ecological scarcities.” (Changwon Declaration 2012).

The NSOC Report 2018 presents key developments in emerging industries and innovations that see us transition away from a conventional economy in the ocean to a “blue” or sustainable, resilient and inclusive ocean economy. It facilitates documentation of the outcomes of policy and management interventions in support of sustainable coastal and marine development. It also aims to increase our understanding of the role of the ocean and its contribution to the national economy; impacts of human activities on ocean health and sustainability; blue economy initiatives; potential areas for investments in environmentally-sound technologies and infrastructure; and the interventions and innovative mechanisms needed to respond to the changing environment and climate.

The development of the NSOC Report 2018 entailed research and compilation of national and local data and reports provided by various agencies, and published papers as well as consultations with DENR and the Technical Working Group, composed of representatives of different national government agencies, international organizations and academe, conducted in June 2016 to September 2018. As agreed with other countries in the EAS Region, the ocean economy figures will be for the year 2015 to establish a baseline, and given that there is lag in reporting in some countries in the region. The timeframe is 2015-2017 for most of the information used in this NSOC, but data from previous years are included to show trends and changes, or when more recent data are not available.

## 2. Where Are We Now?

### 2.1 Geographic and Socioeconomic Features

The Philippines is located in between 4°23' and 21°25' north of the equator (PSA, 2016). The archipelago stretches to a length of 1,880 km from north to south and is composed of 7,641 islands. With a total land area of 298,170 km<sup>2</sup> and a total coastline of 37,008 km, the Philippines is considered to be one of the largest island groups in the world. It has rich marine resources with a total territorial water area of 679,800 km<sup>2</sup>. It is bordered in the north by the Luzon Strait (Bashi Channel), in the south by the Celebes Sea (Sulawesi Sea), in the east by the Philippine Sea and the Pacific Ocean, and in the west by the West Philippine Sea (the Philippine part of the South China Sea).

The country is administratively divided into 18 regions, 81 provinces, 145 cities, 1,489 municipalities and 42,045 barangays.

The population in the last census in 2015 was 100.98 million and it grew by 1.72 percent from the previous census in 2010. In 2017, the estimated population increased to 104.9 million. Likewise, the percentage of urban population increased to 46.7 percent.

Seventy-eight percent (78%) of the provinces in the country is found in the coastal area. About 62 percent of the population live in coastal areas.

The country's gross domestic product (GDP) grew by an average of 6.10 percent during the period 2010 to 2016 while the gross national income (GNI) grew slightly less at 6.06 percent in the same period. In 2017,



the GDP, using purchasing power parity (PPP), was US\$ 797.3 billion (in constant 2011 international \$ prices), or US\$ 875.3 billion (in current international \$ prices). The GNI, using PPP (constant 2011 international \$), on the other hand, was US\$ 960.37 billion in 2017.

The human development index (HDI) value for the Philippines in 2017 was 0.699 — which put the country in the medium human development category, and positioning at 113 out of 189 countries and territories (UNDP 2018). In 2017, life expectancy at birth was 69.2 years, mean years of schooling was 9.3 years, and expected years of schooling was 12.6 years, as the *K-to-12 Program*<sup>b</sup> has been put in place. GNI per capita (at 2011 PPP\$) was US\$ 9,154 in 2017.

As of 2017, 97.7% of the urban population and 89.96% of the rural population use basic drinking water services, while only 76.5% of the total population has access to basic sanitation services (World Bank 2018). However, only 52% of the population in 2017 is using safely managed sanitation services. Access to safe water and improved sanitation services has wider socioeconomic impacts and plays a fundamental role in public health and sustainable development. Moreover, safely managed sanitation facilities would reduce impacts on water resources, fisheries, tourism and welfare. The lack of sanitation facilities can result in pollution of groundwater, rivers and coastal waters. It was estimated that poor sanitation resulted in economic costs equivalent to 1.5% of the country's GDP (World Bank 2008).

The 2015 survey of Filipino families' socio-economic conditions reveal that 16 percent of Filipino households live below the poverty line. For fisherfolk, the poverty incidence is much higher – at 34 percent in 2015 (PSA. FIES, 2015).

**Table 1:** Philippines: Demographic and Socioeconomic Indicators.

Indicator	2017	2018
<b>Land area<sup>1</sup></b>	298,170 square kilometres or km <sup>2</sup>	
<b>Coastline<sup>1</sup></b>	37,008 km	
<b>Sea area<sup>1</sup></b> (territorial waters up to 12 nautical miles)	679,800 km <sup>2</sup>	
<b>Population*</b>	104.9 million	
<b>Coastal population*</b>	62% of total population	
<b>Ocean economy*</b> (Gross value added or GVA, in constant prices)	US\$ 11.9 billion (as of 2016, 7% of GDP)	
<b>Employment in ocean economy*</b>	2.16 million (5.3% of total employment in 2016)	
<b>Estimated value of coastal and marine ecosystems**</b>	US\$ 966.6 billion	
<b>Percentage of coastline with ICM***</b>	>20%	

<sup>b</sup> K-12 is a program that covers kindergarten and 12 years of basic education to provide sufficient time for mastery of concepts and skills, develop lifelong learners, and prepare graduates for tertiary education, middle-level skills development, employment, and entrepreneurship.

**Table 1:** Philippines: Demographic and Socioeconomic Indicators. (cont.)

Indicator	2017	2018
<b>Marine protected area***</b> (percentage of territorial waters)		8.09% <sup>c</sup>
<b>Ocean health index (OHI) score<sup>2</sup></b>	71 - Philippines ranks #83 among 221 EEZs	71 (no change in score and rank from 2017)
<b>Gross domestic product<sup>3</sup></b> (GDP, in constant 2010 US\$ prices)	US\$ 303.4 billion	US\$ 322.3 billion
<b>GDP</b> (using purchasing power parity or PPP), in constant 2011 international \$ prices) <sup>3</sup>	US\$ 797.3 billion	US\$ 847.1 billion
<b>Gross national income (GNI)<sup>3</sup></b> (using PPP, in constant 2011 international \$ prices)	US\$ 960.54 billion	US\$ 1.02 trillion
<b>Human development index (HDI), 2017<sup>4</sup></b>	0.699 medium human development category— positioning the Philippines at 113 out of 189 countries and territories	0.712— high human development category— positioning the Philippines at 106 out of 189 countries and territories.
<b>GNI per capita (at 2011 PPP prices)<sup>4</sup></b>	US\$ 9,133	US\$ 9,540
<b>Life expectancy at birth<sup>4</sup></b>	71.0 years	71.1 years
<b>Mean years of schooling<sup>4</sup></b>	9.4 years	9.4 years
<b>Expected years of schooling<sup>4</sup></b>	12.7 years	12.7 years
<b>Access to basic drinking water services<sup>3</sup></b>	97.7% (of the urban population) 89.96% (of the rural population)	
<b>Access to safely managed drinking water services<sup>3</sup></b>	61.47% (of the urban population) 33.68% (of the rural population)	
<b>Access to basic sanitation services<sup>3</sup></b>	78.49% (of the urban population) 74.82% (of the rural population)	
<b>Access to safely managed sanitation services<sup>3</sup></b>	53.99% (of the urban population) 49.58% (of the rural population)	

Source: \* Philippine Statistics Authority; \*\*Azanza, et al., 2017; \*\*\*Biodiversity Management Bureau

<sup>1</sup> Department of Environment and Natural Resources; NAMRIA

<sup>2</sup> www.oceanhealthindex.org/region-scores/scores/philippines.

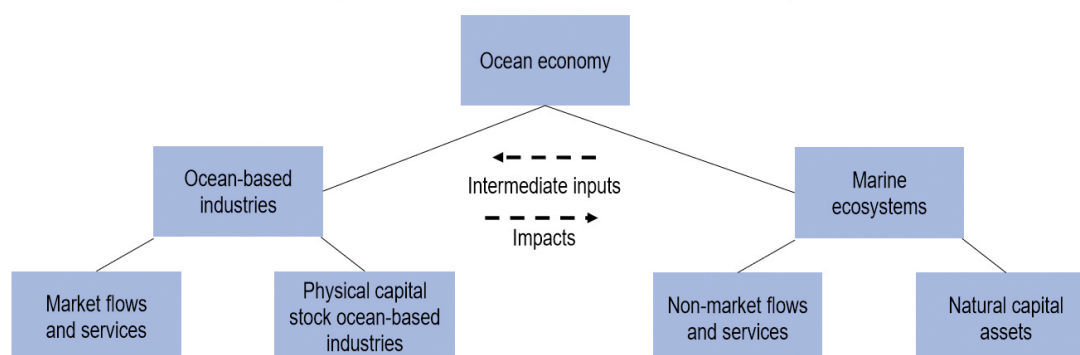
<sup>3</sup> World Bank. World Development Indicators. Accessed from: <https://data.worldbank.org/country/philippines>.

<sup>4</sup> United Nations Development Programme (UNDP). 2018. Human Development Indices and Indicators: 2018 Statistical Update.

## 2.2 Ocean Economy: Benefits and Pressures

The entire ocean economy consists of: (a) ocean industry or economic activities with dependence on the ocean and coastal and marine resources, and (b) natural assets, goods and services of marine ecosystems upon which these industries depend on, and people rely on for food, income, livelihood, recreation, shoreline protection, etc. (Figure 1).

<sup>c</sup> Estimated based on the area of national MPAs under the National Integrated Protected Areas System Act of 1992 (NIPAS) and area of locally-managed MPAs as percentage of territorial waters (up to 12NM from the shore baselines), and excluding the Philippine Rise Marine Resource Reserve (PRMRR) area. This MPA percentage was estimated by the Coastal Management Division of the Biodiversity Management Bureau in 2018. The total area for Locally Managed MPAs is still subject for validation and updating.

**Figure 1:** Components of the Ocean Economy.

Source: OECD (2016), *The Ocean Economy in 2030*, <http://dx.doi.org/10.1787/9789264251724-en>.

In 2016 alone, the total gross value added or GVA of the ocean-based and ocean-related industries or economic activities was placed at **US\$ 11.9 billion (Table 2)**. As shown in **Figure 2**, the top three economic activities are: coastal and marine tourism (25%); fisheries and aquaculture (20%); and manufacturing sector, which includes fish and seafood processing, shipbuilding and ship repair, and marine transport equipment production (19%).

**Table 2:** Gross Value Added of Ocean-based Activities by Industrial Origin.  
In million US\$, at constant prices (2012=100).

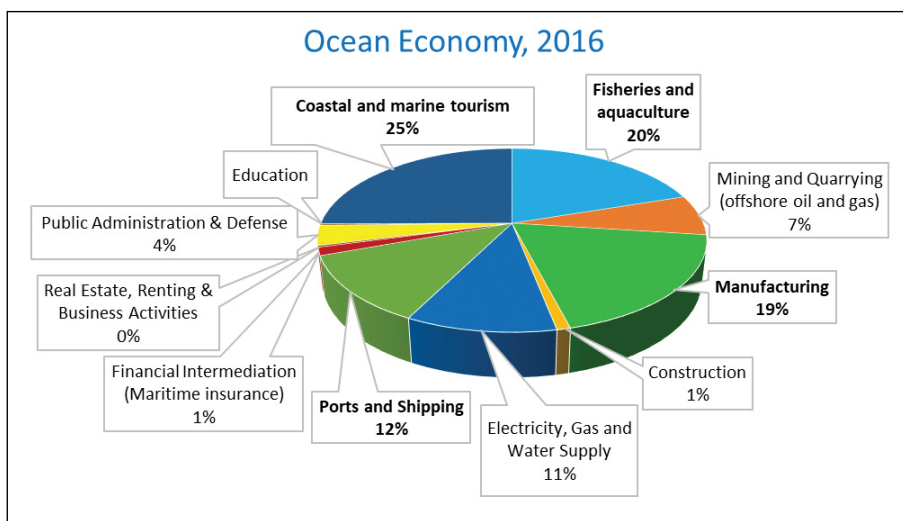
Industry/Year	2012	2013	2014	2015	2016
<b>I. Agriculture, Hunting, Forestry and Fishing</b>	<b>2,886</b>	<b>2,879</b>	<b>2,712</b>	<b>2,587</b>	<b>2,371</b>
a. Fishing	2,886	2,879	2,712	2,587	2,371
<b>II. Industry</b>	<b>4,021</b>	<b>3,892</b>	<b>4,090</b>	<b>4,131</b>	<b>4,475</b>
a. Mining and Quarrying (offshore and gas)	992	891	865	802	852
b. Manufacturing (fish and seafood processing; shipbuilding and repair; marine transport equipment)	1,614	1,597	1,900	1,991	2,256
c. Construction	83	93	100	116	114
d. Electricity, Gas and Water Supply (electricity generated from natural gas and wind power)	1,332	1,310	1,225	1,222	1,254
<b>III. Service Sector</b>	<b>4,256</b>	<b>4,448</b>	<b>4,555</b>	<b>5,096</b>	<b>5,070</b>
a. Transportation, Storage and Communication (Ports and Shipping)	1,164	1,220	1,315	1,384	1,427
b. Financial Intermediation (Maritime insurance)	167	187	173	169	167
c. Real Estate, Renting and Business Activities	24	27	29	31	34
d. Public Administration and Defense	390	401	401	413	417
e. Other Services	<b>2,510</b>	<b>2,613</b>	<b>2,638</b>	<b>3,099</b>	<b>3,025</b>
Education	49	47	45	44	33
Hotels and Accommodations (for coastal and marine tourism)	1,182	2,020	2,021	2,385	2,299
Coastal and marine recreation and tourism	650	545	572	670	693

**Table 2:** Gross Value Added of Ocean-based Activities by Industrial Origin. In million US\$, at constant prices (2012=100). (cont.)

Industry/Year	2012	2013	2014	2015	2016
<b>GROSS VALUE ADDED OF OCEAN-RELATED ACTIVITIES</b>	<b>11,163</b>	<b>11,218</b>	<b>11,357</b>	<b>11,813</b>	<b>11,916</b>
<b>GROSS DOMESTIC PRODUCT (GDP)</b>	<b>149,311</b>	<b>159,040</b>	<b>161,402</b>	<b>167,027</b>	<b>171,109</b>
<b>Share of ocean economy to GDP (%)</b>	<b>7.48%</b>	<b>7.05%</b>	<b>7.04%</b>	<b>7.07%</b>	<b>6.96%</b>

Source: Philippine Statistics Authority.

**Figure 2:** Percentage Share of Ocean Economic Activities in 2016.



Around 2.2 million people are employed in the ocean industries in 2016. This is around 5.3% of the total employment. There are also around 400,000 Filipino seafarers deployed overseas. Remittances of sea-based overseas Filipinos are around US\$ 5.6 billion in 2016.

Supporting the ocean-based and ocean-related industries is the ocean environment and coastal and marine ecosystems. They provide services that are not usually quantified and captured in the national income accounts, such as *regulating services* (e.g., carbon storage, shoreline protection, waste assimilation, nutrient cycling), *supporting services* (e.g., habitat, nursery), and *cultural services*.

According to Azanza *et al.* (2017):

- Based on primary and available secondary data, the marine ecosystems (mangroves, seagrass, and coral reefs, excluding the continental shelf) can contribute a monetary value of **US\$ 966.6 billion** to the economy.

- The estimated total annual net benefits amount to **US\$ 6.35 billion**, with a sizable share accounted for by benefits from coral reefs.
- For mangroves, indirect use values, particularly those pertaining to nursery habitat and shoreline protection, make up more than 90 percent of the estimated total net annual benefits.
- For all marine ecosystem types, regulating services comprise a significant share of the average per hectare monetary value.
- Erosion prevention and waste treatment comprise a substantial proportion of average monetary values of regulating services for coral reefs and coastal systems, and wetlands, respectively.

There is still a need to review the assumptions and methodologies used in estimating the values of the coastal and marine ecosystem services. The regulating services (e.g., shoreline protection, erosion prevention, waste assimilation, and carbon sequestration) depend on the quality, functional integrity, and condition of the ecosystems, so the valuation may have to be adjusted. Moreover, the estimated value of the provisioning service of the three ecosystems – in terms of fisheries for example – is much higher than the fisheries production value reported in the GDP accounts.

**Fisheries and aquaculture.** Fisheries in the Philippines can be generally categorized into large scale and small scale fisheries – the former, targeting mainly small and large pelagic fishes and the latter, targeting mostly the demersal types including reef-associated species. The fisheries sector contributes 1.3% and 1.5% (at current and constant 2000 prices, respectively) to the country's GDP. However, the Philippines ranks among the top fish-producing countries in the world (FAO).

In 2018, the total volume of fisheries production was estimated at 4.35 million tonnes, which was 0.92 percent higher than its previous year's level of 4.31 million tonnes. Of the three subsectors (municipal fisheries, commercial fisheries, and aquaculture), only aquaculture posted positive growth rate of 2.98 percent in 2018. The bulk of total fisheries output came from aquaculture with 52.95 percent share. Aquaculture harvests were 2.30 million tonnes in 2018. It posted a 2.98 percent gain in 2018 from 2.24 million tonnes in 2017 (BFAR 2018).

Production from municipal fisheries and commercial fisheries in 2017 are estimated to be around more than 1 million tonnes each.

From 1980 to 2017, municipal fisheries production has mostly been done in marine waters. In 2016, 86% of municipal capture fisheries production is from marine waters, and only 14% is from inland waters. The volume of production from commercial fisheries was posted at 941.59 thousand tonnes, which went down by 0.71 percent in 2017 compared with its level of 948.28 thousand tonnes in 2018. The subsector comprised 21.64 percent of the total fisheries output.

Looking at the municipal fisheries production by region, the top three highest producing regions in 2016 are Western Visayas with 137,404.88 tonnes; MIMAROPA with 131,183.42 tonnes; and Zamboanga Peninsula with 125,251.76 tonnes. The combined production of these three regions represents about 34.6 percent of the country's total municipal fisheries output of 1,137,931.03 tonnes.

Compared with 2017, the major species that showed improvements in production in 2018 were seaweed (4.45%), skipjack (4.33%) and tilapia (3.25%). However, lesser produce of milkfish (3.90%), roundscad (8.15%), yellowfin tuna (11.91%) and tiger prawn (2.76%) were reported.

Although the commercial subsector is fewer in number compared to the small-scale subsector which comprise the millions of artisanal fishers along the coastal areas, their annual catches are almost similar (Muallil et al., 2015) undermining the issue on equity. The Philippines has been considered as one of the major players in the global fisheries industry. However, comparison of historical catch records to current numbers has shown a declining trend (ADB, 2014; Anticamara, 2016). Currently, aquaculture has significantly contributed to total fisheries production in the country (BFAR, 2017). But in spite of this, it should not weaken policies and actions to address the growing issue on food security.

Moreover, there are major issues that need to be addressed: depleted fishery resources; degraded habitats; pollution; intense resource use competition and conflicts among different users of the coasts and seas; unrealized full potential of aquaculture and commercial fisheries; post-harvest losses; high poverty incidence among the fisherfolk; and limited institutional capacity and governance.

**Coastal and marine tourism.** The tourism industry contributed 12.2 percent to the economy (in gross value added) in 2017. Total employment in the tourism industry was 5,269,000 persons in 2017, or 13 percent of the country's total employment of 40,335,000 individuals. For coastal and marine tourism, the gross value added is US\$2.992 billion in 2016 (in constant 2010 prices).

Ecosystems services value of the beaches and coral reefs, both direct and indirect, form a large part of total socio-economic benefits derived from international and domestic tourism, particularly among territories that are archipelagic or endowed with natural island-beaches like the Philippines. Most of these tourists go to the country's beaches, which are its prime tourism assets. There is a noted increase in arrivals of foreign tourists in leading coastal tourism areas, such as Panay Island (Boracay), Palawan (El Nido, Coron and Puerto Princesa), Bohol, and Cebu. The DOT also identified key national parks and heritage sites in coastal and marine areas for sustainable tourism. The Coral Triangle Initiative, which promotes sustainable marine and coastal

tourism, has observed that visitor arrivals, revenues, and employment generated by this type of tourism have increased dramatically, but need careful management to ensure the protection of the coastal and marine habitats, resources and water quality as well as the sustainable development of coastal communities.

While marine and coastal tourism emerges as a promising source of income, it is nevertheless associated with a multitude of challenges. The principal issues in marine and coastal tourism revolve around unplanned development, slow infrastructure development, inconsistent tourism products that fail to meet the expectations of the public, and negative environmental impacts caused by solid waste, wastewater, and water pollution generated around marine areas.

**Ports and shipping.** Oceans provide navigational lanes and facilitate trade. Interisland water transport is a very important subsector of the national transport system. The gross value added of the ports and shipping sector was US\$ 1.427 billion in 2016 (in constant 2010 prices).

There are about 1,300 ports, of which about 1,000 are government-owned, and the rest are privately-owned and operated. Of the government ports, almost 140 fall under the jurisdiction of Philippine Ports Authority (PPA) and the Cebu Ports Authority (CPA). The rest are the responsibility of other government agencies and local government units (LGUs).

For the year 2017, the highest number of cargoes handled/loaded and discharged at the ports happened at the Port Management Office (PMO) of Manila/Northern Luzon since the bulk of cargoes are being loaded and discharged at the Port of Manila. Container traffic is mostly concentrated at the Port of Manila as well. However, the highest number of passengers embarked and disembarked was recorded in the PMO of Visayas since the Visayas region is composed of several islands that are being inter-linked by water transport network. In most areas though, there is a balance in the transport of cargoes and people, and this explains the significant number of passenger-cargo ships in the domestic fleet.

International and local laws require ports and maritime safety authorities and many national regulatory bodies to monitor any natural and human activity in a port which can harm or damage the nearby bodies of water and marine environment. Port activities can cause deterioration of air and marine water quality in the surrounding areas due to multifarious activities like loading and unloading of cargoes, bunkering activities, and the like. Operational and accidental oil spills, introduced alien and invasive species through the ballast water, wastewater and solid waste from ports and ships, and habitat destruction from port construction/expansion are among the key challenges.

**Fish ports.** In addition to seaports which serve as major hubs for international and domestic/inter-island cargo and passenger vessels, there are also fish ports, feeder ports or commercial ports that can be found in many coastal areas around the country. Fish ports, which are either municipal or regional, are those which primarily serve the fishing industry. Sometimes referred to as landing centers, these fish ports provide the facilities for the main collection and distribution of fish. Through three core programs, namely: (1) Regional Fish Ports Program; (2) Municipal Fish Ports Program; (3) Ice Plants and Cold Storages Program, the Philippine Fisheries Development Authority (PFDA) continuously responds to the need of the sector for post-harvest facilities and services. The following problems beleaguer the fish ports system: (a) underutilization of regional fish ports; (b) depletion of marine resources (fish stock); low catch of commercial fisheries; (c) inadequate number of municipal fish ports; (d) need for more post-harvest facilities; (e) poor environmental management practices in municipal ports ; and (f) need to upgrade fish ports, improve structures, and enhance fish port operations to increase efficiency, and ensure that fishery products can meet international standards.

**Ship-building and repair.** The arrival of foreign shipbuilders in the Philippines propelled the export growth of Philippine-made ships in the international market. After being recognized as the 4th largest shipbuilder in the world in terms of Vessel Completion in Gross Tonnage (GT) in 2015 by the Shipbuilders Association of Japan, shipyards established in the Philippines are now building more ships of larger tonnage capacities like bulk carriers, container ships and passenger ferries. It is, however, essential to note that the country has a long way to achieve in order to become at par with the first three shipbuilding nations of the world. It is likewise important to upgrade the existing shipyard facilities in order to meet globally accepted safety, environmental protection, and quality standards in shipbuilding.

**Offshore oil and gas.** Aggregate domestic oil production, including condensate, was 621.8 kTOE in 2017, while its contribution to total indigenous energy supply stood at 2.1 percent share. Natural gas production stood at 3.2 MTOE, equivalent to an 11 percent share to overall indigenous supply in 2017. As of June 2018, the country produced 54,680,776 BBLs of oil from Nido, Matinloc, North Matinloc and Galoc, and 1,938,305.87 MMSCF of natural gas from Malampaya. Although the DoE's Roadmap shows a lot of potential in discovering and developing additional oil and gas fields, such exploration and production should be aligned with climate goals, and potential for renewable energy. Moreover, the sector is not without a threat of the possibilities of oil spill. However, all offshore operations have their own Emergency Response Plan and Oil Spill Contingency Plan ready to be activated in case of oil spill. All offshore installations have their oil spill equipment and kit ready to be deployed in case of minor oil spill.



## 2.3 State of Ocean Health

The geological, oceanographic and climate attributes of the country have, without doubt, provided home and habitat to a myriad of species teeming at the local biosphere. The influence of these attributes is more specifically illustrated in the more expansive ocean waters, which surround the archipelagic islands. The Philippines currently has a total 797,719 ha of coral reef area, 489,006 ha of seagrass beds, 303,373 ha of mangrove forests, and 200,000 ha of mudflats (NAMRIA Coastal Resource Map 2017).

**Coral reefs.** The Philippines is located at the apex of the Coral Triangle, a tropical area in the planet known as the center of biodiversity where marine biodiversity is highest (Sanciangco et al., 2013). The country is reported to have at least 500 species of corals which include the hard and stony type that primarily make up the platform of coral reefs (ADB, 2014). Coral reefs are one of the most productive systems in the world's biosphere due to the tight coupling of corals and microscopic *zooxanthellae* where nutrients are efficiently utilized by these symbiotic algae through photosynthesis. Due to the structural complexity that these reefs provide to organisms, the associated fish and invertebrate species diversity of coral reefs in the Philippines is also one of the highest in the world (Roberts et al. 2002, Nañola et al. 2010). This biodiversity is the main source of ecosystem goods and services that the archipelagic country is highly reliant on. This comes in the form of food and livelihood through fisheries, tourism-based industries, pharmaceutical drugs, wave buffering and shoreline protection services, etc. (e.g. Cruz-Trinidad et al. 2011).

**Seagrass beds.** The Philippines has a total of 16 seagrass species (Fortes, 2012). Seagrasses have been used as important components of many industrial products (e.g. as packing material, children's toys, compost for fertilizer, animal feed, etc.). However, the major importance of seagrass beds lies in its ecological functions and support to fisheries and, to a certain extent, tourism, and livelihood of coastal populations. Seagrass beds provide habitat for juvenile and small adult fishes (e.g., rabbitfish), invertebrates, reptiles (turtles) and mammals (Dugong). They also serve as buffer against waves and storm surges by maintaining sediment stability, hence, protecting the neighboring mangrove ecosystem and coral reefs. In addition, the high organic matter production of seagrass beds serve as nutrient source for these associated ecosystems. High carbon sequestration rate has been noted for seagrass ecosystem, contributing to climate change mitigation.

**Mangrove forests.** The country is one of the richest in mangrove species, with 42 mangrove species representing 18 families (Spalding et al., 2010, Polidoro et al., 2010). Mangrove forests serve as habitat to crustaceans, mollusks, and fish, some of which are commercially important, and serve as feeding grounds for wild birds. Mangrove areas are utilized for aquaculture and salt production, and are important sources of forest products (e.g., timber) and fishery products (Jacinto et al., 2000).

**Threats to coastal and marine ecosystems and biodiversity.** Goods and services derived from the marine biodiversity at nearshore and oceanic waters in the country are at high risk due to a growing number of environmental and physical stressors. According to the *Philippine Biodiversity Strategy and Action Plan, 2015-2028*, the top five pressures that trigger biodiversity loss in the Philippines are invasive alien species, habitat loss, climate change, pollution and overexploitation. Habitat destruction and degradation are the most prevalent in the country. Loss of seagrass beds, diminishing coral cover and decreasing numbers of fish are the direct results of habitat destruction. The intensive utilization of mangroves has resulted in the decline of their cover. Nutrients, sediments and marine debris also affect the marine habitats and biodiversity. Illegal, unreported and unregulated (IUU) fishing has also resulted in dwindling fish abundance in the country. Loss of biodiversity has cost the Philippines millions of pesos considering the economic value of the resources that have been lost due to mismanagement and non-protection (DENR-PAWB, 2009).

**Water quality.** *The Guidelines for Recreational Waters* (Memorandum Circular 2016-006) state that all recreational waters shall be monitored using the primary parameters, fecal coliform and pH. In 2017, fecal coliform data from 351 monitoring stations located at beaches and bathing waters all around the country showed that only 39% of the monitored recreational waters passed the DENR-EMB standards for fecal coliform tests based on the Class SB water quality parameters.

As of 2017, 158 water bodies were monitored for dissolved oxygen (DO), and 140 water bodies for biochemical oxygen demand (BOD). Eleven (11) rivers were added to the list since 2016. Of the 158 water bodies monitored for DO, 131 rivers or 82.9% passed the standards under their respective classifications while 106 out of the 140 rivers or 75.7% passed the standards for BOD.

**Solid waste and marine debris.** Inefficient solid waste management, and the low cost and convenience of plastic bags and sachets have made the Philippines one of the world's leading plastic polluters, with significant impacts on the environment. Some dumps are poorly located near waterways, resulting in leakage of plastic waste. Communities without access to garbage collection service also use nearby water bodies as dumping grounds. However, around 74 percent of marine plastic debris comes from waste that has already been collected (WWF-Philippines 2018). Some private hauler companies unload their garbage trucks into water bodies on the way to proper disposal sites to cut costs (WWF-Philippines 2018).

Marine debris affect both human and natural systems. Ingestion and entanglements in plastic waste in the ocean have been reported in marine wildlife, such as sea turtles, seabirds, and marine mammals. Humans also face the danger of ingesting microplastics and persistent organic

pollutants (POPs) through eating seafood. The fisheries industry and nature-based marine tourism are also negatively impacted by marine debris.

**Climate change.** Recently, the issue on climate change has been highlighted as many studies have reported its exacerbating effects on the current pressures that our reefs are experiencing today. Fisheries and tourism will be mostly affected. This has very serious implications on the government's goal for sustainable development, food security and employment (ADB 2012; Mamauag et al., 2013). Based on a study by the Asia Development Bank, the Philippines is estimated to lose 6% of its GDP, every year until 2100 if it disregards the risks associated with climate change. However, if the country starts investing on climate change mitigation and adaptation measures by 2020, it is estimated that it can reduce the losses by up to 4% by 2100 (Climate Change Executive Brief, 2018).

The coastal and marine ecosystems play a significant role in ensuring climate resiliency. Mangroves, seagrass and coral reefs provide shoreline protection against storm surge, flooding and erosion. Moreover, these habitats also sequester and store carbon at rates higher than tropical rainforest, thereby contributing to climate change mitigation.

### 3. Moving Forward: Transitioning to Blue Economy

The blue economy paradigm is focused on the economic perspective of the ocean economy and the natural capital assets of oceans, harnessing the oceans for economic growth and livelihoods while meeting the goals of healthy oceans and sustainable development. The following are some examples of blue economy initiatives and supporting policies and programs - transforming the ocean economy to become more sustainable, resilient and inclusive.

#### **Sustainable fisheries and aquaculture:**

- During the period, 2011 to the present, fisheries management shifted its focus from increasing production, which has led to overexploited resources, to protection and conservation through the adoption of the Ecosystems Approach to Fisheries Management (EAFM). One initiative is the partnership with seafood producers and processors for the conservation of blue crabs and swordfish. Another conservation effort is focused on sardines and small pelagics, with regulations on closed fishing season in certain areas of the country. A 30 percent increase in fish catch was reported three years after this policy implementation.
- One tool that can be used to address IUU fishing and support sustainable tuna fisheries is the *Electronic Catch Documentation and Traceability System* (eCDTS), which uses modern technologies, and allows networking of national information systems and provides interface

that will allow system users to input traceability data throughout the supply chain. This is being pilot-tested in General Santos City.

- The vessel monitoring, control and surveillance system using new technologies are required to be installed in fishing vessels to ensure compliance with the fisheries regulations.
- The *Philippine National Aquasilviculture Program* (PNAP) implemented by the Bureau of Fisheries and Aquatic Resources (BFAR), together with the Commission on Higher Education (CHED) is a program focused primarily on mangrove resource rehabilitation and livelihood provision to help address climate change, food security and poverty among municipal/artisanal coastal fisherfolks. Its goal and objectives are (1) replanting of destroyed mangrove resources; (2) establishment of community-based multi-species hatcheries (CBMSH), and (3) provision of aquasilviculture livelihood projects to fisherfolk beneficiaries throughout the country.

### **Sustainable tourism and ecotourism:**

- *Zero Carbon Resort (ZCR) For Sustainable Tourism Program* of the Department of Tourism, with support from a German non-profit organization, GRAT. During the initial phase of the ZCR from 2009 to 2014, over 500 tourism establishments joined the program, and were given capability workshops on the following topics: energy, water, and resource management; and 3R (Reduce, Replace, Redesign). Three of the ZCR first phase participants – Daluyon Beach and Mountain Resort in Palawan, The Manor at Camp John Hay in Baguio City, and Amarela Resort in Bohol – got recognition during the ASEAN Green Hotel Awards from 2014 to 2016. The second phase is ongoing. The impacts of this project are particularly significant as shown by the annual savings incurred by participating tourism establishments, and reduced water and carbon footprints. In 2017, the accumulated annual savings of 247 sampled companies amounted to **US\$ 8,636,208.76**, with a reduction in energy of 38 MWh, reduction of 714,427,966.30 liters of water, and avoided 23,348,538.52 kg of carbon emissions.
- There are some hotels and resorts with wastewater treatment plants due to increased environmental awareness, corporate social responsibility, and/or requirement of the Environmental Compliance Certificate (ECC), DENR or LGU. Treated wastewater is used for watering the gardens and flushing toilets.
- The *Green Fins* initiative aims to protect and conserve coral reefs through environmentally friendly guidelines that promote a sustainable diving and snorkelling industry.
- *Ecotourism in protected areas*: The following are some of the protected areas with sustainable ecotourism activities: Palaui Island Protected Landscape and Seascape in Cagayan Province; Siargao Island Protected Landscape and Seascape in Surigao del Norte; Batanes province; Apo Reef National Park in Occidental Mindoro; Tubbataha Reef in Palawan; Cuatro Islas Protected Landscape and Seascape in Leyte; etc. Examples of regulations include limiting the number of visitors, snorkelers/divers and boats,

designation of mooring and anchoring areas for boats, design and extent of infrastructure development.

#### **Environment- and climate-friendly ports:**

- *Shore reception facilities* have been put in place in all base ports and private ports under PPA.
- *Green ports*: Ports of Batangas and Cagayan de Oro received the Green Port award from APEC Port Services Network (APSN). Both ports incurred savings from efficient energy and fuel use, and reduced GHG emissions.
- *Shore-based power supply, using renewable energy*, has been installed in the Port of Cagayan de Oro
- The Batangas and Cagayan de Oro ports, are Certified to ISO 9001:2008 and recognized for its implementation of the **Port Safety, Health and Environmental Management System (PSHEMS)**. The two ports are now migrating to the **Integrated Management System (IMS)** fusing the three international standards, namely: (a) ISO 9001:2015 for Quality Management System, (b) ISO 14001:2015 for Environmental Management System, and (c) BS OHSAS 18001:2007 for Occupational Safety and Health (PPA 2018). PPA also worked on the certification of the Ports of Zamboanga and Ozamiz, for the IMS. After the third-party audit undertaken in December 2017, both ports passed the requirements of the standards, and were recommended for certification. The Ports of Iloilo and General Santos are also implementing PSHEMS.

#### **Ship-building and repair:**

- Besides shipbuilding and ship repair, the development of *ship recycling yards/facilities* is an investment opportunity in the country considering the older age of the existing ships and entry of newer modern ships.
- With the emergence of the so-called **eco-ship**, the ship-building industry is now considering the design of ships that are much more efficient than that of the existing ships. Eco-ships are designed and constructed primarily to be economically efficient, and reduce greenhouse gas emissions as well as meet the new regulations on sulfur emissions.

#### **Renewable energy:**

- Ocean energy in the country can come from various sources: wave, currents, tides and thermal. Harvesting ocean energy in the country is still in its infant stages however, potential sites have already been identified where possible wave, current, tidal and thermal energy can be harnessed. The potential capacity for ocean thermal energy is established to be 265 million MW. Applied research and development (R & D) is being undertaken to determine the viability of adapting certain renewable energy systems, technologies or processes in the Philippine setting, in areas where there is no or limited local experience.

- Coastal wind power and solar power are fast rising industry as more sites are building and operating wind and solar farms. The Philippines is the largest wind power generator in ASEAN. Some of the most recent developments are the Bangui Wind Farm, Burgos Wind Farm, and Caparispisan Wind Farm in Ilocos Norte; the Wind Energy Power System in Puerto Galera, Oriental Mindoro; San Lorenzo Wind Farm in Guimaras, Nabas Wind Farm in Aklan; and Pililla Wind Farm in Rizal. Most of these are located in coastal municipalities, and have also become tourist attractions.

### **Marine biotechnology:**

- The *Philippine Marine Drug Discovery and Resources Facility* (PHARMASEAS) was created to extract bioactive compounds specifically from sea snails (*conoidea*) and sponges and sponge-associated organisms with the aim of producing potential high-value pharmaceutical products.
- The establishment of Tuklas Lunas Centers all around the Philippines in 2012 also unified the efforts of various institutions in the discovery of new bioactive compounds from natural sources. The program gives research funds to selected institutions to develop standardized herbal drugs from natural sources and to identify and characterize high-value purified active compounds derived from marine and terrestrial sources for specific therapeutic indications.



Balicasag, Bohol. (Photo by DENR)

**Table 3:** Transforming traditional ocean economy to blue economy.

Ocean economy	Blue Economy Initiatives
<p><b>Fisheries and aquaculture</b></p> <ul style="list-style-type: none"> <li>Contributed <b>US\$ 2.37 billion</b> in value added or <b>1.5% of the GDP</b> in 2016, with 260,000 employed in this sector</li> <li>Marine fishery catches have averaged at 2 million tonnes per year for the last 10 years.</li> <li>Tuna remains to be the top exported product in the Philippines, followed by seaweeds, crabs and associated products.</li> <li><b>Pressures:</b> IUU fishing; habitat loss; pollution; coastal development; multiple-use conflicts. The increasing number of fishers and the decreasing fisheries production highlights the need for the country to be more assertive in shifting to more sustainable fishing practices.</li> </ul>	<p><b>Sustainable fisheries and aquaculture</b></p> <ul style="list-style-type: none"> <li>Establishment of community fish landing centers with storage facilities.</li> <li>Establishment of post-harvest facilities to reduce post-harvest losses and increase product value.</li> <li>Shift from volume-based to value-based production.</li> <li>Establishment of closed and open seasons for sardines and small pelagic fishes. A 30% increase in catch was reported 3 years after policy implementation.</li> <li>Maintaining carrying-capacity of fishery resources.</li> <li>Application of environment-friendly technologies and fishing gears.</li> <li>Establishment of MPAs and fish sanctuaries; rehabilitation of fishing habitats.</li> <li>Establishment of community-based multi-species hatcheries</li> <li>Provision of climate-smart aqua-silviculture livelihood projects</li> <li>Collaboration with seafood producers and processors for conservation of blue crabs and swordfish</li> <li>Amended Fisheries Code, which includes measures to address IUU fishing; capacity development of local governments on enforcement</li> </ul>
<p><b>Coastal and marine tourism</b></p> <ul style="list-style-type: none"> <li>Contributed around <b>US\$ 3 billion</b> in value added, with around 900,000 employed in this sector.</li> <li><b>Pressures:</b> pollution; over-development; carrying capacity; habitat destruction; multiple-use conflicts</li> </ul>	<p><b>Sustainable coastal and marine tourism</b></p> <ul style="list-style-type: none"> <li>National Ecotourism Strategy and Action Plan (2013-2022);</li> <li>Zero Carbon Resorts</li> <li>Green Fins program: involving diving operators in coral reef monitoring and conservation, and proper diving practices of tourists</li> <li>MPA/tourism branding; marine and coastal heritage sites and parks</li> <li>Ecotourism and community-based tourism in protected areas</li> <li>Closure and rehabilitation of Boracay Island, a major tourist destination</li> </ul>
<p><b>Ports and shipping</b></p> <ul style="list-style-type: none"> <li>Contributed <b>US\$1.4 billion</b> in value added, employing around 700 thousand people</li> <li><b>Pressures:</b> greenhouse gas emissions; oil spills; ballast water and invasive species; accidents</li> </ul>	<p><b>Sustainable ports</b></p> <ul style="list-style-type: none"> <li>Green Port: Ports of Batangas and Cagayan de Oro (received award from APEC Port Services Network (APSN))</li> <li>Shore reception facilities</li> <li>Shore-based power supply, using renewable energy (Port of Cagayan de Oro)</li> <li>Port Safety, Health and Management System (PSHEMS): Ports of Batangas, Iloilo, Cagayan de Oro and General Santos</li> </ul>
<p><b>Manufacturing</b></p>	<p><b>Ship-building and repair</b></p> <ul style="list-style-type: none"> <li>The ship-building industry is now considering the design of ships that are much more efficient than that of the existing ships, and reduce greenhouse gas emissions, and meet the sulfur cap.</li> </ul>
	<p><b>Marine biotechnology</b></p> <ul style="list-style-type: none"> <li>The Philippine Marine Drug Discovery and Resources Facility (PHARMASEAS) was created to extract bioactive compounds from sponges, sponge-associated organisms, and sea snails (conioidea) and produce potential high-value pharmaceutical products.</li> </ul>

**Table 3:** Transforming traditional ocean economy to blue economy. (cont.)

Ocean economy	Blue Economy Initiatives
	<p><b>Marine renewable energy</b></p> <ul style="list-style-type: none"> <li>• Wind power in the Philippines, with installed capacity of 427 MW, and 66 awarded projects in 2017 with potential capacity of 2461.5 MW. The wind farms in the coastal areas have also become tourist attraction.</li> <li>• R&amp;D projects on ocean energy (tidal power, ocean thermal energy conversion)</li> <li>• Solar farms in coastal areas (908 MW installed capacity of solar energy as of 2017)</li> </ul>
<p><b>Pressures:</b></p> <ul style="list-style-type: none"> <li>• growing population and waste generation; desludging of septic tanks; clogged waterways; plastic waste and marine debris</li> <li>• unregulated development and urban sprawl resulting in pollution, habitat conversion, erosion and sedimentation;</li> <li>• few local government units have established wastewater systems and SWM facilities</li> </ul>	<p><b>Pollution reduction/waste management</b></p> <ul style="list-style-type: none"> <li>• Classification of Water Bodies; Designation of Water Quality Management Areas</li> <li>• Monitoring of water quality of rivers and coastal bathing waters</li> <li>• National Sewerage and Septage Management Program providing national government subsidy of up to 50% of capital cost</li> <li>• Increased wastewater and septage management coverage in Metro Manila and adjacent municipalities/cities to 26% of population in Maynilad service area, and 30% in Manila Water service area (15% sewer coverage and 592,640 septic tanks deslugged as of 2017); Adopt-a-River program to clean up waterways and tributaries of Manila Bay</li> <li>• Use of various cost-effective technologies to meet water quality standards with lower capital and operating and maintenance costs</li> <li>• 10,052 materials recovery facilities established, covering 24% of total barangays</li> <li>• 140 sanitary landfills, covering 19% of local government units; 6,878 illegal dumpsites have been closed</li> </ul>
<p><b>Pressures:</b></p> <ul style="list-style-type: none"> <li>• Habitat and biodiversity loss</li> </ul>	<p><b>Habitat restoration and management</b></p> <ul style="list-style-type: none"> <li>• Philippine Biodiversity Strategic Action Plan for 2015-2028: establishment of marine sanctuaries and no-take zones; and active restoration through coral transplantation and mangrove and seagrass rehabilitation efforts.</li> <li>• SmartSEAS Program;</li> <li>• Biodiversity Financing;</li> <li>• Philippine National Aquasilviculture Program</li> <li>• National Greening Program: replanted 76,514 ha of mangrove areas in 2011-2016 (DENR-FMB 2017)</li> <li>• National and locally managed MPAs: 8.09% of territorial waters but excluding PRMRR area (BMB, 2018)</li> <li>• MPA Network for sea turtles</li> <li>• Biodiversity-friendly enterprises</li> </ul>
<p><b>Pressures:</b></p> <ul style="list-style-type: none"> <li>• Climate change</li> </ul>	<p><b>Climate resiliency</b></p> <ul style="list-style-type: none"> <li>• Mangrove, seagrass and coral reef restoration and protection</li> <li>• People's Survival Fund (community-based watershed management; mangrove planting; reforestation; agroforestry; etc.)</li> <li>• Adaptation measures for aquaculture</li> <li>• Retrofitting and climate-proofing projects of DPWH</li> </ul>



## 4. Gearing Up for the Challenges: Ocean Governance

Major policies, laws, plans and strategies on coastal management, fisheries, habitat and biodiversity conservation, pollution reduction from land- and sea-based sources, disaster risk reduction and management, and climate change mitigation and adaptation have been adopted, but varying degrees of implementation, inadequate capacity, and lack of access to financing and innovative and cost-effective technologies hamper the achievement of targets and desired outcomes. However, there are notable actions that should be continued, replicated and scaled up. (Refer to Sections 16 and 17.)

### 4.1 Protecting Ocean Health

The following are some of the key actions that have been undertaken to protect ocean health and support blue economy development:

**Marine protected areas.** Economic and environmental benefits of MPAs include reconstituting ecosystem services, stabilization of fish population, more sustainable catch level, tourism, reducing risks from natural hazards, and providing carbon sink. Local governments also established fish sanctuaries. As of 2018, the MPAs, both nationally and locally managed, comprise around 8.09% of the country's territorial waters. However, more seagrass-based MPAs are needed and effective protection and management of key biodiversity areas. There should be more consideration for the interconnectivities of mangroves, seagrass and coral reefs to optimize their ecosystem services.

**Habitat restoration.** In the *Philippine Biodiversity Strategic Action Plan for 2015-2028*, one of the direct program interventions identified is the restoration of ecosystem functions. A 2-way approach has been used namely (1) passive restoration - which is the establishment of marine sanctuaries and no-take zones, and (2) active restoration, which can be done through coral transplantation and mangrove and seagrass rehabilitation efforts.

- The coral restoration program focuses on both sexual (the use of coral egg and sperm in the formation of coral propagules) and asexual methods (the fragmentation method) stressing on the importance of public-private-academe partnership in the implementation of the restoration effort. Coral gardening on the other hand, was used in the reef restoration of 10 areas devastated by Typhoon Yolanda. Molecular genetics and the identification of susceptible and resilient species to the rise in sea surface temperature and eutrophication have also been done.
- The *National Greening Program* (NGP) is one of the pioneering programs by the government on mangrove restoration. Through the NGP, 76,514 ha of mangrove areas have been replanted, with 199,367,952 seedlings planted all throughout the country in 2011-2016 (DENR-FMB 2017).

**Solid waste management.** The *Philippine National Solid Waste Management Strategy, 2012-2016* was created to implement feasible waste management programs in government agencies, private institutions and the general public. In compliance with Section 16 of RA 9003 (*Ecological Solid Waste Management Act of 2000*), all local government units were required to formulate a 10-year Solid Waste Management Plan that should be consistent with the objectives stated by the Philippine National Solid Waste Management Framework.

The *Solid Waste Management Plan* requires all barangays to allocate a parcel of their land for a Material Recovery Facility (MRF). There are 10,052 MRFs, but servicing only 24% of all barangays. The MRF collects mixed waste for sorting, segregation, recycling and composting. Recyclables are sold to junk shops and recycling companies. The residual waste is then transferred to a disposal facility or a sanitary landfill for long-term disposal. The rehabilitation of existing disposal facilities and closure of open dumpsites is also part of the solid waste management program. As of 2017, 6,878 illegal dumpsites have been closed. As of 2018, there are 140 operating sanitary landfills, accessed by 308 local government units, which is only 18.84% of the total number of LGUs in the country.

**Wastewater management.** The *Philippine Clean Water Act of 2004* (RA 9275) declares that the State shall pursue a policy of economic growth in a manner that is consistent with the protection, preservation and revival of the quality of marine and freshwater bodies and groundwater.

As of January 2018, thirty-four (34) Water Quality Management Areas (WQMA) have been designated in selected river basins and water resources regions. The objectives and activities inside the WQMAs include: (1) cleaning esteros and water bodies, (2) institutionalize good solid waste and wastewater management practices, (3) reduce waterborne diseases among children and vulnerable groups, (4) reduce the incidence and risks of prolonged flooding due to impeded water flow, (5) minimize pollution loads into receiving surface waters, and (6) strengthen public-private-community partnerships by incorporating them into LGU programs and local policies.

To address the wastewater problem in Metro Manila, a sewerage and sanitation system was implemented through the Metropolitan Waterworks and Sewerage System (MWSS) and its two concessionaires. Their services include sewage treatment plants, septage treatment plants, combined sewer-drainage systems, and desludging trucks. As of March 2018, a total of 55 sewage treatment plants, 3 septage treatment plants, 3 sewage and septage treatment plants (combined), and 132 desludging trucks are serving the MWSS Area. The sewerage system (separate and combined) covers a total area of 6,461,92 km<sup>2</sup>, servicing an estimated 2,452,602 individuals. In addition, sanitation services (desludging of septic tanks) have been delivered to 2,983,740 people from 2017-2018. Around 592,640 septic tanks have been desludged in 2003-2017.

There are also LGUs with decentralized wastewater or septage management systems, e.g., Baliwag and San Jose Del Monte in Bulacan; Dumaguete, Manjuyod, Bayawan in Negros Oriental; San Fernando City, La Union; Zamboanga City (sewerage extension under construction).

## 4.2 Protecting Communities from Natural Disasters and Climate Change

The Philippine Government has undertaken a program of hazard and risk analysis capacity building to support formulation and adoption of disaster risk reduction and management plans as well as risk reduction and response capabilities. The *Philippine Disaster Risk Reduction and Management Act* (RA 10121) provides a comprehensive, all-hazard, multi-sectoral, inter-agency, and community-based approach to disaster risk management. The Act shifted the policy environment and the way the country deals with disasters from mere response to preparedness. *DRRM Plans* (from national to local levels) highlight, among others, the importance of mainstreaming DRRM and climate change adaptation (CCA) in the development processes, such as policy formulation, socioeconomic development and land-use planning, and budgeting, particularly in the area of environment, agriculture, water, energy, public infrastructure, housing, etc. The DRRM plans adhere to the principles of good governance within the context of poverty alleviation and environmental protection.

**R.A. 9729** – *Climate Change Act of 2009* – calls for the State to integrate the concept of climate change in various phases of policy formulation, development plans, poverty reduction strategies, and other government development tools and technique. The *National Framework Strategy on Climate Change* (NFSCC) stresses a balance between adaptation and mitigation, and laid the groundwork for the development of the *National Climate Change Action Plan* (NCCAP) for 2011– 2028. The phases of implementation under NCCAP is aligned with the *National Disaster Risk Reduction and Management Plan* and the *Philippine Development Plan* (PDP), the country's development framework, which aims to address poverty, create employment opportunities, and achieve inclusive growth.

The **People's Survival Fund** (PSF) is an annual budgetary allocation intended for LGUs and Community Organizations to implement climate change adaptation projects to help improve the ability of local communities to deal with the impacts of climate change. Projects and the climate-proofed development plans, such as *the enhanced climate change adaptation and disaster risk reduction Comprehensive Land Use Plans* (CLUPs) or *Local Climate Change Action Plans* (LCCAPs), need to be aligned with the *National Climate Change Action Plan* (NCCAP) for approval.

The Department of Public Works and Highways (DPWH) is implementing a program on creating **Livable, Sustainable and Resilient Communities**. This program is comprised of: (1) Integrated Water Resource Management Program, (2) Disaster Risk Reduction and Climate Change Adaptation Program, (3) Infrastructure Support for Marginalized Sectors and (4) the creation of environment friendly communities. A *Flood Management Master Plan* has been created for flood-prone cities and urbanized areas. The DPWH is also rehabilitating and retrofitting existing structures, which are identified as highly vulnerable to flooding, earthquakes and other climate-change related calamities.

## 5. Conclusion and Recommendations

The NSOC Report is an important tool to advance scientific support, raise public awareness, promote good governance and partnerships for blue economy, and foster the development of synergies among the various sectors and stakeholders. The evidence base provided by the NSOC report is fundamental in informing policy- and decision-makers on ocean-related issues as well as innovations and best practices that can be replicated and scaled up. The report provides a review of the added value of blue economy, and its contribution to income, jobs, well-being, and the overall ocean agenda. The NSOC Report also discusses key policies and actions that lay the foundation for an integrated ocean management framework for healthy and resilient oceans and communities and sustainable and inclusive blue economy.

**Development of ocean accounts.** Current national income accounts do not have the breakdown for some of the ocean economic activities. Data disaggregation to account for key sectors, such as small-scale fisheries, coastal and marine tourism, coastal and offshore wind power, etc., is one of the challenges in developing the ocean accounts. Moreover, there is also a lack of waste accounting, and availability of studies showing the environmental cost and economic losses. The valuation of coastal and marine ecosystem services also needs more work and studies to get more robust estimates. The ocean accounts must be promoted at both the macroeconomic and sectoral level planning to show the contribution of oceans to the economy, incomes, livelihood, shoreline protection, climate resiliency, and well-being as well as the potential investment and business opportunities. The ocean accounts can help make blue economy development and integrated coastal and ocean management a priority of the government, investors, and development partners.

**Integrated coastal management.** The delicate situation of balancing biodiversity conservation and economic development may crumble if critical parts of the ocean ecosystems are not considered. One of the management strategies currently recommended for coastal areas is the *integrated coastal management* (ICM) to ensure effective management of our coastal resources and that the various uses of the coastal (and oceanic) waters be considered and harmonized (Chua 2003), and this time, taking into account climate-informed actions (e.g. Heenan et al. 2015) into the ICM system. ICM has been adopted as national policy for the sustainable development and management of coasts and seas (EO 533). A more recent but similar approach is the *marine spatial planning* (MSP), which like ICM, is a process that brings together multiple users of the ocean – including energy, industry, government, conservation, and recreation – to make informed and coordinated decisions about how to use marine resources sustainably. The ICM policy (EO 533) needs to be implemented in more coastal areas.

**Habitat protection and pollution reduction.** While many LGUs have coastal resource management (CRM) programs, it is essential to note that CRM is just one component of ICM system. It is laudable that LGUs have taken actions on reforestation, mangrove restoration, and protecting coral reefs and fish habitats through establishment of marine protected areas. However, more needs to be done if the country is to meet its international commitment and targets on establishing MPAs, addressing

IUU fishing, and reducing marine pollution. Furthermore, it is imperative to increase the focus on management of wastewater and plastic waste to ensure ocean health and protect marine life as well as improve human health and living conditions. Investments in these areas are crucial as impacts and economic losses are increasing. Commitments from political leaders and finance and environment ministries to prioritize the ocean agenda are therefore critical. Integrated ocean management, including habitat restoration, MPAs, climate resilient infrastructure, pollution reduction, and waste management should not be seen as a cost burden and investment dead-end, but rather as opportunities for more responsible businesses, income generation, job creation, innovations, and a more sustainable, resilient and inclusive economic growth path.

**Disaster risk reduction and climate resiliency.** Ecosystem-based disaster risk management recognizes that ecosystems, particularly mangroves, seagrass and coral reefs, can act as first line of defense for vulnerable community against disasters. DRRM funds have not been fully utilized to enhance preparedness as well as restore and properly manage these coastal ecosystems, which provide shoreline protection (among other ecosystem services). Integrating coastal land-and sea-use planning, DRRM, appropriate infrastructure development and coastal ecosystem conservation would enhance climate resiliency.

**Monitoring of marine water quality and ecosystems.** Monitoring of coastal and offshore water, including additional parameters for observation, as well as more nutrient loading studies in major bays are needed due to increasing incidence of eutrophication, hypoxia, harmful algal blooms and fish kills. Likewise, more regular fish stock assessment, and monitoring of coral reefs, seagrass, mangroves, and rare, threatened and endangered species are necessary to assess the status, changes and pressures on fisheries, and biodiversity, and the impacts on the environment, and incomes, livelihoods, climate resiliency and well-being of coastal communities. Moreover, properly monitoring the ecosystem response to the various policies and actions is important to identify which interventions are effective and which are not. Timely access to data and research projects is also necessary to ensure that information is readily available for policy and planning.

The drivers-pressures-state-impacts-response (DPSIR) approach of this report attempts to elucidate the process of understanding the importance of the various uses of coastal and oceanic resources in the country that are subjected to several threats, both anthropogenic and natural. A good understanding of the linkages and processes in the DPSIR flow can improve the management through monitoring and evaluation actions which are sorely lacking in the current management regime.

**Blue economy development.** Private sector involvement in innovative blue economy is essential – from research to design, deployment, operation, and financing. Public and private partnership (PPP) is important to move the blue economy forward. However, enabling conditions have to be put in place to ensure viability, and make PPP work. Blue economy offers opportunities to create new jobs, bring in new businesses and infrastructure, deploy new technologies, and promote innovative and

sustainable industries (e.g., fisheries and aquaculture; ecotourism; ports and shipping; shipbuilding; marine biotechnology; marine renewable energy). There are unlikely synergies across sectors that have developed like agriculture and tourism; wind power and tourism. The contributions of the blue economy initiatives to the national economy, employment, local incomes and livelihood, investments, innovations, climate resiliency, and well-being need to be measured also to show the monetary, socioeconomic and environmental benefits. Moreover, there are backward and forward linkages and multiplier effects that need to be assessed to show the gains from blue economy development - and convince policymakers to support it.

**Linking of blue economy initiatives to the achievement of the SDGs.** To get more support, it is essential to show the interactions, combined effect, and benefits of blue economy as well as green economy, circular economy, and other initiatives and approaches to accelerate actions and achieve the targets of SDGs, SDS-SEA, and other international agreements.

**Regular SOC reporting.** The development of the NSOC report is a significant step beyond the traditional State of Environment reports. The NSOC report looks deeper into the value and contributions of oceans and marine ecosystems to national and regional economies, livelihood and welfare; impacts of human activities; challenges and response measures. This report is quite comprehensive and provides information on socioeconomic and ocean health conditions; good practices and innovations in ocean economy; linkage to the SDGs and various areas of investments. Moreover, it highlights the intervention needs, policies and other governance mechanisms to respond to changing environments and climate. It is important to note that this NSOC report provides the baseline, which can be used for comparison with results of future monitoring and assessment of the state of ocean economy and ocean health. Regular updating of the NSOC report would show the gaps, progress, outcomes and benefits of blue economy development and ICM and SDS-SEA implementation.



Batanes: Overlooking the Luzon Strait where the Pacific Ocean merges with the South China Sea. (Photo by R. Bautista-Olfato)

# 1 Introduction

## 1.1 Background

Oceans cover more than 70 percent of the planet's surface, yet only 5 percent of the world's oceans have been explored. As our technology improves, along with our understanding of oceans and their complex interaction with the land at the coastal interface, so too does our ability to utilize and exploit coastal and marine resources. In the context of global megatrends, such as population growth, migration to coastal cities, climate change, and concerns about food and water security and energy demands, our relationship with the oceans becomes even more complex. It is clear that our current use of coastal and marine ecosystems is outstripping their ability to sustainably provide critical goods and services.

Coasts and oceans are receiving increasing attention in the media and in national and international policy discussions. More countries are developing national ocean policies to protect their coastal and marine ecosystems, while, at the same time, viewing oceans as a relatively untapped source of economic growth. "Blue economy" has become a popular term for this emerging focus on coasts and oceans as a sustainable driver of economic growth. While the concept of blue economy has been around for 20 years, no shared definition yet exists, with several organizations and governments developing their own understanding of what it means. In July 2012, at the Fourth Ministerial Forum during the East Asian Seas Congress 2012, Ministers from Cambodia, China, Indonesia, Japan, Lao PDR, the Philippines, RO Korea, Singapore, Timor-Leste and Viet Nam signed the "Changwon Declaration Toward an Ocean-based Blue Economy: Moving Ahead with the Sustainable Development Strategy for the Seas of East Asia (SDS-SEA)." The **Changwon Declaration 2012** provides the definition of blue economy<sup>1</sup>, and was adopted by the ministers of the East Asian Seas (EAS) Region as a way to respond to the challenges of changing environment and climate as well as fostering economic development through activities that reduce negative impacts on ocean health and communities. The *blue economy* entails the sustainable and innovative use of ocean resources for economic growth, livelihoods, jobs, disaster and climate resiliency, and amenities, while protecting the environment and preserving the health of marine and coastal ecosystems.

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<sup>1</sup> "We understand the Blue Economy to be a practical ocean-based economic model using green infrastructure and technologies, innovative financing mechanisms, and proactive institutional arrangements for meeting the twin goals of protecting our oceans and coasts and enhancing its potential contribution to sustainable development, including improving human well-being, and reducing environmental risks and ecological scarcities." (Changwon Declaration 2012).

In addition, the ministers of the East Asian Seas (EAS) Region adopted the Da Nang Compact during the EAS Congress held in Da Nang, Viet Nam in November 2015. One of its targets is the development of a Regional SOC report. The Philippines prepared this NSOC report as its contribution to the regional report, which directs attention to: (a) the state of coastal and marine environment and ecosystems in the EAS region, (b) benefits generated by the oceans, (c) pressures and threats to ocean health and socioeconomic welfare, and (d) actions being undertaken in line with the implementation of the Sustainable Development Strategy for the Seas of East Asia (SDS-SEA) and other related international agreements.

## 1.2 Objectives

This NSOC report aims to contribute to the over-all assessment and monitoring, not only of the SDS-SEA implementation, but also the UN Sustainable Development Goals (SDGs) and other related international conventions and national policies. As expressed in the Changwon Declaration 2012, PEMSEA and the EAS countries believe that blue economy offers a useful framework and organizing principle for the sustainable development of coastal and marine areas. With a growing global population, mounting pressures on the environment and existing resource base, and increasing access to coastal and marine areas through technological advances, the accelerated development and exploitation of coasts and oceans is a certainty. Hence, a developmental framework that will put a premium on balancing economic development with environmental protection, habitat and biodiversity conservation, and social welfare is of utmost importance.

## 1.3 Rationale

One of the most important but little noticed change over the past decades is how our perspective on the world's oceans has changed. Oceans were first considered vast and limitless. Following centuries of exploration, oceans became areas for exploitation for food, oil and gas, minerals, and other resources, nuclear testing, and dumping of wastes. Given the current challenges, studies on the state of the marine environment have become more significant. There is now increasing recognition that oceans are finite, with fragile ecosystems and biodiversity under pressure from human activities, and climate and environmental changes. Yet, the benefits derived from the oceans have not been fully quantified as well as the environmental and societal impacts and costs of over-exploitation, pollution, and years of neglect. It has therefore become critical to realize that each of our uses of oceans involves real or potential tradeoffs with other uses, and there are outcomes. While there is now recognition for the need to transform production and consumption patterns to more sustainable way, and to have policies, plans and management systems that support both economic development and healthy oceans and people, there is no common framework on how to achieve this.



Within this context, the term “blue economy” has entered into the vocabulary of economic development in all parts of the world. Many consider that the meaning of “blue economy” is still evolving, with some emphasizing the possibilities of new ocean-based industries, such as renewable energy or bio-pharmaceuticals, and others emphasizing the need to transform the traditional ocean economy and the emerging ocean industries into a more sustainable and inclusive blue economy, conserving the oceanic natural capital and providing opportunities across the society. The blue economy, as discussed during the EAS Congress 2012 and 2015, refers to a sustainable ocean-based economic model; one that employs environmentally-sound and innovative infrastructure, technologies, and practices, including institutional and financing arrangements, for meeting the goals of: (a) sustainable and inclusive development; (b) protecting our coasts and oceans, and reducing environmental risks and ecological scarcities; (c) addressing water, energy, and food security; (d) fostering ecosystem-based climate change mitigation and adaptation measures; and (e) protecting the health, livelihoods, and welfare of the people, especially those in the coastal zone.

All of these changes are taking place in a changing climate that is altering the physical properties of oceans that may dramatically shift the foundations of ocean and coastal economies. Though changes like sea-level rise and ocean acidification are becoming known, uncertainty remains about the extent and timing with which these ocean changes will affect resources, coastal communities, and well-being. This means we need to have a much better and more detailed understanding of the economic values of oceans and coastal and marine resources, the state of ocean health, and the ocean governance underpinning the sustainable development of oceans and coasts. The NSOC Report provides an overview of these aspects, and describes blue economy initiatives that contribute to more sustainable and resilient ocean health, economy, and people.

## 1.4 Framework and Scope

The development of the NSOC Report is anchored on the blue economy theme, and entailed the use of the drivers-pressures-state-impacts-response (DPSIR) framework for the analysis (**Figure 1**). All data presented in this report are sourced from related literature, published reports, collated data from key government agencies, and consultations with the academe, private and public sectors, NGOs and international organizations. The scope of the report is at national level, but includes inputs at the local level on good practices and governance. The ocean economy, state of ocean health as well as changes over time are discussed in this report to provide a better visualization of the trends, and outlook for blue economy in the country. Most of the data are as of end of 2017 and earlier years.

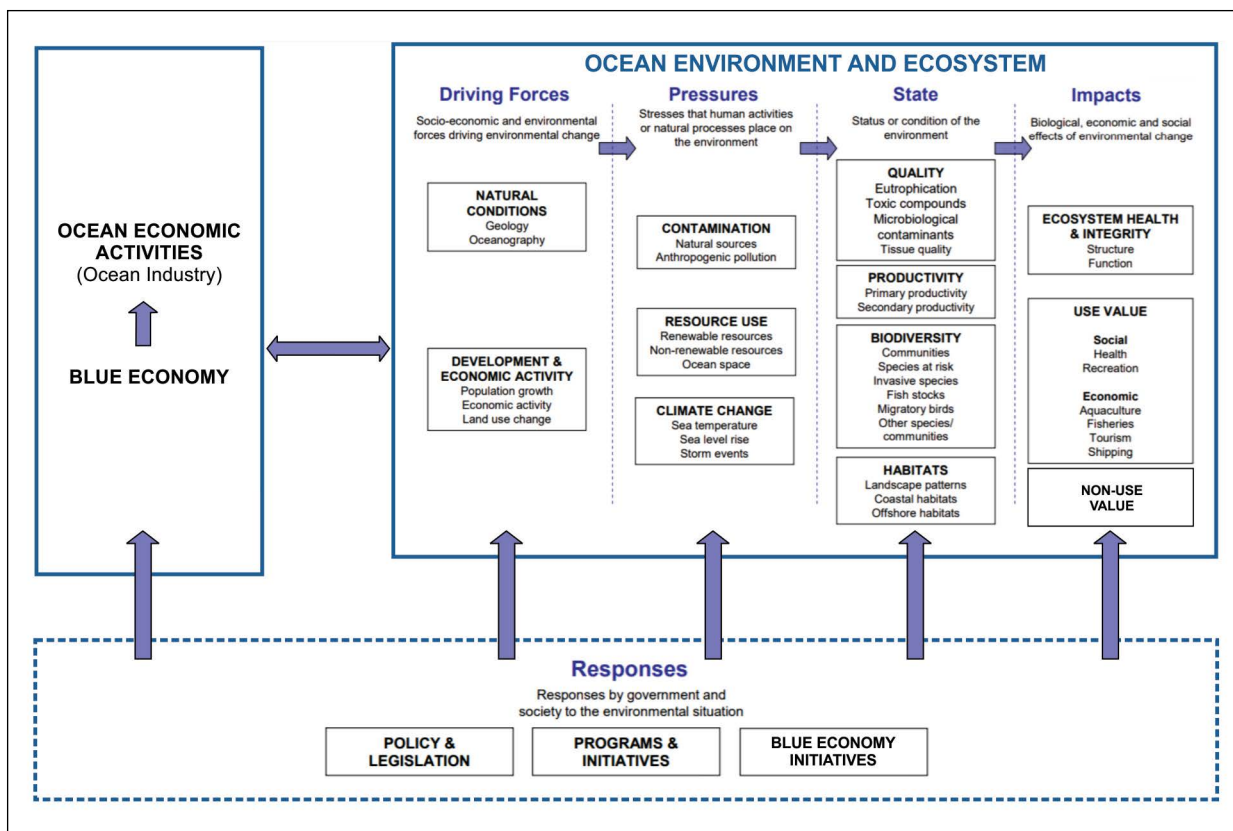
The NSOC report aims to provide the baseline assessment, which will be useful for future monitoring and reporting. It presents the description of the following:

Part 1 provides an overview of the *demographic and socioeconomic conditions*, which have implications on the developments in the ocean economy, impacts on resources, environment and climate, and the potential transformation towards blue economy. These socioeconomic features are forces driving environmental, economic and institutional changes.

Part 2 describes the state of the *ocean economy* as well as the issues, and the response in terms of policies and actions. The ocean economy has two dimensions: the ocean industry, and the oceans and ecosystems, and these two are interlinked. Oceans and the coastal and marine ecosystems contribute a significant amount to the national economies, and to the incomes, livelihood and welfare in the coastal communities as well as provide important ecosystem services, such as food, recreation, shoreline protection, waste assimilation, carbon sequestration, etc. This section shows the value of the oceans in terms of the gross value added of the different ocean industries, and their contribution to the country's gross domestic product and employment, as well as the coastal and marine ecosystem services. This section also presents details of the various ocean industries, e.g., fisheries and aquaculture; coastal and marine tourism; ports and shipping; fish ports; ship-building; offshore oil and gas, and other maritime services, as well as the challenges these ocean industries or economic activities face, and the pressures on the oceans.

Part 3 of this report highlights the *blue economy* as a transformational initiative towards an innovative and sustainable framework for managing our ocean economy while protecting our ocean and coastal resources. Blue economy offers an alternative paradigm, and it is one of the promising answers to the country's need for restoring and managing the national oceanic capital and achieving more sustainable, inclusive, and climate resilient ocean economic activities. Examples of such initiatives, and emerging industries are discussed in this section to show the developments and opportunities for investments and partnerships in blue economy in the Philippines. These include sustainable and climate-smart fisheries and aquaculture; ecotourism; green ports; marine renewable energy; eco-ship-building; and marine biotechnology.

Part 4 describes the *state of ocean health underpinning the blue economy*, in particular, the natural conditions as shown by the oceanographic and geological features, as well as the current marine water quality, and status of coastal and marine habitats and biodiversity. Large marine ecosystems (LMEs) in the country and transboundary issues are also presented in this section. Identifying the socio-economic and environmental forces that are driving environmental changes, the pressures that affect the natural environment, including climate change, and the impacts that these pressures produce are key to creating appropriate responses and solutions to the current problems of coastal and marine ecosystems and the associated sustainability of the ocean economy.

**Figure 1.1:** Drivers-Pressures-State-Impacts-Response (DPSIR) Framework.

Part 5 of this report focuses on governance structure supporting blue economy development. This includes:

- Institutional arrangements: Description of key policies, laws, and international agreements adopted that would address the pressures and threats to ocean health and ocean economy, and support blue economy development.
- Sustainable development strategy and actions: Description of plans, programs, initiatives and best practices on ocean and coastal management, fisheries management, ecosystem and biodiversity conservation, marine protected areas, pollution reduction, natural hazard management and climate change response to achieve the SDG 14 targets, SDS-SEA targets, other international commitments, and national targets to ensure ocean health and sustainable and inclusive blue economy.

## 1.5 Caveats

The development of the NSOC Report 2018 entailed research and compilation of national and local data and reports, and published papers provided by the DENR and the Technical Working Group, composed of representatives of different national government agencies, international organizations and academe, and consultations conducted in June 2016 to September 2018. The

timeframe for most of the information used in this NSOC would be 2015-2017. Data from previous years are included to show trends and changes, and also when recent data are not available. As agreed with other countries in the EAS Region, the ocean economy figures will be for the year 2015 to establish a common baseline, and given that there is lag in reporting in some countries in the region.

The NSOC Report is limited by accessibility and availability of data on ocean economy. Disaggregated data of the national income, macroeconomic, and sectoral accounts; new Input-Output tables; assessment of the state of the coastal and marine ecosystems and water quality; more robust studies and estimation of the valuation of coastal and marine ecosystems and environmental damage are needed for the ocean economy accounts. Regular monitoring of marine water quality (coastal and offshore), habitats, fishery resources and biodiversity are needed to see the impacts of human activities as well as assess the effectiveness of policies and management interventions. The ocean accounting framework showing the economic-environmental linkage needs to be further developed. The incremental value of the blue economy initiatives also need to be shown, and highlight their contribution to the national economy, sectoral value added, incomes, and jobs, and improvement of environment, climate resiliency, and well-being. Due to lack of awareness of blue economy, there are only a few examples of best practices on ensuring sustainable and healthy oceans and communities given in this report.



One of the islands in the El Nido-Taytay Managed Resource Protected Area. (Photo by M. Ebarvia)

**PART 1**

**THE SEAS, PEOPLE AND  
ECONOMY OF THE PHILIPPINES**

# 2 Geography

The Philippine archipelago is found between 4°23' and 21°25' north of the equator (PSA, 2016). The archipelago stretches to a length of 1,880 km from north to south and is composed of 7,641 islands. With a total land area of 298,170 km<sup>2</sup> and a total coastline of 37,008 km, the Philippines is considered to be one of the largest island groups in the world. It has rich marine resources within a total territorial water area of 679,800 km<sup>2</sup>. It is bordered in the north by the Luzon Strait (Bashi Channel), in the south by the Celebes Sea (Sulawesi Sea), in the east by the Philippine Sea and Pacific Ocean, and in the west by the West Philippine Sea (the Philippine part of the South China Sea).

The Philippine archipelago is composed mainly of three (3) island groupings, namely: Luzon in the north, Mindanao in the south and Visayas in the central portion of the country. Luzon is the largest among all of the islands, with an area of 104,687 km<sup>2</sup>. The second largest island is Mindanao at 94,631 km<sup>2</sup>, and the third is Samar at 13,271 km<sup>2</sup> (**Figure 2.1**).

In 2016, the country is administratively divided into 18 regions: Regions I to XII, the National Capital Region (NCR), Caraga (Region XIII), Cordillera Administrative Region (CAR), the Autonomous Region of Muslim Mindanao (ARMM), and Negros. The NCR has 16 highly urbanized cities and 1 urban municipality. The capital of the Philippines is Manila, which is located along the coast of Manila Bay, and part of the NCR.

There are 81 provinces, 145 cities, 1,489 municipalities and 42,045 barangays (**Table 2.1**). Seventy-eight percent (78%) of the provinces in the country is found in the coastal area.

**Figure 2.1:** Map of the Philippines.



Source: <https://www.cia.gov/library/publications/the-world-factbook/attachments/maps/RP-map.gif>

**Table 2.1:** Number of Provinces, Cities, Municipalities and Barangays, 2018.

Region	Provinces	Cities	Municipalities	Barangays
National Capital Region (NCR)	-	16	1	1,710
Cordillera Administrative Region (CAR)	6	2	75	1,177
I (Ilocos Region)	4	9	116	3,267
II (Cagayan Valley)	5	4	89	2,311
III (Central Luzon)	7	14	116	3,102
IV-A (CALABARZON)	5	19	123	4,019
IV-B MIMAROPA	5	2	71	1,460
V (Bicol Region)	6	7	107	3,471
VI (Western Visayas)	6	16	117	4,051
VII (Central Visayas)	4	16	116	3,003
VIII (Eastern Visayas)	6	7	136	4,390
IX (Zamboanga Peninsula)	3	5	67	1,904
X (Northern Mindanao)	5	9	84	2,022
XI (Davao Region)	5	6	43	1,162
XII (SOCCSKSARGEN)	4	5	45	1,195
CARAGA	5	6	67	1,311
ARMM	5	2	116	2,490
<b>TOTAL</b>	<b>81</b>	<b>145</b>	<b>1,489</b>	<b>42,045</b>

Source: DILG, 2018.



Photo by D. Bautista

# 3 The People and Economy of the Philippines

## 3.1 Demography

### 3.1.1 Population

Based on the 2015 census, total population increased, from 92.34 million in 2010 to 100.98 million in 2015 (**Table 3.1**). On average, the Philippine population increased by 1.72 percent annually in 2010-2015. This is lower compared to the population growth rate of 1.9 percent registered during the period 2000 to 2010.

In 2016, the estimated population was 103.3 million, of which the urban population is 44.5 percent. The population density in 2017 was 352.73 people per km<sup>2</sup>, and increased to 357.69 people per km<sup>2</sup> in 2018. The estimated population increased to 105.17 million in 2017, and 106.65 million in 2018. (**Table 3.2**). Likewise, the percentage of urban population increased to 46.68 percent in 2017, and 46.91 percent in 2018. Majority of the population is still rural as of 2018.

**Table 3.1:** Population of the Philippines.

Census Year	Census Reference Date	Population (in millions)
2000	May 1, 2000	76.51
2010	May 1, 2010	92.34
2015	August 1, 2015	100.98

Source: Philippine Statistics Authority.

**Table 3.2:** Demographic Features.

	2017	2018
Land area (km <sup>2</sup> )	298,000	
Population	105,173,264	106,651,922
% Urban population	46.68%	46.91%
% Rural population	53.32%	53.09%
% Male population	50.28%	50.26%
% Female population	49.72%	49.74%
Population density (people per km <sup>2</sup> )	352.73	357.69
Population growth rate	1.45%	1.40%
Urbanization rate (2015-2020 est.)*	1.57%	1.57%

Source: World Bank. 2018; \*CIA World Factbook



Among the 18 regions<sup>2</sup>, Region IV-A or CALABARZON had the largest population in 2015 with 14.4 million people, followed by the National Capital Region or NCR with 12.88 million, and Region III or Central Luzon with 11.22 million. Combining the population of these three regions comprises more than a third (38.1%) of the 2015 Philippine population. The least number of regional populations, on the other hand, is found in Cordillera Administrative Region or CAR with 1.70 million; Caraga (Region XIII) with 2.6 million, and MIMAROPA (Region IV-B) with 3 million whereas the fastest growing region is the Autonomous Region of Muslim Mindanao or ARMM, with an average annual population growth rate of 2.89 percent.

Among the provinces, Cavite was the most populous with 3.68 million people, followed by Bulacan (3.29 million), and Laguna (3.04 million). **Table 3.3** below shows the list of provinces which hit the one million mark in 2015.

**Table 3.3:** Provinces with More Than One Million Population: 2015.

Rank	Province	Population (in thousands)	Rank	Province	Population (in thousands)
1	Cavite	3,678	15	Isabela	1,594
2	Bulacan	3,292	16	Bukidnon	1,415
3	Laguna	3,035	17	Cotabato (North Cotabato)	1,380
4	Pangasinan	2,957	18	Tarlac	1,366
5	Cebu*	2,939	19	Negros Oriental	1,355
6	Rizal	2,884	20	Albay	1,315
7	Batangas	2,694	21	Bohol	1,314
8	Negros Occidental*	2,497	22	Cagayan	1,199
9	Pampanga*	2,198	23	Maguindanao	1,174
10	Nueva Ecija	2,151	24	Lanao del Sur	1,045
11	Camarines Sur	1,953	25	Davao del Norte	1,016
12	Iloilo*	1,936	26	Zamboanga del Norte	1,011
13	Quezon*	1,857	27	Zamboanga del Sur*	1,011
14	Leyte*	1,752			

\* Excluding the population of highly urbanized cities in the province.

Source: Philippine Statistics Authority, 2015 Census of Population.

### 3.1.2 Number of Households

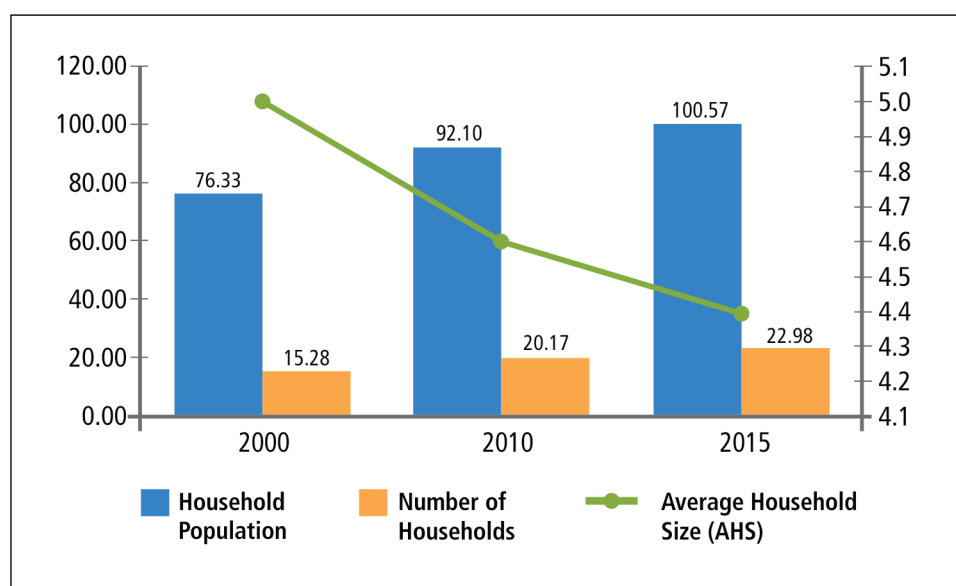
There were 22.9 million households in 2015 (**Table 3.4**). The average household or family size was 4.4 members, down from an average of 5 members per household in 2000 (**Figure 3.1**).

<sup>2</sup> There were 18 regions in the Philippines based on the official count in 2016. In 2015-2017, the Negros Island became a region.

**Table 3.4:** Household Population, by Region, in 2015.

Region	Household Population	Number of Households	Average Household Size
Philippines	100,573,715	22,975,630	4.4
National Capital Region (NCR)	12,787,669	3,095,766	4.1
Cordillera Administrative Region (CAR)	1,714,220	395,881	4.3
I – Ilocos	5,014,622	1,151,629	4.4
II – Cagayan Valley	3,443,493	804,524	4.3
III – Central Luzon	11,184,068	2,566,558	4.4
IV-A – Southern Luzon (CALABARZON)	14,365,137	3,395,383	4.2
IV-B – MIMAROPA	2,946,505	682,668	4.3
V – Bicol	5,780,963	1,216,421	4.8
VI – Western Visayas	4,464,277	1,014,987	4.4
VII – Central Visayas	6,008,987	1,388,475	4.3
Negros Island Region	4,402,196	1,012,323	4.3
VIII – Eastern Visayas	4,425,172	986,003	4.5
IX – Zamboanga Peninsula	3,615,108	799,219	4.5
X – Northern Mindanao	4,663,108	1,042,929	4.5
XI – Davao	4,867,168	1,177,461	4.1
XII – SOCCSKSARGEN	4,531,642	1,050,680	4.3
Caraga	2,588,131	574,338	4.5
Autonomous Region in Muslim Mindanao	3,771,249	620,385	6.1

Source: Philippine Statistics Authority, 2015 Census of Population.

**Figure 3.1:** Household Population.

Source: Philippine Statistics Authority, 2000 and 2010 Census of Population and Housing and 2015 Census of Population.

### 3.1.3 Coastal Population

Around 53 percent of the population in 2010 lives in the coastal areas or areas with a marine coastline. A lower growth rate is observed for the coastal population at 1.6 percent (**Table 3.5**).

**Table 3.5:** Total Population vs. Coastal Population, 2000 and 2010.

Region	Year 2000		Year 2010		Growth Rate Total Population, 2000	Growth Rate Coastal Population, 2010
	Total Population, 2000	Coastal Population, 2000	Total Population, 2010	Coastal Population, 2010		
REGION I – ILOCOS	4,196,276	1,907,549	4,785,083	2,166,526	1.3%	1.3%
REGION II - CAGAYAN VALLEY	2,809,520	571,584	3,237,301	677,290	1.4%	1.7%
REGION III - CENTRAL LUZON	8,021,325	1,606,550	10,276,094	2,101,669	2.5%	2.7%
IV-A – CALABARZON			12,553,188	4,585,194		
IV-B – MIMAROPA			2,718,000	2,630,578		
REGION IV - SOUTHERN TAGALOG	11,764,246	6,003,748	15,271,188	7,215,772	2.6%	1.9%
REGION V – BICOL	4,681,111	3,500,191	5,435,380	4,068,074	1.5%	1.5%
REGION VI - WESTERN VISAYAS	6,202,431	4,503,712	7,408,560	5,337,984	1.8%	1.7%
REGION VII - CENTRAL VISAYAS	5,689,814	5,179,283	6,772,257	6,221,004	1.8%	1.8%
REGION VIII - EASTERN VISAYAS	3,603,708	3,177,460	4,135,110	3,633,084	1.4%	1.3%
REGION IX - WESTERN MINDANAO	3,085,322	2,506,721	3,510,574	2,759,896	1.3%	1.0%
REGION X - NORTHERN MINDANAO	2,743,894	1,608,763	4,282,186	2,642,687	4.6%	5.1%
REGION XI - SOUTHERN MINDANAO	5,181,299	3,502,958	4,461,252	3,402,224	-1.5%	-0.3%
REGION XII - CENTRAL MINDANAO	2,591,472	1,028,630	4,104,559	1,424,472	4.7%	3.3%
NATIONAL CAPITAL REGION	9,880,102	3,072,995	11,846,071	3,471,809	1.8%	1.2%
CORDILLERA ADMINISTRATIVE REGION	1,360,611	-	1,497,906	-	1.0%	
AUTONOMOUS REGION IN MUSLIM MINDANAO	2,708,329	1,901,747	3,281,191	2,159,871	1.9%	1.3%
CARAGA	2,091,505	1,388,017	2,469,712	1,617,973	1.7%	1.5%
<b>TOTAL</b>	<b>76,610,965</b>	<b>41,459,908</b>	<b>92,774,424</b>	<b>48,726,949</b>	<b>1.9%</b>	<b>1.6%</b>
<b>Male</b>	38,550,779	20,868,083	46,787,941	24,620,983		
<b>Female</b>	38,060,186	20,591,825	45,986,483	24,105,966		

Source: Philippine Statistics Authority.

### 3.1.4 Age-Sex Structure and Dependency

In 2017, the average age of Filipinos is 23.5 years. From the age structure, the dependency ratio can be estimated. The **dependency ratio** is the ratio of those typically not in the labor force (the *dependent part*, ages 0 to 14 and 65+) and those typically in the labor force (the *productive part*, ages 15 to 64) (**Table 3.6**). It is used to measure the pressure on the productive population. In 2017, the country has a high total dependency ratio at 58.2. This indicates more financial stress on working people.

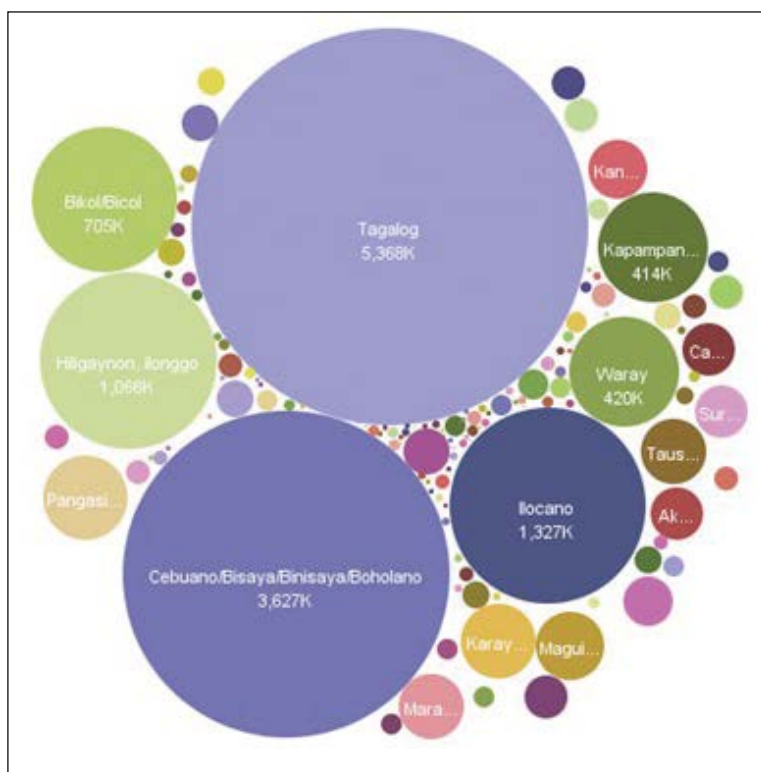
**Table 3.6:** Age Structure, Dependency Ratio, and Sex Ratio, 2017.

<b>Age structure</b>	<b>0-14 years:</b> 33.39% (male 17,764,826/female 17,050,168)
	<b>15-24 years:</b> 19.16% (male 10,199,389/female 9,780,025)
	<b>25-54 years:</b> 36.99% (male 19,597,675/female 18,964,900)
	<b>55-64 years:</b> 5.97% (male 2,844,739/female 3,375,139)
	<b>65 years and over:</b> 4.49% (male 1,930,273/female 2,748,942) (2017 est.)
<b>Dependency ratios</b>	<b>total dependency ratio:</b> 58.2
	<b>youth dependency ratio:</b> 51
	<b>elderly dependency ratio:</b> 7.2
	<b>potential support ratio:</b> 13.8 (2015 est.)
<b>Median age</b>	<b>total:</b> 23.5 years
	<b>male:</b> 23.1 years
	<b>female:</b> 24 years (2017 est.)
	<b>at birth:</b> 1.05 male(s)/female
<b>Sex ratio</b>	<b>0-14 years:</b> 1.04 male(s)/female
	<b>15-24 years:</b> 1.04 male(s)/female
	<b>25-54 years:</b> 1.03 male(s)/female
	<b>55-64 years:</b> 0.84 male(s)/female
	<b>65 years and over:</b> 0.72 male(s)/female
	<b>total population:</b> 1.01 male(s)/female (2016 est.)

Source: World Bank. 2018; CIA World Factbook.

### 3.1.5 Ethno-linguistic groups

There are 20 languages and dialects generally spoken around the country. Of these, more than one-third or 35.1 percent of the population speak the country's national language or Tagalog (**Table 3.7; Figure 3.2**). The second most widely spoken language is Cebuano or Bisaya (23.7%) while Ilocano ranks third at 8.7 percent. **Table 3.7** lists down the top 20 languages and dialects used around the country.

**Figure 3.2:** Ethno-linguistic Groups.

Source: PSA, 2013.

**Table 3.7:** Top 20 Languages or Dialects Generally Spoken in the Households: Philippines, 2010.

No.	Language/Dialect	Number of Households	Percent Distribution	No.	Language/Dialect	Number of Households	Percent Distribution
1	Tagalog	5,368,187	35.1	11	Maranao	150,151	1.0
2	Cebuano/Bisaya/Binisaya/Boholano	3,627,473	23.7	12	Karay-a/kiniray-a	193,316	0.7
3	Ilocano	1,327,211	8.7	13	Kankanaei/Kankaney/Kankanaey	112,831	0.6
4	Hiligaynon/Ilonggo	1,065,767	7.0	14	Akeanon/Aklanon	93,205	0.6
5	Bicol/Bicol	705,147	4.6	15	Capizeño	92,879	0.6
6	Waray	419,899	2.7	16	Surigaonon	90,597	0.6
7	Kapampangan	413,552	1.6	17	Masbateño/Masbatenon	87,488	0.6
8	Pangasinan/Pangalato	237,181	1.3	18	Zamboangeño-Chavacano	69,041	0.5
9	Maguindanao	165,718	1.1	19	Ibanag	64,425	0.4
10	Tausug	151,277	1.0	20	Manobo/Ata-Manobo	48,215	0.3
<b>Total Households Enumerated = 100%</b>							

Source: PSA, 2013.

**Table 3.8:** Ethnicity, Language and Religious Affiliation.

<b>Ethnic groups</b> (2000 census)	Tagalog 28.1%, Cebuano 13.1%, Ilocano 9%, Bisaya/Binisaya 7.6%, Hiligaynon Ilonggo 7.5%, Bikol 6%, Waray 3.4%, other 25.3%
<b>Languages</b>	Official: Filipino (based on Tagalog) and English Eight major languages: Tagalog, Cebuano, Ilocano, Hiligaynon or Ilonggo, Bicol, Waray, Kapampangan/Pampango, and Pangasinan
<b>Religions</b> (2000 census)	Catholic 82.9% (Roman Catholic 80.9%, Aglipayan 2%), Muslim: 5% Evangelical: 2.8% Iglesia ni Kristo: 2.3% Other: Christian 4.5% others: 1.8%, unspecified: 0.6% none: 0.1%

Source: CIA World Factbook.

## 3.2 Economic Features

### 3.2.1 Gross Domestic Product (GDP) and Gross National Income (GNI)

The country's gross domestic product (GDP) grew by an average of 6.10 percent during the period 2010 to 2016, from approximately PhP 5.7 trillion in 2010 to PhP 8.1 trillion in 2016 (**Table 3.9**). The gross national income (GNI) grew slightly less than GDP at 6.06 percent in the same period, from around PhP 6.85 trillion in 2010 to PhP 9.26 trillion in 2016 (**Table 3.9**). In 2017, GDP was PhP 8.7 trillion, while GNI was PhP 10.4 trillion.

Data from the World Bank (2019) showed that the GDP, using purchasing power parity (PPP), was US\$ 797.3 billion (in constant 2011 international \$ prices), or US\$ 877.2 billion (in current international \$ prices) in 2017. It increased to US\$ 847.1 billion (PPP, in constant 2011 international \$), or US\$ 954.7 billion (PPP, in current international \$ prices) in 2018. The GNI, using PPP (constant 2011 international \$), on the other hand, was US\$ 960.54 billion in 2017, and US\$ 1.02 trillion in 2018.

The country's per capita GDP (PPP, constant 2011 international \$ prices) was US\$ 7,580.85 in 2017, and US\$ 7,942.51 in 2018 (World Bank 2019). The GDP per person employed (constant 2011 PPP \$) was US\$ 19,116.88 in 2017, and US\$ 19,917.52 in 2018 (World Bank 2018).

Using PPP, GNI per capita (constant 2011 international \$) was US\$ 8,728.97 in 2016, and US\$ 9,153.54 in 2017 (World Bank 2019; UNDP 2018).

Data from PSA show that the services sector continues to be the engine of domestic economic growth contributing 55.76 percent in 2010, and 57.31 percent in 2016. This sector grew at an average of 10.66 percent per year in 2010-2016. Meanwhile, the industry sector contributed 32.61 percent in 2010, and 33.94 percent in 2016, whereas the agriculture, hunting, forestry, and fishing sector contributed 11.62 percent in 2010, and 8.74 percent in 2016.

**Table 3.9:** Gross National Income And Gross Domestic Product, By Industrial Origin, 2010 to 2017, At Constant 2000 Prices, In Million Pesos.

INDUSTRY	2010	2011	2012	2013	2014	2015	2016	2017
<b>AGRICULTURE, HUNTING, FORESTRY AND FISHING</b>	<b>662,665</b>	<b>679,835</b>	<b>698,978</b>	<b>706,957</b>	<b>718,797</b>	<b>719,742</b>	<b>711,001</b>	<b>739,195</b>
a. Agriculture and forestry	526,238	549,306	568,946	575,953	588,004	591,269	587,654	616,963
b. Fishing	136,427	130,529	130,032	131,005	130,794	128,473	123,347	122,232
<b>INDUSTRY SECTOR</b>	<b>1,859,515</b>	<b>1,893,950</b>	<b>2,031,443</b>	<b>2,219,068</b>	<b>2,391,268</b>	<b>2,545,411</b>	<b>2,750,593</b>	<b>2,945,538</b>
a. Mining & Quarrying	65,898	70,509	72,047	72,893	81,695	80,500	83,665	84,795
b. Manufacturing	1,264,523	1,324,330	1,395,711	1,538,912	1,666,514	1,760,989	1,885,514	2,044,189
c. Construction	325,820	294,564	348,262	381,747	409,277	456,932	512,113	538,107
d. Electricity Gas and Water Supply	203,274	204,547	215,423	225,516	233,781	246,990	269,301	278,447
<b>SERVICE SECTOR</b>	<b>3,179,359</b>	<b>3,336,416</b>	<b>3,574,808</b>	<b>3,824,606</b>	<b>4,055,413</b>	<b>4,335,022</b>	<b>4,661,781</b>	<b>4,981,084</b>
a. Transport, Storage and Communication	427,766	446,026	476,855	505,415	538,044	581,289	611,902	636,612
b. Trade and Repair of Motor Vehicles Motorcycles Personal and Household Goods	948,743	981,022	1,055,672	1,121,102	1,185,810	1,270,526	1,367,438	1,467,006
c. Financial Intermediation	374,716	394,371	426,787	480,683	515,484	546,714	590,112	635,139
d. Real Estate, Renting & Business Activities	588,947	638,244	678,898	739,025	798,081	854,747	930,685	999,420
e. Public Administration and Defense; Compulsory Social Security	255,087	259,962	274,870	282,323	293,850	297,449	318,540	346,234
f. Other Services	584,100	616,791	661,725	696,058	724,144	784,297	843,105	896,674
<b>GROSS DOMESTIC PRODUCT</b>	<b>5,701,539</b>	<b>5,910,201</b>	<b>6,305,229</b>	<b>6,750,631</b>	<b>7,165,478</b>	<b>7,600,175</b>	<b>8,123,375</b>	<b>8,665,818</b>
Net Primary Income from the rest of the world	1,149,599	1,147,835	1,254,283	1,401,578	1,474,725	1,542,980	1,632,345	1,728,528
<b>GROSS NATIONAL INCOME</b>	<b>6,851,138</b>	<b>7,058,037</b>	<b>7,559,511</b>	<b>8,152,210</b>	<b>8,640,203</b>	<b>9,143,155</b>	<b>9,755,720</b>	<b>10,394,346</b>

Source: Philippine Statistics Authority.

In terms of national expenditure, the share of the household sector consistently accounted for more than half of the country's GNI at 57.6 percent in 2010 and 57.6 percent in 2017, as well as GDP, at 69.2 percent in 2010 and 68.9 percent in 2017 (**Table 3.10**). Exports sector increased from 42.1 percent of GNI in 2010 to 47.5 percent in 2017. Likewise, share of investments (capital formation) in GNI increased from 17 percent in 2010 to 24 percent in 2017. Investments also contributed 28.9 percent to GDP in 2017, compared to only 20.8 percent in 2010 (**Table 3.10**).

**Table 3.10:** Gross National Income and Gross Domestic Product, By Expenditure Shares  
2010 to 2017 (At Constant 2000 Prices, In Million Pesos).

Type of Expenditure	2010	2011	2012	2013	2014	2015	2016	2017
<b>1. Household Final Consumption Expenditure</b>	<b>3,945,827</b>	<b>4,166,410</b>	<b>4,442,523</b>	<b>4,692,438</b>	<b>4,952,967</b>	<b>5,266,632</b>	<b>5,642,389</b>	<b>5,974,351</b>
<b>2. Government Final Consumption Expenditure</b>	<b>570,208</b>	<b>582,099</b>	<b>672,176</b>	<b>705,811</b>	<b>728,905</b>	<b>783,955</b>	<b>854,570</b>	<b>907,580</b>
<b>3. Capital Formation (FC+CI)</b>	<b>1,183,650</b>	<b>1,216,884</b>	<b>1,164,718</b>	<b>1,490,196</b>	<b>1,553,029</b>	<b>1,838,432</b>	<b>2,290,308</b>	<b>2,505,449</b>
A. Fixed Capital (FC)	1,182,206	1,159,857	1,285,180	1,437,196	1,540,271	1,800,535	2,270,587	2,484,245
1. Construction	490,659	450,346	528,569	582,828	632,219	701,802	793,470	839,234
2. Durable Equipment	567,833	583,225	624,112	717,980	763,159	938,733	1,292,959	1,431,079
3. Breeding Stock & Orchard Dev't	98,928	98,678	100,066	98,568	97,295	99,286	102,845	106,255
4. Intellectual Property Products	24,785	27,608	32,432	37,819	47,598	60,713	81,313	107,677
B. Changes in Inventories (CI)	1,444	57,027	-120,462	53,000	12,757	37,897	19,721	21,204
<b>4. Exports</b>	<b>2,886,133</b>	<b>2,812,968</b>	<b>3,054,291</b>	<b>3,024,646</b>	<b>3,406,560</b>	<b>3,695,428</b>	<b>4,124,942</b>	<b>4,935,700</b>
A. Exports of Goods	2,367,520	2,199,355	2,426,493	2,417,822	2,755,017	2,936,403	3,249,966	3,928,434
B. Exports of Services	518,613	613,613	627,797	606,824	651,544	759,025	874,976	1,007,266
<b>5. Less: Imports</b>	<b>2,884,280</b>	<b>2,868,160</b>	<b>3,028,479</b>	<b>3,162,459</b>	<b>3,475,982</b>	<b>3,984,272</b>	<b>4,788,834</b>	<b>5,657,262</b>
A. Imports of Goods	2,330,115	2,344,013	2,415,218	2,501,608	2,744,133	3,129,043	3,871,839	4,632,180
B. Imports of Services	554,165	524,147	613,261	660,852	731,849	855,229	916,995	1,025,082
<b>6. Statistical Discrepancy</b>	<b>0.22</b>	<b>(0.00)</b>	<b>-</b>	<b>0.00</b>	<b>(0.32)</b>	<b>(0.34)</b>	<b>0.05</b>	<b>-</b>
<b>GROSS DOMESTIC PRODUCT</b>	<b>5,701,539</b>	<b>5,910,201</b>	<b>6,305,229</b>	<b>6,750,631</b>	<b>7,165,478</b>	<b>7,600,175</b>	<b>8,123,375</b>	<b>8,665,818</b>
Net Primary Income from the rest of the world	1,149,599	1,147,835	1,254,283	1,401,578	1,474,725	1,542,980	1,632,345	1,728,528
<b>GROSS NATIONAL INCOME</b>	<b>6,851,138</b>	<b>7,058,037</b>	<b>7,559,511</b>	<b>8,152,210</b>	<b>8,640,203</b>	<b>9,143,155</b>	<b>9,755,720</b>	<b>10,394,346</b>

Source: Philippine Statistics Authority.



### 3.2.2 Gross Regional Domestic Product

**Table 3.11** shows the regional gross domestic product (GRDP) of each of the 17 regions of the country. From regional growth perspective, the Cordillera Autonomous Region registered as the fastest growing region in 2016-2017, with growth rate of 12.1%, followed by Region XI or Davao Region (10.9%), and Region III or Central Luzon (9.3%). However, in terms of the regional contribution to national domestic growth, NCR was the biggest contributor to the GDP in 2017, with 36.4% share. NCR consistently contributed an average of 36% to the GDP from 2010 to 2017.

**Table 3.11:** Gross Regional Domestic Product, 2010 to 2017 (In Thousands, At Constant 2000 Prices).

Region	2010	2011	2012	2013	2014	2015	2016	2017
<b>PHILIPPINES, GDP</b>	5,701,539,196	5,910,201,357	6,305,228,511	6,750,631,383	7,165,477,851	7,600,175,069	8,122,741,433	8,665,707,506
NATIONAL CAPITAL REGION	2,038,178,776	2,102,867,146	2,250,041,299	2,455,228,444	2,597,052,167	2,770,552,677	2,976,234,624	3,158,081,656
CORDILLERA ADMINISTRATIVE REGION	115,882,879	117,629,785	118,240,639	124,630,544	128,688,178	133,848,201	136,873,913	153,411,322
I – Ilocos Region	184,181,184	188,471,938	197,596,725	211,361,389	224,979,174	237,178,755	257,277,270	272,257,487
II – Cagayan Valley	99,839,760	105,494,400	113,060,564	120,474,018	129,114,289	134,444,616	139,548,688	149,578,296
III – Central Luzon	510,617,864	546,756,621	586,185,348	612,282,603	668,918,294	706,343,196	773,108,325	844,709,530
IVA – CALABARZON	1,009,389,533	1,025,925,324	1,097,789,972	1,170,574,623	1,230,372,013	1,302,297,272	1,364,736,594	1,456,088,132
IVB – MIMAROPA	101,835,838	104,997,401	109,260,357	110,673,201	119,911,229	122,258,656	125,432,256	133,228,208
V – Bicol Region	114,109,823	116,250,752	126,495,080	136,852,119	142,760,974	155,449,066	164,065,917	172,358,884
VI – Western Visayas	227,241,684	241,401,054	258,188,783	266,982,502	280,852,008	305,503,332	323,535,392	350,821,902
VII – Central Visayas	340,700,776	363,826,007	397,923,743	427,258,117	460,280,508	482,898,676	524,597,384	551,179,952
VIII – Eastern Visayas	150,799,368	153,900,653	143,420,096	150,072,628	146,476,790	153,224,685	171,610,264	174,669,515
IX – Zamboanga Peninsula	117,018,919	117,192,723	131,730,511	137,214,139	146,320,802	157,640,786	164,866,496	168,702,094
X – Northern Mindanao	210,965,521	223,230,074	237,653,180	250,536,070	268,424,368	283,769,262	304,952,799	323,009,662
XI – Davao Region	217,313,462	225,431,679	241,169,384	257,385,537	281,348,316	304,412,137	333,405,134	369,797,076
XII – SOCCSKSARGEN	151,318,180	159,315,513	170,875,256	185,305,980	196,770,182	203,183,377	213,182,370	230,598,148
Caraga	64,534,772	70,033,593	78,100,301	84,475,406	92,419,812	96,587,795	98,511,669	102,701,036
ARMM – Autonomous Region in Muslim Mindanao	47,610,858	47,476,696	47,497,273	49,324,066	50,788,748	50,582,581	50,802,338	54,514,604

Source: Philippine Statistics Authority.

### 3.2.3 Employment and Labor Productivity

The Philippines has a 68.74-million labor force (in 2016) representing the population aged 15 years old and above. Out of this, 43.72 million or 63.60 percent are actively participating in the jobs market. Based on 2016 Labor Force Survey (LFS), the country's employment level stood at 95.3 percent; unemployment rate was at 4.7 percent; while underemployment was at 18.0 percent. Among regions, Region IX - Zamboanga Peninsula posted the highest (97.5%) employment rate, followed by Cagayan Valley, and Western and Eastern Visayas (97%), then by SOCCSKSARGEN (96.8%). The labor productivity (GDP per employed person) of the agriculture, forestry and fishing sector posted a very high growth rate of 12.1 percent in 2017, compared to industry (4.1%) and services sector (7.2%). Overall, total labor productivity went up from 0.4 percent in 2010 to 8.4 percent in 2017. The labor data are shown in **Tables 3.12** and **3.13**.

**Table 3.12:** Labor Force Participation, Employment, Unemployment and Underemployment Rates, by Region, 2016.

Region	Total Population 15 Years Old and Over (in thousands)	Labor Force Participation Rate (In Percent)	Employment Rate (In Percent)	Unemployment Rate (In Percent)	Underemployment Rate (In Percent)
<b>Philippines</b>	<b>68,743</b>	<b>63.6</b>	<b>95.3</b>	<b>4.7</b>	<b>18.0</b>
National Capital Region	8,961	63.0	94.0	6.0	7.5
Cordillera Administrative Region	1,221	65.8	95.5	4.5	19.0
I – Ilocos Region	3,427	61.3	94.6	5.4	17.0
II – Cagayan Valley	2,352	66.4	97.0	3.0	14.8
III – Central Luzon	7,647	62.0	94.3	5.7	19.5
IVA – CALABARZON	9,618	64.4	93.9	6.1	15.5
IVB – MIMAROPA	2,009	66.1	96.0	4.0	17.0
V – Bicol Region	3,912	62.2	95.7	4.3	30.0
VI – Western Visayas	3,131	63.0	97.0	3.0	23.2
VII – Central Visayas	4,134	68.1	95.0	5.0	16.6
VIII – Eastern Visayas	3,020	60.5	97.0	3.0	31.2
IX – Zamboanga Peninsula	2,504	65.7	97.5	2.5	28.0
X – Northern Mindanao	3,196	67.3	95.8	4.2	26.7
XI – Davao Region	3,387	61.9	96.5	3.5	14.6
XII – SOCCSKSARGEN	3,031	64.8	96.8	3.2	20.0
Caraga	1,803	63.1	96.5	3.5	23.1
Autonomous Region in Muslim Mindanao	2,284	54.4	95.8	4.2	14.2
Negros Island Region	3,106	66.9	96.0	4.0	9.0

Source: Philippine Statistics Authority, October 2016 Labor Force Survey (LFS).

**Table 3.13:** Labor Productivity, by Sector, 2010-2017 (in constant 2000 prices).

Region and Sector	2010	2011	2012	2013	2014	2015	2016 <sup>r</sup>	2017
<b>Labor Productivity (PhP)</b>								
<b>Philippines</b>	<b>158,222</b>	<b>158,911</b>	<b>167,692</b>	<b>177,098</b>	<b>185,389</b>	<b>196,179</b>	<b>198,125</b>	<b>214,849</b>
Agriculture, forestry and fishing	55,425	55,420	57,800	59,734	60,910	63,728	64,256	72,023
Industry	344,418	342,486	353,725	373,769	387,752	405,643	384,137	399,878
Services	170,183	172,033	180,875	187,988	196,075	204,753	204,689	219,336
<b>Growth Rates (%)</b>								
Philippines		<b>0.4</b>	<b>5.5</b>	<b>5.6</b>	<b>4.7</b>	<b>5.8</b>	<b>0.99</b>	<b>8.4</b>
Agriculture, forestry and fishing		*	4.3	3.3	1.97	4.6	0.8	12.1
Industry		(0.6)	3.3	5.7	3.7	4.6	(5.3)	4.1
Services		1.1	5.1	3.9	4.3	4.4	(0.03)	7.2

## Notes:

1. Labor productivity data for 2014 were computed using the average of April, July and October employment data, and excluded Leyte province. For comparability, the 2014 growth rates were computed using the 2013 labor productivity data whose employment data was the average of April, July and October which excluded Leyte province.
2. Labor productivity data for 2015 were computed based on the annualized LFS data using the average of January, April, July and October employment data which excluded Leyte province.  
The use of the annualized LFS data using the four survey rounds was based on the result of the referendum among members of the Inter-Agency Committee on Labor and Productivity Statistics.  
For comparability, the 2015 growth rates were computed using the average of the 2015 April, July and October employment data which excluded Leyte province.
3. Starting April 2016 round, the LFS adopted the 2013 Master Sample and population projections based on the 2010 Census of Population. Previous survey rounds adopted the 2003 Master Sample and population projections based on the 2000 CPH.
4. Labor productivity data for 2016 were computed using the average of the four survey rounds employment data with the January 2016 data based on the 2010 Census-based population projections.
5. For comparability, the 2016 growth rates were computed using the average of July and October employment data for 2015 and 2016.

\* Less than zero percent.

<sup>r</sup> Revised figures.

Sources: Philippine Statistics Authority, National Accounts of the Philippines and Labor Force Survey (LFS).

## 3.3 Social Development

### 3.3.1 Household Composition

Filipino households consist of an average of 4.2 people. Twenty-one percent of households are headed by women. One-third of the Philippine population is under age 15.

### 3.3.2 Housing Characteristics: Access to Energy, Water, Sanitation, Communications and Transportation

One of the three pillars of sustainable development is social development and inclusiveness.

Ninety-three percent of Filipino households have access to electricity. Urban households are more likely to have electricity than rural households (96% versus 90%).

As of 2017, 97.7% of the urban population and 89.96% of the rural population use basic drinking water services (World Bank 2018). The MDG target of halving the population without access to basic drinking water services by 2015 has been achieved.

In 2017, the majority of households (95%) use an improved source of drinking water, with bottled water/refilling station (44%) and water piped into their homes (24%) as the most common improved sources (PSA and ICF 2018). Nine in ten urban households and 71% of rural households have water on the premises. Most households (79%) report that they do not treat their water prior to drinking.

People using basic sanitation services were 77.5% of urban population, and 71.5% of rural population in 2015 (World Bank 2018). The MDG target of halving the population without access to basic sanitation services by 2015 has been achieved. In 2017, 76.5% of the total population has access to basic sanitation services. However, only 52% of the population in 2017 is using safely managed sanitation services. Around 13% of population in Metro Manila has access to wastewater and septage management system (MWSS 2017). More actions and investments are needed to achieve SDG 6 targets on water and sanitation.<sup>3</sup>

According to the 2017 National Demographic and Health Survey (NDHS 2017), three in four households have an improved toilet facility. In 2017, 64% of households have a flush or pour-flush toilet connected to septic tank (67% in urban areas and 62% in rural areas). Around 17% use a shared facility of an acceptable type. Around 3% use an unimproved facility, and 5% have no facility. Six percent of households in rural areas have no toilet facility, compared with only 3% of urban households.

In 2017, 89% of Filipino households own a mobile phone, 77% have a television, and 51% own a radio (PSA and ICF 2018). Households in urban areas are more likely than rural households to own a mobile phone, television, or radio. Mobile cellular subscription is around 110.4 per 100 people in 2017 (World Bank 2018). Only 22% of households own a computer.

Of the NDHS 2017 respondents, 36 percent of households own a motorcycle or scooter, 19% own a bicycle, and 10% own a car or truck (PSA and ICF 2018).

Only 16% of households has a member who is a beneficiary of the cash transfer program for the poor – the Pantawid Pamilyang Pilipino Program (4Ps).

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<sup>3</sup> The SDG 6 targets on water and sanitation include: By 2030, achieve universal and equitable access to safe and affordable drinking water for all, and to adequate and equitable sanitation and hygiene for all; and improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and substantially increasing recycling and safe reuse globally.

### 3.3.3 Human Development Index (HDI)

The Philippines' HDI value for 2017 was recorded to be 0.699 — which put the country in the medium human development category (UNDP, 2018). For 2018, the HDI improved to 0.712— which put the country in the high human development category — positioning it at 106 out of 189 countries and territories (UNDP, 2019). **Table 3.14** shows the Philippines' progress in achieving the key HDI indicators. Between 1990 and 2018, Philippines' HDI value increased from 0.590 to 0.712, an increase of 20.6 percent. During this period, the life expectancy at birth increased by 4.7 years, mean years of schooling increased by 2.8 years and expected years of schooling increased by 1.9 years. The GNI per capita increased by about 140.6 percent between 1990 and 2018.

In 2018, life expectancy at birth was 71.1 years, mean years of schooling was 9.4 years, and GNI per capita (at 2011 PPP\$) was US\$ 9,540 (UNDP 2019). The expected years of schooling in 2018 was 12.7 years, as the *K-to-12 Program*<sup>4</sup> has been put in place.

**Table 3.14:** Trends in Human Development Index (based on consistent time series data).

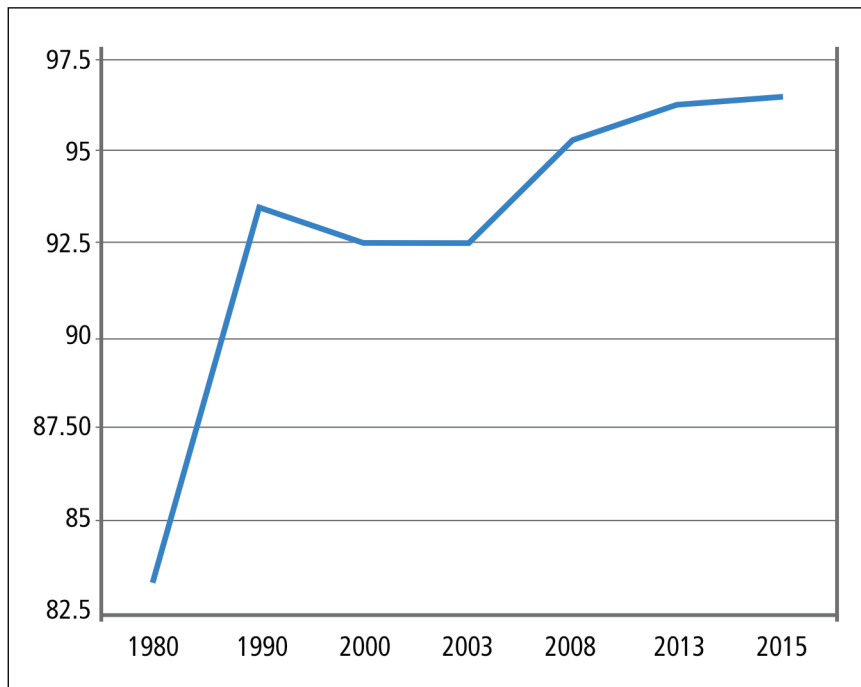
	Life expectancy at birth	Expected years of schooling	Mean years of schooling	GNI per capita (2011 PPP\$)	HDI value
<b>1990</b>	65.3	10.8	6.6	3,962	0.586
<b>1995</b>	66.3	10.8	7.1	4,099	0.598
<b>2000</b>	67.2	11.4	7.6	4,972	0.624
<b>2005</b>	67.8	11.5	8.7	5,678	0.650
<b>2010</b>	68.3	11.7	8.9	6,754	0.665
<b>2015</b>	69.0	12.6	9.3	8,323	0.693
<b>2016</b>	69.1	12.6	9.3	8,729	0.696
<b>2017</b>	69.2	12.6	9.3	9,154	0.699

Source: UNDP 2018.

### 3.3.4 Literacy

Based on the 2013 *Functional Literacy, Education and Mass Media Survey* (FLEMMS), the country registered a 90.3% rate, which means that nine out of every 10 Filipinos aged 10-64 were *functionally literate*. The basic literacy rate is 96.8 percent among females, slightly higher than for males, which is 95.1 percent in 2015. The adult (ages 15 years and above) literacy rate was 96.6 % in 2015, up from 96.4 % in 2013. The literacy of youth (ages 15-24) was 98.1 percent in 2013.

<sup>4</sup> **K-12 is a program** that covers kindergarten and 12 years of basic education to provide sufficient time for mastery of concepts and skills, develop lifelong learners, and prepare graduates for tertiary education, middle-level skills development, employment, and entrepreneurship.

**Figure 3.3:** Adult Literacy Rate (% of population 15 years old and above).

Source: World Bank, 2018.

**Table 3.15:** Literacy and Education Indicators.

<b>Literacy</b>	<b>definition:</b> age 15 and over can read and write
	<b>total population:</b> 98.18%
	<b>male:</b> 98.12%
	<b>female:</b> 98.24%
<b>School life expectancy</b> (primary to tertiary education)	<b>total:</b> 12.6 years
	<b>male:</b> 12 years
	<b>female:</b> 13 years (2013)
<b>Education expenditures</b>	2.7% of GDP (2009)

Source: World Bank, 2018.

### 3.3.5 Health

The most recent data on health and nutrition status of Filipinos indicate a generally improving trend and condition in terms of the number of hospitals, bed capacity of government and private hospitals, number of government medical practitioners, number of barangay health stations and licensed drug distributor establishments around the country.

Infant mortality has decreased from 17.9 deaths per 1,000 live births in 1993 to 13.6 deaths per 1,000 live births in 2017 (World Bank 2018). During the same time period, mortality of children under five years old has declined by half from 49 to 28 deaths per 1,000 live births (World Bank, 2018).

Around 25% of deaths in 2016 was caused by communicable diseases and maternal, prenatal and nutrition conditions. Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene was 4.2 per 100,000 population in 2016 (World Bank, 2018). Safely managed sanitation facilities would reduce impacts on water resources, fisheries, tourism and welfare. It was estimated that poor sanitation resulted in economic costs equivalent to 1.5% of the country's GDP (World Bank, 2008).

**Table 3.16:** Water, Sanitation and Health Indicators, 2015.

<b>Drinking water source</b>	<b>improved:</b>
	urban: 93.7% of population
	rural: 90.3% of population
	total: 91.8% of population
	<b>unimproved:</b>
	urban: 6.3% of population
rural: 9.7% of population	
total: 8.2% of population (2015 est.)	
<b>Sanitation facility access</b>	<b>improved:</b>
	urban: 77.9% of population
	rural: 70.8% of population
	total: 73.9% of population
	<b>unimproved:</b>
	urban: 22.1% of population
rural: 29.2% of population	
total: 26.1% of population (2015 est.)	
<b>Major infectious diseases</b>	<b>degree of risk:</b> high
	<b>food or waterborne diseases:</b> bacterial diarrhea, hepatitis A, and typhoid fever
	<b>vectorborne diseases:</b> dengue fever and malaria
	<b>water contact disease:</b> leptospirosis (2016)
<b>Prevalence of underweight, weight for age (% of children under 5 years)</b>	21.5% (2015)
<b>Prevalence of overweight, weight for height (% of children under 5 years)</b>	3.9% (2015)
<b>Obesity - adult prevalence rate</b>	6.4% (2016)
<b>Hospital bed density (per 1000 people)</b>	1 (2011)
<b>Current health expenditure (% of GDP)</b>	4.38% (2016)

Source: World Bank, 2018.

### 3.3.6 Poverty Incidence

Poverty incidence in the country went down from 26.6 percent in 2006 to 21.6 percent in 2015.

**Table 3.17** shows the poverty incidence of nine basic sectors. Among the nine basic sectors, farmers, fishermen, and children belonging to poor families or families with income below the official poverty threshold posted the highest poverty incidences in 2015 at 34.3%, 34.0% and 31.4%, respectively (PSA 2017). The poverty incidence of fishermen, by region, is shown in **Table 3.18**. Region V (Bicol) has the highest poverty incidence for fisherfolk at 48.6 percent.

**Table 3.17:** Poverty Incidence for Basic Sectors: 2006, 2009, 2012 and 2015.

Sector	2006		2009		2012		2015		Increase/Decrease		
	Poverty incidence (%)	CV	Poverty incidence (%)	CV	Poverty incidence (%)	CV	Poverty incidence (%)	CV	2006-2009	2009-2012	2012-2015
Philippines	26.6	1.9	26.3	2.0	25.2	2.1	21.6	3.5	(0.3)	(1.1)	(3.6)
1. Farmers	38.5	2.1	38.0	2.1	38.3	2.5	34.3	3.0	(0.5)	0.2	(4.0)
2. Fishermen	41.2	4.6	41.3	4.0	39.2	4.7	34.0	5.8	0.1	(2.1)	(5.2)
3. Children	35.2	1.7	35.3	1.4	35.2	1.7	31.4	1.9	0.1	(0.1)	(3.8)
4. Self-employed and Unpaid Family Workers <sup>af</sup>	30.6	2.2	29.9	2.0	29.0	2.4	25.0	2.8	(0.8)	(0.9)	(4.0)
5. Women	25.9	1.9	25.7	1.6	25.6	1.9	22.5	2.1	(0.20)	(0.1)	(3.1)
6. Youth	21.1	2.2	21.6	1.8	22.3	2.2	19.4	2.4	0.5	0.7	(2.9)
7. Migrant and Formal Sector Workers	16.0	2.5	16.8	2.1	16.6	2.6	13.4	2.7	0.7	(0.2)	(3.2)
8. Senior Citizens	16.9	3.1	16.1	2.5	16.2	2.9	13.2	3.1	(0.7)	0.0	(3.0)
9. Individuals residing in urban areas	12.6	4.0	12.6	3.3	13.0	4.2	11.5	5.0	(0.0)	0.4	(1.5)

Notes: cv - coefficient of variation

<sup>af</sup> Considering data available in the Philippine Statistical System, poverty estimates for self-employed and unpaid family workers, which serve as a proxy indicator for informal sector workers, have been generated since the June 2012 release of the 2009 Poverty Statistics for the Basic Sectors.

<sup>1f</sup> Basic sectors are not mutually exclusive, i.e., there are overlaps for sectors (women may also be counted as senior citizens, farmers, etc.)

<sup>2f</sup> Income derived from the FIES, which was used for classifying poor or non-poor basic sectors, refer to the total family income and not necessarily the income of the individual in a particular sector. Hence, total income of a family with two family members who are both working, one is a farmer while the other is a fisherman, for example, is divided among the family members to get the per capita income of each member including the farmer. If the per capita income is below the poverty threshold, then all the members of the family are considered poor.

<sup>3f</sup> Poverty estimates for the three other basic sectors, i.e., indigenous people, persons with disabilities, and victims of calamities and disasters were not generated as information on these were not available in the merged FIES and LFS, the major data sources for the estimation of poverty statistics for the basic sectors. On the other hand, poverty estimates for the remaining two sectors, i.e., nongovernment organization, and cooperatives are not generated as they are not applicable due to the nature of the sector (i.e., not individuals).

Source: Philippine Statistics Authority



**Table 3.18:** Poverty Incidence for Fishermen, by Region: 2006, 2009, 2012 and 2015.

Region	2006	2009	2012	2015	Increase/Decrease		
	Poverty Incidence (%)	Poverty Incidence (%)	Poverty Incidence (%)	Poverty Incidence (%)	Poverty Incidence (%)		
					2006-2009	2009-2012	2012-2015
Philippines	41.2	41.3	39.2	34.0	0.1	(2.1)	(5.2)
NCR							
CAR							
Region I	44.8	39.5	20.1	22.0	(5.3)	(19.4)	2.0
Region II							
Region III							
Region IVA	24.7	27.1	39.2	19.0	2.4	12.1	(20.2)
Region IVB	37.9	38.7	36.5	26.2	0.8	(2.2)	(10.3)
Region V	47.8	45.1	45.6	48.6	(2.6)	0.4	2.9
Region VI	33.5	32.1	27.6	18.6	(1.4)	(4.4)	(9.1)
Region VII	46.						
Region VII	46.0	43.4	40.2	31.2	(2.7)	(3.1)	(9.0)
Region VIII	45.1	49.0	46.4	40.0	3.8	(2.6)	(6.4)
Region IX	56.7	54.3	40.4	34.2	(2.4)	(13.9)	(6.3)
Region X							
Region XI	46.3	43.0	36.5	43.8	(3.3)	(6.6)	7.3
Region XII							
Caraga	61.8	68.6	49.6	38.9	6.8	(19.1)	(10.6)
ARMM	44.5	40.3	42.9	43.4	(4.2)	2.6	0.4

## Notes:

<sup>1/</sup> Fishermen refer to employed individuals 15 years old and over whose primary occupation is fishing.

<sup>2/</sup> Poverty incidence among fishermen refers to the proportion of fishermen (belonging to poor families) with per capita income less than the per capita poverty threshold to the total number of fishermen

<sup>3/</sup> The poverty incidence estimates for fishermen in NCR, CAR, Regions II, III, X and XII were excluded due to very low level of precision (with coefficient of variation greater than 50 percent) and small sample size (less than 50).

Source: *Philippine Statistics Authority*.

### 3.3.7 Socioeconomic Characteristics of Fishing Households

The 2015 survey of Filipino families' socio-economic conditions reveal that 16 percent of all Filipino households live below the poverty line, and 21.6% among the basic sectors (**Table 3.17**). For fishermen, the poverty incidence is much higher – at 34% in 2015 (**Table 3.18**). Among marine resource-dependent households (fishers, fish-workers, gleaners, and aquaculture workers), the poverty incidence is 30.6 percent (**Table 3.19**). There are fewer poor families headed by fish

workers or crews from commercial fishing boats (29.4%) compared to own-account fishing households (32.3%). It must be noted that fishing families have the highest poverty incidence among the rural agricultural sectors.

### ***Educational Attainment***

Based on the results of the 2015 *Family Income and Expenditure Survey* or FIES, more than one-third or 36 percent of fishing households did not finish elementary level of education; 25 percent were able to finish high school; 17 percent graduated from elementary; 12.5 percent had some high school education; and 14.5 were able to finish high school.

### ***Access to Safe water, Sanitary Toilet, Electricity***

In terms of the number of fishing households having access to safe drinking water, the same survey results show that 32 percent did not have access, while 23 percent did not have sanitary toilets, and 21.7 percent did not have access to electricity.

### ***Durable Housing, and House/Lot Ownership***

Based on the 2015 FIES, it was found that only two percent (2%) of the fishing families reside in makeshift houses, whereas 36.1 percent were found to be informal settlers in the houses they occupy.

**Table 3.19:** Number of Fishing Families vs. Poverty Incidence, 2015.

	Families	Poverty incidence
<b>Total Fishing Families</b>	1,255,739.40	30.61%
<b>Total Part-time fishing Families</b>	427,227.24	
<b>Total FULL TIME</b>	828,512.16	
<b>Total Marine Fishing Families</b>	746,039.50	
Fisher	651,283.60	32.3%
Fish Worker	94,755.90	29.4%

Source: PSA. 2015 Family Income and Expenditure Survey (FIES).

**Table 3.20:** Socioeconomic Characteristics of Coastal and Marine Resource-dependent Household.

	2006		2009		2012		2015	
	Count	Frequency	Count	Frequency	Count	Frequency	Count	Frequency
<b>Average Family Size</b>	4.62		5.25		5.35		4.98	
<b>Mean Income (PhP, per capita)</b>	67,622		35,077		32,915		36,646	
<b>Mean Expenditure (per capita)</b>	54,191		28,973		27,600		30,432	
<b>POVERTY INCIDENCE</b>								
Poor	3,749,404	16.5%	384,388	30.6%	211,927	31.4%	39,155	25.6%
Non-Poor	18,981,006	83.5%	871,352	69.4%	463,705	68.6%	113,726	74.4%
<b>TOTAL</b>			<b>1,255,739</b>		<b>675,632</b>		<b>152,880</b>	
<b>EDUCATIONAL ATTAINMENT OF HH LEAD</b>								
No Grade Completed	515,567	2.3%	70,502	5.6%	43,926	6.5%	1,818	1.2%
Elementary Undergraduate	4,391,729	19.3%	452,701	36.1%	262,572	38.9%	45,714	29.9%
Elementary Graduate	4,071,608	17.9%	312,769	24.9%	166,120	24.6%	39,618	25.9%
High School Undergrad	2,615,111	11.5%	156,676	12.5%	79,314	11.7%	26,705	17.5%
High School Graduate	5,660,658	24.9%	182,099	14.5%	91,646	13.6%	27,776	18.2%
College Undgraduate	2,064,644	9.1%	42,241	3.4%	18,135	2.7%	5,105	3.3%
College Graduate or more	3,411,094	15.0%	38,752	3.1%	13,918	2.1%	6,144	4.0%
<b>TOTAL</b>	<b>22,730,410</b>		<b>1,255,739</b>		<b>675,632</b>		<b>152,880</b>	
<b>ACCESS TO SAFE WATER</b>								
Not Safe Source	3,908,902	17.2%	403,174	32.1%	228,560	33.8%	44,901	29.4%
Safe Source	18,821,508	82.8%	852,565	67.9%	447,072	66.2%	107,980	70.6%
<b>TOTAL</b>	<b>22,730,410</b>		<b>1,255,739</b>		<b>675,632</b>		<b>152,880</b>	

Table 3.20: Socioeconomic Characteristics of Coastal and Marine Resource-dependent Household. (cont.)

	2006		2009		2012		2015	
	Count	Frequency	Count	Frequency	Count	Frequency	Count	Frequency
<b>ACCESS TO SANITATION</b>								
Not sanitary Toilet	1,424,530	6.3%	289,645	23.1%	180,854	26.8%	26,994	17.7%
Sanitary Toilet	21,305,880	93.7%	966,094	76.9%	494,778	73.2%	125,886	82.3%
<b>TOTAL</b>	<b>22,730,410</b>		<b>1,255,739</b>		<b>675,632</b>		<b>152,880</b>	
<b>ACCESS TO ELECTRICITY</b>								
With Electricity	20,696,301	91.1%	983,220	78.3%	501,454	74.2%	131,068	85.7%
W/o Electricity	2,034,109	8.9%	272,519	21.7%	174,178	25.8%	21,813	14.3%
<b>TOTAL</b>	<b>22,730,410</b>		<b>1,255,739</b>		<b>675,632</b>		<b>152,880</b>	
<b>SHARE OF MAKESHIFT HOUSING</b>								
Makeshift (roof or wall)	301,441	1.3%	25,065	2.0%	13,957	2.1%	5,751	3.8%
Not makeshift	22,428,969	98.7%	1,230,674	98.0%	661,675	97.9%	147,129	96.2%
<b>TOTAL</b>	<b>22,730,410</b>		<b>1,255,739</b>		<b>675,632</b>		<b>152,880</b>	
<b>SHARE OF INFORMAL SETTLERS</b>								
Formal	17,685,900	77.8%	802,087	63.9%	413,845	61.3%	98,314	64.3%
Informal	5,044,510	22.2%	453,652	36.1%	261,787	38.7%	54,566	35.7%
<b>TOTAL</b>	<b>22,730,410</b>		<b>1,255,739</b>		<b>675,632</b>		<b>152,880</b>	
<b>EXPENDITURE PATTERN (WEIGHTED)</b>								
<b>Total Expenditure</b>	<b>214,816</b>		<b>135,040</b>		<b>131,013</b>		<b>134,707</b>	
Food	89,997	41.9%	75,262	55.7%	75,473	57.6%	74,056	55.0%
Alcohol	1,124	0.5%	1,116	0.8%	1,023	0.8%	1,096	0.8%
Tobacco	2,454	1.1%	2,929	2.2%	2,891	2.2%	2,643	2.0%
Other Vegetables	29	0.0%	39	0.0%	26	0.0%	12	0.0%
Hotel	470	0.2%	228	0.2%	249	0.2%	138	0.1%
Clothing	5,234	2.4%	3,151	2.3%	2,966	2.3%	3,166	2.4%
House and Water	43,191	20.1%	19,958	14.8%	18,755	14.3%	21,269	15.8%
Non-durable furnishing	5,284	2.5%	2,656	2.0%	2,523	1.9%	2,613	1.9%
Medical Care	7,941	3.7%	2,891	2.1%	2,470	1.9%	2,680	2.0%
Transport	13,343	6.2%	5,952	4.4%	5,570	4.3%	6,507	4.8%

**Table 3.20:** Socioeconomic Characteristics of Coastal and Marine Resource-dependent Household. (cont.)

	2006		2009		2012		2015	
	Count	Frequency	Count	Frequency	Count	Frequency	Count	Frequency
Communication	4,764	2.2%	1,476	1.1%	1,309	1.0%	1,516	1.1%
Recreation	1,740	0.8%	901	0.7%	736	0.6%	1,538	1.1%
Education	8,074	3.8%	3,513	2.6%	3,511	2.7%	2,619	1.9%
Miscellaneous	13,618	6.3%	6,988	5.2%	6,692	5.1%	7,414	5.5%
Durable and Equipment	5,454	2.5%	2,439	1.8%	2,104	1.6%	2,130	1.6%
Special Occasion	5,468	2.5%	3,547	2.6%	2,770	2.1%	3,641	2.7%
Other Expenses	6,630	3.1%	1,993	1.5%	1,944	1.5%	1,669	1.2%

Source: PSA. FIES, 2015.



Photo by M. Ebarvia



*Manila Bay: aquaculture; shipping; boardwalk in mangrove area; city skyline. (Photos by M. Ebarvia)*

## PART 2

# HARNESSING THE OCEANS

# 4 Ocean Economy

Oceans provide an extensive range of natural assets and resources – natural capital from which humans derive a wide variety of ecosystem services that make life possible and upon which human activities rely.

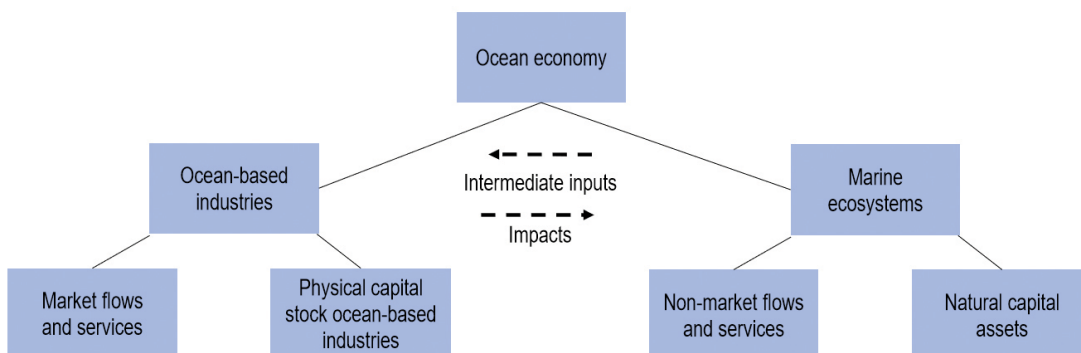
The entire ocean economy is measured as the sum of: (a) the economic activities with dependence on the ocean and coastal and marine resources, and (b) natural assets, goods and services of marine ecosystems upon which these industries depend on, and people rely on for food, income, livelihood, recreation, shoreline protection, etc. (**Figure 4.1**)

The ocean economic activities can be measured using the System of National Accounts (SNA), and include:

- *ocean-based activities*, such as fisheries, marine tourism, shipping, oil and gas, ocean energy, etc.;
- *ocean-related activities*: (a) those that use products from the ocean (e.g., seafood processing, marine biotechnology, salt); (b) produce products and services for the ocean-based activities (e.g., ports, ship-building, communication, maritime insurance); (c) marine education, and research and development; and (d) government agencies with direct maritime responsibilities (e.g., navy, coast guard, marine environmental protection, etc.).

The ocean also provides services that are not usually quantified and captured in the national income accounts, such as *regulating services* (e.g., carbon storage, shoreline protection, waste assimilation, nutrient cycling), *supporting services* (e.g., habitat, nursery), and *cultural services*.

**Figure 4.1:** Ocean Economy.



Source: OECD (2016).



## 4.1 Contribution to Income and Employment

An archipelago as it is, the Philippines is composed of more than 7,641 islands situated in the western Pacific Ocean, with major seas surrounding large and small provinces alike. Thus, people depend significantly on marine and coastal resources for their daily livelihood activities, such as fishing and aquaculture, seaweeds production, transportation, tourism, construction, etc. For the period 2012 to 2016, it was estimated that the ocean economy's contribution to GDP was about seven percent per annum (**Table 4.1**). In 2016 alone, its total gross value added or GVA to total economy was placed at US\$ 11.9 billion. **Figure 4.2** shows the percentage contribution of the major ocean economic activities. The top three sectors are: coastal and marine tourism (25%), fisheries and aquaculture (20%), and manufacturing, which includes fish and seafood processing, shipbuilding and ship repair, and marine transport equipment production (19%). **Table 4.2** shows the sub-categories of ocean economic activities under each key ocean industry.

Overall, the ocean-based and -related industries employed around 1.98 million people in 2012 which increased to 2.2 million workers or about 5.3 percent of the country's total employment in 2016 (**Table 4.3**).

The ocean likewise serves as production base of more than 400,000 Filipino seafarers deployed around the world (**Table 4.4**). Their remittances are a significant portion of the country's gross national income, amounting to US\$5.57 billion in 2016 (PSA).

**Table 4.1:** Gross Value Added of Ocean-based Activities by Industrial Origin.  
In million US\$, at constant prices (2012=100).

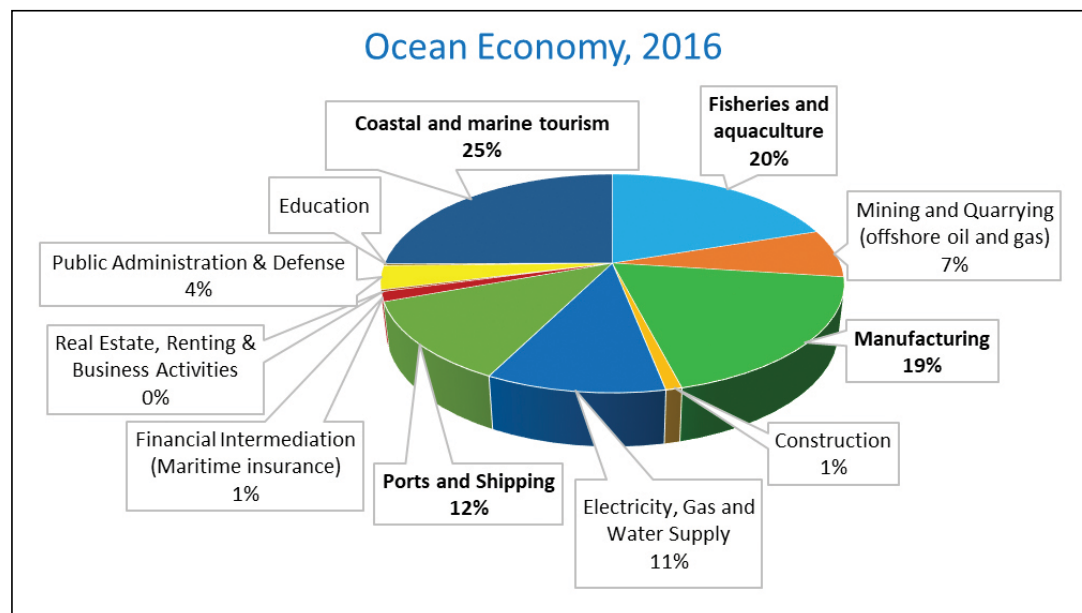
Industry/Year	2012	2013	2014	2015	2016
<b>I. Agriculture, Hunting, Forestry and Fishing</b>	<b>2,886</b>	<b>2,879</b>	<b>2,712</b>	<b>2,587</b>	<b>2,371</b>
a. Fishing	2,886	2,879	2,712	2,587	2,371
<b>II. Industry</b>	<b>4,021</b>	<b>3,892</b>	<b>4,090</b>	<b>4,131</b>	<b>4,475</b>
a. Mining and Quarrying (offshore and gas)	992	891	865	802	852
b. Manufacturing (fish and seafood processing; ship-building and repair; marine transport equipment)	1,614	1,597	1,900	1,991	2,256
c. Construction	83	93	100	116	114
d. Electricity, Gas and Water Supply (electricity generated from natural gas and wind power)	1,332	1,310	1,225	1,222	1,254
<b>III. Service Sector</b>	<b>4,256</b>	<b>4,448</b>	<b>4,555</b>	<b>5,096</b>	<b>5,070</b>
a. Transportation, Storage and Communication (Ports and Shipping)	1,164	1,220	1,315	1,384	1,427
b. Financial Intermediation (Maritime insurance)	167	187	173	169	167
c. Real Estate, Renting and Business Activities	24	27	29	31	34

**Table 4.1:** Gross Value Added of Ocean-based Activities by Industrial Origin.  
In million US\$, at constant prices (2012=100). (cont.)

Industry/Year	2012	2013	2014	2015	2016
d. Public Administration and Defense	390	401	401	413	417
e. Other Services	<b>2,510</b>	<b>2,613</b>	<b>2,638</b>	<b>3,099</b>	<b>3,025</b>
Education	49	47	45	44	33
Hotels and Accommodations (for coastal and marine tourism)	1,182	2,020	2,021	2,385	2,299
Recreation (Coastal and marine recreation and tourism)	650	545	572	670	693
<b>OCEAN-BASED ACTIVITIES GROSS VALUE ADDED</b>	<b>11,163</b>	<b>11,218</b>	<b>11,357</b>	<b>11,813</b>	<b>11,916</b>
<b>GROSS DOMESTIC PRODUCT (GDP)</b>	<b>149,311</b>	<b>159,040</b>	<b>161,402</b>	<b>167,027</b>	<b>171,109</b>
<b>Share of ocean economy to GDP (%)</b>	<b>7.48%</b>	<b>7.05%</b>	<b>7.04%</b>	<b>7.07%</b>	<b>6.96%</b>

Source: Philippine Statistics Authority.

**Figure 4.2:** Percentage Share of Ocean Economic Activities in 2016.



**Table 4.2:** Industries included in the Ocean Economy.

Industry	Industry Description
<b>FISHING</b>	<ul style="list-style-type: none"> <li>• Ocean fishing</li> <li>• Fish corral fishing</li> <li>• Prawn culture in brackish water</li> <li>• Culture of oysters, other bivalves and other mollusks in sea water</li> <li>• Pearl culture and pearl shell gathering</li> <li>• Other fishing activities, n.e.c</li> </ul>
<b>MINING AND QUARRYING</b>	<ul style="list-style-type: none"> <li>• Extraction of crude petroleum (offshore)</li> <li>• Extraction of natural gas (offshore)</li> <li>• Extraction of salt</li> </ul>
<b>MANUFACTURING</b>	<ul style="list-style-type: none"> <li>• Canning/packing of fish and other marine products</li> <li>• Other types of processing of fish and other marine products</li> <li>• Manufacture of engines and turbines for marine propulsion</li> <li>• Manufacture of marine capstans, pulley tackle and hoists, etc.</li> <li>• Building and repairing of ships and boats</li> </ul>
<b>ELECTRICITY</b>	<ul style="list-style-type: none"> <li>• Generation of Electricity from Natural Gas (not explicitly stated in PSIC)</li> </ul>
<b>CONSTRUCTION</b>	<ul style="list-style-type: none"> <li>• Construction of piers, wharves, dredging, beach reconstruction (not explicitly stated in PSIC)</li> </ul>
<b>TRADE</b>	<ul style="list-style-type: none"> <li>• Trading at sea (not explicitly stated in PSIC)</li> </ul>
<b>TRANSPORT AND STORAGE</b>	<ul style="list-style-type: none"> <li>• Ocean passenger transport</li> <li>• Ocean freight transport</li> <li>• Interisland water passenger transport</li> <li>• Interisland water freight transport</li> <li>• Inland freight water transport</li> <li>• Renting of ship with operator</li> <li>• Towing and pushing services on coastal and transoceanic waters</li> <li>• Service activities incidental to water transportation (cargo handling, storage of freight, harbor operations and other activities such as docking, pilotage, lighterage and vessel salvage operations)</li> <li>• Customs brokerage (pertains to shipping)</li> </ul>
<b>FINANCIAL INTERMEDIATION</b>	<ul style="list-style-type: none"> <li>• Passenger travel insurance (part of Life Insurance)</li> <li>• Vehicle (ship) insurance (part of Non-life insurance)</li> </ul>
<b>BUSINESS ACTIVITIES</b>	<ul style="list-style-type: none"> <li>• Renting of water transport equipment</li> <li>• Renting and leasing of recreational and sports goods (specifically equipment which are specific for ocean/sea use)</li> <li>• Research and experimental development in natural sciences (particularly on maritime research and development)</li> <li>• Labor recruitment and provision of personnel (only those recruitment agencies for sea based workers)</li> <li>• Underwater photography</li> </ul>
<b>PUBLIC ADMINISTRATION</b>	<ul style="list-style-type: none"> <li>• Defense activities, public order, and safety activities (refer to services of coast guard and navy, such as rescue operations in the sea)</li> </ul>
<b>EDUCATION</b>	<ul style="list-style-type: none"> <li>• Maritime education and trainings (not explicitly stated in PSIC)</li> </ul>
<b>RECREATIONAL SERVICES</b>	<ul style="list-style-type: none"> <li>• Recreational fishing (not explicitly stated in PSIC)</li> <li>• Tourism activities involving sea/ocean (not explicitly stated in PSIC)</li> </ul>

Source: Philippine Statistics Authority.

**Table 4.3:** Employment in Ocean Economy, 2012-2016.

Industry/Year	2012	2013	2014	2015	2016
<b>I. Agriculture, Hunting, Forestry and Fishing</b>	<b>369,373</b>	<b>328,764</b>	<b>301,168</b>	<b>292,924</b>	<b>260,118</b>
a. Fishing	369,373	328,764	301,168	292,924	260,118
<b>II. Industry Sector</b>	<b>170,501</b>	<b>165,677</b>	<b>162,915</b>	<b>166,870</b>	<b>180,063</b>
a. Mining and Quarrying	3,898	3,762	3,315	3,443	3,024
b. Manufacturing	144,010	142,326	144,621	148,380	156,407
c. Electricity, Gas and Water Supply	22,593	19,590	14,979	15,047	20,631
<b>III. Service Sector</b>	<b>1,435,865</b>	<b>1,463,290</b>	<b>1,507,611</b>	<b>1,686,476</b>	<b>1,715,972</b>
a. Transportation, Storage and Communication	673,124	668,160	667,932	713,366	772,849
b. Real Estate, Renting and Business Activities	4,654	4,532	5,527	4,853	5,192
c. Public Administration and Defense	30,984	28,800	32,177	29,497	35,654
d. Other Services	<b>727,104</b>	<b>761,798</b>	<b>801,974</b>	<b>938,760</b>	<b>902,277</b>
Education	5,997	5,317	5,520	5,396	4,004
Hotels and Accommodations	675,675	721,721	756,951	889,549	851,928
Recreation	45,432	34,759	39,504	43,815	46,345
<b>TOTAL EMPLOYMENT IN OCEAN-BASED ACTIVITIES</b>	<b>1,975,738</b>	<b>1,957,731</b>	<b>1,971,693</b>	<b>2,146,270</b>	<b>2,156,152</b>
<b>TOTAL EMPLOYMENT</b>	<b>37,600,000</b>	<b>36,286,000</b>	<b>37,310,000</b>	<b>38,741,000</b>	<b>40,837,000</b>
<b>Share of ocean-based employment to total employment</b>	<b>5.3</b>	<b>5.4</b>	<b>5.3</b>	<b>5.5</b>	<b>5.3</b>

Source: Philippine Statistics Authority.

**Table 4.4:** Deployment and Remittances of Sea-based Overseas Filipino Workers, 2012-2016.

	2012	2013	2014	2015	2016
<b>Deployment of Filipino Seafarers</b>	366,865	367,166	401,826	406,531	no data
<b>Sea-based Overseas Filipinos' Remittances (in thousand U.S. Dollars)</b>	4,835,342	5,215,378	5,503,179	5,792,459	5,572,148

Source: Philippine Statistics Authority.

## 4.2 Valuation of Ecosystem Services

The estimated monetary values of coastal and marine ecosystems are shown in **Table 4.5**. These are based on figures from the early studies of Samonte, et al. (2007), Padilla (2009), and de Groot (2012), which are shown in **Tables 4.6 to 4.8**. According to Azanza, et al, 2017:

- Based on primary and available secondary data, the marine ecosystems (mangroves, seagrass, and coral reefs, excluding the continental shelf) can contribute a monetary value of **US\$ 966.6 billion** to the economy.

- The estimated total annual net benefits amount to **US\$ 6.35 billion** or PHP 285.75B (at US\$ 1=PHP 45 exchange rate in 2007), with a sizable share accounted for by benefits from coral reefs.
- For mangroves, indirect use values, particularly those pertaining to nursery habitat and shoreline protection, make up more than 90 percent of the estimated total net annual benefits.
- For all marine ecosystem types, regulating services comprise an appreciable share of the average per hectare monetary value.
- Erosion prevention and waste treatment comprise a substantial proportion of average monetary values of regulating services for coral reefs and coastal systems, and wetlands, respectively.

There is still a need to review the assumptions and methodologies used in estimating the values of the coastal and marine ecosystem services shown in **Table 4.5**. It is not clear how the figures from Tables 4.6 to 4.8 were used and adjusted. The area of the habitats in **Table 4.6** also have to be updated. The regulating services (e.g., shoreline protection, erosion prevention, waste assimilation, and carbon sequestration) depend on the functional integrity and condition of the ecosystems, so the estimation may have to be adjusted. Moreover, the value of the provisioning service in terms of fisheries, for example, is higher than the value of actual fisheries production reported in the GDP accounts.

**Table 4.5: Area, Status, and Monetary Value of Coastal and Marine Ecosystems.**

Habitat	Area (km <sup>2</sup> )*	Status	Valuation of ecosystem services (in US\$ billion, 2007 prices)**
Mangroves	3,034	↓	47.918
Coral reefs	7,977	Area: 4% excellent: ↓ 31% good: ↑ 46.6% fair: ↑ 18% poor: ↓	915.847
Seagrass beds	4,890	↓	2.828
Mudflats	2,000	↓	
Continental shelf*			533.808
<b>Total for mangroves, coral reefs and seagrass</b>			<b>966.594</b>
<b>TOTAL (including continental shelf)</b>			<b>1,500.402</b>

Note: Area of continental shelf: 184,600 km<sup>2</sup> (Padilla, 2009)  
Source: \* DENR-NAMRIA, 2017; \*\* Azanza, et al., 2017

**Table 4.6:** Computed Net Annual Benefits (in US\$) from Marine Ecosystem Components.

Marine ecosystem components	Net annual benefits per ha (US\$)	Total area (ha)	Net annual benefits
<b>Coral reefs</b>	<b>2,347</b>	<b>2,600,000</b>	<b>6,102,141,278</b>
Fisheries	1,184		
Tourism	827		
Research	50		
Carbon sequestration	18		
Shoreline protection	50		
Biodiversity	218		
<b>Mangroves</b>	<b>973</b>	<b>247,200.00</b>	<b>240,451,507.54</b>
Fisheries	13		
Mollusks/Echinoderms	26		
Nursery role	243		
Shoreline protection	672		
Biodiversity	19		
<b>Seagrass</b>	<b>41</b>	<b>97,800.00</b>	<b>4,055,676.32</b>
Fisheries	23		
Mollusks/Echinoderms	18		
<b>Total</b>			<b>6,346,648,461.86</b>

Note: The figures are drawn from previous site-specific studies, mostly from Samonte, et al. (2007).

Source: Azanza, et al. 2017.

**Table 4.7:** Net Benefits of the Coastal and Marine Ecosystem Services (US\$ thousands).

Ecosystem Services	Coastal				Oceanic	Total	
	Mangrove	Seagrass	Coral Reef	Other Coastal		Amount	%
<b>Provisioning</b>							
Fisheries	143.1	56.7	997.6	5,912.4	3,176.9	10,286.70	42.7
Timber	595.2					595.2	2.5
<b>Sub-total</b>	<b>738.3</b>	<b>56.7</b>	<b>997.6</b>	<b>5,912.4</b>	<b>3,176.9</b>	<b>10,881.9</b>	<b>45.2</b>
<b>Cultural</b>							
Recreation	26.5		94.7	125.6		246.8	1
Education/Research	7.5	8.3	10.1	4.7		30.6	0.1
Existence			199.3	16.8	1.4	217.5	0.9
<b>Sub-total</b>	<b>34.1</b>	<b>8.3</b>	<b>304.1</b>	<b>147.1</b>	<b>1.4</b>	<b>494.9</b>	<b>2.1</b>
<b>Regulating</b>							
Carbon Sequestration	172.2					172.2	0.7
Shoreline protection	854.1		2,018.4			2,872.5	11.9
Waste Assimilation	53.8	25.2	695.1	6,091.9		6,866.0	28.5
<b>Subtotal</b>	<b>1,080.1</b>	<b>25.2</b>	<b>2,713.5</b>	<b>6,091.9</b>	<b>-</b>	<b>9,910.7</b>	<b>41.2</b>

**Table 4.7:** Net Benefits of the Coastal and Marine Ecosystem Services. (cont.)

Philippines: Net Benefits	Coastal				Oceanic	Total	
	Mangrove	Seagrass	Coral Reef	Other Coastal		Amount	%
<b>Supporting</b>							
Mariculture				2,775.1		2,775.1	11.5
<b>TOTAL</b>	<b>1,852.6</b>	<b>90.1</b>	<b>4,015.2</b>	<b>14,926.5</b>	<b>3,178.3</b>	<b>24,062.6</b>	<b>100</b>
<b>Percent</b>	7.7	0.4	16.7	62	13.2	100	

Source: Padilla (2009); World Bank (2009).

**Table 4.8:** Summary of Monetary Value for Services per Biome of Global Coastal Ecosystems (in US\$/ha/year, 2007 price levels).

Ecosystem services	Coral reefs	Coastal systems	Coastal wetlands
<b>Provisioning services</b>	<b>55,724</b>	<b>2,396</b>	<b>2,998</b>
Food	677	2,384	1,111
Water			1,217
Raw materials	21,528	12	358
Genetic resources	33,048		10
Medicinal resources			301
Ornamental resources	472		
<b>Regulating services</b>	<b>171,478</b>	<b>25,847</b>	<b>171,515</b>
Climate regulation	1,188	479	65
Disturbance moderation	16,991		5,351
Waste treatment	85		162,125
Erosion prevention	153,214	25,368	3,929
Nutrient cycling			45
Habitat services	16,210	375	17,138
Nursery service		194	10,648
Genetic diversity	16,210	180	6,490
<b>Cultural services</b>	<b>108,837</b>	<b>300</b>	<b>2,193</b>
Aesthetic information	11,390		
Recreation	96,302	256	2,193
Inspiration			
Spiritual experience		21	
Cognitive development	1,145	22	
<b>Total economic value</b>	<b>352,249</b>	<b>28,917</b>	<b>193,845</b>

Source: De Groot, et al. (2012).

# 5 Fisheries and Food Security from Coastal and Marine Resources

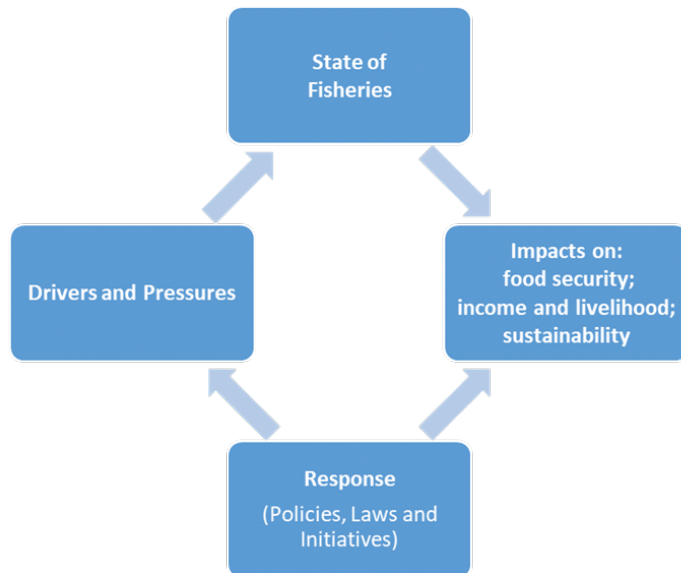


Photo by D. Bautista

## 5.1 Fish Stock Assessment

Pursuant to the Philippine Fisheries Code of 1998 (R.A. 8550), the National Fisheries Research and Development Institute (NFRDI) was created to spearhead fisheries research for the development, management and conservation and protection of the country's fisheries resources. Regular and continuous fish stock assessment is essential for monitoring the status of fish stocks and to determine the possible outcomes of different management interventions (FAO, 2005). To answer to the lack of standardized and consistent information on the country's fisheries stock records, the *National Fish Stock Assessment Program* was created. The program aimed to establish a landed catch and effort monitoring system that could be used for capture fisheries management. Fish stocks can be renewable, but unless managed properly and their habitats protected, they are finite.

The *Philippine Capture Fisheries Atlas 2017* reported an annual total catch of 1,657,576 tonnes in 2014. **Table 5.1** shows the types and volume of fish caught in 2014.



**Table 5.1:** Total Catch Recorded by the National Stock Assessment Program as of Year 2014.

Catch type		Total Catch (tonnes)
<b>Oceanic tunas</b>	Yellowfin Tuna, Bigeye Tuna, Albacore Tuna, Bluefin Tuna and Skipjack	209,197
<b>Neritic tunas</b>	Bullet Tuna, Frigate Tuna, Kawakawa, Longtail Tuna, Striped Bonito, Spanish Mackerel and the Indo-Pacific Mackerel	72,558
<b>Small pelagics</b>	Anchovies, Sardines / Herrings, Scads, Indian Mackerel, Fusiliers and Flying Fishes	456,228
<b>Other pelagic fishes</b>	Barracuda, Needle Fish, Halfbeaks, Cutlassfish, Snake Mackerel, Milkfish, Tarpon, Cobia and Jacks	49,091
<b>Other large pelagics</b>	Black Marlin, Indo-Pacific Blue Marlin, Indo-Pacific Sailfish, Swordfish, Pompano Dolphinfish, Wahoo, Ocean Sunfish, Opah and Striped Marlin	20,900
<b>Demersal fishes</b>	Unicorn Leatherjacket, Lattice Monocle Bream, Splendid Ponyfish, Bluespot Mullet, Japanese Threadfish Bream, Purple-spotted Bigeye, Butterfly Whiptail, Orange-fin Ponyfish, Toothed Ponyfish and the Tiger Perch	97,126
<b>Sharks and Rays</b>	Scalloped Hammerhead, Megamouth, Fox Shark, Whitecheek Shark, Spottail shark, Blue Spotted Stingray, Blue Spotted Maskray, Honeycomb Stingray, Briwn Stingray and Spotted Eagleray	1,664
<b>Invertebrates</b>	Flower Crab, Swordtip Squid, Spider Prawn, Indian Squid, Hawaiian Arrow Squid, Oval Squid, Indian White Prawn, Indian Ocean Squid, Cuttlefish and the Purpleback Flying Squid	44,680
<b>TOTAL</b>		<b>1,657,576</b>

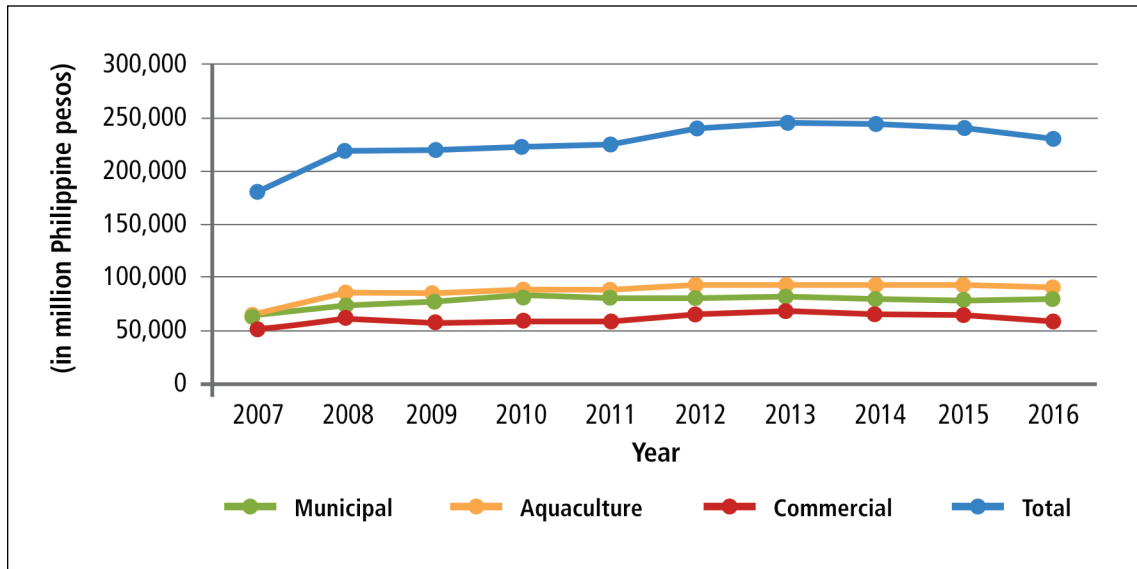
Source: *The Philippines Capture Fisheries Atlas of 2017*.

## 5.2 Fisheries Production

The Philippines remains as one of the top fishery producing markets in the world. In 2015, the total contribution of the fishery sector to the country's gross domestic product was 1.3% and 1.5% for the current and constant 2000 prices, respectively. This amount is equal to around PhP 184.8 billion at current prices, and PhP 122.9 billion at constant prices. However, slowly decreasing trend in volume of fish catch was observed from 2010-2016 (**Figures 5.1** and **5.2**). The 2016 fisheries production in particular, has shown a decline of 6.3% from the previous year's production of 4.6 million tonnes. Marine fishery catches have averaged to about two million tonnes per year for the

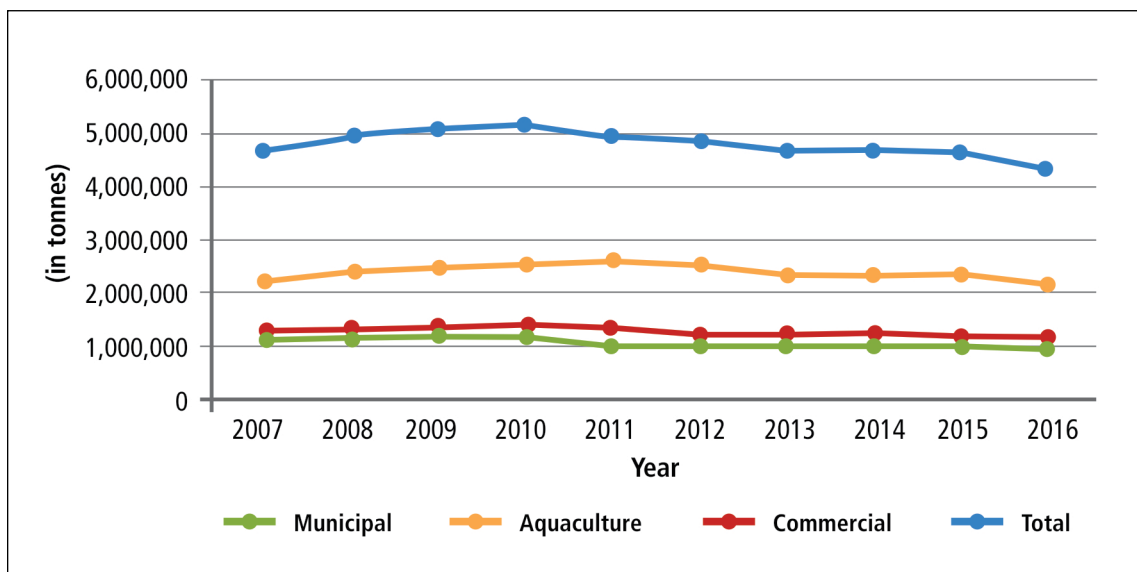
last 10 years. Production from municipal fisheries and commercial fisheries are estimated to be around more than 1 million tonnes each. Tuna also remains to be the top exported product in the Philippines, followed by seaweeds and crabs and its associated products (BFAR, 2017).

**Figure 5.1:** Value of Fish Production, by Sector, from 2007 to 2016.



Source: BFAR, 2016.

**Figure 5.2:** Volume of Fish Production, by Sector, from 2007 to 2016.



Note: 1 tonne = 1 metric ton

Source: BFAR, 2016.

Aquaculture production is about equal to the production of marine capture fisheries in terms of volume, but only 39.8% in terms of value. Among the fisheries sectors in the country, aquaculture remains to be the top producing player with over 2 million tonnes per year or 50.5% of total fisheries production (**Table 5.2**).

**Table 5.2:** Total Fish Production, by Sector, 2016.

Sector	Quantity (tonnes)	% to total	Value Current Prices ('000 P)	% to total
1. Aquaculture	2,200,913.29	50.5	91,141,919.73	39.8
2. Municipal Fisheries	1,137,931.03	26.1	78,925,620.10	34.5
3. Commercial Fisheries	1,016,948.05	23.3	58,866,556.69	25.7
<b>TOTAL</b>	<b>4,355,792.37</b>	<b>100.0</b>	<b>228,934,096.52</b>	<b>100.0</b>

Note: 1 tonne = 1 metric ton

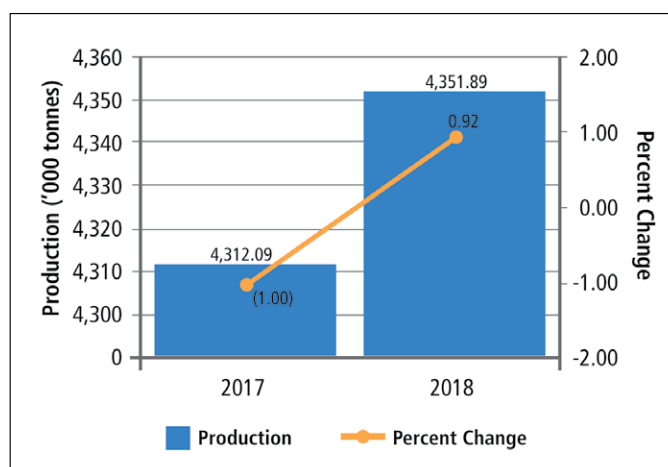
Source: BFAR, *Philippine Fisheries Profile, 2016*.

In 2018, the total volume of fisheries production was estimated at 4.35 million tonnes, which was 0.92 percent higher than its previous year's level of 4.31 million metric tons (**Figure 5.3**).

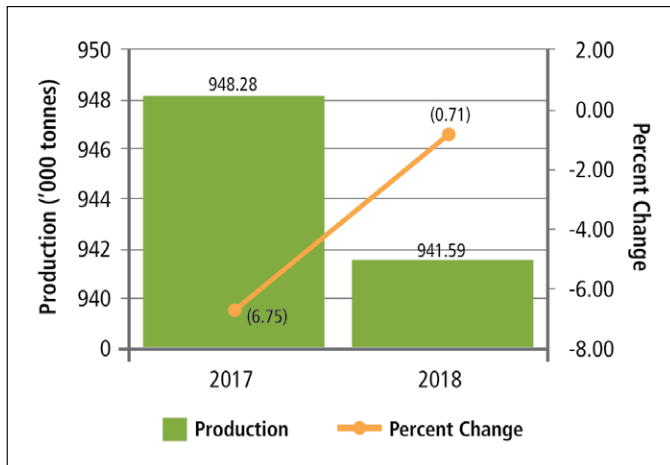
The volume of production from commercial fisheries was posted at 941.59 thousand tonnes in 2018, which went down by 0.71 percent compared with its level of 948.28 thousand tonnes in 2017 (**Figure 5.4**). The subsector comprised 21.64 percent of the total fisheries output.

Of the three subsectors, only aquaculture posted positive growth rate of 2.98 percent in 2018. The bulk of total fisheries output came from aquaculture with 52.95 percent share. Aquaculture harvests were 2.30 million tonnes in 2018. It posted a 2.98 percent gain in 2018 from its record of 2.24 million tonnes in 2017 (**Figure 5.5**).

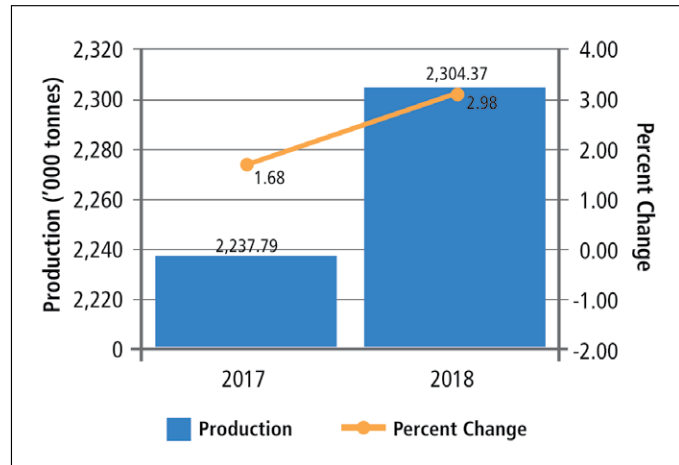
**Figure 5.3:** Volume of Fisheries Production, Philippines 2017 and 2018.



Source: PSA, 2018.

**Figure 5.4:** Volume of Commercial Fisheries Production, 2017 and 2018.

Source: PSA, 2018.

**Figure 5.5:** Volume of Aquaculture Production, 2017 and 2018.

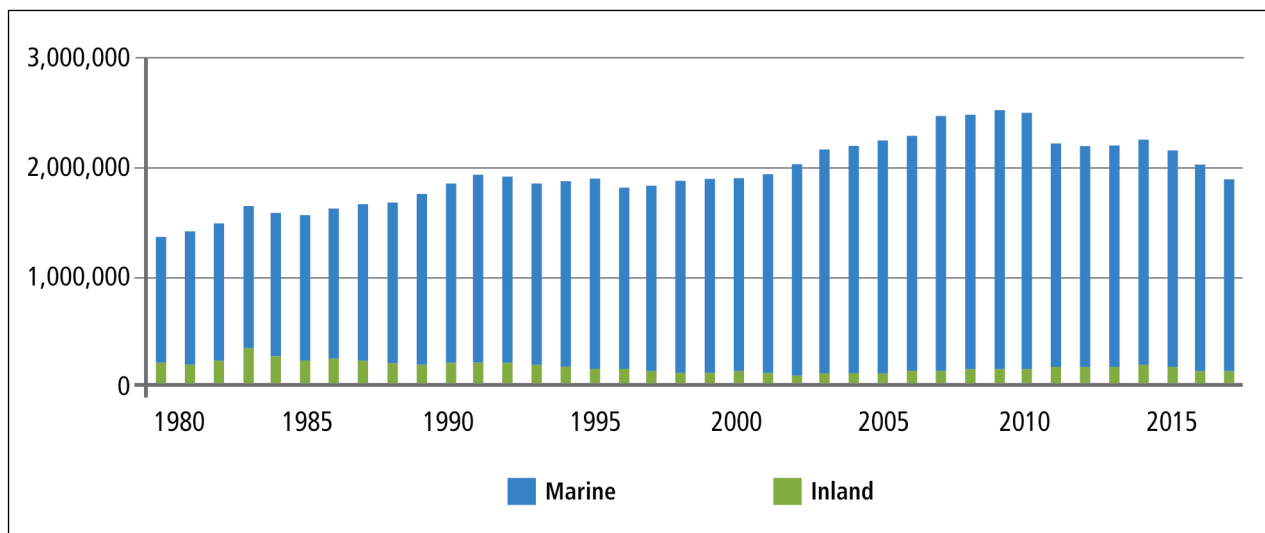
Source: PSA, 2018.

Compared with 2017, the major species that showed improvements in production in 2018 were seaweed (4.45%), skipjack (4.33%) and tilapia (3.25%). However, lesser produce of milkfish (3.90%), roundscad (8.15%), yellowfin tuna (11.91%) and tiger prawn (2.76%) were reported during the period.

### 5.2.1 Municipal and Commercial Fisheries

Municipal fisheries refer to fishing done in inland and coastal areas with or without the use of a fishing boat of up to three gross tonnes, while commercial fisheries refer to fishing done in offshore waters using fishing vessels of more than three gross tonnes (BFAR).

For municipal fisheries production in 2016, 86% is from marine waters, and only 14% is from inland waters (Table 5.3). From 1980 to 2017, municipal fisheries production has mostly been done in marine waters (Figure 5.6).

**Figure 5.6:** Capture Fisheries Production in Marine and Inland Municipal Waters, 1980-2017 in tonnes.Source: FAO FishStat (<http://www.fao.org/fishery/facp/PHL/en#CountrySector-Overview>)

**Table 5.3:** Municipal Fisheries Production, By Region, 2016 (in tonnes).

Region	Marine	Inland	Total
NCR	7,573.61	-	7,573.61
CAR	-	1,238.49	1,238.49
I	22,570.89	1,763.26	24,334.15
II	20,894.72	9,390.64	30,285.36
III	27,682.48	13,940.08	41,622.56
IV-A	36,212.62	69,003.12	105,215.74
IV-B	129,649.28	1,534.14	131,183.42
V	119,484.74	4,567.89	124,052.63
VI	130,602.24	6,802.64	137,404.88
VII	55,336.65	170.97	55,507.62
VIII	82,753.17	689.73	83,442.90
IX	124,275.21	976.55	125,251.76
X	41,657.59	4,071.82	45,729.41
XI	23,006.75	171.58	23,178.33
XII	15,221.16	21,557.34	36,778.50
CARAGA	51,748.16	4,441.43	56,189.59
ARMM	88,271.92	20,670.16	108,942.08
<b>TOTAL</b>	<b>976,941.19</b>	<b>160,989.84</b>	<b>1,137,931.03</b>

Source: BFAR, *Philippine Fisheries Profile, 2016*.

Looking at the municipal fisheries production by region, the top three highest producing regions in 2016 are Western Visayas with 137,404.88 tonnes (**Table 5.3**). MIMAROPA with 131,183.42 tonnes; and Zamboanga Peninsula with 125,251.76 tonnes. The combined production of these three regions represents about 34.6 percent of the country's total municipal fisheries output of 1,137,931.03 tonnes (**Table 5.3**).

In 2016, the three highest commercial fish production in the country, however, was found in SOCCSKSARGEN, Zamboanga Peninsula, and National Capital Region or NCR with a combined production of 579,971.87 tonnes or about more than half (53.03%) of the country's total commercial fishery output of 1,016,948.05 tonnes (**Table 5.4**). Needless to say, the most number of commercial fishing operators and fishing vessels were found in these regions, too (i.e. XII, IX & NCR). As of July 2016, there are 266 operators in SOCCSKSARGEN owning 1,433 fishing vessels; 264 operators in Zamboanga Peninsula owning 725 vessels; and 600 operators in NCR owning 1,715 vessels.

Overall, majority of commercial fish production were hauled, stored and/or processed at traditional landing centers and PFDA port complexes around the country. In 2016, more than one-third (38.3 percent) were gathered and kept at traditional landing centers while almost the same (33.1 percent) were gathered in PFDA fish port complexes. The rest of the catch and production were landed at various private and LGU owned and operated fish ports. (*Refer to Section 9 on Fish Ports*)

**Table 5.4:** Commercial Fish Production, By Region and By Type of Landing Centers, 2016 (In tonnes).

	Private	PFDA	LGU	Traditional	Total
NCR	-	109,758.29	-	5,657.82	115,416.11
I	-	2,258.14	-	1,852.83	4,110.97
II	-	-	-	10,880.58	10,880.58
III	1,347.97	-	57.58	3,484.55	4,890.10
IV-A	-	3,739.13	8,135.34	41,120.70	52,995.17
IV-B	-	-	-	35,585.24	35,585.24
V	6,644.50	-	20,112.73	32,897.33	59,654.56
VI	2,317.10	5,694.03	12,031.40	53,275.24	73,317.77
VII	5,778.54	-	4,141.86	20,533.51	30,453.91
VIII	-	-	18.23	24,595.00	24,613.23
IX	137,871.83	17,700.38	37,114.90	29,848.46	222,535.57
X	-	-	10,163.92	28,873.61	39,037.53
XI	1,215.15	2,179.78	820.71	1,346.16	5,561.80
XII	42,744.84	195,227.72	-	4,047.63	242,020.19
ARMM	-	-	-	90,702.68	90,702.68
CARAGA	-	-	538.00	4,634.64	5,172.64
<b>TOTAL</b>	<b>197,919.93</b>	<b>336,557.47</b>	<b>93,134.67</b>	<b>389,335.98</b>	<b>1,016,948.05</b>

Source: BFAR, Philippine Fisheries Profile, 2016.

## 5.3. Aquaculture Production

### 5.3.1 Aquaculture (Aquatic Animals)

**Figures 5.1** and **5.2** show the contribution of aquaculture to the total fishery output of the country from 2007-2016. Aquaculture has remained to be the top producing sector in the fisheries industry, consistently producing over 2 million metric tons from 2007-2016. Aquaculture production in 2016 was 2.2 million tonnes, and increased by 2.98%, resulting in 2.3 million tonnes produced in 2017 (**Figure 5.5**).



Photo by M. Ebarvia

**Table 5.5** shows the summary of aquaculture production (fish by culture environment (brackish, freshwater and marine), classified by region in 2016. Among the three culture environments, production is highest in brackish water culture at 340,637 tonnes and least in marine water with 117,565 tonnes. About 64% of aquaculture production in marine waters consists of oysters, mussels and seaweeds (**Tables 5.5**). For aquaculture production in brackish waters, Region III tops the list with 93,533 tonnes in production for the said year. Marine water aquaculture has the least amount of production at 116,755 tonnes.

**Table 5.5:** Summary of Aquaculture Production by Culture Environment and Region (2016).

Region	Total Aquaculture		Brackishwater			Freshwater			Marine			Oyster mussel and seaweed	SFR	Rice fish
	Fish pond	Fish cage	Fish pen	Total	Fish pond	Fish cage	Fish pen	Total	Fish cage	Fish pen	Total			
NCR	2,914	-	-	33	-	347	1,998	2,346	-	-	-	535	-	-
CAR	2,964	-	-	-	1,854	1,110	-	2,964	-	-	-	-	-	-
I	128,830	30,329	148	2,032	7,229	51	3	7,283	76,137	11,026	87,163	1,866	6	3
II	12,304	3,818	45	-	3,863	7,216	362	-	7,578	-	-	840	23	-
III	226,139	93,355	-	-	9,355	119,687	12	-	119,699	8,026	-	8,026	5	-
IV-A	173,029	34,316	-	-	34,316	701	86,635	44,842	132,178	4	-	4	6,531	-
IV-B	316,022	2,856	-	-	2,856	176	-	176	68	-	68	312,923	-	-
V	50,689	8,044	-	-	8	1,391	6,578	-	7,969	35	36	4,604	-	-
VI	186,069	81,863	4	31	81,898	2,369	-	2,369	340	187	527	1,275	0.02	1
VII	98,111	8,003	0	6	8,009	113	3	-	116	463	17	89,506	-	-
VIII	32,219	6,851	14	9	6,875	287	11	-	298	183	0	24,863	-	-
IX	207,580	13,989	0	-	13,989	99	-	1	100	84	-	193,406	-	-
X	82,003	38,030	-	-	38,030	846	-	-	846	3,163	-	39,965	0	-
XI	29,280	2,440	6	1	2,447	2,687	3	0	2,690	16,231	37	7,874	1	-
XII	13,210	7,062	-	-	7,062	715	2	2,674	5,430	619	-	71	27	-
CARAGA	14,883	2,658	761	7	3,427	86	146	-	232	907	4	10,313	-	-
ARMM	624,670	3,934	-	-	3,934	200	270	7,091	7,561	0.3	-	613,174	-	-
<b>TOTAL</b>	<b>2,200,913</b>	<b>337,582</b>	<b>979</b>	<b>2,086</b>	<b>340,647</b>	<b>145,655</b>	<b>97,569</b>	<b>56,611</b>	<b>299,835</b>	<b>106,257.40</b>	<b>11,307.20</b>	<b>1,442,806</b>	<b>57</b>	<b>3.6</b>

Note: Figures are in tonnes.

Source: BFAR, Philippine Fisheries Profile, 2016.

The top 3 species produced through aquaculture are seaweeds (63.82%), milkfish (18.09%) and tilapia (11.77%) producing more than 90% of the total aquaculture produce while the last in the list are the shrimps and prawns at 51,449 tonnes which only contributed 2.34% of the total aquaculture produce for 2015 (**Table 5.6**).

**Table 5.6:** Major Species Produced from Aquaculture Production in 2015.

Species	Quantity (MT)	Percent (%)
Seaweeds	1,404,519	63.82
Milkfish	398,088	18.09
Tilapia	259,045	11.77
Shrimps / Prawns	51,449	2.34
Others	87,813	3.99
<b>Total</b>	<b>2,200,914</b>	<b>100.00</b>

Source: BFAR Philippine Fisheries Profile, 2016.

About 64% of aquaculture production in marine waters consists of oysters, mussels and seaweeds (**Tables 5.5** and **5.7**).

**Table 5.7:** Mariculture Products in 2015 (in tonnes).

Region	Total	Oyster	Mussel	Seaweeds
NCR	534.84	-	534.84	-
CAR	-	-	-	-
I	1,865.72	1,391.41	448.28	26.03
II	840.16	643.27	-	196.89
III	5,059.05	4,323.08	435.79	300.18
IV-A	6,531.01	454.79	2,434.21	3,642.01
IV-B	312,922.64	-	-	312,922.64
V	34,604.34	-	404.89	34,199.45
VI	101,274.91	11,409.64	8,065.01	81,800.26
VII	89,506.38	768.98	-	88,737.40
VIII	24,863.17	0.94	6,450.97	18,411.26
IX	193,406.47	298.86	-	193,107.61
X	39,964.58	0.01	0.42	39,964.15
XI	7,874.02	221.38	0.15	7,652.49
XII	71.36	-	-	71.36
CARAGA	10,313.22	-	-	10,313.22
ARMM	613,174.28	-	-	613,174.28
<b>TOTAL</b>	<b>1,442,806.15</b>	<b>19,512.36</b>	<b>18,774.56</b>	<b>1,404,519.23</b>

Source: BFAR Philippine Fisheries Profile 2016.





Igang Marine Station of SEAFDEC in Guimaras. (Photo by M. Ebarvia)

### 5.3.2 Aquaculture (Seaweed and Aquatic Plants)

Aquaculture production of seaweeds in 2014, 2015 and 2016 can be seen in **Table 5.8**. There has been no significant increase or decrease in production in 2014-2016, with values fluctuating from 140,000 to 160,000 tonnes in this period. As shown in **Table 5.6**, seaweeds remain to be one of the highest produced commodity in the aquaculture sector in the country. In 2016, total seaweed production was estimated to be 1,549,575.98 metric tons (**Table 5.8**).



Seaweed farm in Antique. (Photo by M. Ebarvia)

**Table 5.8:** Aquaculture Production of Seaweed from 2014-2016 in tonnes.

Region	Total		
	2014	2015	2016
NCR	-	-	-
CAR	-	-	-
I	26.47	26.03	34.97
II	266.46	196.89	527.18
III	1,827.50	300.18	2,368.53
IV-A	23,492.73	3,642.01	32,617.74
IV-B	395,125.80	312,922.64	361,352.59
V	55,382.09	34,199.45	59,863.75
VI	80,569.18	81,800.26	77,466.93
VII	96,363.53	88,737.40	104,943.47
VIII	18,513.49	18,411.26	17,925.84
IX	204,180.50	193,107.61	206,161.12
X	39,409.13	39,964.15	40,784.83
XI	8,384.02	7,652.49	6,005.49
XII	358.65	71.36	144.05
CARAGA	14,798.71	10,313.22	16,383.89
ARMM	627,435.50	613,174.28	622,995.60
<b>TOTAL</b>	<b>1,566,361.72</b>	<b>1,404,519.23</b>	<b>1,549,575.98</b>

Source: BFAR Philippine Fisheries Profile 2014, 2015 and 2016.

## 5.4 Contribution to Income and Livelihood

The fisheries sector contributes 1.3% and 1.5% (at current and constant 2000 prices, respectively) to the country's GDP. This translates to some PhP 184.8 billion (current prices), and PhP 122.9 billion (constant prices) of the country's GDP.

The top producing sub-sector is the aquaculture sector, valued at PhP91.14 billion or 40 percent of the total production. This is followed by the municipal fisheries sub-sector with a total production worth PhP 78.93 billion.

**Table 5.9:** Fisheries Contribution to the Economy, 2016.

A. Fisheries Contribution to Total GDP				
1. At Current Prices				<b>1.30%</b>
2. At Constant Prices				<b>1.50%</b>
B. Fisheries Contribution to GVA in Agriculture, Hunting, Forestry and Fishing by Industry Group				
Industry Group	At Current Prices (PhP M)	% to Agricultural Sector	At Constant Prices (PhP M)	% to Agricultural Sector
1. Agricultural crops (Palay, corn, etc.)	780,329	45.8	338,557	47.6
2. Livestock	184,570	13.2	104,153	14.7
3. Poultry	140,255	10.0	83,478	11.7
4. Agricultural activities	105,247	7.5	57,744	8.1
5. Forestry	2,418	0.2	3,622	0.5
6. Fishing	184,796	13.2	122,955	17.3
<b>Total</b>	<b>1,397,616</b>	<b>100</b>	<b>710,510</b>	<b>100.0</b>

Note: GDP at current and constant 2000 prices.  
Source: BFAR, *Philippine Fisheries Profile, 2016*.

There were around 1,614,368 fishing operators in 2002 (**Table 5.10**). The municipal fisheries sub-sector has the most number of fishing operators with over 1 million operators registered, followed by the aquaculture sub-sector and the commercial subsector with 226,195 operators and 15,497 operators, respectively.

Data from the Food and Agriculture Organization (FAO) reported 1,907,435 registered fisherfolk in the country as of 2010 (**Table 5.11**). This has increased by over 34% from 1,421,715 in 2005.

**Table 5.10:** Total Number of Fishing Operators Based on the 2002 NSO Census for Fisheries.

Aquaculture	226,195 operators
Municipal	1,371,676 operators
Commercial	16,497 operators
<b>TOTAL</b>	<b>1,614,368 operators</b>

Source: BFAR *Philippine Fisheries Profile, 2016*.

**Table 5.11:** Number of Registered Fishers from 2005-2010 in the Philippines.

Year	Number of registered fishers
2005	1,421,715
2006	1,497,000
2007	1,901,000
2008	1,861,738
2009	1,902,520
2010	1,907,435

Source: FAO 2014.

## 5.5 Contribution to Food Security

Most recent data on the mean one-day per capita food consumption among Filipino households show that fish and fish products remain to be the most common source of body-building food (**Table 5.12**). The average Filipino households consume 101 g/day of fish or fish-derived products amounting to 37 kg/year. A decline in fisheries production was observed from 2012 to 2016, with volume dropping from 5 million tonnes to 4.35 million tonnes. A 13% drop in production could have significant implications to food security. Fish and other fish products take up 11.9% of the total protein intake in Filipino households. Meat and poultry products take up 7.3% and 3.3% of the total consumption, respectively.

**Table 5.12:** Mean One-day per Capita Food Consumption (g/day) among Filipino Households, Specifically for Body-building Food Sources.

Body-Building Food Sources	2008 (g/day)	2013 (g/day)	2015 (g/day)	% of total intake for 2015
<b>Fish, Meat and Poultry</b>	<b>193</b>	<b>207</b>	<b>190</b>	<b>22.5</b>
Fish and Fish Products	110	109	101	11.9
Meat and Meat Products	58	65	61	7.3
Poultry	24	33	28	3.3
<b>Eggs</b>	<b>14</b>	<b>16</b>	<b>18</b>	<b>2.1</b>
<b>Milk and Milk Products</b>	<b>42</b>	<b>45</b>	<b>42</b>	<b>5.0</b>
Whole milk	33	34	33	3.9
Milk products	10	11	9	1.1
<b>Dried Beans, Nuts and Seeds</b>	<b>9</b>	<b>9</b>	<b>8</b>	<b>1.0</b>

Source: BFAR, Philippine Fisheries Profile, 2016.

Among the sub-groups of fishery products, the most commonly consumed products by the average Filipino household are fresh fish (**Table 5.13**). Topping the list are freshwater and brackish water species, Tilapia and Bangus which are consumed at 3.7 and 3.6 kg per year as of the 2015 data by BFAR. Milkfish and tilapia are the second and third major species that are produced in the aquaculture fisheries in the Philippines with a total production of 398,088 tonnes and 259,045 tonnes, respectively as of 2016 (**Table 5.6**).

**Table 5.13:** Mean One-day per Capita Fish and Fish Products Consumption as of 2015.

Food Groups / Sub Groups	Mean (kg/year)
<b>Fish and Products</b>	<b>36.8</b>
<b>Fresh fish</b>	<b>24.7</b>
Tulingan	2
Bangus	2.6
Galunggong	2.4
Dilis, buo	0.5
Alumahan	0.4
Tamban	1.7
Dalagang bukid	0.5
Sapsap	0.8
Bisugo	0.6
Tilapia	3.7
Albakora / tambakol	0.9
Balila / espada	0
Hasa-hasa	0.4
Lapu-lapu	0.2
Matangbaka	1.5
Maya-maya	0.3
Salay-salay	0.1
Silinyas / tunsoy	0
Tanigue	0.1
Other fresh fish and cooked fish recipe	3.9
<b>Dried fish (as fresh fish)</b>	<b>4.2</b>
<b>Processed fish</b>	<b>4.9</b>
Bagoong (as fresh fish)	0.6
Patis	0.1
Canned fish (sardines, mackerel, salmon, etc.)	3.6
Smoked fish (all tinapa type)	0.5
<b>Crustacean and mollusks</b>	<b>3.0</b>
Shrimp (all types)	0.8
Crabs	0.4
Squid / octopus	0.6
Tahong (mussels)	0.2
Others (fresh)	0.7
Dried and processed (as fresh)	0.1
Bagoong (as fresh)	0.2
Cooked / mixed shellfish dishes	0.0

Source: BFAR, *Philippine Fisheries Profile, 2016*.

## 5.6 Number of Fishing Vessels

According to the number of fishing vessels registered by BFAR, there were 120,537 municipal fishing vessels in 2014, and 192,351 vessels in 2015 (**Table 5.14**). Before 2014 and 2015, the last available data fishing vessel count was in 2000 where 469,807 vessels were reported, of which 177,627 were motorized and 292,180 were non-motorized. In 2016, there were 6,901 commercial fishing vessels reported (**Table 5.15**).

The number of commercial fishing vessels was reported to be 3,610 in 2000 and 6,371 in 2007. Commercial fishing vessels almost doubled in number from 1999 to 2007 while 2016 had the most number of registered commercial fishing vessels on record (**Table 5.15**).

**Table 5.14:** Number of Municipal Fishing Vessels in Selected Years.

Year	Municipal fishing vessels	
	Powered	Non-powered
2000	177,627	292,180
2015	120,537	
2016	192,351	

Source: BFAR Philippine Fisheries Profile, 2016.

**Table 5.15:** Number of Commercial Fishing Vessels in Selected Years.

Year	Number of fishing vessels
1999	3,610
2007	6,371
2016	6,901

Source: BFAR Philippine Fisheries Profile, 2016.

In terms of the number of registered municipal fishing vessels in 2016, the most number of vessels can be found in MIMAROPA, Central Visayas, and Western Visayas or a total of 74,969 registered vessels representing about 40 percent of the country's total number of registered municipal fishing vessels of 192,351 (**Table 5.16**). NCR and Region 12 have the highest number of commercial fishing operators and vessels (**Table 5.17**).

**Table 5.16:** Number of Municipal Fishing Vessels, By Region, 2016.\*

Region	Number of Municipal Fishing Vessels Registered	Region	Number of Municipal Fishing Vessels Registered
NCR	718	VII	27,036
CAR	234	VIII	22,211
I	3,571	IX	13,602
II	6,500	X	6,946
III	3,892	XI	6,392
IV-A	11,214	XII	7,243
IV-B	23,172	CARAGA	6,245
V	13,804	ARMM	14,810
VI	24,761		
<b>TOTAL= 192,351</b>			

\* Source: Data as of July 4, 2016 BFAR- National Program for the Municipal Fishing Vessels and Gears Registration (BoatR)

Source: BFAR, *Philippine Fisheries Profile, 2016*.

**Table 5.17:** Number of Commercial Fishing Operators and Vessels, By Region, 2016.

Region	No. of Operators	Total			
		Large Scale (>150 GT*)	Medium-Scale (20.1-150 GT)	Small-Scale (3.1-20 GT)	Sub-Total
NCR	600	326	825	564	<b>1,715</b>
CAR	-	-	-	-	-
I	151	-	44	199	<b>243</b>
II	71	1	11	89	<b>101</b>
III	158	-	80	155	<b>235</b>
IV-A	195	9	99	152	<b>260</b>
IV-B	259	-	94	244	<b>338</b>
V	122	1	63	146	<b>210</b>
VI	175	25	297	169	<b>491</b>
VII	200	3	153	238	<b>394</b>
VIII	245	-	41	213	<b>254</b>
IX	264	80	401	244	<b>725</b>
X	93	1	60	87	<b>148</b>
XI	107	2	73	139	<b>214</b>
XII	266	100	911	422	<b>1,433</b>
CARAGA	75	-	32	76	<b>108</b>
ARMM	35	-	4	28	<b>32</b>
<b>TOTAL</b>	<b>3,016</b>	<b>548</b>	<b>3,188</b>	<b>3,165</b>	<b>6,901</b>

\* GT - Gross tonnage.

Source: BFAR, *Philippine Fisheries Profile, 2016*.

## 5.7 Key Issues

The *Comprehensive National Fisheries Industry Development Plan* lists the following as the major problems of the fishery industry:

1. Depleted fishery resources largely brought about excessive fishing effort and open access regimes
2. Degraded fishery habitats due to destructive fishing methods, conversion of fishery habitats into economic uses and negative impacts from land-based activities
3. Intensified resource use competition and conflicts among fisher groups and other economic sectors
4. Unrealized full potential of aquaculture and commercial fisheries as there are still underutilized areas for industry development
5. Uncompetitive products due to inferior quality and safety standards
6. Post-harvest losses in terms of physical, nutritional and value losses; inadequate post-harvest facilities
7. Limited institutional capabilities from the local up to the national levels of governance
8. Inadequate/Inconsistent fisheries policies that should promote conducive environment for sustainable development
9. Weak institutional partnerships among government agencies, civil society organization, and private sector.

## 5.8 Major Response Measures

As a country heavily reliant on fish for its major protein source, sustainable fishing practices is key to avoiding overharvesting its limited fishery resources and ensuring adequate fish stocks for the future generations. Fisheries production has been on the decline since 2012.

The state recognizes the vital role of its fishery sector ensuring national food security, whether this is done by inland, small-scale fishers or offshore. Hence, innovative and sustainable practices in fisheries are of utmost importance to guarantee the sustainability of this limited resource.

### 1. Fisheries development plan

The *Comprehensive National Fisheries Industry Development Plan* was created to create a framework that will promote optimal development and long-term sustainability of Philippine fisheries for the period of 2006-2025. This is a two-part plan that focuses on (1) development of appropriate structures (e.g. physical infrastructures, system for marketing, etc.), and (2) conservation (e.g. restoration of habitats and rehabilitation of fisheries). The framework also identifies six (6) critical actions that need to be prioritized for the sustainable development for the country's fisheries industry.





Small-scale fisherfolk and boats. (Photo by M. Ebarvia)

- (a) Reduction and rationalization of fishing effort
- (b) Protection and rehabilitation of fishing habitats
- (c) Improved utilization of harvests
- (d) Improved local stewardship and management of resources
- (e) Provision of supplemental and/or alternative livelihoods for fishers
- (f) Capacity building and institutional strengthening

## 2. Registration of fisherfolk and fishing vessels

One way to address illegal, unreported and unregulated (IUU) fishing is to register and monitor the number of fishing vessels and fisherfolk. The apparent increasing number of fishers and the decreasing fisheries production highlights the need for the country to be more assertive in shifting to more sustainable fishing practices. The **Fish R** and **Boat R** programs of BFAR were created to help enhance and fast track the registration of fishers and fishing boats under the *Municipal Fisherfolk Registry of the Local Government Units* for detailed and more accurate monitoring and management purposes. More aggressive measures have also been taken to address Illegal, Unreported and Unregulated (IUU) fishing.

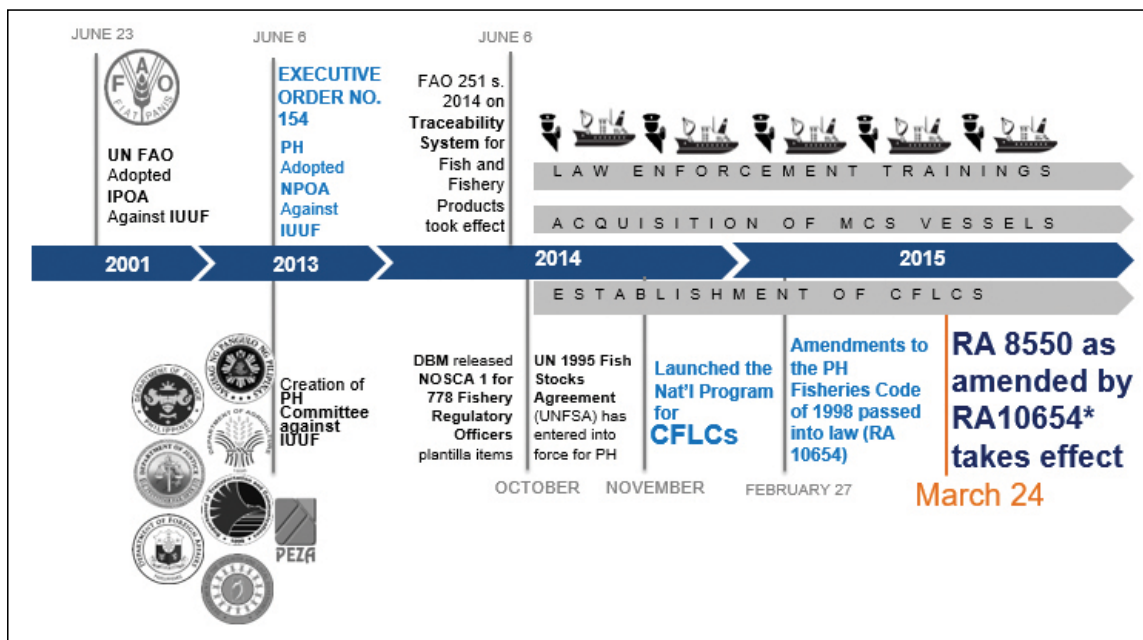
## 3. Codification of IUU Fishing (RA 10654)

The new law - **RA 10654** (*amending RA 8550*), passed in 2015 as an amendment to the Fisheries Code, intends to “prevent, deter, and eliminate illegal, unreported and unregulated fishing, With the passing of the law, the country was able to maintain its access to the EU market, which imports 39% percent of the country’s tuna products.

In the hunt for more fish, many commercial fishers resort to unsustainable fishing practices like using big purse seine nets or fish aggregating devices which lure fish and other sea creatures like sharks, dolphins and even turtles. This is why sharks and dolphins end up being sold in markets, adding to the illegal trade of endangered species.

Under **RA 10654**, it is now unlawful to fish or take, catch, gather, sell, purchase, possess, transport, export, forward or ship out aquatic species listed by the *Convention on the International Trade in Endangered Species of Wild Flora and Fauna* (CITES), or those categorized by the International Union for Conservation of Nature and Natural Resources (IUCN) as threatened, or those marine and aquatic species determined by the Department of Agriculture (DA) as such.

**Figure 5.7:** Timeline of Efforts Against IUU Fishing.



Source: BFAR.

#### 4. A shift of policy “focus” from production to conservation

During the period, 2011 to the present, fisheries management shifted its focus from increasing production, which has led to overexploited resources, to protection and conservation through the adoption of the Ecosystems Approach to Fisheries Management (EAFM). An example of conservation effort is focused on sardines and small pelagics, with the regulations on closed fishing season in certain areas of the country (**Figure 5.8**). A 30 percent increase in fish catch was reported after three years of implementing this policy (BFAR). Another key initiative is the partnership with seafood producers and processors for the conservation of blue crabs and swordfish.

**Figure 5.8:** Major Conservation Efforts in the Fisheries Sector.

Source: BFAR.

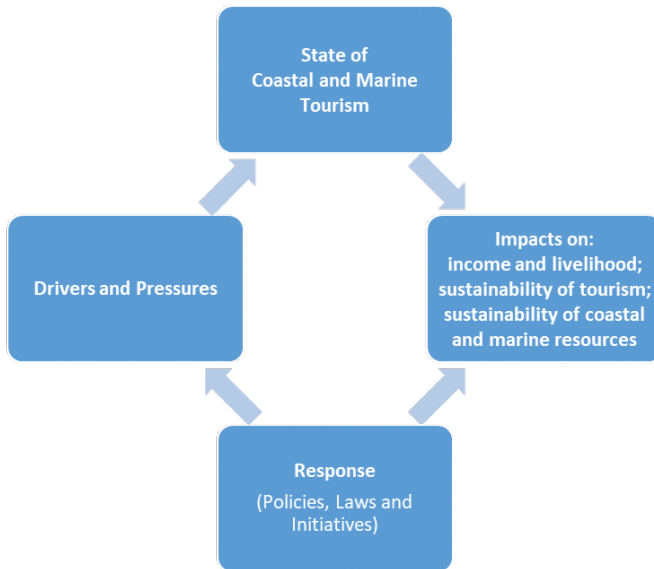
## 5. Research and development support

The National R&D Program on Blue Swimming Crabs is paving the way to increase production of this commercially important commodity. This program is funded by the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development of the Department of Science and Technology (DOST-PCAARRD), and in partnership with Southeast Asian Fisheries Development Center (SEAFDEC) in collaboration with the University of the Philippines Visayas (UPV) and Mindanao State University. The program aims to refine existing technologies on hatchery and grow-out culture and develop nursery culture of blue swimming crabs for sustainability and industry competitiveness.



Current initiatives of the program include the verification of science-based hatchery technology, which will be disseminated to state colleges and universities and industry stakeholders. Public awareness campaign on conservation and management of blue swimming crabs are also being done among beneficiaries of the program, including small-scale crab farmers, hatchery operators, and crabmeat processors, traders, and exporters.

# 6 Coastal and Marine Tourism



El Nido, Palawan.  
Photo by M. Ebarvia

## 6.1 Performance of Philippine Tourism Sector

The latest results of the Philippine Tourism Satellite Accounts (PTSA)<sup>5</sup> provide information on tourism industry's performance:

- Inbound tourism expenditure, which refers to the expenditure of non-resident visitors (foreign visitors and Filipinos permanently residing abroad) within the Philippines, grew by 43.9 percent in 2017, amounting to PhP 448.6 billion from PhP 311.7 billion in 2016. Compared to the country's total exports, the share of inbound tourism expenditure was 9.2 percent. Inbound tourism ranked third among the biggest export items in 2017, after semiconductors at 21.9 percent and miscellaneous services at 15.7 percent.
- Domestic tourism expenditure, which includes expenditure of resident visitors within the country either as domestic trip or part of an international trip, grew by 25.5 percent, from PhP 2,108.2 billion in 2016 to PhP 2,644.8 billion in 2017. Domestic tourism expenditure represents 22.8 percent of the household final consumption expenditure (HFCE) in 2017.
- Employment in tourism characteristic industries was estimated at 5.3 million in 2017, higher by 0.9 percent compared to 5.2 million in the previous year. Share of employment in tourism industries to total employment in the country was recorded at 13.1 percent in 2017.

<sup>5</sup> The PTSA is compiled by the Philippine Statistics Authority (PSA) based on the international recommendations for tourism statistics and tourism satellite accounts of the United Nations World Tourism Organization. The PTSA tables are available at <https://psa.gov.ph/tourism-satellite-accounts-press-releases>.

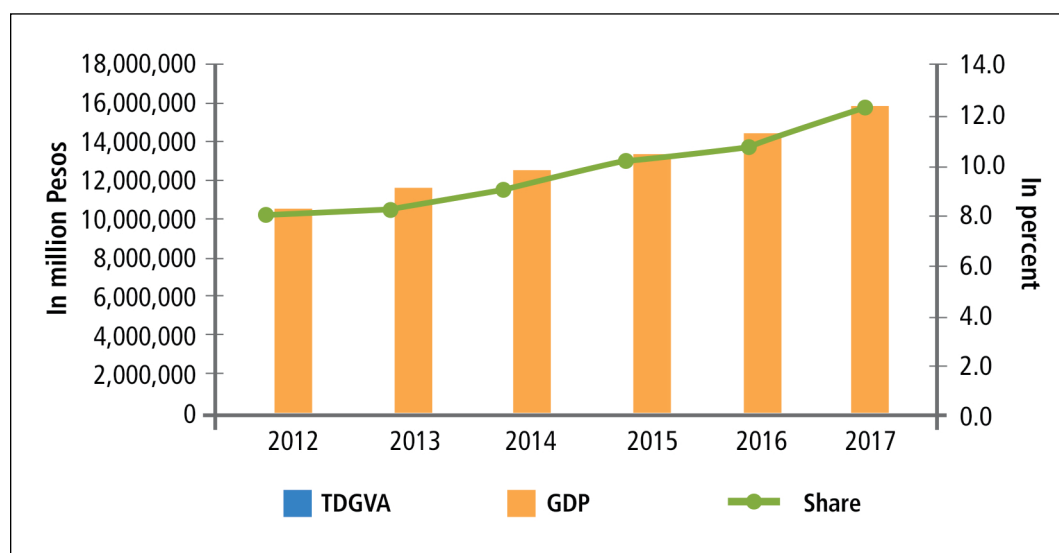
## 6.2 Contribution to Income

Revenues from tourism was estimated to be PhP 335.6 billion in 2017 (**Table 6.1**). In 2017, the tourism industries contributed 12.2 percent to the economy (**Figure 6.1**). It is measured by the share of Tourism Direct Gross Value Added (TDGVA) to the Gross Domestic Product (GDP). The TDGVA amounted to PhP 1,929.3 billion at current prices in 2017. This is higher by 24.2 percent than the previous year's record of PhP 1,553.7 billion. The TDGVA is estimated using the benchmark 2012 Input-Output (I-O) table.

**Table 6.1:** Estimated Visitor Receipts, 2017.

Year/Month	In Million PhP
January	21,681.23
February	18,400.62
March	25,245.48
April	26,011.55
May	27,858.62
June	27,136.52
July	33,525.63
August	32,471.78
September	30,895.76
October	31,123.85
November	27,868.37
December	33,406.72
<b>Total</b>	<b>335,626.13</b>

**Figure 6.1:** Share of Tourism to GDP, Philippines 2012-2017.



Source: DOT.



Coron, Palawan. (Photo by DENR)

**Table 6.2** shows the TDGVA of the country's tourism industry by product and service, foremost of which are services in accommodation, food and beverages, transportation, travel agencies/reservation, leisure and recreation, and shopping. In 2016, the tourism sector contributed a total of more than PhP 1.2 trillion to the national economy. The data also show that its TDGVA has been increasing yearly since 2010. Specifically, in 2016, accommodation services to visitors contributed more than PhP 287 billion (12.5% more than in 2015); shopping contributed about PhP 141 billion (16% more than in 2015); whereas leisure and entertainment services added more than PhP 113 billion (16.3% more than in 2015). These are the top three products/services of tourism sector in 2016.

**Table 6.2:** Tourism Direct Gross Value Added (TDGVA), Philippines: 2010-2016.

	In Million PhP						
	2010	2011	2012	2013	2014	2015	2016
<b>A.1 Tourism Characteristic products</b>	<b>371,910</b>	<b>459,613</b>	<b>527,003</b>	<b>598,064</b>	<b>693,455</b>	<b>822,699</b>	<b>948,899</b>
1. Accommodation services for visitors	87,840	112,249	134,340	161,011	203,055	254,923	286,774
2. Food and beverage serving services	18,505	21,077	24,686	29,248	35,004	41,523	48,887
3. Transport services	48,043	63,544	71,339	77,654	92,851	112,721	132,674
4. Travel agencies and other reservation services	35,414	42,301	47,157	48,640	59,975	75,651	87,964
5. Entertainment and recreation services	42,328	51,129	59,027	63,580	79,050	97,278	113,147
6. Country-specific tourism characteristic services - shopping	76,391	95,720	106,540	120,042	112,592	121,239	140,664
7. Miscellaneous	63,389	73,594	83,915	97,889	110,927	119,365	138,788
<b>A.2 Other products</b>	<b>186,669</b>	<b>200,483</b>	<b>217,054</b>	<b>236,087</b>	<b>258,745</b>	<b>270,734</b>	<b>294,576</b>
<b>TOTAL DIRECT GROSS VALUE ADDED (TDGVA)</b>	<b>558,578</b>	<b>660,096</b>	<b>744,056</b>	<b>834,151</b>	<b>952,201</b>	<b>1,093,433</b>	<b>1,243,474</b>

	Growth Rates (%)					
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
<b>A.1 Tourism Characteristic products</b>	<b>23.6</b>	<b>14.7</b>	<b>13.5</b>	<b>16.0</b>	<b>18.6</b>	<b>15.3</b>
1. Accommodation Services for visitors	27.8	19.7	19.9	26.1	25.5	12.5
2. Food and Beverage serving services	13.9	17.1	18.5	19.7	18.6	17.7
3. Transport Services	32.3	12.3	8.9	19.6	21.4	17.7
4. Travel agencies and other reservation services	19.4	11.5	3.1	23.3	26.1	16.3
5. Entertainment and recreation services	20.8	15.4	7.7	24.3	23.1	16.3
6. Country-specific tourism characteristic services - shopping	25.3	11.3	12.7	(6.2)	7.7	16.0
7. Miscellaneous	16.1	14.0	16.7	13.3	7.6	16.3
<b>A.2 Other products</b>	<b>7.4</b>	<b>8.3</b>	<b>8.8</b>	<b>9.6</b>	<b>4.6</b>	<b>8.8</b>
<b>TOTAL DIRECT GROSS VALUE ADDED (TDGVA)</b>	<b>18.2</b>	<b>12.7</b>	<b>12.1</b>	<b>14.2</b>	<b>14.8</b>	<b>13.7</b>

**Table 6.2:** Tourism Direct Gross Value Added (TDGVA), Philippines: 2010-2016. (cont.)

	Percent Share						
	2010	2011	2012	2013	2014	2015	2016
<b>A.1 Tourism Characteristic products</b>	<b>66.6</b>	<b>69.6</b>	<b>70.8</b>	<b>71.7</b>	<b>72.8</b>	<b>75.2</b>	<b>76.3</b>
1. Accommodation services for visitors	15.7	17.0	18.1	19.3	21.3	23.3	23.1
2. Food and beverage serving services	3.3	3.2	3.3	3.5	3.7	3.8	3.9
3. Transport services	8.6	9.6	9.6	9.3	9.8	10.3	10.7
4. Travel agencies and other reservation services	6.3	6.4	6.3	5.8	6.3	6.9	7.1
5. Entertainment and recreation services	7.6	7.7	7.9	7.6	8.3	8.9	9.1
6. Country-specific tourism characteristic services - shopping	13.7	14.5	14.3	14.4	11.8	11.1	11.3
7. Miscellaneous	11.3	11.1	11.3	11.7	11.6	10.9	11.2
<b>A.2 Other products</b>	<b>33.4</b>	<b>30.4</b>	<b>29.2</b>	<b>28.3</b>	<b>27.2</b>	<b>24.8</b>	<b>23.7</b>
<b>TOTAL DIRECT GROSS VALUE ADDED (TDGVA)</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Note: TDGVA was derived based on the Production Accounts of Tourism Industries and Other Industries and Total Domestic Supply and Internal Tourism consumption which were computed using the data Accounts of the Philippine Statistics Authority from the Input-Output Table, Input-Output Survey of Philippine Business and Industry.

The same trend can be said about the levels of inbound tourism expenditure in the past five years (2011-2016). Total expenditure in 2016 amounted to PhP313,618 million, up by 2.3 percent from its 2015 level of PhP306,576 million (**Table 6.3**). The top three tourism products/services on the other hand, in terms of total spending, are accommodation (25.9%), food and beverages (24.1%), and transport (22.8%).



Surfing in Baler, Quezon (Photo by M. Ebarvia)



Swimming with the whale sharks in Cebu (Photo by G. Olfato)



**Table 6.3:** Total Inbound Tourism Expenditure, Philippines: 2011-2016.

	In Million PhP					
	2011	2012	2013	2014	2015	2016
<b>A. Consumption Products</b>						
<b>A.1 Tourism Characteristic products</b>						
1. Accommodation services for visitors	30,437	46,213	61,974	80,448	91,556	81,163
2. Food and beverage serving services	31,844	40,940	53,654	60,203	69,361	75,735
3. Transport services	38,619	43,232	44,871	52,657	60,369	71,538
4. Travel agencies and other reservation services	421	530	341	1,991	3,896	2,418
5. Entertainment and recreation services	19,773	24,054	22,832	30,818	36,159	39,719
6. Country-specific tourism characteristic services						
6.a Shopping	35,486	37,161	37,546	46,419	42,148	39,243
7. Miscellaneous	1,880	3,056	4,082	4,358	3,087	3,791
<b>A.2 Tourism-connected products</b>						
<b>A.3 Non-tourism-related consumption products</b>						
<b>B.1 Valuables</b>						
<b>TOTAL INBOUND TOURISM EXPENDITURE</b>	<b>158,460</b>	<b>195,186</b>	<b>225,300</b>	<b>276,894</b>	<b>306,576</b>	<b>313,608</b>

	Growth Rates (%)					
		2011-12	2012-13	2013-14	2014-15	2015-16
<b>A. Consumption Products</b>						
<b>A.1 Tourism Characteristic products</b>						
1. Accommodation services for visitors		51.8	34.1	29.8	13.8	(11.4)
2. Food and beverage serving services		28.6	31.1	12.2	15.2	9.2
3. Transport services		11.9	3.8	17.4	14.6	18.5
4. Travel agencies and other reservation services		25.9	(35.7)	484.6	95.7	(37.9)
5. Entertainment and recreation services		21.6	(5.1)	35.0	17.3	9.8
6. Country-specific tourism characteristic services						
6.a Shopping		4.7	1.0	23.6	(9.2)	(6.9)
7. Miscellaneous		62.5	33.6	6.8	(29.2)	22.8
<b>A.2 Tourism-connected products</b>						
<b>A.3 Non-tourism-related consumption products</b>						
<b>B.1 Valuables</b>						
<b>TOTAL INBOUND TOURISM EXPENDITURE</b>		<b>23.2</b>	<b>15.4</b>	<b>22.9</b>	<b>10.7</b>	<b>2.3</b>

**Table 6.3:** Total Inbound Tourism Expenditure, Philippines: 2011-2016. (cont.)

	Percent Share					
	2011	2012	2013	2014	2015	2016
<b>A. Consumption Products</b>						
<b>A.1 Tourism Characteristic products</b>						
1. Accommodation services for visitors	19.2	23.7	27.5	29.1	29.9	25.9
2. Food and beverage serving services	20.1	21.0	23.8	21.7	22.6	24.1
3. Transport services	24.4	22.1	19.9	19.0	19.7	22.8
4. Travel agencies and other reservation services	0.3	0.3	0.2	0.7	1.3	0.8
5. Entertainment and recreation services	12.5	12.3	10.1	11.1	11.8	12.7
6. Country-specific tourism characteristic services						
6.a Shopping	22.4	19.0	16.7	16.8	13.7	12.5
7. Miscellaneous	1.2	1.6	1.8	1.6	1.0	1.2
<b>A.2 Tourism-connected products</b>						
<b>A.3 Non-tourism-related consumption products</b>						
<b>B.1 Valuables</b>						
<b>TOTAL INBOUND TOURISM EXPENDITURE</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Sources: Arrival Cards of the Bureau of Immigration, Visitor Sample Survey and Meeting, Incentive, Convention, Exhibitions Survey of the Department of Tourism.

Looking further into expenditure level of international/inbound tourists, the country received around 5,361,000 international tourists in 2015, up by 2,344,000 from its 2009 level (**Table 6.4**). This can be translated to total inbound tourism expenditure of US\$6,418 million (up from US\$ 2,916 million in 2009) or a share of exports of 8.9 percent in 2015 (up from 6.7% share in 2009).

**Table 6.4:** International Tourists and Inbound Tourism Expenditure: 2009 and 2015.

Year	International tourists (in thousands)		Inbound tourism expenditure		Outbound tourism expenditure	
	Inbound	Outbound	\$ millions	% of exports	\$ millions	% of imports
2009	3,017	3,188	2,916	6.7	4,056	7.8
2015	5,361	--	6,418	8.9	12,191	13.5

Source: DoT

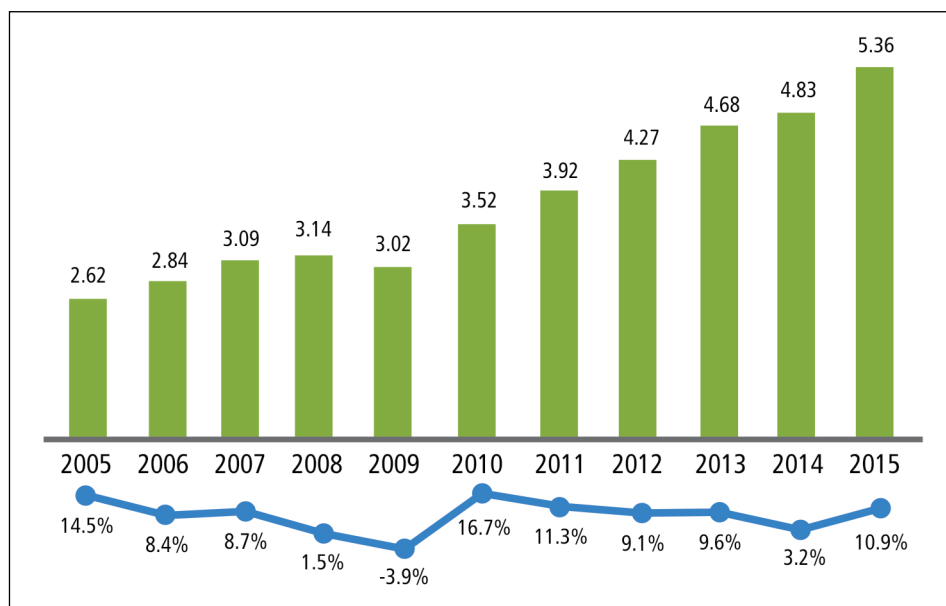
**Figure 6.2** shows the number of visitor arrival and growth rate from 2005 to 2015. The top 10 source markets (origin of international tourists) in 2015 are: (1) RO Korea; (2) USA; (3) Japan; (4) China; (5) Australia; (6) Singapore; (7) Taiwan; (8) Canada; (9) Malaysia; and (10) United Kingdom.

As of February 2017, by regional grouping, East Asia is the biggest source of arrivals with 312,240 arrivals with a market share of 53.91%. This figure rose by 2.69% relative to its arrivals in February 2016. Korea, Japan and China which belong to this region accounted for 48.85% of the total volume.

North America provided the second biggest influx of tourists with 99,788 arrivals, forming 17.23% of the total tourist traffic. This volume showed a 14.46% growth vis-à-vis its arrivals of 87,178 for the same period last year. The ASEAN region accounted for 37,980 arrivals, contributing 6.56% to the total.

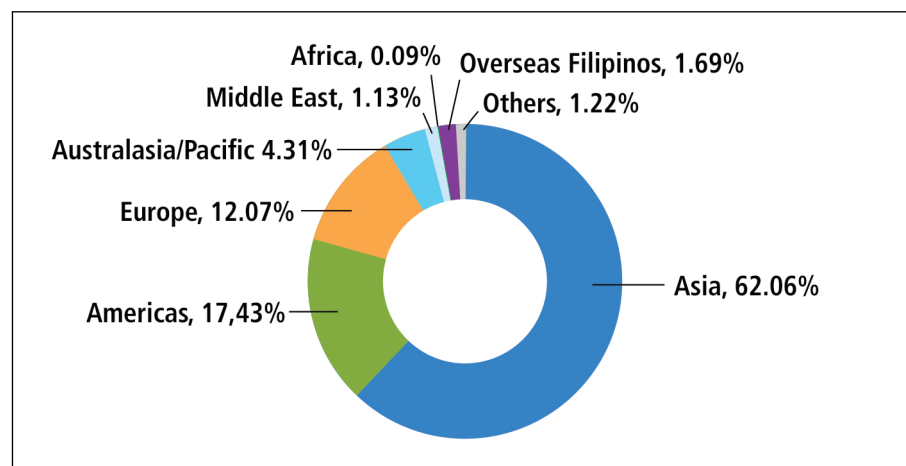
In addition to the top ten markets, countries with substantial growth in visitor volume are Saudi Arabia with 9,071 arrivals (+15.22%), Vietnam with 7,303 arrivals (+30.02%), and European countries, such as: France with 15,957 arrivals (+27.64), Russia with 9,512 arrivals (+29.24%), Netherlands with 6,890 arrivals (+13.90%), Italy with 6,604 arrivals (+25.60%), and Spain with 6,244 arrivals (+22.62%).

**Figure 6.2:** Number of Visitor Arrival and Annual Growth Rate, 2005-2015.



Source: DOT.

**Figure 6.3:** Visitor Arrival to the Philippines, February 2017.



Source: DOT.

## 6.3 Contribution to Employment

Total employment in the tourism industry was 5,269,000 persons in 2017, or 13 percent of the country's total employment of 40,335,000 individuals (**Table 6.5**). Accommodation, food and beverages, and passenger services employ a subtotal of 3,735,000 individuals, representing 70.8 percent of the country's total employment in tourism industry in 2017. Growing at 5 percent from 2016-2017, the tourism sector continues to be one of the major sources of local employment.

**Table 6.5:** Employment in Tourism Industries, 2010 - 2017 (In thousand persons).

	2010	2011	2012	2013	2014	2015	2016	2017
<b>Total Employment in the Philippines</b>	<b>36,047</b>	<b>36,614</b>	<b>37,600</b>	<b>38,118</b>	<b>38,092</b>	<b>38,741</b>	<b>40,837</b>	<b>40,335</b>
<b>Employment in Tourism-Related Industries</b>	<b>4,126</b>	<b>4,266</b>	<b>4,561</b>	<b>4,709</b>	<b>4,819</b>	<b>4,971</b>	<b>5,224</b>	<b>5,269</b>
Accommodation and food and beverage	1,045	1,116	1,579	1,601	1,694	1,743	1,756	1,740
Passenger transport	1,902	1,870	1,675	1,746	1,713	1,779	1,927	1,995
Travel Agents, tour operators and tourism guides	26	30	26	29	30	26	33	35
Recreation, entertainment and cultural services	279	328	338	343	349	349	368	325
Retail trade on tourism-characteristic goods	276	307	300	312	319	323	353	348
Miscellaneous	598	615	643	678	714	751	787	826
<b>Share of Employment in Tourism Industries to Total Employment</b>	<b>11.4%</b>	<b>11.7%</b>	<b>12.1%</b>	<b>12.4%</b>	<b>12.7%</b>	<b>12.8%</b>	<b>12.8%</b>	<b>13.1%</b>

Source: PSA



Pamilacan Island, Bohol. (Photo by DENR)

## 6.4 Coastal and Marine Tourism

The Philippines receives more than 5 million foreign tourists yearly representing about 2 percent of the world total (DOT). The tourism sector also earned about US\$ 5 billion worth of visitor receipts in 2015, and this is about 67 percent higher than the receipts in 2010. The share of tourism to GDP in 2010 was 6.4 percent, and consistently increased on a yearly basis since then. The same trend can be observed in the visitor arrivals, receipts, as well as employment (**Table 6.5**). DoT likewise reported that the total contribution of *travel and tourism* to GDP stood at 19.7 percent in 2016 (**Figure 6.4**). PSA estimated the GVA of coastal and marine tourism in 2016 at US\$2.992 billion (in constant 2012 prices) - (**See Table 4.1**). There are 898,273 people employed in the coastal and marine tourism industry (PSA 2018; **Table 4.3**).

Ecosystems services value of the beaches and coral reefs, both direct and indirect, form a large part of total socio-economic benefits derived from international and domestic tourism, particularly among territories that are archipelagic or endowed with natural island-beaches like the Philippines. Most of these tourists go to the country's beaches, which are its prime tourism assets. There is a noted increase in arrivals of foreign tourists in leading coastal tourism areas, such as Panay Island (Boracay), Palawan (El Nido, Coron and Puerto Princesa), Bohol, and Cebu. The DOT also identified key national parks and heritage sites in coastal and marine areas for sustainable tourism (**Figure 6.5**). The Coral Triangle Initiative of Coral Reefs, Fisheries and Food Security (CTI-CFF) has observed that visitor arrivals, revenues, and employment generated by this type of tourism have increased dramatically, but need careful management to ensure the protection of the coastal and marine habitats, resources and water quality as well as the sustainable development of coastal communities. The CTI-CFF, which promotes sustainable marine and coastal tourism, also identified key marine protected areas in the country that possess substantial income potential from sustainable tourism. These are the Tubbataha Reefs Natural Park in Palawan, Apo Reef Natural Park in Occidental Mindoro, Turtle Islands Wildlife Sanctuary in Tawi-Tawi, and Apo Island Marine Reserve in Negros Oriental (**Table 6.6**).

**Figure 6.4:** Contribution of Travel and Tourism to GDP.



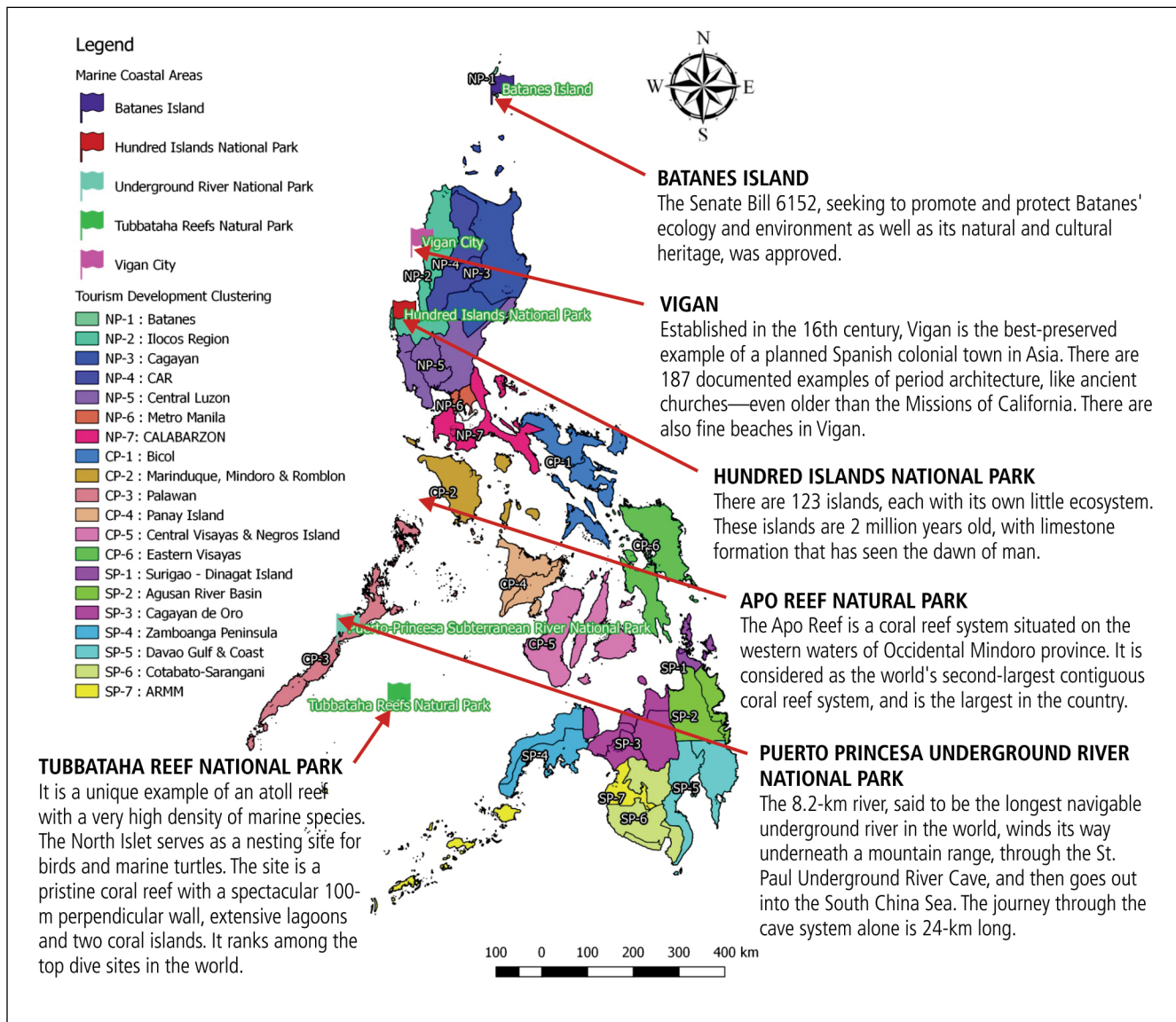
Source: DOT, World Travel and Tourism Council (2017).

**Table 6.6:** Marine Natural Parks, Sanctuaries and Reserves.

Destination	Location
Tubbataha Reefs Natural Park (World Heritage Site)	Sulu Sea
Apo Reef Natural Park	Mindoro Strait
Turtle Islands Wildlife Sanctuary	Tawi-Tawi
Apo Island Marine Reserve	Negros Oriental

Source: CTI-CFF-Tourism: Sustainable Marine Tourism in Sulu-Sulawesi Seas.

**Figure 6.5:** National Parks and Heritage Sites in Coastal and Marine Areas.



Source: DOT (2016).

## 6.5 Issues and Response

While marine and coastal tourism emerges as a promising source of income, it is nevertheless associated with a multitude of challenges. The principal issues in marine and coastal tourism revolve around slow infrastructure development, inconsistent tourism products that fail to meet the expectations of the public, and negative environmental impacts caused by solid waste, wastewater, and unregulated development in beach areas and coastal habitats.

### 6.5.1 National Policies and Laws

**Republic Act (RA) 9593 – Tourism Act of 2009:** An act declaring a national policy for tourism. The State declares tourism as an indispensable element of the national economy and an industry of national interest and importance, which must be harnessed as an engine of socioeconomic growth and cultural affirmation to generate investment, foreign exchange and employment. This policy recognizes *sustainable tourism development* as integral to the national socioeconomic development efforts to improve the quality of life of the Filipino people. It also aims to promote a tourism industry that is ecologically sustainable, responsible, participative, culturally sensitive, economically viable, and ethically and socially equitable for local communities. Private sector participation and *agri-tourism* for countryside development and preservation of rural life is also encouraged under this law.

**Republic Act (RA) 10816 titled “Farm Tourism Development Act of 2016”:** Farm tourism, as defined by the law, is the practice of attracting visitors and tourists to farm areas for production, educational, and recreational purposes. This law recognizes that combining tourism with agriculture can disseminate the value of agriculture in the economic and cultural development of the country, serve as a catalyst for the development of agriculture and fishery communities, and provide additional income for farmers, farmworkers and fisherfolk. The Act also seeks to promote environment-friendly, efficient and sustainable farm practices; provide alternative recreation facilities and farm tourism activities for families, students and other clientele; and promote health and wellness with high-quality farm-produced food.

**National Tourism Development Plan 2016-2022** – continuity is the focus, building on the momentum of what has already been achieved from the previous plan (*National Tourism Development Plan 2011-2016*), and from the initiatives of various stakeholders comprising the tourism industry

### 6.5.2 National Ecotourism Strategy and Action Plan (NESAP)

**Table 6.7** below summarizes the different issues and challenges of the industry that were first identified in the *National Ecotourism Strategy and Action Plan (NESAP) 2002-2012*, and the strategies that were adopted in the *NESAP 2013-2022*.

**Table 6.7:** Issues in NESAP 2002-2012 and Responses in NESAP 2013-2022.

Issues	Response
Not all sites have ecotourism plans and business plans for specific products to guide the development of ecotourism in the sites, and the sustainability of the ecotourism products.	<p><b>STRATEGY 1:</b> Establish system on ecotourism planning and development</p> <p><b>STRATEGY 3:</b> Develop ecotourism enterprises</p>
Inadequate implementation of ecotourism standards and accreditation system to maintain quality and integrity, which will satisfy the community and the visitors	<p><b>STRATEGY 1:</b></p> <ul style="list-style-type: none"> <li>• Review and update standards.</li> <li>• Implement accreditation system</li> </ul>
Carrying capacities of ecotourism areas are not determined to manage influx of visitors and expansion of facilities.	<p><b>STRATEGY 1:</b> Visitor management</p> <ul style="list-style-type: none"> <li>- Carrying capacity for ecotourism</li> <li>- Site development plans</li> <li>- Zoning plans</li> </ul>
Lack of policies and procedures to encourage ecotourism investments	<p><b>STRATEGY 2:</b></p> <ul style="list-style-type: none"> <li>• Develop and streamline policies and procedures on ecotourism investments.</li> <li>• Identify and promote ecotourism sites for public-private partnership (PPP).</li> <li>• Establish one-stop shops for ecotourism investments.</li> </ul>
Need to formulate regional action plans to implement the NESAP, and facilitate the mainstreaming of the NESAP to the plans, programs and budgets of DENR, DOT, other government agencies and LGUs.	<p><b>STRATEGY 4:</b> Mainstreaming NESAP in national and local tourism plans</p>
The NESAP 2002-2012 was not widely disseminated to the stakeholders to fully realize its implementation. The new NESAP 2013-2022 needs to be fully disseminated to all stakeholders, through IEC, regular consultations.	<p><b>STRATEGY 4:</b></p> <ul style="list-style-type: none"> <li>• IEC campaign to include communication plan and advocacy plan</li> <li>• Dissemination of IEC materials to stakeholders.</li> </ul>
EO 111 bodies need to meet regularly to discuss key issues, formulate policies and assess progress of NESAP implementation.	<p><b>STRATEGY 6:</b></p> <ul style="list-style-type: none"> <li>• Mobilize EO 111 bodies</li> <li>• Engage other stakeholders.</li> </ul>
Inadequate funds, staff and other resources to enable ecotourism development in the sites.	<p><b>STRATEGY 7:</b></p> <ul style="list-style-type: none"> <li>• Facilitate/initiate access to funding sources.</li> <li>• Access Overseas Development Assistance (ODA)</li> <li>• Develop and implement payment for ecosystem services (PES) for ecotourism</li> </ul>
Lack of monitoring and evaluation (M&E) mechanism to regularly monitor the implementation of NES and ecotourism programs and projects.	<p><b>STRATEGY 8:</b></p> <ul style="list-style-type: none"> <li>• Establish M&amp;E system.</li> <li>• Conduct monitoring program.</li> <li>• Conduct impact/outcome monitoring.</li> </ul>

Source: DOT.



### 6.5.3 DoT-ASEAN Tourism Strategic Plan

In addition to NESAP, there is the **DoT-ASEAN Tourism Strategic Plan of 2015** which was formulated based on the momentum established by the ASEAN Tourism Strategic Plan 2011-2015. The Plan seeks to make a greater contribution towards the ASEAN integration goal of achieving a regional economic growth scenario that is more “inclusive, green and knowledge-based.” In particular, it seeks to promote ASEAN region as a “sustainable and more socio-economically inclusive and integrated tourism destination.”

In this context, the vision for ASEAN tourism over the next decade up to 2025 is “a quality tourism destination offering a unique, diverse ASEAN experience that will be committed to responsible, sustainable, inclusive and balanced tourism development, so as to contribute significantly to the socioeconomic well-being of ASEAN people.”

To be able to achieve this vision, it will be necessary to complete and continue existing initiatives:

- Marketing of ASEAN as a single destination;
- Implementation of the ASEAN tourism standard and implementation of the ASEAN Mutual Recognition Arrangement on Tourism Professionals (MRA-TP);
- Adoption of new and innovative approaches to destination and product development and marketing; mainstreaming existing sub-regional tourism initiatives, such as the Greater Mekong Sub-region (GMS), the Brunei, Indonesia, Malaysia and Philippine East ASEAN Growth Area, (BIMP-EAGA), and the Indonesia, Malaysia and Thailand Growth Triangle (IMT-GT) within ASEAN; and
- Working with other agencies controlling or influencing key connectivity, investment, safety and security and natural and cultural heritage conservation.

Based on the ASEAN Tourism Plan, the strategic actions needed to meet the aforementioned core challenges to be able to achieve the vision for ASEAN tourism have been grouped as follows:

**Table 6.8:** Tourism Strategies under the ASEAN Tourism Plan.

No.	Strategic Action	Activites
<b>Strategic Direction 1:</b> To Enhance The Competitiveness of ASEAN as a Single Tourism Destination		
1.1	Intensify Promotion And Marketing	1.1.1 Enhance the ASEAN tourism statistical framework
		1.1.2 Expand the ASEAN regional destination-marketing program
1.2	Diversify Tourism Products	1.2.1 Complete the ongoing and identify new product development and marketing approaches
		1.2.2 Support the development of ASEAN sub- regional destinations/ corridors targeting more inclusive tourism outcomes
1.3	Attract Tourism Investments	1.3.1 Prepare an ASEAN tourism investment program that identifies investment corridors where the convergence and consolidation of investments in tourism infrastructure and products will take place
		1.3.2 Promote further liberalization of tourism services

**Table 6.8:** Tourism Strategies under the ASEAN Tourism Plan. (cont.)

No.	Strategic Action	Activites
1.4	Raise Capacity and Capability of Tourism Human Capital	1.4.1 Continue the implementation of the ASEAN mutual recognition arrangement on tourism professionals (MRA-TP)
		1.4.2 Prepare and implement the ASEAN tourism human resources development plan in coordination with the ASEAN tourism resources management and development network (ATRM)
1.5	Implement and Expand ASEAN Tourism Standards for Facilities, Services And Destinations	1.5.1 Promote the adoption and implementation of the ASEAN tourism standards certification system into the policy and regulatory and tourism HRD framework of the Member States
		1.5.2 Identify and implement new ASEAN tourism standards
		1.5.3 Develop ASEAN tourist protection guidelines
1.6	Implement and Expand Connectivity and Destination Infrastructure	1.6.1 Enhance ASEAN Air Connectivity by supporting implementation of the ASEAN Single Aviation Market (ASAM)
		1.6.2 Promote the development of cruise and river tourism including its infrastructure for sea and river cruise
		1.6.3 Implement the Agreement on the Recognition of Domestic Driving Licenses issued by ASEAN Countries to promote drive/overland tourism across ASEAN
		1.6.4 Promote the development of road connectivity along major tourism corridors
1.7	Enhance Travel Facilitation	1.7.1 Prepare white paper to implement the facilitation of intra-ASEAN and international travel (Article 2 of ASEAN Tourism Agreement 2002)
2.1	Upgrade Local Communities and Public-Private Sector Participation in the Tourism Value Chain	2.1.1 Develop and implement the strategy on participation of local communities and private sectors in tourism development
2.2	Ensure Safety and Security, Prioritize Protection and Management of Heritage Sites	2.2.2 Work with official bodies and organizations in support of the protection and management of heritage sites
2.3	Increase Responsiveness to Environmental Protection and Climate Change	2.3.1 Work with official bodies and organizations to address environmental, and enhance climate change responsiveness
		2.3.2 Prepare a manual of guidelines for incorporating environment and climate change mitigation, adaptation, and resilience

Source: DOT.

Furthermore, once the strategic programs and projects are fully funded and implemented, it is expected that by 2025, the following have been realized:

- The Philippine contribution to ASEAN tourism increased from 12 to 15 percent;
- Tourism's share of total employment to increase from 3.7 to 7 percent;
- Per capita spending by international tourists to increase from US\$ 877 to US\$ 1,500;
- The average length of stay of international tourist arrivals to increase from 6.3 to 8 nights; and
- The number of accommodation units to increase from 0.51 units per 100 head of population.

#### 6.5.4 National Cruise Tourism Development Strategy and Action Plan 2016-2022

Under the *National Tourism Development Plan (NTDP) 2011-2016*, cruise tourism has been identified as one of the strategic products capable of attracting large regional market, i.e., China, South Korea, Japan, India, Taiwan, Malaysia, Australia, USA and Europe, with moderate length of stay and expenditure. According to the Plan, cruising has become the fastest growing form of tourism in much of Asia in recent years, but the Philippines is at present seeing little of the activity and few benefits despite having diverse and rich tourism opportunities and a vigorous maritime industry.

The *National Cruise Tourism Development Strategy and Action Plan 2016-2022* was prepared by the Philippine Department of Tourism and the United States Agency for International Development (USAID) under the Advancing Philippine Competitiveness Project. The aim of this strategy is to provide direction to both government and the private sector to build the number of cruise ship calls to ports and islands through the Philippines, create excellent guest experiences, earn increased economic benefits, and promote sustainable tourism. It is to benefit the Philippine economy and its people by creating a compelling proposition to the cruise lines and their guests. The strategy focuses on the development of the Philippines as a destination for the world's cruise lines and so to capture benefits from the extraordinary growth of the industry in the region, in line with the NTDP 2011-2016 vision of positioning the Philippines as a must-see destination in Asia.

The strategy adopts a phased approach to achieve development with ambitious yet realistic objectives, targeted investment justified by long-term rewards, and manageable efforts. These rewards come in the form of multiplier effects of tourism, the role of ports as gateways to the economy, the infrastructure investments for their value to all shipping and to city-wide commerce, and the opportunities to showcase and preserve the culture and natural advantages of the nation, especially in more remote and less-travelled regions.

This, however, does not mean that huge investments or major capital works are required just for the cruise industry, nor are they easily justified, at least until there is much greater cruise activity at few sites. Cruising can usually make use of existing port facilities where all that may be needed is rearranging, repairing, cleaning and beautifying. Incremental investments can be made at other sites for improved facilities but these can be shared by the whole community – used for other tourism activities, fishing, inter-island trading, local commerce, and so on.

The Philippines is presently attracting very few cruise calls – surprisingly, considering its rich variety of destinations, culture, natural attractions, history, sophistication, cuisine, shopping and significant port infrastructure. Due to its geographical location, the Philippines is just a little too far for inclusion in the short cruises that account for the majority of capacity deployed in China and Southeast Asia. A key to bringing more cruise calls to the Philippines, especially in the short-term, is to attract vessels that operate out of the principal Asian home ports (**Table 6.9**).

**Table 6.9:** Major Asian Cruise Homeports in the Vicinity of the Philippines.

Home port	Principally Serving	Number of ships home-ported during 2015	Number of turnarounds during 2015	Sea distance to Manila (Nm)
<b>NORTH ASIA</b>				
Shanghai, CN	Korea, Japan	7	143	995
Hong Kong, SAR	Taiwan, Korea, Japan, China	19	142	633
Kaohsiung, TW	Japan	1	2	507
Keelung, TW	Japan	3	94	730
<b>SOUTHEAST ASIA</b>				
Singapore, SG	Malaysia, Thailand, Vietnam	26	308	1,370

Source: National Cruise Tourism Development Strategy and Action Plan 2016-2022 (March 2016).

Out of the 15 destinations called on in the Philippines from 2013-2016, only Manila, Puerto Princesa, Coron and Boracay showed prominence during all four years. Puerto Princesa accumulated the most aggregate visits with 39 transits and 16 overnights. Manila, the second most visited port of call, accumulated 48 transits but only 5 overnights. It is the only Philippine port to be nominated as a turnaround, that being on one cruise operated by Hapag Lloyd's Europa in 2015. (This operation would have seen some passengers combining two cruises as part of a longer voyage, so the entire passenger complement would not have changed over in Manila). Boracay is the Philippines' third largest destination with 29 calls over the four-year period. Coron and Malcapuya Island account for 11 calls and the nearby islands of Culion, Busuanga and El Nido account for another 6 altogether.

**Table 6.10:** Number of Cruise Calls in Philippine Ports (2013-2016).

Scheduled Calls	2013	2014	2015	2016*	4-Year Total
<b>LUZON</b>					
Manila					
Manila transit	7	11	15	15	48
Manila overnight		4	1		5
Manila turnaround			1		1
Hundred Islands and Lingayen Gulf	1	1	1	3	6
Currimao, Ilocos Norte			1		1
Aparri, Ilocos Norte		1			1
Palawan					
Puerto Princesa					
Puerto Princesa transits	3	12	16	8	39
Puerto Princesa overnight	1	8	6	1	16

**Table 6.10:** Number of Cruise Calls in Philippine Ports (2013-2016). (cont.)

Scheduled Calls	2013	2014	2015	2016*	4-Year Total
Coron	2	4	3	1	10
Culion Island (near Coron) and Malcapuya Island			1	1	2
Busuanga Island (near Coron)			1	3	4
El Nido		1			1
<b>VISAYAS</b>					
Boracay	2	8	12	7	29
Kalanggaman Islands (Palompon)			1		1
Cebu	3	1	1		5
Bantayan Island (Cebu Province)	1				1
Bohol	1	2	4		7
<b>TOTAL CALLS</b>	<b>21</b>	<b>53</b>	<b>64</b>	<b>39</b>	<b>177</b>
<b>TOTAL NUMBER OF PORTS</b>	<b>8</b>	<b>7</b>	<b>11</b>	<b>9</b>	

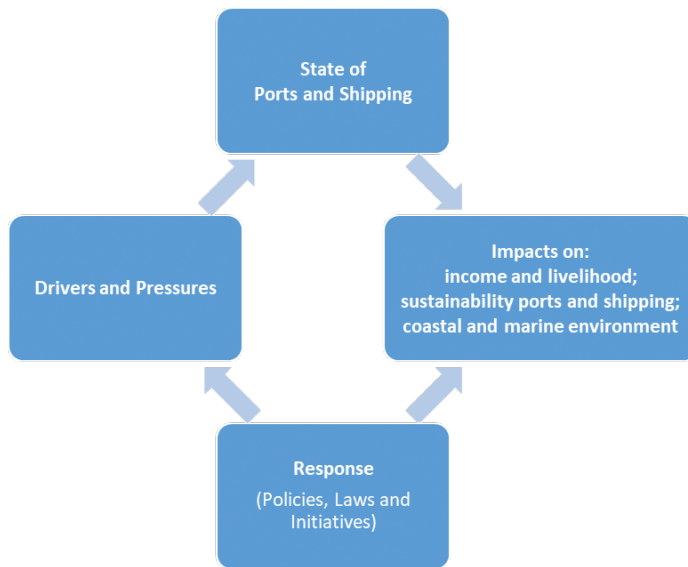
\* 2016 calls published in June 2016.

See Section 12 for examples of best practices and blue economy initiatives in coastal and marine tourism.



Yachts in Puerto Galera. (Photo by M. Ebarvia)

# 7 Ports and Shipping



Ships on Manila Bay.  
Photo by M. Ebarvia

Being an archipelago, the maritime industry in the Philippines remains a vital component in achieving socioeconomic progress. In fact, shipping is still the major means by which islands are linked and through which movements of good and people are achieved. A port, on the other hand, serves as the hub for economic trade and development and serves as the gateway to domestic, regional and international markets.

About 80 percent of global trade (by volume) and over 70 percent (by value) is carried by sea and handled by ports worldwide. According to UNCTAD (2012), worldwide sea-borne trade grew by 4 percent or to 8.7 billion tonnes in 2011 despite the global economic crisis. Container traffic is likewise projected to triple by 2030 (OECD 2012).

Interisland water transport is a very important subsector of the national transport system. There are about 1,300 ports, of which about 1,000 are government-owned, and the rest are privately-owned and operated. Of the government ports, almost 140 fall under the jurisdiction of Philippine Ports Authority (PPA) and the Cebu Ports Authority (CPA). The rest are the responsibility of other government agencies or local government units (LGUs).

## 7.1 Port Classification and Services

A port can be defined according to its use and purpose. A port can be referred to as haven for ships, a point of departure and arrival of ocean and sea-going vessels, a point of embarkation and disembarkation of passengers and the point of loading and unloading of cargoes.

### 7.1.1 Classification of Ports

Ports can be classified further according to the following:

(a) Geographical Location:

- Coastal/Sea Port - a port established along the coast or shoreline. It can be natural or man-made;
- Inland Port - a port established on an *inland* waterway, such as a river, lake, or canal, which may or may not be connected to the ocean. The term "*inland port*" is also used to refer to a dry *port* which is an *inland* extension of a seaport, usually connected by rail to the docks; and
- Seaward Port- an artificial port built in a small island/structure separated from the shore.

(b) Administration:

- State-owned Port - a port operated by a national port authority;
- Municipal Port - a public port owned and maintained by the municipal government;
- Autonomous Port - a port other than that of a state-owned and operated by a local port authority; and
- Private Port - a port owned and maintained by a private entity. It may be commercial or non-commercial as may be allowed by PPA.

(c) Ship/Cargo Handled:

- Conventional Port
- Container Port
- Ferry/RoRo Terminal
- Grain Terminal
- Bulk Terminal
- Specialized Port



Cagayan de Oro port. (Photo by PPA)

### 7.1.2 Services in the Ports

#### (a) Major Services

- Arrastre - a Spanish word which refers to hauling of cargoes or handling of cargoes on the dock/wharf/quay or storage areas; and
- Stevedoring - refers to the handling of cargoes on board a vessel and/or between the ship's tackle and its holds.

#### (b) Cargo Handling Operations

- RORO Operation - the loading and discharging of self-powered vehicles like cars, trucks on their own wheels by their owners or drivers between the vessel and shore via a ramp;
- CHA-RO - chassis or trailers, empty or loaded with cargo, whether break-bulk, unitized palletized, containers, are towed or wheeled into or out of the RORO vessel by means of a prime mover, tractor, or tow motor, without cargo, re-handling, shifting or grounding on the vessel and where no other cargo handling is rendered except lashing or unlashng; and
- STO-RO - conventional, unitized, palletized cargoes or containers which are carried from the apron and stowed into RORO vessel or out of RORO vessel to apron or waiting truck by means of a forklift or similar wheeled equipment. The forklift provides the temporary mobile system for such cargo.

#### (c) Allied Services

- Trucking
- Chandling
- Bunkering
- Brokerage
- Warehousing
- Scaling/Weighing
- Security
- Litharging/Barging
- Pilotage



RORO ships. (Photo by M. Ebarvia)

## 7.2 Port Authorities in the Philippines

Port authorities may be established at all levels of government: national, regional, provincial, or local. The most common form is a **local port authority**, which is an authority administering one port area only.

### 7.2.1 The Philippine Ports Authority (PPA)

Prior to the creation of PPA, port administration was merged with the traditional revenue collection of Bureau of Customs (BOC). At the same time, port and harbor maintenance was the responsibility of the former Bureau of Public Works (BPW).



In the later years, BOC proposed to Congress' Reorganization Committee the creation of a separate government agency to integrate the functions of port operations, cargo handling and port maintenance. It was felt then that the same level of benefits could be derived with a national port authority administering and managing the country's ports as to the case with BOC and BPW. This led to the creation of Philippine Ports Authority under Presidential Decree 505 which was subsequently amended by PD 857 in December 1975, expanding further its functions to include the integration and coordination of ports nationwide.

The PPA is a government owned and controlled corporation attached to Department of Transportation (DoTr). It is one of the largest revenue-earning agencies in the Philippines. Many of the ports owned by the PPA are operated by private companies through short term lease. Warehousing, storage, and cargo handling are provided by both PPA and private operator.

#### **(a) Mandate of Philippine Ports Authority (PPA)**

Under the law, the Philippine Ports Authority or PPA is currently mandated to establish, develop, regulate, manage and operate a rationalized national port system in support of trade and a national port system in support of overall national development.

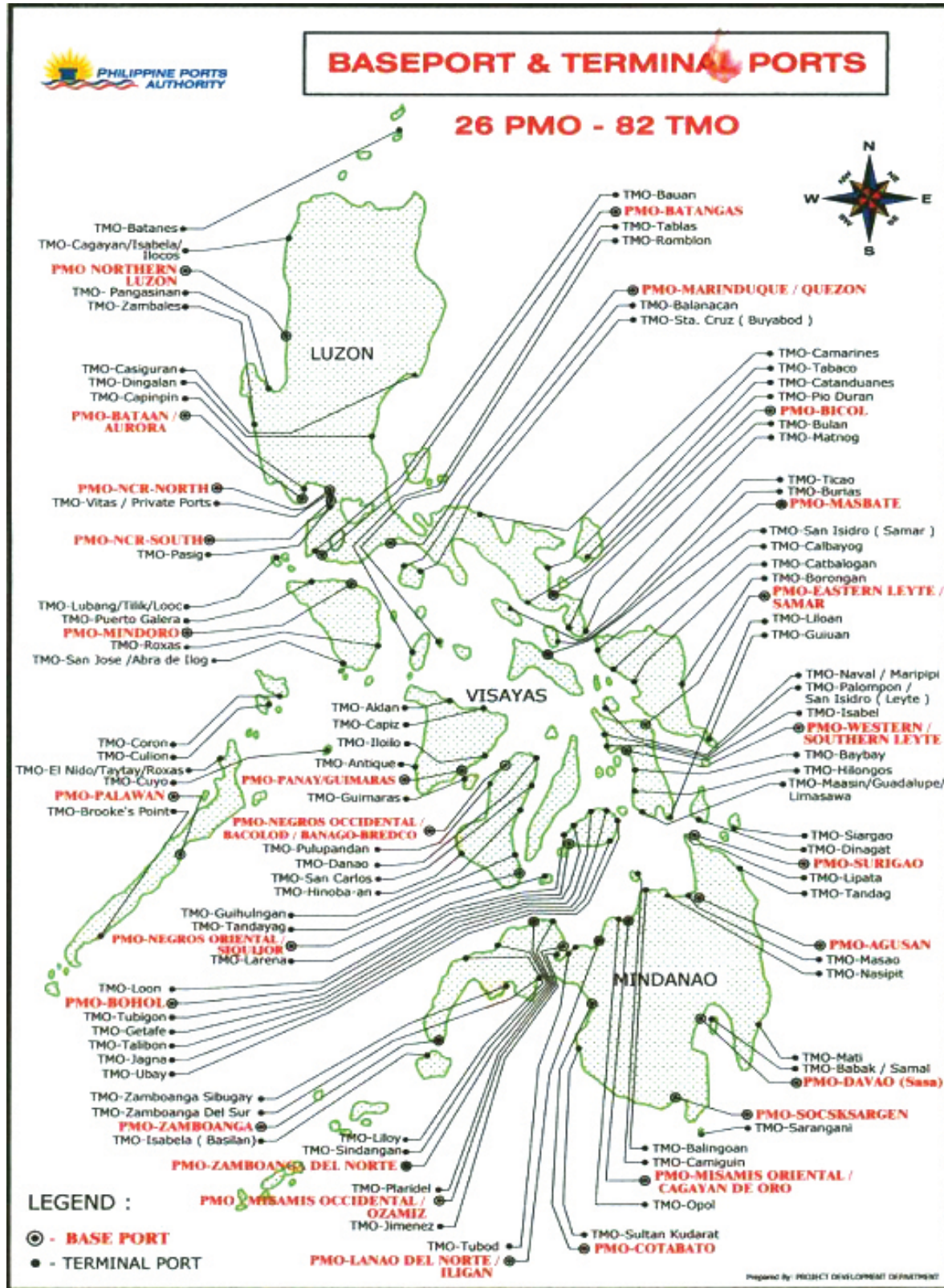
#### **(b) Major Ports in the Philippines under the Jurisdiction of PPA**

PPA operates and manages a total of 108 base ports and terminal ports across the Philippines through its 26 PMOs (**Figure 7.1**). These ports are on top of the 211 private ports being supervised by PPA as part of its regulatory powers provided under its corporate charters.

Under the newly established port system, PMOs Masbate and MarQuez (Marinduque/Quezon) are the newly created field offices. Below is the definition of terminologies commonly used by PPA:

- **Port Management Office (PMO)** – the PPA's administrative and operational arm in every port district of the Philippines; each of the 26 PMOs in the country maintains a base port and all or any of the terminal, municipal and private ports under its jurisdiction.
- **Terminal Management Office (TMO)** – an office in a terminal under the administration of the base port; it serves as the extension of the base port in the regulation of ports in the country.

Figure 7.1: Location of Major Base Ports and Terminal Ports.



**Table 7.1:** List of Port Management Offices of PPA.

Port Management Office	Code	Address
<b>LUZON CLUSTER</b>		
1. PMO NCR South	NCS	23 Muelle De San Francisco, St., South Harbor, Port Area, Manila
2. PMO NCR North	NCN	Pier 8, Marcos Road, North Harbor, Tondo, Manila
3. PMO Northern Luzon	NLZ	Gov. Joaquin L. Ortega Ave., Poro Point, San Fernando City, La Union
4. PMO Bataan Aurora	BNA	Administration Bldg., Brgy. Lamao, Limay, Bataan
5. PMO Batangas	BGS	PPA Administration Bldg., Port Access Road, Calicanto, Batangas City 4200
6. PMO Mindoro	MDO	Port Area, San Antonio, Calapan City, Mindoro
7. PMO Bicol	BCL	Government Regional Center, Rawis, Legazpi City, Albay
8. PMO Palawan	PLW	Port Area, Brgy. BagongPag-asa, Puerto Princesa City, Palawan
9. PMO Marinduque/ Quezon	MRQ	2ndFlr., Padillo Building, Quezon Ave., cor. Trinidad St., Lucena City
10. PMO Masbate	MSB	
11. PMO Negros Oriental/Siquijor	NOS	Port Area, Lo-oc, Dumaguete City, Negros Oriental, 6200
12. PMO Panay/Guimaras	PNG	Port of Iloilo, Iloilo City
13. PMO Western Leyte/ Biliran	WLB	Lot 2, Blk. 13, Doña Felipe Mejia Subd., Veloso St., Ormoc City, Leyte 6541
14. PMO Eastern Leyte/Samar	ELS	Port Area, Tacloban City, Leyte
15. PMO Bohol	BHL	Port Area, 6300 Tagbilaran City, Bohol
16. PMO Negros Occidental Bacolod/BREDCO	NBBB	Barangay Banago, Banago Port, Bacolod City
<b>MINDANAO CLUSTER</b>		
17. PMO Misamis Oriental/Cagayan de Oro	MOC	Port Area, Macabalan, Cagayan de Oro City, Misamis Oriental
18. PMO Lanao del Norte/Iligan	LNI	Port Area. Iligan City, 9200
19. PMO Agusan	AGS	Port Area, San Francisco St., Butuan City, 8600
20. PMO Misamis Occidental/Ozamiz	MOO	Port Area, Ozamiz City
21. PMO Surigao	SUG	Brgy. Taft, Port Area, Surigao City, 8400
22. PMO Cotabato	CBO	Rajah Tabunway Blvd., Port Area, Cotabato City 9600
23. PMO Zamboanga del Norte	ZDN	Port Area, San Vicente, Dapitan City
24. PMO Davao	DVO	Km.10, Port Area, Sasa, Davao City
25. PMO SOCCSKSARGEN	SSG	Makar Wharf, Labagal, General Santos City, PO Box 53
26. PMO Zamboanga	ZBA	R.T. Lim Boulevard, Zamboanga City

Source: PPA.

**Table 7.2:** List of Terminal Management Offices of PPA.

LUZON	VISAYAS	MINDANAO
1. TMO Pasig	32. TMO Iloilo	60. TMO Balingoan
2. TMO Vitas/Private Ports	33. TMO Antique	61. TMO Opol
3. TMO Batanes	34. TMO Aklan	62. TMO Camiguin
4. TMO Cagayan/Isabela/Ilocos	35. TMO Guimaras	63. TMO Ubod
5. TMO Pangasinan	36. TMO Tandayag	64. TMO Masao
6. TMO Zambales	37. TMO Larena	65. TMO Nasipit
7. TMO Capinpin	38. TMO Guihulngan	66. TMO Siargao
8. TMO Casiguran	39. TMO Borongan	67. TMO Tandag
9. TMO Dingalan	40. TMO Calbayog	68. TMO Lipata
10. TMO Tablas	41. TMO Catbalogan	69. TMO Dinagat
11. TMO Romblon	42. TMO Guiuan	70. TMO Plaridel
12. TMO Bauan	43. TMO San Isidro	71. TMO Jimenez
13. TMO Balanacan	44. TMO Liloan	72. TMO Liloy
14. TMO Sta. Cruz	45. TMO Tubigon	73. TMO Sindangan
15. TMO San Jose/Abra de Ilog	46. TMO Talibon	74. TMO Mati
16. TMO Puerto Galera	47. TMO Getafe	75. TMO Babak/Samal
17. TMO Roxas	48. TMO Ubay	76. TMO Isabela
18. TMO Lubang/Tilik/Looc	49. TMO Jagna	77. TMO Zamboanga del Sur
19. TMO Tabaco	50. TMO Loon	78. TMO Zamboanga Sibugay
20. TMO Catanduanes	51. TMO Hinobaan	79. TMO Sarangani
21. TMO Camarines	52. TMO Pulpandan	80. TMO Sultan Kudarat
22. TMO Bulan	53. TMO Danao	81. TMO Basilan
23. TMO Matnog	54. TMO Baybay	
24. TMO Pio Duran	55. TMO Isabel	
25. TMO Burias	56. TMO Hilongos	
26. TMO Ticao	57. TMO Maasin/Guadalupe/Limasawa	
27. TMO Coron	58. TMO Palompon/San Isidro	
28. TMO Brooke's Point	59. TMO Naval/Maripipi	
29. TMO Cuyo		
30. TMO Culion		
31. TMO El Nido/Taytay/Roxas		

Source: PPA.

### 7.2.2 Other Port Authorities

There are also several port authorities, which cater to the specialized needs of their client within their area of jurisdiction (**Table 7.3**). Each port authority has its own mandates, regulations and policies in place.

**Table 7.3:** List of Other Port Authorities in the Philippines.

Port Authority	Contact Details
Cebu Port Authority	CIP Complex, Sergio Osmena Blvd, North Reclamation Area, 6000 Cebu City, Philippines W: <a href="http://www.cpa.gov.ph/index.php">www.cpa.gov.ph/index.php</a>
Poro Point Special Economic & Freeport Zone	John Hay Poro Point Development Corp, Port Management Office, San Fernando, La Union, Luzon Island, Philippines
Bases Convention and Development	Email: <a href="mailto:bcda@bcda.gov.ph">bcda@bcda.gov.ph</a>
Subic Bay Metropolitan Authority	Seaport Department, Bldg 228, Waterfront Road, 2222 Subic Bay Free Port Zone, Philippines W: <a href="http://www.sbma.com">www.sbma.com</a>

Source: PPA.

### 7.3 Port Performance Indicators

Port performance indicators are simply measures of various aspects of the port's operations. This statistics provides insight to port management into operation of key areas. This can be used to compare performance against a target and to observe trends in performance levels across time.

The following are some terminologies used as performance indicators in the shipping sector:

- **Cargo Throughput** - total volume of cargo discharged and loaded at the port;
- **Gross Registered Tonnage** - the measure of internal volume within the expressed in terms of 100 cubic feet a ton;
- **Service Time** - the number of hours spent by a vessel at berth or anchorage; it is computed by finding the difference between the time and vessel arrived at and departed from berth or anchorage;
- **Ship-calls** - the number of vessels which call or arrive at a particular port at any given time; and
- **TEU (Twenty-Foot-Equivalent Unit)** - the unit of measurement equivalent to a container's length of 20 feet.

For the year 2017, the highest number of cargoes handled/loaded and discharged at the port happened at the PMO of Manila/Northern Luzon since the bulk of cargoes are being loaded and discharged at the Port of Manila. Container traffic is mostly concentrated at the Port of Manila as well. However, the highest number of passengers embarked and disembarked was recorded in the PMO of Visayas since the Visayas region is composed of several islands that are being inter-linked by water transport network. In most areas though, there is a balance in the transport of cargoes and people, and this explains the significant number of passenger-cargo ships in the domestic fleet. **Table 7.4** shows the relevant statistical information from PPA in terms of cargo throughput, container, shipping and passenger traffic, by area.

**Table 7.4:** Summary of Port Performance: 2017.

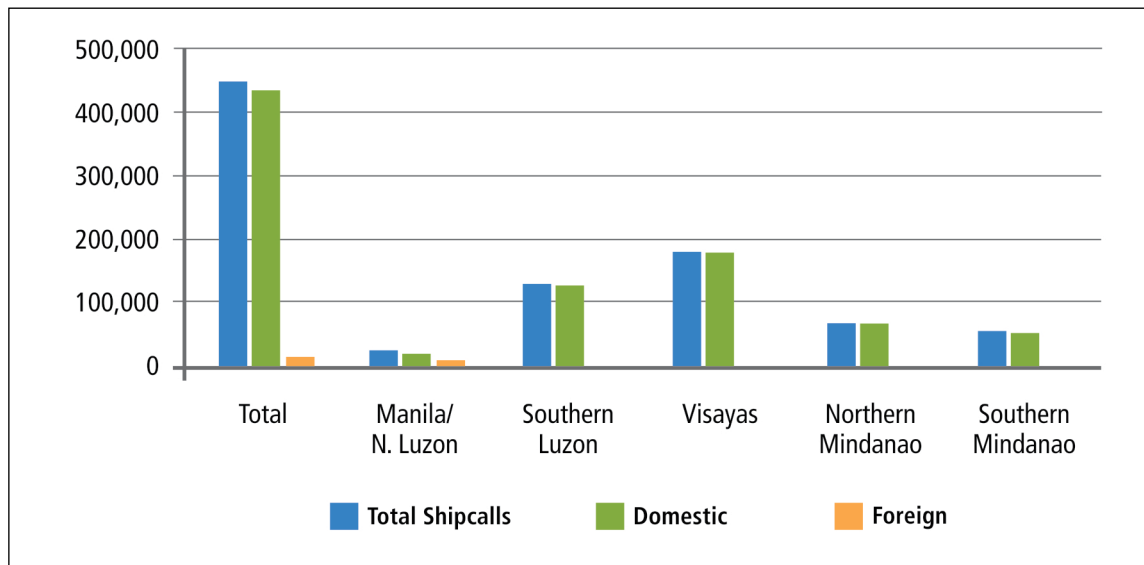
Particulars	Total	Manila/ N. Luzon	Southern Luzon	Visayas	Northern Mindanao	Southern Mindanao
<b>1. Shipcalls</b>	<b>449,008</b>	<b>21,578</b>	<b>128,302</b>	<b>180,807</b>	<b>66,039</b>	<b>52,282</b>
Domestic	437,054	16,361	126,170	179,870	64,863	49,790
Foreign	11,954	5,217	2,132	937	1,176	2,492
<b>2. Cargo Throughput (tonnes)</b>	<b>253,560,514</b>	<b>101,379,797</b>	<b>40,610,892</b>	<b>35,794,645</b>	<b>50,583,317</b>	<b>25,191,863</b>
<b>Domestic</b>	<b>101,496,602</b>	<b>39,293,093</b>	<b>16,223,484</b>	<b>21,667,035</b>	<b>12,926,255</b>	<b>11,386,735</b>
Inward	57,376,142	18,644,302	10,267,439	13,686,293	7,065,208	7,712,900
Outward	44,120,461	20,648,791	5,956,045	7,980,742	5,861,048	3,673,836
<b>Foreign</b>	<b>152,063,912</b>	<b>62,086,704</b>	<b>24,387,408</b>	<b>14,127,610</b>	<b>37,657,062</b>	<b>13,805,128</b>
Import	89,612,379	52,945,041	19,405,147	4,902,770	4,542,736	7,816,685
Export	62,451,533	9,141,664	4,982,260	9,224,840	33,114,326	5,988,443
<b>3. Container Traffic (in TEU)</b>	<b>7,014,170</b>	<b>4,810,886</b>	<b>291,307</b>	<b>437,478</b>	<b>375,902</b>	<b>1,098,597</b>
<b>Domestic</b>	<b>2,840,573</b>	<b>1,425,425</b>	<b>93,991</b>	<b>437,440</b>	<b>375,453</b>	<b>508,265</b>
Inward	1,427,875	684,839	48,365	232,822	189,958	271,890
Outward	1,412,698	740,586	45,625	204,618	185,496	236,375
<b>Foreign</b>	<b>4,173,597</b>	<b>3,385,462</b>	<b>197,316</b>	<b>38</b>	<b>449</b>	<b>590,332</b>
Import	2,118,026	1,747,838	96,541	38	449	273,159
Export	2,055,571	1,637,623	100,775	0	0	317,173
<b>4. Passenger Traffic</b>	<b>72,438,609</b>	<b>1,380,911</b>	<b>23,927,718</b>	<b>26,719,339</b>	<b>12,448,949</b>	<b>7,961,692</b>
Disembarked	37,227,215	657,613	12,463,821	13,768,143	6,348,728	3,988,910
Embarked	35,100,855	652,817	11,449,257	12,925,879	6,100,120	3,972,782
Cruise Ships Passengers	110,539	70,481	14,640	25,317	101	0
<b>5. RoRo Traffic</b>	<b>6,105,151</b>	<b>3,351</b>	<b>2,169,309</b>	<b>2,056,773</b>	<b>1,638,598</b>	<b>237,120</b>
<b>Inward</b>	<b>3,060,099</b>	<b>2,772</b>	<b>1,050,379</b>	<b>1,057,737</b>	<b>831,514</b>	<b>117,697</b>
Type 1	555,546	2	54,584	119,762	326,646	54,552
Type 2	1,102,772	699	354,735	410,237	312,883	24,218
Type 3	462,579	392	220,663	134,147	92,222	15,155
Type 4	939,202	1,679	420,397	393,591	99,763	23,772
<b>Outward</b>	<b>3,045,052</b>	<b>579</b>	<b>1,118,930</b>	<b>999,036</b>	<b>807,084</b>	<b>119,423</b>
Type 1	562,297	7	66,920	116,027	324,200	55,143
Type 2	1,154,065	126	454,036	379,528	297,684	22,691
Type 3	361,519	108	128,126	127,315	90,363	15,607
Type 4	967,171	338	469,848	376,166	94,837	25,982

## Notes:

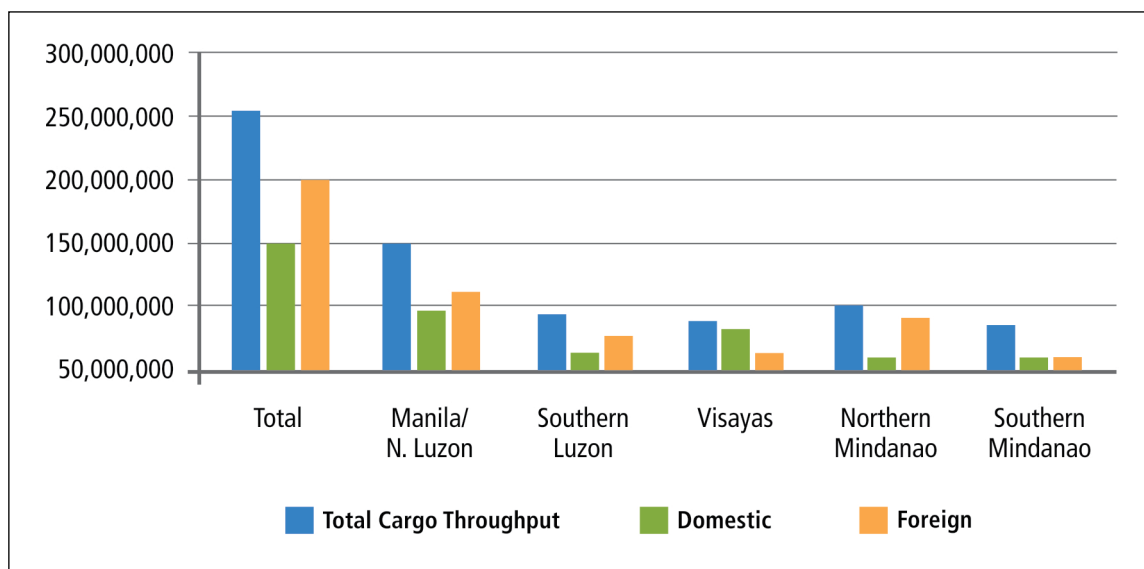
\* Values may not add up to totals due to rounding off.

\*\* TMOs' statistics contain only the Terminal Ports under its jurisdiction. Statistics for Other Government Ports and Private Ports are presented in lump-sum totals.

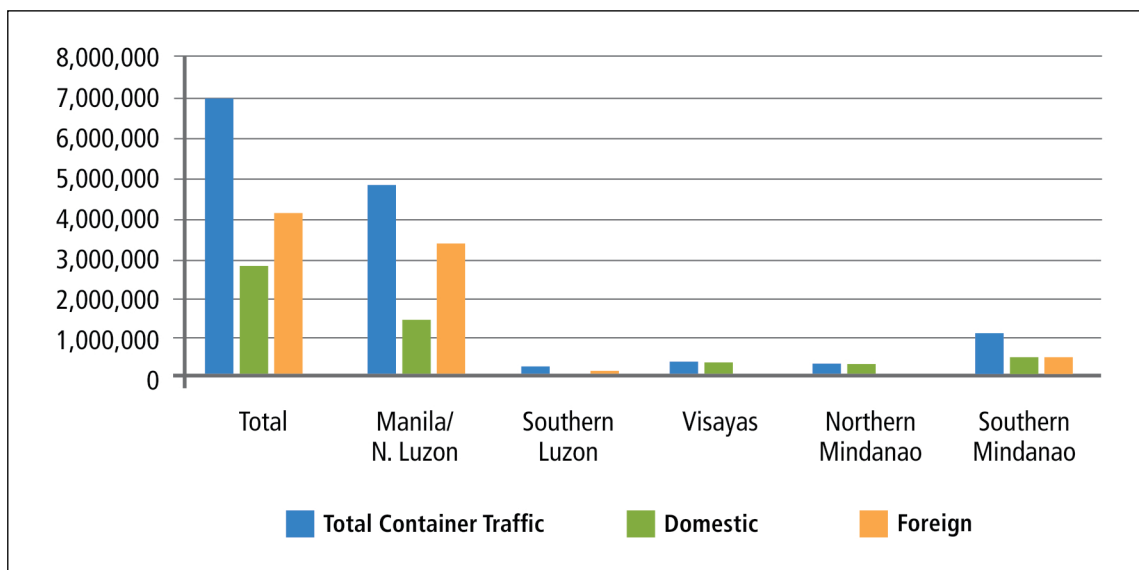
Source: Port Management Offices' Monthly Statistical Report, PPA.

**Figure 7.2:** Number of Shipcalls in 2017.

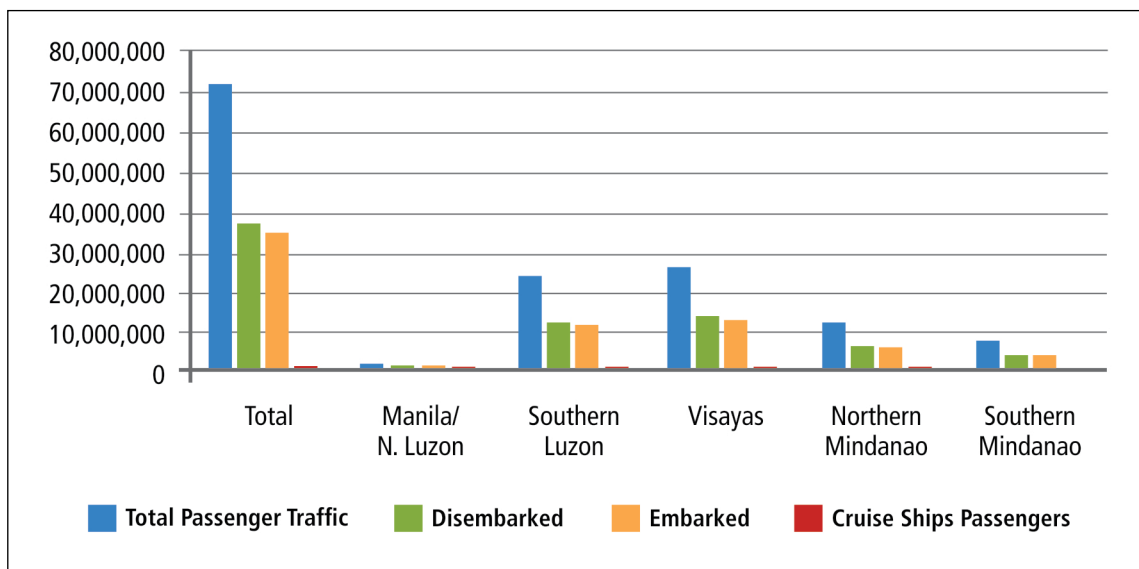
Source: PPA.

**Figure 7.3:** Cargo Throughput (in tonnes), 2017.

Source: PPA.

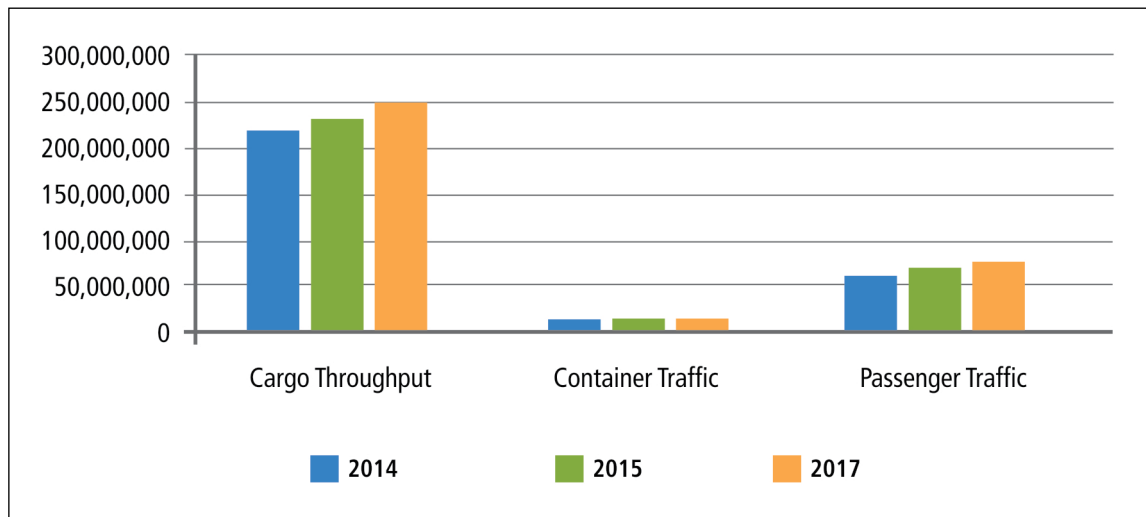
**Figure 7.4:** Container Traffic (in TEU), 2017.

Source: PPA.

**Figure 7.5:** Passenger Traffic, 2017.

Source: PPA.



**Figure 7.6:** Comparative Port Performance, 2014-2017.

Source: PPA.

In 2017, port statistics show increases in cargo, container, passenger, and vessel traffic from 2016 figures. The most remarkable of these were in domestic cargo, which registered an increase of 7.56 percent (7,132,144 tonnes) from the previous year; and foreign container volume, which expanded by 7.47 percent (290,215 TEUs), with export trade gaining by 7.77 percent (148,239 TEUs).

The total cargo volume reached 253.6 million tonnes in 2017, with more than half (152.1 million tonnes) accounted for by foreign cargo. However, the total cargo volume increase of 4 percent from previous year was contributed mainly by a rise in domestic cargo volume. Notable is the cargo performance of the ports in NCR North, Panay/Guimaras, Davao, Misamis Oriental/Cagayan de Oro, Negros Oriental/Bacolod/Banago/BREDCO, and NCR South (PPA 2017).

Also notable is the surge in the volume of passengers—from almost 69 million in 2016 to more than 72 million in 2017, a difference of 4.90 percent. Ro-Ro vessels, fast crafts, and motorized bancas are used as mode of transportation for interisland travel, contributing to the ecotourism program of the government.

These increases translated to more revenue for the PPA, which posted a total revenue of Php15.356 billion, more than Php1 billion or 7.22 percent higher than 2016 figures.

**Table 7.5** shows the comparative port and trade performance in 2014-2015. In 2015, the country's ports received 395,095 vessels, up by 8.84 percent from its 2014 level. Of these ship-calls, domestic calls increased by 8.94 percent whereas foreign calls increased by 5.45 percent during the same period.

The total volume of cargo for the year 2015 was 223,670,720 tonnes, and this is higher by 4.12 percent or 8.86 million more than the previous year's record, indicative of a sustained movement of cargo passing through the ports. The strong domestic consumption in 2014-2015 level fuelled the better-than-expected rise in both conventional and containerized domestic cargo subsector, and to a certain extent, counterbalanced the performance of foreign cargo traffic. As mentioned, ship-calls progressed by 8.84 percent in 2015, with domestic shipping showing stronger growth, while passenger volume escalated by 12.10 percent, demonstrating the renewed interest of the sea travelling public via inter-island RORO system.

Container traffic in 2015 posted a respectable improvement of 6.09 percent or about 336.709 TEUs higher compared to 2014 level. Domestic container traffic showed better performance of 9.61 percent while foreign container traffic posted a less impressive growth of 3.82 percent.

Passenger traffic for the year 2015 reached 62.76 million, a favorable movement of 12.10 percent compared to 55.99 million passenger volume recorded in 2014.

Domestic inter-island shipping makes up the vast bulk of port traffic across the whole country. A large part of this is passenger traffic which increased by 4 percent to 12.65 million in the first quarter of 2015, from 12.16 million passengers a year earlier. Of the five PPA port districts, Manila/Northern Luzon and Northern Mindanao experienced declines in passenger traffic of 4.5 percent and 6.7 percent, respectively, while Southern Mindanao posted the biggest increase of 26.7 during the same period.

While the Manila/Northern Luzon port district accounts for only 5 to 6 percent of total ship traffic, it handles a little more than half of the country's incoming and outgoing foreign traffic and about 45 percent of the country's total cargo tonnage, the majority of which passes through Manila.

Cargo volume increased by 6.2 percent year-on-year across the whole country, but in the Manila/Northern Luzon area, it grew by 8.2 percent in the same period - from 18.5 million tonnes in the first quarter of 2013 to just over 20 million tonnes in the same quarter of 2014. Both Northern and Southern Luzon typically have more foreign than domestic cargo volume whereas the situation is reversed elsewhere. The pattern is reversed in terms of imports and exports; however, the two Luzon districts import more than they export, while the rest of the ports in the country exports more than they import.

**Table 7.5:** Comparative Trade/Port Performance: 2014 and 2015.

Particulars	2015	2014	Increase/Decrease	
			Volume	%
<b>1. Shipcalls</b>	<b>395,095</b>	<b>362,994</b>	<b>32,101</b>	<b>8.84%</b>
Domestic	384,895	353,323	31,574	8.94%
Foreign	10,200	9,671	527	5.45%
<b>2. Cargo Throughput (tonnes)</b>	<b>223,670,720</b>	<b>214,812,620</b>	<b>8,859,450</b>	<b>4.12%</b>
Domestic	89,051,156	79,713,223	9,337,974	11.71%
Foreign	134,619,564	135,099,387	(478,524)	-0.35%
Import	73,765,140	66,633,058	7,132,490	10.70%
Export	60,854,424	68,466,329	(7,611,014)	-11.12%
<b>3. Container Traffic (TEU)*</b>	<b>5,861,780</b>	<b>5,525,121</b>	<b>336,709</b>	<b>6.09%</b>
Domestic	2,379,743	2,171,163	208,545	9.61%
Foreign	3,482,127	3,353,958	128,164	232,822
Import	1,737,731	1,712,206	25,667	1.50%
<b>Export</b>	<b>1,744,396</b>	<b>1,641,752</b>	<b>102,497</b>	<b>6.24%</b>
<b>4. Passenger Traffic</b>	<b>62,762,732</b>	<b>55,990,029</b>	<b>6,772,703</b>	<b>12.10%</b>
Disembarked	32,194,820	28,746,341	3,448,479	12.00%
Embarked	30,567,912	27,243,688	3,324,224	12.20%

Source: PPA.

## 7.4 Port Infrastructure

### 7.4.1 Berthing Facilities in Port of Manila

In terms of port infrastructure, a port offers a wide range of facilities intended for the use of shipping lines and port users. These infrastructure and support facilities, including wharves, piers, sheds, warehouses, yards, and docks, provide a specific location in the port where passengers or commodities are transferred between land and water carriers or between two water carriers.

The ports under the jurisdiction of PPA provide a wide range of state-of-the-art facilities that cater to the needs and growing demand for cargo handling as the volume of incoming and outgoing foreign and domestic cargoes continue to climb in recent years. For example, the Port of Manila is the largest and busiest seaport of the Philippines. It is located in the vicinity of Manila Bay, one of the finest natural harbors in the world. The Port of Manila is the premier international shipping gateway to and from the Philippines and considered as the core of the Philippine ports system.



Port of Manila. (Photo by M. EBarvia)

The Port of Manila is composed of three (3) major facilities, namely: the PMO NCR North (Manila North Harbor), PMO NCR South (Manila South Harbor), and Manila International Container Terminal (MICT).

#### **(a) PMO NCR-North (Manila North Harbor)**

Manila North Harbor, which is occupying a 53-hectare multi-purpose port terminal, is used for handling general and containerized cargo as well as passenger accommodation. It is being operated by the Manila North Harbor Port Incorporated (MNHPI). North Harbor is accessible by road through Radial Road 10.

North Harbor has seven (7) piers and six (6) slips in between piers occupying a total area of 630 m in length, as follows:

Pier 2 - two (2) berths	Slip 3 - one (1) berth
Pier 4 - five (5) berths	Slip 5 - one (1) berth
Pier 6 - five (5) berths	Slip 7 - one (1) berth
Pier 8 - five (5) berths	Slip 9 - one (1) berth
Pier 10 - five (5) berths	Slip 13 - one (1) berth
Pier 12 - five (5) berths	
Pier 14 - two (2) berths	

With this number of berthing facilities, North Harbor can serve close to 4,000 vessel calls annually. During its modernization phase, this port facility recently engaged in acquisition of heavy equipment, dredging operations, information technology, and container terminal expansion. It also completed the North Port Passenger Terminal that can accommodate more passengers and boost tourism in the country.

**(b) PMO NCR South (Manila South Harbor)**

Manila South Harbor is an 80-hectare port facility located in Port Area, Manila that handles all types of cargo including containers, bulk cargo, break-bulk cargo, general cargo and vehicles, and is being operated by Asian Terminals, Incorporated (ATI).

South Harbor has five (5) piers from north to south, as follows:

Pier 3 - four (4) berths

Pier 5 - five (5) berths

Pier 9 - five (5) berths

Pier 13 - seven (7) berths

Pier 15 - four (4) berths

The above-mentioned are large piers, measuring 83 m to 103 m wide to 350 to 400 m long. A ferry service terminal is located at the slip between Piers 13 and 15. It serves as the landing point for small crafts serving ship crews, harbor pilots, quarantine and customs officers, ships agents, and passengers travelling between shores and anchorages.

**(c) Manila International Container Terminal (MICT)**

The Manila International Container Terminal (MICT) is operated by International Container Terminal Services, Inc. (ICTSI). It is one of Asia's major seaports and one of the Philippines' most active ports. It lies between Manila North Harbor and Manila South Harbor and can be accessed by road through MICT South Access Road.

A dedicated container terminal with a size of 93.9 hectares – MICT – mainly handles international containerized cargo with an average annual capacity of 2.75 Million TEUs. In 2011, MICT ranked 38th in the list of world's busiest container ports with container traffic of 3,260,000 TEUs.

MICT has a straight wharf with a total length of 1,300 meters providing five (5) berths numbered 1-5 seaward ends. Berths 1-4 are all 250 meters long with a common depth of 12.5 meters. Berth 5 is 300 meters long and has a depth of 14.5 meters. Berth 6 has the same dimension as berth 5, and became operational in 2012. The addition of berth 6 increased the port's annual capacity by 450,000,000 TEUs. The container yard of MICT occupied 58.16 hectares with full Rubber Tyred Gantry (RTG) cranes in full operation.

**7.4.2 Storage and Warehouses**

Many other logistics facilities like ports, terminals, and warehouses are managed in a way that they contribute as much as possible to the efficient flow of goods, services, as well as useful ports/shipping information.

A warehouse can be defined as a place where the supply chain is held or stored under good conditions. Warehouses are generally used for receiving goods from a source, storing goods over a certain period until they are needed by the customer and retrieved when requested.

PPA has built and provided several warehouses in ports nationwide in order to better serve the transacting public. For example, MICT has three (3) Container Freight Stations (CFS) dedicated to stripping and stuffing operations with a 27,238 m<sup>2</sup>-covered area and 18,873 m<sup>2</sup> for inbound cargo. A storage space of 900 refrigerated containers is provided in cellular reefer rack that is supplied with both 220V and 440V 3-phase electrical power. On the other hand, South Harbor has four (4) sheds with a total area of 14,307 m<sup>2</sup> and two (2) warehouses with a total area of 6,908 m<sup>2</sup>.

## 7.5 Contribution to Income and Jobs

### 7.5.1 Gross Value Added of Ports and Shipping

The ports and shipping sector contributed 12% of the gross value added of the ocean economy in 2016 or around US\$1.43 billion (in constant 2012 prices). This sector has spurred economic development in many provinces/islands by facilitating trade and transportation.

### 7.5.2 Employment in Ports

There is a wide array of work opportunities in technical work, administration, customs and management of ports. On March 25, 2014, Governance Commission for GOCCs has approved the Rationalization Plan (RatPlan) per Memorandum Order No.2014-10, and this involves the approval of 298 organizational position/units of PPA, thereby allowing the filling up of 3,151 positions. The PPA RatPlan is expected to be completed through a staggered filling-up plan to be implemented over a period of five (5) years.

As of 31 December 2015, there were 1,814 PPA personnel, with 1,407 assigned at PPA field offices around the country, and 407 stationed at the Head Office. Since its implementation, some 514 personnel were promoted and/or transferred to new work stations. PPA also outsourced 1,112 personnel to augment the present PPA manpower.

## 7.6 Investment in Ports

A port generally offers a value scheme of economic and social benefits to its region and the entire country. However, it is also prone to environmental constraints. Significant increases in cargo throughput, particularly in the containerized sector, have put pressures on the development of new port infrastructure around existing facilities as well as restricting development of entirely new port facilities in order to serve additional passengers and/or process cargoes that otherwise cannot

be accommodated in existing sites. And because building ports infrastructure are capital intensive, investors are likely to face a wide array of socio-economic implications.

Though PPA has been profitable, a large portion of its revenues come from the transfer of operating revenues as part of the lease and concession agreements with ATI (terminal operator of PMO NCR South) and International Container Terminals Inc. (terminal operator of the MICT).

Investment in ports modernization, however, has been limited. In order to finance much needed capital requirements, PPA has borrowed from various multilateral institutions and turned to private operators who are willing to take part in the more challenging role of port operation. The Board of the PPA is currently discussing the possibility of its own privatization. Although the final decision has not been made official and fully public, interviews with officials suggest that the Board is considering expanding the leasing and concession contracts of its terminal operations without prejudice to PPA's tariff setting or regulatory powers.

In 2015 alone, PPA completed 38 major infrastructure projects valued at PhP 1.238 billion, which have provided nine (9) additional RORO ramps, 307.30 meters of berth, and 26,538.87 square meters of back up area in order to support operations and accommodate additional passenger/cargo traffic. PPA continues to pour a large portion of its resources in port infrastructure and facilities nationwide. As of end-November of 2016, it has completed 55 projects, 64 still on-going, one (1) suspended, and 51 others that are about to start. PPA has allotted approximately 6.068 billion pesos (?) for the said projects. These investments are targeted to improve the capacity, service standards, and efficiency of the ports in line with the government's development agenda and strategic objective and vision of providing port services that meet global quality standards.

## **7.7 Major Issues and Concerns Regarding Safety and Marine Environment**

International and local laws require ports and maritime safety authorities and many national regulatory bodies to monitor any natural and human activity in a port which can harm or damage the nearby bodies of water and marine environment. Port activities can cause deterioration of air and marine water quality in the surrounding areas due to multifarious activities like loading and unloading of cargoes, bunkering activities, and the like. Operational and accidental oil spills, introduced alien and invasive species through the ballast water, wastewater and solid waste from ports and ships, and habitat destruction from port construction/expansion are among the key challenges.

## 7.8 Response: Policies and Initiatives

PPA has an existing environmental policy in its ports and is compliant with some international conventions. PPA is also gearing toward a greening program through implementing some best practices that aim to make the ports and port operations more environment friendly.

### 7.8.1 Compliance with the International Conventions

#### 1. International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)

MARPOL is the main international convention covering the prevention of pollution of marine environment including dumping, oil and exhaust pollution of accidental causes. With Philippines as signatory to this Convention, PPA complies with the following:

- Annex I-Regulation for the Prevention of Pollution by Oil,
- Annex II- Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk,
- Annex IV- Prevention of Pollution by Sewage from Ships,
- Annex V-Prevention of Garbage from Ships through the establishment and operationalization of Shore Reception Facilities' (SRF) in different ports.

In compliance with the provision of Shore Reception Facilities (SRF) that requires the provision of waste collection, treatment and disposal services of ships' generated waste in ports, PPA procured the services of Golden Dragon International Terminals Inc. (GDITI) which, for 15 years, covers all base ports and private ports under PPA.

#### 2. International Convention for Safety of Life at Sea (SOLAS)

SOLAS Convention issued by International Maritime Organization (IMO) is regarded as the most important of all international treaties concerning the safety of merchant ships. This convention aims to specify minimum standards for the construction, equipment and operation of ships, compatible with safety. In compliance with Chapter V of SOLAS (Safety of Navigation), PPA has provided VTMS (Vessel Traffic Management System) at the Ports of Manila and Batangas that became operational in 2005 and 2008, respectively.

With the expected increase in vessel traffic, PPA also plans to procure four (4) more VTMS to be located at the ports of Dangay (Roxas, Oriental Mindoro), Iloilo, Davao and Zamboanga.

#### 3. International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM)

Invasive aquatic species present a major threat to the marine ecosystems, and shipping has been identified as a major pathway for introducing species to new environments. The BWM, adopted



in 2004, aims to prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for the management and control of ships' ballast water and sediments. Under Article 5 Sediment Reception Facilities Parties undertake to ensure that ports and terminals where cleaning or repair of ballast tanks occurs, have adequate reception facilities for the reception of sediments. The Maritime Industry Authority (MARINA) announced that the Philippines has deposited instruments of accession to the BWM Convention in 2018.

### 7.8.2 Other Value-added Best Practices of PPA

#### **(a) Installation of Automatic Identification System (AIS)**

In December 2014, PMO Surigao procured through public bidding its AIS unit and was installed at Baseport Surigao.

In 2015, MARINA issued MARINA Circular No.2015-02 otherwise known as "*Rules to Govern the Installation and Implementation of the Automatic Identification System (AIS) of the Passenger Ships 300 GT and Above Cargo Ships 500GT and above*".

Consistent with the MARINA issuance, PPA in 2016 programmed the installation and operationalization of AIS units in selected PPA ports namely, the ports of Puerto Princesa (Palawan), Ormoc (Western Leyte/Biliran), Cagayan de Oro (Misamis Oriental), Iligan (Lanao del Norte) and General Santos (SOCCSKSARGEN). As to this date, AIS at said ports are all installed and operational.

#### **(b) Compliance with Supreme Court's Order to Clean and Rehabilitate Manila Bay**

In a bid to restore life in Manila Bay, the Supreme Court of the Philippines ordered several government agencies to be at the forefront of the rehabilitation of the historic water landmark. The Supreme Court rendered a Decision in G.R. Nos. 171947-48 in a unanimous decision penned by Justice Presbitero Velasco Jr. that ruled in favor of "concerned citizens." The Decision ordered the petitioners to clean up, rehabilitate and preserve Manila Bay in their different capacities. As a result, the Manila Bay Advisory Committee was created to receive and evaluate the quarterly progress reports on the activities undertaken by the agencies in accordance with said decision and to monitor the execution phase. In the absence of specific completion periods, the Committee recommended that a timeframe be set for the agencies to perform and finish their assigned tasks.

As one of the mandamus agencies, PPA was tasked to immediately adopt measures to prevent discharge and dumping of solid wastes and other ship-generated wastes into the Manila Bay waters. It is likewise tasked to apprehend vessels that commit violations while docked at the ports. PPA religiously submits quarterly reports to the Supreme Court.

### **(c) Publication of PPA Orange Book on Safety Health and Environmental Management and Handling Dangerous Cargo**

PPA, in collaboration with the German International Technical Cooperation Agency (GIZ), developed a compendium of all PPA policies, rules and regulations on safety, health, and environment or the so-called orange book with three volumes (Book I, II and III).

### **(d) Use of renewable energy**

In accordance with the 25-year port development roadmap adopted by Philippine port stakeholders, PPA started taking steps to use renewable energy in its operations at the Head Office as well as PMOs across the country (PPA 2017). This is one of PPA's initiatives to have environment-friendly and disaster-resilient ports as well as to be at par with international maritime stakeholders, who have agreed to reduce carbon emissions.

### **(e) Shore reception facilities**

Shipping ports must provide shore reception facilities to collect residues, oily mixtures, and garbage generated from an ocean-going vessel. Wastes and contaminants generated by ships cannot be discharged directly to the ocean. Shore reception facilities have been put in place in all base ports and private ports under PPA.

### **(f) Awards and certification**

In October 2017, the Port of Manila finished in the 32<sup>nd</sup> spot on Lloyd's List of the 2016 top 100 container ports worldwide, and among the Asian ports, Manila ranked 22<sup>nd</sup> (PPA 2017).

According to the Lloyd's List, Manila recorded positive performance due to the country's booming economy. In addition, the higher volume handled at the Manila Port's international terminals, composed of the MICT and the Manila South Harbor, was due to the *Terminal Appointment Booking System* put into place in 2015. This has facilitated the smooth flow of containers, resulting in a 13.8% hike in container volume from 3.976 million TEUs in 2014 to 4.523 million TEUs in 2015.

### **Green Port Award System (GPAS) Program**

PPA, as an active member of APEC Port Services Network (APSN), is institutionalizing the green port development strategy as environmental performance measure of all ports under the jurisdiction of PPA Port Management Offices. PPA is developing an implementation plan and criteria for the Green Port Award System (GPAS).

The Port of Batangas received the Green Port Award from APSN in 2017. The Port of Cagayan de Oro likewise received this award in 2018.

## **Certification for PSHEMS and ISO**

In addition, the Batangas and Cagayan de Oro ports, are Certified to ISO 9001:2008, and recognized for its implementation of the **Port Safety, Health and Environmental Management System** (PSHEMS).

The two ports are now migrating to the **Integrated Management System** fusing the three international standards, namely:

- (a) ISO 9001:2015 for Quality Management System,
- (b) ISO 14001:2015 for Environmental Management System, and
- (c) BS OHSAS 18001:2007 for Occupational Safety and Health.

The aim is to further solidify quality, safety, health and environmental policies, and commitment for the protection of the environment, provision of safe and healthy working conditions, and improved quality of port operations and services (PPA 2018).

PPA also worked on the certification of the Ports of Zamboanga and Ozamiz, for the Integrated Management System (IMS). After the third-party audit undertaken in December 2017, both ports passed the requirements of the standards, and were recommended for certification. The Ports of Iloilo and General Santos are also implementing PSHEMS.

### **(g) ECC Compliance Monitoring on PPA Locally-funded Projects**

Prior to any port project implementation, determination of levels of pollution, identification of pollution sources, control and disposal of waste from various point and non-point sources, and prediction of pollution levels for future, regular monitoring and assessment are required during the entire construction and operation phase of a major port.

It is extremely essential that port and harbor projects should have an environmental management plan (EMP) which also incorporates monitoring of air and marine water quality along with the collection of online meteorological data throughout the life of the project.

Started in 2015, PPA is committed to ensuring that locally-funded projects implemented by PPA Head Office are compliant with the provisions of the Environmental Compliance Certificate (ECC) and applicable national and international environmental laws and policies.

*Refer to Section 12 for other PPA initiatives that are transforming the ports into green and sustainable ports, thereby contributing to the country's transition towards blue economy.*

## 8

## Ship-Building and Repair

### 8.1 Location of Shipyards and Capacity

The ship-building and ship repair (SBSR) sector is a capital- and labor-intensive industry and plays a vital role in the socioeconomic development of the country. The sector is composed of all enterprises engaged in the design, construction, overhaul, alteration and repair of watercrafts. Mainly, these enterprises operate a facility called shipyard/drydock where ships are being built or repaired. However, it is significant to note that most of these enterprises are doing ship repairs only, and a small percentage, particularly large and medium shipyards, are building ships.

#### 8.1.1 Capacity and Facilities

In terms of capacity, the Maritime Industry Authority or MARINA regulations categorized shipyards as large, medium and small (**Table 8.1**). Large shipyards have lifting capacities of 20,000 and above Deadweight Tonnage (DWT) ships for building or repair; medium shipyards of 3,000 to 19,000 DWT; and small shipyards of 2,999 DWT and below.

**Table 8.1:** Number of Entities Operating Shipyards per Region  
(As of December 2016).

Maritime Regional Office (MRO)	Large	Medium	Small	Total
Central Office (Manila)		7	35	45
MRO1/2 (La Union)	-	-	-	0
MRO 4 (Batangas)	1	-	3	4
MRO 5 (Bicol)	-	-	1	1
MRO 6 (Iloilo)	1	-	7	8
MRO 7 (Cebu)	1	3	16	20
MRO 8 (Tacloban)	-	1	-	1
MRO 9 (Zamboanga)	-	1	11	12
MRO 10 (Cagayan De Oro)	1	-	-	1
MRO 11 (Davao)	-	-	2	2
MRO 12 (General Santos)	-	1	19	20
MRO 13 (Surigao)	-	1	3	4
<b>TOTAL</b>	<b>7</b>	<b>14</b>	<b>97</b>	<b>118</b>

Source: MARINA2.

The shipyards utilize various major equipment/facilities (**Table 8.2**), and employ more than 45,000 employees nationwide, excluding subcontractors. Based on 2015 MARINA Statistics, the Philippine shipyards have constructed 118 ships corresponding to about 1.8 million Gross Tonnage (GT). Most of the ships constructed are of below 500 GT, and were mainly intended for domestic use, while a large percentage of the 1.8 million GT were cargo ships, which were constructed by large shipyards for export.

**Table 8.2:** Major Facility/Equipment Utilized by Shipyards, 2016.

Facility/Equipment	Number
Slipways	76
Launching Pads	23
Graving Dock	6
Floating Dock	11
Ship Lift	2
Quay/Pier	11

Source: MARINA.

### 8.1.2 Foreign-owned Shipyards

The arrival of foreign shipbuilders in the Philippines propelled the export growth of Philippine-made ships in the international market. After being recognized as the 4th largest shipbuilder in the world in terms of Vessel Completion in Gross Tonnage in 2015 by the Shipbuilders Association of Japan, shipyards established in the Philippines are now building more ships of larger tonnage capacities like bulk carriers, container ships and passenger ferries (BOI, 2017). The construction of 320,000-DWT commercial ship by Hanjin Heavy Industries Corporation, a South Korean shipbuilding company, shows that the Philippines can build world-class ocean-going vessels. BOI (2017) reports the following:

#### Tsuneishi

- The Tsuneishi Cebu shipyard, operated by Japan's Tsuneishi Holdings Corp., in partnership with Cebu's Aboitiz Group had produced about 77 ships by the end of 2007.
- Starting in 1997 with the 23,407-DWT M/V Sea Amelita, a log/bulk carrier named after then-First Lady Amelita Ramos, the company proceeded to make history in the local shipbuilding industry.

#### Hanjin

- Hanjin, which started building its US\$1.7 billion shipyard on a 200-ha land in Subic in early 2006, has increased the momentum of big ship production recently.
- Launched the first container ship to be built in the Philippines in July of 2008
- The huge capacity of Hanjin's dry dock in Subic, where four vessels can be built at a time, resulted in faster production.

#### Keppel

- Keppel started operating its shipyard in the Philippines in early 1994 with a capacity of 28 vessels per year. It expanded its operation by fabricating tugboats and oil rig hull.
- It operates two (2) shipyards in the Philippines, namely: Subic and Batangas It offers a complete solution in offshore rig construction, shipbuilding, ship repair and conversion, with a full range of drydocks in its three shipyards strategically located in the Philippines.

**Figure 8.1:** Geographical Location of Existing Foreign-owned Shipyards in the Philippines.

Source: BOI (2017).

**Table 8.3:** Annual Capacity Vessel Types, Location, Project Cost, and Employment Capacity of Foreign-Owned Shipyards.

	Hanjin	Keppel	Tsuneishi
Annual Capacity	18 Vessels	8 Vessels and 16 Tugboats	16 Vessels
Types of Vessels and Tonnage	Bulk Carrier 205K DWT Container 12,800 TEU Tanker 320K DWT	Bulk Carrier 50K DWT	Bulk Carrier 180K DWT, Cape Size 4,100 Car Carrier
Location	Subic	Batangas and Subic	Cebu
Project Cost	US\$ 1.77 Billion	US\$ 33.33 Million	US\$ 267 Million
Employment	33,000	5,801	13,000

Source: BOI (2017).

### 8.1.3 Filipino-owned Shipyards

There are also Filipino-owned shipyards: Herma Shipyard in Bataan; Colorado Shipyard in Cebu, and Gen San Shipyard in General Santos City in South Cotabato. **Figure 8.2** shows their location. Their annual capacity and types of vessels that they build are shown in **Table 8.4**.

According to BOI (2017), shipbuilding has a big opportunity in the local the market, particularly in the following areas:

- Planned RORO Modernization Program
- Replacement of old vessels (cargo ships)
- Export of Philippine-made ships

**Figure 8.2:** Geographical Location of Existing Filipino-owned Shipyards in the Philippines.

Source: BOI (2017).

**Table 8.4:** Annual Capacity Vessel Types, Location, Project Cost, and Employment Capacity of Filipino-Owned Shipyards.

	Herma Shipyard	Colorado	GenSan
Annual Capacity	6 Vessels	5 Vessels	3 Vessels
Types of Vessels and Tonnage	Tankers 7K DWT	Passenger Cargo Vessel 15K DWT	Passenger Cargo Vessel 15K DWT
Location	Bataan	Cebu	General Santos
Project Cost	US\$ 5 Million	US\$ 23 Million	US\$ 5 Million
Employment	290	820	127

Source: BOI (2017).

### 8.1.4 Strategic location of Philippine shipyards nationwide

Figure 8.3: Large Shipyards.

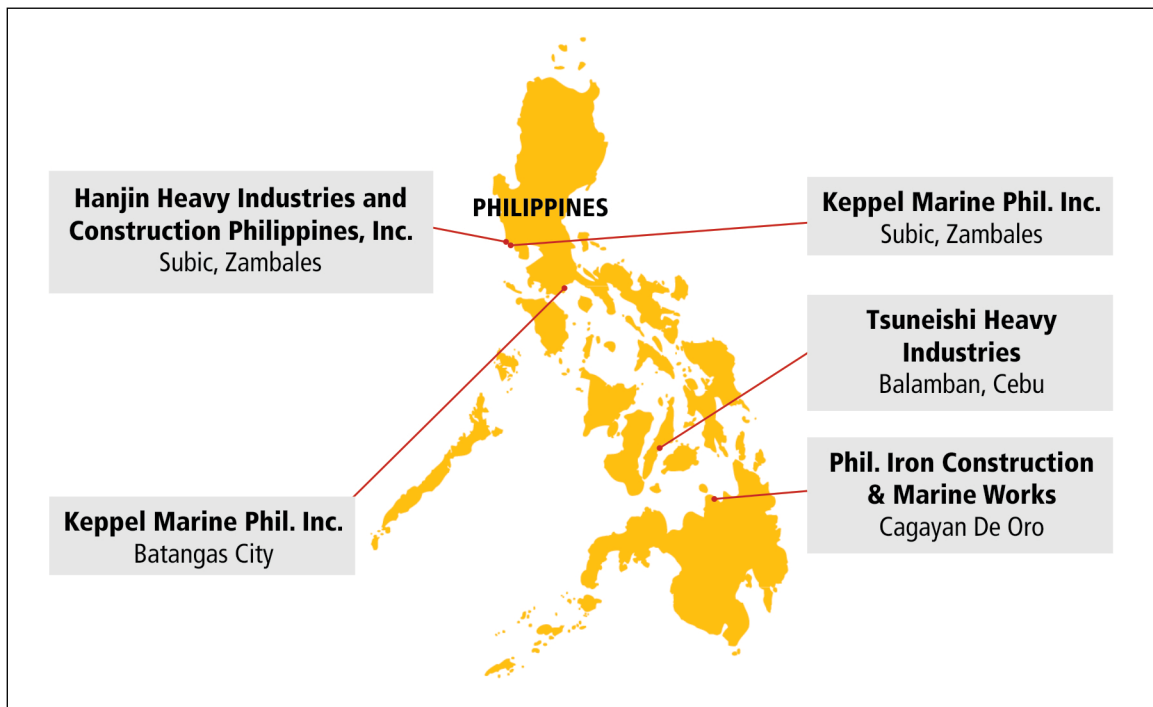


Figure 8.4: Medium Shipyards.

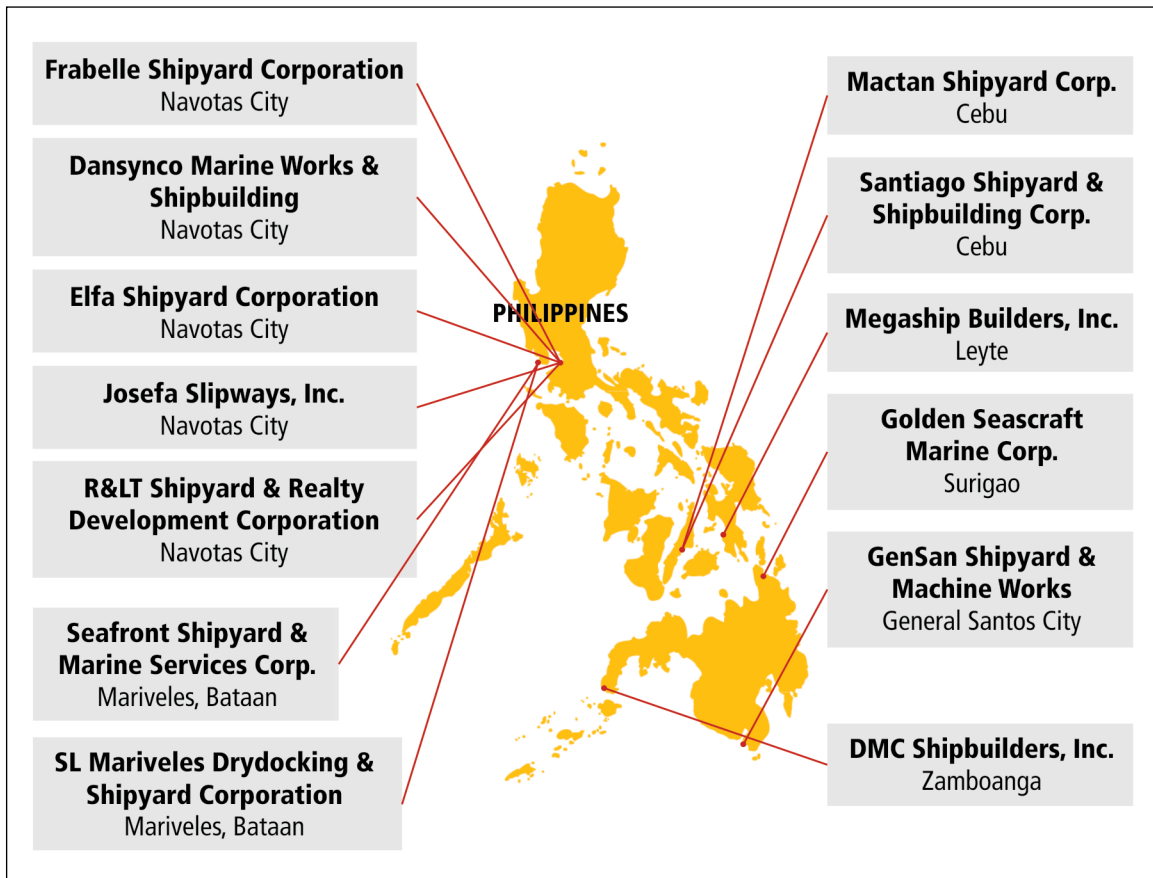
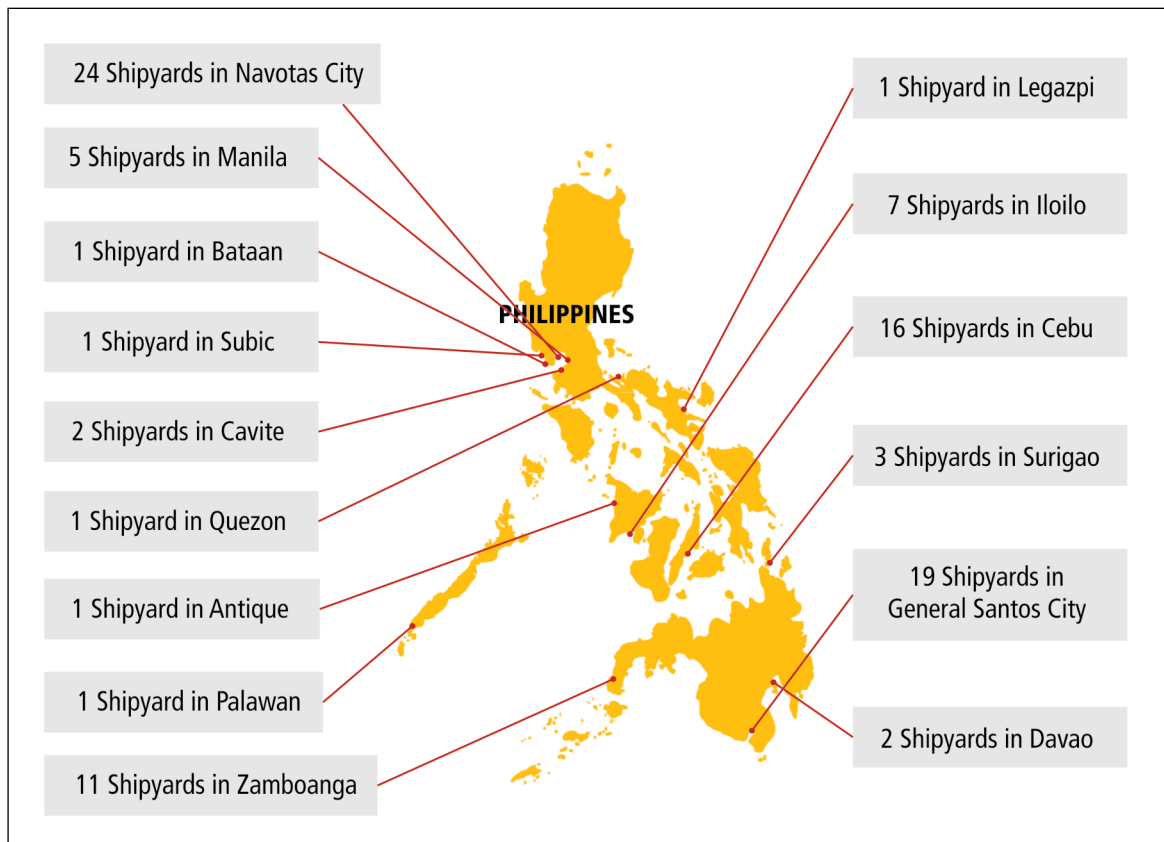




Figure 8.5: Small Shipyards.



Source: MARINA and BOI.



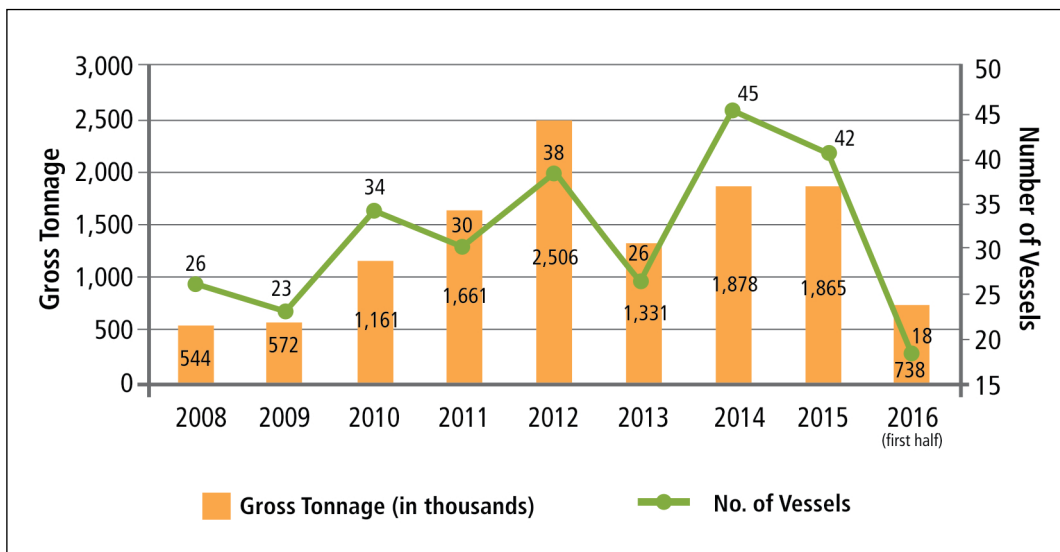
Shipbuilding in General Santos. (Photo by BOI and Gensan Shipyard and Machine Works, Inc.)

## 8.2 The Shipbuilding Output

The Philippines has maintained its ranking as the fourth shipbuilding country in the world in terms of Vessel Completion in Gross Tonnage. It is however essential to note that the country has a long way to achieve in order to come at par with the first three shipbuilding nations of the world.

While maintaining the required minimum paid-up capitalization (i.e., Large - PhP 50,000,000; Medium - PhP 25,000,000; Small - PhP 10,500,000), which may be owned wholly or partially by Filipinos or foreigners, Philippine shipyards are able to accomplish the construction of ships intended either for domestic use (**Table 8.5**) or export (**Table 8.6**). Philippine exports of ships and boats amounted to US\$ 1.68 billion in 2017, but declined to US\$ 1.216 billion in 2018 (**Figure 8.7**). On the other hand, imports of ships and boats amounted to US\$ 187 million in 2017, and increased to US\$ 231 million in 2018 (BOI; UN Comtrade/ITC).

**Figure 8.6:** Shipbuilding Completion in the Philippines from 2008 to 2016 (First half).



Source: "Shipbuilding Statistics, September 2016", Shipbuilding Association of Japan - from BOI 2017.

**Table 8.5:** Locally-constructed Ships for Domestic Operations.

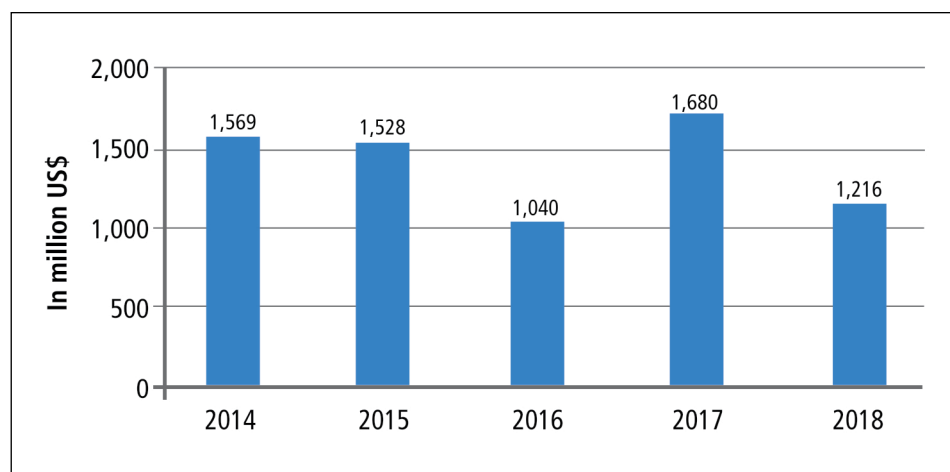
Type of Ships	2013		2014
	Total Number	Total Gross	Total Number
Cargo Ships	23	1,328,461	23
Tanker Ships	1	83,824	1
Miscellaneous Ships	3	426	3
<b>TOTAL</b>	<b>27</b>	<b>1,412,711</b>	<b>27</b>

Source: MARINA.

**Table 8.6:** Locally-constructed Ships for Export.

Type of Ships	2013		2014	
	Total Number	Total Gross	Total Number	Total Number
Cargo Ships	23	1,328,461	37	1,714,126
Tanker Ships	1	83,824		
Miscellaneous Ships	3	426	1	50
<b>TOTAL</b>	<b>27</b>	<b>1,412,711</b>	<b>38</b>	<b>1,724,176</b>

Source: MARINA.

**Figure 8.7:** Philippine Exports of Vessels/Ships, Boats and Floating Structures (in million US\$).

Source: BOI; UN Comtrade (ITC).

### 8.3 Contribution to Employment

The increase in shipyard operations is establishing a trend in employment that is favorable to the sector. **Table 8.7** shows the profile of manpower employed by the shipyard operations as of 2016. The biggest bulk of workers comprise the skilled and semi-skilled workers, with a total number of 32,827 or 69% of total manpower. More than 57,000 graduates of engineering and architectural courses in 2014 are employable in the industry.

**Table 8.7:** Manpower Profile and Shipyard Operations in the Philippines.

Category	2016	%	Skills Set
Managerial Personnel	3,405	7	Management
Administrative Personnel	5,657	11	Administrative
Technical Personnel	6,558	13	Architects and Engineers, Electricians
Skilled Workers/ Semi-skilled Workers	33,827	69	Welders, Crane Operators, Steel cutters, Outfitters, Painters, and others
<b>TOTAL</b>	<b>49,447</b>	<b>100</b>	

Source: BOI (2017).

## 8.4 Issues and Challenges in the Shipbuilding and Ship Repair (SBSR) Industry

There are numerous challenges as regards to developing a modern SBSR for the Philippines. Primary of these is that materials and equipment for shipbuilding are mostly imported, thereby having an added cost compared to the acquisition of those locally made, if available. This includes marine grade steel, which is the primary component of a ship.

It is likewise important to upgrade the existing shipyard facilities in order to meet safety, environmental protection, and quality standards globally accepted in shipbuilding. Though some of the shipyards, particularly the large ones, are continuously employing innovative measures to improve and modernize, the Government should likewise offer high impact incentives and effective financing options in order to generally involve all shipyards in upgrading its facilities and operations.

Another challenge in the SBSR industry is the shortage of technical and skilled manpower for the industry. The Philippines has an abundant trainable technical and skilled people with cheaper labor. However, once trained, these people tend to go overseas due to the high demand and higher pay offered by other shipbuilding nations.

The government therefore is reviewing and revising its existing rules and regulations in order to adopt and effectively regulate the industry with the objective of enhancing and promoting a modernized and sustainable Philippine SBSR. This is also in response to the growing economic significance of shipbuilding for the Philippines, which has a great potential to become a top shipbuilding nation.

## 8.5 Response: Policies and Initiatives

### Compliance with International Conventions

With the emergence of various world treaties/conventions, e.g., *International Convention on the Control of Harmful Anti-fouling Systems in Ships* (AFS Convention) and the *International Convention for the Control and Management of Ships Ballast Water and Sediments* (BWM Convention 2004) where the Philippines is a party, shipyards are also expected to comply. Philippine rules, regulations, policies and guidelines shall likewise conform to these Conventions in order to implement such standards for the protection of the marine environment.

As for the AFS Convention, the Government through MARINA is now strictly implementing the standards stipulated therein during the construction or repair of ships in shipyards. The greater challenge is the formulation of the required rules and guidelines for the implementation of the

BWM Convention wherein the draft law is yet to be finalized. Implementation of the BWM Convention affects not only shipyards but also ports, which entails great cost and requires some additional infrastructure. Nonetheless, nonimplementation of such measures will put our marine environment at greater risk from pollution and invasive marine species.

**Table 8.8:** Shipyard Practices on Certain Activities to Prevent Pollution.

Enclose, cover, or contain blasting and sanding areas to the maximum extent practical to prevent abrasives, dust and paint chips from reaching storm sewers or receiving water.
Use shrouded or vacuum-assisted tools that prevent abrasives, dust and paint chips from leaving immediate area being worked on (dustless sanders, vacuum blasting robots).
Use blast media that does not contain pollutants (examples: garnet, steel, ultra-high- pressure water).
Cover drains, trenches, and drainage channels to prevent entry of blasting debris to the system.
Prohibit uncontained blasting or sanding activities over open water.
Prohibit blasting or sanding activities during windy conditions that render containment ineffective
Inspect and clean sediment traps to ensure the interception and retention of solids before entering the drainage system.
Vacuum or sweep accessible areas of the drydock to remove debris and spent sandblasting material before flooding.
Improve work area to reduce areas which are hard to clean: alter keel support layout, seal crevices, make surfaces smoother.
Segregate water that has come into contact with abrasives and paint chips from water that has not; treat separately
Collect spent abrasives frequently and store in an enclosed, covered area from which it cannot escape or be rained upon.
Consider testing paint before removal to establish potential pollutant levels. Establish objective measures of cleanliness that will need to be met before proceeding to next work process.
<b>PAINTING</b>
Enclose, cover or contain painting activities to the maximum extent practical to prevent overspray from reaching the receiving water.
Prohibit uncontained spray painting activities over open water.
Prohibit spray painting activities during windy conditions that render containment ineffective.
Mix paints and solvents in designated areas away from drains, ditches, piers and surface waters, preferably indoors or under a shed.
When painting from floats, paint should be in cans five gallons or smaller, with drip pans and drop cloths underneath.
Have absorbent and other cleanup items readily available for immediate cleanup of spills.
Allow empty paint cans to dry before disposal.
Keep paint and paint thinner away from traffic areas to avoid spills.
Recycle paint, paint thinner and solvents.
Train employees on proper painting and spraying techniques, and use effective spray equipment that delivers more paint to the target and less overspray.
Investigate and use non-pollutant bearing paints (hard epoxies, fluorinated polyurethanes, isothiazolone-containing paint).
<b>PRESSURE WASHING AREAS</b>
Perform pressure washing only in designated areas where washwater containment can be effectively achieved.
Do not use detergents or additives in the pressure washwater.
Direct deck drainage to a collection system sump for settling and/or additional treatment.

**Table 8.8:** Shipyard Practices on Certain Activities to Prevent Pollution. (cont.)

Install diagonal trenches, or berms and sumps to contain and collect washwater at marine railways.

Use solid decking, gutters and sumps at lift platforms to contain and collect washwater.

Segregate stormwater from process water; consider using stormwater for applications that do not demand high cleanliness.

Educate the customer about the environmental consequences of paint choice.

#### **DRYDOCK MAINTENANCE**

Clean and maintain drydock on a regular basis to minimize the potential for pollutants in the stormwater runoff.

Vacuum or sweep accessible areas of the drydock to remove debris and spent sandblasting material before flooding.

If hosing must be used as a removal method, treat as pressure washwater. Clean the remaining areas of the dock after a vessel has been removed and the dock raised.

Remove and properly dispose of floatable and other low-density waste (wood, plastic, insulations).

#### **DRYDOCK ACTIVITIES**

Use plastic barriers beneath the hull, between the hull and drydock walls for containment.

Use plastic barriers hung from the flying bridge of the drydock, from the bow or stem of the vessel, or from temporary structures for containment.

Weight the bottom edge of the containment tarpaulins or plastic sheeting during a light breeze.

Use plywood and/or plastic sheeting to cover open areas between decks when sandblasting.

Install tie rings or cleats, cable suspension systems, or scaffolding to make implementation containment easier.

#### **ENGINE MAINTENANCE AND REPAIRS**

Maintain an organized inventory of materials used in the maintenance shop.

Dispose of greasy rags, oil filters, air filters, batteries, spent coolant and degreasers properly.

Label and track the recycling of waste material (e.g., used oil, spent solvents, batteries).

Drain oil filters before disposal or recycling.

Store cracked batteries in a non-leaking secondary container.

Promptly transfer used fluids to the proper container; do not leave full drip pans or other open containers around the shop. Empty and clean drip pans and containers.

Do not pour liquid waste down floor drains, sinks, or outdoor storm drain inlets.

Plug floor drains that are connected to the storm or sanitary sewer; if necessary, install a sump that is pumped regularly.

Inspect the maintenance area regularly for proper implementation of control measures.

Train employees on proper waste control and disposal procedures.

#### **MATERIALS HANDLING**

Store permanent tanks in a paved area surrounded by a dike system that provides sufficient containment for the larger of either 10 percent of the volume of all containers or 110 percent of the volume of the largest tank.

Maintain good integrity of all storage tanks.

Inspect storage tanks to detect potential leaks and perform preventive maintenance.

Inspect piping systems (pipes, pumps, flanges, couplings, hoses, valves) for failures or leaks.

Train employees on proper filling and transfer procedures.

Store containerized materials (fuels, paints, solvents) in a protected, secure location and away from drains.

Store reactive, ignitable, or flammable liquids in compliance with the local fire code.

Identify potentially hazardous materials, characteristics and use.

Control excessive purchasing, storage and handling of potentially hazardous materials.

Keep records to identify quantity, receipt date, service life, users, and disposal routes.

**Table 8.8:** Shipyard Practices on Certain Activities to Prevent Pollution. (cont.)

Secure and carefully monitor hazardous materials to prevent theft, vandalism and misuse of materials.
Train employees on proper storage, use, cleanup and disposal of materials.
Provide sufficient containment for outdoor storage areas for the larger of either 10 percent of the volume of all containers or 110 percent of the volume of the largest tank.
Use temporary containment where required by portable drip pans.
Use spill troughs for drums with taps.
Mix paints and solvents in designated areas away from drains, ditches, piers and surface waters.
<b>IF SPILLS OCCUR...</b>
Stop the source of the spill immediately.
<ul style="list-style-type: none"> <li>• Contain the liquid until cleanup is complete.</li> <li>• Deploy oil containment booms if the spill may reach the water.</li> <li>• Cover the spill with absorbent material.</li> <li>• Keep the area well ventilated.</li> <li>• Dispose of cleanup materials properly.</li> <li>• Do not use emulsifier or dispersant.</li> </ul>
<b>TRAINING</b>
Establish training programs for practices that prevent stormwater pollution. Include stormwater pollution prevention training in new employee orientations.
Establish incentive programs of material rewards to encourage stormwater pollution prevention ideas and implementation. Provide prompt feedback.
Recognize successful practices and publicize them internally (newsletters, posters, plaques) and externally (speaking engagements, press releases to industry journals and local media).
Appoint a specific stormwater pollution prevention coordinator and task force to develop and implement a stormwater pollution prevention program. Keep records.
Conduct an annual program evaluation at the corporate level.
Establish quantifiable goals. Chart progress by individual, by unit and overall.
Incorporate stormwater pollution prevention accomplishments into annual job performance evaluations.

Source: MARINA.

# 9 Fish Ports

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In addition to seaports which serve as major hubs for international and domestic/inter-island cargo and passenger vessels, there are also fish ports, feeder ports or commercial ports that can be found in many coastal areas around the country. Fish ports, which are either municipal or regional, are those which primarily serve the fishing industry. Sometimes referred to as landing centers, these fish ports provide the facilities for the main collection and distribution of fish. Meanwhile, feeder ports are ports that provide linkages among neighboring small islands and nearby urban centers. They generally cater to small passenger and fishing vessels.

## 9.1 Fish Port Development

Commercial fish ports can also be privately or publicly owned and/or operated. They cater to the general public and to vessels weighing more than 30 tonnes. As of 2016, there are eight (8) regional fish port complexes owned and operated by PFDA or Philippine Fisheries Development Authority (**Table 9.1**) and 118 sites of municipal fish ports in various localities around the country (**Table 9.2**).

A study of PIDS in 2000 (Israel & Roque, 2000) provided a historical and legal background of the management of the country's fishery industry. In order to address fish marketing problems due to inadequate fish marketing infrastructure, poor fish handling practices, chaotic system of distribution and limited post-harvest processing technology, Presidential Decree No. 977 was declared in 1976. This law created the Philippine Fish Marketing Authority (PFMA) placing it under the Ministry of Natural Resources (MNR).

After transferring PFMA to the National Food Authority (NFA) in 1981, it was moved back to MNR in 1982 by virtue of Executive Order No. 772. The E.O was intended to implement the *Integrated Fisheries Development Plan* (IFDP).

In 1984, the PFMA was renamed the Philippine Fisheries Development Authority (PFDA) through E.O. No. 965 and placed under the jurisdiction of the Department of Agriculture (DA). The PFDA, which remains to this day, has been mandated to "strengthen the government's thrust in balancing production ventures with adequate post-harvest support facilities through the establishment and administration of fish ports, fish markets and other infrastructure." (Israel and Roque, 2000)

The objectives of the PFDA are as follows (Philippine Institute for Development Studies, 2000):

- a. Establish fish ports, markets, ice plants and cold storages, and other supportive facilities necessary for the efficient handling and distribution of fish and fishery products;



- b. Provide essential fisheries-related post-harvest services that would improve the quality of fish products that could compete in the global market;
- c. Encourage the development of new products and provide an environment that is conducive to the growth of private business enterprises;
- d. Open avenues for additional employment opportunities as new fishery infrastructure and related industries are established;
- e. Sustain promotional activities for exportation of traditional and non-traditional fishery products to traditional and non-traditional export markets; and
- f. Help improve the income of small fishermen, fish farmers and fish workers through the provision of services and facilities which add to the value of their produce.

**Table 9.1:** Philippine Fisheries Development Authority - Regional Fish Port Complexes.

Regional Fish Ports	Location	Source of Fund	Project Cost
Navotas Fish Port Complex Area: 46.7 hectares Start of Operation: 1977	North Bay Blvd., Navotas, MM	ADB	P88M
Iloilo Fish Port Complex Area: 21 hectares Start of Operation: 1985	Tanza, Iloilo City	Overseas Economic Cooperation Fund, Japan (OECF)	Part of the Nationwide Fishing Ports Projects Package I P597.5M
Zamboanga Fish Port Complex Area: 12.5 hectares Start of Operation: 1988	Brgy. Sangali, Zamboanga City	OECF	Part of the Nationwide Fishing Ports Projects Package I P477.2M
Camaligan Fish Port Area: 1.5 hectares Start of Operation: 1991	Brgy. Dugcal, Camaligan, Cam Sur	OECF	Part of the Nationwide Fishing Ports Projects Package I P40.9M
Lucena Fish Port Complex Area: 7.8 hectares Start of Operation: 1992	Brgy. Dalahican, Lucena City	OECF	Part of the Nationwide Fishing Ports Projects Package I P283.9M
Sual Fish Port Area: 3.8 hectares Start of Operation: 1992	Poblacion, Sual, Pangasinan	OECF	Part of the Nationwide Fishing Ports Projects Package I P29M
Davao Fish Port Complex Area: 4.5 hectares Start of Operation: 1995	Daliao, Toril District	OECF	Part of the Nationwide Fishing Ports Projects Package II P359.2M
General Santos Fish Port Complex Area: 32 hectares Start of Operation: 1998	Brgy. Tambler, General Santos City, South Cotabato	OECF	Part of the Nationwide Fishing Ports Projects Package II P394.2M

Source: PFDA

**Table 9.2:** Municipal Fish Port and Development Program.

Source of Fund	Region	No. of Sites	Project Cost
2015 Subsidy to PFDA	IV-A IV-B VII VIII	5	77,289,045.71
FY 2014 Supplemental Appropriations	I VI XI	4	43,909,413.06
BFAR-Post Harvest and Other Infrastructure	VIII	1	10,000,000.00
Corporate	IV-A	1	1,497,674.32
CDF	VI	1	5,946,003.00
DAP	X V VI	3	39,474,345.31
FSP	III IV-A IV-B V VI	9	99,353,917.97
GATT	VII IX	15	217,255,428.51
Ginintuang Masaganang Ani (GMA)	CAR I II III IV-A IV-B NCR V VI VII VIII IX ARMM	41	485,053,307.79
Agrikulturang Makamasa Program	II VIII X	6	32,082,467.50
National Equity	VII VIII	2	2,318,036.82
National Fisheries Program	I II III IV-A IV-B V VIII X XII XIII	19	432,977,446.13
PAMANA Program	V	1	9,054,390.11
Poorest of the Poor	IV-A VI IX XI XII	5	100,047,290.22
ARMM-TISP	ARMM	4	78,076,471.08
	VII	1	3,661,629.30
<b>TOTAL</b>		<b>118</b>	<b>1,637,996,866.83</b>

Source: PFDA

## 9.2 PFDA Regional Fish Ports

### 9.2.1 Navotas Fish Port Complex

The Navotas Fish Port Complex (NFPC), the premier fish center of the Philippines and one of the largest in Asia, is the first major fishing port and fish market complex placed under the jurisdiction, control and supervision of the Philippine Fisheries Development Authority (PFDA). It is a traditional landing place of commercial fishing boats operating in various fishing grounds in the Philippines. NFPC, is centrally located within a five-kilometer radius of the cities of Manila, Quezon, Caloocan, Navotas and Malabon.



Navotas Fish Port. (Photo by PEMSEA)

The fish port supplies fish and other aquatic products to major markets in Metro Manila. It is a business center with markets, ice plants and cold storage, fish processing facilities, canneries, shipbuilding and ship repair facilities, restaurants, fuel depot, gasoline stations and other facilities necessary for the fishery sector. Thousands of buyers visit the port daily where an estimated 15 commercial fishing vessels call port and unload a total volume of about 300 tons. Overland vehicles from different provinces also bring in additional volume of 50 tons.

### Services

- Unloading and marketing of fish both from commercial and municipal fishing vessels.
- Provision of facilities for harbor operations, including drydocking, fishing gear repair, ice, water and fuel conveyance and product transshipment.
- Provision of processing and refrigeration facilities and services and companies engaged in sardines and tuna canning.
- Marketing information dissemination, e.g., fish prices, species processed inside the port and volume of processed products.
- Provision of communication facilities, office spaces and raw land for the establishment of fishery-related factories.

### 9.2.2 General Santos Fish Port Complex

The fishing industry in Region XII, is primarily centered in General Santos City, supporting thousands of jobs and generating millions in foreign exchange earnings. It aspires not only to exhibit fish and frozen tuna to the local and foreign market, but endeavors to optimize opportunities by adding more value to its fishery products.



Unloading of tuna in GSFPC.  
(Photo by CDD- CRFMS of DENR Region 12)

The operationalization of General Santos Fish Port Complex (GSFPC) is considered of great importance in East Asia Growth Area (EAGA) as it is noted to be the major fishing post-harvest infrastructure in the Mindanao area. The GSFPC, covering an area of 32 ha, is strategically located at Brgy. Tambler, General Santos City in South Cotabato. GSFPC which lies along the shores of Sarangani Bay is 17 km south of the city proper. GSFPC boasts of a complete six -35°C cold storage each with 300-tonne capacity; 4 tonnes/day brine freezer; a 60 tonner ice plant and a 1680-meter landing/preparation area.

GSFPC attracts investors involved in an array of economic interests, among which are some of the largest companies in the Philippines' fishery sector. More clients are lured to put their investments at the fish port with the completion of the port's expansion project that included additional refrigeration facilities and wharves that can accommodate huge capacity refrigerated vessels, among others. The

newly constructed facilities boosted trading and business transactions in GSFP and with their core thrust in quality assurance, the port is linked to various global market communities.

### **Services and Port Operation**

As designed, port activities include the following:

- Unloading and marketing of marine products both for local and foreign markets;
- Harbor operations, which cater to tuna handline boats, purse seiners and huge capacity refrigerated foreign vessels; and
- Processing and refrigeration services.

**Food Safety Statement:** To ensure the safety and quality of fish and processed goods intended for domestic and international markets through modern facilities and infrastructures, as well as by technical soundness and truthfulness of product information for the protection of consumers.

### **9.2.3 Davao Fish Port Complex**

The Davao Fish Port Complex (DFPC) is the seventh commercial fish port operated and administered by the Philippine Fisheries Development Authority (PFDA). It is the second major fish port complex established and located in the Mindanao Area (the third being the General Santos Fish Port Complex that started operations in CY 1998). DFPC is situated in Daliao, Toril District, that is about 16 kilometers south of the center or downtown Davao City. Hence, it is readily accessible either by land or sea transport from downtown Davao City.

Aside from the standard and basic port operations of berthing and unloading of fish catch by domestic fishing vessels, the DFPC serves as a center for the collection, processing, storage and packaging of fishery and other marine products for distribution to both domestic and export markets. During its initial year of operation, the DFPC has become attractive to foreign long-line vessels thereby making it as an alternative transshipment port in the Asia Pacific Region. Similarly, the DFPC has been widely considered as center of trade within the East Asia Growth Area (EAGA) for the simple reason that this fish port complex is now recognized as one of the most modern commercial fishery post-harvest infrastructure in the Mindanao Region.

### **Services and Port Operation**

- Berthing and discharging of fish cargoes by domestic fishing vessels
- Berthing and discharging of fish cargoes by foreign fishing vessels
- Processing of fish and other marine products
- Quick Freezing and Storage of fish and other marine products
- Trading and Auction of fish and other marine products
- Block Ice Production and Trading

### 9.2.4 Zamboanga Fish Port Complex

The establishment of Zamboanga Fish Port Complex (ZFPC) in Western Mindanao provided the fishing industry in the region with a systematized fish marketing and distribution system. It also supplemented current and future infrastructure development programs that support the integration of the fishing industry nationwide.

ZFPC is situated in a 12.5-ha complex in Barangay Sangali, Zamboanga del Sur, about 28 km. or 1/2-hour travel time from the city proper. The port has emerged as the largest marine products processing center in Peninsular Zamboanga. The diverse and high quality marine products that are being produced at the port led to the restrengthening of trade links in Western Mindanao (which includes the province of Zamboanga del Norte, Zamboanga del Sur, Basilan and the four cities of Dapitan, Dipolog, Pagadian and Zamboanga, and their neighbors, an ancient trading partnership that existed since 1635.

Its strategic location in the country as well as within the East Asean Growth Area (EAGA) is recognized by businessmen, both local and national; and those belonging to the Brunei, Indonesia, Malaysia, Philippines (BIMP)-EAGA Region as manifested by the number of business missions that visited the Complex.

#### Services

- Unloading and marketing of fish both from commercial and municipal fishing vessels
- Provision of facilities for harbor operations including drydocking, fishing gear repair, ice, water and fuel conveyance and product transshipment
- Provision of processing and refrigeration facilities and services including product pre-processing, freezing through contact freezer and product preservation through the use of the cold storage (-25°C) rooms, individual quick freezing machine and blast freezer
- Marketing information dissemination, e.g., fish prices, species processed inside the port and volume of processed products.
- Provision of communication facilities, office spaces and raw land for the establishment of fishery-related factories

### 9.2.5 Iloilo Fish Port Complex

The Iloilo Fish Port Complex (IFPC) is a major center of fish trading and marine products processing in Region VI. IFPC is situated in a 21-ha reclaimed area at Barangay Tanza, Iloilo City. It is served by extensive concrete road network that links it to the major business centers in the region and adjacent municipalities.

The port complex is the traditional landing site of bagnetters and other fishing bancas in Iloilo City and nearby towns. This strategic location has made the port the major fish source of Iloilo City's major public markets and adjacent municipalities.

**Services**

- Unloading and marketing facilities for fish and other fishery/aquatic products both for local and foreign markets;
- Services and facilities for harbor operations, e.g., drydocking/repair shop, fuel, oil, water and ice conveyance and for transshipping products;
- Processing, refrigeration and other post-harvest services including product pre-processing, freezing through contact freezer, cold storages and top-grade facilities for the processing of marine products, such as Prawn, Abalone, Cuttlefish, Lobster, Nylon Shell, Octopus, Slippertail, Squid, Whiting and Bangus; and,
- Raw land for establishment of fishery-related factories.

**9.2.6 Lucena Fish Port Complex**

As one of the regional fish port complexes being managed and operated by the PFDA, the Lucena Fish Port Complex (LFPC) is committed to realize PFDA's Corporate Vision as a "dynamic and viable government corporation that provides services and contributes to the country's food security by supporting an environmentally sustainable and competitive fishing industry through technologically advanced post-harvest facilities and infrastructure".

The LFPC was established as part of the Nationwide Fish Ports Project Package I and was constructed in a reclaimed area of 7.8 ha. It is located at Barangay Dalahican, Lucena City, which is about five (5) km from the city proper, and 162 km from Manila.

**Services**

- Unloading and marketing of fish both from commercial and municipal fishing vessels as well as fish supplies from overland vehicles.
- Use of harbor facilities including dry docking and repair activities.
- Provision of fuel, oil, water and ice supplies for product transshipment and for other fishing activities.
- Lease of space and raw land for fishery-related establishments.
- Refrigeration inclusive of processing space, cold storages, ice plant and freezing equipment.
- Provision of fish market information

**9.2.7 Camaligan Fish Port**

The Camaligan Fish Port (CFP) is the fourth major fish port project completed by the government under the *Nationwide Fishing Ports Projects Package I*. Nestled at the bank of the Bicol River in Barangay Dugcal, the CFP is strategically located just 1.5 km from the poblacion, and only four km from Naga City – Camarines Sur's largest urban settlement

The completion of the fish port in Camaligan enabled the PFDA to extend its services to the Bicol Region in terms of efficient handling and distribution of fish and fishery products. The operation of fish ports is a necessary component of the government's avowed objective of providing steady and sufficient supply of fish at reasonable prices. The fish port makes this possible by providing necessary post-harvest facilities to ensure that newly hauled fish and other fishery products are handled properly and expeditiously at least costs.

Camaligan Fish Port, which was built on a 4-ha property, is provided with multi-purpose pier, a market hall and an administration building. The other important features include an adequate water and power supply, paved parking area and a guarded entrance.

A major component of the fish port is its refrigeration system designed to meet international standards. The system is housed in a separate building complete with 15-ton ice making plant, cold storage and contact freezers ideal for processing.

Interested investors may set up within the complex, under a lease arrangement, their own processing plants for better access to these facilities.

### **Services**

- Use of unloading and marketing facilities for fish and other fishery/aquatic products both for local and foreign markets.
- Provision of facilities for harbor operations, e.g., ice, water and fuel conveyance and product transshipment.
- Lease of processing and refrigeration facilities including pre-processing, product preservation through cold storage and contact freezer.
- Information dissemination regarding fish prices, volume of processed products, species unloaded and volume of unloadings.
- Lease of office spaces and raw land for establishment of fishery-related factories.

### **9.2.8 Sual Fish Port**

The Sual Fish Port (SFP) is one of the fish ports under the Fishing Ports Project Package I of the PFDA. It was established to provide basic post-harvest facilities and services for the fishery sector in Region 1. As the only regional fish port in Northern Luzon, SFP was designed to accommodate bigger fishing boats and cargo vessels.

SFP is constructed on a 3.8-ha reclaimed land located at Poblacion, Sual, Pangasinan. The fish port was established for the unloading of rich marine products of Lingayen Gulf and the waters of the western coastline of Pangasinan and the harvests from the province's vast inland resources.

### Services

- Use of unloading and marketing facilities for fish & other fishery/aquatic products.
- Provision of facilities for harbor operations, e.g., ice, water and fuel conveyance and product transshipment.
- Information dissemination regarding fish prices, volume of processed products, species unloaded and volume of unloadings.
- Lease of office spaces and raw land for establishment of fishery-related factories.

## 9.3 Fish Port Programs and Performance

Through three core programs, namely: (1) Regional Fish Ports Program; (2) Municipal Fish Ports Program; (3) Ice Plants and Cold Storages Program, PFDA continuously responds to the need of the sector for post-harvest facilities and services. The beneficiaries are fisherman, fish brokers/consignacion, fishing vessel operators, and fish buyers/traders/viajeros.

### 9.3.1 Regional Fish Ports Program

The *Regional Fish Ports Program* involves the provision and operation of fish port complexes in strategic fish landing centers nationwide. These fish ports are equipped with facilities, such as breakwater, landing quay, market halls, refrigeration and processing facilities, slipway, and related facilities. In particular, the program addresses the needs of the commercial fishing boat operators, municipal fishermen, and fish processors/exporters, among others. The eight (8) fish port complexes in Navotas, Sual, Lucena, Camaligan, Iloilo, Davao, Zamboanga, and General Santos are being managed by PFDA under this program.

Among the fish ports, General Santos Fish Port Complex and Navotas Fish Port Complex show the highest fish unloadings (**Table 9.3** and **Figure 9.1**). Only the fish ports of General Santos, Zamboanga, Camaligan (and Davao in some years) have processing of fishery products (**Table 9.4**).

General Santos Fish Port has the highest number of commercial fishing vessel arrivals (**Table 9.5**). However, Zamboanga Fish Port has the highest fishing vessel arrival in terms of gross registered tonnage (GRT), followed by Lucena Fish Port (**Table 9.6**).

Two ports showed foreign fishing arrival. Davao Fish Port has the highest number of foreign fishing arrival, followed by General Santos (**Table 9.7**).

Municipal fishing vessels also used the regional fish ports. Zamboanga Fish Port, followed by Lucena Fish Port, have the highest number of municipal fishing vessel arrivals (**Table 9.8**).



### 9.3.2 Municipal Fish Ports Program

The *Municipal Fish Port Program* caters to the post-harvest requirement of sustenance fishermen. It entails the provision of smaller fish landings and market facilities in selected fishing communities nationwide. Some of these municipal fish ports act as satellite ports for the regional fish ports. The PFDA provides the needed training on port operations and maintenance for the eventual turnover of the ports' management to the Local Government Units (LGUs).

### 9.3.3 Ice Plants and Cold Storage Program

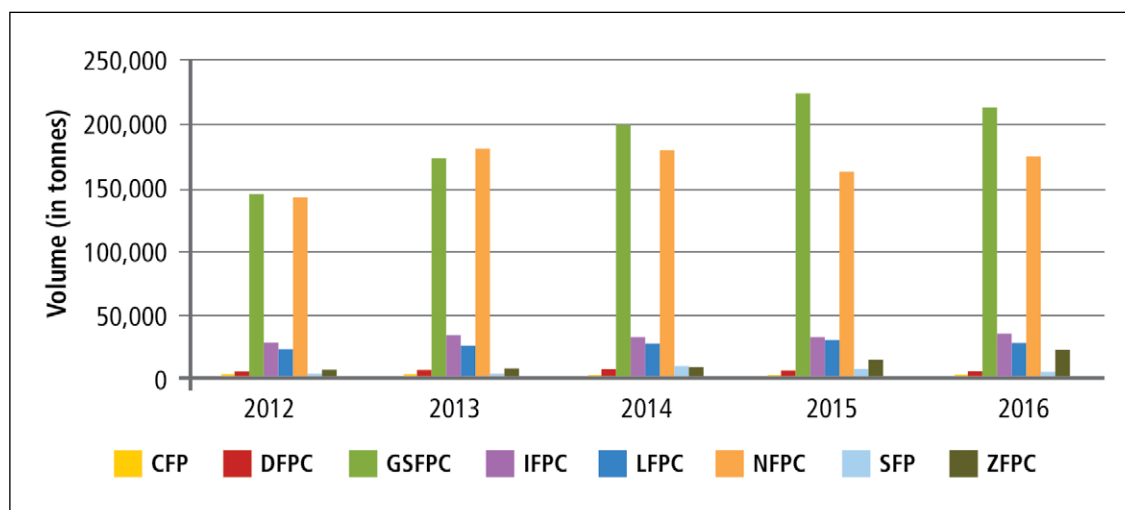
The *Ice Plants and Cold Storage Program* helps satisfy the ice requirements of the fishing industry. It involves the provision of ice-making machines of different magnitudes, and cold storages of varying capacities. **Table 9.9** shows the ice production by port in 2012 to 2018.

**Table 9.3:** Fish Unloadings (tonnes).

Year	CFP	DFPC	GSFPC	IFPC	LFPC	NFPC	SFP	ZFPC
2012	N/A	3,287	139,613	25,033	20,600	137,650	748	5,213
2013	N/A	4,971	167,579	30,546	23,728	174,011	1,151	4,862
2014	N/A	3,936	193,868	29,488	24,555	174,119	6,459	5,658
2015	123	3,158	217,630	29,433	26,333	157,542	4,672	11,622
2016	183	2,587	206,719	31,341	23,963	169,437	2,842	19,279
2017	2,006	2,191	210,761	29,100	21,577	122,810	1,804	12,189
2018	1,545	2,277	241,056	26,989	20,055	134,591	487	10,053

Source: PFDA

**Figure 9.1:** Regional Fish Ports Annual Volume of Fish Unloadings (tonnes).



Source: PFDA.

**Table 9.4:** Fishery Products Processed in the Regional Fish Ports (tonnes).

Year	CFP	DFPC	GSFPC	IFPC	LFPC	NFPC	SFP	ZFPC
2012	349	40	836	N/A	N/A	N/A	N/A	886
2013	25	N/A	691	N/A	N/A	N/A	N/A	807
2014	24	16	496	N/A	N/A	N/A	N/A	1,068
2015	84	N/A	853	N/A	N/A	N/A	N/A	286
2016	373	9	468	N/A	N/A	N/A	N/A	557
2017	468	N/A	411	N/A	N/A	N/A	N/A	543

Source: PFDA

**Table 9.5:** Number of Commercial Fishing Vessel Arrivals.

Year	CFP	DFPC	GSFPC	IFPC	LFPC	NFPC	SFP	ZFPC
2012	2	1,635	7,869	1,336	2,691	4,498	880	669
2013	19	708	6,474	581	2,683	6,714	684	1,002
2014	8	915	6,564	655	2,844	5,889	693	1,009
2015	90	893	5,804	539	2,720	5,652	934	1,647
2016	88	1,021	10,074	619	2,935	5,727	626	1,647

Source: PFDA

**Table 9.6:** Fishing Vessel Arrival (in GRT).

Year	CFP	DFPC	GSFPC	IFPC	LFPC	NFPC	SFP	ZFPC
2012	N/A	2,508	8,338	42	11,384	11,443	N/A	4,731
2013	N/A	1,365	9,178	151	16,258	8,442	N/A	5,250
2014	N/A	1,532	9,290	213	10,030	12,305	N/A	8,001
2015	N/A	1,511	7,775	388	7,967	10,926	N/A	15,176
2016	1	1,453	6,627	631	11,209	8,114	N/A	10,005
2017	2	1,049	8,264	690	9,301	7,227	N/A	10,563
2018	2	1,190	6,760	6,456	8,183	7,323		8,213

Source: PFDA

**Table 9.7:** Number of Foreign Fishing Arrival.

Year	CFP	DFPC	GSFPC	IFPC	LFPC	NFPC	SFP	ZFPC
2012	N/A	327	53	N/A	N/A	N/A	1	N/A
2013	N/A	279	54	N/A	N/A	N/A	N/A	N/A
2014	N/A	305	65	N/A	N/A	N/A	N/A	N/A
2015	N/A	291	49	N/A	N/A	N/A	N/A	N/A
2016	N/A	280	54	N/A	N/A	N/A	N/A	N/A

Source: PFDA

**Table 9.8:** Number of Municipal Fishing Vessel Arrival.

Year	CFP	DFPC	GSFPC	IFPC	LFPC	NFPC	SFP	ZFPC
2012	N/A	2,508	8,338	42	11,384	11,443	N/A	4,731
2013	N/A	1,365	9,178	151	16,258	8,442	N/A	5,250
2014	N/A	1,532	9,290	213	10,030	12,305	N/A	8,001
2015	N/A	1,511	7,775	388	7,967	10,926	N/A	15,176
2016	1	1,453	6,627	631	11,209	8,114	N/A	10,005
2017	2	1,049	8,264	690	9,301	7,227	N/A	10,563
2018	2	1,190	6,760	6,456	8,183	7,323		8,213

Source: PFDA

**Table 9.9:** Ice Production (tonnes), by Port.

Year	CFP	DFPC	GSFPC	IFPC	LFPC	NFPC	SFP	ZFPC
2012	3,501	7,788	19,128	N/A	5,376	N/A	N/A	9,929
2013	4,227	7,707	18,976	N/A	6,704	N/A	N/A	9,642
2014	3,812	5,915	19,851	N/A	6,213	N/A	N/A	9,008
2015	2,839	7,848	16,880	N/A	6,418	N/A	N/A	4,007
2016	2,947	9,058	19,152	N/A	4,568	N/A	N/A	10,191
2017	1,555	8,671	17,547	N/A	3,607	N/A	N/A	7,820

Source: PFDA

## 9.4 Issues and Challenges

Israel and Roque (2000) identified several issues and challenges that beset the development of fish ports in the country. By way of conducting a survey through interviews with selected LGU personnel in charge of municipal fish ports, owners/operators of commercial ports, officers of PFDA, and other stakeholders, the study revealed the following problems that beleaguer the fish ports system:

- a. Underutilization of regional fish ports,
- b. Depletion of marine resources (fish stock),
- c. Inadequate number of municipal fish ports;
- d. Poor environmental management practices in municipal ports.

Regarding the issue of **underutilization of existing ports**, it has been argued that some regional fish ports have significant excess capacity. This may be due to limited post-harvest facilities or that some of the programmed equipment were still not available in the ports in the first place (Israel and Roque, 2000). For these reasons alone, the clamor for the construction of additional fish ports became a major concern albeit the fact that fish ports are highly needed around the country.

Another important issue plaguing the fishery sector is **marine resource depletion**. Putting up more fishing ports can encourage stock overfishing which the study found to be already happening at a very rapid and alarming rate.

Despite these valid concerns, **additional fishing ports and post-harvest facilities are still needed** today. Many coastal towns and regions do not have ports, jeopardizing their potentials for full economic development. Based on the survey done by PIDS, the national ratio of municipal ports to coastal municipalities was found to be only 50 percent. In particular, more than half of coastal towns had no fishing port to service municipal fishing (though there are a few municipalities which have more than one port). The problem of inadequate number of municipal fishing ports and postharvest facilities for proper unloading, selling and processing is further feared to worsen when new coastal towns are created because of increasing population.

Furthermore, the PIDS study claims that the **poor catch of commercial fisheries** is exacerbated by another limitation besides overfishing in traditional fishing areas. This raises the issue of local commercial fishing fleet not able to fish in far-flung, deep sea areas within the Exclusive Economic Zone (EEZ) because these EEZs are actively poached on by foreign fishers (but under-fished by Filipinos).

**Poor environmental management practices** in fishing ports was also mentioned by PIDS as an issue in establishing and developing fish ports system, particularly municipal ports. Though in the case of regional ports, all had drainage and sewage systems that can systematically handle the discharge of solid and liquid wastes produced as by-products of fish port operations.

## 9.5 Recommendations

Based on the findings of the PIDS study on the issues affecting fish port development, it was concluded that the government should aggressively pursue port development, which has strong forward and backward linkages to the coastal municipalities, regions and the national economy. The study cautions nevertheless that port development should proceed with proper planning and implementation, and meet environmental regulations. Specifically, PIDS put forward the following recommendations:

- a. The underutilized facilities of existing regional ports must be considered by the PFDA for use in the processing of other agricultural products like vegetables, livestock and poultry. Turning the ports into integrated fisheries-agriculture processing centers will improve their economic viability.
- b. On the issue of whether or not new regional fishing ports should be built and where they will be located, a general rule has to be followed. It is argued that new ports may be established in any region as long as the decision to do so is based on sound technical, financial, economic, environmental and other important considerations and not purely on political reasons. Decision-makers should be wary of fantastic growth rate projections of landings which cannot be supported by solid evidence, but are likely used only to justify the construction of large and expensive ports.
- c. The Environmental Impact Statement (EIS) System should be forcefully applied in the building of new municipal ports. In particular, an Environmental Compliance Certificate (ECC) should be secured before new ports are built. It also goes without saying that the environmental management in the existing regional ports must be improved by putting up the environmental facilities needed for these ports.
- d. The problem of overfishing in coastal waters must be a significant factor to consider in building new regional ports. Other things the same, ports should be built if they encourage commercial fishing in the EEZ waters and other distant areas. New ports should not be built if they will just exacerbate stock overfishing and the competition between the municipal and commercial fishermen for the rapidly dwindling coastal fisheries resources.
- e. For municipal ports, a major concern should be the upgrading of existing ports so they can contribute better to the growth of the communities they are in. This will require the following: (1) Investment in more post-harvest facilities, especially ice-plants, should be done in municipal ports (as provided for and under the guidance of AFMA and Fisheries Code); (2) improve the environmental management of municipal ports; and (3) construction of new municipal ports, especially in localities where there are no existing ports yet.

In addition, there should be actions for the upgrading of regional fish ports, improvement of structures, and enhancement of fish port operations to increase efficiency, and ensure that fishery products can meet international standards.

# 10 Offshore Oil and Gas

## 10.1 Production

Aggregate domestic oil production, including condensate, declined by 11.5 percent, from 702.4 kTOE in 2016 to 621.8 kTOE in 2017, while its contribution total indigenous energy supply stood at 2.1 percent share. The reduction is attributable to the lower production output reported in Matinloc, Galoc, and Malampaya fields during this period.

Likewise, natural gas production was lower by 1.4 percent in 2017 compared with its 2016 level of 3.3 MTOE. Natural gas production stood at 3.2 MTOE, equivalent to an 11 percent share to overall indigenous supply in 2017. The decline in outputs is due to the following factors:

- Malampaya's 20 days maintenance shutdown in first quarter of 2017
- Effect of Magnitude 5.6 and 6.0 earthquakes in Mabini, Batangas on 8 April 2017, which led to the outages of Avion, Santa Rita, San Lorenzo, San Gabriel and Ilijan Natural Gas Power Plants. The country sources 100 percent of its natural gas requirements from the Malampaya gas field in Palawan.

As of June 2018, the country produced 54,680,776 BBLs of oil from Nido, Matinloc, North Matinloc and Galoc, and 1,938,305.87 MMSCF of natural gas from Malampaya (**Table 10.1**). Based on the Upstream Oil and Gas Roadmap (**Table 10.2**), the DoE expects to be able to discover and explore additional oil fields and be able to produce more oil and gas in the long term. Accordingly, this is in anticipation of the forthcoming depletion of Malampaya gas (DoE, Energy Annual Report 2017).

Although the DoE's Roadmap shows a lot of potential in discovering and developing additional oil and gas fields, the sector is not without a threat of the possibilities of oil spill.

Although natural gas is a fossil fuel, the global warming emissions from its combustion are much lower than those from coal or oil. Natural gas emits 50 to 60 percent less carbon dioxide (CO<sub>2</sub>) when combusted in a new, efficient natural gas power plant. The combustion of natural gas produces negligible amounts of sulfur, mercury, and particulates. However, burning natural gas produces nitrogen oxides (NO<sub>x</sub>), which are precursors to smog, but at lower levels than gasoline and diesel used for motor vehicles.

**Table 10.1:** Upstream Oil and Gas Roadmap 2017-2040.

	Field	Total Production (bbls oil or condensate / mmscf gas) As of 30 June 2018	Location
<b>Oil</b>	Nido	19,276,841.00	Northwest Palawan
	Matinloc	12,584,966.00	Northwest Palawan
	North Matinloc	2,276,413.00	Northwest Palawan
	Galoc	20,542,556.12	Northwest Palawan
<b>Gas</b>	Malampaya	1,938,305.87	Northwest Palawan
<b>Condensate</b>	Malampaya	75,041,800.82	Northwest Palawan

Source : <https://www.doe.gov.ph/pep/upstream-oil-and-gas-roadmap-2017-2040>.

**Table 10.2:** Total Production of Oil and Natural Gas: As of June 2018.

	Short Term (2017-208)	Medium Term (2019-2022)	Long Term (2023-2040)
Petroleum Reserves	Assess oil reserves of 41.57 MMB oil, 3.36 TCF gas and 37.87 MMB condensate	Increase delineated oil from 42.79 MMB to 78.73 MMB, gas from 3.09 TCF and condensate from 30.28 MMB to 47.24 MMB	Increase delineated oil from 48.73 MMB to 57.12 MMB, gas from 4.67 to 5.87 TCF, condensate from 47.24 MMB to 56.81 MMB
Additional Discovery	No new field discovery	Drill: 1 oil field in Calubian with 20 MMB; 2 fields in Sta. Monica 1 with 1.798 TCF and North Cliffhead with 0.42 TCF; 2 fields in Sta. Monica 1 with 30 MMB associated condensate	Drill: 2 oil fields in Salamanca with 3.6 MMB and Popototan with 20 MMB; 2 gas fields in Sta. Monica 2 with 1.2 TCF and RB-PO4 with 2.4 TCF; 1 field in New Gas Field B with 40 MMB associated condensate
Production	Produce: 2 oil fields (Galoc and Polyard A6 with 3.78 MMB; 2 gas fields (Malampaya and Polyard A8 with 0.29 TCF; 1 field (Malampaya with 7.59 MMB associated condensate)	Produce: 5 oil fields (Galoc, West Linapacan, Polyard A6, Cadlao and Octon with 18.5 MMB); 3 gas fields (Malampaya, San Martin and Polyard A8 with 0.645 TCF); 1 field (Malampaya with 13.04 MMB associated condensate)	Produce: 11 oil fields (Galoc, West Linapacan, Cadlao, Octon, Malampaya, Linapacan, Calait, Malolos, Elephant, Calubian and Salamanca with 115 MMB; 7 fields (Malampaya, Sampaguita, Progreso and Sampaguita with 45.93 MMB associated condensate)
Producing Service Contracts (SCs)	Administer: 2 SCs oil; 2 SCs gas; 1 SC associated condensate	Administer: 5 SCs oil; 3 SCs gas; 1 SC associated condensate	Administer: 11 SCs oil; 7 SCs gas; 4 SCs associated condensate

Source: DOE

## 10.2 Policies and Strategies<sup>6</sup>

### 10.2.1 Energy Plans, Incentives, and Institutional Arrangements

#### 1. Philippine Energy Plan 2017-2040

The Department of Energy (DoE) laid down *Eight Energy Sector Strategic Directions* (ESSDs) to jumpstart the country's policy direction for the energy sector for the next 22 years. As indicated in the *Philippine Energy Plan* (PEP) 2017-2040, the DoE expects to have achieved the following by 2040:

- increase renewable energy (RE) installed capacity to at least 20,000 megawatts (MW);
- increase reserves and production of local oil, gas and coal;
- deliver quality, reliable, affordable, and secure power supply; expanded access to electricity; and a transparent and fair power sector playing field provide nationwide electricity access
- improve downstream oil industry policies for the continuous supply of high quality and quantity petroleum products;
- establish a world class and investment driven natural gas industry in the Philippines;
- secure stable energy supply through secure stable energy supply through a technology responsive energy sector; and
- reduce energy intensity and consumption

Under the Philippine Energy Plan, the DoE plans to adopt and implement the following strategies:

- Attract more investors to participate in the upstream petroleum exploration, development and production;
- Undertake information, education and communication campaigns to concerned/involved stakeholders/LGUs, local community about petroleum operations;
- Monitor compliance of SCs with work commitments and regulations relating to the exploration, development and production activities;
- Harmonize and integrate projects with other government agencies to ensure unified and coordinated efforts to ensure energy security;
- Formulate and implement policy issuances on upstream petroleum sector to streamline petroleum related activities of service contract operators/holders;
- Conduct and participate in resource assessment projects to update the current indigenous petroleum resources;
- Pursue international cooperation activities to keep abreast with the development in upstream petroleum industry;
- Undertake capacity building of human resources and upgrading of office and field equipment

<sup>6</sup> From DoE Annual Report, 2017.



## **2. Philippine Downstream Natural Gas Regulation Department Circular No. DC2017-11-0012**

Otherwise known as the “Philippine Downstream Natural Gas Regulation” (PDNGR), this circular sets forth the rules and regulations governing the downstream natural gas industry in the country. This includes infrastructure siting, design, construction, expansion, modification, operation, and maintenance. It also seeks to ensure the continued operations of other gas-fired power plants once Malampaya runs dry.

In addition to promoting the use of natural gas to meet the growing energy demands in Asia Pacific, PDNGR also intends to transform the country as a regional Liquefied Natural Gas or LNG trading and transshipment hub.

In response to the DOE’s major directives, the Philippine National Oil Company (PNOC) is currently undergoing a major reorganization to be able to develop and operate the Batangas LNG Hub Project, the Batangas Energy Supply Base, and the PNOC Petrochemical Park in Bataan.

## **3. Batangas Liquefied Natural Gas (LNG) Hub Project**

The PNOC was mandated to be the flag carrier in realizing the PNOC Batangas LNG Hub Project. The project aims to establish a complete value chain LNG facility and ensure the supply of gas to the existing and future gas-fired power plants upon the termination of the Malampaya Service Contract in 2024 and beyond. The project components shall cover sourcing of the LNG supply, establishing LNG storage units, regasification, distribution facilities and a power plant. The power plant shall serve as the project’s social component, envisioned to produce cheaper electricity to supply Philippine Economic Zone Authority’s identified industries and small power utilities groups (SPUG) areas. The project is also envisioned to expand to other parts of the country where natural gas may be deemed necessary in the future, especially those that are not yet connected to the grid. PNOC received and is evaluating eight unsolicited proposals for the PNOC LNG Hub Project.

## **4. PNOC Exploration Corporation (PNOC-EC)**

In 2017, PNOC Exploration Corporation (PNOC-EC) continues to work towards becoming the energy exploration and production company in the country with global reach, as well as becoming the partner of choice of other energy companies by exploring new possibilities and holding its operations to the highest standards.

PNOC-EC continues to be an active partner in the Malampaya Gas-to-Power project, where it holds 10 percent participating interest. The Malampaya project continues to provide the gas fuel requirements of power plant customers in Batangas with a total capacity of 3,200 MW, providing at least 30 percent of the power requirements of Luzon.

PNOC-EC continues exploration activities in existing petroleum and coal projects in its pursuit for petroleum and coal resources to replace diminishing reserves. PNOC-EC continued studies on various prospects in Service Contract (SC) 37 Cagayan Basin for possible well drilling. Seismic data interpretations in SC 59 West Balabac and in SC 74 Linapacan were also continued.

These exploration activities must be placed in context not just of the energy security, but also climate goals. Alternative renewable energy sources must be also pursued as renewable energy technologies become more accessible and affordable.

### 10.2.2 Plans and Actions to Mitigate the Environmental Risk and Threats

#### 1. **Department Circular No. DC2017-12-0017: Adopting the Philippine Energy Contracting Program (PCECP) of Awarding Petroleum Service Contracts (PSCs) and Creating the Review and Evaluation Committee (REC)**

Under the guidance of this circular, the Committee is currently drafting the upstream petroleum operation safety, health and environment rules and regulations. (It is now on its Consultation Phase.)

#### 2. **Emergency Response Plan and Oil Spill Contingency Plan**

All offshore operations have their own Emergency Response Plan and Oil Spill Contingency Plan ready to be activated in case of oil spill.

All offshore installations have their oil spill equipment and kit ready to be deployed in case of minor oil spill.

All offshore operations are engaged with 3rd party well control and oil spill services, that will provide the services needed in case of major oil spill which is beyond the capability of the Service Contractors. The services can mobilize all the equipment and personnel needed within 24 hours directly from Singapore.

All offshore operations have their regular monitoring and testing of air and water discharge to monitor its compliance not only with DENR standards but also with the industry standards.

Major fields (Galoc and Malampaya) have their Inter-Agency Monitoring Team and Multi-Partite Monitoring Team (composed of representatives from different Government Agencies including PCSD, DENR, LGU) which is in charge in the monitoring of the environmental compliance of the Service Contractors.

### 3. ISO Certification

PNOC has secured the ISO Certification 9001:2015 in October 2017. All the processes at PNOC, Management of the Provision of Vital Energy Infrastructure Conducive to a Clean Environment and Balanced and Sustainable Economic Growth," have been found compliant with the requirements of the standard for a quality management system.

### 4. Decommissioning and Abandonment Plan

All fields are required to submit their decommissioning and plug and abandonment plan one (1) year before the end of its production, to ensure that all petroleum wells will be plugged and abandoned safely, and all offshore production facilities and structures will be decommissioned in accordance to international industry standards.



Malampaya natural gas field.  
(Photo by DOE)



Natural gas power plant in Batangas. (Photo by First Gen)

# 11

## Maritime Services and Education

### 11.1 Philippine Maritime Services

A study of *Arangkada Philippines* (2017) reported that one major component of the maritime industry is crewing and manning of seafarers. Accordingly, almost 90 percent of trade activities worldwide are through ships. Thus, seafarers play a key role in sustaining both the efficiency and stability of the global maritime industry.

According to Seaman Republic, 2016 and DoTr, the top 10 nationalities of seafarers are:

- |                       |             |
|-----------------------|-------------|
| 1. China              | 6. Ukraine  |
| 2. Philippines        | 7. Poland   |
| 3. Indonesia          | 8. Latvia   |
| 4. Russian Federation | 9. India    |
| 5. United Kingdom     | 10. Croatia |

Filipino seafarers in particular significantly contribute to sustaining the global maritime sector, being the second largest nationality comprising 30 percent of one million seafarers in the world (Arangkada, 2017). **Table 11.1** shows the number of Filipino seafarers deployed around the world as well as remittances from sea-based overseas Filipinos from 2012 to 2016.

**Table 11.1:** Deployment of Filipino Seafarers and Remittances.

	2012	2013	2014	2015	2016
<b>Deployment of Filipino Seafarers</b>	366,865	367,166	401,826	406,531	No Data
<b>Sea-based Overseas Filipinos' Remittances</b> (in thousand U.S. Dollars)	4,835,342	5,215,378	5,503,179	5,792,459	5,572,148

Source: PSA

Filipino seafarers contribute about US\$ 5 billion in annual OFW remittances while the number of Filipino seafarers continues to rise through the years, from 366,865 in 2012 to 406,531 in 2015 (**Table 11.1**). Furthermore, most of these seafarers are deployed aboard the national flag of registry of Panama, Bahamas and Liberia (**Table 11.2**). Furthermore, **Table 11.3** lists down the top ten skills of Filipino seafarers that were deployed in 2014 and 2015.

**Table 11.2:** Deployed Filipino Seafarers, by Top 10 Flags of Registry.

Flag of Registry	2015	2014	% Change
Panama	69,502	71,356	-2.6
Bahamas	50,272	50,379	-0.21
Liberia	37,537	35,974	4.34
Republic of Marshall Islands	36,057	32,179	12.05
Malta	25,547	23,793	7.37
Singapore	24,011	22,561	6.43
Bermuda	17,324	16,509	4.94
Italy	12,960	12,297	5.39
Norway	11,724	13,232	-11.4
Netherlands	10,657	12,582	-15.3
Other Flags of Registry	110,940	110,964	-0.02
<b>Total</b>	<b>406,531</b>	<b>401,826</b>	<b>1.17</b>

Source: PSA

**Table 11.3:** Deployed Filipino Seafarers, by Top 10 Skills.

Skill Category	2015	2014	% Change
Able Seaman	58,994	58,219	1.33
Oiler	31,563	32,263	-2.17
Ordinary Seaman	28,556	28,437	0.42
Chief Cook	15,634	15,890	-1.61
Bosun	15,020	14,645	2.56
Second Mate	14,864	14,873	-0.06
Third Engineering Officer	13,228	13,184	0.33
Messman	11,753	11,711	0.36
Third Mate	11,743	11,586	1.36
Waiter/Waitress	10,859	11,538	-5.88
Other Skills	194,317	189,480	2.55
<b>Total</b>	<b>406,531</b>	<b>401,826</b>	<b>1.17</b>

Source: PSA

**Table 11.4:** Deployed Filipino Seafarers, by Type of Hiring.

Type	2015	2014	% Change
Landbased	1,437,875	1,430,842	0.49
- New Hires	515,217	487,176	5.76
- Rehires	922,658	943,666	-2.23
Seabased	406,531	401,826	1.17
<b>Total</b>	<b>1,844,406</b>	<b>1,832,668</b>	<b>0.64</b>

Source: PSA; MARINA.

**Table 11.5:** Documentation of Overseas Filipino Workers (Contracts Processed).

Type	2015	2014	% Change
Landbased	1,823,715	1,873,180	-2.64
- New Hires	614,748	639,679	-3.90
- Rehires	1,208,967	1,233,501	-1.99
Seabased	519,977	517,972	0.39
<b>Total</b>	<b>2,343,692</b>	<b>2,391,152</b>	<b>-1.98</b>

Source: PSA; MARINA.

**Table 11.6:** Deployed Filipino Seafarers, By Major Category, in 2016.

Major Category	Count
Officer	100,605
Rating	159,858
Non-Marine	179,203
Others (NEC)	3,154
<b>Total</b>	<b>442,820</b>

Source: MARINA, 2018.

## 11.2 Maritime Education and Training

In the past decades, the Philippines has enormously benefited from its record of being the world's largest supplier of maritime services. At present however, China has overtaken the country in terms of numbers. Nevertheless, even though the Philippines now stands as second largest supplier of maritime services, the country remains to be the best-rated source of seafarers. (Arangkada, 2017)

Experts believe that it is essential that seafarers as professionals also have career paths into other shipping services, which include ship management, technical supervision, port management, trainers and teachers, among others. Moreover, education and training programs and schools for seafarers should be developed in order to sustain and further enhance the status of the country's maritime services industry. The learning and training institutions should maintain and develop the needed level of knowledge and skills under the guidance and supervision of Government authorities, such as CHED, TESDA, and MARINA (Arangkada, 2017).



Simulation equipment at Maritime Academy of Asia and the Pacific in Bataan. (Photo by M. Ebarvia)

Authorities also need to understand that the maritime services sector is composed of four subsectors:

- **Crew management.** There is a need to retain and expand the Philippines as the leading seafaring country in the world, and eventually become the next maritime services center of Asia and the world.
- **Business process management services including education and training.** There is a need to deepen this part of the BPO industry with opportunity to develop business outsourcing services for ship managers, marine insurance, legal services, and others.
- **Ship finance, insurance, maritime law, and maritime arbitration.** There is a need to develop a professional cadre of maritime lawyers, bankers, and insurance professionals.

The study of Arangkada Philippines underscores the status of the country's maritime industry, which should be one of the major focal points of BPO activities. According to them, "there is an opportunity to leverage the manning industry to add value and provide comprehensive services, such as sourcing, recruiting, training and development, performance management, and payroll. Being a large provider of globally-trained seafarers, the Philippines has an opportunity to

develop careers beyond the sea to work in landbased services. Shipboard officers with competence and experience with global standards on all kinds of vessels are a talent pool for ships. The pool of seafarers also serve as a pipeline for surveyors and auditors needed by certifying bodies like Class Societies, insurance underwriters, and insurance adjusters.”

As of 2018, MARINA reported that there are 65 maritime higher education institutions, and 124 maritime training institutions across the country (**Table 11.7**). The International Maritime Organization has a ‘white list’ of accredited maritime schools.

Around 1 million certificates have been issued to seafarers. These are: Certificate of Proficiency (COP); Certificate of Competency (COC); and Certificate of Endorsement (COE). There are 34 accredited Assessment Centers.

The Department of Education and MARINA (STCW Office) also approved the institutions with Senior High School offering K-12 Maritime Specialization.

For deployment, MARINA reported that there are 405 Manning Agencies (forum and consultation).

**Table 11.7:** Maritime Higher Education and Training Institutions (As of April 2018).

Region	Maritime Higher Education Institutions	Maritime Training Institutions
NCR	10	72
I	4	2
II	2	0
III	7	2
IV	8	8
V	5	1
VI	9	13
VII	7	12
VIII	1	2
IX	2	1
X	3	2
XI	3	7
XII	2	1
Caraga	2	1
<b>TOTAL</b>	<b>65</b>	<b>124</b>

Source: MARINA.



**PART 3**

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**DEVELOPMENTS IN  
BLUE ECONOMY**

# 12 Blue Economy Initiatives

## 12.1 Sustainable Fisheries and Aquaculture

### 12.1.1 Climate-smart Aquaculture and Supplemental Livelihood Programs for Fishers

The *Philippine National Aquasilviculture Program* (PNAP) implemented by the Bureau of Fisheries and Aquatic Resources (BFAR), together with the Commission on Higher Education (CHED) is a program focused primarily on mangrove resource rehabilitation and livelihood provision to help address climate change, food security and poverty among municipal/artisanal coastal fisherfolks (Dieta and



Aquasilviculture in Alabat island, Quezon. (Photo by PCAARRD)

Dieta, 2015). Its goal and objectives are (1) replanting of destroyed mangrove resources; (2) establishment of community-based multi-species hatcheries (CBMSH), and (3) provision of aquasilviculture livelihood projects to fisherfolk beneficiaries covering 61 provinces and 71 state universities and colleges (SUCs) all throughout the country.

As of September 2013, around 31,000,000 out of 36,000,000 mangrove propagules have been planted. This represents 85 percent of the target for the said year, covering 10,000 ha throughout the country. For aquasilviculture, 76 percent has been attained, thereby benefitting almost 1,900 fisherfolk throughout the country. Almost 20 percent of participating SUCs has completed the establishment of CBMSHs while the others are still in the process of construction (Dieta and Dieta, 2015).

The ecosystems services of mangroves, such as habitat for diverse marine species, nutrient cycling and waste assimilation, are benefiting the aquaculture farms, and in addition, provide shoreline protection and carbon sequestration services. Moreover, the multi-species farms will diversify and increase the income of fisher-beneficiaries.

The *Comprehensive National Fisheries Industry Development Plan for 2016 – 2020* includes the *Sustainable Fisheries Livelihoods Support*, which has a goal of increasing the income of

small fisherfolk families and organizations through engagement in resource and non-resource-based livelihood initiatives. It identified potential livelihood projects (e.g. seaweed culture, fish cage culture, agri-ecotourism, etc.), and aims to establish fisherfolk livelihood centers, and build partnerships between the government and private entities to give fishing communities access and long-term support for alternative livelihood.

Agri-tourism is now considered as a catalyst for both sustainable agriculture and tourism and inclusive development, with the release of the Implementing Rules and Regulations (IRR) of **Republic Act 10816 titled “Farm Tourism Development Act of 2016.”** The aquasilviculture farms offer potential for agri-tourism as visitors can also walk through the mangroves.

### 12.1.2 Electronic Catch Documentation and Traceability System for Sustainable Tuna Fisheries<sup>7</sup>

One tool that can be used to address IUU fishing is the Catch Documentation and Traceability System (CDTS). The Electronic catch documentation and traceability (eCDT) is the practice of documenting key information about the harvest, processing, and transportation of a fisheries product electronically to enable traceability of the seafood product back through each step of its journey — from point of catch to the consumer's plate. Doing so electronically, eCDT enables this information to be more quickly and easily captured, shared, and managed. eCDT provides a practical way to:

- Ensure fisheries resources are legally caught and properly labeled;
- Encourage the collection and analysis of ecological and economic data throughout the seafood supply chain;
- Support effective national fisheries management and fisheries monitoring, control and surveillance; and
- Comply with national, regional and international seafood regulations and import requirements.



*Photo by J. Fernandez*

Using modern technologies, USAID Oceans, SEAFDEC and BFAR unveiled the eCDT in September 2017 after months of coding and development. A team of 15 developers worked to create the

<sup>7</sup> Accessed from <https://www.seafdec-oceanspartnership.org>; Silvestre, Geronimo. 2017. “Electronic catch documentation and traceability system to address IUU fishing,” Presentation at the Blue Economy Forum 2017, held in Bangkok, Thailand on 14-15 November 2017.

software in partnership with USAID Oceans. The CDTs has been developed to be part of a larger network of the Philippines' national information systems, all connected through a centralized database or *Data Exchange* (DEX). The back-end of the CDTs is the interface that will allow system users to input traceability data throughout the supply chain. System Users include the Fishing Vessel Operator, Fisheries Officer (a BFAR-appointed port inspector), Vessel Monitoring System Operator, Processing Company Representative, and the Evaluator, Endorser and Approver who evaluate, validate and sign the product's final Catch Certificate. With Users at each point in the seafood product's supply chain, the system rolls up all required forms into one central interface and location, including the *Fishing Logsheet*, *Catch Origin Landing Declaration* (COLD), the *Fish Unloading Monitoring Form*, and the *Catch Certification*. In addition to capturing the data required for each, the system also intakes required supporting documentation. With the system developed, BFAR and USAID Oceans are preparing to begin deploying the system in the General Santos City Fish Port for use by first-mover companies that have agreed to test initial data entry and user experience. This shows that eCDT initiatives require a great amount of coordination, cooperation and cohesive action.

Challenges for eCDT across Southeast Asia vary greatly by country, but commonly include: lack of supporting fisheries policies and regulations; inefficient or outdated documentation protocols; unsynchronized documentation processes throughout the supply chain; a lack of harmonized efforts across national or regional fisheries agencies; and inadequate infrastructure for electronic data capture.<sup>8</sup>

### 12.1.3 Monitoring, Control and Surveillance (MCS) system

In addition to the registration of fishing vessels, another significant feature of **RA 10654 (Amended Fisheries Code)** is the installation of a *Monitoring, Control and Surveillance (MCS)* system in "all Philippine flagged fishing vessels regardless of fishing area and final destination of catch." There are so many available technologies right now that can help the government and people in monitoring the behavior of fishing vessels. The MCS system would make it easier to ensure compliance with fisheries regulations. The use of these devices can show if commercial fishing vessels are operating in the right areas. This can help the artisanal fishers regain their municipal waters from encroachment by large fishing vessels.

### 12.1.4 Sustainable Fisheries through Strengthening Governance: The Iligan Bay Alliance in Misamis Occidental (IBAMO) Success Story<sup>9</sup>

In 2005, Misamis Occidental became a beneficiary of the Philippine Australia Community Assistance Program (PACAP). WorldFish provided support for better management of coastal resources and easing

<sup>8</sup> <https://www.seafdec-oceanspartnership.org/catch-documentation-and-traceability>.

<sup>9</sup> WorldFish - Philippines. Presentation by Idohna Leah J. Buendia at the Subregional Workshop on Sulu-Sulawesi Seas, held at the PEMSEA Office, 31 March – 1 April 2016.

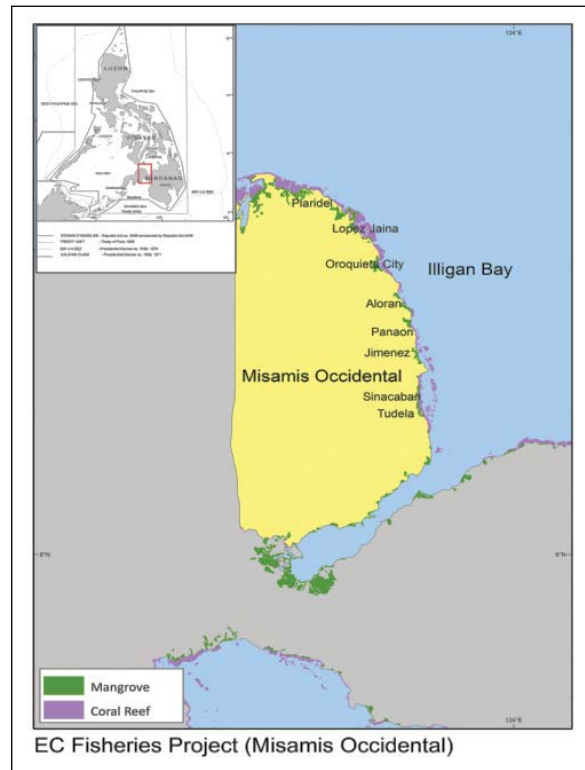
the pressure on capture fisheries in Iligan Bay. The following actions were undertaken:

- 2008: Development of an Integrated Coastal Resource Management (ICRM) Plan in 4 LGUs (Jimenez, Lopez Jaena, Panaon, Sinacaban)
- 2010: MOA signing of the Iligan Bay Alliance in Misamis Occidental (IBAMO) with four LGUs: Jimenez, Panaon, Sinacaban, Tudela
- 2011: USAID-funded Ridge to Reef Project – for the strengthening of coastal resource management (CRM) program of six coastal LGUs of Misamis Occidental (Jimenez, Panaon, Sinacaban, Tudela, Aloran and Oroquieta City)
- 2012: Re-establishment of IBAMO with eight LGUs (Jimenez, Lopez Jaena, Oroquieta City, Panaon, Plaridel, Sinacaban, Tudela) through the Fisheries Governance Project
- 2013: Policy and implementation by the eight LGUs; Support to FishR and BoatR (registration of fisherfolk and fishing boats); Implementation of Capacity Building Activities of IBAMO
- 2014:
  - Capacity Building activities;
  - Scholarship program;
  - Harmonization of fisheries ordinances;
  - CRM Certification
  - Finalization of MPA Management Plans
  - IBAMO Operation Manual

Governance structure of the IBAMO:

- Information, Education, and Communication Committee
- Law Enforcement Committee
- Habitat Enhancement Committee
- Institutional/Capacity Building Committee
- Monitoring and Evaluation Committee

**Figure 12.1:** Eight LGUs of the Iligan Bay Alliance in Misamis Occidental (IBAMO).



Source: WorldFish - Philippines (2016).

The advantage of joining the alliance was recognized given that no individual local government unit is capable of responding adequately to all of the identified problems. The following factors made the IBAMO a success story:

- Increasing resilience of coastal households through cost-effective (ecosystem-based) adaptation strategies
- Improving aquatic resources use and management through EAFM, capacity development of key stakeholders, and policy research
- Rehabilitation of mangroves
- Conservation of giant clams (transferred to deeper waters for higher chance of survival)
- Regular monitoring of MPAs/marine sanctuaries (with Maritime Police, Philippine Coast Guard, DENR-PENRO, and PG-ENRO)
- Strengthening of inter-bay alliances through EAFM and other fishery management modalities
- Strict law enforcement: Increasing awareness about RA 10654 (Amended Fisheries Code to address IUU fishing); Adopting/Promoting legal fishing gear/practices; Organizing of IBAMO Fishery Law Enforcement Team (IFLET), which makes regular monitoring as well as unannounced seaborne patrol as deterrence to illegal fishers; Confiscation of dynamites and illegal fishing gears; color-coding of boats to regulate fishing activities and lessen poachers
- Improving existing livelihoods/livelihood systems, and exploring opportunities for alternative non-fishing livelihoods

## 12.2 Sustainable Coastal and Marine Tourism

### 12.2.1 Zero Carbon Resorts

The Department of Tourism (DOT) and the Tourism Infrastructure and Enterprise Zone Authority (TIEZA) signed a four-year agreement in March 2015 with Gruppe zur Forderung der Angepassten Technologie (GrAT) or the Center for Appropriate Technology, a non-profit scientific research association of the Vienna University of Technology, for the second phase of its *Zero Carbon Resort (ZCR) For Sustainable Tourism Project*. This project targets 1,000 stakeholders in the Philippines and 300 in Thailand, composed of micro-, small- and medium-sized tourism enterprises that include hotels, resorts, and any form of accommodation, as well as related tourism establishments, e.g., restaurants and dive shops. Aiming to advance towards carbon-neutral operations, interventions range from simple measures with low or no investment, through the adoption of innovative practices and technology, the use of renewable resources, and resource efficiency.

During the initial phase of the ZCR from 2009 to 2014, over 500 tourism establishments joined the program, and were given capability workshops on the following topics: energy, water, and resource management; and 3R – Reduce, Replace, Redesign.

Three of the ZCR first-phase participants – Daluyon Beach and Mountain Resort in Palawan, The Manor at Camp John Hay in Baguio City, and Amarela Resort in Bohol – got recognition during the ASEAN Green Hotel Awards from 2014 to 2016. The second phase is ongoing.

The benefits accruing to 297 sampled companies include: accumulated annual savings amounting to US\$8,636,208.76; a reduction in energy of 38 MWh; 714,427,966.30 liters of water saved; and avoided 23,348,538.52 kg of carbon emissions.<sup>10</sup> This project thus builds the case that making businesses more sustainable do not just make economic sense, but also significantly reduces its carbon and water footprint, ensuring long-term growth and resilience.

This project is an example of a blue economy initiative in the tourism sector contributing to achieving the SDGs, in particular SDG 8 (*By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products*); SDG 12 (*Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products*); SDG 13 (climate action); SDG 6 (clean water and sanitation); and SDG 14 (life below water).

In collaboration with DOT, the project has contributed to the development of the **ANAHAW - Philippine Sustainable Tourism Certification**, a national green certification for accommodations and tourism-related enterprises in the Philippines, launched in January 2018. Based on indicator and performance-based metrics, the certification is focused on enabling innovation initiatives that help reduce operational costs and carbon emissions through smart methods, processes and technologies. To reach the minimum standards of this certification, a hotel or resort must comply with the mandatory requirements, and achieve 50 percent of the individual performance measures.

### 12.2.2 Green Fins<sup>11</sup>

The Green Fins initiative aims to protect and conserve coral reefs through environmentally friendly guidelines that promote a sustainable diving and snorkeling industry. Green Fins is coordinated internationally by The Reef World Foundation, in partnership with the UN Environment.

Green Fins is a proven conservation management approach, which has been adopted by 11 countries and nearly 600 individual marine tourism companies since its inception in 2004.

Green Fins encourages and empowers members of the diving industry to act on reducing the pressures on coral reefs by offering dive and snorkel companies practical, low-cost alternatives to harmful practices - such as anchoring, fish feeding and chemical pollution – as well as providing strategic support and resources. Members receive annual assessments, training and feedback

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<sup>10</sup> <https://www.oneplanetnetwork.org/initiative/zero-carbon-resorts-sustainable-development-tourism-sector-philippines-and-thailand>

<sup>11</sup> <http://www.greenfins.net>

to help them reduce their environmental impact in line with the Code of Conduct. By reducing the local direct and indirect pressures tourism puts on coral reefs, it helps make corals healthier and more resilient to other stressors like the effects of climate change.

Among the top members is **Evolution**, located in Malapascua Island, Cebu, Visayas Region (Region VII). Evolution is a small owner-operated resort. Malapascua is known for daily sightings of the famous Thresher sharks at Monad Shoal. The **El Nido Resorts** in Palawan is also another Green Fins member.

### 12.2.3 Ecotourism

Ecotourism is defined as “responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education.”<sup>12</sup> Ecotourism is about uniting conservation, communities, and sustainable travel. This means that those who implement, participate in and market ecotourism activities should adopt the following ecotourism principles:

- Minimize physical, social, behavioral, and psychological impacts.
- Build environmental and cultural awareness and respect.
- Provide positive experiences for both visitors and hosts.
- Provide direct financial benefits for conservation.
- Generate financial benefits for both local people and private industry.
- Deliver memorable interpretative experiences to visitors that help raise sensitivity to host countries’ political, environmental, and social climates.
- Design, construct and operate low-impact facilities.
- Recognize the rights and spiritual beliefs of the Indigenous People in the community, and work in partnership with them to create empowerment.

#### 1. Ecotourism enterprise: Batanes<sup>13</sup>

Batanes is the only province that is also a protected area. It is also the smallest province in the Philippines in terms of size. There are six municipalities located in 3 islands: Batan, Sabtang and Itbayat. Due to the strength of its natural and cultural assets, Batanes is a high value destination that needs proper management for tourism to thrive. It is more vulnerable to changes and to the negative impacts of uncontrolled tourism. Ecotourism enterprise development is being introduced as a strategy to provide an economic incentive for the villagers to maintain and repair their Ivatan houses and to protect their natural resources.

#### 2. Community-based tourism: Sagay, Negros Occidental<sup>13</sup>

Sagay is blessed with one of the biggest marine protected areas in the country – the Sagay marine reserve or SMR. It is composed of small islands, sand bars and shallow reefs. The coastline of the city

<sup>12</sup> The International Ecotourism Society. <https://ecotourism.org/what-is-ecotourism/>.

<sup>13</sup> <http://www.ecotourismphilippines.net>



is dotted with mangrove forests and fishing communities. Suyac island is a small community where the oldest mangrove forest of the city thrives. A community-based tourism project has been established by the City government, and it is providing an economic incentive for the island residents to protect their natural resources.

### **3. Ecotourism business model with community engagement: Palau Island Protected Landscape and Seascape, Cagayan Province**

Palau Island Protected Landscape and Seascape is located at the northeastern-most part of Luzon. Through the Integrated Coastal Resources Management Project (2008-2012), the community was capacitated on various ecotourism services, which served as a framework that is being replicated in many ecotourism destinations in the country. An organised group of island residents called *Palau Environmental Protectors' Association* (PEPA) is actively engaged in the provision of various services to visitors. They had been trained in many skills, including guideship services, community spa management, camp site development, trail management, etc. Palau became the living laboratory of tourism planners who have developed the business model of ecotourism, after years of engagement with the community. Palau has been declared by CNN in 2012 as the 25th among the top 100 beaches in the world. In 2013, it ranked 10th among the top 100, making it a valued destination of Cagayan. The reality show, *Survivor US*, also shot two seasons in 2013, increasing its popularity even more.

### **4. Protecting marine turtles: Mati City, Davao Oriental**

Dahican beach in Mati City, Davao Oriental is frequently visited by marine turtles (*pawikan*), especially from January to June every year, when several females lay their eggs on the beach. Dahican beach is also known for sightings of dugong and whale sharks. Pods of dolphins also pass through the eastern seaboard of Mindanao allowing visitors to experience them during summer. A partner group called *Amihan sa Dahican* has taken it upon themselves to protect the turtle eggs by putting fences around them or transferring them to the hatchery that they have established with assistance from the DENR-Biodiversity Management Bureau. The *Amihan sa Dahican* is a group of young surfers and skim boarders who are passionate about the environment. Some of them had been trained as reef rangers and conduct snorkelling activities with visitors.

### **5. Bucas Grande Flagship Tourism Economic Zone (BGFTEZ): Siargao Island Protected Landscape and Seascape, Surigao Del Norte<sup>14</sup>**

The Surigao del Norte Province has made tourism as one of its main drivers for economic development. Subsequent master plans, such as the Siargao and Bucas Grande Master Plan (2008-2020), have consistently highlighted the role of tourism in the development of the area.

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<sup>14</sup> Source: Provincial Government of Surigao del Norte.

The Tourism Development Goals for BGFTEZ are:

- Tourist arrivals to reach an unprecedented annual growth of 50-75% in the next three years targeting both foreign and local high-end markets from the Generation X and Millennial markets.
- BGFTEZ will be a sustainable ecotourism destination carving a niche market whose average length of stay is 4-5 nights with an average daily expenditure of of PhP 6,500 to PhP 10,000 per person.
- Reforest designated Strict Protection Zones/Watershed in BGFTEZ that can become settings for future tourism developments.
- Prepare designated areas for agriculture that can become sustainable sources of fruits and vegetables as well as a setting for agri-tourism.
- Develop independent water systems in BGFTEZ for reforestation, agriculture and tourism needs.
- Provide an internal road network for mobility within BGFTEZ.
- Create an overall environment and culture of tourism that will add value to the area and attract the investments necessary to build the accommodations and other facilities.

Identified as environmentally fragile and also a protected area under the **Siargao Islands Protected Landscape and Seascape** (SIPLAS), any type of development would create impacts that may affect the environmental quality of the site, thereby potentially distressing the long-term tourism viability of the destination.

## 6. Sustainable tourism in Cuatro Islas Protected Landscape and Seascape, Leyte

The protected area of Cuatro Islas covers an area of 12,500 ha, known for white sandy shores and coral gardens. It is home to *Tridacna* (large saltwater clams), Green and Hawksbill sea turtles. Experts found 287 species of reef-building corals (DENR).

Taking into consideration the carrying capacity and environmental impacts, visitors to Cuatro Islas have been limited to 500 persons per day, with recommendations being considered by the local government to improve waste management, limit snorkelers to 200 per day and entry of boats to the island at 20 per day, and strictly use designated docking areas and mooring zones to mitigate reef destruction. Cruise ships have been docking at Cuatro Islas.

## 12.3 Sustainable and Green Ports

### 12.3.1 Port of Cagayan de Oro

The **Port of Cagayan de Oro** is an international seaport in Mindanao, and it is the most modern outside Metro Manila. It is dubbed as the Global Gateway to Mindanao for its strategic location at the Northern Coast of Mindanao within Macajalar Bay. As the busiest government port in Northern Mindanao in terms of cargo throughput, the port helped spur economic development in this region. The port serves as the entry and exit point of passengers and goods to and forth adjacent urban cities and provinces and other parts of the Philippine archipelago. It also links conveyances to countries,

such as Vietnam, China, Australia and the United States, among others. In 2009, this port has handled more than 3.3 million metric tons of cargoes and served around one (1) million passengers.

This port has been recognized by PEMSEA for its implementation of the **Port Safety, Health and Environmental Management System (PSHEMS)**, which covers three standards: ISO 9001:2008 (Quality Management), ISO 14001:2004 (Environmental Management) and OHSAS 18001:2007 (Occupational Safety and Health). The Port is also compliant with the **International Ship and Port Facility Security (ISPS) Code**.

Among the innovations introduced in this port are: the **Internet-Based Port Operations and Receipting for Terminals System (iPORTS)**; **shore-based power supply for ships using renewable energy**; **solar power for lighting**; and **shore reception facilities** to handle solid and liquid wastes from ships. The Port of Cagayan de Oro received the **Green Port Award** from APEC Port Services Network (APSN) in 2018.

### Installation of Shore-based Power Supply (SBPS):

Ships docked in ports use their auxiliary engines to produce electricity for hotelling, unloading and loading activities. Alternatively, a shore-to-ship power supply can be used to cover the electric demand of ship at berth.

Due to the considerable size and growth rate, the port authority and operators became concerned about the impact of their activities on the environment. The port is motivated to comply with the Philippine Clean Air Act, and in consonance with the port's *Clean, Green and Blue Port Program*, the Port of Cagayan de Oro initiated the implementation of Shore Based Power Supply (SBPS), using renewable energy, the first in PPA port system.

In line with the continuing implementation of the PSHEMS, the port adopted an air emission reduction program.

The system in Cagayan de Oro provides a low voltage power derived from the ports' power supply.



In order to deliver power to ship at berth, a cable reel with a 440V-power cable was installed. The system is capable of delivering 125kW to the ship.

The port has 6 units of Shore-Based Power Supply with a total of 8,455 kilowatts utilization for the year 2017. The power supply system is programmed to expand its services to cater to all vessels docking in the port.

### **Utilization of solar panel lighting at the Port of Cagayan de Oro**

In its earnest effort to use renewable energy, and in congruence with the International Ship and Port Security (ISPS) Code, the PMO installed solar panel lightings to reduce dependence on traditional power supply sources. Even during power outages, the port sufficiently illuminates the berthing facilities and operational and perimeter areas to promote safety, security, efficiency and productivity especially during night-time operations.

### **12.3.2 Port of Batangas**

Increased environmental consciousness in Port of Batangas was a result of concerted efforts of employees triggered by the institutionalization of PSHEMS, with technical assistance from PEMSEA.

In 2017, Port of Batangas was awarded Green Port Award System (GPAS) conferred by the APSN. Among the significant milestones of Port of Batangas in its Greening Project are:

- Establishment of 2.37-ha Tree Park planted with indigenous species. This helps in the absorption of CO<sub>2</sub> and other air pollutants, and improves the microclimatic condition at the port.
- Earth-Balling Permit secured from the DENR to salvage trees affected by the construction of multi-level parking.
- Replacement of streetlights into solar panel lights along major street which generated a monthly average savings of 14,976 kilowatt/hr with an equivalent monetary value of PhP 127,296.00. Additional solar panel completed in 2018 provided an additional monthly savings of 5,452.80kw/hr with an equivalent monetary value of PhP 45,501.06.
- Installation of motion-sensor for lighting facilities at warehouse
- Replacement of High Pressure Sodium Lamps with LED that served as lighting fixture in pier and yard
- Replacement of lighting fixtures with LED bulbs.
- Attainment of Integrated Management System EHSQ Objective of 5% energy reduction from the time it was implemented. The port attained 6% reduction after IMS implementation.
- Designation of Pollution Control Officers to monitor port's environmental performance.
- Continuous implementation of Environmental Education Extension program.

The green ports initiative is an example of transforming the ports and shipping sector to blue economy, and contributing to achieving the SDGs. In particular SDG 8 (*decent work and economic growth*); SDG 11 (*sustainable cities and communities*); SDG 13 (climate action); SDG 3 (good health and well-being); and SDG 14 (life below water).

## Emerging industries

### 12.4 Marine Renewable Energy

Marine renewable energy is supported by **Republic Act no. 9513: Renewable Energy Act** (s. 2008). “*An Act Promoting the Development, Utilization and Commercialization of Renewable Energy Resources and for Other Purposes*”. This law provides following incentives for the renewable energy sector:

- seven-year income tax holiday and tax exemptions for the carbon credits generated from renewable energy sources.
- 10% corporate income tax, as against the regular 30%, is also provided once the income tax holiday expires.
- 1.5% realty tax cap on original cost of equipment and facilities to produce renewable energy.

The **National Renewable Energy Program 2011-2030** (NREP) has set the goal of adopting 9,931.3 megawatts (MW) of renewable energy by 2030. A breakdown of this reveals that wind power will account for the greatest share of this at 23.6 percent (2,345 MW), as shown in **Table 12.1**. On a per technology basis, NREP aims to:

- Increase geothermal capacity by 75 percent
- Increase hydropower capacity by 160 percent
- Deliver additional 277 MW biomass power capacities
- Attain wind power parity with the commissioning of 2,345 MW additional capacities
- Mainstream an addition 284 MW solar power capacities, and pursue the achievement the 1528-MW aspirational target
- Develop the first ocean energy facility

The entry of the above-cited RE-based capacities is highly dependent on the successful implementation of the NREP as well as the policy and incentive mechanisms in the RE Law. Particular attention will be given to the timely conduct of grid impact studies required for all facilities connecting to the grid. Moreover, the **feed-in tariff** (FIT) scheme the country adopted in 2012 provides incentives and targets wind



Caparispisan Wind Farm.

power, biomass, solar power, and hydroelectric power along rivers. The price for wind power has been set at PhP8.53/kWh, which is the second most expensive purchase price after solar power (PhP 8.69/kWh). As of December 2017, the total installed capacity of the various renewable energy sources was 4,751.59 MW (**Table 12.2**).

**Table 12.1:** Renewable Energy Targets from 2011-2030.

Sector	Short Term	Medium Term	Long Term	Total
	2011-2015	2016-2020	2021-2030	
Geothermal	220 MW	1,100 MW	175 MW	<b>1,495 MW</b>
Hydropower	341.3 MW	3,161 MW	1,891.8 MW	<b>5,394.1 MW</b>
Biomass	276.7 MW	0	0	<b>276.7 MW</b>
Biofuels	<ul style="list-style-type: none"> <li>• DC on E10 in 2011</li> <li>• Mandatory E10 to all Gasoline by 2012</li> <li>• PNS for B5 by 2014</li> <li>• DC on B5 by 2015</li> <li>• Mandatory B5 to all Diesel by 2015</li> </ul>	<ul style="list-style-type: none"> <li>• PNS for B20 and E85 by 2020</li> <li>• DC on B10 and E20 by 2020</li> </ul>	<ul style="list-style-type: none"> <li>• DC on B20 and E85 by 2025</li> </ul>	
Wind	200 MW	700 MW	1,445 MW	<b>2,345 MW</b>
Solar	50 MW	100 MW	200 MW	<b>350 MW</b>
Ocean Power	0 MW	35.5 MW	35 MW	<b>70.5 MW</b>
<b>Total</b>	<b>1,088 MW</b>	<b>5,096.5 MW</b>	<b>3,746.80 MW</b>	<b>9,931.3 MW</b>

Source: Department of Energy.

**Table 12.2:** Summary of Renewable Energy Projects as of 31 December 2017.

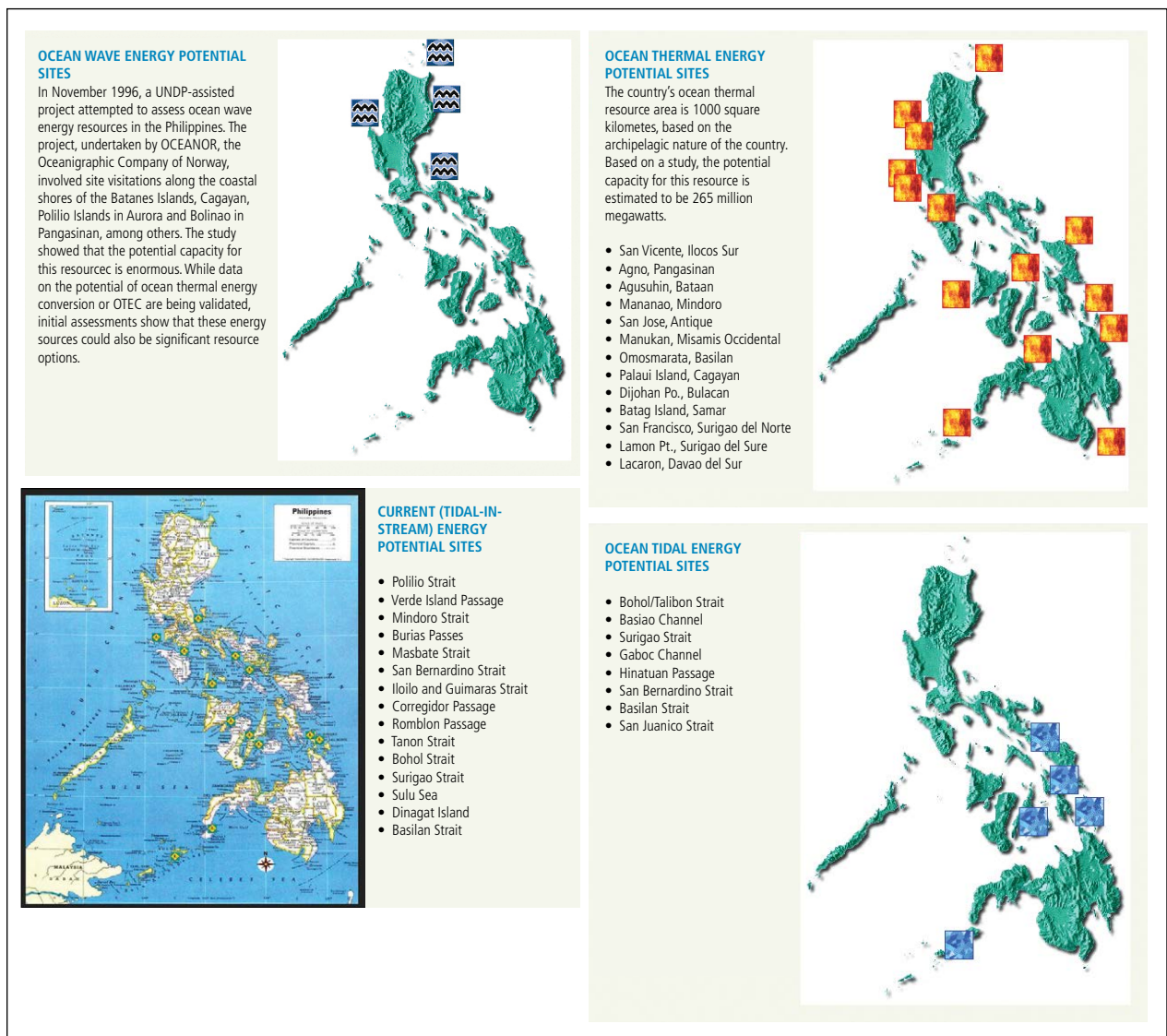
Resources	Awarded Projects		Potential Capacity (MW)		Installed Capacity (MW)	
	Commercial	Own-Use	Commercial	Own-Use	Commercial	Own-Use
Hydro Power	444	-	13,467.53	-	974.79	-
Ocean Energy	7	-	26.00	-	-	-
Geothermal	41	-	575.00	-	1,906.19	-
Wind	65	1	2,461.50	-	426.90	0.006
Solar	216	16	6,882.92	4.286	905.18	3.218
Biomass	55	24	346.68	16.77	407.15	128.16
<b>Subtotal</b>	<b>828</b>	<b>41</b>	<b>23,759.63</b>	<b>21.056</b>	<b>4,620.21</b>	<b>131.38</b>
<b>TOTAL</b>	<b>869</b>		<b>23,780.69</b>		<b>4,751.59</b>	

Source: Department of Energy.

### 12.4.1 Ocean Energy

Ocean energy in the country can come from various sources: wave, currents, tides and thermal. Harvesting ocean energy in the country is still in its infant stages however, potential sites have already been identified where possible wave, current, tidal and thermal energy can be harnessed (**Figure 12.2**). The potential capacity for ocean thermal energy is established to be 265 million megawatts.

**Figure 12.2:** Areas Showing Potential Sources for Wave, Tidal, Current and Ocean Thermal Energy in the Philippines.



Source: Department of Energy.

Applied research and development (R&D) is being undertaken to determine the viability of adapting certain RE systems, technologies or processes in the Philippine setting, in areas where there is no or limited local experience. As may be warranted, demonstration or pilot projects shall be implemented to showcase the feasibility of the technology or process. Research and development projects of DOST-PCIEERD have included marine renewable energy. **Tables 12.3** and **12.4** provide a brief description of some of these projects.

**Table 12.3:** Tidal Current Energy.

<b>Project Title</b>	<b>Tidal Current Energy Integrated Resource Assessment and Spatial Planning Tool</b>
<b>Duration</b>	Two (2) Years (April 2014 – April 2016)
<b>Implementing Agency</b>	Department of Geodetic Engineering, UP Diliman
<b>Project Leader</b>	Engr. Ma. Rosario Concepcion O. Ang
<b>Funding Agency</b>	Philippine Council for Industry, Energy, Emerging Technology Research and Development (PCIERRD)
<b>Description</b>	Estimation of annual energy yield is an important achievement in the course of Ocean Renewable Energy (ORE) development. Simulation and modelling of energy systems would provide a preliminary insight of how much energy and other benefits could be extracted from ocean energy potential sites. These are beneficial steps to take prior to installation and validation, as they probe and quantify, to appreciable accuracy, parameters that will affect the risks for investment and that will impact the existing energy sector, especially those in the nearby islands and immediate local communities.
<b>Project Objectives</b>	The goal of the project is to set groundworks for the advancement of ORE development in the Philippines. Specifically, it aims to: <ol style="list-style-type: none"> <li>1. Develop a robust web GIS-based marine spatial planning tool for analysis of the country's potential sites for the development of Ocean Renewable Energy, i.e., tidal in-stream, wave, ocean thermal</li> <li>2. Perform modelling of energy conversion and estimation of energy yield</li> </ol>
<b>Beneficiaries</b>	<ul style="list-style-type: none"> <li>• Department of Energy (DOE)</li> <li>• Financial Institutions</li> <li>• Local Government Units (LGUs)</li> <li>• People of the Philippines, ENergy Sector (Government and Private)</li> </ul>
<b>Expected Output/s</b>	Web-GIS based marine spatial planning tool for ORE

Source: PCIEERD, 2016.



**Table 12.4:** Ocean Current Energy.

<b>Project Title</b>	<b>Technology Demonstration of Marine Current Energy Technology for Power Generation in the Philippines</b>
<b>Duration</b>	Two (2) Years Six (6) Months (May 2008 – December 2010)
<b>Implementing Agency</b>	University of San Carlos
<b>Project Leader</b>	Dr. Anthony S. Ilano
<b>Funding Agency</b>	Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD)
<b>Description</b>	As a follow up of the initial phase of the promotional program for the MCE in Southeast Asia carried out in 2005, the prototype equipment for the pilot plant to be installed in the Philippines will be built and assembled locally. To the aim technical, operational and conceptual exchange of information and agreement on partnership arrangements have to take place between the technology owners and the technology users. Furthermore, training and specific brainstorming will be organized utilizing competent international expertise.
<b>Project Objectives</b>	<ol style="list-style-type: none"> <li>1. To develop and demonstrate the viability of the Kobold turbine technology for harnessing marine current for power generation;</li> <li>2. To assess and evaluate the potential of the Kobold turbine technology in a selected Philippine site;</li> <li>3. To develop local capability in the development of the technology in the Philippines;</li> <li>4. To assess the marine environment impact of the Kobold Turbine application.</li> </ol>
<b>Expected Output/s</b>	<ol style="list-style-type: none"> <li>1. Local manufacturing and setting in place of a pilot Kobold turbine in the Philippines. The pilot plant is intended to test and prove the efficiency and the viability of exploiting marine current in the Philippines.</li> <li>2. A comprehensive assessment and overview of the most promising locations and sites of the Philippines where the Kobold technology could be used with the most cost-effective advantages for energy production.</li> </ol>

Source: PCIEERD, 2016.

### 12.4.2 Coastal Wind Power

Apart from ocean energy, coastal and offshore wind and solar power are considered as other potential sources of renewable energy. In the **National Renewable Energy Program 2011-2030**, the government targets to harness a total of 2,345 MW from wind and 350 MW from solar power (**Table 12.2**). Technology in wind and solar electricity generation has advanced while the cost has been drastically reduced, thereby enabling these clean renewable energy to now compete with coal, and help in reducing greenhouse gas emissions. Wind power in the



Bangui wind farm. (Photo by M. Ebarvia)

Philippines has gained traction, with installed capacity of 427 MW, and 66 awarded projects in 2017 with potential capacity of 2461.5 MW. Solar farms have an installed capacity of 908 MW as of 2017.

The Philippines is the largest wind power generator in ASEAN. The country's wind energy sector has significant potential and could provide up to 76 gigawatts (GW) of power. Some of the most recent developments are: the Bangui Wind Farm, Burgos Wind Farm, and Caparispisan Wind Farm in Ilocos Norte; the Wind Energy Power System near Puerto Galera, Oriental Mindoro; San Lorenzo Wind Farm in Guimaras; Nabas Wind Farm in Aklan; and Pililla Wind Farm in Rizal. Most of these wind farms are located in coastal municipalities, and they have become tourist attractions as well.

The **Bangui Wind Farm** is located in Ilocos Norte, Philippines. The wind farm uses 20 units of 70-m high Vestas V 821.65 MW wind turbines, arranged on a single row stretching along a 9-km shoreline off Bangui Bay, facing the West Philippine Sea. It is operated by the NorthWind Power Development Corporation. Both the beach and the windmills in Bangui are tourist destinations, which boost economic development in the coastal areas.

Similar to the Bangui Wind farm, the 54-MW **San Lorenzo Wind Farm** in Guimaras, with 27 turbines, is also a tourist destination. Tourists can view 26 wind turbines at Lookout Point Number Seventeen, an integrated tourism center, and on this area stands one turbine. It is operated by Trans Asia Renewable Energy Corporation (TAREC), which plans to add 20 more wind turbines through the construction of the Sibunag Wind Farm. The San Lorenzo wind farm not only generates electricity for the island province of Guimaras, but contributes to the whole Visayas grid.

The 48-MW Wind Energy Power System project being built on a mountain top in Baclayan is expected to boost the ecotourism industry of the resort town of Puerto Galera in Oriental Mindoro. The wind farm overlooks the white beaches and coves of Puerto Galera, which is located within the Verde Island Passage, the world's center of fish diversity. It is operated by Philippine Hybrid Energy Systems Inc. (PHESI). Baclayan is also the source of water supply of Puerto Galera. Of PHESI's 220 employees at the wind farm, 118 are indigenous people or *Mangyans*.

## 12.6 Marine Biotechnology

The *Philippine Marine Drug Discovery and Resources Facility* (PHARMASEAS) was created to extract bioactive compounds specifically from sea snails (*conoidea*) and sponges and sponge-associated organisms with the aim of producing potential high-value pharmaceutical products. The *Philippine Pharmaseas Drug Discovery Program* is one of examples of government-academe collaborations on marine biotechnology research. **Table 12.5** shows the projects under the *Discovery and Development of Health Products (Marine Component) - Phase I* and their specific objectives. The program is implemented by the University of the Philippines–Marine Science Institute (UP-MSI) and the Mindanao State University (MSU).

**Table 12.5:** Marine Biotechnology Projects under the Discovery and Development of Health Products (Marine Component) - Phase I.

Program Title	Project Title	Implementing Agency	Objectives
<b>Discovery and Development of Health Products (Marine Component)- Phase I</b>	High-throughput Multiomics Discovery of Bioactive Marine Compounds and Establishment of a Marine Chemical Library and Informatics Facility	UP-MSI	To set up the Philippine Marine Drug Discovery and Resources Facility (PHARMASEAS) for high-throughput screening (extraction, purification, assays) of marine of compounds and extracts; To characterize chemistry and bioactivity of compounds and extracts from selected sponges, sponge-derived marine microorganism, and conoideans; To discover and express enzymes involved in the biosynthesis of bioactive compounds via genomic and proteomic approaches; To develop a technology for open sea and land-based culture of sponges for production of high-value health products.
	Anti-Pain and Anti-Neurodegeneration Drug Candidates: Discovery and Development	UP-MSI	To discover, characterize and develop antipain and antineurodegeneration compounds from Philippine conoideans and to test their efficacy in electrophysiology and DRG neuroactivity assays.
	Anti-Infective and Anti-Cancer Drug Candidates: Discovery and Development	UP-MSI	To discover, characterize and develop anti-infective and/or anticancer compounds from Philippine marine sponges and associated microorganisms, to test the efficacy in in vitro assays and animal models of infection or cancer.
	Extraction, Purification, Cytotoxicity, Antioxidant Potential and Antimicrobial Assessments of the Secondary Metabolites from Marine Sponges Collected off the Coasts of Mindanao	MSU-IIT	To obtain various polar and non-polar extracts and bioactive semi-pure/ pure compounds from marine sponges collected off the coasts of Mindanao

Source: DOST.

The establishment of Tuklas Lunas Centers all around the Philippines in 2012 also unified the efforts of various institutions in the discovery of new bioactive compounds from natural sources– furthering biotechnology research in the country. The program gives research funds to selected (government or non-government) institutions to develop standardized herbal drugs from natural sources, and to identify and characterize high-value purified active compounds derived from marine and terrestrial sources for specific therapeutic indications. ([www.healthresearch.ph/index.php/about-pnhrs](http://www.healthresearch.ph/index.php/about-pnhrs))

Marine biotechnology is an emerging blue economy industry. It also contributes to SDG 3 (Good health and well-being) and SDG 14.

## 12.7 Investment Opportunities: Ship-building and Ship Repair

As the world's 4<sup>th</sup> shipbuilding nation, the Philippines is still considered a "Go To" location for shipbuilding activities. This is because the Philippines has a pool of qualified, skilled and trainable manpower, with protected areas for ships against rough seas and strong winds, has adequate space and water depths for anchorage and entry/launching of ships, has sea channels favorable for sea trials, and yard areas that have a distant proximity to communities. **Figure 12.3** shows the areas that are suitable for setting up shipyards.

### (a) Ship recycling

Besides shipbuilding and ship repair, the development of ship breaking or ship recycling yards/facilities is also considered an investment opportunity in the country. Considering the older age of the existing ships and entry of newer modern ships, ship recycling and/or ship breaking of uneconomical ships is inevitable.

**Table 12.6:** Philippine Ship Breaking/Recycling Entities.

MRO/Location	Number of Ship-breaking Entities
<b>Central Office</b>	
Tondo, Manila	1
Navotas City	1
Mariveles, Bataan	1
<b>MROVI</b>	
Iloilo City	1
<b>MROVII</b>	
Consolacion, Cebu	2
San Fernando, Cebu	1
<b>TOTAL</b>	<b>7</b>

Source: MARINA.

### (b) Marine Industrial Hubs

Furthermore, the government, through the collaboration of the different concerned agencies, is presently inclined and working for the development of **Marine Industrial Hubs**. These industrial hubs to be strategically located in the Luzon, Visayas, and Mindanao are being drafted to enhance the operations of shipbuilding and ship repair in the country.

At present, MARINA, through the Shipyards Regulation Service (SRS), is primarily charged with the registration/licensing of shipyards to operate in the Philippines (excluding shipyards operating in Freeport Zones and catering foreign ships and for foreign registry only). In registering a shipyard in the Philippines, the SRS is being guided by the *MARINA Memorandum Circular (MC) No. 2007-02*. The MC provides for the submission of pertinent Company permits and documents, such as local business permit, environmental compliance certificate for its operation, information on its financial capability, personnel and facilities/ equipment. It also provides for the required regular inspections on the shipyard to ensure its continuous compliance to the requirements provided thereof. Nonetheless, the said MC is being reviewed and to be revised as necessary to adopt to the changes in the industry and effectively support and enhance the Philippine SBSR.

As to the registration/licensing of Ship Breaking entities, SRS is presently being guided by MARINA MC No. 95. However, the said MC is in the process of revision in order to adopt and support more responsible breaking or recycling of ships.

To encourage investments and to ensure the development of a viable shipbuilding industry, the following incentives are granted:

To encourage investments and to ensure the development of a viable industry in shipbuilding, ship repair and ship recycling, the aforementioned are listed under the 2017 Investments Priorities Plan (IPP), and the following incentives may be granted:

- **For Projects Registered with the Board of Investments (BOI)**

- (1) Income Tax Holiday
  - (a) 6 years – Pioneer or located in Less Development Area (LDA)
  - (b) 4 years – New with Non-Pioneer status
- (2) Duty exemption on imported Capital Equipment, Spare Parts and accessories under E.O. 85
- (3) Exemption from wharfage dues and any export tax, duty, impost and fees;
- (4) Other Incentives (if applicable)
  - (a) Tax and duty-free importation of consigned equipment;
  - (b) Additional deduction for labor expense
  - (c) Employment of foreign nationals;
  - (d) Simplification of customs procedures; and
  - (e) Access to bonded manufacturing warehouse
  - (f) Others: Exemption from payment of business tax (4 years for Non-Pioneer; 6 years for Pioneer)

- **For Projects Registered with the Philippine Economic Zone Authority (PEZA)**

- (1) Income Tax Holiday for 4 to 8 years
- (2) Special 5% tax rate on gross income after the lapse of ITH

- (3) Tax and duty exemption on imported capital equipment
- (4) Exemption from 12% input VAT on allowable local purchase of goods and services (e.g., communication charges)
- (5) Unrestricted use of consigned equipment
- (6) Employment of foreign nationals

### (c) Ship design and manufacturing of eco-ships

As one of the emerging industries with great significance in a developing country like the Philippines, the Shipbuilding and Ship Repair industry needs to continuously innovate and improve in order to meet the demands required of it. Hence, best practices should be effectively employed in such industry to attain objectives and obtain the full benefit it can offer.

Shipyards undertaking shipbuilding normally provide ship designs in accordance to the operational requirements and satisfaction of ship owners. With the emergence of the so-called **eco-ship**, the industry is now very much concerned with the design of ships that are much more efficient than that of the existing ships. Eco-ships are designed and constructed primarily to be economically efficient and reduce the burning of fuels that normally generate pollution. Presently, some of the large Philippine shipyards have such designs, and are continuously improving and optimizing to attain its full advantage. The whole Philippine Shipbuilding Industry is gearing towards more efficient and 'green' ships. In addition, actions are being taken in preparation for the compliance of the industry to the IMO sulfur cap.

**Figure 12.3:** Available Areas Suitable to Set up Shipyards in the Philippines.



Source: BOI (2017).

PART 4

STATE OF OCEAN HEALTH  
UNDERPINNING THE  
BLUE ECONOMY

# 13 Oceanography and Other Physico-Chemical Features

## 13.1 Oceanography<sup>15</sup>

Physical parameters, such as water circulation, bathymetry (ocean depth in relation to the sea surface), temperature (sea surface and sub-surface), salinity and density, greatly affect the distribution and behavior of all organisms in the ocean. Primary productivity, for example is highest in areas with upwelling where nutrient-rich water from the deep part of the ocean are forced up into the surface, providing sustenance for primary producers – which in turn are food source for organisms in the higher trophic levels.

### 13.1.1 Ocean Circulation

The ocean circulation around the Philippine Archipelago (**Figure 13.1**) is a by-product of the complex dynamics of the bathymetry, the seasonally reversing monsoons and the tidal and non-tidal circulation between the West Philippine Sea (WPS) and the Western Pacific (Wang et al., 2008; Han et al., 2009; Gordon et al., 2011 as cited in Villanoy et al., 2011). The North Equatorial Current bifurcates at around 14°N (Nitani, 1972; Toole et al., 1990; Qiu and Lukas, 1996; Qiu and Lukas, 2003) which create the boundaries for the Mindanao Current and Kurushio Current. Waters from the Western Pacific are directly connected to the Philippine seas through the San Bernardino and Surigao Straits. Water from the Pacific seeps into the interior seas of the archipelago (Sibuyan and Bohol Seas) through both straits and also – at a greater extent through the deep Luzon Strait that leads directly into the West Philippine Sea (Metzger and Hurlburt, 1996, 2001; Centurioni et al., 2004; Qu et al., 2006).

Water from the western side of the archipelago (West Philippine Sea) enters into the interior seas through the Mindoro and Panay Straits. This is interconnected with the Sulu, Bohol and Sibuyan seas through the Tablas and Dipolog Straits and the Verde Island Passage (VIP). The southern part of the WPS is also connected to the Sulu Sea through the Balabac Strait. Sulu Sea on the other hand, is also interconnected to the Celebes or Sulawesi Sea through the Sibutu passage.

The bodies of water in the interior portions of the Philippine archipelago have its own unique circulation and stratification patterns as it is subjected to monsoonal winds, unique bathymetric

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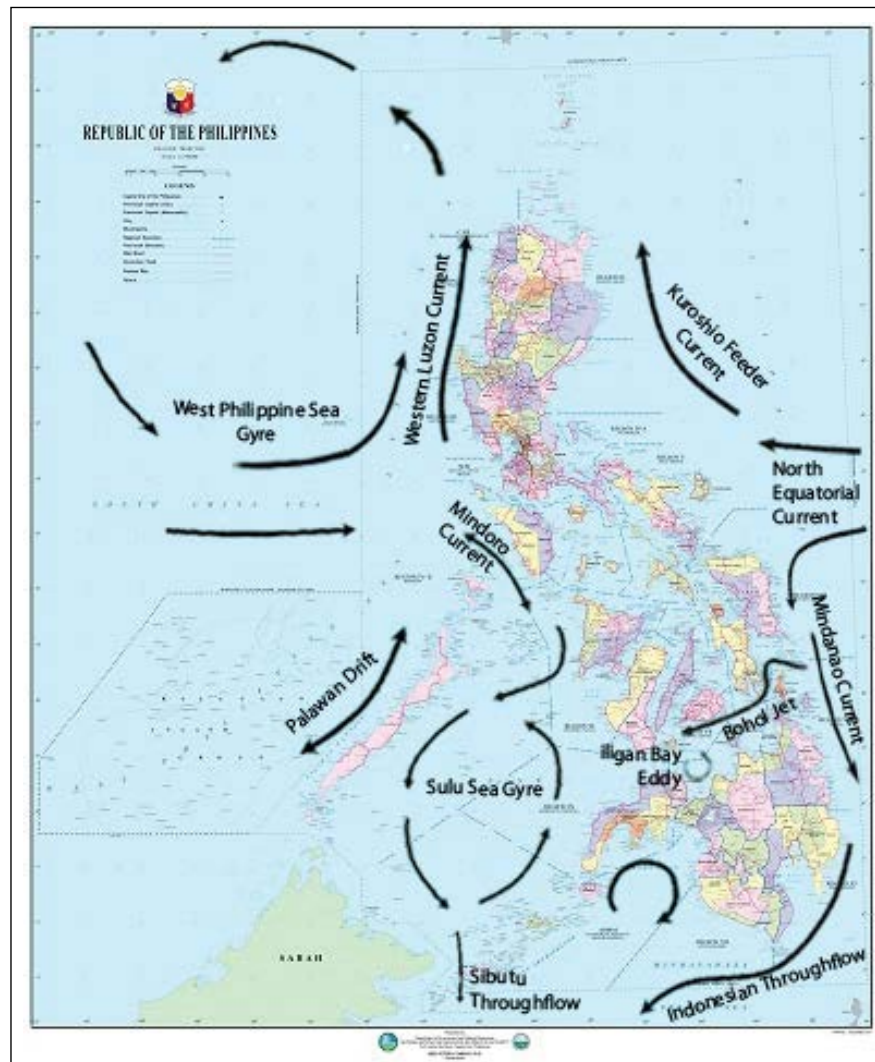
<sup>15</sup> The information in this section is taken from ADB, 2014, with additional data from DENR, PCAARRD and PAGASA.



and geomorphologic characteristics (Pullen et al., 2008, 2011; May et al., 2011), sea-air interaction processes, land-based freshwater inputs and tidal currents. Isolated basins, like the Sulu Sea and the Bohol and Sibuyan seas, are ventilated through overflows across <500-m deep topographic sills.

During monsoon surges, the Northeast and Southwest monsoon winds often give rise to lee eddies and wind stress curl zones as they are forced to pass through complex topography in between islands (Pullen et al., 2008, 2011). The forced movement of winds in between island masses can bring about upwelling, such as that in the northern coast of Zamboanga Peninsula or downwelling, which usually occurs in the leeward sides of the islands (Chavanne et al., 2002).

**Figure 13.1:** Water Circulation Around the Philippine Archipelago.

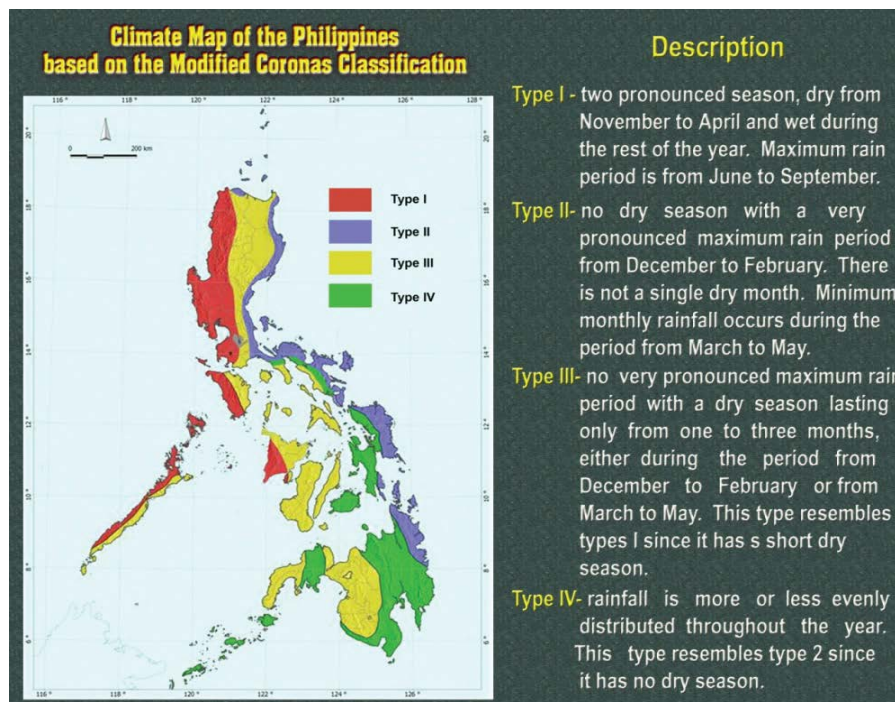


Source: modified from David et al., 2012.

### 13.1.2 Climate

Climate in the Philippines is largely dominated by the Asian monsoon that blows northeast between December and March, locally known as *amihan*, and winds that blow southwest between June and October, locally known as *habagat* (Wang, et al. 2001). The characteristic patterns of the Asian monsoon affect the wind, rainfall and temperature patterns in the country. The climate is classified according to the Philippine Corona Classification (PCC) (**Figure 13.2**). Being an archipelago, the over-all climatology of the country is characterized by decadal patterns of variability as a result of the Pacific Decadal Oscillations (PDO), and the monsoonal patterns.

**Figure 13.2:** Climate Map of the Philippines Based on the Modified Corona Classification.



Source: <http://kidlat.pagasa.dost.gov.ph/cab/statfram.html>.

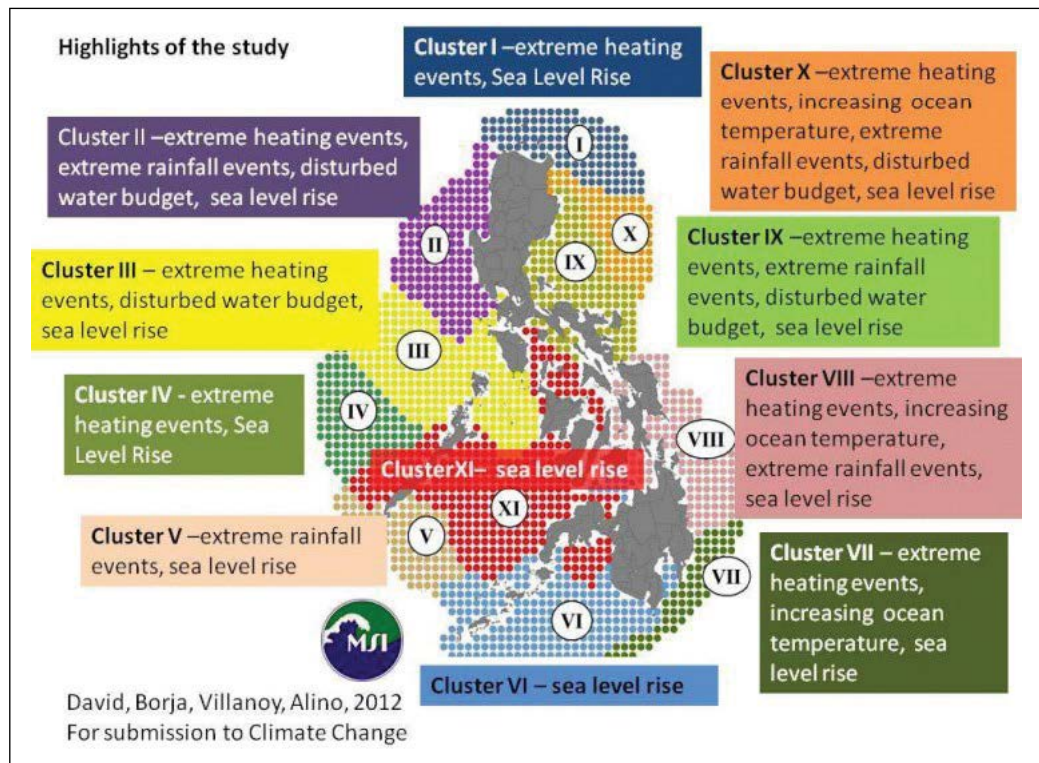
The Department of Science and Technology (DOST) – Philippine Council for Agriculture and Aquatic Resource and Research Development (PCAARRD) provided a complimentary classification system of the seas around the archipelago through the *Remote Sensing Information for Living Environments and Nationwide Tools for Sentinel Ecosystems in our Archipelagic Seas Program for Climate Change* (RESILIENT SEAS Program, 2009-2012). The climatology pattern divides the seas surrounding the Philippine archipelago into 11 distinct clusters (David, 2012) (**Figure 13.3**). The clusters are characterized by their direct exposure to a unique set of conditions brought about by complex land-sea interactions in the coastal and marine environments (e.g., precipitation, sea surface temperature, sea surface height, etc.). This classification is useful for formulating climate change adaptation measures.

Areas which experience the highest increase in sea surface temperature (SST) are grouped under Cluster 1. Clusters II, III, VI, VII and X show the highest increase in SST during negative PDO occurring every 10

years. During episodes of El Niño, Cluster II show a negative change in SST while positive change occurs during periods of La Niña. Clusters II to IV have distinctly pronounced rainfall during the southwest monsoon (June to October). During the northeast monsoon, most clusters exhibit cooler SST except for Clusters V to VII. Strong monsoonal winds are most experienced in Clusters I, VII, IX and X, especially during the northeast monsoon.

Clusters I to V extend from the north to the south and are the most directly exposed to the southwest monsoon. Clusters VIII to X on the other hand are most exposed to the northeast monsoon. The first three clusters (I to III) almost correspond to the Type 1 climate of the modified PCC. The overlapping Clusters of III, IV and V and some parts of Cluster VI highly corresponds to the Type III of PCC. Clusters VI to VII and some parts of IV are comparable to Type IV of PCC. Lastly, Clusters VIII-X are most similar to the Type II of the PCC.

**Figure 13.3:** Climate Typologies in the Philippines.



Source: David, 2012.

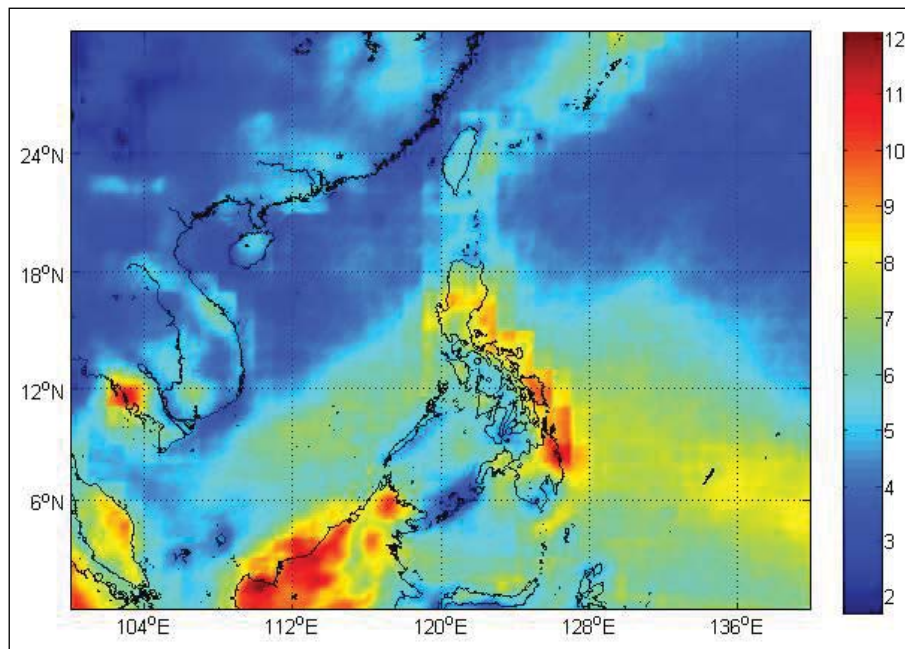
### 13.1.3 Hydrology

The Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) reports that the mean annual rainfall in the country varies annually from 965 to 4,064 millimeters (mm). Baguio City, eastern Samar, and eastern Surigao receive the greatest amount of rainfall while the

southern portion of Cotabato receives the least amount of rain.<sup>16</sup> The average surface runoff is estimated to be at 125,790 million cubic meters (mcm) per year (ADB, 2014). However, different parts of the country receive varying amounts of precipitation in a year (**Figure 13.4**).

The amount of water available for consumption per day is estimated to be around 431 mcm per day while estimated total demand for water in the country is 77 mcm per day (ADB, 2014). The agricultural sector consumes the most amount of water resources primarily for irrigation purposes to water an estimated 1.5 million ha of cropland all throughout the country. It accounts for 84 percent of the total water demand or around 64.68 mcm per day. On the other hand, water consumption of domestic sources is estimated at 4.64 mcm per day or six percent of the estimated demand. Around 8 percent of the total water consumption is used for commercial and industrial purposes. Non-consumptive uses are power generation and recreational use.

**Figure 13.4:** Daily Mean Rainfall Distribution in the Philippines.



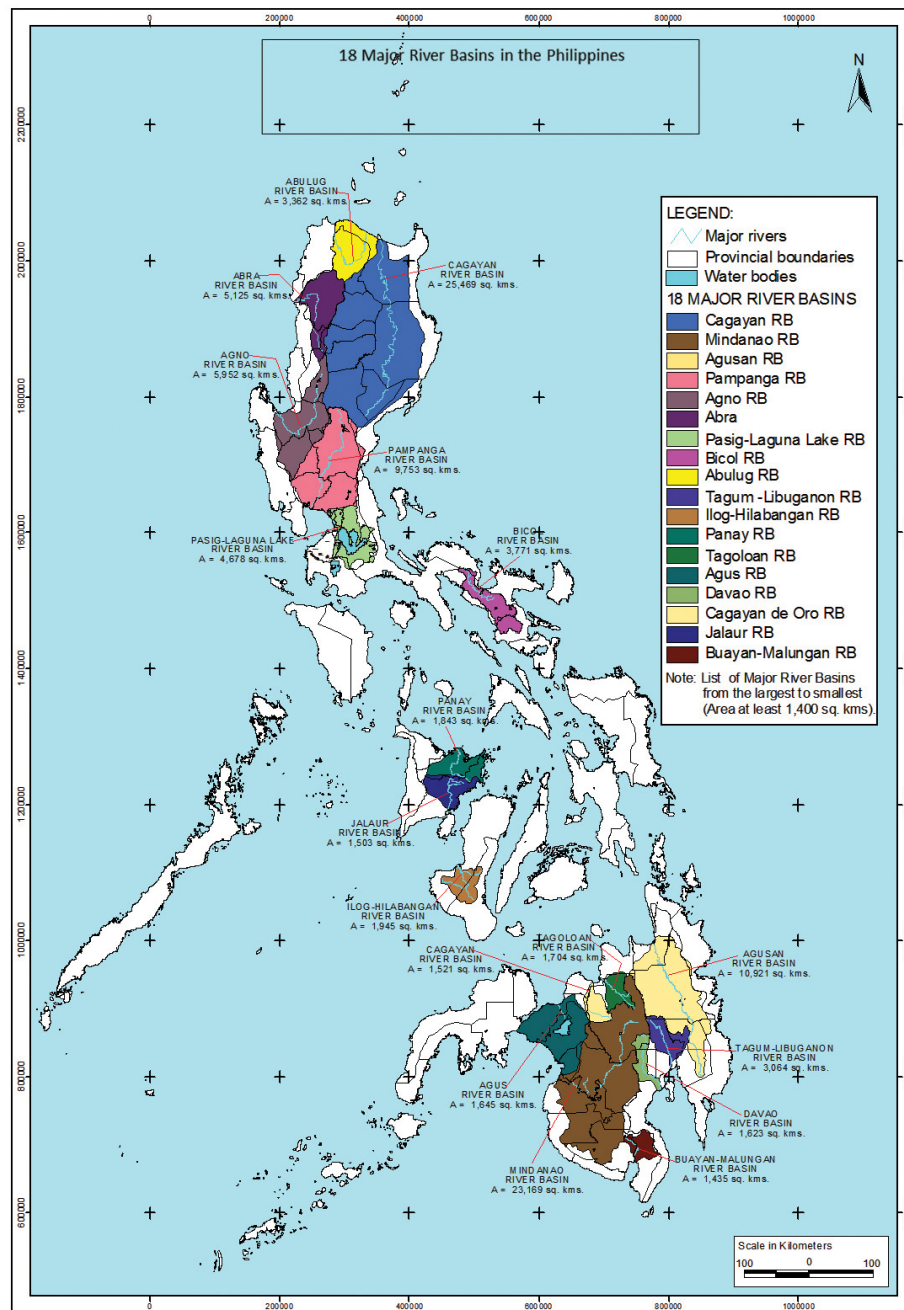
Source: RESILIENT SEAS Project, DOST-PCAMRD 2011.

As reported in the *Philippine Biodiversity Strategy and Action Plan (PBSAP) 2015-2028*, the Philippine Biodiversity Conservation Priorities identified 216 lakes, 421 principal rivers and 22 marshes, swamps and lakes all over the country. These are the primary sources of surface freshwater. Groundwater drawn from aquifers comprises 14% of the Philippines' total water resource potential (Philippine Environment Monitor 2003). Cagayan River is the longest, largest and widest river in the country and traverses the provinces of Nueva Vizcaya, Quirino, Isabela and Cagayan. The river's mouth covers the Babuyan Channel and Cagayan and empties into the Aparri estuary (DENR, 2015).

<sup>16</sup> [pagasa.dost.gov.ph/index.php/27-climatology-and-agrometeorology](http://pagasa.dost.gov.ph/index.php/27-climatology-and-agrometeorology).

Seventy percent (70%) of the country's total land area are watersheds. The country has 18 major river basins: seven of which are found in Luzon, three in the Visayas, and eight in Mindanao. However, many of the country's watersheds are considered to be in a critical state as they are exposed to highly destructive anthropogenic activities, e.g., pollution, logging, and upland farming. Seventeen of the major watersheds in the Philippines are in the critical list, namely: Santo Tomas, Busol, Lonoy, Angat, Marikina, Kaliwa, Umiray, Maasin, Mananga, Kotkot-Lusaran, Binahaan, Pasonangca, Ambogoc, Mahoganao, Malagos, Koronadal, and Lake Lanao.

**Figure 13.5:** Major River Basins in the Philippines.



Source: National Water Resources Board: [nwr.gov.ph/index.php/products-and-services/water-resources-region-map](http://nwr.gov.ph/index.php/products-and-services/water-resources-region-map).

## 13.2 Water Quality

Water quality monitoring for both inland and coastal waters is under the responsibility of the Environmental Management Bureau of the Department of Environment and Natural Resources (DENR-EMB). In 2016, a new Administrative Order for the classification of water bodies was implemented, the *DENR Administrative Order 2016-08*, in compliance with section 19e and 19f of RA 9275 (Clean Water Act). *DAO 2016-08* provides water body classification (**Table 13.1**), new water quality guidelines for primary parameters (**Table 13.2**), and effluent quality parameters based on the most common pollutants created by specific industries (e.g., inorganics, metals, organics) (**Tables 13.3**).

**Table 13.1:** Water Body Classification for Freshwater and Marine Water Bodies Based on the DAO 2016-08.

Water Body Classification and Usage of Freshwater	
Classification	Intended Beneficial Use
<b>Class AA</b>	Public Water Supply Class I - intended primarily for waters having watersheds, which are uninhabited and/or otherwise declared as protected areas, and which require only approved disinfection to meet the latest PNSDW.
<b>Class A</b>	Public Water Supply Class II - intended as sources of water supply requiring conventional treatment (coagulation sedimentation, filtration and disinfection) to meet the latest PNSDW.
<b>Class B</b>	Recreational Water Class I - intended for primary contact recreation (bathing, swimming, etc.)
<b>Class C</b>	<ol style="list-style-type: none"> <li>1. Fishery water for the propagation and growth of fish and other aquatic resources</li> <li>2. Recreational Water Class II - for boating, fishing, or similar activities</li> <li>3. For agriculture, irrigation, and livestock watering</li> </ol>
<b>Class D</b>	Navigable waters
Water Body Classification and Usage of Freshwater	
<b>Class SA</b>	<ol style="list-style-type: none"> <li>1. Protected Waters - waters designated as national or local marine parks, reserves, sanctuaries and other areas established by law (Presidential Proclamation 1801 and other existing laws) and/or declared as such by appropriate government agency, LGUs, etc.</li> <li>2. Fishery Water Class I - suitable for shellfish harvesting for direct human consumption</li> </ol>
<b>Class SB</b>	<ol style="list-style-type: none"> <li>1. Fishery Water Class II - waters suitable for commercial propagation of shellfish and intended as spawning areas for milkfish (<i>Chanos chanos</i>) and similar species</li> <li>2. Tourist Zones - for ecotourism and recreational activities</li> <li>3. Recreational Water Class I - intended for primary contact recreation (bathing, swimming, skin diving, etc.)</li> </ol>
<b>Class SC</b>	<ol style="list-style-type: none"> <li>1. Fishery Water Class III - for the propagation and growth of fish and other aquatic resources and intended for commercial and sustenance fishing</li> <li>2. Recreational Water Class II - for boating, fishing, or similar activities</li> <li>3. Marshy and/or mangrove areas declared as fish and wildlife sanctuaries</li> </ol>
<b>Class SD</b>	Navigable waters

Source: DENR.



Wastewater discharge from a coastal resort. (Photo by M. Ebarvia)

**Table 13.2:** Water Quality Guideline for Primary Parameters.

Parameter	Unit	Water Body Classification								
		AA	A	B	C	D	SA	SB	SC	SD
BOD	mg/L	1	3	5	7	15	N/A	N/A	N/A	N/A
Chloride	mg/L	250	250	250	350	400	N/A	N/A	N/A	N/A
Color	TCU	5	50	50	75	150	5	50	75	150
Dissolved Oxygen <sup>(a)</sup>	mg/L	5	5	5	5	2	6	6	5	2
Fecal Coliform	MPN/100mL	<1.1	<1.1	100	200	400	<1.1	100	200	400
Nitrate as NO <sub>3</sub> -N	mg/L	7	7	7	7	15	10	10	10	15
pH (Range)		6.5-8.5	6.5-8.5	6.5-8.5	6.5-9.0	6.5-9.0	7.0-8.5	7.0-8.5	6.5-8.5	6.0-9.0
Phosphate	mg/L	<0.003	0.5	0.4	0.4	5	0.1	0.5	0.5	5
Temperature <sup>(b)</sup>	°C	26-30	26-30	26-30	25-31	25-32	26-30	26-30	25-31	25-32
Total Suspended Solids	mg/L	25	50	65	80	110	25	50	80	110

Notes:

MPN/100mL - Most Probable Number per 100 milliliter

N/A - Not applicable

TCU - True Color Unit

(a) Samples shall be taken from 9:00 AM to 4:00 PM.

(b) The natural background temperature as determined by EMB shall prevail if the temperature is lower or higher than the WQG; provided that the maximum increase is only up to 10 percent and that it will not cause any risk to human health and the environment.

Source: DENR.

**Table 13.3:** Effluent Standards (DAO 2016-08).

Parameter	Unit	Water Body Classification								
		AA	A	B	C	D	SA	SB	SC	SD
Ammonia as NH <sub>3</sub> -N	mg/L	NDA	0.5	0.5	0.5	7.5	NDA	0.5	0.5	7.5
BOD	mg/L	NDA	20	30	50	120	NDA	30	100	150
Boron	mg/L	NDA	2	2	3	12	NDA	2	20	80
Chloride	mg/L	NDA	350	350	450	500	NDA	N/A	N/A	N/A
COD	mg/L	NDA	60	60	100	200	NDA	60	200	300
Color	TCU	NDA	100	100	150	300	NDA	100	150	300
Cyanide as Free Cyanide	mg/L	NDA	0.14	0.14	0.2	0.4	NDA	0.04	0.2	0.4
Flouride	mg/L	NDA	2	2	2	4	NDA	3	3	6
Nitrate as NO <sub>3</sub> -N	mg/L	NDA	14	14	14	30	NDA	20	20	30
pH (Range)		NDA	6.0-9.0	6.0-9.0	6.0-9.5	5.5-9.5	NDA	6.5-9.0	6.0-9.0	5.5-9.5
Phosphate	mg/L	NDA	1	1	1	10	NDA	1	1	10
Selenium	mg/L	NDA	0.02	0.02	0.04	0.08	NDA	0.02	0.2	0.4
Sulfate	mg/L	NDA	500	500	550	1,000	NDA	500	550	1,000
Surfactants (MBAS)	mg/L	NDA	2	3	15	30	NDA	3	15	30
Temperature <sup>(h)</sup>	°C change	NDA	3	3	3	3	NDA	3	3	3
Total Suspended Solids	mg/L	NDA	70	85	100	150	NDA	70	100	150
Arsenic	mg/L	NDA	0.02	0.02	0.04	0.08	NDA	0.02	0.04	0.08
Barium	mg/L	NDA	1.5	1.5	6	8	NDA	1.5	2	8
Cadmium	mg/L	NDA	0.006	0.006	0.01	0.02	NDA	0.006	0.01	0.02
Chromium as Hexavalent Chromium (Cr <sup>6+</sup> )	mg/L	NDA	0.02	0.02	0.02	0.04	NDA	0.1	0.1	0.2
Copper as dissolved Copper	mg/L	NDA	0.04	0.04	0.04	0.08	NDA	0.04	0.04	0.08
Iron	mg/L	NDA	5	5	7.5	35	NDA	7.5	7.5	35
Lead	mg/L	NDA	0.02	0.02	0.1	0.2	NDA	0.02	0.1	0.2
Manganese	mg/L	NDA	2	2	2	20	NDA	4	4	40
Mercury	mg/L	NDA	0.002	0.002	0.004	0.008	NDA	0.002	0.004	0.008
Nickel	mg/L	NDA	0.1	0.2	1	5	NDA	0.2	0.3	1.5
Zinc	mg/L	NDA	4	4	4	8	NDA	0.1	1.5	3



Table 13.3: Effluent Standards (DAO 2016-08). (cont.)

Parameter	Unit	Water Body Classification								
		AA	A	B	C	D	SA	SB	SC	SD
Benzo(a)pyrene	µg/L	NDA	1.5	1.5	3	6	NDA	1.5	3	6
BTEX	mg/L									
Benzene	mg/L	NDA	0.1	0.1	0.5	5	NDA	0.1	0.5	5
Toluene	mg/L	NDA	3.5	5	20	25	NDA	5	20	25
Ethylbenzene	mg/L	NDA	1.5	1.5	7.5	10	NDA	1	7.5	10
Xylenes	TCU	NDA	5	5	15	18	NDA	5	15	18
Malathion (Organophosphate)	µg/L	NDA	1	1	3	6	NDA	1	3	6
Oil and Grease	mg/L	NDA	5	5	5	15	NDA	5	10	15
Polychlorinated Biphenyls <sup>(i)</sup>	µg/L	NDA	<0.1	<0.1	<0.1	<0.1	NDA	<0.1	<0.1	<0.1
Phenol and Phenolic Substances <sup>(j)</sup>	mg/L	NDA	0.01	0.01	0.5	5	NDA	0.01	0.5	5
Trichloroethylene	mg/L	NDA	0.7	0.7	9	20	NDA	0.7	9	20
Total Organochlorine Pesticides <sup>(k)</sup>	µg/L	NDA	<0.419	50	50	50	NDA	50	50	50
Aldrin	µg/L	NDA	<0.02	<0.02	<0.02	<0.02	NDA	<0.02	<0.02	<0.02
Chlordane	µg/L	NDA	<0.02	<0.02	<0.02	<0.02	NDA	<0.02	<0.02	<0.02
DDT	µg/L	NDA	<0.04	<0.04	<0.04	<0.04	NDA	<0.04	<0.04	<0.04
Dieldrin	µg/L	NDA	<0.02	<0.02	<0.02	<0.02	NDA	<0.02	<0.02	<0.02
Endrin	µg/L	NDA	<0.02	<0.02	<0.02	<0.02	NDA	<0.02	<0.02	<0.02
Heptachlor	µg/L	NDA	<0.02	<0.02	<0.02	<0.02	NDA	<0.02	<0.02	<0.02
Lindane	µg/L	NDA	<0.02	<0.02	<0.02	<0.02	NDA	<0.02	<0.02	<0.02
Methoxychlor	µg/L	NDA	<0.03	<0.03	<0.03	<0.03	NDA	<0.03	<0.03	<0.03
Toxaphene	µg/L	NDA	<0.03	<0.03	<0.03	<0.03	NDA	<0.03	<0.03	<0.03
Fecal Coliform	MPN/100mL	NDA	4	200	400	800	NDA	200	400	800
Total Coliform	MPN/100mL	NDA	3,000	3,000	10,000	15,000	NDA	3,000	10,000	15,000

## Notes:

NDA - No Discharge Allowed

(g) General Effluent Standards (GES) values are maximum allowable unit.

(h) GES values for temperature refer to the temperature difference of the background value and discharge point. Specific sampling locations shall be established based on the EMB Ambient Water and Effluent Quality Monitoring Manual. Sampling locations for temperature monitoring, established and approved by EMB, prior to this Order shall remain valid.

(i) PCBs include the nine Aroclors and 19 individual PCB congeners described in Section 6.1 of this Order.

(j) Phenols include 2-chlorophenol, 2,4-dichlorophenol, and 2,4,6-trichlorophenol

(k) When monitoring for Class A waters, the individual organochlorine pesticides shall be monitored. For Class B, C, D, SB, SC, and SD, Total Organochlorine Pesticides shall be monitored, which refers to the organochlorine pesticides listed in Table 0-2 plus BHC, 4,4DDE, Endosulfan (I, II, and sulfate).

Source: DENR.

As of 2018, there have been 1,037 water bodies (marine and freshwater) classified by DENR-EMB from various regions of the country – comprising of 917 freshwater bodies and 122 marine water bodies (**Table 13.4**).

**Table 13.4:** Classified Water Bodies by DENR-EMB as of 2018.

Region	Freshwater bodies					Marine and coastal waters				Total
	AA	A	B	C	D	SA	SB	SC	SD	
I	–	9	7	11	–	–	1	1	–	<b>29</b>
II	–	3	11	42	5	–	–	–	–	<b>61</b>
III	–	19	16	41	2	–	3	2	–	<b>83</b>
IV-A	–	4	24	41	–	–	–	1	–	<b>70</b>
IV-B	1	20	14	35	4	4	11	9	–	<b>98</b>
V	–	26	16	22	2	–	4	5	–	<b>75</b>
VI	1	28	23	41	1	1	14	11	–	<b>120</b>
VII	1	23	16	12	3	2	7	3	–	<b>67</b>
VIII	–	3	9	48	–	–	1	8	2	<b>69</b>
IX	–	32	42	7	–	–	5	3	–	<b>89</b>
X	–	48	3	16	–	2	–	2	–	<b>71</b>
XI	2	10	16	14	2	–	5	1	–	<b>50</b>
XII	–	9	16	22	5	–	–	5	–	<b>57</b>
CARAGA	–	17	2	14	8	1	4	3	–	<b>49</b>
CAR	2	11	21	9	–	–	–	–	–	<b>43</b>
NCR	–	–	–	5	–	–	1	–	–	<b>6</b>
<b>Total</b>	<b>7</b>	<b>262</b>	<b>236</b>	<b>380</b>	<b>32</b>	<b>10</b>	<b>56</b>	<b>54</b>	<b>2</b>	<b>1037</b>

Source: DENR database, 2018.

Classification includes principal rivers, other rivers and lakes. Majority of the freshwater bodies were classified as Class C, which indicates that their intended beneficial use are for fisheries, recreation (non-contact, such as boating and fishing), and agriculture, irrigation and livestock watering.

### Coastal and Marine Water Assessment

A total of 122 coastal areas from all around the Philippines were assessed and classified by the DENR – Environmental Management Bureau (EMB) as of the year 2018. Around 46 percent of the coastal waters (56 out of 122) sampled by DENR were classified as Class SB, sites that are fit for tourism, recreational and fishery use.

The *Guidelines for Recreational Waters* under Sec. 3.1 of the Memorandum Circular 2016-006 state that all recreational waters shall be monitored using the primary parameters, which are the fecal coliform and pH. The 2017 data for fecal coliform concentration in recreational waters covered 351 monitoring stations in beaches, bathing waters, and beach resorts all around the country. As shown in **Table 13.5**, only 39% of the monitored recreational waters passed the DENR-EMB standards for fecal coliform based on the Class SB water quality parameters (100 MPN/100 mL). This indicates that more action and investments are needed on sanitation and wastewater management. Fecal Coliform level is especially significant for Class SB water bodies as activities in these waters involve high human interaction (e.g., bathing, swimming, and diving); hence, exposing humans to the threat of diseases caused by bacteria.

**Table 13.5:** Fecal Coliform Counts in Recreational Waters (Class SB), 2017.

Region	No. of Monitoring Stations	Failed	Passed
I	28	18	10
II	16	7	9
III	18	15	3
IVA	28	26	2
IVB	16	12	4
V	28	24	4
VI	44	14	29
VII	26	26	0
VIII	24	0	24
IX	36	36	0
X	13	6	7
XI	31	18	14
XII	14	0	14
CARAGA	29	13	16
<b>Total</b>	<b>351</b>	<b>215 (61%)</b>	<b>136 (39%)</b>

Source: DENR Database, 2018.

Data on selected recreational water bodies that were monitored for pH levels, on the other hand, show readings that range from 7.00 to 8.48 (**Table 13.6**). To be able to pass as tourist zones (Class SB), pH levels in recreational waters need to be between 7.0 and 8.5. All of the monitored recreational water bodies are within this range for pH parameter standards.

**Table 13.6:** The pH Levels of Selected Water Bodies Monitored for pH by DENR-EMB as of 2017.

Recreational Water Body Monitoring CY 2017			
Region	Name of Bathing Beaches	Location	Average pH
1	Sto. Domingo Beach	Sto. Domingo, Ilocos Sur	–
	Sinait Beach	Sinait, Ilocos Sur	–
2	Angib Beach	Gonzaga, Cagayan	8.05
	Nangaranbuan Beach	Sta. Ana, Cagayan	8.11
3	Montemar Beach Club	Bagac, Bataan	7.96
	Juness Beach Resort	Morong, Bataan	7.98
4A	Nasugbu Beach	Nasugbu, Batangas	7.90
	Laiya Beach	San Juan, Batangas	7.99
4B	Bacuit Bay	El Nido, Palawan	8.15
	White Beach	Puerto Galera, Oriental Mindoro	8.48
5	Diwata-Imacoto Beach	Oas, Albay	7.47
	Maramba Beach	Oas, Albay	7.45
6	Bugang River	Barotac Viejo, Iloilo	–
	Tingib White Beach	Banate, Iloilo	7.00
7	Liloan Beach	Liloan, Cebu	–
	Mactan Beach	Lapu-Lapu, Cebu	–
8	Sabang Dagitan Surfing Camp	Dulag, Leyte	8.34
	San Jose Skimboarding Camp	Dulag, Leyte	8.28
9	Caragasan Beach	Maasin, Zamboanga City	8.16
	Bolong Beach	Bolong, Zamboanga City	7.97
10	Roan Beach, Macalajar Bay (Opol)	Misamis Oriental	–
	Raagas Beach, Macalajar Bay (Bonbon)	Misamis Oriental	–
11	Passig Islets	Sta. Cruz, Davao del Sur	8.21
	Leling Beach Resort	Hagonoy, Davao del Sur	8.14
12	Lion Beach Resort	Gen. Santos City, South Cotabato	7.79
	London Beach Resort	Glan, Sarangani	7.96
CAR	Lower Chico River	Dalimuno, Tabuk, Kalinga	7.32
	Pasil River	Mosimos, Dupag, Tabuk	7.22
Caraga	Brgy. Cambatong	Hinatuan, Surigao del Sur	7.66
	Britania Group of Islands	San Agustin, Surigao del Sur	8.06

Source: DENR-EMB, 2018.

## Monitoring and Assessment of Priority Rivers

Water bodies are classified by DENR-EMB according to their beneficial uses (e.g. as sources of drinking water, as habitat for aquatic organisms, etc.). Land-based pollution specifically domestic, livestock and industrial-based, are the known major sources of contaminants in water bodies. Pollutants can be disposed directly into coastal areas (point sources) or these can come from rivers which flow out to sea (non-point sources). The regular monitoring and assessment of priority rivers is crucial to coastal ecosystems as these water bodies are connected, hence, pollutants disposed into these river systems will eventually end up at sea. Periodic monitoring is also essential for water bodies that have already been previously classified to check if the current parameters are meeting the standards under its classification.

As of 2017, 158 water bodies were monitored for dissolved oxygen (DO), and 140 water bodies for biological oxygen demand (BOD). Eleven (11) rivers were added to the list since 2016. Of the 158 water bodies monitored for DO, 131 rivers or 82.9% passed the standards under their respective classifications while 106 out of the 140 rivers or 75.7% passed the standards for BOD (**Table 13.7**). All the major river systems in the NCR (Parañaque River, Malabon-Navotas-Tullahan-Tenejeros river system, and Meycauayan-Valenzuela river system)



Post Office along Pasig River. (Photo by M. Ebarvia)

have failed the BOD and DO criteria in 2015. According to the Pasig River System – Water Quality Index (PRS-WQI) for 2017, all 14 stations in Pasig River got a ‘FAILED’ grade, using the grading scale for six indicators: BOD, DO, nitrates, phosphates, oil and grease, and fecal coliform (PRRC, 2017).

**Table 13.7:** Annual Average DO and BOD.

	2016		2017	
	DO	BOD	DO	BOD
<b>Total Water Bodies Monitored</b>	147	127	158	140
<b>Passed</b>	121	101	131	106
<b>Passed (%)</b>	82.31%	79.53%	82.91%	75.71%
<b>Failed</b>	26	26	27	34
<b>Failed (%)</b>	17.69%	20.47%	17.09%	24.29%

Source: EMB, 2018.

# 14 Coastal and Marine Ecosystems and Biodiversity

The Philippines lies within the planet's center of marine biodiversity – the Indo-Malayan triangle or Coral Triangle (Burke et al., 2002). The country's marine resources are found within the total territorial water area of around 679,800 km<sup>2</sup> and a shelf area of 184,600 km<sup>2</sup>. The coastline all throughout the archipelagic country is 37,008 km in length. The Philippines currently has a total 797,719 ha of coral reef area, 489,006 ha of seaweeds/seagrass beds and 303,373 ha of mangrove forests (**Table 14.1**).



Coral reef monitoring. (Photo by ERDB)

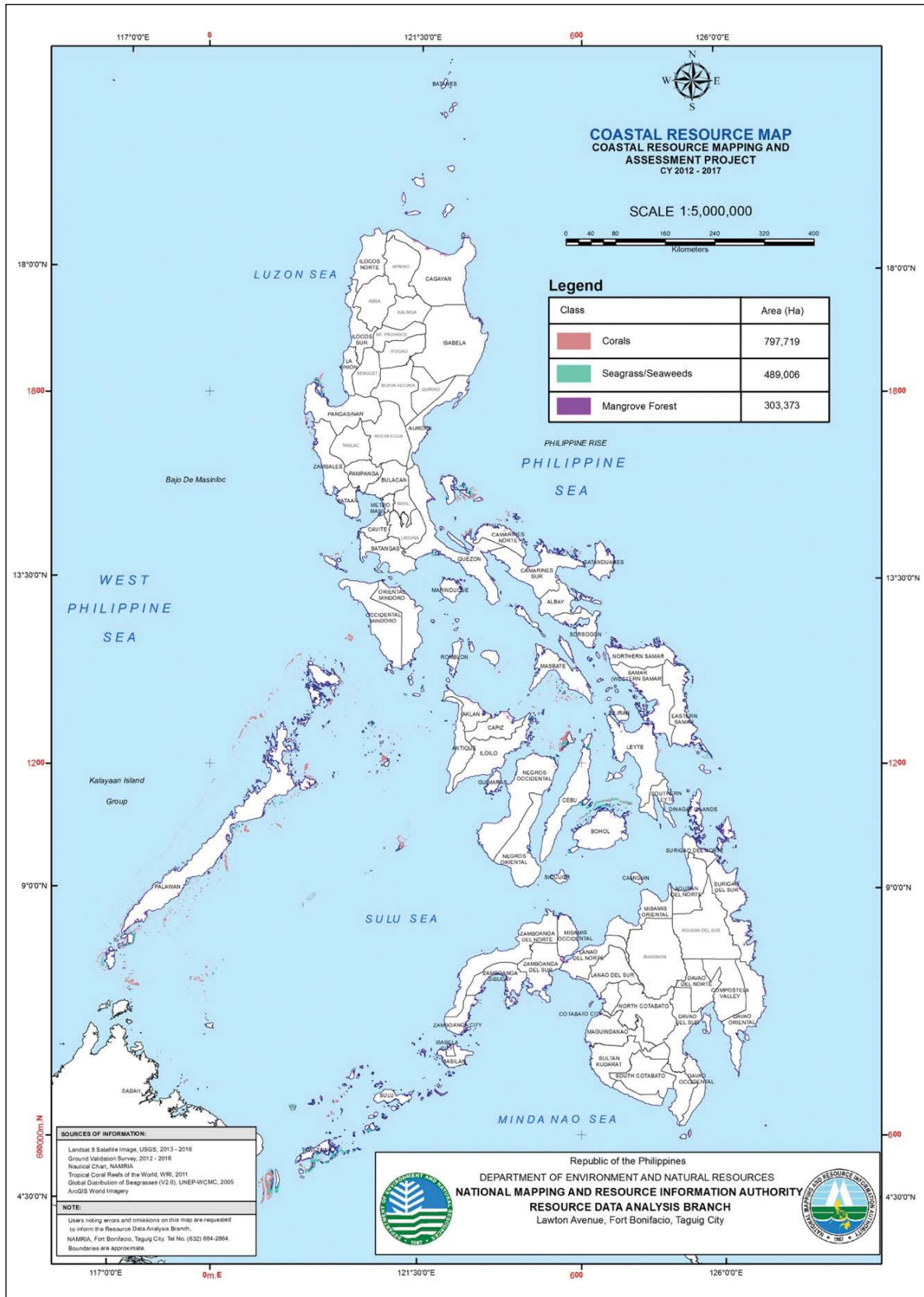
A Coastal Resource Map was generated by DENR-NAMRIA in 2017, and shows the location and areal extent of the coastal and marine habitats (**Figure 14.1**). The country's coral reef area of 797,719 ha in 2016 indicated a sharp decline if compared to the data reported by the PBSAP 2015-2028 with a reported total area of 2.5 million ha in 2009. Similarly, a sharp decline can also be seen for seagrass/seaweeds cover – from 2.73 million ha in 2009 to 489,006 ha in 2016.

**Table 14.1:** Coastal and Marine Ecosystems.

Ecosystem type	Area (ha.)	
	Year 2009	Year 2016
Corals	2.5 million	797,719
Seagrass/Seaweeds	2.73 million	489,006
Mangroves	No data reported	303,373
Mudflats		200,000
<b>Total</b>		<b>1,790,097</b>

Source: PBSAP 2015-2028; DENR-NAMRIA, 2017.

**Figure 14.1:** Resource Map Showing Total Coral, Seagrass/seaweeds and Mangrove Cover in the Philippines as of 2016.



Source: DENR-NAMRIA, 2017.

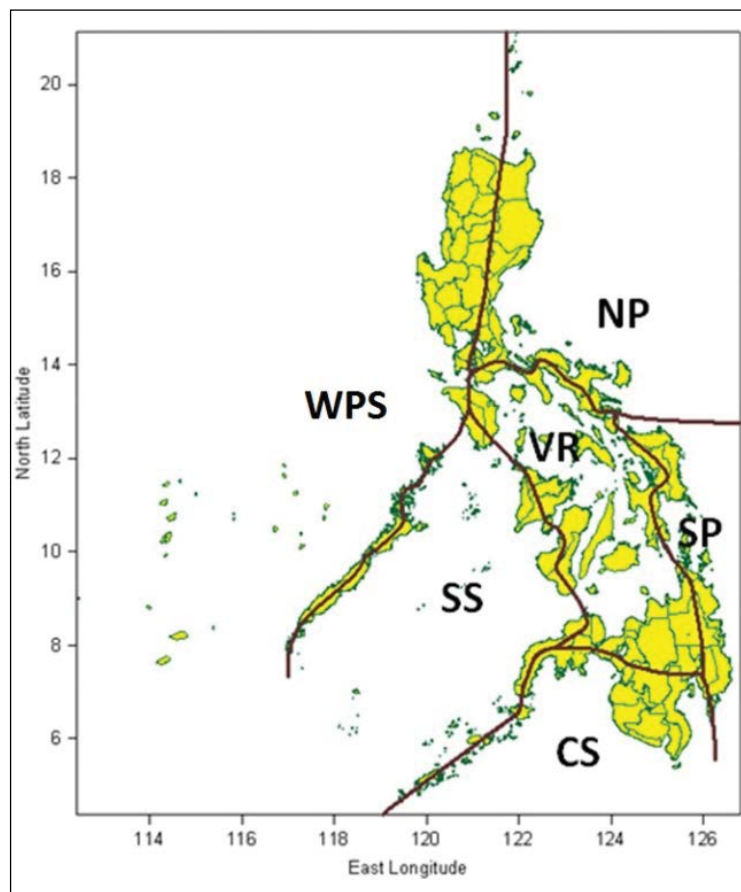
## 14.1 Key Habitats

### 14.1.1 Coral Reefs

The Philippines has the second largest coral reef area in Southeast Asia (Burke et al., 2002) (**Figure 14.1**) and is considered to lie within the planet's center of marine biodiversity, known as the Coral Triangle or the Indo-Malayan Triangle. DENR and NAMRIA reported that the national coral cover was 797,719 ha or 7,977 km<sup>2</sup> as of 2017 (**Figure 14.1**). The coral reefs in Benham Rise (Philippine Rise) is not yet included in this estimate. Based on the biophysical attributes of the reef communities, six biogeographic regions have been identified in 2002: the West Philippine Sea (South China Sea), Sulu Sea (SS), Celebes Sea (CS), Visayas Region (VR), the Northeastern Philippine Sea (NP), and the Southeastern Philippine Sea (SP) (Nañola et al., 2002) (**Figure 14.2**). The Philippine Rise (Benham Rise) is part of the Northeast Philippine Sea, but not yet included as assessments are still ongoing (as of 2017).



Coral Reef in Tagililing MPA, Mati, Davao Oriental.  
(Photo by DENR)



**Figure 14.2:** The Six Biogeographic Regions in the Philippines Based on Coral Reef Fish Communities and Associated Benthic Characteristics.

Source: Nañola et al., 2002.



Under the Coral Triangle Initiative, the Philippines declared two priority seascapes: (1) the Sulu-Sulawesi Marine Ecoregion (SSME), which has an existing formal cooperation agreement with Indonesia and Malaysia, and (2) the West Philippine Sea (WPS). The former encompasses the Sulu Sea, Celebes Sea, Visayas Region and a small part of the West Philippine Sea biogeographic region. The latter, on the other hand, covers only the West Philippine Sea biogeographic region.

The six biogeographic regions are further subdivided into 15 sub-regions (**Table 14.2**). In terms of reef cover, the Palawan group of islands, which includes the Kalayaan Islands Group (KIG) has the highest known reef cover in the country (41.52%), followed by the Visayas region (29.07%), and Mindanao (18.14%), while Luzon and Mindoro have the least (11.27%) coral reef cover (**Table 14.2**).

**Table 14.2:** Estimated Cover of Coral Reef Area among the Different Sub-divisions, 2002.

Region	Area (km <sup>2</sup> )	% of total area
<b>WEST PHILIPPINE SEA (WPS)</b>		
West Philippine Sea	306.5	2.85
Kalayaan Islands	3,257.7	30.3
Western Palawan (NW Palawan Shelf)	147.9	1.38
<b>SULU SEA (SS)</b>		
Sulu Sea	468.8	4.36
Calamianes and Balabac transition*	222.7	2.07
Visayas transition	108.2	1.01
Sulu archipelago transition	143.4	1.33
Sulu archipelago transition	114.6	1.07
<b>CELEBES SEA (CS)</b>		
Mindanao	811.3	7.55
<b>VISAYAN REGION (VR)</b>		
South Luzon facing Visayas Region	229.3	2.13
Western Visayas	298.7	2.78
Central Visayas	1,750.8	16.29
Eastern Visayas	1,075.1	10
Northern Mindanao (including Southern Bohol)	317.3	2.95
<b>NORTHEASTERN PHILIPPINE SEA (NP)</b>		
Eastern Luzon**	20.4	0.19
	655.5	6.1

**Table 14.2:** Estimated Cover of Coral Reef Area among the Different Sub-divisions.  
(cont.)

Region	Area (km <sup>2</sup> )	% of total area
<b>SOUTHEASTERN PHILIPPINE SEA (SP)</b>		
Eastern Mindanao	821.6	7.64
<b>Total</b>	<b>10,749.8</b>	<b>100.00</b>

\* There are some areas where 2 values are reported. Probably because there are 2 sampled sites, e.g., Calamianes and Balabac transition and Eastern Luzon.

\*\* The coral reef area in Benham Rise is not included in this assessment.

Source: Ong et al., 2002; Nañola et al., 2011; ADB, 2014.

The result of studies on species composition of reef-associated fishes in the country are highly varied as these studies are done at different sites, conducted in various temporal scales and use different methods for assessment (e.g. depth, number of transect, time of assessment, etc.).

Around 3,053 species of fish are found in the Philippines (Herre, 1953; Allen et al, 2003; Allen & Erdman, 2009; Fishbase.org 2009), of which 2,724 are marine-based and 173 are freshwater species. Of the total marine fish species recorded, 1,659 species are reef-associated, 693 are found in nearshore habitats, and 277 are found in the deep sea. Moreover, the fish species are also categorized as demersal (2,351 species) and pelagic (177 species).

Nañola et al. (2011) identified a total of 721 species of reef-associated fishes from their study transects belonging to 205 genera and 52 families; and four species of cartilaginous fishes from three genera in two families. The families found to be rich in species were Pomacentridae (125 species), Labridae (105), Serranidae (48), Chaetodontidae (41), Acanthuridae (36), Scaridae (36), and Apogonidae (30). These families comprised 58% of the total number of species observed. Other important families observed with more than ten species were Lutjanidae (21), Blenniidae (20), Balistidae (18), Pomacanthidae (18), Holocentridae (17), Nemipteridae (17), Carangidae (15) and Gobiidae (15) (**Table 14.3**).

However, Allen et al. (2011) identified at least 800 reef fish species in Calamianes Islands, Palawan alone. New studies with bigger sampling size are needed to assess the species number, distribution and composition in the six biogeographic regions and sub-divisions as well as in the Philippine Rise area.

**Table 14.3:** Total Number of Species of Reef Fish Observed by Family in the Six Biogeographic Regions in the Philippines.

No.	Family	CS	NP	WPS	SP	SS	VR	All Regions
<b>Class: Osteichthys</b>								
1.	Acanthuridae	26	28	27	21	24	18	36
2.	Apogonidae	14	16	15	11	13	21	30
3.	Balistidae	13	7	10	5	11	6	17
4.	Blenniidae	8	9	15	7	9	7	21
5.	Caesionidae	7	11	10	5	11	7	12
6.	Carangidae	5	5	6	1	11	3	15
7.	Chaetodontidae	32	35	30	34	34	27	41
8.	Cirrhitidae	3	3	4	3	4	3	5
9.	Diodontidae	2	1	1	0	1	1	3
10.	Ephippidae	2	1	1	0	3	2	3
11.	Gobiidae	2	6	9	1	3	6	15
12.	Haemulidae	5	5	7	6	8	6	9
13.	Holocentridae	8	10	8	9	13	2	18
14.	Labridae	75	70	82	57	84	69	105
15.	Lethrinidae	3	3	6	3	5	2	7
16.	Lutjanidae	14	11	12	9	14	7	21
17.	Microdesmidae	2	3	4	2	3	3	6
18.	Monacanthidae	11	8	9	6	5	8	13
19.	Mullidae	9	9	8	7	11	7	12
20.	Muraenidae	2	0	1	1	2	0	4
21.	Nemipteridae	11	8	14	5	13	12	17
22.	Ostraciidae	4	3	4	3	3	4	4
23.	Pempheridae	1	1	1	1	1	2	2
24.	Pinguipedidae	5	4	5	2	6	3	6
25.	Pomacanthidae	11	15	14	11	13	10	18
26.	Pomacentridae	83	85	79	64	87	72	125
27.	Priacanthidae	0	1	1	0	2	1	3
28.	Pseudochromidae	2	3	4	3	2	2	5
29.	Scaridae	23	27	29	19	28	23	36
30.	Scombridae	1	1	2	0	0	0	3
31.	Scorpaenidae	3	3	3	1	3	3	7
32.	Serranidae	26	16	31	12	33	19	48
33.	Siganidae	9	10	8	9	10	8	11
34.	Sphyrnaenidae	2	1	2	0	3	2	3

**Table 14.3:** Total Number of Species of Reef Fish Observed by Family in the Six Biogeographic Regions in the Philippines. (cont.)

No.	Family	CS	NP	WPS	SP	SS	VR	All Regions
36.	Synodontidae	3	4	4	2	3	3	5
37.	Tetraodontidae	9	9	10	5	6	8	13
	Other families	8	7	6	5	9	7	16
<b>Class: Chondrichthys</b>								
1.	Dasyatidae	0	0	0	0	3	0	3
<b>Total no. of species</b>		<b>445</b>	<b>441</b>	<b>484</b>	<b>331</b>	<b>494</b>	<b>386</b>	<b>721</b>

Source: Nañola et al., 2011.

The Coral Reef Visualization and Assessment (CORVA) Project of the DENR, which monitored the fish community status in the Verde Island Passage, El Nido (Palawan), Biri (Northern Samar), Guiuan (Eastern Samar) and Siargao (Surigao del Norte) reported the following data (**Table 14.4**) for the year 2014.

**Table 14.4:** Species Richness Abundance and Biomass Ratings (as per Hilomen et al., 2000) for the 5 Monitored Sites under the CORVA Project.

	Species Richness	Abundance	Biomass
Verde Island Passage	Very high	High	High
El Nido, Palawan	Very high	Moderate	High
Biri, Northern Samar	Very high	Moderate	Poor
Guiuan, Eastern Samar	Very high	Moderate	Poor
Siargao, Surigao del Norte	Very high	Moderate	Moderate

Source: CORVA, 2014.

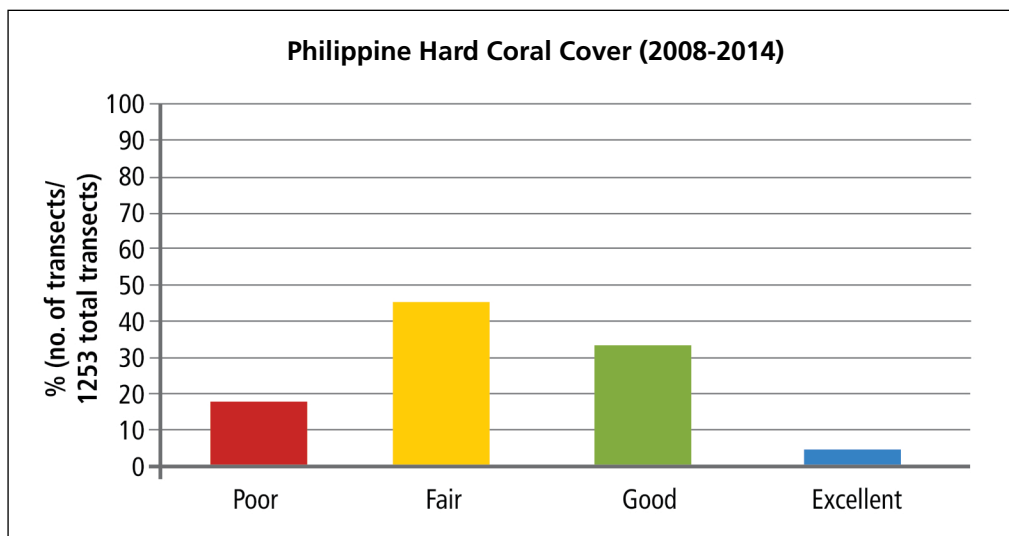
Across the monitored sites, Verde Island Passage showed the highest species count, abundance count and biomass values. Most of the fishes identified in the study sites, and making up the bulk of the figures, are damselfishes and labrids. Over-all status for the reef condition among all 5 sites fell within moderate to relatively good condition.

In 2016, an inter-agency collaboration was initiated to conduct oceanographic and biological surveys in the Philippine Rise and some parts of the Bicol Shelf. Initial assessments of selected shallow reef areas in the Bicol Shelf reported reefs that are mostly algal dominated with hard coral cover ranging from 3-25%. Declared as the first offshore marine protected area in the country, the Philippine Rise is now considered as a priority research area and current studies are being done to more thoroughly quantify coral cover in both the shallow reef areas and the mesophotic reef areas of the Philippine rise.

### Status of Coral Reefs

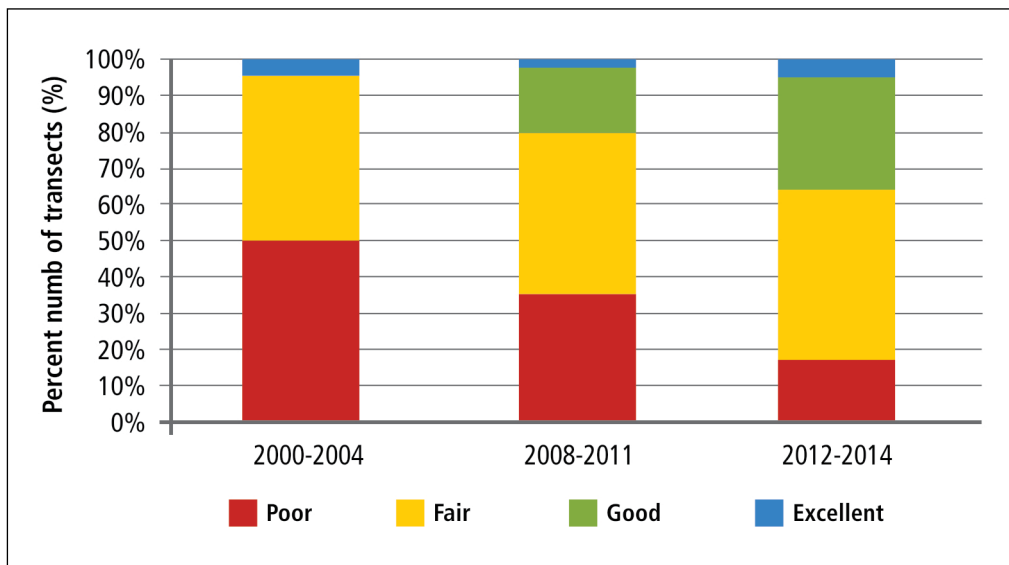
As of 2014, only 4 percent of the hard corals in the Philippines are classified as being in excellent condition, 18.4 percent are in poor condition, 46.6 percent are in fair condition and 31 percent are in good condition (Figure 14.3). However, seen relative to previous years, the hard coral reefs in poor condition have noticeably decreased in 2014, while those in excellent condition have increased (Figure 14.4) and there is a noticeable shift to more reefs in “good” condition. However, the percentage of coral reefs in excellent condition is still very low.

**Figure 14.3:** Percentage of Transects Surveyed in 2008-2014 Under Different Categories of Reef Status Based on the Quartile Percentage Hard Coral Cover from 74 Municipalities in the Philippines.



Source: Kimura et al., 2016.

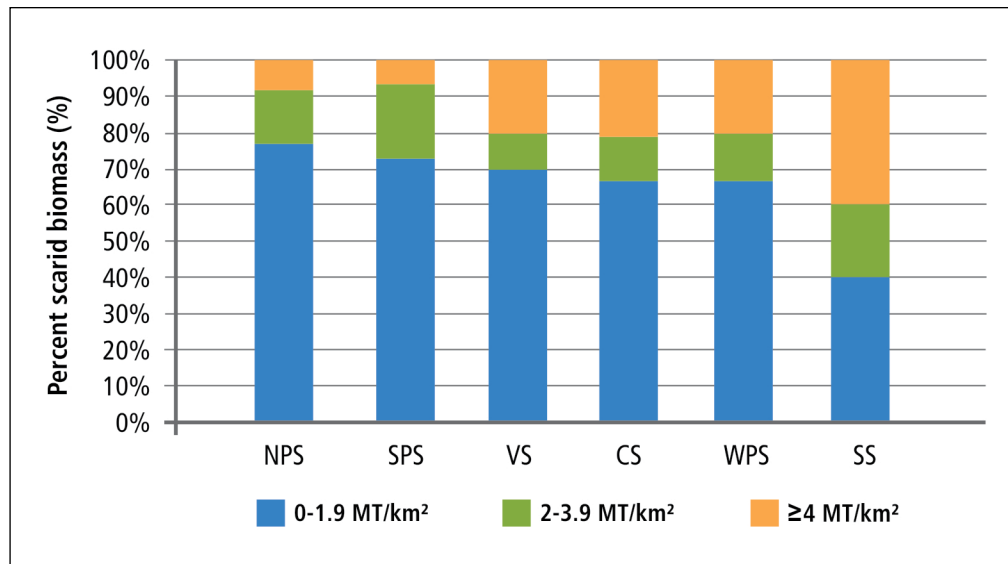
**Figure 14.4:** Trends in Benthos Cover from 2000 to 2014.



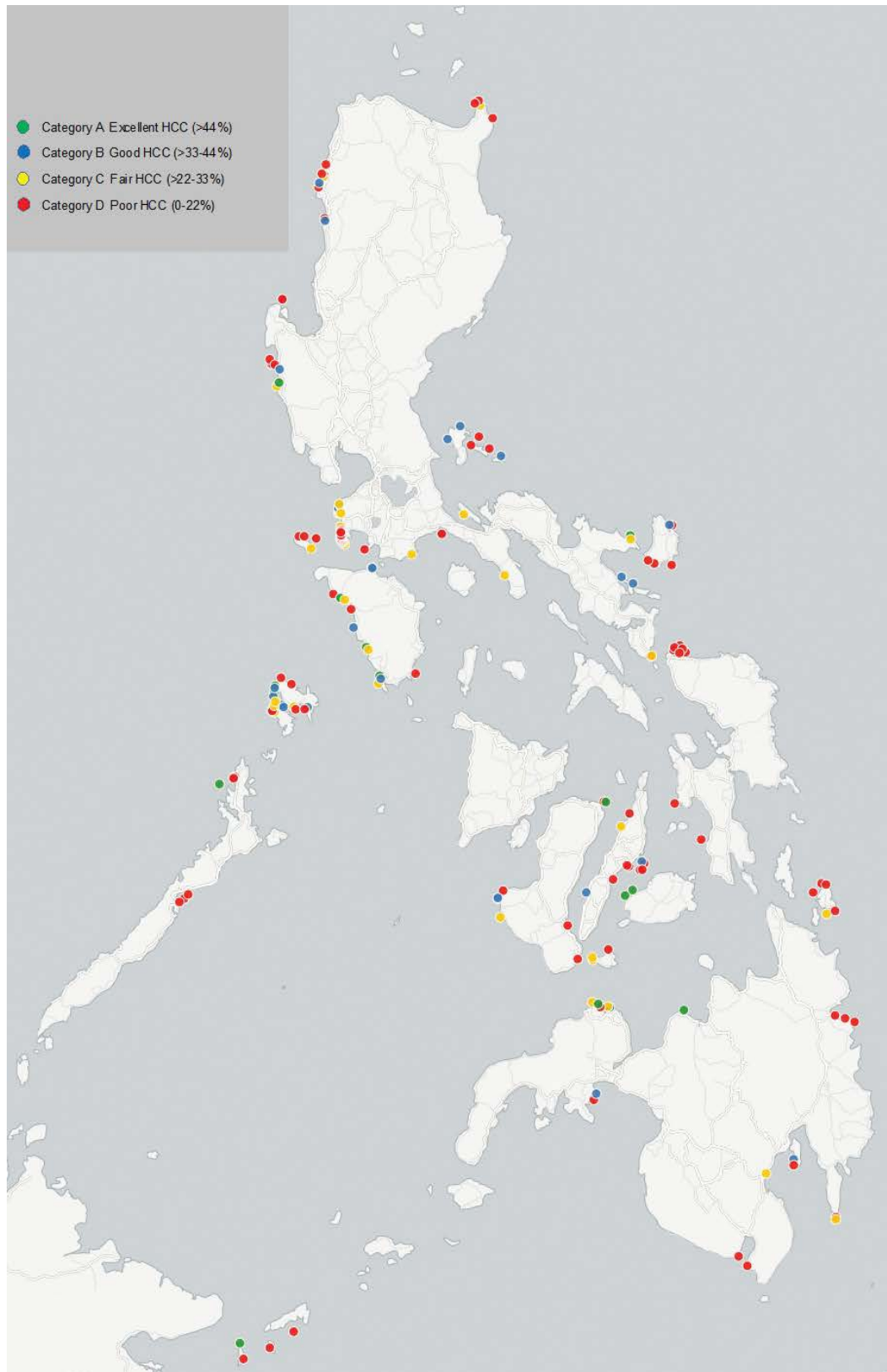
Sources: Nañola et al. 2006; Kimura et al., 2016.

A good indicator of coral reef health is scarid (parrotfish) biomass. Scarid fish prevents the spread of algae on hard corals which have several effects to the reef community. The overgrowth or uncontrolled growth of algae can greatly affect the ability of coral larvae to settle, attach and grow. Even established coral colonies experience mortality during episodes of algal overgrowth as they can smother coral tissue, which are highly dependent on sunlight for life. The biogeographic regions with high (>4MT/sqkm) scarid biomass are Sulu Sea (39% of the transects surveyed), Celebes Sea (20%), West Philippine Sea (19 %) and Visayan Sea (19%) (**Figure 14.5**). This supports the previously mentioned data where the West Philippine Sea, the Sulu Sea and the Celebes Sea having the highest reported coral cover and the most number of reef species.

**Figure 14.5:** Percentage Scarid Biomass Found in the Coral Reefs of Six (6) Biogeographic Regions in the Philippines namely: North Philippine Sea (NPS), South Philippine Sea (SPS), Visayan Sea (VS), Celebes Sea (CS), West Philippine Sea (WPS) and the Sulu Sea (SS).



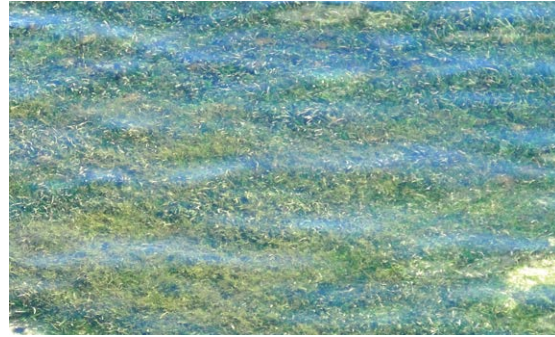
A *National Assessment of Coral Reef Environments* (NACRE) program was funded by DOST-PCAARRD in 2014 to undertake a nationwide assessment and update the status of reefs in the Philippines. The program was implemented through the University of the Philippines - Marine Science Institute (UP-MSI) and De La Salle University - Shields Ocean Research Center (DLSU-SHORE). Initial data from 2015 to 2017 were gathered from 166 stations plus an additional 40 stations across 31 provinces. Results of the assessment using hard coral cover confirmed the disappearance of excellent live hard coral cover category reefs, and widespread decline in reef condition over the last four decades (NACRE Project 1 Terminal Report 2017; Licuanan, et al., 2017). **Figure 14.6** shows the state of the coral reefs in 206 stations using hard coral cover. These results reveal an urgent need for the revision and update of the country's conservation and management policies on coral reefs. Furthermore, the assessment allowed for management-oriented surveys in the future (Licuanan, et al., 2017).

**Figure 14.6:** Status of Hard Coral Reefs, 2017.

Source: PCAARRD, 2018.

### 14.1.2 Seagrass

The Philippines has a total of 16 seagrass species as shown in **Table 14.5** (Fortes, 2012; PNSC, 2004; Burke et al, 2002). Of the 16 seagrass species, 6 belong to the Family Cymodoceaceae, 1 belongs to Family Ruppiceae while 9 species to the family Hydrochariticeae. As of 2017, DENR-NAMRIA reported that seagrass beds in the country have a total area of 489,006 ha (**Table 14.1**).



Seagrass bed in Bohol. (Photo by M. Ebarvia)

Despite the ecological and economic value of seagrasses, 30%–50% of the Philippines seagrass beds have been lost due to industrial, tourism and port developments (Fortes, 2012). Seagrasses support coastal livelihoods - fisheries and tourism. Seagrass beds provide habitat for juvenile and small adult fishes (e.g., rabbitfish), invertebrates, reptiles (turtles) and mammals (Dugong). They also serve as buffer against waves and storm surges and maintain sediment stability, hence, protecting the neighboring mangrove ecosystem and coral reefs. In addition, the high organic matter production of seagrass beds serve as nutrient source for these associated ecosystems. High carbon sequestration rate has been noted for seagrass ecosystem, contributing to climate change mitigation.

### 14.1.3 Mangroves

The Philippines had around 400,000-500,000 ha of mangrove area in the early 1900s (Brown and Fischer, 1998). The country is one of the richest in mangrove species, with 42 mangrove species representing 18 families (**Table 14.6**) (Spalding et al. 2010, Polidoro et al. 2010, Samson and Rollon 2011). As of 2017, mangrove forests in the country have a total cover area of 303,373 ha. (DENR-NAMRIA, 2017).

**Table 14.5:** Seagrass Species Found in the Philippines.

Family	Species
<b>Cymodoceaceae</b>	<i>Cymodocea rotundata</i>
	<i>Cymodocea serrulata</i>
	<i>Halodule pinifolia</i>
	<i>Halodule uninervis</i>
	<i>Syringodium isoetifolium</i>
	<i>Thalassodendron ciliatum</i>
<b>Ruppiceae</b>	<i>Ruppia maritima</i>
<b>Hydrochariticeae</b>	<i>Halophila becarii</i>
	<i>Halophila decipiens</i>
	<i>Halophila minor</i>
	<i>Halophila minor var nov.</i>
	<i>Halophila ovalis</i>
	<i>Halophila spinulosa</i>
	<i>Halophila sp.</i>
	<i>Enhalus acoroides</i>
<i>Thalassia hemprichii</i>	

Source: Fortes, Unpublished.



**Table 14.6:** Mangrove Species in the Philippines.

FAMILY	SPECIES	FAMILY	SPECIES
Acanthaceae	<i>Acanthus ebracteatus</i>	Pteridaceae	<i>Acrostichum aureum</i>
	<i>Acanthus ilicifolius</i>		<i>Acrostichum speciosum</i>
Arecaceae	<i>Nypa fruticans</i>	Rhizophoraceae	<i>Bruguiera cylindrical</i>
Avicenniaceae	<i>Avicennia alba</i>		<i>Bruguiera exaristata</i>
	<i>Avicennia marina</i>		<i>Bruguiera gymnorhiza</i>
	<i>Avicennia officinalis</i>		<i>Bruguiera hainessi</i>
	<i>Avicennia rumphiana</i>		<i>Bruguiera parviflora</i>
Bignoniaceae	<i>Dolichandrone spathacea</i>		<i>Bruguiera sexangula</i>
Bombacaceae	<i>Compostemon philippinense</i>		<i>Ceriops decandra</i>
	<i>Compostemon schultzii</i>		<i>Ceriops tagal</i>
Caesalpiniaceae	<i>Cynometra iripa</i>		<i>Kandelia obovata</i>
Combretaceae	<i>Lumnitzera littorea</i>		<i>Rhizophora apiculata</i>
	<i>Lumnitzera racemosa</i>	<i>Rhizophora mucronata</i>	
Euphorbiaceae	<i>Excoecaria agallocha</i>	<i>Rhizophora stylosa</i>	
Lythraceae	<i>Pemphis acidula</i>	<i>Rhizophora x lamarckii</i>	
Meliaceae	<i>Xylocarpus granatum</i>	Rubiaceae	<i>Scyphiphora hydrophylaceae</i>
	<i>Xylocarpus moluccensis</i>	Sonneratiaceae	<i>Sonneratia alba</i>
Myrsinaceae	<i>Aegiceras corniculatum</i>		<i>Sonneratia caseolaris</i>
	<i>Aegiceras floridum</i>		<i>Sonneratia ovate</i>
Myrtaceae	<i>Osbornia octodonta</i>	<i>Sonneratia x gulngai</i>	
Plumbaginaceae	<i>Aegialitis annulata</i>	Sterculiaceae	<i>Heritiera littoralis</i>

Source: Spalding et al. 2010, Polidoro et al., 2010, Samson and Rollon, 2011.

The estimated mean production rates of Philippine mangroves range from 1-2 grams of carbon per m<sup>2</sup> per day (Jacinto et al., 2000). Mangrove forests serve as habitat to at least 54 species of crustaceans, 63 species of mollusks, and 110 species of fish, some of which are commercially important (PNMC, 1987 in PCAMRD, 1991; De la Paz and Aragonés, 1985). Mangrove areas are utilized for aquaculture, salt production, and human settlement, and are important sources of forest products (e.g., timber) as well as fishery products (e.g., fish, shrimps, mollusks, crabs, fry) (Jacinto et al., 2000)

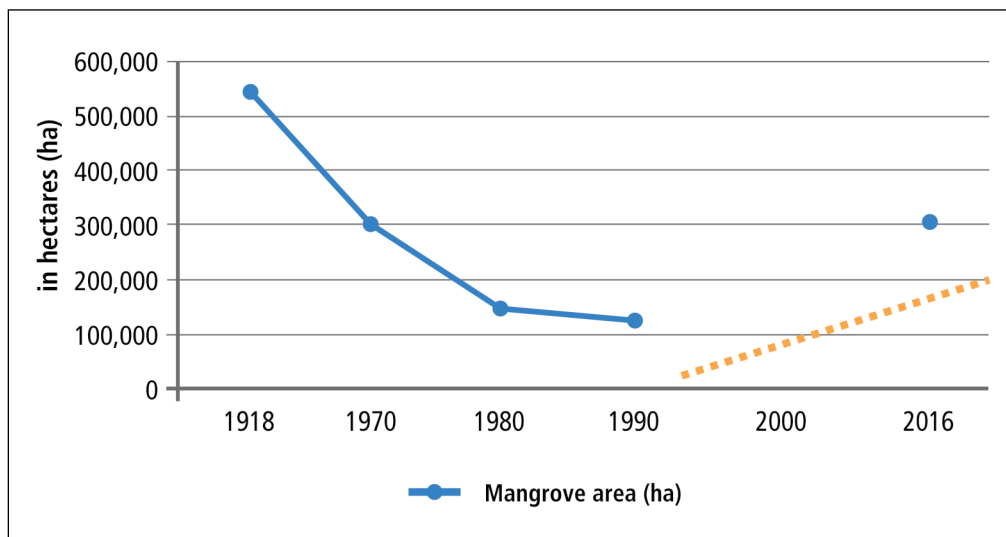


Photo by M. Ebarvia

Mangroves contribute significantly to maintaining the quality of the coastal waters. They act as a “sink” not only for sediments, but also for nutrients like nitrogen and phosphorus, and contaminants, such as heavy metals, which are carried seawards from inland sources (UNEP, 2004). Mangroves also protect coastlines by decreasing the risk of flooding and erosion, and reducing the impacts of storm surge. However, the intensive utilization of mangroves has resulted in the decline of their cover. An estimated 337,000 ha (75%) of mangrove areas have been lost, the bulk (278,657 ha or 66%) of which occurred between 1950–1990 (Samson and Rollon, 2008). In the mid-1980s, the highest rate of exploitation was recorded in the Visayas (at 72%) followed by Luzon (at 64%). Lesser degree of utilization was found in Mindanao and Palawan, at 10% and 21%, respectively.

By 2005, natural mangrove cover had declined to 247,268 ha, while planted mangroves have already reached up to more than 44,000 ha (Primavera, et al., 2011). However, the extensive mangrove restoration efforts all over the country has significantly increased and improved mangrove cover. The mangrove cover has increased to 303,373 ha as of 2017 (almost the same area as in 1970). **Figure 14.7** illustrates the decline of mangrove cover extent in the Philippines from 1918 to 1988 (DENR, 1988; World Bank, 1989), and an increase in 2016-2017 (DENR-NAMRIA, 2017).

**Figure 14.7:** Mangrove Cover Extent.



Source: DENR, 1988; World Bank, 1989; DENR, 2016; DENR-NAMRIA, 2017.

Around 23 percent of the total mangrove forest is found in Region IV-B (MIMAROPA), 17 percent in Autonomous Region in Muslim Mindanao (ARMM), and 11 percent in Region VIII (Eastern Visayas) (**Table 14.7**). The provinces with the highest mangrove cover are Palawan in Region IV-B (59,421 ha), Sulu in ARMM (26,531 ha), Quezon in Region IV-A (18,448 ha), Tawi-Tawi in ARMM (14,285 ha), and Surigao del Norte in Caraga (13,913 ha).

The country's largest contiguous mangrove forest – 4,051 ha – is found in the Municipality of Del Carmen in Siargao Island, Surigao del Norte (DENR-NAMRIA, 2017).

**Table 14.7:** Forest Cover of the Philippines in 2015 (In hectares).

Region	Total Area	Closed Forest	Open Forest	Mangrove Forest
<b>Philippines</b>	<b>7,014,152</b>	<b>2,028,015</b>	<b>4,682,764</b>	<b>303,373</b>
CAR	807,220	250,545	556,675	
I	147,602	24,163	122,061	1,378
II	1,050,963	488,033	557,188	5,743
III	536,565	234,839	299,826	1,900
NCR	2,106	-	2,000	106
IV-A	271,512	107,044	145,165	19,303
IV-B	947,794	110,161	769,217	68,416
V	199,379	41,149	133,826	24,404
VI	203,789	62,025	127,365	14,400
VII	79,487	4,226	56,224	19,037
VIII	511,962	42,667	435,243	34,052
IX	170,970	28,775	116,920	25,275
X	382,357	179,007	198,132	5,217
XI	400,613	151,822	245,290	3,501
XIII	277,891	93,153	182,889	1,849
CARAGA	724,772	125,937	571,786	27,050
ARMM	299,168	84,468	162,958	51,742

Source: DENR-FMB, 2018.

Mangroves act as natural biophysical barriers against typhoon, storm surge and tsunami. Most tropical cyclones entering the Philippine area of responsibility (PAR) develop within the warm waters of the Northwest Pacific (Corporal-Lodangco and Leslie 2016). The areas along the eastern seaboard of the Philippines, especially the coastline above the 10°N-latitude, usually bear the impact of storms and typhoons when they are at their peak strengths (i.e., first landfalls). **Table 14.8** shows the top ten municipalities along the eastern seaboard with the largest areal extent of mangroves as of 2017.

**Table 14.8:** Top Municipalities in the Eastern Seaboard with the Largest Areal Extent of Mangroves.

Municipality	Province	Region	Mangroves (ha)
Del Carmen	Surigao Del Norte	Caraga	4,051.20
Laoang	Northern Samar	VIII	1,825.66
San Jose	Northern Samar	VIII	1,407.00
Salcedo	Eastern Samar	VIII	1,372.00
Garchitorena	Camarines Sur	V	1,327.00
Tinambac	Camarines Sur	V	1,326.00
Capalonga	Camarines Norte	V	1,225.00
Pilar	Surigao Del Norte	Caraga	1,029.61
San Benito	Surigao Del Norte	Caraga	1,029.00
Lavezares	Northern Samar	VIII	1,027.00

Source: Rollon, 2018.

## Mangrove rehabilitation

Mangroves are part of the commodities listed under the **Commodity Roadmap of the Enhanced National Greening Program (NGP)**, a government initiated reforestation program whose second phase started in 2017 up to 2028. The national program aims to cover the remaining 7.1 million ha of denuded, unproductive and degraded forestlands all throughout the country. As of 2016, a total of 199,367,952 seedlings or mangrove propagules have been planted covering a total of 76,514 ha all throughout the country (**Table 14.9**).

**Table 14.9:** National Greening Program: Mangrove Accomplishment Report, 2011-2016.

Year	Area Planted with Mangrove Species (ha)	Number of Seedlings
2011	1,262	2,700,629
2012	826	4,628,428
2013	6,989	13,483,600
2014	12,318	25,751,560
2015	54,418	151,221,667
2016	701	1,582,068
<b>Grand Total</b>	<b>76,514</b>	<b>199,367,952</b>
<b>Area (ha)</b>		
<b>Natural mangrove</b>	247,268	
<b>Planted mangrove</b>	76,514	

Source: DENR-FMB, 2017.

### 14.1.4 Other Coastal Wetlands

Wetlands, as defined in the Ramsar Convention, encompass both inland (e.g., lakes, rivers, swamps, marshes, etc.) and coastal wetlands (coral reefs, seagrass beds, mangroves, tidal flats, estuaries, coastal lagoons, etc). The Philippines has extensive areas of both wetland types, four of which are now designated as Wetlands of International Importance or Ramsar sites. These are the Olango Island Wildlife Sanctuary in Cebu, Naujan Lake National Park in Oriental Mindoro, Agusan Marsh Wildlife Sanctuary in Agusan del Sur and Tubbataha Reefs Natural Park in the Sulu Sea. However, a study by Scott (1993) reported that the country has already lost an estimated 78% of its total wetland area - one of the highest reported in Southeast Asia. To preserve the remaining areas, the **National Wetland Action Plan of the Philippines (NWAPP, 2011-2016)** identified priority wetlands for conservation (**Table 14.10**). These priority wetlands for the period covered have been identified to optimize resources and achieve maximum impacts and outcomes from the activities in the NWAPP (ADB, 2014).



Tidal flats. (Photo by M. Ebarvia)

**Table 14.10:** Priority Wetlands Identified by the National Wetland Action Plan of the Philippines (2011-2016).

Coastal and Marine Wetlands	
Batanes Islands Protected Landscape and Seascape	Olango Island
Babuyan Islands	Biliran and Maripipi Island
Buguey Wetlands	Siargao Island Protected Land and Seascape
Manila Bay	Tawi-tawi Island
Pagbilao and Tayabas Bay	Simunul and Manuk Manka Islands
Ragay Gulf	Sibutu and Tumindao Islands
Mactan, Kalawisan, Cansaga Bay	El Nido Managed Resource Protected Area
Tubbataha Reef National Marine Park	Cabulao Bay
Polillo Island	Malampaya Sound
Caramoan Peninsula	Balayan Bay
Puerto Galera	Talabong Island and Bais Bay
Ursula Island	Panguil Bay
Balabac Group of Islands	Ulugan Bay
Northwest Panay Peninsula Natural Park	Inabanga Coast

Source: NWAPP, 2011-2016.

## 14.2 Rare, Threatened, and Endangered Species

Identifying endangered/threatened species in the country is crucial for conservation planning, management, monitoring and policy- and decision-making. The Red List by the International Union for the Conservation of Nature (IUCN) has listed a number of marine species under the threatened, endangered and extinct categories. **Table 14.11** shows the various species in the Philippines that have been listed under the IUCN Red List and CITES listing in 2011 that call for immediate protection because of their endangered or threatened status. In 2017, the number of threatened species<sup>17</sup> are:

- Mammal species: 39
- Plant species (higher): 243
- Fish species: 93
- Bird species: 93



Photo by M. Ebarvia

<sup>17</sup> World Bank, 2018.

**Table 14.11:** List of Marine Species in the Philippines with Protection and Conservation Status.

Kingdom	Phylum	Class	Order	Number of species listed under IUCN			Number of species listed under CITES		
				VU	EN	CR	Appendix I	Appendix 2	
Animalia	Chordata	Actinopterygii	Atheriniformes	1					
			Clupeiformes	1					
			Ophidiiformes	1					
			Perciformes	10	1	1			
			Pleuronectiformes	1					
			Syngnathiformes	5				(All Hippocampus species)	
		Aves	Anseriformes	1					
			Charadriiformes	2	1	2			
			Ciconiiformes	1					
			Pelecaniformes			1			
		Chondrichthyes	Carcharhiniformes	3	3				
			Pristiformes			4	3	1	
			Lamniformes	6				2	
			Orectolobiformes	3				1	
			Rajiformes	7		2			
			Squaliformes	2					
		Mammalia	Carnivora	1					
			Cetartiodactyla	2	2		5	16	
			Sirenia	1			1		
		Reptilia	Testudines	1	2	2	5		
		Cnidaria	Anthozoa	Helioporacea	1				
			Anthozoa	Scleractinia	176	10			
			Hydrozoa	Milleporina	1				
Mollusca	Bivalvia	Veneroida	2				7		
Plantae	Tracheophyta	Magnoliopsida	Malvales		1				
		Magnoliopsida	Lamiales	1					
		Liliopsida	Hydrocharitales	1					
<b>Total</b>				<b>231</b>	<b>20</b>	<b>12</b>	<b>14</b>	<b>&gt;30</b>	

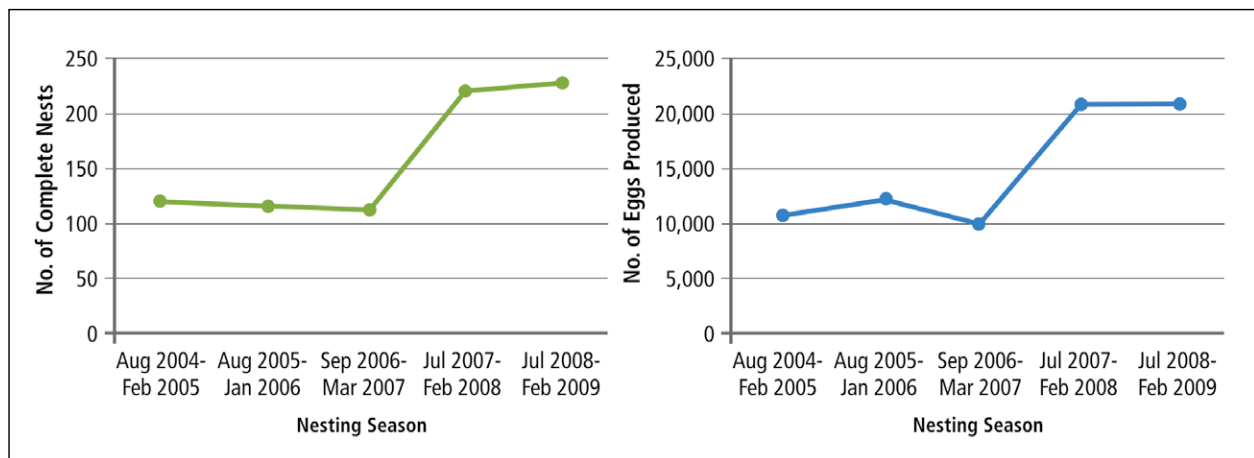
Source: CITES 2011, IUCN Red List 2011.

### (a) Marine Turtles

Five species of marine turtles are found in the Philippines, namely: the green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), olive ridley turtle (*Lepidochelys olivacea*), loggerhead turtle (*Caretta caretta*) and leatherback turtle (*Dermochelys coriacea*). Among the five, only the green, hawksbill and olive ridley turtles nest in the Philippines while the rest are known to forage only in Philippine waters (ADB, 2014). Green and hawksbill turtles have their nesting sites throughout the Philippine archipelago, all year year round, while the olive ridley turtles nest mostly in the provinces of Zambales, Bataan and Batangas, particularly from August to September. The marine turtles keep seagrass beds healthy. However, they are targeted for their eggs, leather, oil, skin, fat and bones, which are consumed as food and for medicinal purposes. The Pawikan Festival is held yearly at the Pawikan Conservation Center in Morong, Bataan to raise awareness.

Nesting population and egg production are used as indicators to assess the status and population abundance of marine turtles. The Biodiversity Management Bureau (formerly known as Parks and Wildlife Bureau)-Pawikan Conservation Project (PCP) in collaboration with DENR Regional Office, local government units (LGUs), non-government organizations (NGOs) and resort owners observed an increase in the number of olive ridley nests and eggs produced in Morong and Bagac (Bataan) and in San Antonio (Zambales) from August 2004 to February 2009 (**Figure 14.8**).

**Figure 14.8:** Complete Nests and Egg Production of Olive Ridley in Bataan and Zambales (August 2004 – February 2009).

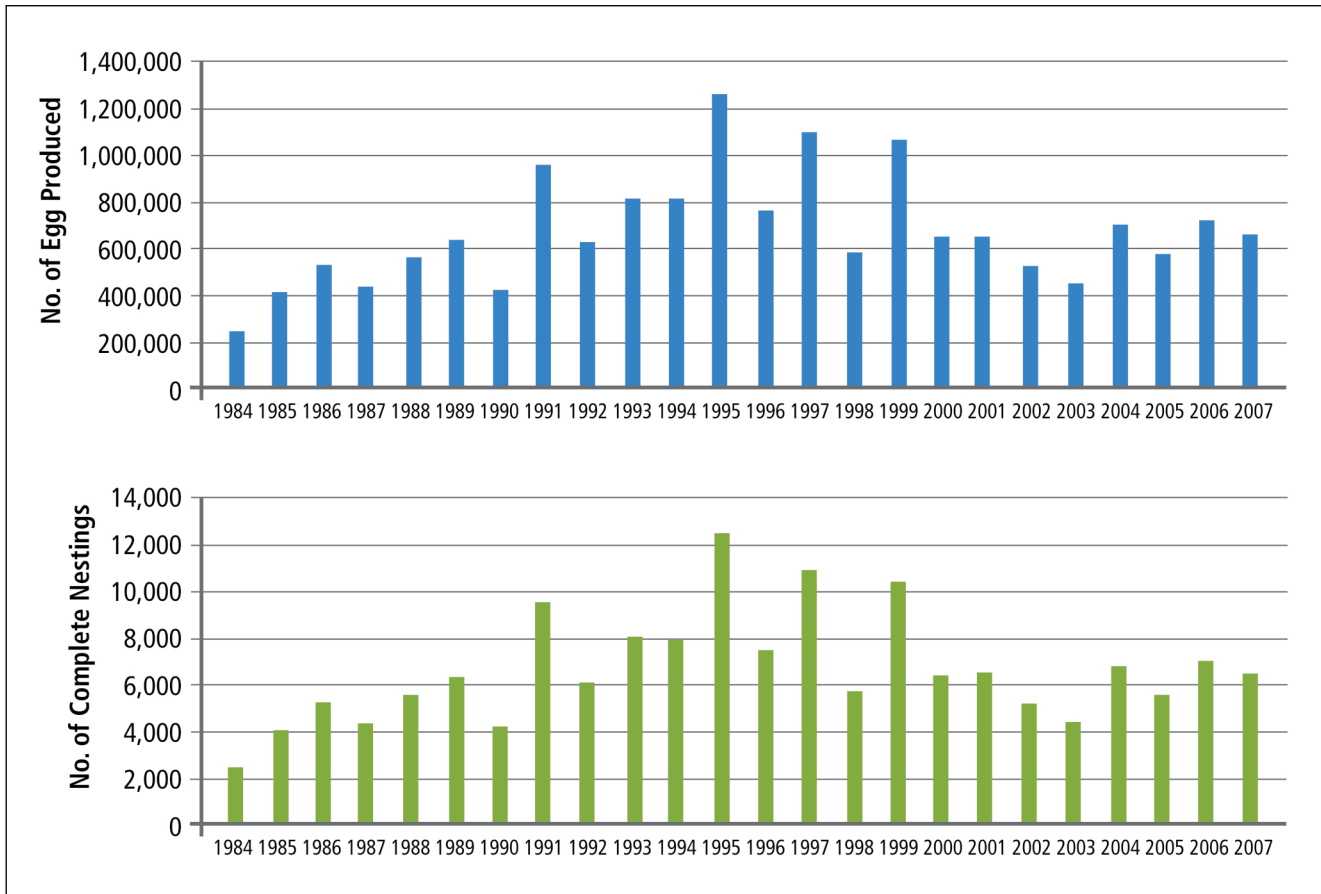


Source: PAWB-PCP, 2009.

Other well-known nesting areas are the Philippines Turtle Islands (also known as the Turtle Islands Wildlife Sanctuary or TIWS) and the Sabah Turtle Islands (Malaysia), both of which have been declared as the **Turtle Islands Heritage Protected Area (TIHPA)**. TIHPA is the first transboundary protected area for marine turtles in the world, and covers six islands administered by the Philippines and three islands administered by Sabah. in Southeast Asia.

From 1984 to 2007, the PCP recorded egg production and number of complete nestings in Baguan Island Marine Turtle Sanctuary (BIMTS) (**Figure 14.9**). Fluctuations in egg production and number of complete nests have been noted due to changes in weather patterns brought about by the El Niño or La Niña phenomena, and predation by monitor lizards (e.g., *Varanus sp.*) (ADB, 2014).

**Figure 14.9:** Number of Complete Nests and Egg Production per Year at BIMTS (1994–2007).



Source: PAWB-PCP, 2007; ADB, 2014.

## (b) Sharks

The whale shark, *Rhincodon typus*, is one of two protected species in the Philippines, and is listed as vulnerable in the *IUCN Red List Criteria, and Appendix II of the Convention on International Trade on Endangered Species (CITES)*. The Department of Agriculture (DA)-Fisheries Administrative Order (FAO) 193, S. 1998 bans the “taking or catching, selling, purchasing and possession, transporting and exporting of whale sharks and manta rays”.



### (c) Other Indicator Species

Other indicator species used by the Biodiversity Indicators for National Use (BINU) to assess status of marine and coastal biodiversity include humpback whales, and Irrawaddy dolphins. There are, however, insufficient data available for assessment.

Humpback whales (*Megaptera novaeangliae*) migrate annually to the Philippines to breed off Babuyan Islands, which is a significant marine conservation area. Over 100 individuals have been photo-identified from surveys conducted since 2000 (Acebes et al., 2007 as cited in CREE website).

Irrawaddy dolphins, *Orcaella brevirostris*, are found in estuaries and semi-enclosed water bodies, such as bays and sounds. They are listed in *Appendix 1 of the Convention on Migratory Species* (CMS) to which the Philippines is a member-party. Range states of this migratory species are encouraged to develop a conservation and management plan. In the Philippines, there is only one known population of less than 100 found in Malampaya Sound in Palawan.

## 14.3 Large Marine Ecosystems

### 14.3.1. South China Sea

The South China Sea (LME#36) is a global center of shallow water tropical marine biodiversity and is central to defining environmental sustainability and food security in the region. It is bordered by China, Hong Kong, Indonesia, Macau, Malaysia, Philippines, Taiwan and Vietnam (**Figure 14.10**). The South China Sea occupies a significant portion of the world fisheries production (Talaue-McManus, 2000), and has one of the highest biological productivity in all of the regions, covering an area of 5.66 million km<sup>2</sup> (TWAP 2015).

The South China Sea has a Class II – moderate production ecosystem with a biological production of 150-300gCm<sup>-2</sup>yr<sup>-1</sup>. Over 450 species of scleractinian corals have been recorded in the Philippines alone. Twelve percent of the world's total mangrove areas are found in the countries bordering this LME. Around 0.31% is protected, and contains 7.04% and 0.93% of the world's coral reefs and sea mounts, respectively (Sea Around Us, 2007). Because of its rich ecosystem, the SCS is home to many species that have been listed as threatened or vulnerable by the IUCN – which includes six species of marine turtles, the dugong and many other large marine vertebrate species. This LME is also reported to be one of the most overexploited regions in the world. Overfishing and destructive fishing have been reported as one of the major concerns within the South China Sea (UNEP, 2005). The South China Sea is particularly vulnerable to the El Nino Southern Oscillation (ENSO), which has caused significant weather changes around its bordering countries, such as Indonesia and Malaysia (<http://lme.edc.uri.edu>).

**Figure 14.10:** South China Sea LME.

Source: TWAP, 2015.

#### a. Major risks<sup>18</sup>

The countries surrounding the South China Sea have undergone very rapid economic development and rapid population increase in coastal areas over the past two decades resulting in degradation and loss of coastal habitats and resources.

**Sea Surface Temperature.** From 1957 to 2012, the South China Sea (LME #36) has warmed by 0.80°C, thus being on a threshold between Categories 2 and 3 (fast-to-moderate warming LME).

**Fish stock status.** The Stock-Catch Status Plots indicate that almost 40% of the stocks in the LME are collapsed or overexploited. However, the majority of the catches are supplied by fully exploited stocks.

**Nutrient (Nitrogen) load.** Human activities in watersheds are affecting nutrients transported by rivers into LMEs. Large amounts of nutrients (in particular *nitrogen load*) entering coastal waters of LMEs can result in high biomass algal blooms, leading to hypoxic or anoxic conditions, increased turbidity and changes in community composition, among other effects. In addition, changes in the *ratio of nutrients* entering LMEs can result in dominance by algal species that have deleterious effects (toxic, clog gills of shellfish, etc.) on ecosystems and humans. The Nitrogen Load risk level for contemporary (2000) conditions in South China Sea LME is very high.

<sup>18</sup> The information in this section is from: Transboundary Water Assessment Programme (TWAP) 2015. Factsheet on South China Sea (LME 36). GEF/UNEP/UNESCO-IOC.

**Plastic debris.** Modelled estimates of floating plastic abundance (items km<sup>-2</sup>), for both micro-plastic (<4.75 mm) and macro-plastic (>4.75 mm), indicate that this LME is among those with the highest plastic concentration.

**Mangrove and coral cover and reefs at risk.** Around 0.2% of this LME is covered by mangroves (US Geological Survey, 2011) and 0.42% by coral reefs (Global Distribution of Coral Reefs, 2010). This LME has a very high integrated threat index (combining threat from overfishing and destructive fishing, watershed-based and marine-based pollution and damage). Around 12% of coral reefs cover is under very high threat, and 17% under high threat. When combined with past thermal stress (between 1998 and 2007), these values increase to 19% and 24% for very high and high threat categories respectively. By year 2030, 26% of coral cover in this LME is predicted to be under very high to critical level of threat from warming and acidification; this proportion increases to 35% by 2050.

**Ocean Health Index.** The South China Sea LME has an Ocean Health Index (OHI) score of 60.4, which is lower compared to other LMEs (TWAP 2015). This score indicates that the South China Sea LME is well below its optimal level of ocean health. This LME scores lowest on food provision, coastal protection, carbon storage, tourism and recreation, sense of place and clean waters goals and highest on artisanal fishing opportunities.

**Climate-related threats.** Present day climate threat index of this LME is within the very high-risk (very high threat) category. The combined contemporaneous risk due to extreme climate events, degrading LME states and the level of vulnerability of the coastal population, is very high.

## **b. Transboundary issues**

The South China Sea is considered one of the most controversial areas in the globe. Access to resources within this body of water, particularly fisheries and mineral resources, are highly disputed among its neighboring countries. There have been significant territorial disputes over the sovereignty of the Spratly Islands and other offshore resources (Christy 1980, Catley & Keliat 1997, Castro 1998, Naess 1999). According to the *1982 United Nations Convention on the Law of the Sea* (UNCLOS), littoral states have the right to declare the area up to 200 nautical miles away from its coastline as an Exclusive Economic Zone (EEZ). This provision has caused a number of disputes over maritime delimitation. In the area around the Spratly Islands, six states have made overlapping claims to ocean space. Some of the states have even used arms to prevent other nations from occupying islands or reefs. (Naess, 1999 as cited by the GEF/Global International Waters Assessment (GIWA) -Regional Assessment of the South China Sea, 2005).

Transboundary issues on fisheries mostly involve the exploitation of migratory and pelagic species and excessive bycatch. Habitat modification (e.g., reclamation and island construction on coral reefs), decline of important or already critical species, and pollution (land based and ship based) are also among the key issues that were identified. Based on a combined measure of the Human Development Index, and the averaged indicators for fish and fisheries production, and pollution and ecosystem health modules, the overall risk factor is very high (TWAP, 2015).

### c. Strategic action plan

Recognising that actions were urgently needed to halt degradation of the environment of this LME, the countries around this LME prepared a Transboundary Diagnostic Analysis (TDA) of the issues and problems and their societal root causes, with the assistance of UNEP and the Global Environment Facility (GEF). The TDA became the basis for development of a Strategic Action Programme (SAP). A key element in this process has been the development of detailed National Action Plans by each country to address the specific concerns and issues relevant to the components of the SAP. Regional-level actions include *inter alia* networking, capacity building, public awareness and education, and applied research into management techniques and approaches that maximise the level of sustainable use without adverse environmental impact. Strategic priority actions were identified for mangroves, coral reefs, seagrass, and coastal wetlands. Regional actions were also identified for management of fish habitat and fish stocks as well as land-based pollution loadings in the South China Sea basin. One significant element of the SAP is the inclusion of economic values for coastal habitat goods and services, and their use in the determination of regionally applicable Total Economic Values.

Listed in **Table 14.12** is the engagement of key institutions in answering to the current issues in the South China Sea. Common issues of concern are biodiversity (due to pollution and habitat modification), fisheries (illegal, unreported and unregulated fishing) and other general issues. This LME has two transboundary arrangements for fisheries—Western and Central Pacific Fisheries Commission (WCPFC) and Asia-Pacific Fishery Commission (APFIC)—where each cover high seas highly migratory tuna and tuna-like fisheries and the fisheries within national jurisdiction.

With support from GEF and UN Environment, there is an initiative entitled “Implementing the Strategic Action Programme for the South China Sea” in partnership with the Ministries responsible for environment in Cambodia, China, Indonesia, Philippines, Thailand and Vietnam.

**Table 14.12:** Summary Data for Engagement by Countries in the South China Sea for Each Relevant Agreement.

Agreement	Binding	Issue Category	No. of Countries	No. of Ineligible	No. of engaged	% engaged
<b>LME - South China Sea</b>						
Dugong MOU	-	Biodiversity	7	1	1	17
IOSEA	-	Biodiversity	7	3	4	100
SEAFDEC	-	Fisheries	7	2	5	100
COBSEA	-	General	7	1	6	100
PEMSEA	-	General	7	1	6	100
APFIC	1	Fisheries	7	1	5	83
FFA	1	Fisheries	7	-	-	-
WCPFC	1	Fisheries	7	2	2	40

Source: TWAP, 2015.

### 14.3.2 Sulu-Sulawesi Seas

The Sulu-Sulawesi Seas LME, also called Sulu-Sulawesi Marine Ecoregion (SSME), and Sulu-Sulawesi Seascape, is located within the Coral Triangle, and it is bordered and protected by the governments of Indonesia, Malaysia and the Philippines (**Figure 14.11**). It is bounded by the Palawan trough in the north and by a promontory by the Sulawesi Island to the south. This LME covers an area of about 900,000 km<sup>2</sup> and is composed of two major seas, namely the Sulu Sea and the Sulawesi Sea or Celebes Sea (TWAP, 2015). Other smaller seas can also be found within the SSME, namely the Sibuyan, Visayan and Camotes Seas in the northeast, and the Bohol Sea in the south. These bodies of water are mostly enclosed by island masses in the Philippines (DeVantier, 2004). The SSME provides food, shelter, livelihoods and recreation to 40 million people.

The SSME is home to over 2,000 species of shallow water marine fishes in the Philippine and Indonesian regions alone, 400 species of marine algae, 16 species of seagrass, 33 species of mangroves, (WWF, 2004). It supports megadiversity as exemplified by 500 species of reef-building corals, 2500 species of marine fishes, five species of marine turtles, and at least 22 species of marine mammals (DeVantier, et al., 2004). The SSME are known habitats for many endangered species, e.g., Irrawaddy dolphin and the dugong. It is also home to the prehistoric Indonesian coelacanth species and has the largest population of Green Turtles in the whole of Southeast Asia.

All of these are now under threat from unsustainable fishing, pollution, and climate change. Moreover, rapid population growth and development in the countries surrounding the Sulu-Sulawesi Seas has resulted in dredging, shore conversion and habitat destruction. Population-related problems, such as waste management and pollution, direct sewage from domestic and industrial sources, siltation and run-offs, are now also the most serious threats to the SSME reef ecosystem (WWF International Corals Initiative). Illegal, unregulated, and destructive fishing has also led to the decline of commercially important species in the region. Quarrying of corals used for the aquarium industry and other purposes is also a common practice in the Philippines, Indonesia and Malaysia.

**Figure 14.11:** Location and GIWA Assessment Boundaries of the Sulu-Sulawesi (Celebes) Sea and the Adjacent GIWA Subregions.



Source: DeVantier et al., 2004.

### a. Major risks<sup>19</sup>

**Sea Surface Temperature.** From 1957 to 2012, the Sulu-Celebes Sea LME has warmed by 0.64°C, thus belonging to Category 3 (moderate warming LME). The steady warming of the Sulu-Celebes Sea was accentuated by two warm events, in 1988 and 1998, the latter being of the global scale (El Niño 1997-98).

**Fish stock status.** The Stock-Catch Status Plots indicate that about 27% of the stocks in this LME has collapsed or currently overexploited, and that the reported landings are largely supplied by fully exploited stocks (almost 70%).

**Plastic debris.** Modelled estimates of floating plastic abundance (items km<sup>-2</sup>), for both micro-plastic (<4.75 mm) and macro-plastic (>4.75 mm), indicate that this LME is in the group with the highest plastic concentration.

**Mangrove and coral cover and reefs at risk.** 0.7% of this LME is covered by mangroves (Giri, et al., 2011) and 1.99% by coral reefs (Global Distribution of Coral Reefs, 2010). This LME has a very high integrated threat index (combining threat from overfishing and destructive fishing, watershed-based and marine-based pollution and damage). Around 29% of coral reefs cover is under very high threat, and 34% under high threat. When combined with past thermal stress (between 1998 and 2007), these values change to 43% and 28% for very high and high threat categories respectively. By year 2030, 61% of coral cover in this LME is predicted to be under very high to critical level of threat from warming and acidification; this proportion increases to 62% by 2050.

**Ocean Health Index.** The Sulu-Celebes Sea LME scores below average on the Ocean Health Index compared to other LMEs. The OHI score for this LME is 60.13 (TWAP, 2015). This score indicates that the Sulu-Celebes Sea LME is well below its optimal level of ocean health, although there are some aspects that are doing well. This LME scores lowest on mariculture, coastal protection, carbon storage, coastal livelihoods, tourism and recreation, sense of place, and clean waters goals, but highest on artisanal fishing opportunities.

**Climate-related threats.** Present day climate threat index of this LME is within the very high-risk (very high threat) category. The combined contemporaneous risk due to extreme climate events, degrading LME states and the level of vulnerability of the coastal population, is very high.

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<sup>19</sup> The information in this section is from: Transboundary Water Assessment Programme (TWAP) 2015. Factsheet on Sulu-Celebes Seas (LME 37). GEF/UNEP/UNESCO-IOC.

## b. Transboundary issues

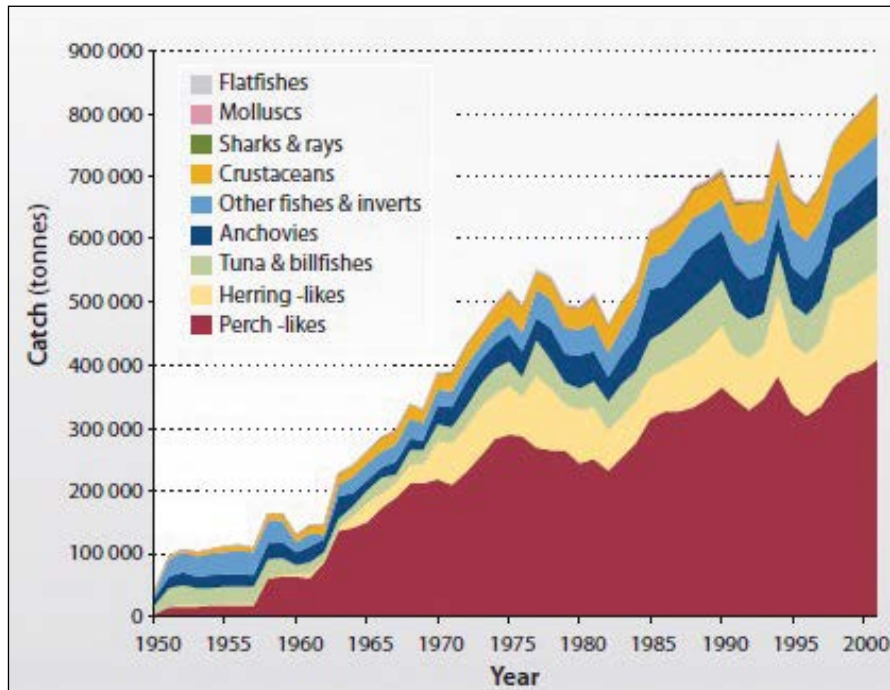
The key transboundary features, significance and problems in the SSME were analysed under the GEF/UNEP Global International Waters Assessment (GIWA) project (2002-2005), and GEF/UNDP/UNOPS Sulu-Celebes Seas Sustainable Fisheries Management Project (2010-2015). The priority transboundary problems identified were: (a) unsustainable exploitation of fish; (b) habitat modification and community destruction; (c) marine pollution; (d) freshwater shortage; (e) global warming, climate change; and (f) alien and invasive species.

Freshwater shortage is one of the identified issues within the Sulu-Sulawesi Marine Ecoregion. The construction of dams has resulted in drastic modifications of river systems, which are furthermore exacerbated by loss of vegetation and major cleaning of catchments. This in turn, has led to drastically increased rates of sedimentation flowing into coastal waters.

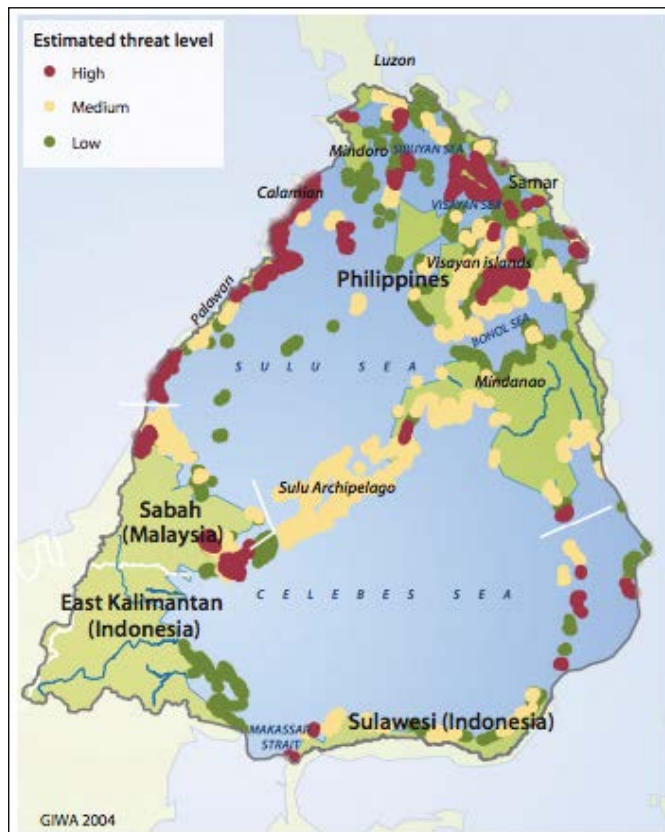
Industrial and agricultural pollution is also widespread in the region. Industrial pollution is most concentrated in the urban cities of the Philippines, e.g., Davao and Zamboanga City in Mindanao; Cebu, Bacolod and Dumaguete City in the Visayas and Puerto Princessa, Batangas City and Lucena in Luzon. A study (World Bank, 2009) reported that an estimated 2.2 million tonnes of organic pollutants are released out into the environment. In 2013, an estimated 4.5 million tonnes of BOD load was generated by point sources of pollution while 465,595 tonnes were reported to come from non-point sources – majority of which come from agricultural run-off.

The area of the Sulu-Sulawesi LME supports one of the most diverse coastal ecosystems in the world. However, various pressures have ultimately resulted to wide-scale habitat and community modification. Between the 1850s and 1970s alone, it has been estimated that 30% of the original ecotones in the Sulu-Sulawesi region have been lost (UNEP, 2005).

This LME is considered as an ecosystem with low productivity at less than 150g Cm<sup>-2</sup>year<sup>-1</sup>. The offshore waters are relatively unexploited and commonly fished areas are found near the coast of the neighboring states (UNEP, 2005). However, many of the fishing techniques are highly destructive, such as blast fishing and cyanide. Destructive fishing has led to the widespread destruction of coral reefs and soft-bottom communities in the region. Since the 1950s, fish catch have been reported to be steadily increasing (**Figure 14.12**) and if not properly managed, this could contribute to the fast-growing problem of overfishing in the region. The SSME is already considered to be at medium to high risk of overfishing (**Figure 14.13**). Seventy percent of Philippine reefs are considered highly overfished, producing less than 5 tonnes/km<sup>2</sup>/year. Healthy reefs are estimated to produce 15-20 tonnes/km<sup>2</sup>/year (Licuanan and Gomez, 2000).

**Figure 14.12:** Catches of Various Fish Resources in the Sulu-Sulawesi Region.

Source: University of British Columbia Fisheries Center, 2003.

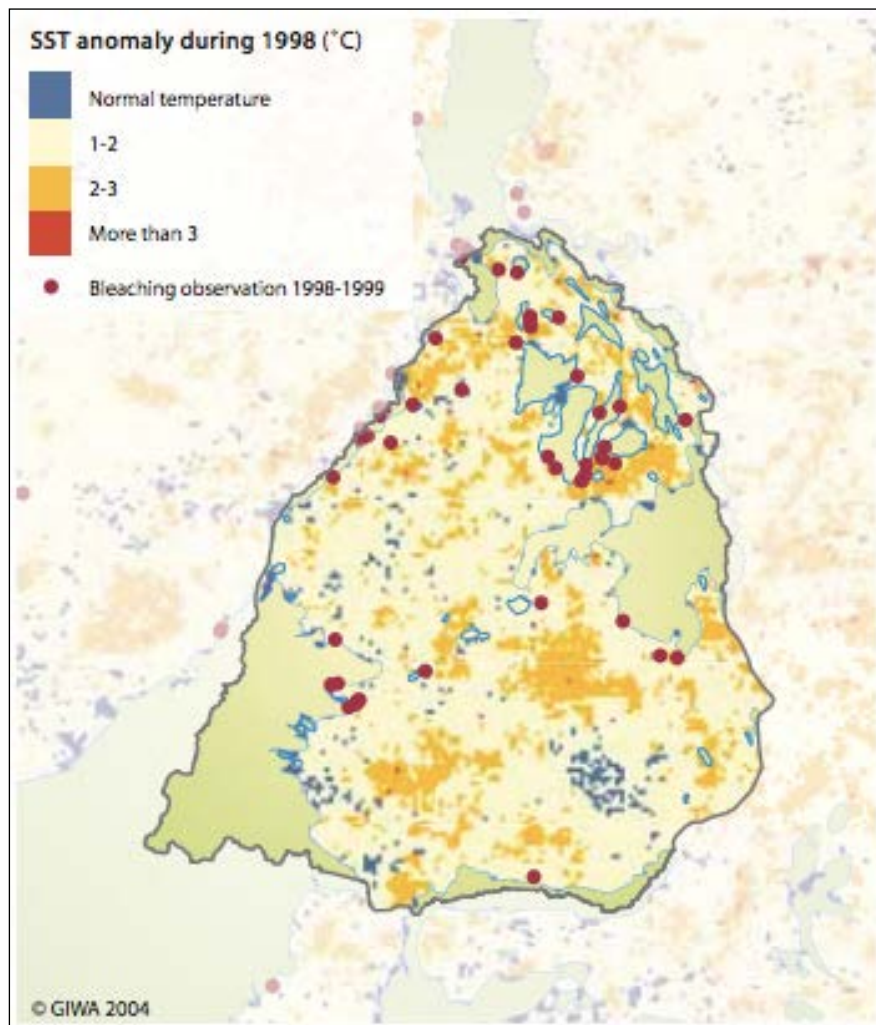
**Figure 14.13:** Reef Areas at Risk due to Overfishing Practices in the Sulu-Sulawesi Region.

Source: UNEP, 2005; Burke et al., 2002.



Changes in sea surface temperature (SST) around the SSME are predicted to have major implications in the region's marine ecosystem. As of 2001, there were no known environmental impacts associated with changes in UV-B radiation and ocean CO<sub>2</sub> source/sink function in the region. However, the effects of climate change are now manifesting through changes in hydrological cycle and ocean circulation, sea level change and changes in SST. **Figure 14.14** shows areas around the SSME most affected by the SST anomaly during the 1998 ocean warming event.

**Figure 14.14:** Sea Surface Temperature Anomalies around the SSME in 1998.



Source: UNEP, 2005; NOAA/NESDIS, 2003.

### c. Strategic action plans

A tri-national committee for the Sulu-Sulawesi Marine Ecoregion was established in 2004 during the Seventh Conference of the *Parties to the Convention on Biological Diversity* in Kuala Lumpur, Malaysia for the conservation of this region. The conservation plan was focused mainly on three

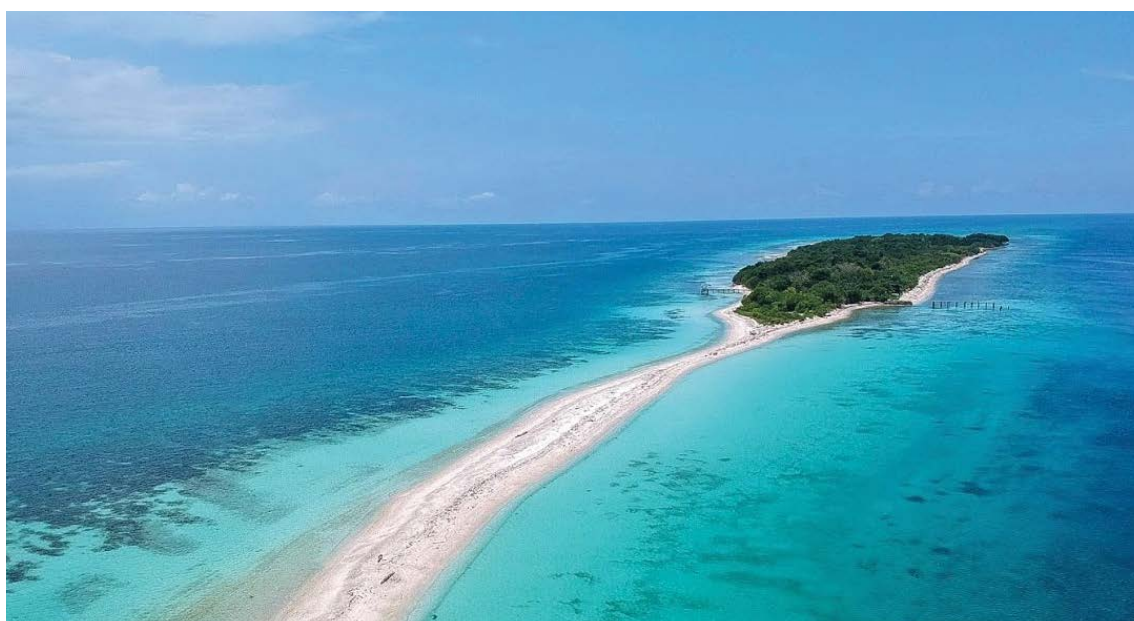
programs: (1) Threatened, Charismatic and Endangered Species, (2) Sustainable Fisheries and (3) Marine Protected Areas and Networks. (See the *Logical Framework of the Sulu Sulawesi Marine Ecoregion Comprehensive Action Plan in Annex A for more detailed information.*)

Engagement among the surrounding countries of the Sulu-Sulawesi LME is relatively good. Data from the UNESCO Transboundary Waters Assessment Program (TWAP 2015) reported that common issues in the area are biodiversity-related (e.g. habitat degradation and modification), fisheries-related (specifically those found within the EEZ) and pollution (both marine-based and land-based). In almost all of the programs, all three countries have 100% engagement, except for the Dugong MOU (**Table 14.13**). A number of initiatives resulted in the development of Strategic Action Plans and tri-national governance structure, and implementation of programs and projects (**Table 14.14**). The Sulu-Sulawesi Seascape is a priority transboundary seascape under the broader Coral Triangle Initiative (CTI).

**Table 14.13:** Summary Data for Engagement by Countries in the Sulu-Celebes Sea for Each Relevant Agreement.

Agreement	Binding	Issue Category	No. of Countries	No. of Ineligible	No. of engaged	% engaged
<b>LME - Sulu-Celebes Sea</b>						
Dugong MOU	-	Biodiversity	3	-	1	33
IOSEA	-	Biodiversity	3	-	3	100
SEAFDEC	-	Fisheries	3	-	3	100
COBSEA	-	General	3	-	3	100
PEMSEA	-	General	3	-	3	100

Source: GEF/UNEP/UNESCO-IOC. TWAP, 2015



Little Sta. Cruz Island, Zamboanga City - part of the Great and Little Sta. Cruz Islands Protected Landscape and Seascape. (Photo by DENR)

**Table 14.14:** Timeline of Initiatives in Sulu-Sulawesi Seas.

Year	Initiatives				
	Sulu-Sulawesi Marine Ecoregion (SSME)			Sulu-Sulawesi Seascape (under CTI)	Sulu-Celebes Seas LME
	Action Plans	Institutional Arrangements	Programs/Projects	Programs/Projects	Programs/Projects
1999			<b>Sulu-Sulawesi Marine Ecoregion Conservation Program</b> (WWF), 1999-2004		
2001	<b>Biodiversity conservation vision for SSME</b> , involving 58 priority conservation areas				
2002					<b>Regional Assessment of Sulu-Celebes Seas LME</b> (GEF/UNEP/Global International Waters Assessment (GIWA)) - Transboundary Diagnostic Analysis
2003	<b>Ecoregion Conservation Plan</b> , with 3 country action plans and 1 ecoregion-level action plan for joint tri-national activities (WWF)	<b>Governance structure – Tri-national MOU</b>			
2004					
2005			<b>Sulu-Sulawesi Seascape Initiative</b> (CI), 2005-2010 - establishment of MPAs and sea turtle MPA networks		
2006		<b>Tri-national Committee for SSME, with 3 sub-committees</b> (2006-2016) • Threatened, Charismatic, and Migratory Species, led by Indonesia • Sustainable Fisheries, led by Malaysia • MPAs and Networks, led by the Philippines			
2007					
2008					<b>Strengthening Environmental Management in BIMP-EAGA</b> (ADB), 2008-2015 - SSME Comprehensive Action Plans (2011)
2009	<b>Action Plans of the SSME</b> (2009-2012) • Workplans of 3 sub-committees (USAID, CI, TNC, WWF)  <b>SSME Action Plan for sea turtles and the design of the transboundary MPA network</b> (CI)				
2010				<b>Sulu-Celebes Seas Sustainable Fisheries Management Project</b> (GEF/UNDP/UNOPS), 2010-2015 - Updating of TDA - Regional Strategic Action Program on Sustainable Fisheries Management	
2011	<b>SSME Comprehensive Action Plans</b> (ADB)		<b>Coastal and Marine Resources Management in the Coral Triangle - Southeast Asia (RETA 7813)</b> (ADB/GEF), 2011-		
2012					
2013			<b>Support to the implementation of the Regional Plan of Action of the CTI-CFF in the Sulu-Sulawesi Seascape Countries</b> (GIZ), 2012-2018		
2014	<b>Regional Strategic Action Program on Sustainable Fisheries Management</b>				
2015					
2016					
2017					
2018					

### Regional Strategic Action Plan (RSAP) of the CTI-CFF in the Sulu-Sulawesi Seascape

**Countries:** Under the CTI-CFF, the Sulu-Sulawesi Seas have been designated as one of the priority seascapes. The RSAP was formulated to manage this seascape, and it has the following features:

- Based on the TDA and Causal Chain Analysis of Priority Problem 1 - unsustainable exploitation of fish
- Focuses on the Ecosystem Approach to Fisheries Management of small pelagic stocks in the SCS-LME
- Embodies a set of **regional targets**, activities and indicators under 6 themes:

**Table 14.15:** Themes of the RSAP.

Theme	Name	No. of Targets/Activities
1	Science-based social and management interventions	2;8
2	Resource valuation	1;3
3	Monitoring, control and surveillance (MCS)	1;3
4	Information, Education and Communication (IEC)	1;3
5	Livelihood development	1;4
6	Capacity building	1;6

Source: *CI-Philippines and DENR (2017); Sulu-Sulawesi Marine Ecoregion Tri-National Committee (2013).*

- Enumerates supporting **national targets** of Indonesia, Malaysia and Philippines; and provides details of the activities, targets, indicators and financial needs of each country in the implementation of the SAP
- Scope and limitation of the RSAP: focuses only on the unsustainable exploitation of fish – which is just the first of the six priorities identified in the TDA. (An expanded SAP will be developed following the same process SAP went through. This expanded SAP will provide an opportunity of improving the governance structure for its implementation.)

Among the actions that have been undertaken are: community-based conservation programs; capacity building to improve fishing practices; establishment and expansion of MPAs to include areas of high biodiversity importance; establishment of a Sea Turtle MPA Network, to connect turtle nesting sites and migratory routes across the Philippines, Indonesia and Malaysia; rehabilitation of mangroves; and integration of ecosystem approach in climate change adaptation strategies (Conservation International).

## 14.4 Other Key Features

### 14.4.1 Philippine Rise (Benham Rise)

Benham Rise, now renamed as the Philippine Rise, is a natural prolongation of the Luzon Island that extends 589 km from the Eastern Philippine seaboard to the Pacific Ocean (**Figure 14.15**). The continental shelf covers a length of 200 nautical miles from the baselines of Luzon and the extension of the seabed and subsoil approximately up to 188 nautical miles beyond the legal continental shelf limits. The Philippine Rise is geo-morphologically distinct from the deep ocean floor and forms a thick crust that is lying 3,000-3,500 meters below sea level. The shallowest point of the shelf is Benham Bank which is found at around 48-70 meters below sea level ([www.fsi.gov.ph](http://www.fsi.gov.ph)).

Benham Bank is highly rich in fishery resources. It is an important fishing ground for fishers from Real (Quezon), Aurora (Baler), Catanduanes and adjacent provinces along the Northern Philippine Pacific Seaboard. Exploratory fishing done on Benham Bank showed that the area is capable of yielding a relatively high rate of tuna species (yellowfin, big eye and albacore) compared to the other fished areas in the Philippines. The Philippine Rise also shows potential as sources of high-value minerals and energy resources.

PCAARRD reported the following in 2018:

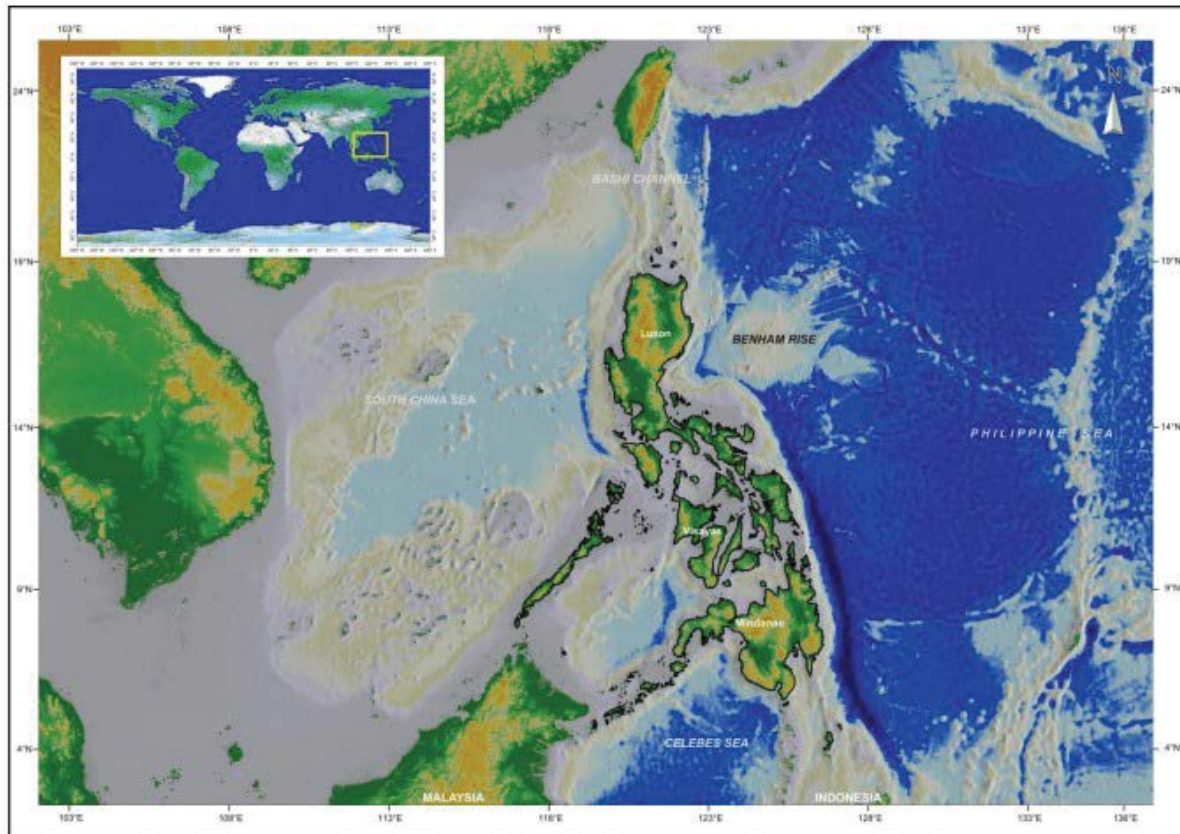
“In 2014, the ‘reefscapes’ and apparent biodiversity of the Bank have been explored. The living hard corals in the Bank were observed with excellent cover of 75% to 100% despite of low light at the bottom. These were described as tiered, thick, rigid, mostly foliose, and plate-forming. These dominant plate-forming corals were identified as *Porites (Synaraea) rus*. Sixty-two (62) fish species of bony fishes were recorded from the visual surveys, and hook-and-line fishing, mostly adults are observed, among the commercially important, and a number were indicators of reef health, e.g., butterfly fish.

The presence of green algae, *Halimeda*, together with growth forms of filter feeding sponges, was also documented. These sponges were arborescent, irregular, and massive, with colors ranging from red to maroon, bright blue and yellow.

A larger area of the Bank, covering 25 stations, was explored in 2016 using advance underwater technologies, such as remotely-operated vehicle (ROV). Five new microhabitats were discovered by their dominant fauna and/or bottom type: (1) sponges and soft corals; (2) green algae, *Halimeda*; (3) mixed algae on hard bottom; (4) *Halimeda* on sand; (5) large areas of sand. The fish species richness was doubled compared with the

first exploration. The baited remote underwater video system (BRUVS) recorded 175 species, including surgeonfish, hawkfish, damselfish, and tiger sharks, altogether for 30 hours. There appeared to be significantly more fish species and larger individuals (>10 cm length) observed at 55-65 m compared to 85-140 m depth. The relatively shallow habitats of the Bank, as a consequence, harboured greater fish biomass.”

**Figure 14.15:** The Philippine Rise off the Eastern Seaboard of Luzon, Philippines.



Source: Republic of the Philippines, Benham Rise Executive Summary.

### a. Major issues

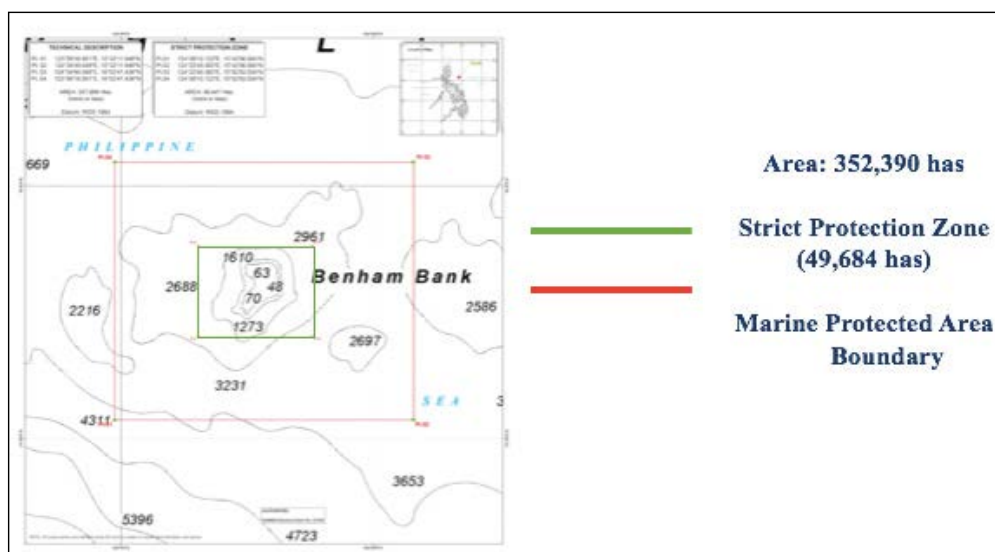
Majority of the PH Rise area, including the Benham Bank, is located in the EEZ of the Philippines. The UN Commission on Limits of the Continental Shelf (CLCS) adopted in 2012 the Extended Continental Shelf (ECS), which granted the Philippines the sovereign rights over the seabed and seafloor in the ECS, but not over the waters above, which is International Waters. The naming of several undersea features within Benham Bank by a foreign country – as approved by the International Hydrographic Organization – sparked further debate on increasing the government’s security measures in the eastern side of the country to efficiently manage and secure this area.

## b. Policies and actions

In May 2017, to strengthen the country's resolve in exercising its sovereignty over the area, Benham Rise was officially renamed as the Philippine Rise through Executive Order No. 25 s. 2017.

In March 2018, the Philippine government declared a ban on all research activities and maritime studies conducted by foreign entities. In May of the same year, *Proclamation No. 489 (s. 2018)* declared part of the 352,390 ha of the underwater plateau, including the Benham Bank, as a Marine Resource Reserve and as a Protected Area under the NIPAS category of Marine Resource Reserve. (**Figure 14.16**). A current initiative of DENR-BMB is the development of a management plan for the Philippine Rise Marine Resource Reserve.

**Figure 14.16:** Areas in the Philippine Rise Declared as a Marine Resource Reserve and a Strict Protection Zone.



Source: DENR-BMB, 2018.

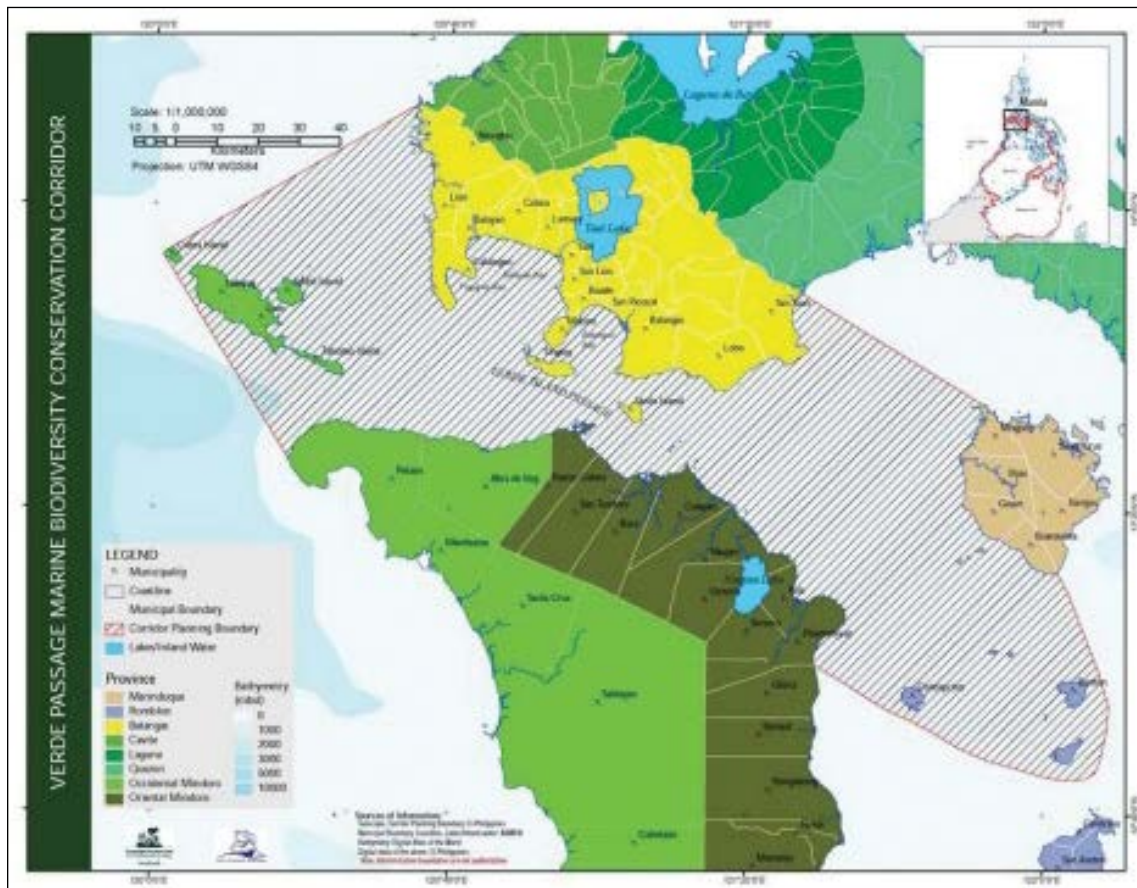
### 14.4.2 Verde island Passage

The Verde Island Passage lies within the Sulu-Sulawesi Marine Ecoregion (SSME), located between the island of Mindoro and the province of Batangas (**Figure 14.17**). The passage is bordered to the northeast by the coast of San Juan, Batangas; Mogpog, Boac, Gasan and Buenavista, Marinduque in the east; Pinamalayan, Oriental Mindoro to the south. The boundary extends further southeast to cover the waters and the island municipalities of Concepcion, Corcuera and Banton, Romblon; Calisurigan Point, Cape Calavite and Paluan, Occidental Mindoro at the southwest; the westernmost tip of Cabra Island of Lubang, Occidental Mindoro at the west, and the Limit Point, Nasugbu Batangas at the northwesternmost side (DENR-BMB, 2009).

In 2005, the Verde Island Passage (VIP) was merited to have the highest concentration of shore fish species per unit area and was declared as the **center of the center of marine shorefish biodiversity** by Carpenter and Springer (2005). But even long before the said study, the VIP has been well recognized by the Philippine government as one of the rich biodiversity areas in the country, and is therefore a priority for conservation during the *Philippine Biodiversity Conservation Priority-setting Program* in 2000.

The VIP is divided into two main channels namely the North Pass and the South Pass covering an estimated area of 1.4 million ha. It is a crucial marine corridor that facilitates the movement and transfer of marine organisms (adult or larvae) across its connecting bodies of water. In 2003, 25 new species of sclerectinan corals were discovered and added to the list of coral species in the VIP. The survey on the VIP in 2007 reported 339 hard coral species – including one newly discovered *Acropora* species by Dr. Wilfredo Licuanan and Dr. Rob Van Woesik – in Lian, Batangas. The finding is currently being subject to confirmation. Known as a Tuna Highway, the passage is frequented not only by the highly migratory tuna species, but also three marine turtles: the Green turtle, *Chelonia mydas*; the Olive Ridley turtle, *Lepidochelys olivacea*; and the critically endangered Hawksbill turtle, *Eretmochelys imbricata*.

**Figure 14.17:** Map of the Verde Island Passage Corridor.



Source: DENR-BMB.



### a. Major issues

A Sulu-Sulawesi Congress was held in 2007 which highlighted critical issues encountered within the Verde Island Passage. The list included institutional, fishing-related, biodiversity, land-use, pollution, resource use, tourism and socio-economic issues. A need to strengthen inter-agency and intra-agency relations was seen for the proper implementation of the existing coastal resource management programs and enforcement inside marine protected areas. Fishing-related issues were mainly due to illegal and unsustainable fishing methods employed by fishers in the area. The Verde Island Passage is known for its abundance of aquarium fish, and the use of poisonous and noxious substances for collection is widely popular. Blast fishing has also been observed in the area. Encroachment of commercial fishers into municipal waters is also a constant complaint among municipal fishers.

Destructive anthropogenic activities, e.g., coral gathering, mangrove cutting and by-catch of threatened marine species, are among the factors that contribute to biodiversity loss in the VIP. Because of several ports situated around the VIP, biological pollution is now becoming an emerging concern. Invasive species that are being brought into the VIP through the ballast water of ships compete with the native population for food and space. Toxic invasive species have also led to harmful algal blooms that have led to fish and bird kills (DENR-PAWB, 2009).

### b. Policies and actions

**Executive Order No. 578 (2006)** is the **National Policy on Biological Diversity**, prescribing its implementation throughout the country, particularly in the Sulu Sulawesi Marine Ecosystem and the Verde Island Passage Region. EO 578 stipulates the formation of a task force for Verde Island Passage to ensure the protection, conservation and sustainable use of the biological diversity of the Verde Island Passage Marine Corridor. The task force is composed of these agencies: DENR, DOT, DOST, DA, DOH, DOE, DOTC, DFA, DTI, DND, DILG, NEDA and all local government units.

In accordance with EO 578, the *Verde Island Passage Marine Corridor Management Plan* was created to preserve and sustainably manage the resources within the Verde Island Passage Marine Corridor (VIPMC) and address the current problems that threaten these resources. The general management strategies of the VIPMC Management Plan include a community-based approach to coastal management planning, which emphasizes a multi-stakeholder partnership between the local government unit, the community, NGOs and experts from the academe and other institutions. Mangrove planting, implementing seasonal fishing closures, designating marine protected areas to allow fish populations to recover, and capacity building on income diversification for local communities are among the key activities being implemented. The MPAs are all locally managed, and form an **MPA network** with the aim of maximizing the area of protection around the

VIP. Research and knowledge management is also prioritized. Research data is regarded as a fundamental requirement in the formulation of suitable management policies for the area (DENR-PAWB, 2009). Initiatives of the various partners and stakeholders in the Verde Island Passage have resulted in an increase of over 16,000 ha of marine protected areas, including coral reefs and mangrove forests.



Coral reef in Anilao, Batangas. (Photo by DENR)



Mangroves in Puerto Galera, Oriental Mindoro.  
(Photo by M. Ebarvia)

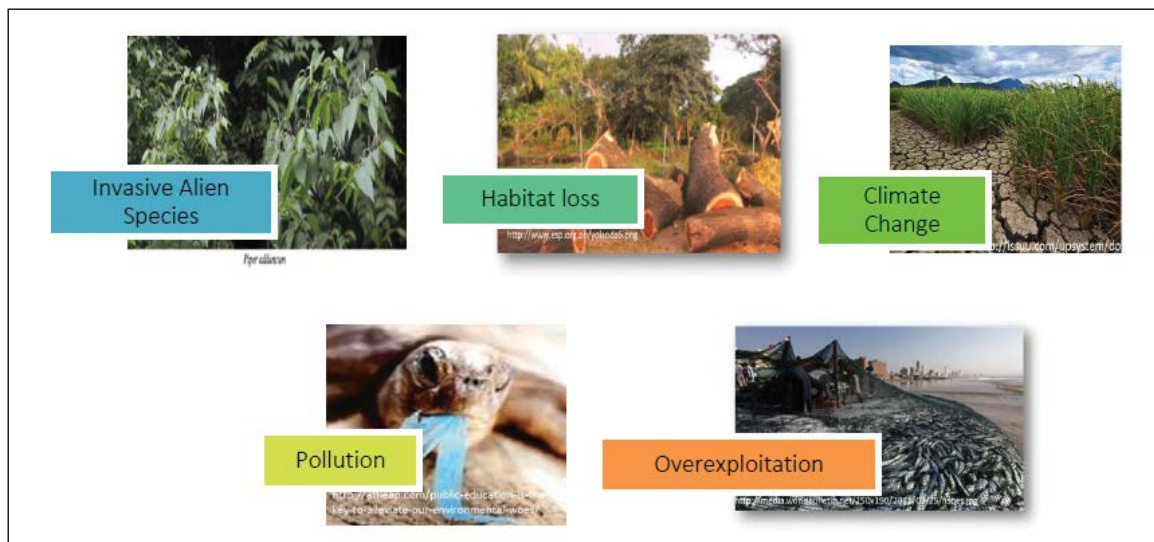


Overlooking VIP from Marinduque. (Photo by M. Ebarvia)

# 15 Risks and Threats to Ocean Health and the Ocean Economy

According to the **Philippine Biodiversity Strategy and Action Plan, 2015-2028**, the top 5 pressures that trigger biodiversity loss in the Philippines are invasive alien species, habitat loss, climate change, pollution and overexploitation (**Figure 15.1**).

**Figure 15.1:** Main Pressures of Biodiversity Loss in the Philippines.



Source: DENR-PAWB, 2009.

Among the five pressures listed, habitat destruction and degradation are the most prevalent in the country. Loss of seagrass beds, diminishing coral cover and decreasing numbers of fish are the direct results of habitat destruction and land use changes. Illegal, unreported and unregulated fishing (IUU) has also resulted in dwindling fish abundance in the country. Urban and agricultural run-off does damage to coral reefs and seagrass beds through pollution, sedimentation, and by blocking the sun's rays. Coral reefs and seagrass thrive in clean water because they need direct sunlight. Loss of biodiversity has cost the Philippines millions of pesos considering the economic value of the resources that have been lost due to mismanagement and non-protection (DENR-PAWB, 2009). Previous estimates of the environmental cost can be seen in **Table 15.1**. New studies are needed to assess the current value of environmental damage.

**Table 15.1:** Summary of Environmental Costs to Coastal and Marine Resources, 2006 (in million PHP).

Source / Impact	Ecosystem				Total	%
	Mangrove	Seagrass	Coral Reef	Other Coastal		
Unsustainable fishing, etc.						
<b>Total related to fisheries</b>	<b>207.97</b>	<b>n.e</b>	<b>1,036.33</b>	<b>1,335.01</b>	<b>2,579.31</b>	<b>45.40</b>
Fisheries impacts, coastal development, pollution and climate change	169.56	0	0.28	0.28	170.12	3
Fisheries impacts from overfishing (depletion)	38.41	n.e	1,036.06	1,074.43	2,409.19	42.40
<b>Coastal development</b>	<b>1,890.61</b>		<b>451.41</b>	<b>0.01</b>	<b>2,342.03</b>	<b>41.20</b>
Conversion to fishponds	1,886.19				1,886.19	33.2
Reclamation	4.42		451.41	0.01	455.33	8.00
<b>Pollution</b>	<b>108.15</b>	<b>5.7</b>	<b>115.62</b>	<b>529.93</b>	<b>759.40</b>	<b>13.40</b>
Human morbidity / mortality				401.66	401.66	7.1
Oil spill (Guimaras)	108.15	5.7	115.62	122.8	352.27	6.20
Harmful algal biomass				3.47	3.47	0.1
Fish kills				2.01	2.01	<0.1
<b>Climate change</b>			<b>2.35</b>		<b>2.35</b>	<b>&lt;0.1</b>
Coral bleaching			2.35		2.35	<0.1
<b>TOTAL</b>	<b>2,206.73</b>	<b>5.7</b>	<b>1,605.71</b>	<b>1,864.55</b>	<b>5,683.08</b>	<b>100.00</b>
%	38.83		28.25	32.82		
Per unit area (Php/ha)	10,533		594.71	78.98		

Note: n.e. = not estimated.

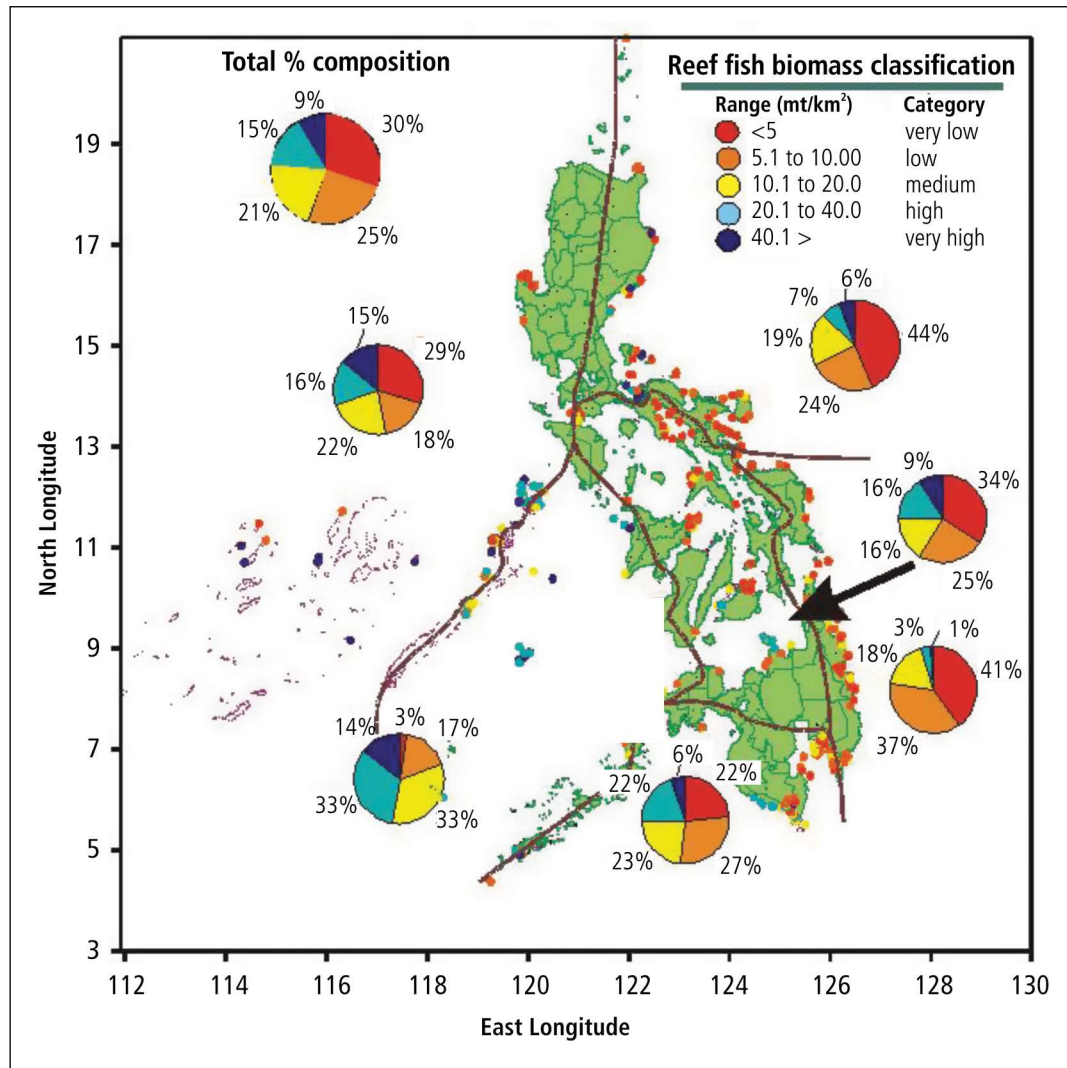
Source: World Bank, 2009.

## 15.1 Human Activities and Environmental Damage

### 15.1.1 Overfishing and Destructive Fishing

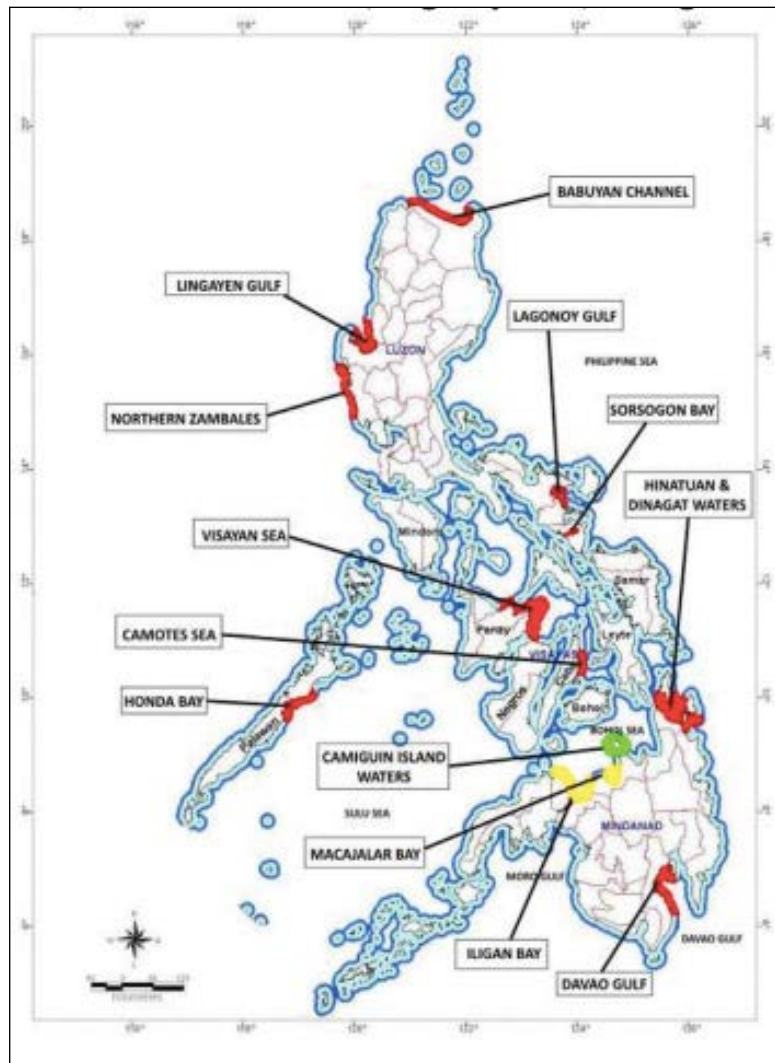
Studies have reported that overfishing is a significant threat in most areas in the country. Low abundance of species at certain regions, especially in the Visayas Region, is characteristic of intense fishing and habitat degradation (Nañola et al., 2011). Continuous overfishing has a cumulative effect on fish biomass and species composition (**Figure 15.2**).

**Figure 15.2:** Percentage of Reef Fish Biomass Categories of the Biogeographic Regions in the Philippines.



Source: Nañola et al., 2002.

Major threats to the fisheries stocks include the ever increasing fishing pressure brought about by the growing number of fishers per fishing area and the use more efficient fishing gears and mechanized fishing operations. The National Fisheries Research and Development Institute (NFRDI) reported in 2009 that out of the 13 major fishing areas in the country, 10 of these are overfished (4<sup>th</sup> National Report to the Convention on Biological Diversity, 2009) as shown in **Figure 15.3**. The major fishing grounds identified were Babuyan Channel, Lingayen Gulf, Northern Zambales, Visayan Sea, Camotes Sea, Honda Bay, Camiguin Island Waters, Macalajar Bay, Iligan Bay, Davao Gulf, Hinatuan and Dinagat Waters, Sorsogon Bay, and Lagonoy Gulf. All of the aforementioned fishing grounds are overfished except for Macalajar Bay and the Camiguin Island Waters, which have exploitation values that are within the normal range and below the minimum range, respectively.

**Figure 15.3:** Major Fishing Areas in the Philippines.

Red: Exploitation Values (E) exceeding the maximum.  
 Yellow: Actual E values falling within the ideal range.  
 Green: actual E values falling lower than the minimum value.

The use of destructive fishing methods (e.g. cyanide, blast fishing and fine mesh nets) has long contributed to the rapid decline of fish stocks and habitat degradation. By-catch and discards from trawling are also considered as threats to fisheries sustainability (<http://www.seafdec.org/fisheries-country-profile-philippines>, 2017).

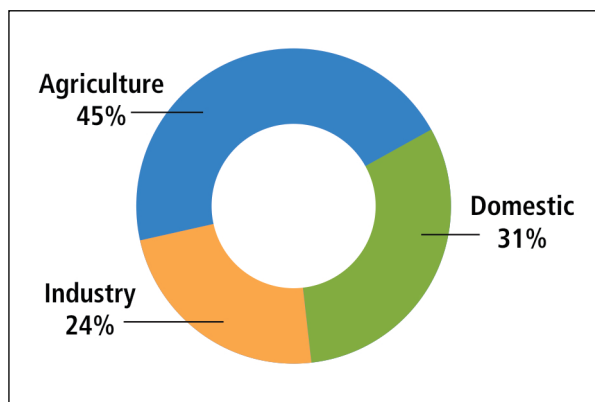
### 15.1.2 Marine Pollution

Major sources of marine pollution include domestic and industrial wastes, agrochemical loading, siltation/sedimentation, toxic and hazardous wastes (including heavy metals and mine tailings), and oil spills (ADB, 2014). The basis for appraising water quality using certain physicochemical indicators, e.g., dissolved oxygen (DO), fecal coliform, some heavy metals, pesticides and pH, has

been revised, and new guidelines for key parameters have been set by the DENR in 2016. The *DENR Administrative Order (DAO) No. 2016-08-WQG* sets the standards for water quality and general effluent for each type of water body (**Table 13.2** and **13.3**).

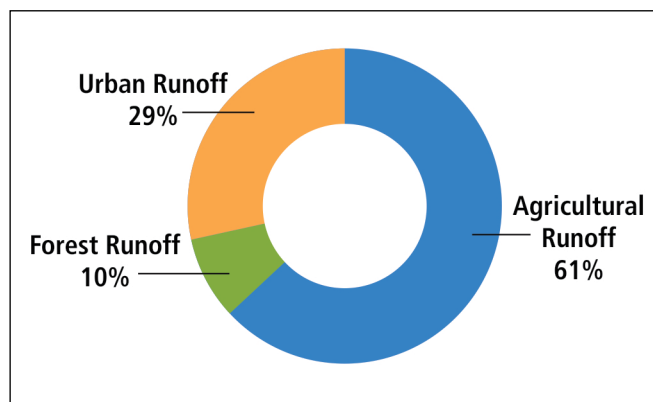
Pollution in the marine environment can be divided into point and non-point sources. Point sources are materials that have a specific and identifiable discharge point in a water body. Non-point sources on the other hand, have no identifiable sources which can include rainwater run-off from farms and urban areas. In 2013, it was estimated that 4.5 million tonnes of BOD load was generated by pollution from identified point sources. The major contributor of BOD from point sources is the agricultural sector, making up 45 percent of the total BOD production (**Figure 15.4**). Similarly, the agricultural sector is also the major contributor of BOD from non-point sources at 61 percent through agricultural run-offs (**Figure 15.5**).

**Figure 15.4:** BOD Contribution from Point Sources.



Source: DENR-EMB, 2013.

**Figure 15.5:** BOD Contribution from Non-point Sources.



Source: DENR-EMB, 2013.

As shown in Section 13.2 on water quality assessment, there is a need to increase the number of coastal water bodies for monitoring. With 36,289 km of coastline in the country, only 122 coastal areas are being monitored as of 2018. The rising number of urban populations living along the coast, increased plastic use, and proper solid waste management and the lack of wastewater treatment facilities have exacerbated the amount of amount of pollution released into the coastal waters.

In terms of water quality and quantity, the four critical regions that are main contributors to water pollution are: the NCR (Metro Manila), Central Luzon, Southern Tagalog and Central Visayas (ADB, 2014).

*(Refer to Section 13.2 for the results of the water quality monitoring of selected/priority rivers and coastal recreational waters.)*



Boracay after the 2018 cleanup. (Photo by DENR)

### 15.1.3 Land Conversion and Destruction of Habitats

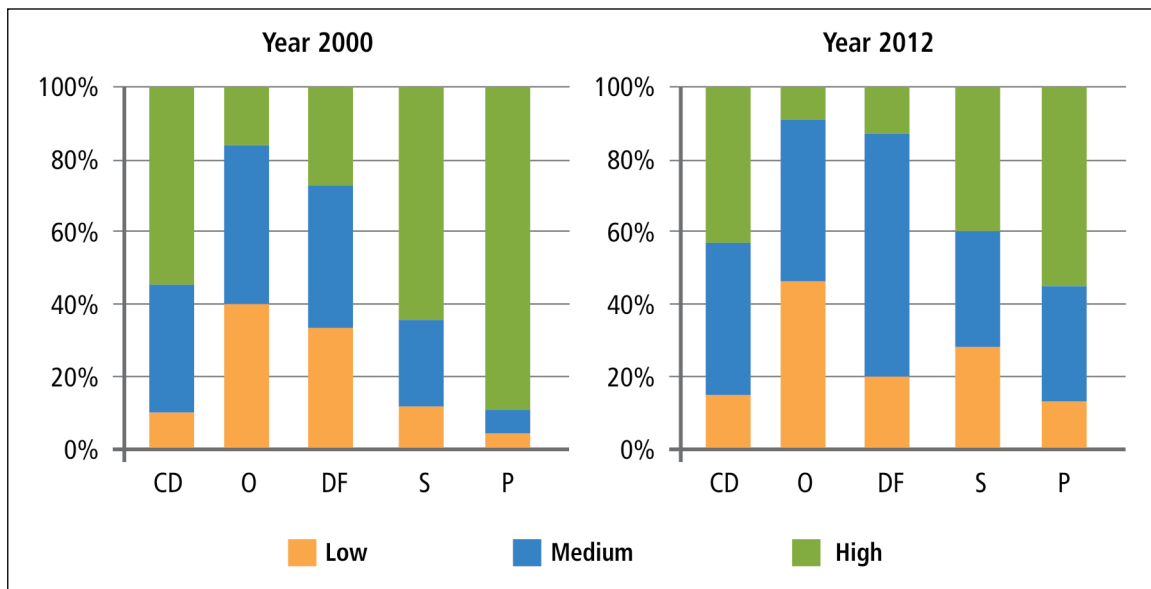
Conversion of forests and agricultural lands to commercial spaces has increased the amount of soil erosion and sedimentation that flow out into the coastal waters. It was estimated that approximately 1 billion m<sup>3</sup> of sediment is lost to coastal waters annually (Burke et al., 2002). This is further exacerbated by the loss of mangrove forests and seagrass cover, which is considered to be the first line of defense in the marine ecosystem against land-sourced run-offs and sedimentation. Philippine seagrass beds have been lost due to industrial development, ports, and recreation (Fortes, 2012). Seagrass ecosystems are threatened by the loss of mangroves areas, which act as ‘filter’ for sediment from land, as well as coral reefs, which serve as buffer against waves and storm surges (PNSC, 2004).

Harvesting of mangroves for fuel wood, construction and charcoal-making contributed largely to the destruction of the resource. Illegal cutting and overharvesting subsequently degraded the habitat and ecosystem (White and de Leon, 2004). But conversion of mangrove areas to fishponds accounts for a large portion of mangrove loss (66%). In the Philippines, about 279,000 ha of mangroves lost from 1951 to 1988 were due to the conversion into culture ponds. The rate of mangrove loss has increased during this period despite the government ban on further conversion of mangroves to fishponds in 1980 (White and de Leon, 2004).

The nature of threats to coral reef health has also changed through the years. From 2002 to 2012, the threat due to coastal development has increased, overfishing threat increased, destructive fishing decreased, while both sedimentation and pollution increased (**Figure 15.6**).



**Figure 15.6:** Change in Level of the Major Threats to Coral Reefs in the Philippines from 2002 (left) to 2012 (right).



CD – coastal development, O – overfishing, DF – destructive Fishing, S – sedimentation, P – pollution  
 Source: Burke et al., 2002, MSN Threat Assessment Workshop, 2012.

### 15.1.4 Biodiversity Loss

#### Endangered and Threatened Species

Dugong, cetaceans, whale sharks, and manta rays are among the listed species that are being caught and killed mainly for their high quality but inexpensive meat (Alava and Cantos, 2004).

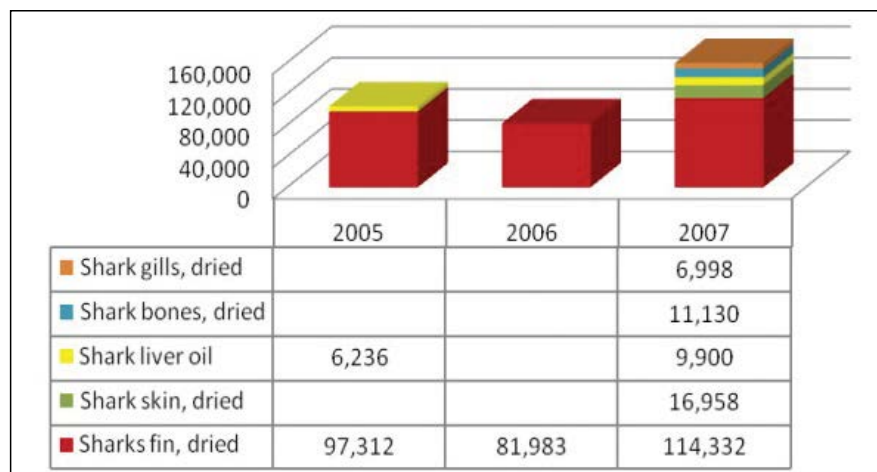
A major threat to marine turtles is large scale illegal harvest of eggs and collection for ornamental trade. Sixty percent of the turtle eggs produced in TIWS except Baguan Island (which produces more than 50%) were being collected for trade. Prior to the passage of RA 9147, or the **Wildlife Resources Conservation and Protection Act of 2001**, collection of turtle eggs in designated islands of the Turtle Islands was regulated through a DENR permit system that allowed collection during the open season from April to December. Only 60% of the eggs were collected, the rest were conserved. After the passage of the Wildlife Act, the collection of sea turtles or any of its derivatives, including eggs, was prohibited. This has resulted in conflicts within and among stakeholders since egg collection is a source of livelihood and accounts for about 35% of the overall income sources in the area (Cola, 1999 as cited in BFAR-NFRDI and DENR-PAWB, 2005). A proposal for a phase-out on the collection of turtle eggs and phase-in of alternative livelihood projects in TIWS under a Memorandum of Agreement among stakeholders has been finalized.

Marine turtles are also threatened by coastal development, fisheries practices, and foreign fishers poaching. Foraging habitats of marine turtles are being proposed for declaration as Critical Habitats pursuant to RA 9147 (Wildlife Resources Conservation and Protection Act). Actual reports gathered by the PCP throughout the country through its tagging program reveal that fish corral, gillnet and hook and line are the fishing gears that capture most turtles. The Sulu Sea is a favorite poaching area of foreign fishers targeting marine turtles (ADB, 2014). In the last decade, over a thousand foreigners have been arrested and charged for poaching in the waters of Palawan alone (WWF-Philippines, 2008).

Irrawaddy Dolphin, which is listed in *Appendix 1 of the Convention on Migratory Species (CMS)* to which the Philippines is a member-party of, are most threatened by accidental killings in fishing gears, habitat degradation, possible prey depletion due to over-fishing, and the destruction of fish spawning grounds (Dolar et al., 2002 as cited in BFAR-NFRDI-PAWB, 2005). Several mortalities have been recorded, averaging about four a year. Experts have proposed that minimizing the contact these dolphins have with conventional fishing gear is the solution to Irrawaddy dolphin mortality (ADB, 2014).

Sharks, which are the top reef carnivores, have been destroyed and are now rarely observed in most reefs in the Philippines (Aliño et al., 2004). Shark industry in the Philippines has been supplying the international market since the 1960s. From 1990 to 1997, a total of 800 whale sharks (*Rhincodon typus*) were supplied to the Taiwanese market from fishing sites in the Bohol Sea (Marine Wildlife Watch of the Philippines, 2014). Due to unregulated fishing, a 27 percent decline in shark fisheries for the succeeding years was documented by Alava et al (2002). Shark meat is not as popular in the market and the industry primarily makes use of the gills, bones, liver oil, skin and fins (**Figure 15.7**). Shark products and by-products have diversified over the years leading to the increase in the Philippine supply of the commodity. As of 2007, the Philippines was able to export a total of 159,318 kg, more than half of which are dried shark fin.

**Figure 15.7:** A Summary of Exported Shark By-products from 2005 to 2007.



Source: NCSO 2005-06 and OSEDC.BFAR 9 Jan-Oct 2007.

### 15.1.5 Aquaculture-related pressures<sup>20</sup>

#### (a) Alteration of Physical Environment

The nets of cages, pens, and associated moorings change the environment by preventing efficient water exchange and changing the current patterns caused by friction with the water currents. Friction from the nets can alter the residence time of water in a bay. Sometimes these structures can also cause obstruction to navigation routes and migration paths of different species of fish.

#### (b) Eutrophication from Aquaculture

Aquaculture, like any other animal production activity, produces wastes in the form of particulates (mainly the uneaten food and faeces) and soluble substances (excreta), which increase the BOD, nitrates and phosphates in the receiving waters. The risk of negative impacts of aquaculture wastes is greatest in enclosed waters or sites with poor water exchange rates, such as in slow moving rivers, lakes and shallow bays. In these conditions, aquaculture production can lead to a build up of organic sediments and addition of nutrients to the water column. This, in turn, can lead to secondary effects, such as eutrophication, algal blooms, and low dissolved oxygen levels.

#### (c) Changes in Ecosystem Structure and Function

Some impacts of seaweed culture include changes in the marine ecosystem structure and function, alteration of currents and increasing shading of bottom environments. Nutrient stress, perhaps caused by too much seaweed culture in an area, has also been implicated in 'ice-ice' disease, which can result in lower yields of seaweeds. Changes in salinity, ocean temperature and light intensity as well as bacterial infection when seaweeds are stressed can cause the ice-ice disease (Largo et al., 1995).

Mussel and oyster farming also increases biodeposition of wastes on the seabed, with the resulting organic enrichment inducing changes in sediment chemistry and biodiversity. For shrimp culture, effluents from shrimp ponds are high in both dissolved and particulate nitrogen and phosphorus, which elevate nutrient levels in receiving waters and promotes eutrophication. In brackishwater ponds, intensification of production methods can result in greater production of wastes, which unless intercepted and treated (filter traps, settlement ponds, biofiltration beds), are discharged into the coastal environment causing eutrophication and self-pollution problems in some areas of the country (e.g., Bolinao).

### 15.1.6 Harmful Algal Blooms<sup>21</sup>

The occurrence of harmful algal blooms (HABs or red tide) has become another important indicator of the degree of water pollution in the country. This phenomenon is caused by seasonal high organic

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<sup>20,21</sup> These environmental impacts are discussed in ADB, 2014.

loadings from rivers that drain into the bays. Red tide occurrences have been reported in 20 coastal areas, and there had been 42 red tide outbreaks from 1983 to 2001.

Harmful algal blooms are one of the marine environmental problems and resource management issues that confront the Philippines. It has been recognized as a catastrophic phenomenon that has affected public health and the economy of the country since 1983. The first recorded occurrence of blooms of *Pyrodinium bahamense var. compressum*, a toxin-producing dinoflagellate was in 1983 in central Philippines, and since it was the first time that the country has experienced this kind of phenomenon, its impact in terms of public health and economy was great. Harmful algal blooms in the country, particularly *Pyrodinium* have expanded both in time and space. Blooms of *Pyrodinium* have spread to around 22 coastal areas of the country. Paralytic shellfish poisoning due to *Pyrodinium* has increased in severity during the last two decades with the country experiencing more than 540 outbreaks of harmful algal blooms with subsequent shellfish poisoning episodes between 1983 and 2002. Some species recur in the same geographic regions each year, while others are episodic, leading to the unexpected deaths of local fish, shellfish, mammals, and birds. Azanza (2005) observed a first-time occurrence of a *Prorocentrum* minimum bloom in Bolinao in 2002, where intensive and extensive aquaculture of *Chanos chanos* (milkfish) in fish pens and cages has been practiced for years now. The fish kill, which lasted almost simultaneously with the bloom of the organism, had its peak when the organisms' bloom was declining. Lack of oxygen in the cages and pens was the fundamental cause of the fish kill (Philminaq, 2007).

### 15.1.7 Invasive Species

Among the possible cases of invasion by marine organisms (mostly phytoplankton) in the Philippine waters are the following (ADB, 2014):

- (a) *Pyrodinium bahamense var. compressum* is a paralytic shellfish toxin-producing species which caused poisoning in Malaysia, Brunei, Indonesia and the Philippines. The first cases of Paralytic Shellfish Poisoning (PSP) in the Philippines was reported in 1983 and since then, *Pyrodinium* blooms have been recurring in various parts of the country. There is a possibility that the species could have been transported naturally or by ships. Its life cycle includes a cyst stage that can remain viable for years and be the source of future blooms once conditions become favorable.
- (b) *Alexandrium spp.* The presence of the species was documented in 2003 in Bolinao, Pangasinan. The species can invade other areas through ship's ballast water. Its life cycle also includes a cyst stage that can remain viable for years.
- (c) *Cochlodinium polykrikoides*. The species bloomed on a regional scale in Southeast Asia from 2004-2005. It started in Brunei in November 2004, then to Sabah, Malaysia from December 2004 to January 2005. It reached Palawan by February 2005. The source of *Cochlodinium* bloom in Southeast Asia is unknown. The mode of transport may include natural currents or anthropogenic like ship's ballast water or transport of infected seafood.

Research on the biological content of the ballast water discharged in Philippine waters is needed for the issuance of appropriate regulatory measures in line with the 2004 Ballast Water Management Convention. Research on possible water treatments is also essential to mitigate possible impacts of invasive species in the marine environment.

### 15.1.8 Solid Waste, Plastics and Marine Debris

Only 24-32 percent of barangays are served by operational Materials Recovery Facilities (MRFs), and only 19 percent of LGUs have access to sanitary landfills (NSWMC, 2018). Inefficient solid waste management, and the low cost and convenience of plastic bags and sachets have made the Philippines one of the world's leading plastic polluters, with significant impacts on the environment. It was noted, however, that around 74 percent of marine plastic debris comes from waste that has already been collected because some private hauler companies unload their garbage trucks into water bodies to cut costs (WWF-Philippines 2018).

Marine debris affect both human and natural systems. Ingestion and entanglements in plastic waste in the ocean have been reported in marine wildlife. Humans also face the danger of ingesting microplastics and persistent organic pollutants (POPs) through eating seafood.

### 15.1.9 Oil Spills

As of 2017, a total of 22 incidents involving oil spills have been reported by the Marine Environmental Protection Command. Oil contaminants range from diesel oil, lube oil, bilge oil, crude coconut oil, bunker oil to tarballs (**Table 15.2**).

**Table 15.2:** Oil Spill Incidences Reported by the Marine Environmental Protection Command of the Philippine Coast Guard for the Year 2017.

Date	Source	Location	Amount	Coast Guard District Station
04 January 2017	MV Don Jose	Sinonoc Shireline, Sinacaban Misamis Occidental	None	STL
05 January 2017	MV Starlite Atlantic	Maricaban Island, Batangas	20,000 Liters diesel oil & 400 Liters lube oil	STL
06 January 2017	Unknown	Mactan Shipyard, Cebu	100 Liters oily water mixture, 5 drums oily water mixture & 40 Kg contaminated absorbent pads	CV
10 January 2017	PKS Shipyard/Horeb	Brgy Tayud, Consolacion, Cebu	5 drums oily water mixture	CV
17 January 2017	M/V Meridian Tres	Sto. Nino Dive Site, Bohol	None	CV
14 February 2017	Unknown	Apo Cement Port, City of Naga	½ drum oily water mixture & 6 drum garbages	NM

**Table 15.2:** Oil Spill Incidences Reported by the Marine Environmental Protection Command of the Philippine Coast Guard for the Year 2017. (cont.)

Date	Source	Location	Amount	Coast Guard District Station
15 February 2017	LCT Yellow River	Casinglot, Tagolaon, Misamis	None	STL
09 March 2017	Fortune Star Marine	1052 M. Naval St, San Jose, Navotas City	MOL 5 Liters oily water mixture	NCR
29 March 2017	FB/BCA Andrea	Poblacion, Initao, Misamis Oriental	None	STL
30 March 2017	M/V Maria Rebecca of Montenegro Shipping Lines	Coast Guard Station, Zamboanga City	Adjudication of violation	SWM
10 April 2017	Vicinity Area of Petron Terminal	Brgy Mainaga, Mabini, Batangas	Approximately 30 Liter of oily water mixture	STL
28 April 2017	PPA Dredger Vessel (D-V)	Muelle Loney Wharf, Iloilo City	15 Liters of bilge oil	WV
03 May 2017	MTKR SL Maple	Brgy. Palilan & Brgy Tabo-O, Misamis Occidental	100 Liters diesel fuel oil	STL
11 May 2017	MTKR Kadayawan	Timoti Port, Jimenez, Misamis Occidental	Approximately 10-20 Liters crude coconut oil	STL
23 May 2017	Third Millenium Oil Mill Incorporated	Jimenez, Misamis Occidental	20 drums coconut oil water mixture	STL
04 June 2017	Chevron Terminal	San Pascual, Batangas	Less than 50 Liters	STL
11 July 2107	MV St. Therese of Child Jesus	Pier 4, North Harbor, Tondo, Manila	Approximately 10 Liters of fuel oil	NCR
22 July 2017	Laraand Sky Ent.	Brgy Luz, Limay, Bataan	Undetermined	NCR
06 August 2017	MV Moreta Cargo Achiever	Pier 4, Berth 5, North Harbor, Tondo Manila	100 Liters	NCR
06 August 2017	Pilipinas Shell Refinery	Jetty Arenan 04, Pilipinas Shell Refinery, Brgy. Tabangaoambulong, Batangas City	Approximately 8000 Liters of light crude oil	STL
07 August 2017	MV Moreta Cargo Achiver	Pier 4, Berth 5, North Harbor, Tondo, Manila	100 Liters	NCR
22 August 2017	Unknown	Ramp 3, Terminal 1, Batangas Port, Batangas City	Approximately 10 Liters of oily water mixture	STL
06 September 2017	Unknown	Lind Hotel, Station 1, Brgy. Balabag, Boracay Island, Malay, Aklan	4 Sacks of contaminated debris and tarballs	WV
24 September 2017	Unknown	Lapuz Wharf, Iloilo River, Iloilo City	6 Liters	WV
14 October 2017	Leakage Pipeline	Fishing Port Complex Sangali Zamboanga	20 Liters bunker oil	SWM
06 November 2017	DMCI Power Corportation	Calapan Plant Oriental Mindoro	800 Liters IFO	STL
09 November 2017	MV Kitty	Bonga Point, Brgy Poblacion Sur, Barcelona, Sorsogon	30 Liters bilge oil mixture	BCL

Source: PCG-Marine Environmental Protection Command, 2017.

### 15.1.10 Mining-related Issues

The mining industry is also faced with various issues ranging from environmental matters (e.g., siltation and sedimentation that may impact on coral reefs, seagrass, and habitats of dugong, marine turtles and whale sharks) to political cases.

#### (a) Potential Risks and Effects

The mining projects claim to provide benefits to the people, but given the risks from irresponsible mining practices and accidents, several communities do not want to accept mining operations.

- *On Sources of Livelihood and Food Security*

One of the negative effects of mining is the loss of farmlands near the coastal areas due to flooding brought about by coastal erosion and deforestation. Mining and quarrying, in particular black sand mining, have destroyed beaches in many areas of the country. Another source of environmental damage is the dumping of mine tailings (whether operational or accidental) into rivers, and flow to the coasts. Consequently, this may affect the conditions of the habitats and associated organisms and fishery resources. In addition to loss of biodiversity as well as livelihood and income, toxic mine tailings can also affect human health and water resources. Mining can also destroy the view and aesthetic value of the place.

- *On Indigenous Peoples' (IPs) Rights*

The mining areas being targeted for explorations are usually those in remote areas being occupied by various ethno-linguistic groups classified as Indigenous Peoples (IPs), whose major sources of livelihood are farming and fishing.

#### (b) Policy Recommendation and Strategies

There is a need to develop national and local mining policies and laws that will recognize and ensure the interests of the local communities and IPs as well as the protection of the environment and ecosystems - from upland forests to coastal habitats.

There is a need to carry out information, education and communication (IEC) activities to raise awareness on the various issues related to mining and its environmental and health impacts, and increase public participation in environmental management and local governance.

### 15.1.11 Transboundary Issues

Transboundary issues are found mostly in the LME areas of the country – West Philippine Sea, Sulu-Sulawesi Seas, and the Philippine Rise. Habitat loss, particularly damage to coral reefs, in the West Philippines Sea, and harvesting of endangered species, such as marine turtles and giant clams, have been reported in South China Sea. Fishery resource issues have also been reported in South China Sea, Sulu-Sulawesi Seas, and the Philippine Rise. A more detailed discussion of the transboundary issues of each LME can be found in **Section 14.4**.

### 15.1.12 Environmental Costs

The environmental costs on the different coastal and marine ecosystems caused by various factors are summarized in **Table 15.1**. The costliest source of disturbance to the country's marine ecosystem in general is unsustainable fishing, amounting to PhP2.579 billion. Coastal development, particularly the conversion of mangrove areas to fishponds and sea reclamation, is also a major cause of the loss, contributing 41.2 percent of the total cost. Over-all, it was estimated that the country has lost a total of PhP5.6 billion per year due to the combined impacts of unsustainable fishing, coastal development, pollution and the effects of climate change. Accounting the natural capital and environmental damage can ensure that ecosystem services and environmental costs are valued and considered in policy and management decisions.

## 15.2 Natural Hazards

In a study conducted by World Bank in 2008, 50.3 percent of the total land area of the Philippines, and 81.3 percent of its population are vulnerable to natural hazards. The country is exposed to multiple hydro-meteorological hazards, such as storms, typhoons, floods, droughts, further aggravated by the effects of climate change, as well as geo-physical hazards, such as earthquakes and volcanic eruptions. The Philippines is one of the most high-risk countries in the world for experiencing natural disasters. The *2016 World Risk Report* published by the United Nations University Institute of Environment and Human Security (UNU-EHS) also revealed that the Philippines ranked third in the most disaster-prone countries in the world with a Risk Index<sup>22</sup> of 26.70 percent (**Table 15.3**).

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<sup>22</sup> The Risk Index measures the country exposure to natural hazards like storms, floods, earthquakes, droughts and sea level rise. The index is based on calculations drawing on the formula: exposure times vulnerability. Vulnerability is defined as "susceptibility times lack of coping capacities times lack of adaptive capacities".



**Table 15.3:** 2016 World Risk Index.

Rank	Country	Risk (%)
1	Vanuatu	36.28
2	Tonga	29.33
3	Philippines	26.70
4	Guatemala	19.88
5	Bangladesh	19.17
6	Solomon Islands	19.14
7	Brunei Darussalam	17.00
8	Costa Rica	17.00
9	Cambodia	16.58
10	Papua New Guinea	16.43

Source: UNU-EHS.

### 15.2.1 Geological Hazards

Except for the Sierra Madre mountain range and some volcanic chains in the eastern part of the archipelago, the country was known to be submerged underwater and was later uplifted along the southern China margin during the late Cretaceous period (Magdaraog, 1998). Philippines is surrounded by the Philippine Sea plate and the Pacific Plate to the east, the Eurasian plate to the west, the Australian plate to the south and buffeted by the Indonesian plate. The interaction of these large lithospheric plates over time has resulted in the geologic and tectonic evolution, which now forms the present Philippine archipelago.

The terranes or old lithospheric blocks that make up the archipelago were formed during the Tertiary period, roughly about 65 million years ago. The blocks were said to have originated from various regions and are made out of a combination of oceanic crust, island arc and continental crust materials.

The islands are mainly volcanic in origin. The larger islands are characterized by mountain ranges, e.g., the Sierra Madre Mountain Ranges, the Cordillera Central, the Caraballo Mountains and the Zambales Mountains in Luzon. The Diwata Mountains and Mount Apo – which is considered as the highest peak in the country at 2,954 meters are both found in Mindanao. Palawan, Mindoro and Zamboanga - also known as the Micro-continental block are known to be part of the marginal continental blocks of the Eurasian Plate.

Being part of the Pacific Ring of Fire, the archipelago holds 20 or more active volcanoes and regularly experience seismic activities. Six damaging earthquakes ranging from 5.0 to 6.0 occurred in 2016 in Nueva Vizcaya, Biliran, Agusan del Sur (2 events), Surigao del Norte and Zamboanga del Norte. The strongest seismic activity reported in 2016 was a 6.0 magnitude earthquake in Zamboanga del Norte and in Agusan del Sur. ((PHIVOLCS Annual Report, 2016). **Figure 15.8** shows the active and potentially active volcanoes in the Philippines (PHIVOLCS, 2016).

The Philippine plate convergence occurs in three main locations: the west-dipping Philippine trench and the east Luzon trough to the east; the east-dipping subduction zones of the Manila-Negros-Sulu-Cotabato trench system; and the left-lateral Philippine Fault that cuts across the length of the archipelago (Magdaraog, 1998). Seismic activities occur along the trenches where the Philippine Sea plate is being subducted. The major fault lines in the Philippines are shown in **Figure 15.9**.

The Philippines is vulnerable to tsunami due to the presence of offshore faults and trenches, such as Manila Trench, Negros Trench, Sulu Trench, Cotabato Trench, Philippine Trench, and East Luzon Trough. Tsunamis in the Philippines are rare but could be devastating. **Figure 15.10** shows the DOST-PHIVOLCS Tsunami Prone Map, which identifies coastal areas in the Philippines that can be affected by tsunamis generated by under-the-sea earthquakes or submarine landslide. Tsunami waves generated by earthquakes from other countries may affect the country as well.

One of the recorded tsunami in the Philippines, that caused loss of life, occurred in the Verde Island Passage (between Batangas and Mindoro, affecting Puerto Galera) in the early morning of 15 November 1994, originating from a 7.1 magnitude (Richter) earthquake in Mindoro. 38 people died as result of this tsunami. A magnitude 8.1 earthquake on 17 August 1976 generated by the movement along the Cotabato trench produced massive tsunami waves as high as nine meters. Around 8,000 people were killed or missing and it is known as the most disastrous tsunami to hit the Philippines in the last four decades (phivolcs.dost.gov.ph).

**Figure 15.8:** Active and Potentially Active Volcanoes of the Philippines.

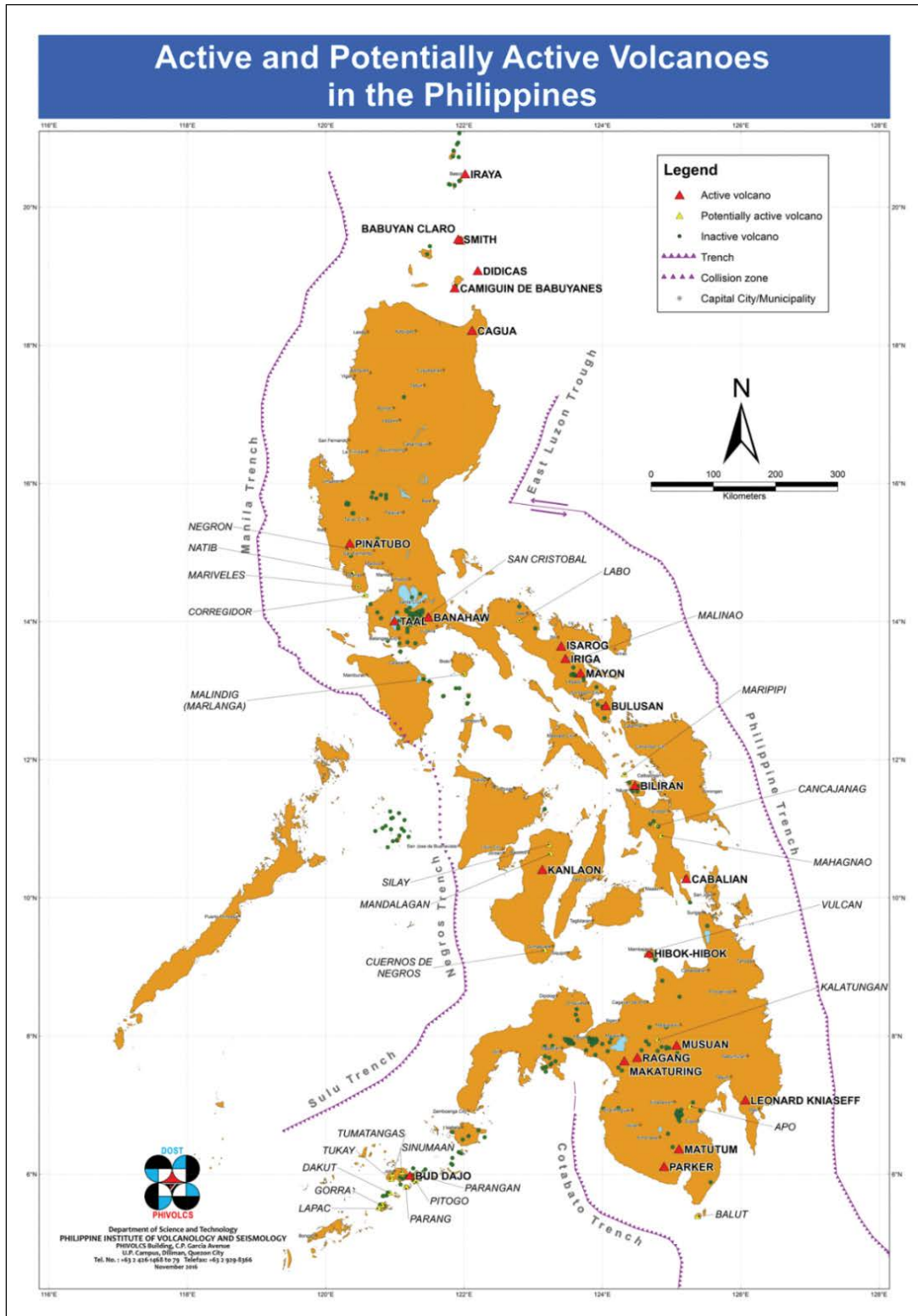
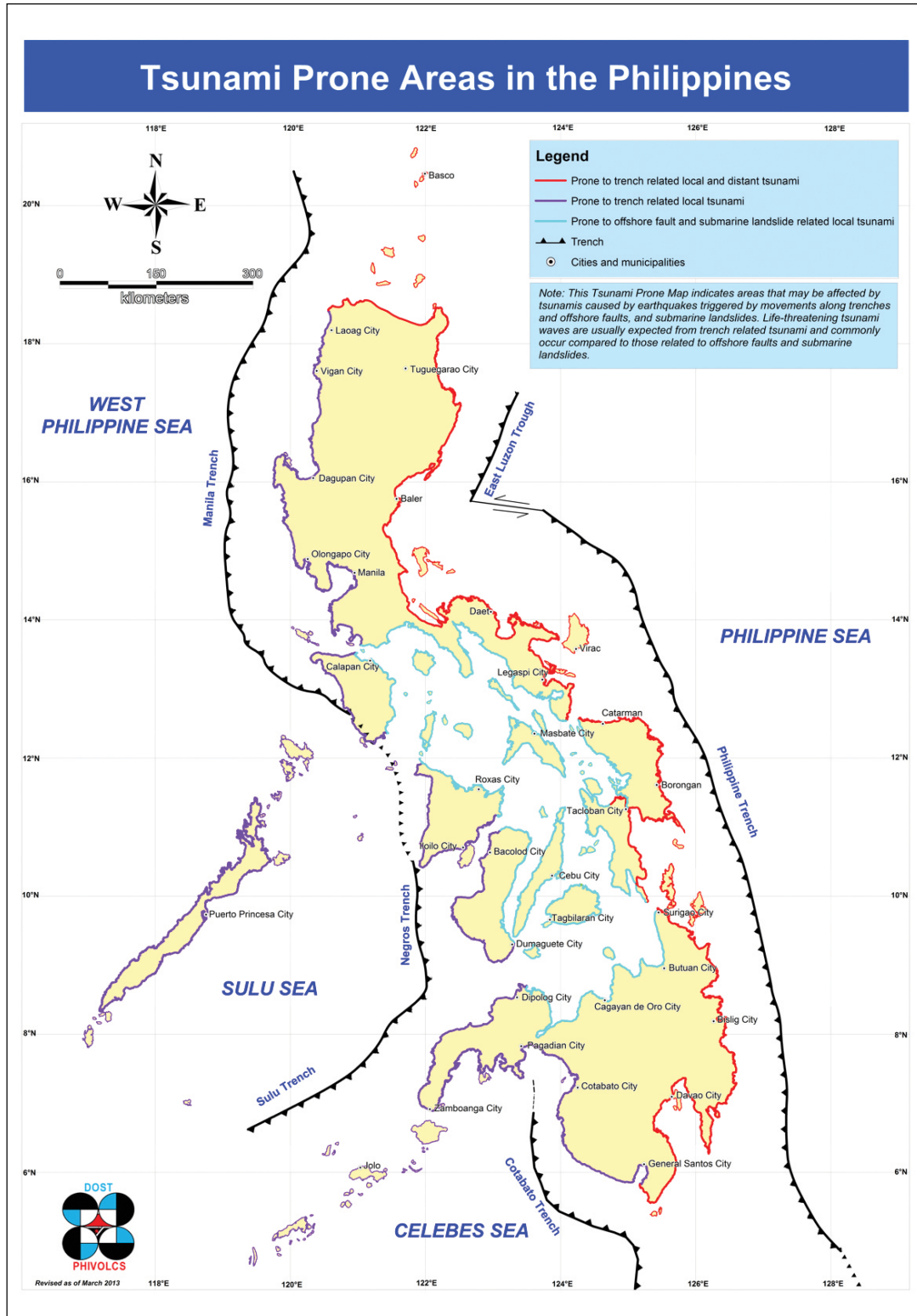




Figure 15.10: Map of Tsunami-prone Areas in the Philippines.



Source: PHIVOLCS, 2013.

## 15.2.2 Meteorological-related Hazards

**Hydrometeorological hazards** are **weather-related** events, such as tropical cyclones (also known as typhoons in the country), floods, droughts, landslides, coastal storm surge, tornadoes, thunderstorms, hailstorms, severe wind, extreme temperature, heat wave, cold spells, EL Niño/La Niña (El Niño/Southern Oscillation), etc. The Philippines is surrounded by large bodies of water, and faces the Pacific Ocean where 60% of the world's typhoons are made.

**Figure 15.11** shows areas in the Philippines that are susceptible to floods and flash floods. Violet areas have high susceptibility to floods. They are usually near bodies of water or prone to flashfloods. Residents in these areas must always be ready to evacuate. Light yellow areas have moderate to low susceptibility to floods. These areas, however, are still vulnerable to “dangerous debris flow” during typhoons.

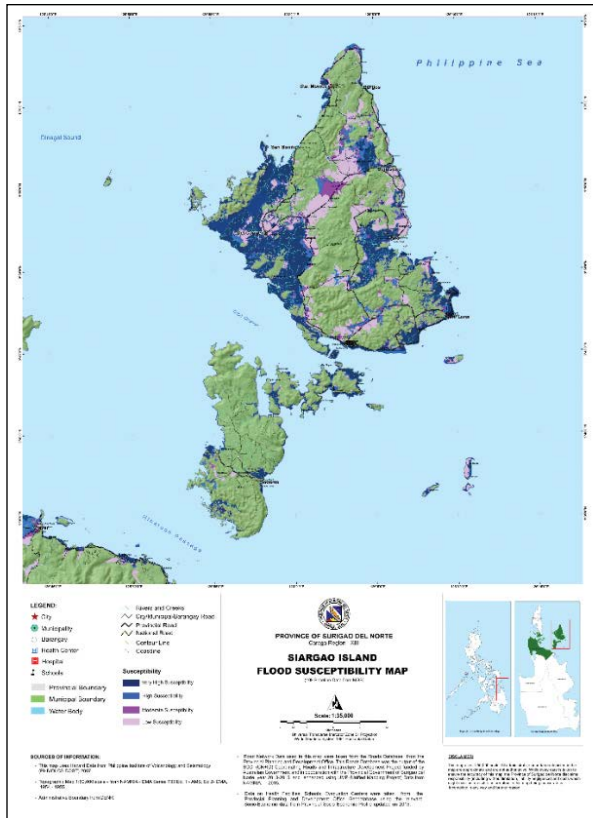
**Figure 15.11:** Flood-prone Areas in the Philippines.



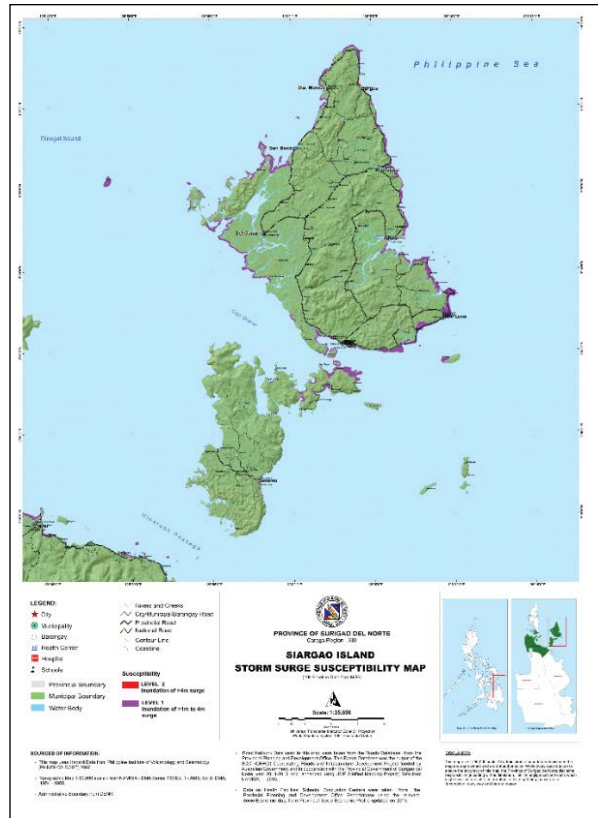
Source: MGB

Hazard maps have also been developed at the local level as local governments are mandated to conduct risk assessment, and develop Local Disaster Risk Reduction and Management Plans. **Figures 15.12** to **15.15** provide examples of hazard maps in Siargao Island in the province of Surigao del Norte used in preparing its Local DRRM Plan. The island is a Protected Landscape and Seascape area, and vulnerable to flooding and rain-induced landslides.

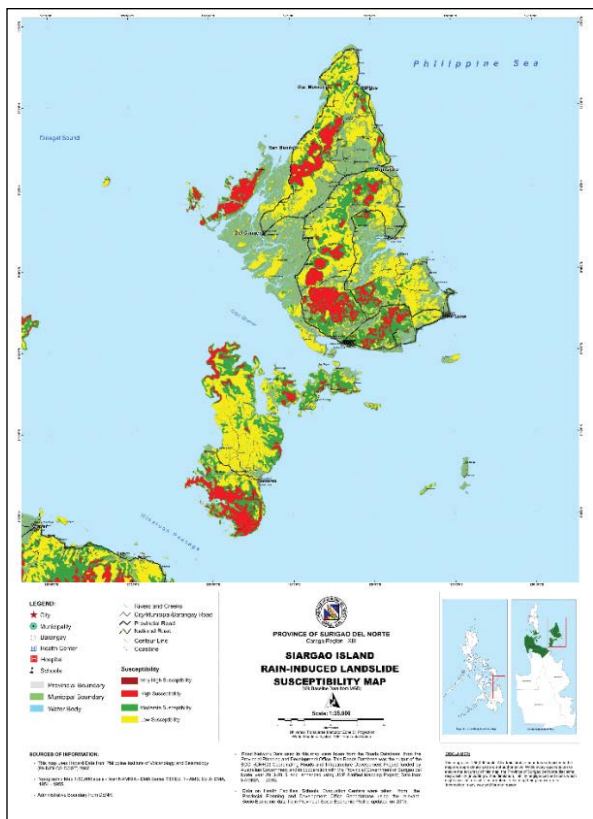
**Figure 15.12: Flood Susceptibility Map for Siargao Island.**



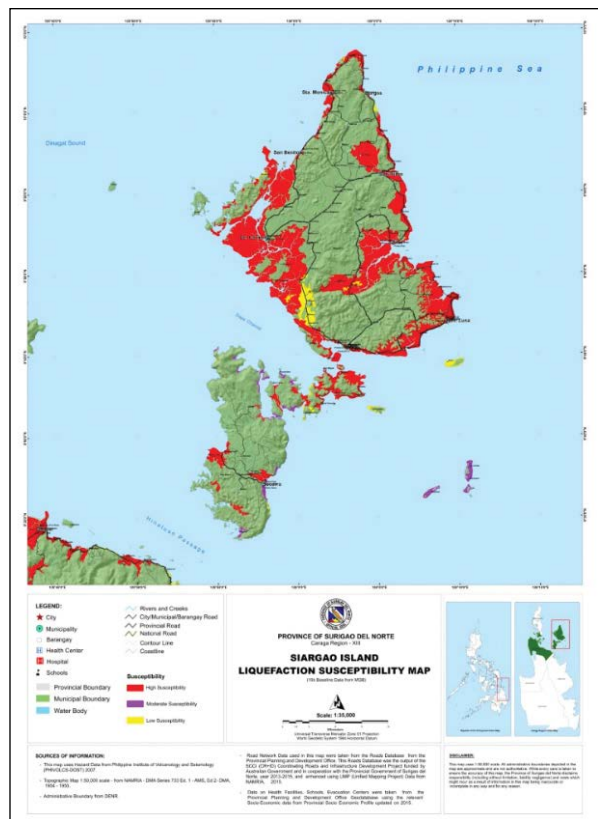
**Figure 15.13: Storm Surge Susceptibility Map for Siargao Island.**



**Figure 15.14: Rain-induced Landslide Susceptibility Map for Siargao Island.**



**Figure 15.15: Liquefaction Susceptibility Map for Siargao Island.**



Source: Provincial Government of Surigao del Norte.

### 15.2.3 Cost of Natural Disasters

Natural hazards are severe or extreme events, such as a flood, storm, or heatwave, which are natural phenomena. These hazards only become disasters when human lives are lost, and livelihoods, physical assets, infrastructure, and environment are damaged or destroyed. The Centre for Research on the Epidemiology of Disasters (CRED) recorded 187 significant damaging natural disasters<sup>23</sup> in the Philippines in 2007-2016, causing the death of 16,262 people and injury to 168,114 persons (**Table 15.4**). They affected more than 100 million individuals in the country during this period and the socio-economic damages are estimated at US\$19.16 billion.

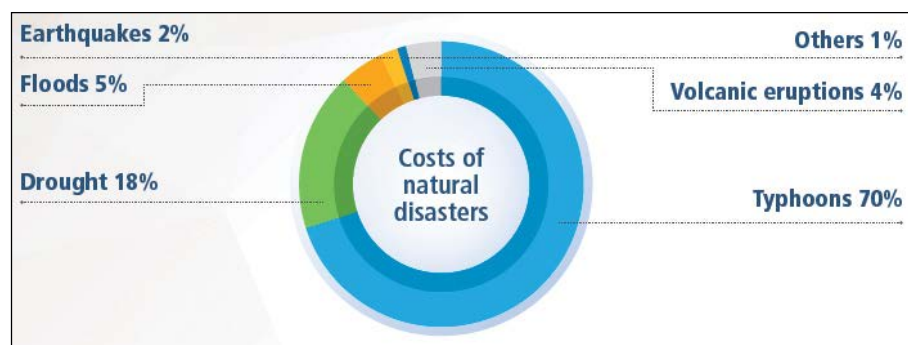
**Table 15.4:** Selected Natural Disaster Statistics in the Philippines, 2007-2016.

Year	Occurrences	Death Tolls	Injured	Total Affected	Total Damages ('000 US\$)
2007	16	129	24	2,023,092	16,815
2008	20	959	1,015	8,459,896	481,202
2009	25	1,307	900	13,352,484	962,107
2010	15	1,113	124,096	5,581,507	335,087
2011	36	1,989	6,703	11,729,947	730,025
2012	22	2,415	2,879	12,531,446	1,005,611
2013	14	7,750	29,893	25,667,133	12,422,810
2014	13	331	2,269	13,274,658	1,062,899
2015	16	201	131	4,019,201	1,965,966
2016	10	68	204	4,234,608	180,074
<b>TOTAL</b>	<b>187</b>	<b>16,262</b>	<b>168,114</b>	<b>100,873,972</b>	<b>19,162,596</b>

Source: CRED (cited in Senate Economic Planning Office, 2017. Policy Brief: Examining the Philippines Disaster Risk Reduction and Management System.).

From 1990 to 2006, the estimated cost of damages to agriculture and fisheries, on average annually, is around PhP12.43 billion, of which 70.3 percent was caused by typhoons, 17.9 percent by droughts, and 5 percent by floods (**Figure 15.16**).

**Figure 15.16:** Estimated Cost of Natural Disasters to Agriculture and Fisheries, 1990-2006.



Source: CCC.

<sup>23</sup> The CRED records an event as a natural disaster if it meets at least one of the following criteria: (1) ten or more people reported killed; (2) 100 or more people reported affected; (3) declaration of a state of emergency; and (4) call for international assistance.



The costliest tragedies in the country have been attributed to natural calamities and disasters. Records of the cost of flooding have also been increasing as typhoons and monsoon rains become stronger and more devastating. Unplanned urbanization, pollution and habitat destruction aggravate the flooding problem. **Table 15.5** shows the cost of losses and damage due to flooding through the years.

**Table 15.5:** Total Population Affected and Estimated Monetary Losses from Floods, 1980-2015.

Year	Total Population Affected	Total Losses (USD million)
1980	25,980	No data
1981	122	No data
1982	853	60
1985	444	No data
1989	47,500	No data
1990	50,236	43
1991	823	1,300
1993	24,485	37,000
1994	37,583	2,492
1995	72,185	700,800
1997	No data	76
2000	2,103,716	4,080
2001	165,643	8,000
2002	91,300	1,842
2003	155,567	No data
2004	3,500	No data
2005	21,694	515
2006	192,946	14,157
2007	717,509	6,600
2008	1,602,889	29,314
2009	1,083,276	50,589
2010	2,846,935	202,787
2011	2,218,828	75,330
2012	4,614,628	2,231,988
2013	4,500,338	No data
2014	102,995	No data
2015	880	No data

Source: *The Philippine Climate Change Assessment, 2017.*

### 15.2.4 Protection Services Provided by Coastal and Marine Ecosystems

The Philippines is at high risk from coastal hazards, and natural defenses like mangroves and coral reefs can help reduce these risks. Between 2005 and 2015, there were 2,754 natural hazards

that affected the Philippines: 56% of property damage was caused by typhoons and storms, and another 29% was caused by floods (Losada et al. 2017). Due to a recognition of these increasing risks, and of the potential role of natural defenses to reduce these risks, the Government of the Philippines has committed to restoring mangroves as part of its risk reduction strategy. However, the potential impacts and benefits of shoreline protection and climate resiliency would be higher if all three ecosystems - coral reefs, seagrass and mangroves - are protected in an integrated way. Coral reefs can also naturally protect coasts from tropical cyclones by reducing the impact of large waves before they reach the shore.

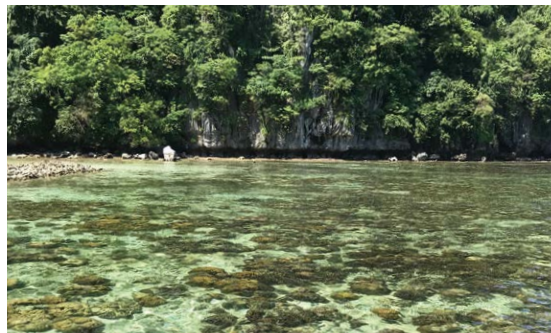
A WAVES<sup>24</sup> study examines the flooding that would occur with and without mangroves under different storm conditions throughout the Philippines, and estimates the annual expected benefits of mangroves for protecting people and property in social and economic terms.

The key findings (World Bank, 2017) are:

- If the current mangroves (data from 2010) were lost, 24% more people would be flooded annually, i.e., an additional 613,000 more people, many of whom live in poverty. Damages to residential and industrial property would increase by 28% to more than US\$1 billion annually; and 766 km of roads would be flooded.
- Based on the Philippines's current population, the mangroves lost between 1950 and 2010 have resulted in increases in flooding to more than 267,000 people every year.
- Restoring these mangroves would bring more than US \$450 million/year in flood protection benefits.
- One hectare of mangroves in the Philippines provides on average more than US \$3200/year of direct flood reduction benefits.
- Mangroves provide the most protection for frequent lower intensity storms (for example, 1-in-10 year storm events). For more catastrophic events, such as the 1-in-25 year storm, they provide more than US \$1.6 billion in averted damages throughout the Philippines. When combined with built infrastructure, mangroves provide an effective defense against storms and coastal flooding.



Destroyed seawall due to typhoon. (Photo by M. Ebarvia)



Corals around islands. (Photo by M. Ebarvia)



Mangrove restoration in Calauag, Quezon. (Photo by DENR)

<sup>24</sup> WAVES – Wealth Accounting and Valuation of Ecosystem Services, is a World Bank program intended to support the Philippine government strategy for incorporating the value of ecosystem services, including coastal protection, into their natural capital accounting system.

## 15.3 Climate Change

### 15.3.1 Effects of Climate Change

The Philippines, together with the rest of Southeast Asia is one of the most vulnerable areas to climate change because of its unique social and economic characteristics, long coastline and tropical climate (ADB, 2009, IPCC 2007). Its agriculture, fisheries and forestry sectors will expectedly be impacted by changes in climate brought about by global warming. Its impacts are currently being experienced through frequent high intensity typhoons, high precipitation and drought. PAGASA reported an estimated 20 tropical cyclones form and/or cross the Philippine Area of Responsibility (PAR) per year with maximum sustained winds of greater than 150 km per hour. It is also projected that in between 2020–2050, a reduction in rainfall will be experienced in most provinces during the summer seasons – which can have serious implications on the agricultural sector.

The impacts of climate change on the aquatic environment of the Philippines, though completely different from that of the impacts of pollution, overexploitation and other irresponsible resources utilization practices, could further exacerbate the existing condition of our fisheries and coastal resources. The changing climate affects all aspects of the ecosystem from the physical environment to the biological and even up to genetic diversity of the resources.

Flores and Ingles (2009) have compiled a list of changes in the marine environment attributed to climate change:

1. **Warming of the aquatic environment.** Since 1971, mean, maximum and minimum temperatures have increased 1.4°C per century (IPCC, 2007). Departures from the 1961–1990 normal values of annual mean, maximum and minimum temperatures in recent years of 0.61°C, 0.34°C, and 0.89°C, respectively, indicate temperature increase (Tibig, 2004 and Manton et al. 2001). The rising temperature of the aquatic environment will produce changes in the sea surface and atmosphere interaction resulting in the intensification of known annual variability of weather phenomenon, e.g., ENSO and decadal-scale (Pacific Decadal Oscillation) regime shifts. Warming is more intense in the surface waters resulting in the shifts in the level of isotherms. According to IPCC (2007) modelling, an increase of 10-20 percent in tropical cyclone intensity is expected due to rise in SST of 2-4 °C relative to the current threshold temperature.
2. **Changes in ocean's salinity.** The oceans in the tropical and subtropical regions where evaporation is intense showed increasing salinity particularly for the near-surface waters while in the higher latitudes ocean's salinity is found to be decreasing due to melting ice, greater precipitation, higher runoffs and advection. Related to ocean salinity is the amount of rainfall in the country. While most of Southeast Asia have experienced decline in precipitation amount, the mean annual rainfall and the number of rainy days in the Philippines since 1960 have increased.

There are variability within the country where decreasing rainfall has been observed in Luzon and in parts of Mindanao while an increase in rainfall in the western and central Visayas (Anglo, 2006). Rainfall variabilities would continue due to the effects of climate variability triggered by ENSO where strong El Niño brings little rain and La Niña is associated with heavy rainfall.

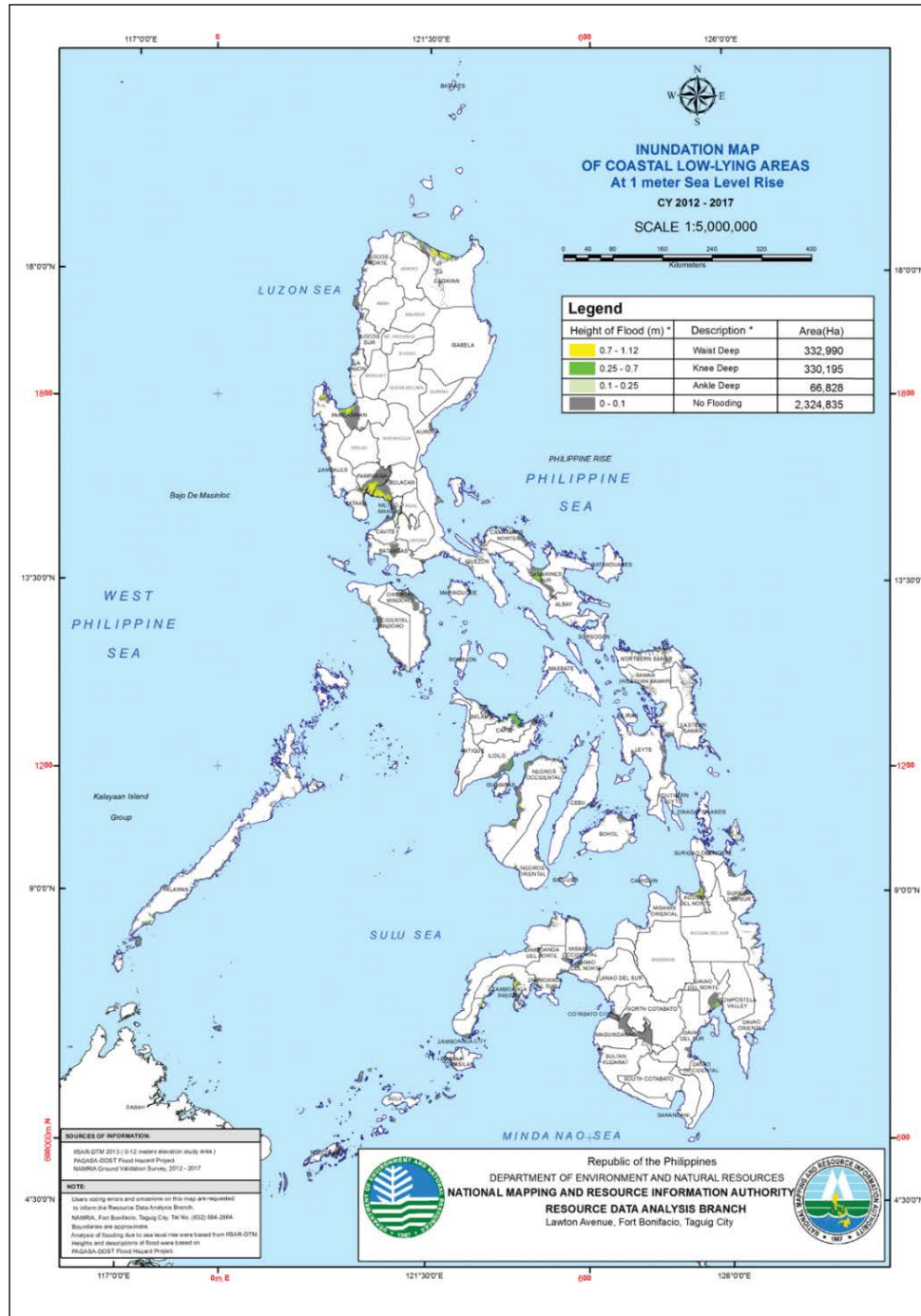
- 3. Sea-level rise.** The global average sea level was observed to be rising since the early 1960s but in 1993, a very significant acceleration or rise was observed and one of the heavily affected countries is the Philippines. Sea levels are projected to rise by 0.19-1.04 meters by 2080 relative to the mean sea level during 1960-1990 (Hulme and Sheard 1999). The global average sea level was reported to increase by 19 cm from 1901 to 2010, as oceans expanded due to warming and melting of ice (IPCC, 2014). The study of Yanagi and Akaki (1994) as cited in ADB 2009 showed a slight rise in sea levels in major coastal cities of the Philippines. Manila, in particular showed the highest sea level rise, probably due to a combination of ground subsidence and global sea level rise (Hulme and Sheard, 1999). **Figure 15.17** shows the inundation map that shows the cities, which are most vulnerable in the advent of a 1-meter rise in sea level.

Apart from that, sea level rise has also significantly increased tsunami hazards. As more and more coastal areas become vulnerable to coastal inundation, even the smallest tsunamis might have destructive effects on these low lying areas. **Figure 15.10** shows the tsunami-prone areas in the country. Coastal areas found in the western part of the archipelago are more prone to trench-related local tsunamis while those found in the eastern seaboard are most prone to both trench-related local and distant tsunamis. The internal seas within the Philippine archipelago, on the other hand, are highly vulnerable to offshore fault and submarine landslides that might be related to local tsunami events.

- 4. Net changes in the ocean processes.** A combination of the three abovementioned physical changes of the marine aquatic environment would significantly change the known oceanographic processes which results in net changes in the upwelling patterns and seasonalities.
- 5. Ocean acidification.** The pH of the global oceans have decreased by ~0.1 units due to the absorption of roughly 30 percent of the excess CO<sub>2</sub> that humans have introduced into the atmosphere (Sabine et al, 2004 as cited in Hoegh Gulberg et al, 2009). Modeling suggests that the aragonite saturation state and hence coral calcification will become marginal for coral reefs of the Coral Triangle countries within the period 2020-2050. The ocean is becoming more acidic and is negatively impacting the marine organisms particularly the "marine calcifiers" - organisms that build skeletons or shells made of calcium carbonates (coral reefs, mollusks, etc.). As the pH decreases, the ability of these organisms to build their skeletons is impaired and will most likely result in physiological diseases, e.g., acidosis of tissues and body fluids leading to metabolic dysfunctions. The eggs and larval stages are more likely to suffer than the adults signifying decrease in productivity. The loss of coral reef habitats means the loss of essential habitats needed for the

support of a part of the complete life stages of an organism (Conover, 2007). Furthermore, the pH-induced shift in the community structure of the ocean’s primary producers (the plants) also has effects in the structure of the marine food web (Conover, 2007).

**Figure 15.17:** Inundation Map of Coastal Low-lying Areas.



Source: DENR-NAMRIA, 2017.

### 15.3.2 The Economic Cost of Climate Change

Extreme weather events characterize the impacts of climate change. These come in the form of increase intensity and frequency of typhoon, increased volume of rainfall, which together with typhoons, trigger floods, erosion and destruction of fishing villages. Droughts and flooding compromised the access to safe drinking water of fishing villages making them more vulnerable to waterborne diseases, such as cholera, typhoid, etc. The impacts of extreme events are the extensive loss of human life, livelihood and property. Rising sea level expand the intrusion of seawater into ground water compromising the supply of fresh water, particularly villages settling on very small islands.

In fisheries, extreme events and the unpredictable weather variability impair the ability of fishers to fish as bad weather can reduce their number of fishing days, threaten their livelihood and source of food security and even place them at high risk when they go out at sea. The physical and biological impact of climate change on fisheries is as varied as the change itself; it would be felt in the availability of fisheries products, marketing costs, prices, and increased risk on the damage of infrastructure. The primary stakeholders are facing the increased risk of losing livelihood and occupational hazards due to harsher weather condition and more offshore fishing grounds, and decreased in the availability and quality of fisheries products.

The changing climate's impact on food security cuts across four main issues: availability, stability, access and utilization (FAO, 2008). The availability of fisheries products would adjust following the shifts in ecosystem (species, production, habitat and distribution) and changing aquaculture options. Availability would depend on the seasonality, variances in ecosystem productivity, increased supply risks and reduced supply predictability. Access of fish as food would depend on changes in the abundance and distribution of the species, prices, competition for supply and information asymmetries. Utilization of the nutritional value of fisheries products depends on the supply chain quality. **Table 15.1** show that climate change along with coastal development and pollution contributed to a total loss of PhP 3.1 billion in 2006. Coral reef bleaching associated with increase in sea surface temperature contributed a loss of more than PhP 2.35 million in 2006.

The impact of climate change on transboundary stocks (i.e., tuna) would also be significant where a north-south expansion of skipjack tuna is expected with increased temperatures. Also known is the close positive impacts of ENSO events to skipjack and sardines recruitment while other species are negatively impacted.

The bleaching of coral reefs arising from increase in sea surface temperatures (SST) will impact the fisheries dependent on the reef areas. Contribution of reef fisheries to the total capture fisheries varied of time from 15 percent in 1977 (Carpenter 1977) to 5 percent in 1987 (Pagdilao et al,

1990) to about 8 percent in 1997 (Campos, 2000). While decline may be due to computational differences, much of the decline is attributed to destruction of reefs. Unfortunately, no literature is available that estimated impacts of fisheries production from reefs following the massive bleaching in 1998 where SST reached 34°C in the western part of the country.

El Niño events are usually associated with high SST that restricts the flow of cold, nutrient rich bottom waters in upwelling areas. In the Philippines, these upwelling areas mostly found in the western part of the country are major spawning grounds of fishes and critical to survival of larvae due to its high productivity that provides food for the new hatchlings.

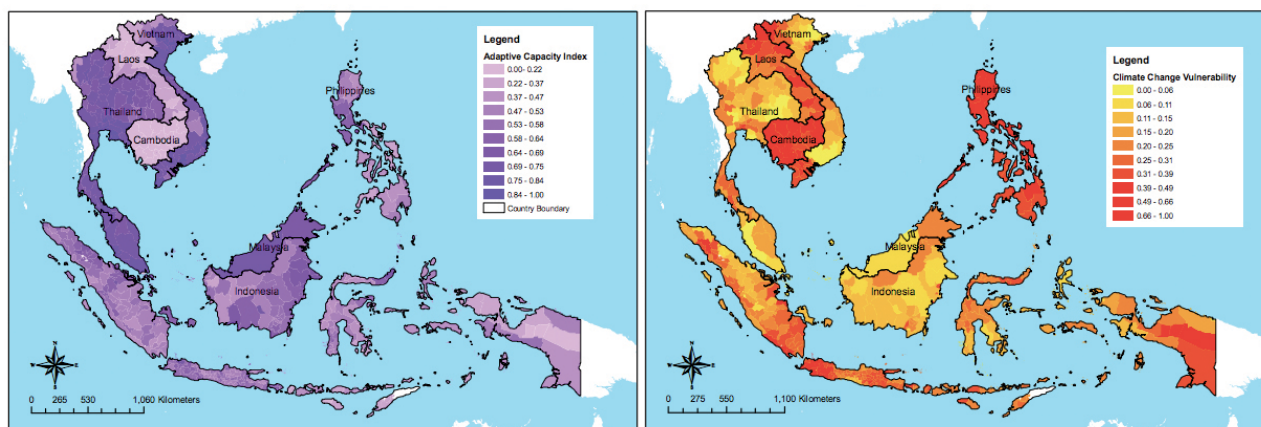
Impacts of climate change on aquaculture is even more steeped being somehow still dependent on capture fisheries for stocks and feeds that the stress on the capture fisheries is still transferred to the aquaculture. Further, the unpredictable and extreme weather changes exerting great physiological stress on the cultured stocks increase the vulnerability of cultured stocks to diseases and lesser yields which translates to lesser returns for the farmers (FAO 2008). There is also the issue of invasive species creating havoc on natural populations or the expansion of the geographic range of diseases in aquaculture farms.

Of the various impacts to fisheries, ocean acidification ranks highest at this could affect the habitats (coral reefs) and the organisms with calcified tissues from tiny dinoflagellate to crabs and shrimps altering their physiology and behavior. Its impacts cut across the entire trophic level, destroying the stability of ecosystems and potentially destroy the entire life support systems of the oceans.

Habitat loss has reduced the ability of coastal and marine ecosystems to provide ecosystem services, such as carbon sequestration and shoreline protection. Maps depicting the country's adaptive capacity to climate change and its degree of vulnerability compared to other Southeast Asian Nations are shown in **Figure 15.18**. A study done in 2008 indicated that the Philippines was considered as the least adaptive and the most vulnerable to climate change in Southeast Asia. Laws on disaster risk reduction and management and climate change, plans with budget allocation, and institutional arrangements from the national to local levels have been adopted since then.

Based on a study by the Asia Development Bank, the Philippines is estimated to lose six percent of its GDP, every year until 2100 if it disregards the risks associated with climate change. However, if the country starts investing on climate change mitigation measures by 2020, it is estimated that it can reduce the losses by up to four percent by 2100 (Climate Change Executive Brief, 2018).

**Figure 15.18:** Adaptive Capacity Index (left) and Climate Change Vulnerability Index (right) of the Southeast Asian Nations.



Source: EEPSEA – Climate Change Vulnerability Mapping of Southeast Asia, 2008.

### 15.3.3 The Role of Coastal and Marine Ecosystems

Coastal and marine ecosystems have a huge role in protecting communities from the effects of climate change. Restoration and conservation of mangroves, seagrass beds, and coral reefs can be an important part of the solution for reducing coastal risks. Millions of people and important infrastructure are vulnerable to coastal flooding, especially in the Philippines, which is affected by an average of 19-20 tropical cyclones per year. Within this context, coastal ecosystems serve as natural coastal infrastructures, lessen erosion and flood exposure by reducing wave height and retaining sediments, and provide additional protection against storm surge.

Not only do they reduce coastal risks, but they also provide additional benefits compared with traditional coastal infrastructures (e.g., breakwaters, seawalls, dikes, etc.). In addition to shoreline protection, coastal ecosystems provide other ecosystem services, such as provisioning (e.g., fisheries, raw material, etc.), cultural (e.g., tourism and recreation), regulating (e.g., carbon sequestration, waste assimilation, etc.), and supporting (e.g., habitat for different species).

Healthy coastal habitats also play an important role in reducing climate change. Salt marshes, mangroves, and seagrass beds absorb large quantities of the greenhouse gas CO<sub>2</sub> from the atmosphere and store it, thus mitigating and decreasing the effects of global warming. IUCN studies have shown that for each hectare of mangrove replanted, the CO<sub>2</sub> removal from the atmosphere is estimated to be between 1,500 and 2,000 tonnes – this is more than a tropical rainforest. However, the destruction of coastal habitats poses a great risk. The carbon stored in the habitats is also released, increasing levels of greenhouse gases in the atmosphere. Thus, when these habitats are damaged or destroyed, not only is their carbon sequestration capacity that is lost, but the carbon they store is also released.



**PART 5**

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**GOVERNANCE STRUCTURE  
SUPPORTING BLUE ECONOMY  
DEVELOPMENT**

# 16 Policies and Institutional Arrangements

Ocean and coastal management issues cut across sectors, making integrated approaches essential for addressing poverty reduction, economic growth, and the governance of human activities affecting the sustainable use of goods and services generated by coastal and marine ecosystems. For blue economy development, it is necessary to establish an enabling environment for ecotourism, marine renewable energy, sustainable fisheries, sustainable sourcing and processing of seafood, marine biotechnology, ecoship-building, coastal habitat restoration, disaster and climate resiliency, marine pollution reduction and safe water supply. This section identifies the major policies, laws, plans and strategies that support sustainable ocean and coastal management, environmental protection, blue economy development, SDS-SEA implementation, and achievement of the SDGs and ocean agenda.

## **Philippine 1987 Constitution**

- Article 1, recognizes the archipelagic character of the country, and describes the territorial jurisdiction of the Philippines  
*"... the Philippines archipelago, with all islands and waters embraced therein and all other territories over which the Philippines has sovereignty or jurisdiction, consisting of its terrestrial, fluvial and aerial domains, including its territorial seas, the seabed, the subsoil, the insular shelves and other submarine areas. The waters around, between and connecting the islands of the archipelago, regardless of their breadth and dimensions, form part of the internal waters of the Philippines."*
- Article 2, section 15-16 declares a state policy on the protection and advancement of the right to health of the people and their right to a balanced and healthful ecology in accordance with the rhythm and harmony of nature.
- Article 13 recognizes the right of people and their organizations to effective and reasonable participation at all levels of social, political, and economic decision making.

The following are the presidential decrees issued related to environmental protection and maritime industry by Marcos during the Martial Law period, and remain in force unless amended, repealed, or superseded by other laws.

### **s. 1974**

- Presidential Decree (PD) No. 474: "Providing for the reorganization of maritime functions in the Philippines, creating the maritime industry, and for other purposes" (MARINA)

**s. 1975**

- PD No.856 Sanitation Code
- PD 705 – Forestry Code

**s. 1976**

- PD No.984 National Pollution Control Decree
- PD No. 1067 Water Code of the Philippines
- PD No.979 Marine Pollution Law

**s. 1977**

- PD No.1152 Philippine Environment Code

**s. 1978**

- PD No.1586 Environmental Impact Statement

The following sections describe the major international agreements, which the country has signed, as well as national laws, policies and action plans on coastal management, fisheries, habitat and biodiversity conservation, pollution reduction from land- and sea-based sources, disaster risk reduction and management, climate change mitigation and adaptation, and ocean industries.

## 16.1 Ocean and Coastal Management

### 16.1.1 International Agreements

- **United Nations (UN) Convention on the Law of the Sea (UNCLOS).** The UNCLOS, also known as the Law of the Sea Treaty is an international agreement that was a product from the 3rd United Nations Convention on the Law of the Sea. As of October 2012, 164 countries have signed the treaty. UNCLOS III was able to set clearer limits to sea navigation, status of archipelagic countries, EEZs, and continental shelf jurisdiction. It also highlighted the importance of scientific research for the conservation of the marine environment.
- **UN Convention on Sustainable Development (UNCSD).** Also known as Rio+20 or Earth Summit 2012, the UNCSD is the third conference on Sustainable Development. It followed the 1992 Earth Summit/United Nations Conference on Environment and Development (UNCED). UNCSD is the key forum for the consideration of issues related to the integration of the three dimensions of sustainable development: economic development, social inclusion and environmental protection. As such, its mandate is not limited to environmental issues.

The conference produced the nonbinding document, **“The Future We Want”**, where heads of state of 192 governments in attendance (including the Philippines) agreed to the 27 principles

intended to guide countries in future sustainable development and the commitment to promote a sustainable future. The document also reaffirms the previous Earth Summit (1992) outcomes, including the Rio Declaration on Environment and Development, Agenda 21, and Forest Principles.

- **2030 Agenda for Sustainable Development and the Sustainable Development Goals.**

The SDG 14 was highlighted during the United Nations Oceans Conference, which was held on June 5-9, 2017 in New York, USA. This was a call for action from UN member nations to conserve and sustainably use the world's oceans. A number of urgent actions were highlighted in SDG 14, which included reducing marine pollution, protecting coastal and marine ecosystems, solving fishery-related problems, improving ocean-related education, strengthening multi-stakeholder relationships, and allocating more resources for marine scientific research.

### 16.1.2 National Policies and Laws

- **The National Marine Policy (s. 1994).** The National Marine Policy of 1994 holds the basic framework for the management of the country's marine and coastal areas. It focuses on archipelagic development as an alternative view to national economic management, stressing the importance of coordination with concerned sectors. The policy calls for the development of other policies, programs and projects necessary to protect the country's marine and coastal resources, advance national interests and fulfil international commitments.
- **Executive Order No. 533: Integrated Coastal Management Policy (s. 2006):** "Adopting Integrated Coastal Management as a National Strategy to Ensure the Sustainable Development of Country's Coastal and Marine Environment and Resources and Establishing Supporting Mechanisms for its Implementation". It provided the national management policy framework to promote sustainable development of the country's coastal and marine environment and resources to achieve food security, sustainable livelihood, poverty alleviation, and reduction of vulnerability to natural hazards whilst preserving ecological integrity. The ICM is designed to be implemented in all coastal and marine areas to address the inter-linkages among watersheds, estuaries, wetlands and coastal areas by all relevant national and local agencies. It calls for the creation of action plans for the sustainable development of coastal areas, and emphasizes the shared responsibility among key stakeholders in the implementation of the ICM program.
- **Executive Order (EO) No. 132, s. 1999:** "Strengthening the Cabinet Committee on Maritime and Ocean Affairs (CABCOM-MOA) and its supporting mechanisms, establishing its Technical Committee, and for other purposes" (Chair-DFA)
- **Republic Act (RA) No. 7898:** Armed Forces of the Philippines Modernization Act (1995)
- **Republic Act (RA) No. 9993:** Philippine Coast Guard Law of 2009: "An Act establishing the Philippine Coast Guard as an armed and uniformed service attached to the DOTC, thereby repealing RA 5173, as amended, for other purposes"
- **Joint Memorandum Circular for the Harmonization of the Comprehensive Land Use Plan and the Comprehensive Development Plan (2009)**

### 16.1.3 Plans and Actions

**Table 16.1:** Priority Areas for the Implementation of the ICM Programs.

	Priority Areas	Coastline (km)	Remarks
Region I	Ilocos Norte; Ilocos Sur La Union; Pangasinan	596	Initiative of local governments facilitation by the Regional Development Council (Region 1) and expanding to neighboring administrative regions
Manila Bay	Bataan, Cavite, Pampanga, Bulacan, NCR	395.5	PEMSEA parallel sites: Bataan and Cavite
Region IV-A: Batangas Province		492	PEMSEA demonstration site
Region X	Macajalar Bay	176	Initiative of alliance of local governments in Macajalar Bay
	Camiguin	55	New Zealand Aid Programme
Region VI	Guimaras Province, Negros Occidental, Ilo-ilo, Capiz, Antique, Aklan	409	PEMSEA parallel site: Guimaras Province
	Boracay Island	7	Facilitated by a private sector foundation (CSR)
Region IV-A	Tayabas Bay (Quezon side)	305.7	Initiative of local governments
Coral Triangle / Sulu Sulawesi Marine Ecoregion	Including Palawan Province	1,921	CTI National Plan of Action; supported by USAID, ADB and international conservation organizations WWF, The Nature Conservancy and CI
Nationwide	ICRMP sites (80 LGUs) including municipalities in Cagayab (12), Zambales (9), Romblon (8), Masbate (17), Cebu (21), Davao Oriental (7) and Siquijor (6)	3,908	ADB loan to the Philippine government

Source: *Integrated Coastal Management Policy Paper, 2013.*

As mandated by EO 533, DENR, BFAR and the Municipal Development Fund Office implemented the Integrated Coastal Resource Management Project (ICRMP) which makes use of the “ridge to reef” approach for the sustainable management of coastal resources. A total of 70 LGUs were funded for the ICRM Program with 411 projects in total (**Table 16.2**). The outputs and results of the ICRMP have to be reviewed and evaluated. There is currently a proposed bill known as the **“Integrated Coastal Management Act”** to adopt the integrated coastal management as a national strategy to ensure the sustainable development of the coastal and marine environments and to establish supporting mechanisms for its implementation. It is pending for approval in the Senate.

**Table 16.2:** Total Number of ICRM Projects Funded and the Allocated Budgets per Site as of 2011.

Region	Province	#LGUs
Region II	Cagayan	12
Region III	Zambales	9
Region IV-B	Romblon	8
Region V	Masbate	17
Region VII	Cebu	21
	Siquijor	6
Region XI	Davao Oriental	7

Source: DENR-ICRMP, 2011.

## 16.2 Fisheries

### 16.2.1 International Agreements

- **Convention on the Conservation and Management of Highly Migratory Fish Stocks in Western and Central Pacific Ocean (2000).** This convention was aimed at the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific Ocean. This was formulated in accordance with the 1982 Convention on the Law of the Sea, and the 1995 Agreement for the Implementation of the Convention's Provisions relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.
- **Port State Measures to Address IUU Fishing (PSMA).** This international agreement highlights the role of participating port states in the surveillance, monitoring and patrolling of their ports against illegal, unreported and unregulated fishing (IUU). The PSMA provides a clear and specific framework for setting conditions for the entry and use of ports for fishing vessels, conducting inspections and how to take clear actions on vessels that doing illegal, unreported and unregulated fishing activities.
- **Convention on the Conservation of Migratory Species of Wild Animals (CMS) or Bonn Convention**

### 16.2.2 National Policies and Laws

- **Republic Act (RA) no. 10654 - An Act to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing, Amending Republic Act No. 8550** (The Philippine Fisheries Code of 1998). RA10654 was enacted as a law in February 2015. It increases the sanctions for illegal commercial fishers and poachers to up to PhP45 million and PhP2.4 million, respectively, intensifying the crackdown on illegal fishing. The amended law also mandated the creation of an **Adjudication Committee** under BFAR, which would speed up the determination of

liability of violators and imposition of penalties. The law also calls for the installation of a **vessel monitoring, control and surveillance system** (MCS) in “all Philippine flagged fishing vessels regardless of fishing area and final destination of catch,” to help identify violators while at sea. Available and new technologies should be used to ensure compliance with fisheries regulations.

- **Republic Act (RA) no. 8550** (s. 1998): Philippine Fisheries Code of 1998
- **Republic Act (RA) no. 8435** (s. 1998): Agriculture and Fisheries Modernization Act (AFMA) – DA

### 16.2.3 Strategic Action Plans

- **Executive Order No 154.** Establishes the Philippines’ National Plan of Action (NPOA) to prevent, deter and eliminate illegal, unreported and unregulated (IUU) fishing. This formally establishes a committee composed of duly authorized representatives from various government agencies, private sectors and stakeholders whose task is to ensure the implementation of the NPOA-IUU.

## 16.3 Coastal and Marine Ecosystem and Biodiversity Conservation

### 16.3.1 International Agreements

- **Convention on Biological Diversity.** The Convention on Biological Diversity (CBD) aims to conserve biological diversity, promote sustainable use of components of biological diversity and the fair and equitable sharing of benefits arising out of the utilization of genetic resources. The Philippine government ratified the Convention on 12 June 1992.
- **Cartagena Protocol on Biosafety to the Convention on Biological Diversity.** This is an international agreement which aims to ensure the safe handling, transport and use of living modified organisms (LMOs) resulting from modern biotechnology that may have adverse effects on biological diversity, taking also into account risks to human health. The protocol further provides the framework for conducting a risk assessment. In the absence of insufficient scientific information, parties are encouraged to use the precautionary approach.
- **Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (ABS) to the Convention on Biological Diversity.** This is a supplementary agreement to the Convention on Biological Diversity. It provides a transparent legal framework for the effective implementation of one of the three objectives of the CBD: the fair and equitable sharing of benefits arising out of the utilization of genetic resources. The Philippines is a Party since 29 September 2015.
- **Aichi Biodiversity Targets – Convention on Biological Diversity.** This is a set of 20 global targets under the **Strategic Plan for Biodiversity 2011-2020**. The Aichi Biodiversity Targets provide a time-bound strategic plan for biodiversity conservation, which includes measurable

targets that must be met by the year 2020. The goals include mainstreaming biodiversity across governments and stake holders, reducing direct pressures on biodiversity and promoting sustainable use, safeguarding ecosystems and biodiversity, enhancing the benefits of biodiversity and ecosystem services, and enhancing implementation through participatory planning, knowledge management and capacity building.

- **Ramsar Convention on Wetlands of International Importance, especially as Waterfowl Habitat** is an international treaty for the conservation and sustainable use of wetlands (adopted in 1971). The convention is an intergovernmental treaty entered into by the Philippines on 8 November 1994. It provides a framework for the conservation and sustainable use of wetlands and their resources. The Philippines currently has seven Ramsar sites, which are considered as wetlands of international importance. As a member to the Ramsar Convention, the Philippines commits to report on the Compliance with the Convention, submitting triennial National Reports which follow the Strategic Plan of the Convention.
- **Convention on International Trade of Endangered Species of Wild Flora and Fauna (CITES).** CITES was formulated to ensure that international trade of wild animals and plants does not in any way threaten their survival. Currently, CITES has 183 members parties, to which Philippines is a member of since 1981.
- **Bonn Convention** (also known as **Convention on Migratory Species** or CMS). CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range. Parties to the CMS aim to conserve and manage terrestrial, aquatic and avian migratory species throughout their range. Through CMS, Parties also agree that Range States (countries where a particular migratory species reside in or traverse through) should take joint conservation action.

### 16.3.2 National Laws and Policies

- **Republic Act (RA) no. 7161** (s. 1991): Revised Forestry Code of the Philippines (contains anti-mangrove cutting provision)
- **Republic Act No. 7586 (s. 1992)** "National Integrated Protected Areas System Act or NIPAS Act"
- **Proclamation No. 128** (s. 1997) "Declaring the entire Sulu and Celebes Seas as an Integrated Conservation and Development Zone, (ICD) creating Presidential Commission for ICD of the area and providing funds therefor"
- **Republic Act No. 9147** (s. 2001): Wildlife Resources Conservation and Protection Act - "An Act providing for the conservation and protection of wildlife resources and other habitats, appropriating funds therefor and for other purposes"
- **Executive Order (EO) No. 533** (s. 2006): "Adopting Integrated Coastal Management as a National Strategy to Ensure the Sustainable Development of Country's Coastal and Marine Environment and Resources and Establishing Supporting Mechanisms for its Implementation"



- **Executive Order (EO) No. 578** (s. 2006): “Establishing the National Policy on Biological Diversity and Prescribes its implementation throughout the country, particularly in the Sulu-Sulawesi Marine Ecosystem and Verde Island Passage Marine Corridor”
- **Executive Order (EO) No. 797** (s. 2009): “Adopting the Coral Triangle Initiative (CTI) National Plan of Action (NPOA)” (DENR-BMB)
- **Executive Order (EO) No. 816** (s. 2009): declares the River Basin Control Office under the Department of Environment and Natural Resources as the lead government agency for integrated planning, management, rehabilitation and development of country’s river basins.
- **DENR Administrative Order (DAO) number 2016-26:** Guidelines for the Implementation of the *Coastal and Marine Ecosystem Management Program* (CMEMP) - aims to comprehensively manage, address and effectively reduce the drivers and threats of degradation of the coastal and marine ecosystems; and achieve and promote sustainability of ecosystem services, food security and climate change resiliency. CMEMP includes integrated coastal management (ICM); sustainable tourism/ecotourism; partnership building; protection, management and law enforcement; communication, education and public awareness; valuation of ecosystem services; and biodiversity-friendly enterprises.
- **Action Plans.** Management and action plans within declared protected areas and LMEs, including community-based approaches on resource conservation are formulated. Community-based resource management plans allow for multi-stakeholder partnerships that include local government unit, all stakeholders, NGOs and the academe to contribute to identifying problems and suitable solutions that are unique to each of their respective jurisdictions. In most cases, knowledge management, monitoring and research are prioritized as they are considered as fundamental tools in creating appropriate policies for resource management.

## 16.4 Pollution Reduction: Solid Waste and Hazardous Waste

### 16.4.1 International Agreements

- **The Basel Convention on the Control of Transboundary Movement of Hazardous Wastes.** The Basel Convention was adopted in 1989 and entered into full force in 1992 with the commitment of 53 member states. The overall objective of the convention is to protect the environment and communities from the effects of hazardous wastes. The convention cover provisions for the reduction of the generation of hazardous wastes, promotion of environmentally sound management and disposal of these compounds, the restriction of the movement of hazardous wastes across countries and a regulatory system of transboundary movement, in cases where they are permissible. The Convention was ratified by the Philippine government in 1994.
- **Stockholm Convention.** This is a global treaty to protect human health and the environment from the adverse effects of persistent organic pollutants (POPs). The Philippines ratified this convention in 2004.

- **The Minimata Convention on Mercury.** The Minimata Convention on Mercury is an international treaty signed on October 2013 by the Governing Council of the United Nations Environment Programme which was specifically created to initiate international action in protecting the environment and communities from the detrimental effects of mercury emissions. The target of the treaty is to eventually reduce the amount of mercury pollution from targeted industries and promote proper storage and disposal of the compound. The Philippines has signed the convention in 2013, but ratification is still ongoing.
- **Rotterdam Convention.** The Convention creates legally binding obligations for the implementation of the Prior Informed Consent (PIC) procedure, covering pesticides and industrial chemicals that have been banned or severely restricted for health or environmental reasons by the Parties to the Convention. These chemicals are listed under Annex III of the convention, which notes the risks of using the chemicals. The Philippines signed the convention in 2006, but ratification is still ongoing.

#### 16.4.2 National Policies and Laws

- **Republic Act 9003.** Also known as the **Ecological Solid Waste Management Act of 2000** adopts a more systematic and comprehensive solid waste management program for the purpose of ensuring public safety. The law calls for the use of environmentally-sound methods in the utilization of the country's natural resources and encourage resource conservation and recovery; set guidelines for solid waste reduction; ensure proper disposal, segregation, collection, treatment and disposal, encourage greater private sector involvement in proper solid waste disposal and promoting national research and development programs to improve solid waste management and conservation of resources.
- **Republic Act No. 6969.** RA 6969 is also known as the **Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990**. The Act highlights the State's responsibility in regulating, restricting and prohibiting the importation, manufacture processing, sale, distribution, use and disposal of any chemical substance or mixtures that pose a threat to the environment. The act also covers the provision of resources for the advancement of research work on the proper management and handling of toxic chemical.
- **DENR Administrative Order No. 1997-38. Chemical Control Order for Mercury and Mercury Compounds**
- **DENR Administrative Order No. 2002-02.** Establishment and Management of **Community-Based Program in Protected Areas**
- **DENR Administrative Order No. 2004-0. Chemical Control Order (CCO) for Polychlorinated Biphenyls (PCBs)**
- **DENR Administrative Order no. 36 of 2004 (DAO 2004-36).** This DAO aims to further strengthen the implementation of RA 6969 and prescribes the use of the Procedural Manual.
- **DENR Administrative Order 2013-22.** Revised Procedures and Standards for the Management of Hazardous Wastes (Revising DAO 2004-36)

- **DENR Administrative Order 2013-24. Chemical Control Order (CCO) for Lead and Lead Compounds**
- The reduction or elimination of the amount of hazardous wastes and other wastes generated and hazardous wastes subject to transboundary movement have been incorporated in the following legislation, regulation and guidelines:
  - a. Presidential Decree 984: Pollution Control Law of 1976;
  - b. Presidential Decree 1586: Environmental Impact Statement (EIS) System
  - c. Republic Act 6969: Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990
  - d. Republic Act 8749: Clean Air Act of 1999
  - e. Republic Act 9003: Ecological Solid Waste Management Act of 2000
  - f. Republic Act 9275: Philippine Clean Water Act of 2004
- **National Marine Policy, s.1994**
- **Presidential Decree 979 (Marine Pollution Law)**

### 16.4.3 Strategic Action Plans

- **Solid Waste Management Plan.** The Philippines' Solid Waste Management Plan calls for the creation of a **Solid Waste Management Board (SWMB)** tasked to monitor and implement the solid waste management plan in close coordination with the Local Government Unit, NGOs and the private sector. The solid waste management plan covers proper waste collection and transfer, waste characterization, processing, reduction at source, recycling and a proper final waste disposal. All LGUs must prepare and submit **10-Year SWM Plans**.
- **National Implementation Plan (NIP) on Persistent Organic Pollutants (POPs).** The updated NIP has been submitted to the Secretariat of the Stockholm Convention.

## 16.5 Pollution Reduction: Environmental Sanitation, Wastewater and Nutrients

### 16.5.1 International Agreements

- **Sustainable Development Goal 6.** Goal 6 of Sustainable Development Goals state that by 2030, water quality should be improved by reducing pollution, eliminating dumping and reducing the release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and substantially increasing recycling and safe reuse globally.

### 16.5.2 National Policies and Laws

- **Republic Act No. 9275.** The Philippine **Clean Water Act of 2004** declares that the State shall pursue a policy of economic growth in a manner that is consistent with the protection, preservation and revival of the quality of our fresh, brackish and marine waters. The law provides a framework

for the prevention, control and abatement of pollution of the country's water resources; use of proper economic instruments to ensure the protection of water resources; cooperation among state agencies, NGOs and private sectors; provision of a comprehensive management program for water pollution prevention; and formulation of a system of accountability for any program or project among industries.

- **Presidential Decree no. 856, s. 1975 or the Sanitation Code of the Philippines.** It prescribed sanitation requirements for food establishments, and refuse collections and disposal system of cities and municipalities.
- **DENR Administrative Order (DAO) 2005-10** (May 16, 2005): Implementing Rules and Regulations of Clean Water Act
- **DENR Administrative Order (DAO) 1990 no. 34 and 35:** Water Quality Guidelines and General Effluent Standards (old)
- **DENR Administrative Order (DAO) 2016-08 WQG:** Water Quality Guidelines and General Effluent Standards (new)

### 16.5.3 Strategic Action Plans

- **National Sewerage and Septage Management Program.** The NSSMP provides subsidy (up to 50% of project cost) from the national government (through the Department of Public Works and Highways) to highly urbanized cities and first class municipalities to provide sewerage and septage services and minimize the deleterious impacts of wastewater discharge to water bodies and the environment, in general. It provides a framework for addressing national issues on wastewater, sanitation, disposal and treatment. It aims to enhance the ability of local implementers to build and operate wastewater treatment systems that are both cost-effective and environmentally sound.

## 16.6 Pollution Reduction: Sea-based Sources (Oil Spills, Marine Debris, etc.)

### 16.6.1 International Agreements

The Philippines' accession to the International Maritime Organization (IMO) instruments highlights the support to the safety of Filipino seafarers and in protecting the marine environment from pollution from sea-based sources.

- **MARPOL 73/78.** The International Convention for the Prevention of Pollution from Ships was developed by the IMO. It covers regulations on the prevention of pollution by oil, control of pollution by noxious liquid substances in bulk, prevention of pollution by harmful substances carried by sea in packaged form and pollution from sewage by ships. The ultimate objective of the treaty is to preserve the marine environment by eliminating pollution due to oil and other substances harmful to the marine environment.

- **The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter.** The London Convention aims to promote the effective control of all sources of marine pollution and take all practical steps to prevent the pollution of the seas due to the dumping of wastes and other matter. It is one of the first conventions that answer to the growing problem of marine pollution. In 1996, the existing protocol was revised with the London Protocol prohibiting all dumping. The London Protocol entered into full force on March 2006 by 30 member countries.
- **Ballast Water Management Convention.** The Ballast Water Management Convention was developed by IMO with the objective of protecting the marine environment from the transfer of harmful aquatic organisms through ballast water carried by ships. The Convention promotes the Ballast Water Management System (BWMS) that will eliminate harmful aquatic organisms and pathogens from ballast water before they are expelled from ships. The convention was entered into force on September 2017.
- **SOLAS Convention 74.** The International Convention for the Safety of Life at Sea (1974, as amended)
- **COLREG 72.** The International Regulations for Preventing Collisions at Sea (1972)
- **Other conventions**
  - **International Convention on Load Lines (1966)**
  - **International Convention on Tonnage Measurement of Ships (1969)**
  - **International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (1978, as amended)**
  - **Special Trade Passenger Ships Agreement (1975)**
  - **Convention on the International Mobile Satellite Organization (1979)**
  - **Operating Agreement on the International Mobile Satellite Organization (1979)**
  - **SUA Convention 88 and SUA Protocol 88.** The convention and protocol for the Suppression of Unlawful Acts Against the Safety of Fixed Platforms Located on the Continental Shelf (1988)
  - **International Convention on the Control of Harmful Anti-fouling Systems on Ships (2001)**

The Maritime Industry Authority (MARINA) announced that the Philippines has deposited instruments of accession to six (6) maritime conventions before the International Maritime Organization (IMO) in 2018. These are:

- The Protocol of 1997 to Amend the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL Annex VI) secures the commitment of the Philippines to the global efforts on reducing air pollution from ships. MARPOL Annex VI, first adopted in 1997, limits the main air pollutants contained in ships' exhaust gas, including sulphur oxides and nitrogen oxides, and prohibits deliberate emissions of ozone depleting substances.
- The Protocol of 1988 Relating to the International Convention on Load Lines, 1966 or the Load Lines Convention prescribes the minimum reserve buoyancy and freeboard of ships to ensure their stability by preventing overloading.

- The Protocol of 1978 relating to the International Convention for the Safety of Life at Sea, 1974, to improve further the safety of ships, particularly tankers. The Convention aims to update the safety standards of crude carriers and product carriers by requiring the specifications of radars and steering gear to enhance safety of navigation.
- The Protocol of 1988 relating to the International Convention for the Safety of Life at Sea, 1974, as amended, specifies the standards for the construction, equipment and operation of ships compatible with their safety.
- The International Convention on the Control of Harmful Anti-Fouling Systems on Ships, (AFS 2001 Convention) aims to prevent the contamination of marine species. Anti-fouling paint containing tributyltin (TBT) has been known to cause imposex and other abnormalities in certain species of invertebrates, fish, sea otters and dolphins.
- The International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM), adopted in 2004 aims to prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for the management and control of ships' ballast water and sediments.

## 16.7 Climate Change Adaptation and Mitigation

### 16.7.1 International Agreements

- **United Nations Framework Convention on Climate Change.** The UNFCCC aims to stabilize the greenhouse gas concentrations in the atmosphere at amounts that will prevent man-made interferences to the climate system. It was first adopted in May 1992 and entered into force on March 1994. The convention sets non-binding limits to member countries on the amounts of greenhouse gases they can emit. UNFCCC was able to set up greenhouse gas inventories which were used as a reference for the 1990 benchmark levels of the Kyoto Protocol.
- **Paris Climate Agreement.** The main objective of the Paris Agreement is to reinforce the global commitment to mitigate climate change. Member countries have committed to keeping the global temperature rise for this century below 2° Celsius above pre-industrial levels and to pursue efforts to limit temperature increase to 1.5°Celsius.
- **The Kyoto Protocol.** The Kyoto Protocol is closely linked to the UNFCCC that sets binding emission reduction targets. The protocol was adopted in Kyoto, Japan in December 1997 and entered into force on February 2005. Adopted in 1997, the Kyoto Protocol is an international treaty under the UNFCCC, and commits 43 Annex I countries to limit their greenhouse gas emissions for the period 2008-2012 below or equal to the level of their emissions in 1990. Emission targets of the member countries are monitored through a registry system. The protocol also has a compliance system which can assist countries that face difficulties in reaching their said targets. An **adaptation fund** was created to help finance adaptation programs that will aid member countries in reaching their respective reduction targets. By 2012, the **Doha Amendment** to the protocol was proposed to extend the protocol to a second commitment period for 2013-2020. However, only 37 countries have committed to binding targets.

### 16.7.2 National Policies and Laws

- **Republic Act (RA) No. 8749: Philippine Clean Air Act of 1999.** In accordance with the UNFCCC and other international agreements, RA 8749, also known as the Philippine Clean Air Act, was put into legislation in 1999. The law aimed to monitor and set standards for greenhouse gas emissions known to increase global temperatures.

To effectively carry out the law, RA No. 8749 tasked the DENR to be the lead agency of the governing board.

The **Air Quality Management Fund** was created, to be sourced from the fines imposed and damages, as well as proceeds of licenses issued by the DENR under this act. Violators of the standards are to be penalized as much as P100,000 per day for operators of facilities, and as much as P6,000 and suspension of registration for motor vehicles.

- **Republic Act (RA) No. 9729:** “An Act Mainstreaming Climate Change into Government Policy Formulations, Establishing the Framework Strategy and Program on Climate Change, creating for this purpose the Climate Change Commission, and for other purposes.” R.A. 9729 – **Climate Change Act of 2009** – calls for the State to integrate the concept of climate change in various phases of policy formulation, development plans, poverty reduction strategies, and other government development tools and technique.
- **Executive Order No. 320, s. 2004.** President Gloria Macapagal-Arroyo designated DENR as the **National Authority for Clean Development Mechanisms** through this order in 2004. It is an adaptation of the UNFCCC’s Clean Development Mechanism whereby projects to be implemented are to prevent or absorb emitted GHGs.
- **Executive Order No. 174, s. 2014.** President Benigno Aquino III signed this EO in 2014 to institutionalize the **Philippine Greenhouse Gas Inventory Management and Reporting System**. This was created to enable the country’s transition towards a climate-resilient path to sustainable development. This task was given to the CCC, with the Department of Agriculture and the Philippine Statistics Authority for the agricultural sector, Department of Energy, DENR, and the Department of Transport and Communications (now Department of Transportation and Department of Information and Communications Technology).

### 16.7.3 Strategies and Plans

- **National Framework Strategy on Climate Change** s. 2010. The Government of the Philippines released in 2010 its National Framework Strategy on Climate Change (NFSCC), which envisions a “climate risk-resilient Philippines with healthy, safe, prosperous and self-reliant communities, and thriving and productive ecosystems.” The framework stresses a balance between adaptation and mitigation, and laid the groundwork for the development of the National Climate Change Action Plan (NCCAP) for 2011– 2028.

- **National Climate Change Action Plan (NCCAP), 2011– 2028.** Using the *National Climate Change Framework Strategy*, the NCCAP 2011-2028 aims to: enhance the adaptive capacities of communities; increase the resilience of vulnerable sectors and natural ecosystems and sustainability of built environment to climate change; and optimize mitigation opportunities towards gender-responsive and rights-based sustainable development. It prioritizes food security, water sufficiency, ecological and environmental stability, human security, climate-smart industries and services, sustainable energy and knowledge and capacity development as the strategic themes and direction for 2011 to 2028. It assesses the current situation of the country with regard to climate change risk and projected impacts, and outlines the response measures.

Section 14 of RA 9729 stipulates that “The LGUs shall be the frontline agencies in the formulation, planning and implementation of climate change action plans in their respective areas...” In line with the NCCAP, the **Local Climate Change Action Plan (LCCAP)** must be science- and risk-based. The LCCAP should be integrated into the LGU’s **Comprehensive Land Use Plan (CLUP)** and **Comprehensive Development Plan (CDP)**.

- **National Adaptation Plan.** The Philippines envisions the Philippine **National Adaptation Plan** as derivative plan from the NCCAP, a nationally driven plan that outlines long-term programs and strategies for adaptation and mitigation focusing on the seven thematic priorities. The phases of implementation under NCCAP is aligned with the National Disaster Risk Reduction and Management Plan and the Philippine Development Plan (PDP), the country’s development framework that seeks to address poverty, create employment opportunities and achieve inclusive growth.
- RA No. 9729 created the **Climate Change Commission (CCC)**, an agency “tasked to coordinate, monitor and evaluate the programs and action plans of the government relating to climate change.” The CCC, under the Office of the President, released the law’s implementing rules and regulations (IRR) in January 2010. The **Climate Change Commission (CCC)** currently spearheads the monitoring and updating of the NCCAP and adopts a Whole-of-Nation approach through coordination and involvement of stakeholders from relevant national agencies and ministries, local government units, academia, business and civil society. In the process of updating the NCCAP, the CCC takes into consideration the NAP technical guidelines.

## 16.8 Disaster Risk Reduction and Management

### 16.8.1 International Agreements

- **Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters (HFA):** It is the first plan to explain, describe and detail the work that is required from all different sectors and actors to reduce disaster losses.



- **Sendai Framework for Disaster Risk Reduction 2015-2030:** It outlines seven clear targets and four priorities for action, and aims to achieve the substantial reduction of disaster risk and losses in lives, livelihoods, health and the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries over the next 15 years.

### 16.8.2 National Policies and Laws

- **Republic Act (RA) 10121 (s. 2015):** As the paradigm shifts from response to mitigation, RA 10121, otherwise known as the **Philippine Disaster Risk Reduction and Management Act**, was enacted in 2010. RA No. 10121, is an act mandated to strengthen disaster management in the Philippines.

It repealed Presidential Decree No. 1566 of 1978, and replaced the National Disaster Coordinating Council (NDCC) with the **National Disaster Risk Reduction and Management Council** (NDRRMC) as the focal body.

NDRRMC, now headed by the Office of Civil Defense (OCD) as its implementing agency, coordinates with the *regional, provincial and local DRRM councils*. The structure of the NDRRMC is replicated at the regional and local levels, thus linking all disaster-related agencies and LGUs that have specific DRRM roles.

RA No. 10121 also established the **National DRRM Fund**, formerly the 'Calamity Fund', which is appropriated through the annual General Appropriations Act (GAA). It is specifically used for disaster risk reduction, mitigation, prevention, and preparedness activities. It is also utilized for relief, recovery, rehabilitation, reconstruction, and other works and services in connection to natural and human-induced calamities. The DRRM Fund was given an allocation of PhP2 billion in 2010, and increased to PhP 15.755 billion in 2017.

Likewise, the mechanism for the **Local DRRM Fund** was established. LGUs are to set aside 5% of their estimated revenue from regular sources for their disaster councils for prevention and mitigation activities.

Of the local DRRM fund, 70% of which shall be used for pre-disaster measures, while 30% shall be allocated as **Quick Response Fund**, which serves as a stand-by fund for relief and recovery programs.

Section 11 of RA 10121 directly states that "LGUs shall ensure the integration of disaster risk reduction (DRR) and climate change adaptation (CCA) into local development plans, programs and budgets as a strategy in sustainable development and poverty reduction."

### 16.8.3 Strategies and Plans

- **NDCC Four Point Action Plan, 2005.** With the Presidential Decree No. 1566 (year 1978) seen to only focus on response, the government created in 2005 the **National Four Point Action Plan** to spearhead prevention and mitigation. This plan involved: (1) improving forecasting capability of concerned agencies, (2) engaging the local disaster councils, (3) holding annual disaster consciousness month in July, and (4) formalizing stakeholder partnerships through memoranda of agreement (MOA).
- **National Disaster Risk Reduction and Management Plan (NDRRMP), 2011-2028.** The NDRRMP fulfils the requirement of RA 10121. The NDRRMP covers four thematic areas, namely, (1) Disaster Prevention and Mitigation; (2) Disaster Preparedness; (3) Disaster Response; and (4) Disaster Rehabilitation and Recovery, which correspond to the structure of the National Disaster Risk Reduction and Management Council (NDRRMC). It conveys a paradigm shift from reactive to proactive DRRM, with the end in view of enhancing people's awareness and understanding of DRRM, increasing their resilience and decreasing their vulnerabilities.

## 16.9 Policies on Other Ocean-related Economic Activities

### 16.9.1 Tourism

- **Republic Act (RA) 9593 – Tourism Act of 2009: An act declaring a national policy for tourism.** This policy recognizes *sustainable tourism development* as integral to the national socioeconomic development efforts to improve the quality of life of the Filipino people. It also aims to promote a tourism industry that is ecologically sustainable, responsible, participative, culturally sensitive, economically viable, and ethically and socially equitable for local communities.
- **Republic Act (RA) 10816 titled “Farm Tourism Development Act of 2016”:** This law serve as a catalyst for the development of agriculture and fishery communities, and provide additional income for farmers, farmworkers and fisherfolk. The Act also seeks to promote environment-friendly, efficient and sustainable farm practices; provide alternative recreation facilities and farm tourism activities for families, students and other clientele; and promote health and wellness with high-quality farm-produced food.
- **National Tourism Development Plan 2016-2022** – continuity is the focus, building on the momentum of what has already been achieved from the previous plan (National Tourism Development Plan 2011-2016), and from the initiatives of various stakeholders comprising the tourism industry
- **National Ecotourism Strategy and Action Plan (NESAP), 2002-2012; 2013-2022:** summarizes the different issues and challenges of the industry, and the corresponding strategies and response measures.

### 16.9.2 Shipbuilding

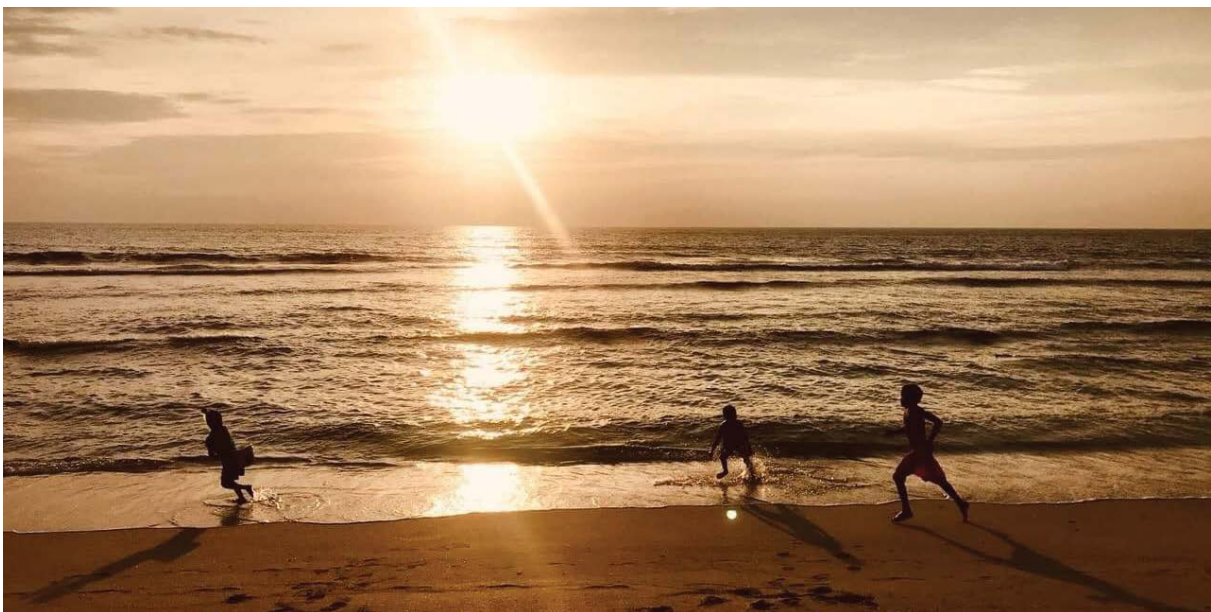
- **Republic Act (RA) No. 9295** (s. 2004): “An Act Promoting the development of Philippine Domestic Shipping, Shipbuilding, Ship repair and Ship breaking, ordaining reforms in government policies towards shipping in the Philippines and for other purposes. (MARINA)

### 16.9.3 Maritime Services

- **Republic Act (RA) No. 8544**: “An Act regulating the practice of the Merchant Marine Profession in the Philippines” (1998)

### 16.9.4 Renewable Energy

- **Republic Act no. 9513: Renewable Energy Act** (s. 2008). “An Act Promoting the Development, Utilization and Commercialization of Renewable Energy Resources and for Other Purposes”. This law provides following incentives for the renewable energy sector:
  - Seven-year income tax holiday and tax exemptions for the carbon credits generated from renewable energy sources.
  - 10% corporate income tax, as against the regular 30%, is also provided once the income tax holiday expires.
  - 1.5% realty tax cap on original cost of equipment and facilities to produce renewable energy.
- **National Renewable Energy Program 2011-2030** - has set the goal of adopting 9,931.3 MW of renewable energy by 2030.



*Long Beach in La Union. (Photo by D. Bautista)*

# 17 Addressing Sustainable Development Aspects to Protect Ocean Health and Support Blue Economy

## 17.1 Ecosystem and Biodiversity Conservation and Habitat Restoration

Habitat destruction has been seen as one of the factors that exacerbated the already negative effects of climate change in the country, as a result, decreasing our ability to adapt to such environmental changes. In the **Philippine Biodiversity Strategy and Action Plan for 2015-2028**, one of the direct program interventions identified is the restoration of ecosystem functions. A 2-way approach has been used namely, (1)

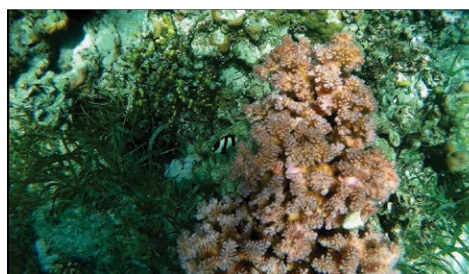


Photo by DENR

*passive restoration* - which is the establishment of marine sanctuaries and no-take zones, and (2) *active restoration*, which can be done through coral transplantation and mangrove and seagrass rehabilitation efforts. **Figure 17.1** shows all the marine and terrestrial protected areas and key biodiversity areas, with their corresponding Biodiversity Importance Index in the country. A study by Weeks (2010) reported 991 MPAs established in the country as of 2010 (**Table 17.1**). This covers a total area of 13,107.6 km<sup>2</sup>. As of 2018, the MPAs, both national and locally managed, comprise around 8.09% of the country's territorial waters, excluding PRMRR (BMB, 2018). MPAs are significant as the only reefs with considerable fish populations are located either in MPAs that have been protected for at least five years, or in remote areas, which are inaccessible to most fishers. It has been pointed out that there is also a need to establish MPAs in key biodiversity areas, including seagrass ecosystems.

**Table 17.1:** Total Coverage of Marine Protected Areas in the Philippines as of 2010.

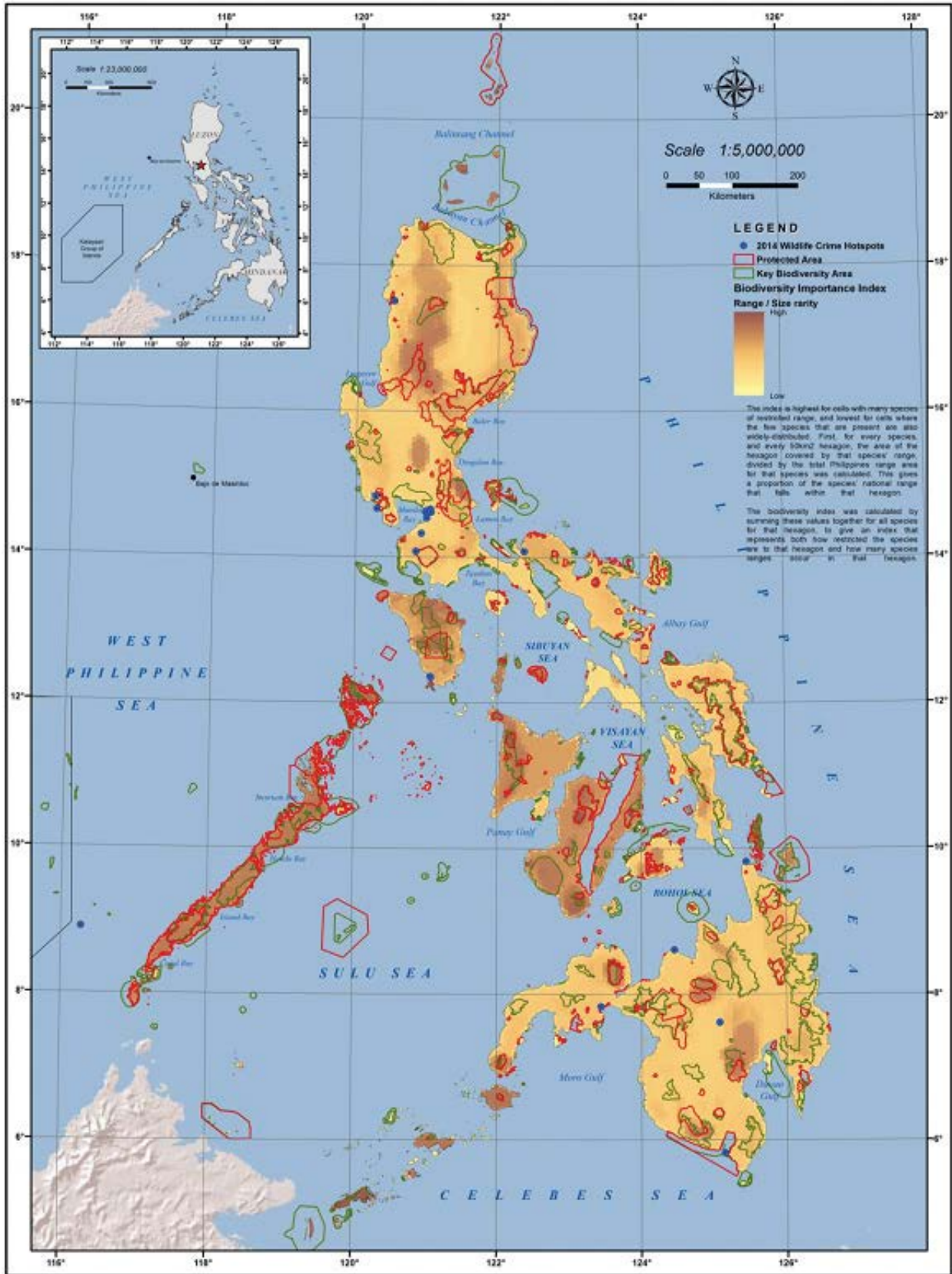
Marine Biogeographic Region <sup>a</sup>	Number of MPAs	MPA Coverage (km <sup>2</sup> )		Municipal Waters <sup>b</sup>	
		All	No-Take	All	No-Take
Celebes Sea	50	2,345.13	7.37	6.77	0.02
Northern Philippine Sea	35	2,469.60	7.54	6.52	0.02
Southern Philippine Sea	102	3,500.02	33.16	12.67	0.12
Sulu Sea	90	3,573.35	991.29	4.52	1.25
West Philippine Sea	51	1,836.93	283.71	4.26	0.66
Visayan Seas (Visayas Region)	663	1,219.50	136.50	1.50	0.17

<sup>a</sup> These are the marine biogeographic regions identified by Ong, et al. (2002).

<sup>b</sup> Municipal water boundaries (15 km offshore) calculated as per DENR (2001)

Source: Weeks, et al., 2010.

**Figure 17.1:** Protected Areas with their Corresponding Biodiversity Importance Index.



Source: PBSAP, 2015-2028.

Included in the *PPBSAP 2015-2028* is the aim to restore or begin the initial state of restoration in one million ha of degraded ecosystems by 2028. Restoration projects for both terrestrial and aquatic ecosystems account for 47 percent of the total estimated cost or PhP159.4 billion. The coral restoration program focuses on both sexual (the use of coral egg and sperm in the formation of coral propagules) and asexual methods (the fragmentation method), and stresses on the importance of public-private-academe partnership in the implementation of the restoration effort.

Reproductive patterns of at least 10 coral species have been monitored – data that is fundamental for the creation of species-specific sexual propagation methods. Molecular genetics and the identification of susceptible and resilient species to the rise in sea surface temperature and eutrophication have also been done. Coral gardening on the other hand, was used in the reef restoration of 10 areas devastated by Typhoon Yolanda (Haiyan).

The *National Greening Program (NGP)* is one of the pioneering programs by the government on mangrove restoration. As mentioned in Section 14.2.3, NGP has restored 76,514 ha of mangrove areas, with 199,367,952 seedlings planted throughout the country in 2011-2016 (see **Table 14.9**).

Mangrove restoration was also initiated under the *Philippine National Aquasilviculture Program (PNAP)* with 61 provinces all throughout the country, aimed to address issues on food security and climate change mitigation. Mangrove rehabilitation under the PNAP involved the coastal fisherfolk in the planting of 100 million propagules for the next 3-4 years. Funding supports from BFAR are P6.00 per surviving propagule, PhP1.2 million each per SUC for the establishment and operation of community-based multi-species hatcheries (CBMSH), and PhP65,000 per aquasilviculture project (Dieta and Dieta, 2015). As of 2013, the PNAP was able to rehabilitate an estimated area of 10,000 ha participated by 32,000 fisherfolks all around the country ([www.bfar.da.gov.ph/files/img/photos/BFARNAP-IWRESA.pdf](http://www.bfar.da.gov.ph/files/img/photos/BFARNAP-IWRESA.pdf)).

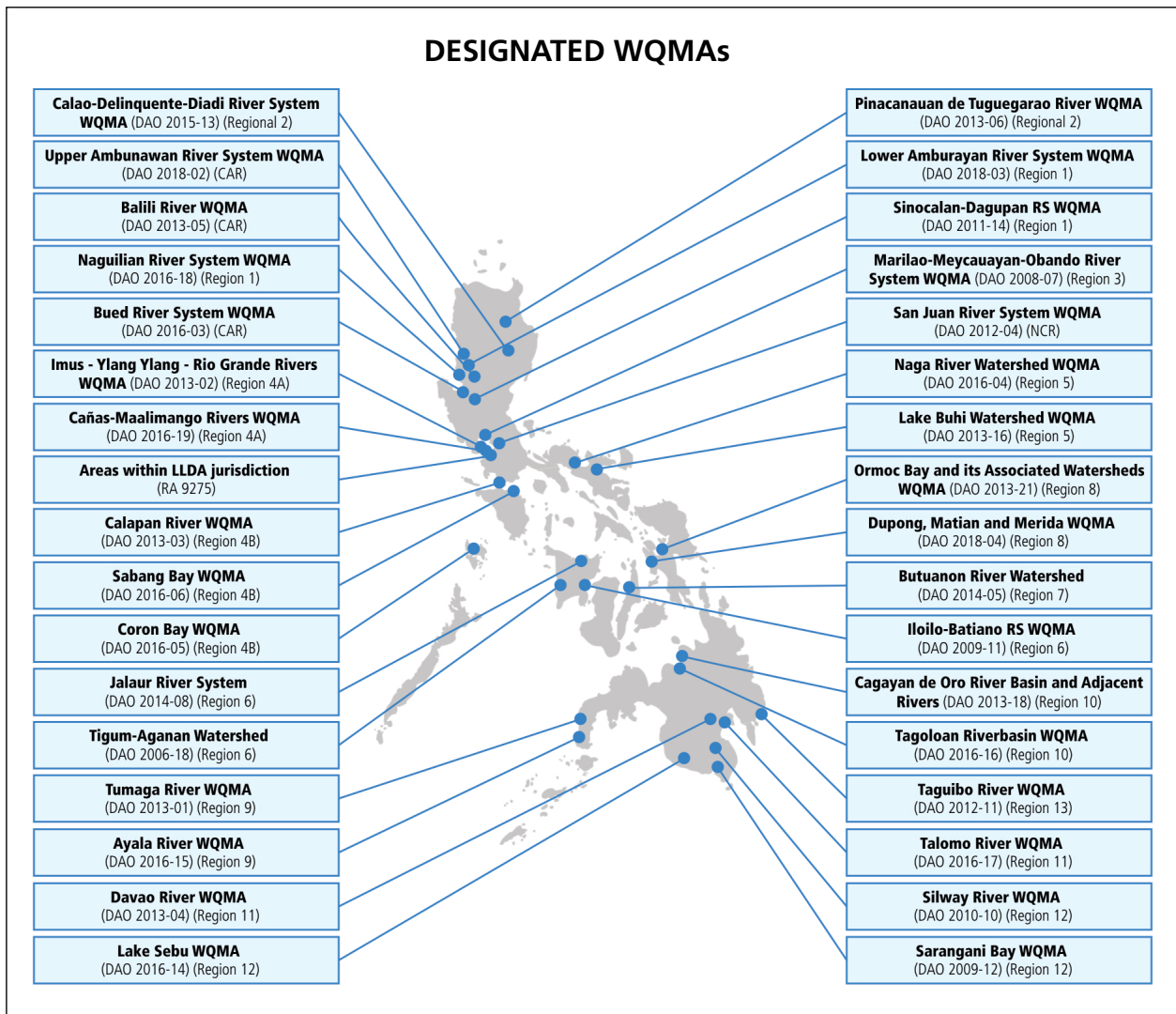
However, the use of inappropriate mangrove species and wrong site selection have led to low survival rate of the transplanted propagules, and in some cases, the destruction of other marine ecosystems (e.g. seagrass beds and mudflats) where the propagules were transplanted. In 2013, the *Manual on Community-Based Mangrove Rehabilitation* was released to serve as a guide to establishing mangrove nurseries and out-planting mangroves, including the means to organizing the community to foster sustainable management of the newly rehabilitated areas.

## 17.2 Pollution Reduction

### 17.2.1 Water Quality Management Areas

As of 2018, there were 37 Water Quality Management Areas (WQMA) that have been designated in selected river basins and water resources regions (WRRs) as stipulated by the Philippine Clean Water Act of 2004 (Environmental Management Bureau, 2017). WQMAs are created to help protect water bodies and its tributaries within the Water Quality Guidelines or Criteria.

Figure 17.2: Water Quality Management Areas.



Source: DENR-EMB.

The objectives and activities inside the WQMAs include:

- (a) Cleaning esteros and water bodies by mobilizing estero communities and getting them involved in cleaning the water bodies.
- (b) Institutionalizing good solid waste and wastewater management practices among the involved communities through IEC and participatory activities.
- (c) Reducing waterborne diseases among children and vulnerable groups.
- (d) Reducing the incidence and risks of prolonged flooding due to impeded water flow.
- (e) Minimizing additional pollution loads into receiving surface waters.
- (f) Strengthening public-private-community partnerships by incorporating them into LGU programs and local policies.

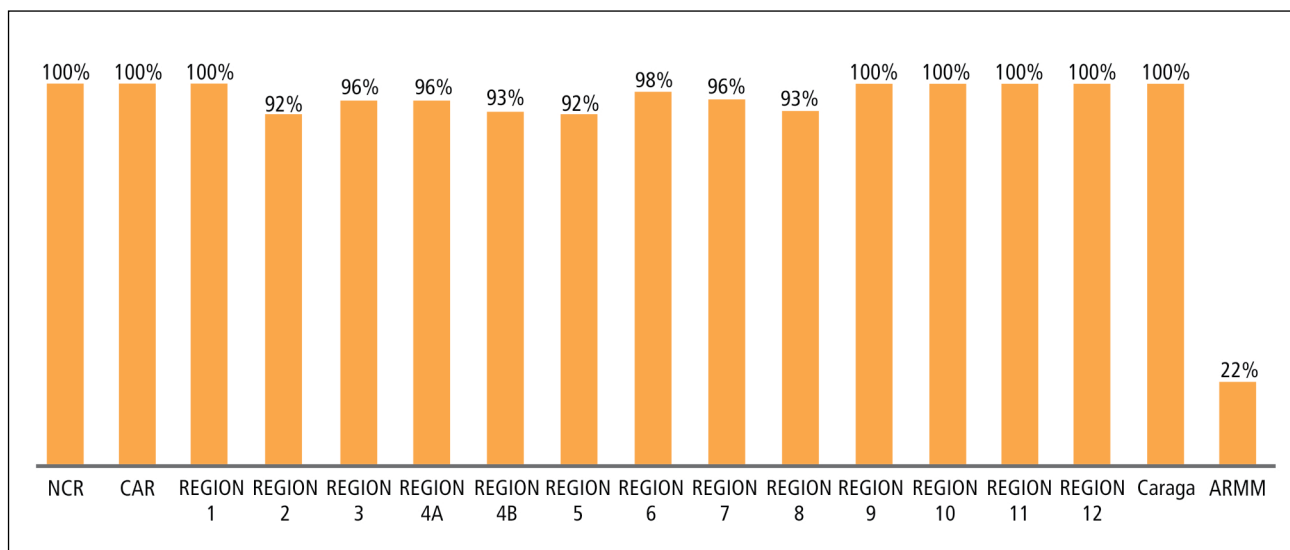
## 17.2.2 Solid Waste Management

The *Philippine National Solid Waste Management Strategy, 2012-2016* was created to implement feasible waste management programs in government agencies, private institutions and the general public. Programs like the *Waste Analysis and Characterization Study* identify the volume, percentage in weight or its volumetric equivalent, material type, and source of generation, which includes residential, commercial, industrial, governmental, or other sources. The Waste Analysis and Characterization Study is used as a tool for informed decision-making for proper waste segregation, collection, management and control in the country.

### a. 10-year Solid Waste Management Plan

In compliance with Section 16 of RA 9003, all local government units were required to formulate a 10-year Solid Waste Management Plan that should be consistent with the objectives stated by the Philippine National Solid Waste Management Framework. The plan shall revolve around the efficient management of solid waste through re-using, recycling and composting of wastes generated within their jurisdictions. The construction of material recovery facilities and the management of disposal sites are one of the key activities under the SWMP. As of December 2017, there were 1,526 *10-Year Solid Waste Management Plans* submitted by different Local Government Units, with 362 approved plans while 582 plans have conditional approvals. Overall, eight of the seventeen regions have 100% compliance as of 2017 (**Figure 17.3**). A key challenge is the implementation of these 10-Year SWM Plans and monitoring their effectiveness.

**Figure 17.3:** Percentage of compliance of LGUS for the development of a 10-year Solid Management Plan.



Source: NSWMC, 2018.

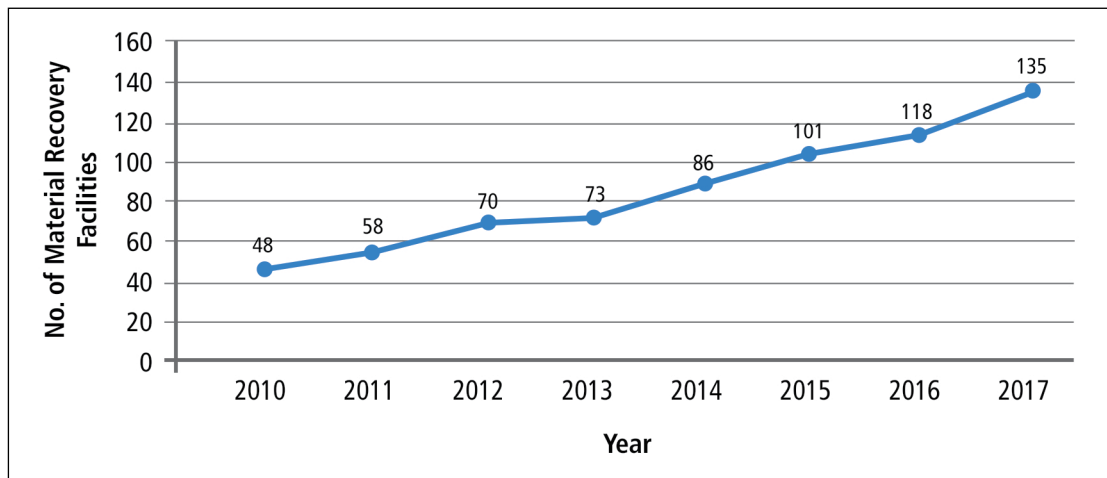


## b. Material Recovery Facilities (MRF)

The Solid Waste Management Plan requires all barangays to allocate a parcel of their land for a Material Recovery Facility (MRF). The MRF collects mixed waste for sorting, segregation, recycling and composting. Recyclables are sold to junk shops and recycling companies. The residual waste is then transferred to a disposal facility or a sanitary landfill for long-term disposal. As of December 2017, 10,052 material recovery facilities have been established in different barangays, servicing 13,324 barangays all across the country. This is 24 percent of the total number of barangay units in the Philippines.



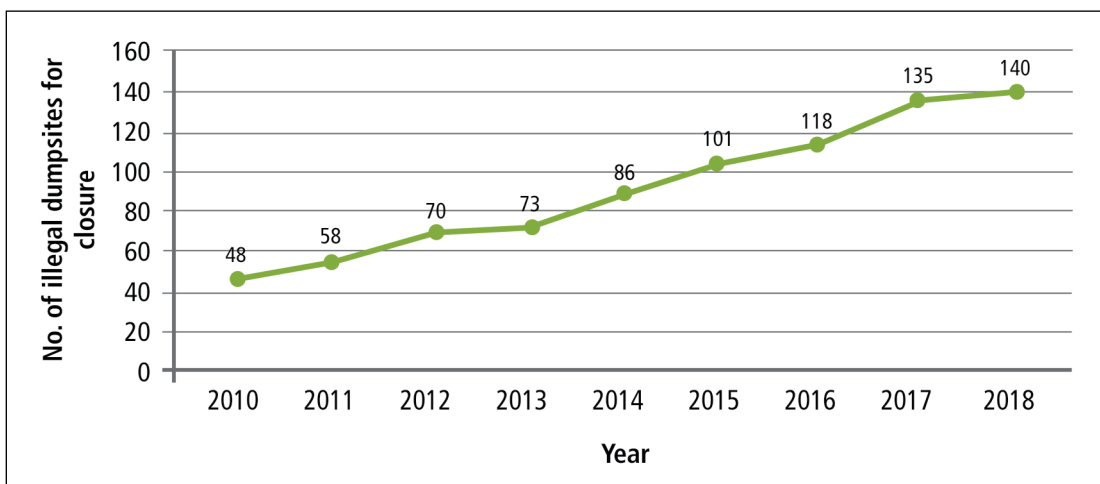
**Figure 17.4:** Numbers of Established Material Recovery Facilities from 2010-2017.



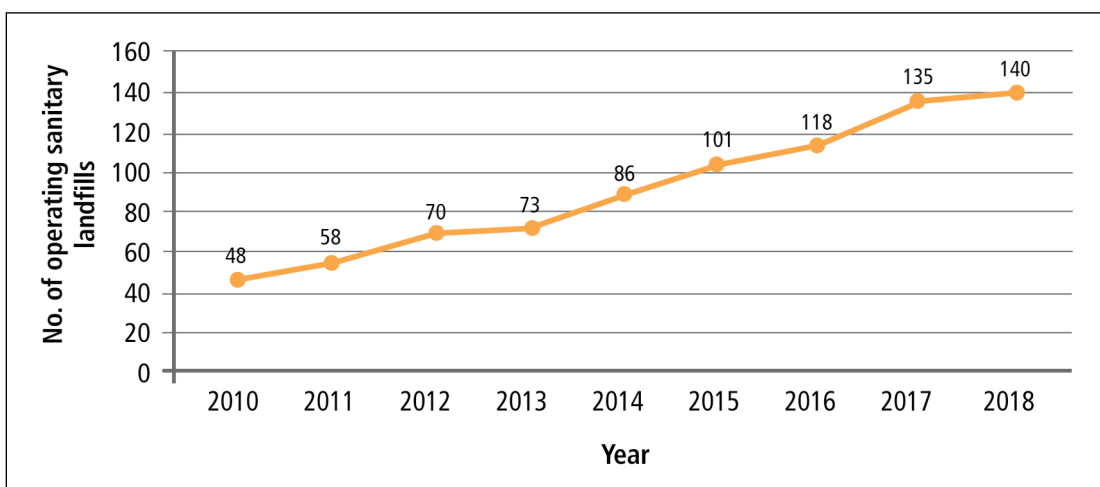
Source: NSWMC, 2018.

## c. Management of Residual Facilities and Disposal Sites

The rehabilitation of existing disposal facilities and closure of open dumpsites is also part of the solid waste management program. Existing disposal sites and landfills are subject to *Modified Guidelines on Site Identification Criteria and Suitability Assessment Procedure for Sanitary Landfills* to ensure sustainability and applicability of the existing sites and that disaster risk reduction and other safety nets have been integrated into the establishment and management of these sites. Illegal dumpsites or landfills that have not met the criteria are to be closed. As of 2017, 6,878 illegal dumpsites have been closed. As of 2018, there are 140 operating sanitary landfills, accessed by 308 local government units, which is only 18.84 percent of the total number of LGUs in the country.

**Figure 17.5:** Illegal Dumpsites that have been Closed from 2010-2018.

Source: NSWMC, 2018.

**Figure 17.6:** Number of Operating Sanitary Landfills from 2010-2018.

Source: NSWMC, 2018.

### 17.2.3 Wastewater and Septage Management

To address the wastewater problem in Metro Manila, a sewerage and sanitation system is being managed by the Metropolitan Waterworks and Sewerage System (MWSS), and its two concessionaires. This provides sewerage services to all customers discharging domestic waste and pre-treated industrial effluents in compliance with all national and local environmental laws and standards related to wastewater treatment. Their services include sewage treatment plants, septage treatment plants, combined drainage systems and desludging trucks. As of March 2018, a total of 55 sewage treatment plants, 3 septage treatment plants, 3 sewage and septage treatment plants (combined), and 132 desludging trucks are serving the MWSS Area. The sewerage systems (separate and combined) cover a total area of 6,461,92 ha, servicing an estimated 2,452,602 individuals. Overall, the concessionaires have offered its sanitation services to 2,983,740 people from 2017-2018. There were 592,640 septic tanks that have been desludged from 2003 to 2017. Sludge is transported to the septage treatment

plants. Treated sludge is used as soil conditioner. Sewer coverage increased from 8 percent in 1997 to 15 percent in 2017, while water supply coverage increased from 69 percent in 1997 to 93 percent in 2017. Future projects by the MWSS are listed in **Annex B**.

**Table 17.2:** Wastewater Operations by the Metropolitan Waterworks and Sewerage System (MWSS) as of March 2018.

Wastewater Operations as of March 2018	Manila Water	Maynilad	Total Service Area
No. of Sewage Treatment Plants (STP)	38	17	55
Total Capacity of Sewage Treatment Plants (MLD)	309.54	540	849.54
Number of Septage Treatment Plants (SpTP)	2	1	3
Total Capacity of Septage Treatment Plants (CMD)	1,400	1,190	2,590
Number of Sewage and Septage Treatment Plants	1	2	3
Sewer Network (km)	360.5	527	887.5
Separate Sewer Coverage (population)	532,113	800,500	1,332,613
Combined Drainage-Sewerage System Area (ha.)	4,075.92	2,386	6,461.92
Combined Drainage System Coverage (population)	434,989	685,000	1,119,989
Sewerage Services (Separate and Combined) - Total Population Covered	967,103	1,485,500	2,452,602
Number of Desludging Trucks	66	66	132
Offered Sanitation Services - Total Population Covered	1,738,140 (2017-2018)	1,245,600 (2017-2018)	2,983,740. (2017-2018)
Volume Desludged (cubic meters)	79,459 (Jan-Mar 2018)	36,497 (Jan-Mar 2018)	115,956. (Jan-Mar 2018)

Source: MWSS.

There are LGUs with wastewater or septage management systems, e.g., Baliwag and San Jose Del Monte in Bulacan; Dumaguete, Manjuyod, Bayawan in Negros Oriental; San Fernando City, La Union; Zamboanga City (sewerage extension under construction).

The *National Sewerage and Septage Management Program* (NSSMP) provides subsidy (up to 50% of project cost) from the national government to highly urbanized cities and first class municipalities to provide sewerage and septage services and minimize the impacts of wastewater discharge to water bodies and the environment. However, there are only a few local governments that have applied for the subsidy. The issues are: lack of political will; lack of ordinances for the collection of user fees and allocation of land for the wastewater or septage treatment plant; conflict between the LGUs and Water Districts; high cost of sewerage system; lack of capacity to develop pre-feasibility/feasibility studies.

#### 17.2.4 Adopt-a-River/Adopt-an-Estero Program

Initiated by DENR in 2010, this program aims to mobilize the private sector and involve communities in river clean up activities to improve the water quality of waterways reaching Manila Bay. As of 2015, 346

waterways have been 'adopted' and cleared of solid waste. However, more efforts and investments in sanitation and wastewater management facilities are needed to prevent discharge of untreated wastewater to these water bodies to be able to meet the water quality standards.

## 17.3 Disaster Risk Reduction and Management

As an affirmative step to implement the Hyogo Framework for Action, the Philippine Government has undertaken a program of hazard and risk analysis capacity building to support formulation and adoption of disaster risk reduction and management plans as well as risk reduction and response capabilities. The **Philippine Disaster Reduction and Management Act (RA 10121)** provides a comprehensive, all-hazard, multi-sectoral, inter-agency, and community-based approach to disaster risk management. The Act shifted the policy environment and the way the country deals with disasters from mere response to preparedness.

### a. Hazard maps and risk analysis

Government agencies have allocated more resources to creating hazard maps that can help triangulate areas that are most vulnerable to climate change and therefore, properly allocate resources to areas that need it the most. Volcanic and earthquake-related maps, rain-induced landslides, flooding and storm surge maps have been created by PHIVOLCS, PAGASA and NAMRIA (*See maps in Section 15.2 of this report*).

### b. Disaster Risk Reduction and Management (DRRM) Plans

DRRM Plans (from national to local levels) highlight, among others, the importance of mainstreaming DRRM and climate change adaptation (CCA) in the development processes, such as policy formulation, socioeconomic development, land-use planning, and budgeting, particularly in the area of environment, agriculture, water, energy, public infrastructure, housing, etc. The DRRM plans adhere to the principles of good governance within the context of poverty alleviation and environmental protection.

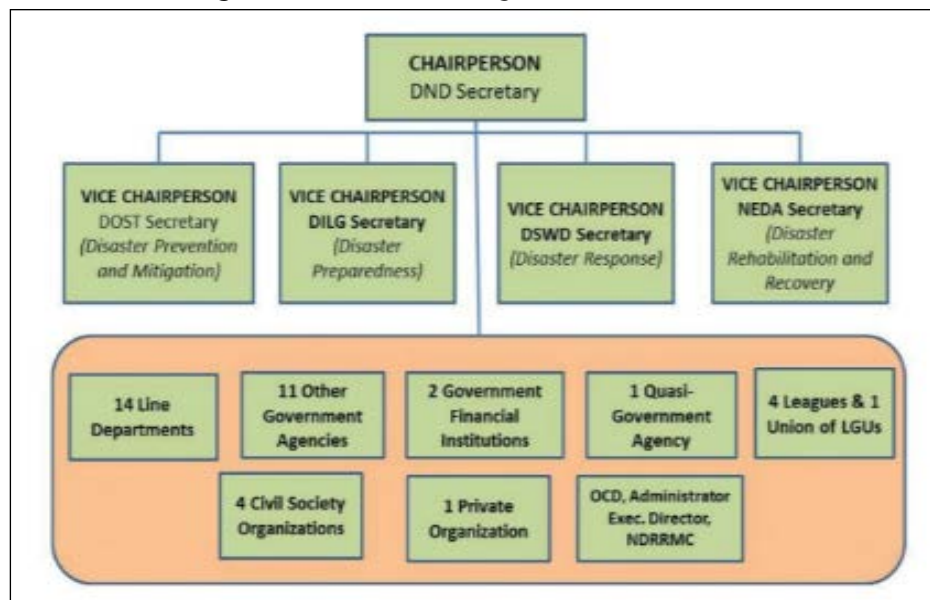
**National DRRM Plan.** The *National Disaster Risk Reduction and Management Plan (NDRRMP), 2011-2028*, serves as the national guide on how sustainable development can be achieved through inclusive growth while building the adaptive capacities of communities; increasing the resilience of vulnerable sectors; and optimizing disaster mitigation opportunities. It outlines the activities aimed at strengthening the capacity of the national government and local government units (LGUs) together with partner stakeholders, to build the disaster resilience of communities and to institutionalize arrangements and measures for reducing disaster risks, including projected climate risks and enhancing disaster preparedness and response capabilities at all levels. It upholds partnerships and engaging the participation of civil society, the private sector and volunteers in the government's DRRM programs to promote complementation of resources and more effective delivery of services.

**Local DRRM Plans.** LGUs have the mandate to be the front-liners in preparing and responding to natural disasters in local communities, and are required to formulate their respective Local DRRM Plan. Since they are the most knowledgeable about their own locality—its terrain, resources, and its people—they are best positioned to lead the people in mitigating risks and responding when an event occurs. The LDRRM Plan guides an LGU on actions to take before, during, and after a natural or man-made hazard or disaster.

### c. Institutional arrangements

**Figure 17.7** shows the organizational structure of the National Disaster Risk Reduction and Management Council (NDRRMC). The NDRRMC is headed by the Secretary of the Department of National Defense (DND) as Chairperson. The Secretary of the Department of Science and Technology (DOST) is Vice Chairperson for Disaster Prevention and Mitigation. The Secretary of the Department of the Interior and Local Government (DILG) is Vice Chairperson for Disaster Preparedness. The Secretary of the Department of Social Welfare and Development (DSWD) is Vice Chairperson for Disaster Response, and the Director-General of the National Economic and Development Authority (NEDA) is Vice-Chairperson for Disaster Rehabilitation and Recovery.

**Figure 17.7:** NDRRMC Organizational Structure.



Source: OCD, DND.

The Act - **RA 10121** – mandates the establishment of a **Disaster Risk Reduction and Management Office** (DRRMO) in every province, city and municipality, and a **Barangay Disaster Risk Reduction and Management Committee** (BDRRMC) in every barangay.

The *Strategic National Action Plan on Disaster Risk Reduction for 2009-2019* aims to enhance the capacities of Local Disaster Risk Reduction and Management Councils.

#### d. Disaster Fund

RA 10121 also provides for the **calamity fund** to be used in support of disaster risk reduction or mitigation, prevention, and preparedness activities for the potential occurrence of disasters and not just for response, relief, and rehabilitation efforts.

**National Disaster Funds.** The budget for NDRRM Fund is appropriated under the annual GAA. It is specifically used for disaster risk reduction, mitigation, prevention, and preparedness activities. It is also utilized for relief, recovery, rehabilitation, reconstruction and other works or services in connection with natural or human-induced calamities.

**Local Disaster Funds.** RA No. 10121 mandated local governments to set aside 5 percent of their estimated revenue from regular sources for the **LDRRM Fund** to support DRRM activities, such as preparedness programmes, including training and purchase of rescue equipment, and for response activities. The LDRRM Fund can also be explicitly used for the payment of premiums on calamity insurance. Of the 5 percent lump sum allocation, 30 percent is automatically allocated as **Quick Response Fund** (QRF), which serves as a stand-by fund for relief and recovery programs. The rest of the 70 percent can be used for pre-disaster measures.

#### e. Early warning systems

- **Deployment of Early Warning System (DEWS Project)**

This project is for implementation in all principal river basins. As of 2017, hydrographic surveys have been done in all regions except in Regions IV-A, IV B and VI. Site validation and Assessment of Hydromet Stations have been conducted in all regions. Information, Education and Communication Campaign (IEC) and Flood Drills have also been done.

- **Flood Forecasting and Warning System (FFWS)**

FFWS Centers have been established in 13 regions in the country. **Figure 17.8** shows the FFWS facilities that have been installed in the Province of Camarines Sur in Region V.

Flood markers have been installed in key flood-prone areas in the country. Examples of flood markers, and automatic weather station are shown in **Figures 17.9 and 17.10**.

- **Automation of Flood Early Warning System for Disaster Mitigation in Metro Manila**

The project aims to improve responsiveness to natural disasters and mitigate damages to residents in Tullahan and Pasig-Marikina river basins. The Pasig-Marikina-Tullahan River Basin Flood Forecasting and Warning Center was established in Quezon City. It is a command



- **Tsunami Early Warning System (TEWS Project)**

The Establishment of a Cost-Effective Local Tsunami Early Warning System for Selected High-risk Coastal Communities of the Philippines, also known as TEWS, is a program aimed at establishing a local tsunami warning system for high risk communities along the coast.

The detection system is made out of 3 different sensor types: (1) dry sensor, (2) wet sensor and (3) the ultrasonic sea level sensor (**Figure 17.11**). Any significant rise or fall of the sea level is detected by the sensors in the advent where strong shaking is recorded. Five community pilot sites were initially chosen for the program, namely Lingayen Gulf, Albay Gulf, Subic Bay, Manila Bay and Batangas Bay.

**Figure 17.11:** The Tsunami Early Warning System (TEWS) made Out of the Dry, Wet and Ultrasonic Sensors.



Source: PHIVOLCS, 2013.

### Major issues and challenges<sup>23</sup>

Among the common problems and issues encountered by various organizations are the following:

- weak coordination and collaboration among various stakeholders – national government agencies, LGUs, civil society organizations, volunteers and the private sector
- lack of capacity of line agencies and LGUs to perform DRRM functions
- weak implementation of laws and policies

<sup>23</sup> Source: Senate Economic Planning Office. 2017. *Policy Brief: Examining the Philippines' Disaster Risk Reduction and Management System*.



- post-disaster focus of disaster funds
- slow disbursement of disaster funds
- monitoring of disaster fund expenditures

## 17.4 Climate Change Mitigation and Adaptation

### 17.3.1 Analysis of Risks, Vulnerability and Adaptive Capacity

The starting point for reducing disaster risk and for promoting a culture of disaster resilience lies in the knowledge of: (a) the hazards, (b) the physical, social, economic and environmental vulnerabilities to disasters, (c) ways in which hazards and vulnerabilities are changing in the short and long term, (d) potential impacts, and (d) capacities. This should be followed by plans and actions taken on the basis of that knowledge.

**Figure 15.18** shows an example of a hazard map that highlights coastal areas that are most vulnerable to a 1-meter increase in sea level rise. Such information is integrated into sectoral and local government development plans to help create the necessary disaster risk reduction and management measures as well as mitigation and adaptation measures that can minimize the effects of climate change.

### 17.3.2 Climate Change Action Plan

#### a. National Climate Change Action Plan

The implementation of the *Climate Change Act of 2009* is being supported by the *2010 National Framework Strategy on Climate Change* (NFSCC) and the *2011 National Climate Change Action Plan* (NCCAP). The *NCCAP 2011 to 2028* outlines the roadmap for adaptation and mitigation, and focuses on seven strategic priorities: food security, water sufficiency, ecological and environmental stability, human security, climate-friendly industries and services, sustainable energy and knowledge and capacity development.

**Table 17.3:** Example of Indicators in the NCCAP's Food Security Strategic Theme.

Immediate outcome 1: Enhanced resilience of agriculture and fisheries production and distribution systems from climate change.	
Output area	Examples of indicators
1.1 Enhanced knowledge on the vulnerability of agriculture and fisheries to the impacts of climate change	Provincial level agriculture and fishery sector vulnerability and risk assessment conducted nationwide.
1.2 Climate-sensitive agriculture and fisheries policies, plans and programmes formulated.	Climate change responsive agriculture and fisheries policies, plans and budgets developed and implemented.
Immediate outcome 2: Enhanced resilience of agriculture and fishing communities from climate change.	
2.1 Enhanced capacity for CCA and DRR of government, farming and fishing communities and industry.	Number of farmers and fisherfold communities trained on adaptation, best practices and DRR.

Source: *Climate Change Commission*.

## b. Local Climate Change Action Plan

Section 14 of RA 9279 - *Climate Change Act of 2009* – recognizes that LGUs are at the frontline for climate change action requiring them to formulate and implement *Local Climate Change Action Plan (LCCAP)* for their respective areas consistent with the national, regional and provincial frameworks on climate change.

### 17.3.3 People's Survival Fund

Amending the Climate Change Act, **Republic Act no. 10174** established the **People's Survival Fund** in 2012 to provide long-term financing to projects to address the problem of climate change. The People's Survival Fund (PSF) is an annual budgetary allocation intended for LGUs and Community Organizations to implement climate change adaptation projects to help improve the ability of local communities to deal with the impacts of climate change. Its PhP1-billion appropriation will be coming from the GAA and is supplementary to any annual appropriations allocated by LGUs for disaster risk reduction and climate change adaptation.

The law also created the **People's Survival Fund Board** to deliberate projects and groups applying for funding assistance. The board consists of the finance secretary, Vice Chairpersons of the CCC, budget secretary (DBM), director-general of National Economic and Development Authority (NEDA), interior secretary (DILG), Philippine Commission on Women chairperson, and representatives from the academe, scientific community, business and nongovernmental organizations.

Recognizing the close interrelation of DRR and CCA activities, RA No. 10174 mandated the integration of disaster risk reduction activities into climate change programs and initiatives. Projects and the climate-proofed development plans, e.g., *the enhanced climate change adaptation and disaster risk reduction Comprehensive Land Use Plans (CLUPs)* or *Local Climate Change Action Plans (LCCAPs)*, need to be aligned with the National Climate Change Action Plan (NCCAP) for approval. **Table 17.4** shows PSF-approved projects implemented by various local government units in the country.

### 17.3.4 Retrofitting and Climate-proofing

The Department of Public Works and Highways (DPWH) aims to rehabilitate and retrofit existing structures that are identified as highly vulnerable to flooding, earthquakes and other climate-change related calamities. It also aims to provide safety access to highly vulnerable areas, improve national roads vulnerable to flooding, landslides and slope failures, build evacuation structures



**Table 17.4:** Climate Change Adaption Projects Funded under the People’s Survival Fund.

Project Title	Project Site	Budget	Objectives
<b>Siargao Climate Field School for Farmers and Fisherfolk</b>	Del Carmen, Surigao del Norte	PhP 80 Million	<ul style="list-style-type: none"> <li>• Capacitate fisher folk, farm owners and helpers to become climate-smart.</li> <li>• Establish sustainable end-to-end institutional system for the generation and application of locally-tailored climate information tools and build the capacity to apply this</li> </ul>
<b>Disaster Risk Reduction and Management (Ridge to Reef) as an Application Mechanism to Resiliency</b>	Lanuza, Surigao del Sur	PhP 40 Million	<ul style="list-style-type: none"> <li>• Management, rehabilitation and protection of watersheds</li> <li>• Protection, rehabilitation and propagation of mangrove ecosystem along the riverine</li> <li>• Enrichment of forest cover</li> <li>• Provision of alternative livelihood and market enrichment</li> </ul>
<b>Establishment and Sustainable Management of River Ecosystem in Kitcharao, Agusan del Norte</b>	Kitcharao, Agusan del Norte	PhP 28.7 Million	<ul style="list-style-type: none"> <li>• Establish a Watershed Management Office and conduct resource management capacity building activities.</li> <li>• Promote and provide sustainable and resilient support livelihood programs</li> <li>• Construct settlement protection along riverbanks</li> </ul>
<b>Saub Watershed Rehabilitation and Flood Risk Reduction for Increased Resilience</b>	Province of Sarangani	PhP 104 Million	<ul style="list-style-type: none"> <li>• Formulate the Saub Water Management Plan and establish a Watershed Management Office</li> <li>• Build capacities of the LGU, development partners and other stakeholders and beneficiaries</li> <li>• Develop agroforestry, through deep rooted fruit trees in the uplands and establish demo farms</li> </ul>
<b>Promoting Resiliency and Climate-Informed Gerona</b>	Gerona, Tarlac	PhP 38 million	<ul style="list-style-type: none"> <li>• Construct riverbank protection through the improvement of the communal irrigation system to regulate floodwater and avoid river siltation</li> <li>• Increase access of communities to climate information and warning services</li> <li>• Enhance preparedness against climate-related hazards (floods; droughts)</li> <li>• Improve Gerona’s water resources</li> </ul>

Source: Climate Change Commission, 2017.

prescribed by NDRRMC, upgrade quality standards of infrastructures to make them more climate resilient and deploy equipment and manpower in the event of calamities. **Table 17.5** shows the current retrofitting and rehabilitation projects by the DPWH on existing bridges and a tide embankment in Tanauan, Leyte, all of which have been identified as highly vulnerable to the effects of climate change.

**Table 17.5:** Retrofitting Projects by DPWH on Existing Bridges and Tide Embankments.

<p><b>Quezon Bridge</b></p> 	<ul style="list-style-type: none"> <li>• Constructed in 1939, it connects the Manila districts of Quiapo and Ermita across the Pasig River</li> <li>• Retrofitting works were done to ensure the structural stability of the bridge, making it more resistant to earthquake.</li> <li>• Its physical appearance was not altered consistent with the policy of National Commission for Culture and the Arts for structures that are 50 years old and above.</li> <li>• Major scope of work underneath the steel bridge involved sand blasting, and replacement of fire damaged structural components, among others.</li> <li>• After completion, the limit of the traffic load of the bridge was increased from 10 tons per vehicle to 20 tons per vehicle.</li> <li>• It will also ensure the safety of 115,000 motorists per day.</li> </ul> <p>Project Cost: PhP 77.83 Million            Schedule: March 2016 – February 2017            Status: Completed</p>
<p><b>Metro Manila Priority Bridges Seismic Improvement Project (Guadalupe Bridge and Lambingan Bridge) - JICA Assisted</b></p> 	<ul style="list-style-type: none"> <li>• Replacement of: 1.) outer bridges and substructure including foundation of inner bridge of Guadalupe Bridge; 2) Lambingan Bridge with vertical geometry improvement of both sides approach road.</li> <li>• The seismic improvement of both bridges will enable quicker recovery of socio-economic activities after a large-scale earthquake. It will also ensure the safety of about 365,000 motorists who use the Guadalupe Bridge and about 30,257 motorists that pass by Lambingan Bridge everyday.</li> </ul> <p>Project Cost: PhP 4.29 Billion (JICA- PhP 3.79 B; GOP- PhP 0.50 B)            Schedule: June 2019 – December 2021            Status: Perfection of Contract for Consulting Services of Detailed Engineering and Tender Assistance is under process.</p>
<p><b>Leyte Tide Embankment</b></p> 	<ul style="list-style-type: none"> <li>• 27.3 km tide embankment from Brgy. Diit, Tacloban City to Brgy. Ambao, Tanauan, Leyte.</li> <li>• To protect coastal communities from the destructive effects of storm surges.</li> <li>• 33,185 houses / buildings and 33.7 km<sup>2</sup> area will be protected.</li> </ul> <p>Project Cost: PhP 7.9 Billion            Schedule: 2016-2022            Status: Ongoing</p>

Source: DPWH.

### 17.3.5 Creation of Livable, Sustainable and Resilient Communities

This DPWH program is divided into: (1) Integrated Water Resources Management (IWRM) Program, (2) Disaster Risk Reduction and and Climate Change Adaptation Program, (3) Infrastructure Support for Marginalized Sectors, and (4) the creation of environment-friendly communities.

### a. Integrated Water Resource Management Program

The *Integrated Water Resource Management program* has identified two measures for implementation, namely the structural measures and the non-structural measures. The structural program aims to construct or rehabilitate flood mitigation structures along the major river basins and principal rivers, construct water impounding projects to optimize use of water resources, construct water supply / seepage and sewerage / rain collectors, and improve drainage capacity to lessen the probability of floods or lessen the damages brought about by such calamities. A total of 18 major river basins, 1,164 principal river basins and other dangerous river basins have been identified and prioritized by the program (**Table 17.6**).

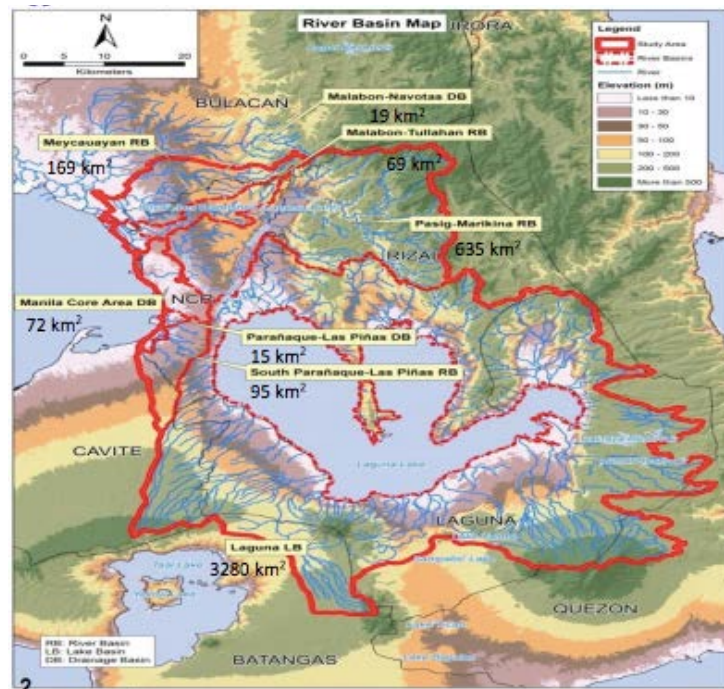
**Table 17.6:** The Drainage Area Size of Major River Basins, Principal River Basins, and Other River Basins Covered by the Integrated Water Resource Management Program.

<b>Major river basins (MRBs)</b>	Drainage area of more than 1,400 km <sup>2</sup> (18 MRBs)
<b>Principal River Basins (PRBs)</b>	Drainage area of more than 40 km <sup>2</sup> , but less than 1,400 km <sup>2</sup> (421 PRBs)
<b>Other/dangerous river basins</b>	Drainage area of less than 40 km <sup>2</sup> in flood-prone areas delineated, 1,164 river basins including 421 PRBs

Source: DPWH.

### b. Disaster Risk Reduction and Climate Change Adaptation Program

A *Flood Management Master Plan* has been created for flood-prone cites and urbanized areas. **Figure 17.12** is an example of a flood risk assessment study created for Metro Manila and its surrounding areas, undertaken from February 2011 to February 2012. The aim of which was to create a flood risk management plan and determine priority structural measures for sustainable flood management in the studied areas.



**Figure 17.12:** Flood risk assessment map for Metro Manila and its surrounding provinces.

Source: DPWH, 2017.

Eleven identified structural projects were proposed to be implemented from 2012-2035 (**Table 17.7**) to address the risks identified by the aforementioned flood risk assessment map. The estimated cost for the structural mitigation measures proposed for this project was PhP 531.718 billion. In addition, around PhP 42,179 billion worth of flood mitigation and intervention projects have been allocated to address the flooding problems in the country's capital.

**Table 17.7:** Eleven Recommended Structural Mitigation Projects Under the Flood Management Master Plan in Metro Manila and Its Surrounding Areas.

Name of Project	Estimated Cost (PhP B)
1. Pasig-Marikina River Improvement and Dam Construction	198.435 B
2. Meycauayan River Improvement	14.040 B
3. Malabon-Tullahan River Improvement	21.635 B
4. South Parañaque-Las Piñas River Improvement	17.335 B
5. East Manggahan Floodway (Cainta and Taytay River Improvement)	25.901 B
6. West Laguna Lakeshore Land Raising	25.185 B
7. Land Raising for Small Cities around Laguna Lakeshore	7.158 B
8. Improvement of the Inflow Rivers to Laguna Lake	0.637 B
9. Manila Core Area Drainage Improvement	27.257 B
10. West Manggahan Area Drainage Improvement	5.522 B
11. Valenzuela-Obando-Meycauayan (VOM) Improvement (to be studied Further)	8.613 B
<b>TOTAL</b>	<b>PhP 351.718 B</b>

Source: DPWH, 2017.

Meanwhile, PhP 28.84 billion-worth of infrastructure projects have been allocated for various areas outside of Metro Manila (**Table 17.8**).

**Table 17.8:** Major Flood Control Projects Nationwide.




Flood Risk Management Project for Cagayan, Tagoloan and Imus Rivers, FRIMP-CTI - JICA Assisted	
	<p><b>Cagayan River</b></p> <ul style="list-style-type: none"> <li>• Revetment structures for the most eroded river banks located at Brgy. Alibago and Catagaman, Tuguegarao City to address serious bank erosion resulting to loss of valuable lands in the targeted areas to Tuguegarao City and parts of Cagayan province.</li> </ul>
	<p><b>Tagoloan River</b></p> <ul style="list-style-type: none"> <li>• Construction of river dikes and partial excavation of river channel together with drainage channel improvement.</li> </ul>
	<p><b>Imus River</b></p> <ul style="list-style-type: none"> <li>• Construction of two (2) off-site retarding basins along Imus River and Bacoor River located in Brgy. Buhay na Tubig and Brgy. Anabu.</li> </ul>
	<p>Project Cost: PhP 6.18 B (JICA- PhP 4.40 B; GOP- PhP 1.78 B)            Schedule: April 2016 – August 2019            Status: 3 contract packages ongoing, 20.30% (as of June 25,2017)</p>

Table 17.8: Major Flood Control Projects Nationwide. (cont.)

<p><b>Flood Risk Management Project (FRIMP) in Cagayan de Oro River - JICA Assisted</b></p> 	<ul style="list-style-type: none"> <li>• Earth dike: 11,928 meters (left and right bank);</li> <li>• Concrete Flood Wall: 3,259 meters (left and right bank) including 1,449 meters reinforced concrete/masonry slope protection;</li> <li>• Gates and Drainage Outlets: 3 steel slide gates; 19 flap gates; 3 reinforced concrete box culverts; 18 reinforced pope culverts; and 1 reinforced concrete headwall;</li> <li>• Retarding basins: preserved 97 hectares of natural retarding basin; developed 13 hectares of natural retarding basin;</li> <li>• New Road and Raising of Existing Road for Evacuation: 2, 756 m;</li> <li>• Improved Kagayan Bridge</li> <li>• It will reduce the number of affected people due to flooding from 280,740 (TS Sendong) in 2011, to 31,873 people, based on a 25-year flood return period. It will also protect a 290 ha area and 18,100 structures after full completion.</li> </ul> <p>Project Cost: PhP 8.55 Billion (JICA- PhP 5.01 B; GOP- PhP 3.54 B)  Schedule: April 2018 – April 2022  Status: Consulting Services for Detailed Design is 45.67% complete (as of May 25, 2017)</p>
<p><b>Integrated Disaster Risk Reduction and Climate Change Adaptation Measures in the Low Lying Areas of Pampanga Bay - KEDCF Assisted</b></p> 	<ul style="list-style-type: none"> <li>• Excavating and dredging of 30.30km. – Third River and Eastern River Branch</li> <li>• Improving the flow of 23.0 km – Caduang Tete River and Sapang Maragul River</li> <li>• Repair of Eight (8) sluice gates</li> <li>• Will reduce flood depth from 1.4-2.9 m to 0.6-1.4 m;</li> <li>• Will shorten flood duration from 66 days to 17 days.</li> </ul> <p>Project Cost: PhP 4.22 Billion (KEDCF- PhP 3.27 B; GOP- PhP 0.95 B)  Schedule: August 2017 – August 2020  Status: Detailed Design and Construction Supervision ongoing, 27.60% (as of June 25, 2017)</p>
<p><b>Cavite Industrial Area Flood Management Project</b></p>	<ul style="list-style-type: none"> <li>• To mitigate the flood damages caused by overflow of San Juan and the poor drainage system of the Maalimango Creek by construction of San Juan River diversion channel of about 2.5 km, widening/ improvement of tributary rivers Yiang-Yiang River of 2.8 km length and Rio Grande River of 4.2 km length, construction of bridges crossing San Juan Diversion Channel, improvement of existing Maalimango Creek and construction of Maalimango diversion channel.</li> <li>• About 7,000 houses in the area of 556 hectares will be protected from flooding.</li> </ul> <p>Project Cost: PhP 9.89 Billion (JICA- PhP 7.10 B; GOP- PhP 2.79 B)  Schedule: 2018-2022  Status: JICA loan is targeted to be approved in November 2017.</p>

Source: DPWH.

Adaptation and mitigation strategies are area- and context-specific to be relatively effective. In the fisheries sector, the Philippines has barely started plotting priority actions to mitigate the probable negative impacts of the changing climate aside from some reactive responses emanated from the recently cases of flooding and landslides in the coastal areas brought about by typhoons. There

is a need to be anticipatory rather than reactive. Flores and Ingles (2009) published a set of proposed adaptation strategies for the fisheries and aquaculture sector:

1. Develop a national plan that integrates CC mitigation/adaptation strategies for fisheries and aquaculture, coastal and marine environments and biodiversity into the economic and social development processes and policy frameworks. Addressing potential complexities of CC changes and responses at different scales of impact would require a highly efficient coordination between and among the various sectors within the governance framework. It is essential therefore that CC and considerations be part of the normal processes of development and engaging people and various stakeholders at all levels.
2. Build capacity for human resources and institutions involved in fisheries and ecosystem in order for them to appropriately adapt and respond to CC impacts. Implement novel ways of training and engaging people at all levels to prepare for environmental / fisheries disaster mitigation, rescue and rehabilitation.
3. Strengthen research capabilities and develop a highly focused research agenda in order to better understand the nuances and impacts of climate change in fisheries and aquaculture at different scales of impact in order to guide policy in developing appropriate and cost effective adaptive measures. The future impacts of CC change on fisheries and aquaculture are poorly understood.
4. Learn and adapt lessons and practices from other areas which contribute to information of impacts of CC. WWF for instance has a program called "climate change witness" that encourage everyone to report anomalies, abnormalities they experience. Fishers for instance report unusual appearance of fish species in their locality, or the disappearance of an organism or a bleaching event. Such information is relayed to scientist who could examine closer these "incidents".
5. Heightened information and knowledge sharing to inform the people and policy makers about CC and its socio-economic ramifications.
6. Enhance cooperation in implementation of mitigation and adaptation measures. There is a need to engage the support of the private sector (businesses) as partners in CC mitigation and adaptation schemes; learn and identify and invest in business opportunities arising from climate changes.
7. Create a pool of multi-sectoral experts with representation of fisheries and aquaculture, to advise governments and businesses to work on minimizing negative impacts and maximizing opportunities. This would include cost/benefit analysis of wide range of creative adaptation strategies for both public and private sectors.
8. Strengthen existing regional structures and processes with special focus on CC change given the transboundary and straddling nature of some of our fisheries resources. Policy and legal mechanisms at the regional level needs to be developed, enhanced or harmonized given that the country is signatory to many of the global, regional and sub-regional treaty organizations.
9. Strengthen our regional and trading mechanisms in order to buffer supply variability and protect fisheries sector investments. This is highly important because the Philippines is a net exporter of seafood products.
10. Improve utilization of marine and fisheries products, through creation of products and markets with value added, reducing losses arising from poor handling, and improving the preservation and post-harvest systems to increase fisher's income and reduce overfishing.



The UN Food and Agriculture Organization (FAO) also published its own potential adaptation measures for the Philippines' capture fisheries industry (**Table 17.9**) and aquaculture industry (**Table 17.10**) based on possible scenarios that can occur in the advent of climate change.

**Table 17.9:** Specific Adaptation Measures for the Philippines' Capture Fisheries (adopted and modified based on FAO, 2008).

Impacts of Climate Change on Fisheries	Potential Adaptation Measures
High vulnerability of all fish stocks of the country	Improve management of all fisheries stocks, utilizing the evaluation on the country's performance on the compliance of the Code of Conduct for Responsible Fisheries
High degree of uncertainty in estimates of fish stocks	Develop and implement a research agenda for fisheries over the short, medium and long term to fill in science gaps needed for policy decision support
Shortage of capacity to manage all the fisheries stocks	Develop informal and formal training courses on management, ICM, stock assessment and research
Lack of capacity on new fields of science and technology spawned by needs to mitigate and adapt to climate change	Develop new curriculum and new specializations in science and technology to be incorporated in the formal training courses.
Reduced availability (yield).	Reduce fishing effort Diversify livelihood to include non-aqua base options Improve post-harvest practices to increase the value of product, reduce losses
Changed in the distribution range of the exploited stocks	Development of appropriate fishing effort strategy, and appropriate processing and distribution facilities For tuna fisheries and highly migratory and transboundary stocks, undertake cost / benefit analysis of expansion of fishing access and land-based facilities to other countries Undertake exploratory surveys to look for new fisheries and undertake cost –benefit analysis.
Reduced profitability	Exit the fishery Reduce fishing effort Undertake life cycle analysis of fishery to improve efficiency in order to cut operating costs and maximize profits
Vulnerability of infrastructures and communities due to flooding, sea level increase, etc.	Rehabilitate infrastructure to incorporate design for disaster mitigation or relocate the community to safer areas Set up early warning systems Integrated coastal management (ICM) paying attention to mapping low and high risk zones depending on CC scenario.
Increased dangers to fishing	Set up weather warning system accessible to fishers Improve vessel stability/safety/communications Mandatory training of fishers on safety of life at sea (SOLAS) Rehabilitate coastal fisheries

Source: <http://www.fao.org>.

**Table 17.10:** Specific Adaptation Measures for the Philippines' Aquaculture. (Adopted from FAO, 2008)

Climatic changes element	Impacts on aquaculture	Adaptive Measures
<b>Warming</b>	Raise above optimal range of tolerance of farmed species	Use better feeds, more care in handling, selective breeding and genetic improvements for higher temperature tolerance (and other related conditions).
	Increase in eutrophication; mortality of farmed stock.	Improve planning and siting to conform to Climate Change predictions; establish regular monitoring and emergency procedures.
	Increase virulence of dormant pathogens and expansion of new diseases	Focus management to reduce stress; set up bio-security measures; monitor to reduce health risks; improve treatments, management strategies; make genetic improvements for higher resistance
	Limitations on fish meal and fish oil supplies/ price	Identify fish meal and fish oil replacement; develop new forms of feed management, make genetic improvement for alternative feeds; shift to non-carnivorous species; culture bivalves and seaweeds wherever possible.
<b>Sea level rise and other circulation changes.</b>	Intrusion of salt water	Shift to steno-haline species; introduce marine or euryhaline species.
	Loss of agricultural land	Provide alternative livelihoods through aquaculture, building capacity and infrastructure.
	Reduced catches from coastal fisheries, seedstock disruptions, reduced options for aquaculture feeds; income loss to fishers	Make greater use of hatchery seeds; protect nursery habitats; develop/use formulated pellet feeds (higher cost but less environmentally degrading); develop alternative livelihoods for suppliers.
	Increase of harmful algal blooms (HABs)	Improve monitoring and early warning systems; change water abstraction points where feasible.
	Prevalence of parasites	Develop monitoring and culture techniques , research on possible cure
<b>Water stress and drought conditions</b>	Limitations for freshwater extraction	Improve efficacy of water usage; encourage non-consumptive water use in aquaculture, e.g. culture based fisheries; encourage development of mariculture where possible.
	Change in water-retention period (inland systems reduced, coastal lagoons increased).	Use different/faster growing fish species; increase efficacy of water sharing with primary users, e.g. irrigation of rice paddy; change species in lagoons.
	Reduced availability and period change of wild seed stocks.	Shift to artificially propagated seed (extra cost); improve seed quality and production efficiency; close the life cycle of more farmed species.
<b>Extreme weather events</b>	Destruction of facilities; loss of stock; loss of business; mass scale escape with the potential impact to biodiversity	Encourage uptake of individual/cluster insurance; improve siting and design to minimize damage, loss and mass escapes; encourage use of indigenous species to minimize impacts on biodiversity; use non-reproducing stock in farming systems.

Source: <http://www.fao.org>.

# PART 6

## CONCLUSION AND RECOMMENDATIONS

# 18 Conclusion and Recommendations

## 18.1 Harnessing the Oceans: Benefits, Pressures, and Blue Economy

### 18.1.1 Ocean Economy

The blue economy paradigm is focused on the economic perspective of the ocean economy and the natural capital assets of oceans, harnessing the oceans for economic growth and livelihoods while meeting the goals of sustainable development, and healthy oceans and people.

The entire ocean economy consists of: (a) the economic activities with dependence on the ocean and coastal and marine resources (ocean industry), and (b) natural assets, goods and services of marine ecosystems upon which these industries depend on, and people rely on for food, income, livelihood, recreation, shoreline protection, etc. (See **Figure 4.1**)

The total gross value added (GVA) of ocean industry is estimated to be **US\$11.9 billion** in 2016. The average percentage contribution of the ocean economy to GDP is around seven (7%) percent from 2012-2016. The sectors with the highest contribution are:

- Coastal and marine tourism: 25%
- Fisheries and aquaculture: 20%
- Manufacturing (fish and seafood processing, ship-building and repair; marine transport equipment): 19%
- Ports and shipping: 12%

Around 2.2 million people are employed in the ocean industries in 2016. This is around 5.2% of the total employment. There are also around 400,000 Filipino seafarers deployed overseas. Remittances of sea-based overseas Filipinos are around US\$5.6 billion in 2016 – a considerable contribution to the country's GNI.

Supporting the ocean-based and ocean-related industries is the ocean environment and coastal and marine ecosystems. They also provide services that are not usually quantified and captured in the national income accounts, such as *regulating services* (e.g., carbon storage, shoreline protection, waste assimilation, nutrient cycling), *supporting services* (e.g., habitat, nursery), and *cultural services*.

According to Azanza, et al. (2017):

- Based on primary and available secondary data, the marine ecosystems (mangroves, seagrass, and coral reefs) can contribute around **US\$966.6 Billion** (excluding the continental shelf) to the economy.
- The estimated total annual net benefits amount to **US\$ 6.35 Billion**, with a sizable share accounted for by benefits from coral reefs.

There is still a need to review the assumptions and methodologies used in estimating the values of the coastal and marine ecosystem services. The regulating services (e.g., shoreline protection, erosion prevention, waste assimilation, and carbon sequestration) depend on the quality, condition and functional integrity of the ecosystems, so the estimated values may have to be adjusted. As studies have shown, only four percent (4%) or less of the coral reefs are in excellent condition. The estimated provisioning service value – in terms of fisheries, for example – is also higher than the fisheries production in the GDP accounts.

### 18.1.2 Fisheries and aquaculture

Fisheries in the Philippines can be generally categorized into large scale and small-scale fisheries. The large scale, commercial subsector targets mainly small and large pelagic fishes. The small scale, municipal subsector, which comprises the millions of artisanal fishers along the coastal areas, targets mostly the demersal types, including reef-associated species. Although the commercial subsector is fewer in number compared to the municipal subsector, their annual catches are almost similar (Muallil et al., 2015), and this highlights the issue on equity. Currently, aquaculture has significantly contributed to total fisheries production in the country.

**Pressures and challenges.** The Philippines has been considered as one of the major players in the global fisheries industry. However, capture fisheries production has shown a declining trend in recent years. This has implications on the sustainability of the fisheries industry, food security, and poverty alleviation of the fisherfolk.

These are the major issues that need to be addressed: depleted fishery resources; degraded habitats; pollution; intense resource use competition and conflicts among different users of the coasts and seas; unrealized full potential of aquaculture and commercial fisheries; post-harvest losses; and limited institutional capacity and governance.

#### **Response measures.**

- Amended Fisheries Code (RA 10654), includes measures to address addressing IUU fishing
- From 2011 to the present, fisheries management shifted its focus from increasing production, which has led to overexploited resources, to protection and conservation through the adoption of the Ecosystems Approach to Fisheries Management (EAFM).

### Transforming towards blue economy

- Sustainable sourcing and processing: One initiative is the partnership of the government with private seafood producers and processors for the conservation of blue crabs and swordfish.
- Another conservation effort is focused on sardines and small pelagics, with the regulations on closed fishing season in certain areas of the country. A 30 percent increase in fish catch has been reported three years after the implementation of these regulations.
- One tool that can be used to address IUU fishing and support sustainable tuna fisheries is the *Electronic Catch Documentation and Traceability System (eCDTS)*, which uses modern technologies, and allows networking of national information systems and provides interface that will allow system users to input traceability data throughout the supply chain.
- The vessel monitoring, control and surveillance system using new technologies are required to be installed in fishing vessels to ensure compliance with the fisheries regulations.
- The *Philippine National Aquasilviculture Program (PNAP)* implemented by the Bureau of Fisheries and Aquatic Resources (BFAR), together with the Commission on Higher Education (CHED) is a program focused primarily on mangrove resource rehabilitation and livelihood provision to help address climate change, food security and poverty among municipal/artisanal coastal fisherfolks. Its goal and objectives are (1) replanting of destroyed mangrove resources; (2) establishment of community-based multi-species hatcheries (CBMSH), and (3) provision of aquasilviculture livelihood projects to fisherfolk beneficiaries throughout the country. The ecosystems services of mangroves, such as habitat for diverse marine species, nutrient cycling and waste assimilation, are benefiting the aquaculture farms, and in addition, provide shoreline protection and carbon sequestration services. The multi-species farms will diversify and increase the income of fisher-beneficiaries.

### 18.1.3 Coastal and Marine Tourism

Ecosystems services value of the beaches and coral reefs, both direct and indirect, form a large part of total socio-economic benefits derived from international and domestic tourism, particularly among territories that are archipelagic or endowed with natural island-beaches like the Philippines. Most of these tourists go to the country's beaches, which are its prime tourism assets. There is a noted increase in arrivals of foreign tourists in leading coastal tourism areas, e.g., Panay Island (Boracay), Palawan (El Nido, Coron and Puerto Princesa), Bohol, and Cebu. The DOT also identified key national parks and heritage sites in coastal and marine areas for sustainable tourism (e.g., Batanes, Hundred Islands National Park in Pangasinan, Vigan in Ilocos Sur, Tubbataha Reef in the Sulu Sea, Siargao Island Protected Landscape and Seascape in Surigao del Norte, etc.).

**Pressures and challenges.** Visitor arrivals, revenues, and employment generated by coastal and marine tourism have increased dramatically, and this requires careful management to ensure the protection of the coastal and marine habitats, resources and water quality as well as the sustainable development of coastal communities.

While marine and coastal tourism emerges as a promising source of income, it is nevertheless associated with a multitude of challenges. The principal issues in marine and coastal tourism revolve around slow infrastructure development, inconsistent tourism products that fail to meet the expectations of the public, coastal erosion, and negative environmental impacts caused by unplanned development, inadequate solid waste and wastewater management systems, volume of tourists exceeding carrying capacity, boats/ships anchoring that damage habitats, etc.

### Transforming to blue economy

- *Zero Carbon Resort (ZCR) For Sustainable Tourism Program* of the Department of Tourism, with support from a German non-profit organization, GRAT. During the initial phase of the ZCR from 2009 to 2014, over 500 tourism establishments joined the program, and were given capability workshops on the following topics: energy, water, and resource management; 3R (Reduce, Replace, Redesign). The impacts of this project are particularly significant as shown by the annual savings incurred by participating tourism establishments, and their reduced water and carbon footprints. In 2017, the accumulated annual savings of 247 sampled companies amounted to **USD 8,636,208.76**, with a reduction in energy of 38 MWh, reduction of 714,427,966.30 liters of water, and avoided 23,348,538.52 kg of carbon emissions.
- There are some hotels and resorts with wastewater treatment plants. Treated wastewater is used for watering the gardens and flushing toilets.
- The *Green Fins* initiative aims to protect and conserve coral reefs through environmentally friendly guidelines that promote a sustainable diving and snorkelling industry. By reducing the local direct and indirect pressures tourism puts on coral reefs, it helps make corals healthier and more resilient to other stressors, like the effects of climate change.
- *Ecotourism in protected areas*: Some of the examples are: Palau Island Protected Landscape and Seascape in Cagayan Province; Siargao Island Protected Landscape and Seascape in Surigao del Norte; Batanes province; Apo Reef National Park in Occidental Mindoro; Tubbataha Reef in Palawan; etc.

### 18.1.4 Ports and Shipping

Oceans provide navigational lanes and facilitate trade. Interisland water transport is a very important subsector of the national transport system. There are about 1,300 ports, of which about 1,000 are government-owned, and the rest are privately-owned and operated. Of the government ports, almost 140 fall under the jurisdiction of Philippine Ports Authority (PPA) and the Cebu Ports Authority (CPA). The rest are the responsibility of other government agencies or local government units (LGUs).

For the year 2017, the highest number of cargoes handled/loaded and discharged at the port happened at the PMO of Manila/Northern Luzon since the bulk of cargoes are being loaded and unloaded at the Port of Manila. Container traffic is mostly concentrated at the Port of Manila as well. However, the highest number of passengers embarked and disembarked was recorded in the PMO of Visayas since the Visayas region is composed of several islands that are being inter-linked by water transport network.

**Pressures and challenges.** International and local laws require ports and maritime safety authorities and many national regulatory bodies to monitor any natural and human activity in a port which can harm or damage the nearby bodies of water and marine environment. Port activities can cause deterioration of air and marine water quality in the surrounding areas due to multifarious activities like loading and unloading of cargoes, bunkering activities, and the like. Operational and accidental oil spills, introduced alien and invasive species through the ballast water, wastewater and solid waste from ports and ships, and habitat destruction from port construction/expansion are among the key challenges.

### Transforming to blue economy

- *Green ports:* Ports of Batangas and Cagayan de Oro received the Green Port award from APEC Port Services Network (APSN). Both ports incurred savings from efficient energy and fuel use, and reduced GHG emissions.
- Shore-based power supply has been installed in the Port of Cagayan de Oro, and the port provides power to ships using renewable energy.
- Shore reception facilities have been put in place in all base ports and private ports under PPA.
- The Batangas and Cagayan de Oro ports are Certified to ISO 9001:2008 and recognized for its implementation of the **Port Safety, Health and Environmental Management System (PSHEMS)**. The two ports are now migrating to the **Integrated Management System (IMS)** fusing the three international standards, namely: (a) ISO 9001:2015 for Quality Management System, (b) ISO 14001:2015 for Environmental Management System, and (c) BS OHSAS 18001:2007 for Occupational Safety and Health (PPA 2018). PPA also worked on the certification of the Ports of Zamboanga and Ozamiz, for the IMS. After the third-party audit undertaken in December 2017, both ports passed the requirements of the standards, and were recommended for certification. The ports of Iloilo and General Santos are also implementing PSHEMS.

### 18.1.5 Fish Ports

In addition to seaports which serve as major hubs for international and domestic/inter-island cargo and passenger vessels, there are also fish ports, either municipal or regional, which primarily serve the fishing industry. Sometimes referred to as landing centers, these fish ports provide the facilities for the main collection and distribution of fish.

**Pressures and challenges.** The following problems that beleaguer the fish ports system: (a) underutilization of regional fish ports; (b) depletion of marine resources (fish stock); low catch of commercial fisheries; (c) inadequate number of municipal fish ports; (d) need for more post-harvest facilities; and (e) poor environmental management practices in municipal ports.

**Response measures.** Through three core programs, namely: (1) Regional Fish Ports Program; (2) Municipal Fish Ports Program; (3) Ice Plants and Cold Storages Program, the PFDA continuously responds to the need of the sector for post-harvest facilities and services. It was also pointed out



that more actions are needed for the upgrading of the fish ports and enhancement of fish port operations to increase efficiency, and ensure that fishery products can meet standards for quality and responsible harvesting. Moving forward, the fish ports should serve as an agro-industrial zone for unloading, processing, storage and marketing of fish, as well as for maintaining and servicing the fishing fleet.

### 18.1.6 Ship-building and Repair

The arrival of foreign shipbuilders in the Philippines propelled the export growth of Philippine-made ships in the international market. After being recognized as the 4th largest shipbuilder in the world in terms of Vessel Completion in Gross Tonnage (GT) in 2015 by the Shipbuilders Association of Japan, shipyards established in the Philippines are now building more ships of larger tonnage capacities like bulk carriers, container ships and passenger ferries.

**Pressures and challenges.** The country still has a long way to go in order to become at par with the first three shipbuilding nations of the world. It is important to upgrade the existing shipyard facilities in order to meet safety, environmental protection, and quality standards that are globally accepted in shipbuilding.

#### Transforming to blue economy

- Besides shipbuilding and ship repair, the development of *ship recycling* yards/facilities is an investment opportunity in the country considering the older age of the existing ships and entry of newer modern ships. **Maritime hubs** are also planned and promoted for investments.
- With the emergence of the so-called **eco-ship**, the ship-building industry is now considering the design of ships that are much more efficient than that of the existing ships. Eco-ships are designed and constructed primarily to be economically efficient, and to reduce greenhouse gas emissions.

### 18.1.7 Offshore Oil and Gas

Aggregate domestic oil production, including condensate, was 621.8 kTOE in 2017, while its contribution total indigenous energy supply stood at 2.1 percent share. Natural gas production stood at 3.2 MTOE, equivalent to an 11 percent share to overall indigenous supply in 2017. As of June 2018, the country produced 54,680,776 BBLs of oil from Nido, Matinloc, North Matinloc and Galoc, and 1,938,305.87 MMSCF of natural gas from Malampaya.

**Pressures and challenges.** Although the DoE's Roadmap shows a lot of potential in discovering and developing additional oil and gas fields, such exploration and production must be aligned with climate goals. Moreover, the sector is not without a threat of the possibilities of oil spill.

**Response measures.** The government has passed the Renewable Energy Act to reduce the dependence on fossil fuel. All offshore operations have their own Emergency Response Plan and Oil Spill Contingency Plan ready to be activated in case of oil spill. All offshore installations have their oil spill equipment and kit ready to be deployed in case of minor oil spill.

### 18.1.8 Emerging blue economy industries

- **Marine renewable energy**

Ocean energy in the country can come from various sources: wave, currents, tides and thermal. Harvesting ocean energy in the country is still in its infant stages however, potential sites have already been identified where possible wave, current, tidal and thermal energy can be harnessed. The potential capacity for ocean thermal energy is established to be 265 million MW. Applied research and development (R & D) and site identification are being undertaken to determine the viability of adapting certain RE systems, technologies or processes in the Philippines.

Coastal wind power is an emerging industry as more sites are building and operating wind farms. The Philippines is the largest wind power generator in ASEAN. Some of the most recent developments are the Bangui Wind Farm, Burgos Wind Farm, and Caparispisan Wind Farm in Ilocos Norte, the Wind Energy Power System in Oriental Mindoro, San Lorenzo Wind Farm in Guimaras, Nabas Wind Farm in Aklan, and Pililla Wind Farm in Rizal. Most of these are located in coastal municipalities, and have become tourist attraction.

- **Marine biotechnology**

The *Philippine Marine Drug Discovery and Resources Facility* was created to extract bioactive compounds specifically from sea snails (*conoidea*) and sponges and sponge-associated organisms with the aim of producing potential high-value pharmaceutical products. The challenge is to move from R&D to commercialization of these new medicines, and making them available and affordable.

## 18.2 Ocean Health: Status, Pressures, and Governance

A healthy ocean sustainably delivers a range of benefits to current and future generations. The geological, oceanographic and climate attributes of the country have, without doubt, provided home and habitat to a myriad of species teeming at the local biosphere. The influence of these attributes is more specifically illustrated in the more expansive ocean waters, which surround the archipelagic islands.

**Ocean health index.** In 2017, the overall OHI score of the Philippines is 71. The country is ranked 83 out of 221 EEZs ([www.oceanhealthindex.org/region-scores/scores/philippines](http://www.oceanhealthindex.org/region-scores/scores/philippines)).

**Marine water quality.** The *Guidelines for Recreational Waters* (Memorandum Circular 2016-006) state that all recreational waters shall be monitored using the primary parameters, fecal coliform and pH. In 2017, fecal coliform data from 351 monitoring stations all around the country showed that only 39% of the monitored water bodies passed the DENR-EMB standards for fecal coliform tests based on the Class SB water quality parameters.

As of 2017, 158 water bodies were monitored for dissolved oxygen (DO), and 140 water bodies for biological oxygen demand (BOD). Eleven (11) rivers were added to the list since 2016. Of the 158 water bodies monitored for DO, 131 rivers or 82.9% passed the standards under their respective classifications while 106 out of the 140 rivers or 75.7% passed the standards for BOD.

**Coastal and marine ecosystems.** The Philippines has a total 797,719 ha of coral reef area, 489,006 ha of seaweeds/seagrass beds and 303,373 ha of mangrove forests as of 2017 (DENR-NAMRIA, 2017). The Philippines is located at the apex of the Coral Triangle, a tropical area in the planet known as the center of biodiversity where marine biodiversity is highest (Sanciangco et al., 2013).

- **Coral reefs.** The country is reported to have at least 500 species of corals which include the hard and stony type that primarily make up the platform of coral reefs (ADB, 2014). Coral reefs are one of the most productive systems in the world's biosphere due to the tight coupling of corals and microscopic zooxanthellae where nutrients are efficiently utilized by these symbiotic algae through photosynthesis. Due to the structural complexity that these reefs provide to organisms, the associated fish and invertebrate species diversity of coral reefs in the Philippines is also one of the highest in the world (Roberts et al. 2002, Nañola et al. 2010). This biodiversity is the main source of ecosystem goods and services that the archipelagic country is highly reliant on. This comes in the form of food and livelihood through fisheries, tourism-based industries, pharmaceutical drugs, wave buffering and shoreline protection services, etc. (e.g. Cruz-Trinidad et al., 2011).
- **Mangroves.** The country is one of the richest in mangrove species, with 42 mangrove species representing 18 families (Spalding et al., 2010, Polidoro et al., 2010). Mangrove forests serve as habitat to crustaceans, mollusks, and fish, some of which are commercially important, and serve as feeding grounds for wild birds. Mangrove areas are utilized for aquaculture and salt production, and are important sources of forest products (e.g., timber) and fishery products (Jacinto et al., 2000). Coastal communities also benefit from shoreline protection given by mangroves.
- **Seagrass beds.** The Philippines has a total of 16 seagrass species (Fortes, 2012). Seagrasses have been used as important components of many industrial products (e.g. as packing material, children's toys, compost for fertilizer, animal feed, etc.). However, the major importance of seagrass beds lies in its ecological functions and support to fisheries and, to a certain extent, tourism, and livelihood of coastal populations. Seagrass beds provide habitat for juvenile and small adult fishes (e.g., rabbitfish), invertebrates, reptiles (turtles) and mammals (Dugong). They also serve as buffer against waves and storm surges by maintaining sediment stability, hence,

protecting the neighboring mangrove ecosystem and coral reefs. In addition, the high organic matter production of seagrass beds serve as nutrient source for these associated ecosystems. High carbon sequestration rate has been noted for seagrass ecosystem, contributing to climate change mitigation.

**Pressures and challenges.** Goods and services derived from the marine biodiversity at nearshore and oceanic waters in the country are at high risk due to a growing number of environmental and physical stressors. According to the *Philippine Biodiversity Strategy and Action Plan, 2015-2028*, the top five pressures that trigger biodiversity loss in the Philippines are invasive alien species, habitat loss, climate change, pollution and overexploitation. Habitat destruction and degradation are the most prevalent in the country. Loss of seagrass beds, diminishing coral cover and decreasing numbers of fish are the direct results of habitat destruction. The intensive utilization of mangroves has resulted in the decline of their cover. Illegal, unreported and unregulated (IUU) fishing has also resulted in dwindling fish abundance in the country. Studies show that the loss of biodiversity has cost the Philippines millions of pesos considering the economic value of the resources that have been lost due to mismanagement and non-protection.

Recently, the issue on climate change has been highlighted as many studies have reported its exacerbating effects on the current pressures that our reefs are experiencing today. Fisheries and tourism will be mostly affected by loss of coral reefs. This has very serious implications on the government's goal for sustainable development, food security and employment (ADB, 2012; Mamauag et al., 2013).

The coastal and marine ecosystems play a significant role in ensuring climate resiliency. Mangroves, seagrass and coral reefs provide shoreline protection against storm surge, flooding and erosion. Moreover, these habitats also sequester and store carbon at rates higher than tropical rainforest, thereby contributing to climate change mitigation.

Based on a study by the Asia Development Bank, the Philippines is estimated to lose 6% of its GDP, every year until 2100 if it disregards the risks associated with climate change. However, if the country starts investing on climate change mitigation and adaptation measures by 2020, it is estimated that it can reduce the losses by up to 4% of GDP by 2100 (Climate Change Executive Brief, 2018).

## **Response strategies and actions**

### **• Habitat restoration and protection**

In the *Philippine Biodiversity Strategic Action Plan for 2015-2028*, one of the direct program interventions identified is the restoration of ecosystem functions. A 2-way approach has been used namely (1) passive restoration - which is the establishment of marine sanctuaries and no-take zones and (2) active restoration, which can be done through coral transplantation and mangrove and seagrass rehabilitation efforts.

- **Marine protected areas.** Economic and environmental benefits of MPAs include reconstituting ecosystem services, stabilization of fish population, more sustainable catch level, tourism, reducing risks from natural hazards, and providing carbon sink. Local governments also established fish

sanctuaries. As of 2018, the MPAs, both nationally and locally managed, comprise around 8.09 percent of the country's territorial waters excluding PRMRR area.

- The **coral restoration program** focuses on both sexual (the use of coral egg and sperm in the formation of coral propagules) and asexual methods (the fragmentation method) stressing on the importance of public-private-academe partnership in the implementation of the restoration effort. Coral gardening on the other hand, was used in the reef restoration of 10 areas devastated by Typhoon Yolanda. Molecular genetics and the identification of susceptible and resilient species to the rise in sea surface temperature and eutrophication have also been done.
- The **National Greening Program (NGP)** is one of the pioneering programs by the government on mangrove restoration. Through the NGP, 76,514 ha of mangrove areas have been restored, with 199,367,952 seedlings planted all throughout the country in 2011-2016 (FMB, 2017).

- **Pollution reduction and waste management**

- **Solid waste management.** The *Philippine National Solid Waste Management Strategy, 2012-2016* was created to implement feasible waste management programs in government agencies, private institutions and the general public. In compliance with Section 16 of RA 9003 (*Ecological Solid Waste Management Act of 2000*), all local government units were required to formulate a 10-year Solid Waste Management Plan that should be consistent with the objectives stated by the Philippine National Solid Waste Management Framework.

The *Solid Waste Management Plan* requires all barangay to allocate a parcel of their land for a Material Recovery Facility (MRF), and LGUs to identify appropriate site for the sanitary landfill. As of 2017, 6,878 illegal dumpsites have been closed. As of 2018, only 24% of barangays have MRFs, and the 140 operating sanitary landfills are accessed by 308 local government units, which is only 18.84% of the total number of LGUs in the country.

- **Wastewater management.** The *Philippine Clean Water Act of 2004* (RA 9275) declares that the State shall pursue a policy of economic growth in a manner that is consistent with the protection, preservation and revival of the quality of our fresh, brackish and marine waters.

As of January 2018, thirty-four (34) Water Quality Management Areas (WQMA) have been designated in selected river basins and water resources regions. The objectives and activities inside the WQMAs include: (1) cleaning esteros and water bodies, (2) institutionalize good solid waste and wastewater management practices, (3) reduce waterborne diseases among children and vulnerable groups, (4) reduce the incidence and risks of prolonged flooding due to impeded water flow, (5) minimize pollution loads into receiving surface waters, and (6) strengthen public-private-community partnerships by incorporating them into LGU programs and local policies.

To address the wastewater problem in Metro Manila, a sewerage and sanitation system was implemented through the Metropolitan Waterworks and Sewerage System and its two

concessionaires. Their services include sewage treatment plants, septage treatment plants, combined sewer-drainage systems, and desludging trucks. As of March 2018, a total of 55 sewage treatment plants, 3 septage treatment plants, 3 sewage and septage treatment plants (combined), and 132 desludging trucks are serving the Metro Manila Area. The sewerage system (separate and combined) covers a total area of 6,461,92 km<sup>2</sup>, servicing an estimated 2,452,602 individuals. In addition, sanitation services (desludging of septic tanks) have been delivered to 2,983,740 people from 2017-2018.

There are also a few LGUs with wastewater or septage management systems, e.g., Baliwag and San Jose Del Monte in Bulacan; Dumaguete, Manjuyod, Bayawan in Negros Oriental; San Fernando City, La Union; Zamboanga City (sewerage extension under construction). Most of the LGUs do not have adequate wastewater and septage management systems in place.

- **Protecting communities from natural disasters and climate change**

- The Philippine Government has undertaken a program of hazard and risk analysis capacity building to support formulation and adoption of disaster risk reduction and management plans as well as risk reduction and response capabilities. The *Philippine Disaster Reduction and Management Act* (RA 10121) provides a comprehensive, all-hazard, multi-sectoral, inter-agency, and community-based approach to disaster risk management. The Act shifted the policy environment and the way the country deals with disasters from mere response to preparedness. *DRRM Plans* (from national to local levels) highlight, among others, the importance of mainstreaming DRRM and climate change adaptation (CCA) in the development processes, such as policy formulation, socioeconomic development and land-use *planning*, and budgeting, particularly in the area of environment, agriculture, water, energy, public infrastructure, housing, etc. The DRRM plans adhere to the principles of good governance within the context of poverty alleviation and environmental protection. The Government has also adopted the Climate Change Act. There are National Climate Change Adaptation Plan, and Local Climate Change Action Plans being implemented in varying degrees.
- The **People's Survival Fund** (PSF) is an annual budgetary allocation intended for LGUs and Community Organizations to implement climate change adaptation projects to help improve the ability of local communities to deal with the impacts of climate change. Projects and the climate-proofed development plans, e.g., *the enhanced climate change adaptation and disaster risk reduction Comprehensive Land Use Plans* (CLUPs) or *Local Climate Change Action Plans* (LCCAPs), need to be aligned with the *National Climate Change Action Plan* (NCCAP) for approval.
- The Department of Public Works and Highways (DPWH) is implementing a program on creating **Livable, Sustainable and Resilient Communities**. This program is comprised of: (1) Integrated Water Resource Management Program, (2) Disaster Risk Reduction and Climate Change Adaptation Program, (3) Infrastructure Support for Marginalized Sectors and (4) the creation of environment-friendly communities. A *Flood Management Master Plan* has been created for flood-prone cities and urbanized areas. The DPWH is also rehabilitating and retrofitting existing structures, which are identified as highly vulnerable to flooding, earthquakes and other climate-change related calamities.

**Table 18.1:** The Philippines's Ocean Economy and Ocean Health: Status, Issues and Response.

Indicator	Status / Trend INCREASING (↑) / DECREASING (↓) / NO CHANGE (–)	Major Issues and Challenges	Response	
			(a) key policies/ laws; (b) national action plan	Best practice or blue economy initiative
<b>State of ocean economy</b>				
Ocean economy	–	<ul style="list-style-type: none"> <li>Lack of awareness, hence oceans not a priority of the government</li> </ul>		<ul style="list-style-type: none"> <li>Blue economy initiative (NEDA)</li> <li>Preliminary ocean accounting by PSA</li> </ul>
Employment in ocean economy	↑			
Ecosystem services	–	<ul style="list-style-type: none"> <li>Lack of robust studies</li> </ul>	<ul style="list-style-type: none"> <li>Restoration and protection of mangroves and coral reefs</li> <li>National and locally managed MPAs</li> <li>Nature-based disaster and climate resiliency</li> </ul>	<ul style="list-style-type: none"> <li>Environment and natural resource accounting</li> <li>Wealth Accounting and Valuation of Ecosystem Services (WAVES) project</li> <li>Valuation of shoreline protection services of mangroves</li> <li>Valuation of benefits from restoring and protecting mangroves, seagrass and coral reefs to ensure their shoreline protection and climate resiliency services</li> <li>Blue carbon initiative</li> </ul>
Fisheries and aquaculture	Fisheries: ↓ Aquaculture: ↑	<ul style="list-style-type: none"> <li>Habitat Loss</li> <li>Destructive Fishing</li> <li>Climate Change (coral bleaching, changes in fish ecology)</li> <li>Pollution</li> </ul>	<ul style="list-style-type: none"> <li>RA 10654 amended Fisheries Code 8550 addressing IUU fishing;</li> <li>Convention on Migratory Species (Tuna, sharks, turtles, dugongs etc.)</li> <li>DA Joint Administrative Order (JAO) regarding the conservation and regulation of Blue Swimming Crab</li> </ul>	<ul style="list-style-type: none"> <li>Web-based fisherfolk registration system</li> <li>Vessel Monitoring, Control and Surveillance System</li> <li>Electronic Catch Documentation and Traceability System</li> <li>Close Seasons for Sardines and other small pelagics in key areas</li> <li>R&amp;D, conservation and management plans for blue crabs and swordfish</li> <li>Fish Sanctuaries and No-take zones in MPAs</li> <li>Habitat restoration (mangrove planting; artificial reef)</li> <li>Fish Ports and Community Fish Landing Centers with post-harvest facilities</li> <li>Mangroves and aquasilviculture/ polyculture</li> <li>Agri-tourism</li> </ul>
Tourism	↑	<ul style="list-style-type: none"> <li>Pollution</li> <li>Inadequate waste water management facilities</li> <li>Lack of setback zoning ordinance</li> <li>Lack of coastal land use planning</li> </ul>	<ul style="list-style-type: none"> <li>RA 9593 – Tourism Act of 2009</li> <li>RA 10816 – Farm Tourism Development Act of 2016.</li> <li>National Ecotourism Strategy 2013-2022</li> <li>National Tourism Development Plan, 2011-2016, 2016-2022</li> </ul>	<ul style="list-style-type: none"> <li>Sustainable ecotourism</li> <li>Zero Carbon Resorts</li> <li>Marine Heritage Sites and Parks</li> <li>Hotels and resorts with wastewater treatment and reuse</li> </ul>

Table 18.1: The Philippines's Ocean Economy and Ocean Health: Status, Issues and Response. (cont.)

Indicator	Status / Trend	Major Issues and Challenges	Response	
	INCREASING (↑) / DECREASING (↓) / NO CHANGE (–)		(a) key policies/ laws; (b) national action plan	Best practice or blue economy initiative
<b>Ports and shipping</b>	↑	<ul style="list-style-type: none"> <li>Sea level rise affecting ports</li> <li>Non-compliance of some service providers for the shore reception facilities</li> <li>Lack of enabling laws for the implementation of MARPOL provisions and other international conventions</li> </ul>	<ul style="list-style-type: none"> <li>MARPOL; Basel Convention; SOLAS; International Maritime Dangerous Goods Code; International Maritime Solid Bulk Cargoes Code; Ballast Water Management Convention (for Ratification)</li> <li>Anti Fouling System; Clean Water Act; Ecological Solid Waste Management Act; Toxic and Hazardous Wastes Acts; Port Safety, Health and Environmental Management System (PSHEMS);</li> <li>Wildlife Act of the Philippines</li> <li>Port Safety, Health and Environmental Management System (PSHEMS); Integrated Management System</li> </ul>	<ul style="list-style-type: none"> <li>Shore Reception Facilities</li> <li>Green Port Initiatives (use of solar panels, LED lighting in port offices, low sulfur fuel)</li> <li>Shore-based power supply for ships (Cagayan de Oro, use of renewable energy)</li> <li>Earth-balling program of PPA (old trees,)</li> <li>Mangrove planting initiative,</li> <li>Ambient Air and Water Quality Monitoring Systems</li> <li>Automatic Identification System (AIS)</li> <li>Vessel Traffic Management System (VTMS)</li> <li>On-going: Draft Port Environmental Policy</li> <li>“Orange Book” Updating and Review of Safety, Health and Environmental Management in Ports</li> </ul>
<b>Offshore oil and gas</b>	↑	<ul style="list-style-type: none"> <li>Offshore quarrying</li> </ul>	<ul style="list-style-type: none"> <li>R.A. 7942 Mining Act of 1995 (All off shore waters are mineral reservation)</li> <li>EIAS Law</li> </ul>	<ul style="list-style-type: none"> <li>LNG Hub</li> <li>Incentives for renewable energy</li> </ul>
<b>Renewable energy:</b> <b>Ocean energy</b> <b>Wind power</b> <b>Solar power</b> <b>Geothermal</b>	↑		<ul style="list-style-type: none"> <li>Renewable Energy Act</li> <li>Feed-in-tariff for renewable energy (e.g., wind and solar power)</li> </ul>	<ul style="list-style-type: none"> <li>Energy from wind power is increasing (wind power farms installed in coastal areas)</li> <li>Synergy between wind power and tourism</li> </ul>
<b>State of ocean health</b>				
<b>Fish stocks</b>	↓	<ul style="list-style-type: none"> <li>Illegal and Destructive Fishing</li> <li>Over Capitalization of Fishing Effort</li> <li>Commercial Fishing Intrusion in Municipal Waters</li> </ul>	<ul style="list-style-type: none"> <li>Fisheries Code of 1998 as amended</li> <li>Stock Assessment Program</li> <li>Fisherfolk and Fishing Gear Registration;</li> </ul>	<ul style="list-style-type: none"> <li>Vessel Monitoring, Control and Surveillance System</li> <li>Electronic Catch Documentation and Traceability system</li> <li>Closed fishing season in key areas</li> </ul>



Table 18.1: The Philippines's Ocean Economy and Ocean Health: Status, Issues and Response. (cont.)

Indicator	Status / Trend	Major Issues and Challenges	Response	
			(a) key policies/ laws; (b) national action plan	Best practice or blue economy initiative
	<b>INCREASING (↑) / DECREASING (↓) / NO CHANGE (-)</b>			
Fish stocks (cont.)		<ul style="list-style-type: none"> <li>Multiple Resource Use Conflict</li> <li>Lack of Marine Spatial Planning and supporting policies</li> <li>Lack of programs for hatcheries (milkfish)</li> <li>Ornamental Fish Collection</li> </ul>	<ul style="list-style-type: none"> <li>Fisheries and Aquatic Resources Management Councils</li> <li>Local Government Code</li> </ul>	<ul style="list-style-type: none"> <li>MPAs and fish sanctuaries</li> <li>Habitat restoration (mangrove planting; artificial reef)</li> <li>Eco-Fish Project</li> <li>CMEM Program (BMB)</li> </ul>
Catch per unit effort	↓		<ul style="list-style-type: none"> <li>Fisherfolk and Fishing Vessel and Gear Registration (FISH-R and BOAT-R)</li> <li>Fish stock assessment studies</li> </ul>	<ul style="list-style-type: none"> <li>Closed fishing season and fish sanctuaries/ MPAs to allow fish population to recover</li> <li>Fish Ports and Community fish landing centers – access to markets</li> <li>Capacity building on sustainable fishing practices, and income and livelihood diversification</li> </ul>
Mangroves	Increased due to replanting (2003-2015) ↑	<ul style="list-style-type: none"> <li>Delayed reversion of AUU ponds for rehabilitation;</li> <li>Illegal cutting of mangroves</li> <li>Low survival rates of planted mangrove seedlings</li> <li>Need capacity building in mangrove rehabilitation</li> <li>Wrong species matching</li> <li>Planting of mangroves in non-mangrove areas</li> <li>Lack of awareness among fisherfolk and coastal communities</li> </ul>	<ul style="list-style-type: none"> <li>R.A 7161 (anti mangrove cutting provision)</li> </ul>	<ul style="list-style-type: none"> <li>National Greening Program</li> <li>Restoration of abandoned, underdeveloped, or underutilized (AUU) fish and shrimp farms back to mangroves</li> <li>Mangrove restoration and enhancement</li> <li>Mangrove parks with facilities for wildbird watching</li> <li>Aquasilviculture in mangrove areas</li> </ul>
Coral reefs	<ul style="list-style-type: none"> <li>Area: Increased ↑ (2002-2014)</li> <li>Condition: Improved ↑ (2002-2014)</li> <li>Excellent coral cover: ↓</li> </ul>	<ul style="list-style-type: none"> <li>Climate Change;</li> <li>Sedimentation,</li> <li>Pollution</li> <li>Destructive Fishing;</li> <li>Illegal coral trade, ornamental fish collection</li> </ul>	<ul style="list-style-type: none"> <li>CITES; Philippine Biodiversity Strategy and Action Plan, NIPAS Act; National Plan of Action under the CTI</li> </ul>	<ul style="list-style-type: none"> <li>Artificial reefs</li> <li>MPAs and no-take zones</li> <li>Tubbataha Marine Protected Area;</li> <li>Designation of <b>Particularly Sensitive Sea Areas</b></li> </ul>
Seagrass beds	↓	<ul style="list-style-type: none"> <li>Lack of baseline studies and monitoring pollution and sedimentation; lack of awareness on the ecosystem's function</li> </ul>	<ul style="list-style-type: none"> <li>CITES; Philippine Biodiversity Strategy and Action Plan, NIPAS Act</li> </ul>	<ul style="list-style-type: none"> <li>Seagrass restoration and protection</li> </ul>

Table 18.1: The Philippines's Ocean Economy and Ocean Health: Status, Issues and Response. (cont.)

Indicator	Status / Trend	Major Issues and Challenges	Response	
	<b>INCREASING (↑) / DECREASING (↓) / NO CHANGE (-)</b>		<b>(a) key policies/ laws; (b) national action plan</b>	<b>Best practice or blue economy initiative</b>
<b>Beach</b> - area; condition - Beach forest cover	No data available as of to date	<ul style="list-style-type: none"> <li>Coastal development (infrastructure)</li> <li>Pollution</li> <li>Coastal erosion</li> </ul>		<ul style="list-style-type: none"> <li>Foreshore management</li> <li>Setback zoning</li> <li>Coastal cleanup</li> </ul>
<b>Salty marshes, tidal swamps, mudflats, etc.</b> - area; cover - condition	No data available as of to date	<ul style="list-style-type: none"> <li>Mangrove replanting mismatch</li> </ul>	<ul style="list-style-type: none"> <li>Ramsar Convention</li> </ul>	<ul style="list-style-type: none"> <li>Protected wetland areas</li> </ul>
<b>Prevention of extinction of known threatened species</b>	–	<ul style="list-style-type: none"> <li>Illegal capture and trade of endangered species</li> <li>Endangered species as by-catch</li> <li>Habitat loss</li> </ul>	<ul style="list-style-type: none"> <li>CITES; CBD; Philippine Biodiversity Strategy and Action Plan</li> <li>Convention on Migratory Species</li> <li>Smart Seas Project (UNDP-DENR)</li> </ul>	<ul style="list-style-type: none"> <li>Turtle Island Heritage Site Protected Area.</li> <li>MPA network and MPA complex</li> </ul>
<b>Marine water quality</b>	Only some baseline data are available	<ul style="list-style-type: none"> <li>Very few marine water quality monitoring stations;</li> <li>Lack of wastewater treatment facilities</li> </ul>	<ul style="list-style-type: none"> <li>Clean Water Act</li> <li>National Sewerage and Septage Management Program</li> </ul>	<ul style="list-style-type: none"> <li>WQMA;</li> <li>Increasing number of LGUs with wastewater or septage management systems</li> <li>Adopt-a-River program in Metro Manila</li> <li>Improved SWM and plastic ban in some LGUs</li> </ul>
<b>Marine protected areas</b>	↑	<ul style="list-style-type: none"> <li>Management effectiveness of locally established MPAs</li> <li>Need to establish more MPAs in key biodiversity areas</li> </ul>	<ul style="list-style-type: none"> <li>CBD; Aichi Biodiversity Targets, SDG 14, Ramsar</li> <li>NIPAS Law</li> <li>Philippine Biodiversity Strategy and Action Plan</li> </ul>	<ul style="list-style-type: none"> <li>Habitat restoration, enhancement, and protection</li> <li>Designation of Particularly Sensitive Sea Areas</li> <li>MPA network and complex</li> <li>Collaboration between national government and LGUs in establishing no-take zones; promoting sustainable fishing practices; tourism and visitor management; surveillance and patrolling; and monitoring of ecosystem health</li> </ul>
<b>Pressures and threats</b>				
<b>Population growth in the coastal areas</b>	↑	<ul style="list-style-type: none"> <li>Unplanned and unregulated development</li> <li>Exceeding the resource carrying capacity;</li> <li>Untreated wastewater discharges;</li> <li>High solid waste generation, but inadequate SWM system</li> </ul>	<ul style="list-style-type: none"> <li>RH Law</li> <li>Philippine Development Plan; Regional development plan; Provincial Development and Physical Framework Plan, and Municipal Comprehensive Development Plan</li> </ul>	<ul style="list-style-type: none"> <li>Education</li> <li>Capacity development and conditional cash transfers</li> </ul>

Table 18.1: The Philippines's Ocean Economy and Ocean Health: Status, Issues and Response. (cont.)

Indicator	Status / Trend	Major Issues and Challenges	Response	
	INCREASING (↑) / DECREASING (↓) / NO CHANGE (–)		(a) key policies/ laws; (b) national action plan	Best practice or blue economy initiative
		<ul style="list-style-type: none"> <li>Resource use conflicts;</li> <li>Human settlements and informal settlers encroaching in waterways, flood catchments, coastal habitats, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Comprehensive Land Use Plans</li> <li>Disaster risk reduction and management plans (national, regional, local)</li> </ul>	
IUU fishing	Decreased ↓ (since 2006)	<ul style="list-style-type: none"> <li>Inadequate enforcement</li> </ul>	<ul style="list-style-type: none"> <li>R.A. 10654</li> <li>BFAR strengthened as a regulatory and enforcement agency</li> </ul>	<ul style="list-style-type: none"> <li>Closed Seasons, No take zones,</li> <li>VMS</li> <li>eCDT system</li> <li>Commercial Fishing Fees</li> </ul>
Coastal erosion and sedimentation	↑	<ul style="list-style-type: none"> <li>Lack of law enforcement; government projects are not subjected to EIA process.</li> </ul>	<ul style="list-style-type: none"> <li>“Ridge to Reef” Integrated Coastal Management Program</li> <li>Integrated Watershed Management Program (DAO 2008-05)</li> <li>Sustainable Integrated Area Development Program</li> <li>Integrated Natural Resource and Environment Management Program</li> <li>CLUP; DRRM Plan</li> </ul>	<ul style="list-style-type: none"> <li>Reforestation of watershed areas</li> <li>River Basin Management plan – in key river basins – incorporating integrated water resource management (IWRM) principles</li> </ul>
Wastewater (untreated) discharge	↑	<ul style="list-style-type: none"> <li>Non-compliance of LGUs</li> <li>Lack of wastewater and septage management systems; few local government units have established wastewater systems</li> <li>Growing population and waste generation; desludging of septic tanks; clogged waterways; plastic waste and marine debris</li> <li>Unregulated development and urban sprawl resulting in pollution, habitat conversion, erosion and sedimentation</li> </ul>	<ul style="list-style-type: none"> <li>Clean Water Act</li> <li>Local Government Code</li> <li>Water Code</li> <li>Sanitation Code</li> <li>National Sewerage and Septage Management Program</li> <li>Monitoring of water quality of rivers and coastal bathing waters</li> </ul>	<ul style="list-style-type: none"> <li>National Sewerage and Septage Management Plan and program: provides subsidy of up to 50% of capital cost</li> <li>Classification of Water Bodies; Designation of Water Quality Management Areas</li> <li>Use of various cost-effective technologies to meet water quality standards with lower capital and operating and maintenance costs</li> </ul>
Solid waste generation	↑	<ul style="list-style-type: none"> <li>Non-compliance of LGUs: Only 24% of barangays has MRFs, and only 19% of LGUs are served by existing sanitary landfills.</li> <li>Plastic waste management</li> </ul>	<ul style="list-style-type: none"> <li>R.A. 9003 Ecological Solid Waste Management Act</li> </ul>	<ul style="list-style-type: none"> <li>10-year Solid Waste Management Plans for all LGUs</li> <li>Closure of Open Dumpsites;</li> <li>MRFs for recyclable waste;</li> <li>Composting of food waste, dried leaves and grass</li> <li>Construction and operation of sanitary landfills,</li> <li>Gas recovery (e.g., Payatas landfill)</li> </ul>

**Table 18.1:** The Philippines's Ocean Economy and Ocean Health: Status, Issues and Response. (cont.)

Indicator	Status / Trend	Major Issues and Challenges	Response	
			(a) key policies/ laws; (b) national action plan	Best practice or blue economy initiative
	<b>INCREASING (↑) / DECREASING (↓) / NO CHANGE (-)</b>			
<b>Plastic waste generation and marine debris</b>	↑	<ul style="list-style-type: none"> <li>Lack of policies</li> <li>Lack of facilities</li> </ul>	<ul style="list-style-type: none"> <li>R.A. 9003</li> </ul>	<ul style="list-style-type: none"> <li>Ban of use of plastics in some cities</li> <li>Turning plastic waste into bricks and pavers, bags, other products</li> </ul>
<b>Oil spills</b>	↓	<ul style="list-style-type: none"> <li>Inadequate monitoring and enforcement</li> </ul>	<ul style="list-style-type: none"> <li>MARPOL and other IMO Conventions;</li> <li>National Oil Spill Contingency Plan;</li> <li>Manila Bay Oil Spill Contingency Plan</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring of Oil and Grease in Marine Waters</li> <li>PSHEMS</li> <li>Navigational lanes and navigational aids</li> </ul>
<b>Greenhouse gas emissions</b>	↑	<ul style="list-style-type: none"> <li>Coal is cheaper fuel</li> <li>Lack of air pollution control facilities in industries</li> <li>Emissions from vehicles are increasing</li> </ul>	<ul style="list-style-type: none"> <li>Clean Air Act</li> <li>Renewable Energy Act</li> <li>Paris Climate Agreement, UNFCC</li> </ul>	<ul style="list-style-type: none"> <li>Zero-carbon resorts</li> <li>Green ports</li> <li>Subsidies and incentives for renewable energy (e.g., feed-in-tariff)</li> <li>Wind farms</li> <li>Solar power farms</li> <li>Use of solar panels in households and establishments is increasing as they become more affordable</li> <li>Other renewable energy: geothermal energy; biomass; ocean energy</li> </ul>
<b>Policies and governance</b>				
<b>Ocean policy and law</b>	None	ICM Bill is still pending at the Congress.		
<b>Related policies and legislation</b>		<ul style="list-style-type: none"> <li>Weak implementation of policies and plans</li> <li>Lack of awareness on impacts of habitat loss, pollution, and climate change</li> <li>Lack of awareness on benefits of oceans and coastal and marine ecosystems, and benefits of MPAs, fish sanctuaries, SWM facilities and wastewater treatment systems</li> </ul>		
• Coastal management;	Yes			
• MPAs and habitat protection	Yes			
• Fisheries management	Yes			
• Wastewater management	Yes			
• Solid waste management	Yes			

**Table 18.1:** The Philippines's Ocean Economy and Ocean Health: Status, Issues and Response. (cont.)

Indicator	Status / Trend INCREASING (↑) / DECREASING (↓) / NO CHANGE (–)	Major Issues and Challenges	Response	
			(a) key policies/ laws; (b) national action plan	Best practice or blue economy initiative
<ul style="list-style-type: none"> <li>• Toxic and hazardous waste management</li> <li>• Plastic waste management</li> <li>• Sea-based pollution</li> <li>• Coastal zoning and marine spatial planning</li> <li>• Climate change adaptation and mitigation</li> </ul>	<p>Yes</p> <p>None specifically</p> <p>Yes</p> <p>None specifically</p> <p>Yes</p>	<ul style="list-style-type: none"> <li>• Inadequate capacity and resources for monitoring and enforcement</li> <li>• Access to innovative and cost-effective technologies</li> <li>• Access to affordable financing; lack of funding for operations and maintenance to ensure sustainability</li> </ul>		
<b>Related international agreements adopted</b>	Yes	Some international conventions have been signed but not yet ratified	<ul style="list-style-type: none"> <li>• Adoption of corresponding national laws and Implementing Rules and Regulations (IRR) to adequately put into effect the international agreements and meet agreed targets</li> </ul>	

### 18.3 Recommendations

The NSOC Report is an important tool to advance scientific support, raise public awareness, promote good governance and partnerships for blue economy, and foster the development of synergies among the various sectors and stakeholders. The evidence base provided by the SOC reports is fundamental in informing policy- and decision-makers on ocean-related issues as well as innovations and best practices that can be replicated and scaled up. The report provides a review of the value added of blue economy, and its contribution to income, jobs, and the overall ocean agenda.

**Development of ocean accounts.** Current national income accounts do not have the breakdown for some of the ocean economic activities. Data disaggregation to account for key sectors, such as small-scale fisheries, mariculture, coastal and marine tourism, coastal and offshore wind power, etc., is one of the challenges in developing the ocean accounts. Moreover, there is also a lack of waste accounting, and availability of studies showing the environmental cost and economic losses. The valuation of coastal and marine ecosystem services also needs more work and studies to get more robust estimates. The ocean accounts must be promoted at both the macroeconomic and sectoral level planning to show the contribution of oceans to the economy as well as to food, water and energy security, incomes, livelihood, shoreline protection, climate resiliency, and well-being. By showing the linkages and the potential investment and business opportunities, the ocean accounts can help make blue economy development a priority of the government, investors, and development partners.

**Integrated coastal management.** The delicate situation of balancing biodiversity conservation and economic development may crumble if critical parts of the ocean ecosystems are not considered. One of the management strategies currently recommended for coastal areas is the *integrated coastal management* (ICM) to ensure effective management of our coastal resources and that the various uses of the coastal (and oceanic) waters be considered and harmonized (Chua 2003), and this time, taking into account climate-informed actions (e.g. Heenan et al. 2015) into the ICM system. ICM has been adopted as national policy for the sustainable development and management of coasts and seas (EO 533). A more recent but similar approach is the *marine spatial planning* (MSP), which like ICM, is a process that brings together multiple users of the ocean – including energy, industry, government, conservation, and recreation – to make informed and coordinated decisions about how to use marine resources sustainably. The ICM policy (EO 533) needs to be implemented in more coastal areas. A Senate bill on ICM is still pending for adoption.

**Habitat protection and pollution reduction.** While many LGUs have coastal resource management (CRM) programs, it is essential to note that CRM is just one component of ICM system. It is laudable that LGUs have taken actions on reforestation, mangrove restoration, and protecting coral reefs and fish habitats through establishment of locally managed MPAs. However, there is a lack of protection and restoration of seagrass, mudflats and other coastal habitats. There should be more consideration for key biodiversity areas, and the interconnectivities of mangroves, seagrass, coral reefs and other coastal habitats to optimize their ecosystem services. Furthermore, it is imperative to increase the focus on management of wastewater and plastic waste to ensure ocean health and protect marine life as well as improve human health and living conditions. Investments in these areas are crucial as impacts and economic losses are increasing. More needs to be done if the country is to meet its international commitment and targets on establishing MPAs, addressing IUU fishing, and reducing marine pollution. Commitments from political leaders and finance and environment ministries to prioritize the ocean agenda are therefore critical. Integrated ocean management, including habitat restoration, MPAs, climate resilient infrastructure, pollution reduction, and waste management should not be seen as a cost burden and investment dead-end, but rather as opportunities for more responsible businesses, income generation, job creation, innovations, and a more sustainable, resilient and inclusive economic growth path.

**Disaster risk reduction and climate resiliency.** Ecosystem-based disaster risk management recognizes that ecosystems, particularly mangroves, seagrass and coral reefs, can act as first line of defense for vulnerable community against disasters. DRRM funds have not been fully utilized to enhance preparedness as well as restore and properly manage these coastal ecosystems, which provide shoreline protection (among other ecosystem services). Integrating coastal land-and sea-use planning, DRRM, appropriate infrastructure development and coastal ecosystem conservation would enhance climate resiliency.

**Monitoring of marine water quality and ecosystems.** Monitoring of coastal and offshore water, including additional parameters for observation, as well as more nutrient loading studies in major bays are needed due to increasing incidence of eutrophication, hypoxia, harmful algal blooms and fish kills. Likewise, more regular fish stock assessment, and monitoring of coral reefs, seagrass, mangroves, and rare, threatened and endangered species are necessary to assess the status, changes and pressures on fisheries, and biodiversity, and the impacts on the environment, and incomes, livelihoods, climate resiliency and well-being of coastal communities. Moreover, properly monitoring the ecosystem response to the various policies and actions is important to identify which interventions are effective and which are not. Timely access to data and research projects is also necessary to ensure that information is readily available for policy and planning.

The DPSIR approach of this report attempts to elucidate the process of understanding the importance of the various uses of coastal and oceanic resources in the country that are subjected to several threats, both anthropogenic and natural. A good understanding of the linkages and processes in the DPSIR flow can improve the management through monitoring and evaluation actions which are sorely lacking in the current management regime.

**Blue economy development.** Private sector involvement in innovative blue economy is essential – from research to design, deployment, operation, and financing. Public-private partnership (PPP) is important to move the blue economy forward. However, enabling conditions have to be put in place to ensure viability, and make PPP work. Blue economy offers opportunities to create new jobs, bring in new businesses and infrastructure, deploy new technologies, and promote innovative and sustainable industries (e.g., fisheries and aquaculture; ecotourism; ports and shipping; shipbuilding; marine biotechnology; marine renewable energy). There are unlikely synergies across sectors that have developed like agriculture and tourism; wind power and tourism. The contributions of the blue economy initiatives to the national economy, employment, local incomes and livelihood, investments, innovations, climate resiliency, and well-being need to be measured also to show these benefits. Moreover, there are backward and forward linkages and multiplier effects that need to be assessed to further show the gains from blue economy development.

**Linking of blue economy initiatives to the achievement of the SDGs.** To get more support, it is essential to show the interactions, combined effect, and benefits to accelerate actions and achieve the targets of SDGs, SDS-SEA, and other international agreements. The blue economy initiatives can be linked to several targets and indicators of the SDGs.

**Regular SOC reporting.** The development of the national State of Oceans and Coasts (NSOC) report is a significant step beyond the traditional State of Environment reports. The NSOC report looks deeper into the value and contributions of oceans and marine ecosystems to national and

regional economies, livelihood and welfare; impacts of human activities; challenges and response measures. This report is quite comprehensive and provides information on socioeconomic and ocean health conditions; good practices and innovations in ocean economy; linkage to the SDGs and various areas of investments. Moreover, it highlights the intervention needs, policies and other governance mechanisms to respond to changing environments and climate. It is important to note that this NSOC report provides the baseline, which can be used for comparison with results of future monitoring and assessment of the state of ocean economy and ocean health. Regular updating of the NSOC report would help in addressing the data gaps, and showing the progress in meeting key SDG targets as well as, outcomes and benefits of blue economy development and ICM and SDS-SEA implementation.



Sunset in Boracay. (Photo by N. Caragay)



# ANNEXES

# Annex A

**Table A.1** Logical Framework of the Sulu-Sulawesi Marine Ecoregion Comprehensive Action Plan.

Logical Framework	
Long-term Goal Statement	Targeted Conservation Outcomes
<p>A marine ecoregion that remains globally unique and a center of diversity with vibrant ecological integrity, including all species assemblages, communities, habitats, and ecological processes.</p> <p>A highly productive ecoregion that sustainably and equitably provides for the socioeconomic and cultural needs of the human communities dependent on it.</p> <p>An ecoregion where biodiversity and productivity are sustained through generations by participatory and collaborative management across all political and cultural boundaries</p>	1 Sustainable fisheries, aquaculture, living aquatic resources use and livelihoods systems in the SSME.
	2 Conserved and sustainably managed biodiversity in the SSME.
	3 Protected and managed threatened, charismatic, and migratory species and their habitats in order to maintain the full range of biodiversity and provide for the long-term socioeconomic and cultural needs of human communities in the SSME.
	4 A model in seascape planning and implementation contributing to the Coral Triangle Initiative.
	5 Resilient habitats and communities adapting to the adverse effects of climate change.

SSME - Sulu-Sulawesi Marine Ecoregion.

Source: Tri-National Committee of the Sulu-Sulawesi Marine Ecoregion.

**Table A.2** Logical Framework of the Sulu-Sulawesi Marine Ecoregion Comprehensive Action Plan: Marine Turtles.

Logical Framework	
Purpose (Short-Term Goal)	Indicators
Facilitate effective management of feeding grounds, migratory routes, and protection of target species from overfishing and as bycatch; design MPAs and MPA networks in relation to the protection and management of target species and their habitat; and promote implementation of best practices in habitat conservation and management.	1 Marine turtles and their habitats are managed and protected through reduction of overfishing and bycatch, criteria are developed on MPA and MPA network design in relation to marine turtle protection and management, and information is disseminated on best practices on marine turtle population and habitat conservation and management in the SSME.
	2 Napoleon wrasse are conserved and managed in the SSME.
	3 Marine mammals are managed and protected from bycatch, entanglement in specific fisheries and fishing gear or gear types, and ship strikes.
	4 Whale sharks and other endemic and CITES-listed cartilaginous fishes (sharks and rays) are conserved and managed particularly from overfishing or as bycatch in specific fisheries and fishing gear.
Strategies or Key Result Areas	Activities
1 Identify best practices in minimizing threats to marine turtle populations and their habitats (i.e., nesting, feeding, and developmental habitats).	1.1 Produce country status on marine turtle populations and habitat in SSME.
	1.2 Review previous and existing legislation on turtle management including but not limited to harvest and trade.
	1.3 Formulate economic incentives to reduce threats and mortality as well as management measures and protocols for the protection and management of marine turtle populations and their habitats.

**Table A.2** Logical Framework of the Sulu-Sulawesi Marine Ecoregion Comprehensive Action Plan: Marine Turtles. (cont.)

Logical Framework			
Strategies or Key Result Areas		Activities	
2	Develop and implement nesting habitats and management programs to maximize hatchling production and survival.	2.1	Quantify threats and evaluate the effectiveness of the threats and their mitigation measures (nest and beach management).
		2.2	Develop guidelines on threats and mitigation measures.
3	Provide recommendations on specific features or criteria in MPA design and MPA network design in relation to the protection and management of marine turtles in SSME waters.	3.1	Identify areas of critical habitats., such as migratory corridors, nesting beaches, and inter-nesting and feeding areas.
		3.2	Identify and design best formats for incentives and disincentives for the adequate protection of critical habitats outside protected areas.
		3.3	Review and develop practical guidelines on management and regulation on the use of beaches on coastal dunes, including but not limited to revegetation of frontal dunes at nesting beaches with indigenous flora as far as possible, and removal of debris that impedes turtle nesting and hatching production; enhancement of recovery of degraded marine habitats, e.g., coral reefs, mangrove forests, seagrass beds; and evaluation of disposal of shipborne wastes.
4	Undertake initiatives to promote reduction of incidental capture and mortality of marine turtles.	4.1	Collate information on in-water threats and potential interaction of turtles with fisheries.
		4.2	Develop guidelines on incidental capture mitigation mechanisms, including (i) modification and use of fishing gear, devices, and techniques to minimize incidental capture of marine turtles in fisheries; (ii) reduction of fishing gear and vessel disturbance to sea turtle habitats; (iii) vessel monitoring systems and inspections at sea, in port, and at landing sites; (iv) national on-board observer program coordination arrangement with fisheries industries and fisheries management organization; and (v) net retention and recycling schemes to minimize the disposal of fishing gear at sea and on beaches.
5	Conduct turtle population habitat research and monitoring protocols.	5.1	Review existing research methods and monitoring protocols and develop standard guidelines on genetic identity, population status, migration routes, and other biological and ecological aspects of marine turtles (life history).
6	Develop guidelines for MPA network design for marine turtles.	6.1	Develop criteria and indicators for the designation of protected or conservation areas and sanctuaries or seasonal exclusion zones within critical habitats of marine turtles.
		6.2	Identify candidate areas for MPA networks important for marine turtles.
7	Publish information to promote best practices and successes for marine turtle conservation.	7.1	Prepare country reports based on the following steps: form a publication task group, prepare proposal for book publication, prepare format for publication of country reports, write country reports, compile country reports, and identify common recommendations for best practices in the SSME.
		7.2	Finalize and distribute documents for publication in electronic and hard-copy formats.
		7.3	Popularize the technical advice and recommendations for marine turtle management.

CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora, MPAs - marine protected areas, SSME - Sulu-Sulawesi Marine Ecoregion

Source: Subcommittee on Threatened, Charismatic, and Migratory Species of the Sulu-Sulawesi Marine Ecoregion.

**Table A.3** Logical Framework of the Sulu-Sulawesi Marine Ecoregion Comprehensive Action Plan: Napoleon Wrasse.

Logical Framework			
Purpose (Short-Term Goal)		Indicators	
Facilitate effective management of feeding grounds, migratory routes, and protection of target species from overfishing and as bycatch; design MPAs and MPA networks in relation to the protection and management of target species and their habitat; and promote implementation of best practices in habitat conservation and management.		1	Marine turtles and their habitats are managed and protected through reduction of overfishing and bycatch, criteria are developed on MPA and MPA network design in relation to marine turtle protection and management, and information is disseminated on best practices on marine turtle population and habitat conservation and management in the SSME.
		2	Napoleon wrasse are conserved and managed in the SSME.
		3	Marine mammals are managed and protected from bycatch, entanglement in specific fisheries and fishing gear or gear types, and ship strikes.
		4	Whale sharks and other endemic and CITES-listed cartilaginous fishes (sharks and rays) are conserved and managed particularly from overfishing or as bycatch in specific fisheries and fishing gear.
Strategies or Key Result Areas		Activities	
1	Promote conservation and management of Napoleon wrasse in the SSME.	1.1	Complete a non-detrimental finding study of Napoleon wrasse at the country level.
		1.2	Identify critical sites for protection and management of Napoleon wrasse (e.g., MPAs).
		1.3	Identify gaps in management (e.g., illegal, unregulated, and unreported fishing) and develop recommendations to promote conservation of Napoleon wrasse (e.g., banning export by sea and quota on domestic trade).
		1.4	Establish alternative livelihoods that are capable of weaning people away from unsustainable resource extraction and ensuring ecosystem integrity.

CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora, MPAs - marine protected areas, SSME - Sulu-Sulawesi Marine Ecoregion

Source: Subcommittee on Threatened, Charismatic, and Migratory Species of the Sulu-Sulawesi Marine Ecoregion.

**Table A.4** Logical Framework of the Sulu-Sulawesi Marine Ecoregion Comprehensive Action Plan: Marine mammals.

Logical Framework		
Purpose (Short-Term Goal)		Indicators
Facilitate effective management of feeding grounds, migratory routes, and protection of target species from overfishing and as bycatch; design MPAs and MPA networks in relation to the protection and management of target species and their habitat; and promote implementation of best practices in habitat conservation and management.		1 Marine turtles and their habitats are managed and protected through reduction of overfishing and bycatch, criteria are developed on MPA and MPA network design in relation to marine turtle protection and management, and information is disseminated on best practices on marine turtle population and habitat conservation and management in the SSME.
		2 Napoleon wrasse are conserved and managed in the SSME.
		3 Marine mammals are managed and protected from bycatch, entanglement in specific fisheries and fishing gear or gear types, and ship strikes.
		4 Whale sharks and other endemic and CITES-listed cartilaginous fishes (sharks and rays) are conserved and managed particularly from overfishing or as bycatch in specific fisheries and fishing gear.
Strategies or Key Result Areas		Activities
1 Minimize threats to marine mammal populations and their habitats.	1.1 Complete a non-detrimental finding study of Napoleon wrasse at the country level.	
	1.2 Identify critical sites for protection and management of Napoleon wrasse (e.g., MPAs)	
	1.3 Identify gaps in management (e.g., illegal, unregulated, and unreported fishing) and develop recommendations to promote conservation of Napoleon wrasse (e.g., banning export by sea and quota on domestic trade).	
2 Promote initiatives on the protection and management of marine mammal habitats and migratory routes.	2.1 Identify critical habitats, such as migratory corridors and breeding and feeding grounds.	
	2.2 Review and develop practical guidelines on the use of bays, migratory channels, and coastal areas, including but not limited to regulation of ship and boat traffic; sustainable whale and dolphin watching tours; and enhanced recovery of degraded marine habitats (e.g., coral reefs and seagrass beds).	
3 Facilitate reduction of incidental capture and mortality of marine mammals in fisheries.	3.1 Collate information on entanglements, bycatch, and potential interactions with fisheries.	
	3.2 Develop guidelines on incidental capture mitigation mechanism that include but are not limited to gear modification, reduction of fishing gear and vessel disturbance, vessel monitoring and inspection system, on-board onserver program, and coordination with fisheries industries.	
	3.3 Facilitate information sharing about entanglement events to better understand the nature, source, and extent of the problem in the SSME.	
4 Provide recommendations on marine mammal stranding responses to minimize mortality in stranding events and maximize data collection.	4.1 Collate and organize data on marine mammal strandings in the SSME.	
	4.2 Develop practical guidelines and build regional capacity on marine mammal stranding responses.	

CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora, MPAs - marine protected areas, SSME - Sulu-Sulawesi Marine Ecoregion

Source: Subcommittee on Threatened, Charismatic, and Migratory Species of the Sulu-Sulawesi Marine Ecoregion.

**Table A.5** Logical Framework of the Sulu-Sulawesi Marine Ecoregion Comprehensive Action Plan: Sharks.

Logical Framework		
Purpose (Short-Term Goal)		Indicators
Facilitate effective management of feeding grounds, migratory routes, and protection of target species from overfishing and as bycatch; design MPAs and MPA networks in relation to the protection and management of target species and their habitat; and promote implementation of best practices in habitat conservation and management.		1 Marine turtles and their habitats are managed and protected through reduction of overfishing and bycatch, criteria are developed on MPA and MPA network design in relation to marine turtle protection and management, and information is disseminated on best practices on marine turtle population and habitat conservation and management in the SSME.
		2 Napoleon wrasse are conserved and managed in the SSME.
		3 Marine mammals are managed and protected from bycatch, entanglement in specific fisheries and fishing gear or gear types, and ship strikes.
		4 Whale sharks and other endemic and CITES-listed cartilaginous fishes (sharks and rays) are conserved and managed particularly from overfishing or as bycatch in specific fisheries and fishing gear.
Strategies or Key Result Areas		Activities
1	Develop and promote options and new conservation and management agreements for whale sharks and other CITES-listed species in the SSME.	1.1 Produce the status of whale sharks and other CITES-listed sharks and rays in the SSME that includes, but is not limited to (i) existing data on population, distribution, habitat, utilization; (ii) information on the trade in specimens; (iii) previous and existing legislation on the conservation and management of the species; (iv) gap identification and technical recommendations for adaptation and adoption of the best conservation and management practices; and (v) collaborative research in aid of policy development for conservation and management.
2	Provide recommendations on the management of threatened pelagic migratory sharks and rays on overfishing or as bycatch in specific fisheries and fishing gear.	2.1 Produce country status report on threatened pelagic migratory sharks and rays.
		2.2 Draft SSME plan of action pursuant to the <i>The Conservation Status of Pelagic Sharks and Rays</i> (Camhi et al., 2009) and the <i>International Plan of Action for Conservation and Management of Sharks</i> (FAO, 2010-2011), including national on-board observer program to monitor and report bycatch, coordination arrangements with fisheries management organizations, and precautionary catch limits for sharks and rays.
		2.3 Establish alternative livelihoods that are capable of weaning people away from unsustainable resource extraction and ensuring ecosystem integrity.
3	Promote conservation and management of endemic cartilaginous species (sharks and rays).	3.1 Collate and review existing information on endemic sharks and rays.
		3.2 Identify and quantify threats to the populations of endemic sharks and rays.
		3.3 Identify gaps in conservation and management, develop recommendations to fill gaps, and promote conservation of endemic sharks and rays.

CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora, MPAs - marine protected areas, SSME - Sulu-Sulawesi Marine Ecoregion

Source: Subcommittee on Threatened, Charismatic, and Migratory Species of the Sulu-Sulawesi Marine Ecoregion.

**Table A.6** Logical Framework of the Sulu-Sulawesi Marine Ecoregion Comprehensive Action Plan: Model Seascape.

Logical Framework			
Purpose (Short-Term Goal)		Indicators	
The SSME is officially designated as a priority seascape in the Coral Triangle and serves as a geographic focus of investments and actions for the CTI based on a comprehensive action plan agreed upon by Indonesia, Malaysia, and the Philippines.		1	Six Coral Triangle countries at the ministerial level officially recognize SSME as a priority seascape for delivering conservation results under the CTI Regional Plan of Action; and a comprehensive action plan with clear strategies, activities, budgets, and indicators is published and disseminated.
		2	The SSME is adopted as a general model for planning, implementation, and sustainable management of seascapes across the Coral Triangle and beyond.
Strategies or Key Result Areas		Activities	
1	Secure political, stakeholder, and donor community acceptance to strengthen the position of the SSME as a working priority model seascape in the Coral Triangle.	1.1	Advocate for the recognition of the SSME as a priority seascape within the CTI political and decisionmaking processes.
		1.2	Formulate and implement a fundraising strategy and aggressive engagements with donors and the private sector.
2	Build capacity for seascapes at various levels.	2.1	Publish and disseminate information and educational materials promoting the SSME as a model seascape in the Coral Triangle.
		2.2	Support the development of capacity on seascape planning, implementation, and sustainable management for their seascapes within the COral Triangle and beyond.

CTI - Coral Triangle Initiatives, SSME - Sulu-Sulawesi Marine Ecoregion.  
Source: *Tri-National Committee of the Sulu-Sulawesi Marine Ecoregion.*

**Table A.7** Logical Framework of the Sulu-Sulawesi Marine Ecoregion Comprehensive Action Plan: Climate Change.

Logical Framework			
Purpose (Short-Term Goal)		Indicators	
Climate change mitigation and adaption strategies are considered in the implementation of plans and programs at all levels.		Baseline information and policies are in place to ensure that habitats and communities are safeguarded from the adverse effects effects of climate change.	
Strategies or Key Result Areas		Activities	
1	Build capacity of relevant institutions and stakeholders on climate change adapattation strategies.	1.1	Capacitate the respective secretariats with facilities, manpower, logistics, and expertise by linking with potential centers of excellence on climate change adaptation.
2	Coordinate and implement research programs on climate change adapattation and mitigation to enhance the understanding of the adverse effects of climate change in the Sulu-Sulawesi Marine Ecoregion as basis for technical advice and recommendations for management and policy development.	2.1	Conduct research and studies on climate change adaptation and mitigation (e.g., reef resilience against global climate change).
3	Ensure the resiliency of fisheries and coastal communities to climate change.	3.1	Promote ecosystem-based climate change adaptation strategies for sustainable fisheries.

Source: *Tri-National Committee of the Sulu-Sulawesi Marine Ecoregion.*

# Annex B

## B.1 MWSS: Wastewater and Septage Management

**B.1.1:** Future MWSS projects from 2018-2037.

Projected Year	Project Name	Capacity (MLD)	Population Served	Location	Concessionaire	% Coverage
2018-2022	Pinugay SpTP	0.05	323,210	Marikina City	Manila Water	32% (2021)
	Hinulugang Taktak STP	20	148,329	Antipolo City	Manila Water	
2023-2027	Navotas-Malabon-South Caloocan	205	1,325,000	Caloocan City	Maynilad	47%
	Las Piñas	88	652,300	Las Piñas City	Maynilad	
	Muntinlupa Stage 2 (Poblacion)	14	173,800	Muntinlupa City	Maynilad	
	Kawit	13	84,300	Kawit, Cavitr	Maynilad	
	Mandaluyong+West+SJ South+QC South STP	130	654,020	Mandaluyong City	Manila Water	65% (2026)
	Taguig Central STP	125	875,005	Taguig City	Manila Water	
	Makati-Manila STP	75	350,256	Manila City	Manila Water	68%
	Quezon City East	40	399,500	Quezon City	Maynilad	
	Bacoor Stage 1	93	571,000	Bacoor City, Cavite	Maynilad	
	Imus Stage 1	47	325,900	Imus, Cavite	Maynilad	
Rosario-Noveleta	20	163,600	Cavite	Maynilad		
Caloocan North Stage 1	58	565,500	Caloocan City	Maynilad		
Quezon City West Stage 1 Upgrading	40	75,200	Quezon City	Maynilad		
Valenzuela West Stage 2	24	161,500	Valenzuela City	Maynilad		
Manila South Expansion	124	354,600	Manila City	Maynilad	68%	
Manila South Stage 2 Malate	12	19,600	Manila City	Maynilad		
Parañaque Stage 2 STP 2	29	108,200	Parañaque City	Maynilad		
Pasay-Makati Stage 1 Upgrading	28	81,800	Pasay City	Maynilad		
2028-2037	QC North + QC West STP	160	607,277	Quezon City	Manila Water	99%
	San Mateo-Rodriguez STP	75	776,060	San Mateo, Rizal	Manila Water	
	Marikina South STP	20	130	Marikina City	Manila Water	
	QC East STP	20	129,953	Marikina City	Manila Water	
	Antipolo STP	35	393,157	Antipolo City	Manila Water	
	East of Manggahan STP	145	1,236,606	Taytay, Rizal	Manila Water	



B.1.1: Future MWSS projects from 2018-2037. (cont.)

Projected Year	Project Name	Capacity (MLD)	Population Served	Location	Concessionaire	% Coverage
2028-2032	Quezon City North Stage 1	45	308,400	Quezon City	Maynilad	87%
	Manila North Stage 2 STP 2	10	33,200	Manila City	Maynilad	
	Manila North Stage 2 STP 3	18	69,400	Manila City	Maynilad	
	Manila North Stage 2 STP 5	48	210,000	Manila City	Maynilad	
	Manila North Stage 2 STP 6	8	55,200	Manila City	Maynilad	
	Pasay-Makati Stage 2	78	184,000	Pasay City	Maynilad	
	Parañaque Stage 2 STP 3	32	130,000	Parañaque City	Maynilad	
	Parañaque Stage 2 STP 4	10	21,900	Parañaque City	Maynilad	
	Caloocan North Stage 2	56	382,500	Caloocan City	Maynilad	
	Valenzeula East	30	189,100	Valenzuela City	Maynilad	
	Manila North Expansion	80	292,900	Manila City	Maynilad	
	Bacoor Stage 2	15	382,700	Bacoor City, Cavite	Maynilad	
	2033-2037	Quezon City North Stage 2	101	653,600	Quezon City	
Caloocan North Stage 3		30	278,100	Caloocan City	Maynilad	
Parañaque Stage 1 Upgrading		11	28,400	Parañaque City	Maynilad	
Imus Stage 2		41	466,400		Maynilad	



Dagat-Dagatan waste stabilization ponds



Paco WWTP using Johkasou tanks and moving bed biofilm reactor



Tanks for reuse of treated wastewater



Taguig septage treatment plant



Sequential batch reactor in Project 7 WWTP



Tandang Sora WWTP using STM Aerotor  
(Photos by M. Ebarvia)

## B.2. PCIEERD:

### B.2.3: Research and Development Projects for Wastewater Treatment.

WASTEWATER TREATMENT TECHNOLOGIES (COMPLETED) PROJECTS 2010-2017						
	Biological	Physical-chemical			Advanced Treatment	Emerging Technology
Lab scale	Screening and Identification of Biofilm Formers as Potential Microbial Remediators for Heavy Metal Contaminated Wastewater	Pasig River Stewardship Program: Biochemical and Mechanical Remediation Techniques for the Rehabilitation of Estero de Balete (Proj. 3)	Assessing Biosorption Performance of Water hyacinth and other Aquatic plants	Development of Nanofiber Membrane Nanoclay/montmorillonite purification technique	Radiation Induced grafting of non-woven fabrics for wastewater treatment	
Beach Scale	Use of Microbial Biofilm Formers	Bioremediation through Selective Recovery of Heavy Metals from Industrial Wastewaters using Biogenics H2S	Development of Compact and Efficient Electrocoagulation Treatment System for Pharmaceutical Waste Products and Other Pharmaceutical and Personal Care Product		Development of Biological + Ozonation pProcess as Treatment for Effluents of Distillery and Other Large-water Demand Industries with the Prospect of Water Recycling	Photocatalytic Treatment of Colored Wastewater from Textile Industries (ERDT)
Pilot Scale	Deployment and Field-testing of Eco-friendly Septic System (Eco-Sep)	Compact Wastewater Treatment System Enhanced with Bio-augmentation Technology	Indigenous Plant Hyperaccumulators (Cu and As)	Nanofiber membrane absorption as Third Level Method for Small-scale		
Application	Heavy-metal Contaminated Wastewater	Resort Hotels Public Markets Ports and Airports Residential Units	Quick Service Restaurants, Dairy Processing Plants	Tannery and Gold Melting Companies	Emerging Group of Micropollutants (PPCP)	Small-scale Mine Tailings
						Small-scale Tailings
						Wastewater from Distillery, Sugar mill/pulp/peppermill and textile
						Color Problem of a Textile Industry in the Philippines

**B.2.1.1.3:** Research and Development Projects for Wastewater Treatment. (cont.)

WASTEWATER TREATMENT TECHNOLOGIES (COMPLETED) PROJECTS 2010-2017			
Biological	Earth Materials (clay)		Advanced Treatment (membranes)
Lab scale			
Beach Scale/ Prototype	High Grade Ceramics Development Utilizing Kaolinite Clay Deposits in Ilocos Norte Province	Prototyping of Ceramic Water Filtration System: Ceramic Pot Filter with Colloidal Silver	Low-cost Modular Type Rainwater Collection
Pilot Scale	Field Testing of Ceramics-based Water Filtration System	Performance Testing of Ceramic Pot Filter/ Dome Type Ceramic Water Filter	Improved Ceramic Products
Materials Used	Local Kaolinite Clay	Red Clay	Plastic with Nano Material Coating
Results of Study	Resource Verification of Kaolinite Clay in the Eastern Part of Ilocos Norte. Deployed in Leyte	Redesigned, Established Production Centers	Sustainability Issues - Maintenance of Facility; and - Product Quality
Implementing Agency	Mariano Marcos State University	ITDI-DOST	Mariano Marcos State University ITDI-DOST
Project Leader	Dr. Chelo Pascua	Ms. Josefina Celorico/ Dr. Blessie Basilia	Dr. Blessie Basilia

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