National State of Oceans and Coasts 2018:

Blue Economy Growth

INDONESIA

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Acronyms and Abbreviations

ADB	–	Asian Development Bank
AEI	–	Air Emissions Inventory
AFF	–	Agriculture, forestry and fishery
APFIC	–	Asia-Pacific Fishery Commission
Arlindo	–	*Arus Lintas Indonen* (Indonesia Throughflow)
ASEAN	–	Association of Southeast Asian Nations
ASLs	–	Archipelagic Sea Lanes (ALKI)
ATS	–	Arafura-Timor Seas
bbl	–	barrel of oil
BBOE	–	billion barrels of oil equivalent
BIOFIN	–	UNDP Biodiversity Finance Initiative
BMG	–	Agency for Meteorology and Geophysics
BMKG	–	Badan Meteorologi, Klimatologi, dan Geofisika (Meteorology, Climatology, and Geophysical Agency)
BNPB	–	Badan Nasional Penanggulangan Bencana (National Disaster Management Authority)
BOBLME	–	Bay of Bengal Large Marine Ecosystem
BOD	–	biochemical oxygen demand
BOP	–	Balance of Payments
BTDC	–	Bali Tourism Development Corporation
CBD	–	Convention of Biological Diversity
CCSBT	–	Commission for the Conservation of Southern Bluefin Tuna
CF	–	Cooperation Forum (for the Marine Electronic Highway)
CITES	–	Convention on Trade of Endangered Species
cm	–	centimeter
CMSP	–	Coastal and Marine Strategic Plan
CO_2	–	carbon dioxide
COD	–	chemical oxygen demand
COREMAP	–	Coral Reef Rehabilitation and Management Program
CSR	–	corporate social responsibility
CTI-CFF	–	Coral Triangle Initiative for Coral Reefs, Fisheries and Food Security
DDT	–	dichlorodiphenyltrichloroethane
DEN	–	Dewan Energi Nasional (National Energy Council)
DFS	–	District Fisheries Services
DGST	–	Directorate General of Sea Transportation
DPSIR	–	drivers-pressures-state-impacts-response
DSCP	–	Dugong and Seagrass Conservation Project
DSDP	–	Denpasar Sewerage Development Project
DWT	–	deadweight tonnage
EAS	–	East Asian Seas
eCDT	–	Electronic Catch Documentation and Traceability System
EEZ	–	exclusive economic zone
EIA	–	United States Energy Information Administration
EIA	–	environmental impact assessment
ENSO	–	El Niño–southern oscillation
EOP	–	effect on productivity approach
ESDM	–	Kementerian Energi dan Sumber Daya Mineral (Ministry of Energy and Mineral Resources)
EU	–	European Union
FAD	–	fish aggregating devices
FAO	–	Food and Agriculture Organization of the United Nations
FMAs	–	fisheries management areas (or WPP)
FQR	–	Formal Qualification Review
ft	–	foot; feet
GDP	–	gross domestic product
GEF	–	Global Environment Facility
Gg	–	giga-gram (= 1000 tonnes)
GHG	–	greenhouse gas
GIWA	–	Global International Waters Assessment
GMF	–	Global Maritime Fulcrum
GMT	–	Greenwich Mean Time
GNI	–	gross national income
GOI	–	Government of Indonesia
GPA	–	Global Programme of Action for the Protection of the Marine Environment from Land-based Activities
GRDP	–	gross regional domestic product
GT	–	gross tonnage

GVA – gross value added
ha – hectare
HCH – hexachlorocyclohexane
HDI – human development index
HSTWG – Hydrographic Survey Technical Working Group (for the Marine Electronic Highway)
IATTC – Inter-American Tropical Tuna Commission
IBSAP – Indonesian Biodiversity Strategy and Action Plan 2015-2020
ICM – Integrated coastal management
ICP – Indonesian Crude Price
IDR – Indonesian rupiah
ILO – International Labor Organization
IMO – International Maritime Organizations
IOC – Intergovernmental Oceanographic Commission
IOD – Indian Ocean Dipole
IOPP – International Oil Pollution Prevention
IOTC – Indian Ocean Tuna Commission
IPB – Institut Pertanian Bogor (Bogor Agricultural University)
ISIC – International Standard Industrial Classification of All Economic Activities
ISLME – Indonesian Sea Large Marine Ecosystem
ITDC – Indonesia Tourism Development Corporation
IUCN – International Union for Conservation of Nature
IUU – Illegal, Unregulated and Unreported
kg – kilogram
KEMENPAR – Kementerian Pariwisata (Ministry of Tourism)
KIARA – Koalisi Rakyat untuk Keadilan Perikanan (People's Coalition for Fisheries Justice)
KKP – Kementerian Kelautan dan Perikanan (Ministry of Marine Affairs and Fisheries)
KLHK – Kementerian Lingkungan Hidup dan Kehutanan (Ministry of Environment and Forestry)
km – kilometer
km^2 – square kilometers
kW – kilowatt
kWh – kilowatt-hour
L – liter
LCU – local currency unit (Indonesian rupiah)
LIPI – Lembaga Ilmu Pengetahuan Indonesia (Indonesian Institute of Sciences)
LME – large marine ecosystem
LNG – liquefied natural gas
m – meter
m^2 – square meter
m^3 – cubic meter
MBOEPD – Million barrels oil equivalent per day
MBOPD – Millions of Barrels of Oil Per Day
MCS – monitoring, control, and surveillance
MEH – Marine Electronic Highway Demonstration Project
MEHWG – Marine Electronic Highway Working Group
Mg – megagram (=1000 kilograms = 1 tonne)
MICE – Meetings, Incentives, Conferences and Exhibitions
mm – millimeter
MMAF – Ministry of Marine Affairs and Fisheries (Kementerian Kelautan dan Perikanan or KKP)
MMSCFD – million standard cubic feet per day
MOE – Ministry of Environment
MOEF – Ministry of Environment and Forestry
MoEMR – Ministry of Energy and Mineral Resources
MoF – Ministry of Finance
mpdl – Meter di atas permukaan laut (meters above sea level)
MRV – Measurement, Reporting and Verification
MSC – Marine Stewardship Council
MSP – Marine spatial planning
N – nitrogen
NACA – Network of Aquaculture Centers in Asia-Pacific
NDCC – National Dugong Conservation Committee
NGOs – non-government organizations
NH_4 – ammonium
NO_3 – nitrate
no. – number
NOEP – National Ocean Economics Program
NP – Non-motorized vessels propelled by oars or sails
NSOC – National State of Oceans and Coasts
OECD – Organisation for Economic Co-operation and Development
OHI – Ocean Health Index
OPEC – Organisation of Petroleum Exporting Countries

OTEC	–	ocean thermal energy conservation
P	–	phosphorus
P2O-LIPI	–	Pusat Penelitian Oseanografi - Lembaga Ilmu Pengetahuan Indonesia (Center for Oceanographic Research-Indonesian Institute of Sciences)
PCBs	–	polychlorinated biphenyls
PEMSEA	–	Partnerships in Environmental Management for the Seas of East Asia
Pg	–	petagram (= 1 billion tonnes)
PMU	–	Project Management Unit
POPs	–	persistent organic pollutants
PPP	–	public-private partnership
PPP	–	purchasing power parity
PROPER	–	Program for Pollution Control, Evaluation and Rating
PT	–	*Perseroan Terbatas* (Limited Liability Company)
PW	–	powered or motorized vessels propelled by engines
R&D	–	research and development
RAN-API	–	*Rancana Aksi National – Perubahan Iklim* or Indonesia's National Action Plan on Climate Change Adaptation 2015-2019
REDD+	–	reducing emissions from deforestation and forest degradation, and role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries
RFMO	–	Regional Fisheries Management Organizations
RPJMN	–	Rencana Pembangunan Jangka Menengah Nasional (National Medium-term Development Plan 2015-2019)
RSW	–	refrigerated sea water
SAP	–	Strategic Action Programme
SCS	–	South China Sea
SCSLME	–	South China Sea Large Marine Ecosystem
SDGs	–	Sustainable Development Goals
SDS-SEA	–	Sustainable Development Strategy for the Seas of East Asia
SEAFDEC	–	Southeast Asian Fisheries Development Center
SIMP	–	Seafood Import Monitoring Program
SOC	–	State of Oceans and Coasts
SOMS	–	Straits of Malacca and Singapore
SSME	–	Sulu-Sulawesi Marine Ecoregion
SSS	–	Sulu-Sulawesi Seas
SST	–	sea surface temperature
TCEC	–	Turtle Education and Conservation Center
TCF	–	Trillion cubic feet
TDA	–	Transboundary Diagnostic Analysis
TFC	–	trillion cubic feet
Tg	–	teragram (= 1 million tonnes)
TMFA	–	Tunas Mekar Fisher Association
TO3	–	Operation Terminal 3
tonne	–	1000 kilograms
TPS	–	*Tempat Penampungan Sementara* (Temporary Shelter for garbage)
TRISMADES Project	–	Trikora Seagrass Management Demonstration Site
TTCI	–	Travel and Tourism Competitiveness Index
TTEG	–	Tripartite Technical Expert Group (for the Marine Electronic Highway)
TWAP	–	Transboundary Waters Assessment Programme
ULCC	–	Ultra-Large Crude Carriers
UNCLOS	–	United Nations Convention of the Law of the Sea
UNCTAD	–	United Nations Conference on Trade and Development
UNDP	–	United Nations Development Programme
UNEP	–	United Nations Environment Programme
UNESCO	–	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	–	UN Framework Convention on Climate Change
UNWTO	–	UN World Tourism Organization
USA	–	United States of America
USAID	–	United States Agency for International Development
USD	–	United States dollar
VLCC	–	Very Large Crude Carrier
WA	–	Working Area
WCPFC	–	Western and Central Pacific Fisheries Commission
WEF	–	World Economic Forum
WTO		World Trade Organization
WTTC		World Travel and Tourism Council
WWF		World Wildlife Fund
WWTP		wastewater treatment plant
YPBB		Yayasan Pengembangan Biosains dan Bioteknologi
ZP	–	Zoning Plan
µm	–	micrometer

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- KTA – KLHK: Directorate of Land and Water Conservation, MOEF
- PROPER – KLHK: Program for Pollution Control, Evaluation and Rating, MOEF
- KEMENPAR: Ministry of Tourism and Creative Economy
- Kementerian Perhubungan: Ministry of Transportation
- SDP: Ministry of Transportation's Research and Development
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- Indonesian Sea and Coast Guard
- KLN: Kementerian Luar Negeri (Ministry of Foreign Affairs)
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EXECUTIVE SUMMARY

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 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.

> "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 National State of Oceans and Coasts (NSOC) report of Indonesia aims to:

- Compile data and information related to the country's ocean uses and values, ocean health and pressures, ocean governance structure, and blue economy initiatives to serve as baseline information on blue economy development in Indonesia;
- Contribute to the regional and national blue economy assessment and monitoring of the implementation of the National Ocean Policy, Sustainable Development Strategy for the Seas of East Asia (SDS-SEA), SDGs, other related international agreements, and national laws and policies; and
- Aid policy-making, planning and management of the coastal and marine areas and resources of the country, and highlight the need to protect the marine environment and ecosystems to optimize the benefits of blue economy and ecosystem services.

2. Bridging Two Oceans and Two Continents

Indonesia is a unique archipelago flanked by two oceans – Indian Ocean and Pacific Ocean, and lies between two continents of Asia and Australia. Indonesia's geographical location extends from 6° 04′ 30″ North latitude to 11° 00′ 36″ South latitude, and between 94° 58′ 21″ and 141° 01′ 10″ East longitude. Straddling the equator, the sprawling archipelago of 16,056 islands encompasses the sixth-largest exclusive economic zone (EEZ) in the world. The coastline of Indonesia reaches 99,093 kilometers (km), the third longest in the world after Canada and Norway (BPS, 2016). In terms of area, Indonesia is the 15th largest country in the world. Indonesia's area of national jurisdiction is composed of 1,916,906.77 square kilometers (km^2) of land (BPS, 2018), and 2.8 million km^2 of archipelagic waters, 0.8 million km^2 of territorial sea, and 2.7 million km^2 of exclusive economic zone or EEZ (BPS, 2016).

With such a large ocean to land ratio, its climate is strongly influenced by the seas within the Indonesian archipelago and around its geopolitical territory. Indonesia is a tropical country with a wet, hot, humid climate the entire year. The main climate variation in Indonesia is a seasonal factor known as monsoon. Temperatures and rainfall vary across the archipelago because of elevation and monsoon patterns.

Given its geographic location, Indonesia is at the center of atmospheric circulation activity as well as global ocean circulation. The circulation of ocean currents is driven by the large sea-level differences between the Indian and Pacific Oceans. Ocean currents in the waters of Indonesia are very dynamic, and influenced by ***Arlindo***[a]—the **Indonesian throughflow**—the water mass transport from the Pacific Ocean to the Indian Ocean through various straits and channels in Indonesia. Indonesian waters, especially the eastern part of the archipelago, play an important role in the global water mass transport system, in which warm water at the surface conveys heat to the deeper cold water in what is known as the great ocean conveyor belt.

Indonesia is also situated on two continental plates – Eurasian plate (Sunda shelf) and Australian plate (Sahul shelf), and between two oceanic plates – Philippine Sea Plate-Pacific Plate and Indian Ocean plate. The western Indonesia is part of the Sunda Shelf, which covers islands like Sumatera, Kalimantan, and Java, and characterized by shallow waters with depth less than 200 m. The Sahul Shelf is mostly the eastern part of Indonesia, such as Sulawesi, Ambon and Papua, and characterized by deep seas, such as Arafura Sea (3.6 km), Flores Sea (5.1 km), Savu Sea (3.4 km), and Flores Sea and Banda Sea (5 km). Based on the bathymetry map, eastern Indonesia shows a great depth, ranging from 2 km (Timor Trough) to over 7 km (Weber Basin).

Predominantly mountainous, Indonesia has around 400 volcanoes, of which 127 are active. The subduction of the Indian Ocean plate under the Eurasian continental plate forms a volcanic arc in

[a] "Arlindo" is an acronym for Arus Lintas Indonen, meaning 'Indonesia Throughflow' in Bahasa Indonesia.

the western part of Indonesia. Active volcano chains form Sumatra, Java, Bali, and the islands of Nusa Tenggara. On the other hand, movement of the Indian-Australian plate and the Philippine-Pacific plate controls the tectonics in eastern Indonesia. Usually, the epicenter of earthquake is located along tectonic plate collision course. Indonesia is part of the Pacific Ring of Fire.

Indonesia has the world's largest area of mangrove forests, which cover about 3.7 million ha, and contain five times as much carbon per hectare as tropical forests. The coral reef area in Indonesia is around 2.5 million ha or about 18% of total global coral reef area, and found in areas that are part of the Coral Triangle region, which contains the richest marine biodiversity on earth. A global hotspot and priority for conservation, Indonesia is home to world-renown marine reserves, such as the Bird's Head Seascape and Sunda Banda Seascape. Its coastal and marine waters make up one of the most fertile fishing grounds in the world: Indonesia is the second largest fish producer in the world, second only to China. Roughly 55% of this production comes from coastal areas, particularly from mangroves, estuaries, seagrass beds, and coral reefs.

3. The People and Economy of Indonesia

A number of important factors and recent developments have been shaping the coastal and marine areas of Indonesia. In broad terms, the coastal and marine sectors like all other sectors respond to macro-level factors. These include: (a) population growth and changes in demographic attributes; (b) economic growth; (c) coastal land- and sea-use changes (including urbanization, increased settlements in coastal areas, deforestation, conversion of coastal habitats, reclamation, infrastructure development); (d) changes in social dimensions; and (e) evolution of policies and institutional adaptations (such as economic deregulation, decentralization, becoming parties to international agreements and the associated obligations).

Demographic Features

Indonesia's population was 265 million people in 2018, and expected to reach as many as 267.92 million people by 2020. Indonesia is the fourth most-populated country in the world, after China, India, and the United States of America. Around 65% of the population lives in the coastal areas. Jawa Barat (West Java) is the province with the highest population among the 34 provinces.

The population density of Indonesia increased from 107 people/km^2 in 2000 to 138 people/km^2 in 2018. The province with the highest density in 2018 were DKI Jakarta (15, 764 people/km^2), while the province with lowest density were North Kalimantan or Kalimantan Utara (9 people/km2) and West Papua or Papua Barat (9 people/km^2).

The age groups of 0-14 years old (young or minors), and 65 years old and above (seniors) are considered to be the dependents of the working age group (15-64 years old). The dependency ratio has been declining since the 1970s, with the proportion of the working age group increasing, while the age group of 0-14 years old decreasing, and age group of 65 years old and above only slightly increasing.

The urban population is around 55% of the total population in 2018. The percentage of urban population is increasing by an average of 2.6% in 2010-2018 as the urban economy grows and attracts rural people to the urban working areas. Consequently, urban areas will need more housing, and urban infrastructure and services, such as water supply, energy, roads, transportation systems, sanitation, wastewater and solid waste management, etc. On the other hand, the share of rural population to total population has been decreasing from 2010 to 2018, creating pressures on agricultural and food production. Urbanization has direct effects on biodiversity and the state of the coastal and marine environment. The expansion of coastal urban development places increasing pressure on the natural environment through the effects of land clearing, habitat conversion, groundwater extraction, waste disposal and pollution. Building along the foreshore areas affects the coastal landscape and processes.

Economic Development

Indonesia is the largest economy in Southeast Asia. The real GDP (in constant 2010 prices) was US$1.15 trillion in 2018. The gross national income or GNI (in constant 2010 prices) was US$1.11 trillion in 2018, slightly lower than the GDP. More than 80% of the economy is concentrated in Java and Sumatra. However, Maluku Utara had the highest growth rate among the 34 provinces in 2017 and 2018.

The GDP growth rate has been declining since 2010. From 6.22% growth rate in 2009-2010, the GDP grew by only 5.17% in 2017-2018. Nevertheless, such growth rate is still good enough amid the global economic slowdown. Moreover, GDP per capita (constant 2010 US$) increased from US$ 3122 in 2010 to US$ 4285 in 2018.

Services sector constituted 54.2% of total GDP in 2018, an increase from 41.4% share in 2011. The share of industry has been declining, from 44.8% of total GDP in 2011 to 41.4% in 2018 while the share of Agriculture, Forestry and Fishery (AFF) sector in the national economy has remained stable in 2011-2018, averaging 13.7% during this period. The fishery subsector contributed 2.60% of GDP in 2018.

Inflation went down from 6.36% in 2015 to 3.2% in 2018.

Unemployment is 4.51% of the total labor force in 2018. The AFF sector is still the dominant source of livelihood and employment, with 38 million people employed in this sector in 2016. Around 27 million people are working in the trading, restaurant and accommodation services sector, and 16 million people are employed in the manufacturing industry sector.

Trade is 43% of GDP in 2018. The contribution of Indonesia to the international trade is seen from the value of exports and imports, worth US$ 176 billion and US$ 178 billion, respectively (WTO, 2015). The domestic component of Indonesia's exports is the fifth highest among exporting countries (OECD, 2017). This means that trade has a significant role in the economic growth of the country.

Social Sustainability

As reported by UNDP (2018), Indonesia's human development index[b] (HDI) value for 2017 is 0.694— which put the country in the medium human development category. In 2018, Indonesia's HDI further improved, and went up to **0.707**, which puts the country in the **high** human development category—positioning it at 111 out of 189 countries and territories (UNDP, 2019). In 2018, Indonesia's life expectancy at birth was 71.5 years while mean years of schooling was eight (8) years and expected years of schooling was 12.9 years. Between 1990 and 2018, Indonesia's GNI per capita increased by about 155.9%. In 2018, the GNI per capita (2011 PPP$) was US$11,256.

Like all averages, the HDI masks inequality in the distribution of human development across the population at the country level. When the HDI value is discounted for inequality, it falls to **0.584**, a loss of 17.4% due to inequality in the distribution of the HDI dimension indices (UNDP, 2019). Papua province has the lowest HDI (0.6006), while DKI Jakarta has the highest HDI (0.8047) in 2018.

The poverty incidence declined during 2010-2018. The proportion of poor declined to 9.8% of the total population in 2018, using the poverty headcount ratio at national poverty line. Among the 34 provinces, Papua province has the highest percentage of poor.

Water is a basic necessity, and an important resource for sustaining life. Access to clean and safe freshwater is vital for economic growth and sustainable, inclusive and resilient development. Average income levels have increased dramatically over the last 20 years, yet 28.5 million Indonesians still lack safe water, and 71.9 million people lack access to basic sanitation facilities, especially in the rural areas. Inadequate provision of water and sanitation services has an impact not only on human health, but also on the health of the environment, through pollution of waterways and coastal waters in particular. Discharges of untreated wastewater to rivers and coasts have affected surface and marine water quality, which have consequent effects on fisheries, habitats and marine life, water supply, recreation and tourism.

[b] The human development index (HDI) is a summary measure for assessing long-term progress in three basic dimensions of human development: (a) a long and healthy life (measured by life expectancy), (b) access to knowledge (measured by mean years of education among the adult population; and access to learning and knowledge by expected years of schooling for children of school-entry age), and (c) a decent standard of living (measured by Gross National Income (GNI) per capita expressed in constant 2011 international dollars converted using purchasing power parity (PPP) conversion rates) (UNDP, 2018).

Table 1: Key Geographic, Demographic and Socioeconomic Indicators.

Indicators	2015	2018
Land area (km²)[a]	1,916,906.77	1,916,906.77
Coastline (km)[b]		99,093
Territorial sea (km²)[b]	800,000	
Archipelagic waters (km²)[b]	2.3 million	
Exclusive Economic Zone, EEZ (km²)[b]	2.7 million	
Population, total[c]	258,383,256	267,663,435
Coastal population (% of total population)[b]	65	65
Urban population (% of total population)[c]	53.31	55.33
Population growth (annual %)[c]	1.27	1.13
Population density (persons/km²)[c]	142.63	147.75
Gross domestic product (GDP)[c] (in constant 2010 US$ prices)	988,128,596,686	1,146,844,815,417
GDP per capita (in constant 2010 US$ prices)	3,824	4,285
Gross national income (GNI)[c] (in constant 2010 US$ prices)	956,489,622,342	1,112,082,625,438
Human development index (HDI)[d]	0.696 medium HD category	0.707 high HD category
GNI per capita[d] (using PPP, in constant 2011 international $ prices)	10,029	11,256
Life expectancy at birth (years)[d]	70.8	71.5
Mean years of schooling[d]	7.9	8
Expected years of schooling[d]	12.8	12.9
Access to least basic drinking water services[c] (% of population)	87.96	89.34 (as of 2017)
People using safely managed drinking water services[c] (% of population)	--	--
Access to least basic sanitation services[c] (% of population)	69.38	73.13 (as of 2017)
People using safely managed sanitation services[c] (% of population)	--	--
Poverty headcount ratio at national poverty lines[c] (% of population)	11.2	9.8
Ocean economy[e] (Gross value added or GVA of ocean economic sector, US$, in constant prices)	188.5 billion (20% of GDP)	
Employment in ocean economy[f]	5.2 million (as of 2013); 27.95 (as of Aug 2015)	
Estimated value of coastal and marine ecosystem services (US$)[e]	403 billion to 411 billion	
Percentage of coastline with ICM plan[e]	48.55%	

Table 1: Key Geographic, Demographic and Socioeconomic Indicators. (cont.)

Indicators	2015	2018
Marine protected area (ha)[e] (Percentage of total marine area)	17,302,801.16 6.4%	
Ocean health index (OHI) score[g]	65	65

Sources:

[a] *BPS. Statistik Indonesia 2019*

[b] *BPS. Statistics of Coastal and Marine Resources 2016.*

[c] *World Bank, 2019.*

[d] *UNDP, 2019.*

[e] *Estimated or reported by TWG/consultants for the NSOC Report.*

[f] *Two approaches for estimating the employment in the ocean economic sector were used.*

[g] *OHI (http://www.oceanhealthindex.org/region-scores/scores/indonesia)*

4. Ocean Values: Where Are We Now?

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 on. Coastal and marine ecosystems provide a variety of *ecological functions* that directly and indirectly translate to economic services with value to humans. 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. (OECD, 2016).

The first component of the ocean economy—**ocean economic sector**—was estimated to be US$ 188.5 billion, contributing around 20% to the Indonesian GDP based on the GDP of seven *established* ocean economic activities or industries: fisheries, marine tourism, marine transportation, offshore oil and gas and minerals, marine industry (ocean-related manufacturing), marine construction, and government (maritime services have not been estimated yet). The highest contribution was from marine construction and the lowest was marine transportation. This indicates the need to invest more in the marine transportation sector as ports and shipping are crucial for trade, commerce, travel and tourism, which are among the biggest contributors to Indonesia's GDP. Impacts of marine construction on the ocean ecosystems should be considered as this sector expands with more coastal developments taking place. The sector with a higher growth rate in 2014-2015 was fisheries and aquaculture industry. This has positive impacts on subsistence livelihood, food security, and jobs and incomes from commercial fishing and aquafarming; nonetheless, overfishing issues should be addressed. The GVA of *emerging* ocean industries should be included in future ocean economy accounts as these industries develop and as data become available.

There were 5.2 million people employed in the ocean economic sector in 2008, of which 1.85 million worked in the marine construction sector and 1.69 million people in the fisheries and aquaculture. Another estimate of employment in the ocean industry showed that as of 2016, there were 28.58 million people working in the ocean economic sector. This does not include yet the people employed in the maritime services and marine-related public/government sectors. as well as emerging ocean industries.

In addition, there were 78,000 seafarers in 2016, mostly working in international vessels, according to the Human Resource Development of Ministry of Transportation (2017).

The second component of the ocean economy—**coastal and marine ecosystems and oceanic waters**—has a value of around US$ 403-411 billion. Note that this includes the provisioning services that are already captured in the value-added of the ocean economic sector above. The other major ecosystem services that were estimated in this report are the nonmarket services, which are not usually captured by the ocean economic sector accounts: cultural services (existence value), regulating services (carbon sequestration), and supporting services (habitat, supporting aquaculture and mariculture).

Table 2: Ocean Industry: GDP and Employment.

Ocean economic activities/Sector	GDP (US$, in millions, in constant prices)			Employment	
	2013	2014	2015	2008	2015 (Aug)
Fisheries and Aquaculture	13,048.10	14,006.64	15,179.24	1,687,560	11.32 M
Mining (minerals, oil and gas)	23,209.49	22,721.26	22,759.96	69,397	0.66 M
Marine industries (manufacturing)	34,020.96	37,248.61	40,057.33	302,201	4.58 M
Marine transportation (shipping)	2,027.59	2,183.24	2,235.09	840,390	2.04 M
Marine tourism and recreation	18,055.43	19,097.44	19,929.96	343,080	7.71 M
Marine construction	57,238.49	61,230.79	65,302.51	1,850,627	1.64 M
Maritime services				190,444	
Defense/Government	21,440.66	21,950.35	22,992.14		
TOTAL	**169,040.72**	**178,438.33**	**188,456.23**	**5,283,699**	**27.95 M**
Contribution to Total GDP (%)	**19.32**	**19.42**	**19.69**		
Share in Total Employment (%)				**5.11**	**24.34**

Table 3: Valuation of Coastal and Marine Ecosystem Services.

Habitat	Area (ha)[a]	Condition[a]	Valuation[b] (US$/ha)	Valuation (US$)
Mangroves	2013: 3,989,689.08 2014: 4,418,105.57 2015: 3,668,075.6	Good: 21.48% Fair: 8.55% Poor: 7.01% Unidentified: 48.43%	25,779.00	**94,559,331,204.00**
Seagrass	2013: 1,496,996.78 2014: 847,385.33 2015: 474,920.93 2017: 150,693.16	Good: 20.62% Moderate: 6.14% Damaged: 4.43% Unidentified: 68.81%	106,199.59	**15,993,993,844.70**
Coral reefs	2013: 2,692,301.69 2014: 3,185,616.85 2015: 2,692,302.00 2017: 2.5 million	Very good: 5.00% Good: 27.01% Moderate: 37.97% Damaged: 30.02%	115,698.61	**289,246,525,000.00**
Oceanic	Territorial water: 80,000,000 EEZ: 270,000000	840,390	41.97	**3,357,600,000 to 11,331,900,000**
TOTAL				**403,157,450,048.70 to 411,131,750,048.7**

Source: [a] *BPS. Statistics of Coastal and Marine Resources - 2014, 2015 and 2016; P2O-LIPI 2017; Hermawan, et al. 2017.*
[b] *Fahrudin, 2017.*

In addition to their provisioning services (food, water, wood, medicines, etc.), coastal and marine ecosystems play an essential role in providing breeding, nursery and feeding grounds for fish and marine species. For the poor who are highly resource dependent, ecosystems essentially provide them with food, livelihoods, shoreline protection, and recreational areas. Coastal ecosystems perform as natural coastal infrastructures by lessening erosion and flood exposure, supporting coastal water quality, and serving as natural barriers by reducing wave height and strength, dampening wind, retaining sediments, and providing additional shoreline protection against storm surge and tsunami. The value of shoreline protection service should be further estimated since this is an ecological function that has tangible benefit to people, especially in the coastal areas, and considering their role in the face of increasing intensity and frequency of extreme weather events.

Blue carbon is the carbon captured by coastal ecosystems, such as mangrove forests, seagrass meadows, tidal or salt marsh, and potentially macroalgae. These ecosystems play an important role in climate change mitigation by sequestering the greenhouse gas CO_2 from the atmosphere and storing it in plant biomass (leaves, stems, branches, and roots), their underlying sediments, underground and below-ground biomass. IUCN studies have shown that for each hectare of mangrove replanted, the CO_2 removal from the atmosphere is estimated to be between 1,500 and 2,000 tonnes – this is more than a tropical rainforest. Moreover, coastal ecosystems can store carbon for thousands of years, but they can release the CO_2 stored in biomass, sediments and soil when they are damaged.

Ocean Health

The major environmental issues in the coastal areas include habitat loss, pollution, over-exploitation and unsustainable use of marine resources, coastal erosion, loss of water absorption capacity, and in some areas sea water intrusion.

Ocean health index. Using a common framework, the Ocean Health Index (OHI) measures progress towards achievement of ten widely-agreed public goals for healthy oceans: food provision, artisanal fishing opportunities, coastal livelihoods and economies, natural products, recreation and tourism, carbon storage, coastal protection, clean waters, biodiversity, and sense of place. The OHI score reflects the impacts of human activities, policies and interventions on ocean health. For Indonesia, the OHI score in 2018 is **65** and is ranked at 145 among 221 EEZs.[c] The OHI score of Indonesia is lower than the global OHI score of 70. The score remains far from 100 (perfect score), indicating that the oceans and marine life would fare better, and more benefits would be gained if the ocean is used in more sustainable ways. Looking at the evaluation of each goal, Indonesia scored lowest in terms of food provision, and tourism and recreation goals, but got the highest score for natural products goal (92), followed by coastal protection (88) and biodiversity goals (85). The extent, condition and integrity of the coastal and marine ecosystems, however,

[c] http://www.oceanhealthindex.org/region-scores/annual-scores-and-rankings

need to be maintained to continue getting benefits of coastal protection, carbon storage, natural products and biodiversity. The low score for food provision shows the need to make harvest more sustainable by enhancing fishing and culture practices, increasing sustainable mariculture production, and improving the management of wild-caught stocks.

Mangrove forests. The mangrove ecosystem in Indonesia is the largest mangrove forest in Southeast Asia, about 76% of the total mangrove forest in this region. The mangrove forest in Indonesia is around 36,680.7560 km^2 in 2015 (BPS, 2016). Mangrove species diversity is also high, with the dominant mangrove species found to contain 47 true mangrove species, and 22 associated species of mangroves. However, the mangrove area with good quality decreased by 11.90%. Conversion of mangroves to aquaculture farms and encroachment of human settlements in mangrove areas have resulted in the significant decrease of mangrove areas in Indonesia.

Coral reefs. The diversity of coral species in Indonesia is very high, with 590 species of 82 coral genera, with 3 important genera of Indonesian coral reefs, *Acropora* (104 species), *Montipora* (39 species), and *Porites* (24 species). BPS reported that the coral reef area in Indonesia was 26,923.02 km^2 in 2015. In 2017, the Center for Oceanographic Research (P2O-LIPI) released its estimate of Indonesia's coral reef cover: it went down to 2.5 million ha (25,000 km^2). Based on the monitoring of 1064 stations in 108 locations throughout Indonesian waters, P20-LIPI (2017) reported the following condition of coral reefs: very good (6.39%), good (23.40%), fair or moderate (35.06%), and damaged (35.15%). Destructive fishing, siltation and sedimentation due to deforestation and mining activities in the watershed areas as well as unregulated coastal developments, loss of mangroves, pollution, etc. have affected the condition and areal coverage of coral reefs. Coral bleaching due to higher sea temperatures resulting from El Niño affected coral reefs in1983 and 1997-98.

Seagrass beds. There are 15 seagrass species, and two species in the form of specimen in Indonesia – out of 24 species of seagrass found in the tropical Indo-Pacific region. In 2017, P2O LIPI reported that the extent of the seagrass ecosystem is 150,693.16 ha (1,506.9 km^2), with 41.76% in less healthy condition. BPS (2016) also reported a significant decline in seagrass area– from 14,969.97 km^2 in 2013 to 4,729,21 km^2 in 2015, and seagrass beds in good condition were only 20.6% in 2015. The decrease in seagrass area and deteriorating condition are caused by both natural (e.g., waves, strong currents, storms, earthquakes, and tsunami), and man-made factors. Seagrass ecosystems in some parts of Indonesia are under threat from pollution, siltation and sedimentation, tourism activities, ports, boating traffic, aquaculture, reclamation, dredging, sand mining, and loss of mangroves.

Coastal and river water quality. Generally, marine water quality in Indonesia is in good condition and complying with the water quality standards established under *Decree of Environment Ministry Number 51/2004*. However, some sample locations (several big ports) are already in fair condition for DO parameter, and poor condition for nitrates and phosphates parameters. Coastal waters in many provinces have levels of nitrate and phosphate that are higher than water quality standards for these parameters. Rivers in each province are also polluted, with 25 provinces having rivers with *heavy polluted* status, either entire stretch of the river or part of the river (BPS, 2019).

Table 3: Valuation of Coastal and Marine Ecosystem Services.

Parameters	Rating
Dissolved oxygen (DO)	Fair
Nitrates	Poor
Phosphates	Poor
Heavy metals	No data
Total suspended solids (TSS)	Good

Note: For standard values for marine water quality, refer to Ministry of Environment Decree No. 51/2004.
Rating of marine water bodies:

- **Excellent**: 98-100% of water bodies comply with the water quality criteria and standards, and fully support the intended use or classification of the water body
- **Good**: 75-97% of water bodies partially comply with the water quality standards
- **Fair**: 50-74% of water bodies partially comply with the water quality standards
- **Poor**: less than 50% of water bodies comply with the water quality criteria and standards, and do not support the intended use or classification of the water body.

Source: Analyses from environment statistics for Indonesia 2016 (TWG).

Organic waste from industry and households have significant impacts on the marine environment. Nutrient loading results in eutrophication, fish kills, and algal blooms. Indonesia also daily produces 0.48-1.29 tonnes of plastic waste plus other materials like paper, polystyrene, rubber, fabric, metal , etc. There is a need to invest in solid waste and wastewater management facilities, and sustainably operate them to effectively serve more areas and reduce pollution and its impacts. Stormwater management is also crucial to address agricultural and urban runoff as well as control flooding.

Transboundary issues. Indonesia is surrounded and located within four large marine ecosystems (LMEs), namely Bay of Bengal (BOBLME), Indonesia Seas (ISLME), South China Sea (SCSLME), and Sulu-Sulawesi Seas (SSS). The SSS is most vulnerable to climate change. The major transboundary issues in these LMEs are:

(a) Destructive fishing, and unsustainable exploitation of fish and other living resources
(b) Pollution, in particular nutrients and plastic waste. All four LMEs are at very high risk from microplastic waste. Persistent organic pollutants (POPs) and suspended solids from deforestation and agricultural runoff are additional pollution issue in SCSLME. Oil pollution is an additional issue in BOBLME and some parts of the ISLME. Sediments, heavy metals and POPs are additional issues in BOBLME.
(c) Habitat modification. Areas of mangroves, coral reefs and seagrass beds have significantly decreased in the recent decades.

The BOBLME and SSS got OHI score of 62, while SCSLME and ISLME got 63 and 76, respectively. These OHI scores are below the average compared to other LMEs. Based on a combined measure of the Human Development Index and the averaged indicators for fish & fisheries, and pollution & ecosystem health modules, the overall risk factor is **very high** for all four LMEs (TWAP 2015).

As the waters warm, the Arafura and Timor Sea (ATS) region plays an important role in world ocean circulation, as it is situated between the Indian Ocean and the Pacific Ocean. Based on the Transboundary Diagnostic Analysis report for ATS, the major concerns are:

(a) Unsustainable fisheries and decline and loss of living coastal and marine resources;
(b) Decline and loss of biodiversity and key marine species;
(c) Modification, degradation and loss of coastal and marine habitats;
(d) Marine and land-based pollution, and
(e) Impacts of climate change.

5. Harnessing the Oceans: Benefits, Pressures and Policy Response

Among the seven ocean economic activities or industries, four – marine fisheries and aquaculture, coastal and marine tourism, ports and shipping, and offshore oil and gas – are directly related to use of ocean resources. The following are their contribution to the economy, jobs and livelihood as well as the pressures they create on ocean resources, constraints these sectors face, and the response measures.

Fisheries and Aquaculture

Indonesia is the second-largest fish producer in the world after China, accounting for 8% of the world capture fisheries production. Wild capture fisheries and aquaculture (including seaweeds and other aquatic plants and non-food products) production was seven million tonnes and 16 million tonnes, respectively in 2017. However, in terms of value, capture fisheries and aquaculture production amounted to US$14.75 billion and US$13.99 billion, respectively, indicating higher-value species for capture fisheries. The annual average growth rate of wild catch or capture fisheries in Indonesia was 3.1% from 2000 to 2015, while aquaculture production has more than quadrupled, with annual average growth rate of 20.2% during the same period (World Bank 2017). Notable also is the seaweed production, which increased by 53.14% between 2005 and 2014.

Although the fisheries sector contributed only 2.6% to GDP in 2018, this sector is an important contributor to national food security and employment in Indonesia. A recent study ranked Indonesia as the eighth-most fish-dependent nation in the world, measured by dependence on fish-derived animal protein (California Environmental Associates. 2018). Average fish consumption reached 47.34 kg/capita in 2017. The fisheries sector plays a particularly valuable role in coastal communities, where people are likely to engage in fishing as a form of subsistence, and as a primary or secondary source of employment. The wild capture fisheries and aquaculture sectors employ approximately 2.7 million and 3.3 million workers, respectively, and an additional one million workers are involved in the processing and marketing of fisheries products. The majority of Indonesian fishers are small-scale fishers, with vessels under 10 gross tonnes (GT).

Most of the capture fisheries and aquaculture production was done in marine waters. For capture fisheries, 93% is from marine waters. For aquaculture, marine culture accounts for 61% of production, while 17% is culture in brackishwater, and 22% in freshwater.

Pressures and constraints. Like many other countries, Indonesia's marine and fisheries sector faces urgent issues. The ability of capture fisheries to contribute to food and nutrition security in Indonesia could become significantly compromised by overfishing, fish loss and waste, climate change, unregulated coastal development, habitat loss, pollution, and associated declines in fish catch. The following constraints affect fisheries management in Indonesia: (a) overfishing in both marine and inland fisheries waters; (b) low income and standard of living for fishers and fish farmers; (c) lack of financial support in terms of credit schemes; and (d) illegal, unreported and unregulated (IUU) fishing and weak fisheries management, particularly concerning monitoring, control and surveillance (MCS) and enforcement (FAO, n.d.). For the aquaculture sub-sector, poor farming practices, environmental degradation and pollution, habitat conversion, lack of access to credit by small-scale aquaculture farmers, expensive inputs, problems in marketing, and conflicts in the use of coastal areas have lowered the productivity of this subsector (ADB 2015).

Policy response. The main law regulating fisheries in Indonesia is *Law 31 of 2004*, as amended by *Law 45 of 2009*. In 2005, Indonesia developed a *National Plan of Action* as part of the implementation of the International Plan of Action to eliminate IUU Fishing. To address the major issues in fisheries and aquaculture sector, the government has set the following priorities:

- Community development and empowerment programs for small-scale fishers and fish farmers or aquaculturists in coastal and small island areas;
- Climate change mitigation and adaptation strategies for the marine fisheries sector;
- Improvement of the quality and profitability of fish products for small-scale fishers;
- Improvement of fishery-related infrastructure;
- Strengthened MCS systems to improve management and combat IUU fishing;
- Human resource capacity development.

Coastal and Marine Tourism

The islands of Bali, Yogyakarta, and Jakarta are the main tourist destinations in Indonesia to date. In the *medium term development plan* (2015-2019), the government has set ten (10) major tourist destinations, of which seven are based on marine tourism. These include Raja Ampat, Padaido in Biak, Banda in Maluku, Kei Islands in Southeast Maluku, Bintan and Natuna Islands in Riau, Togean Islands and Luwuk in Central Sulawesi, Karimunjawa in Central Java, and Sumbawa and Gili Sekotong in Nusa Tenggara Barat.

The number of foreign tourist arrivals more than doubled between 2010 and 2018. Consequently, international tourism receipts also doubled. The highest growth rate of international tourism arrivals was in 2016-2017 when the number of arrivals increased by 21.88%. In 2018, around 16 million foreign tourists visited Indonesia. Foreign tourists stayed around eight days on average. Due to increasing international tourism arrivals and revenues, the contribution of tourism to the national GDP increases every year. The GVA of tourism increased by 16.9% from 2014 to 2015. The GVA of tourism in 2015 was US$34.5 billion, contributing 4.23% of the total GDP. In particular, the GVA of coastal and marine tourism and recreation in 2015 was US$ 19.9 billion.

In addition to income generation, the tourism sector absorbs a lot of manpower. The tourism sector in 2015 employed 3.326 million people or accounted for 2.8% of the total Indonesian workforce. In 2017, Travel and Tourism directly supported 4,585,000 jobs (3.7% of total employment).31 This includes employment by hotels, travel agents, airlines and other passenger transportation services (excluding commuter services). It also includes, for example, the activities of the restaurant and leisure industries directly supported by tourists. Thus, the Travel and Tourism sector is an effective contributor to job creation and poverty reduction.

Pressures and constraints. Many of the identified tourist destinations in Indonesia, especially marine tourism sites, are still natural and untouched, and there are some conflicts that were reported between local communities and tourism developers from private sector or national government. In order to remain sustainable, environmentally and financially, there is a need to develop a sustainable tourism business network that can enhance the competitiveness of Indonesia's tourism business and quality of tourism destinations. The problems that need to be addressed include: (a) the limited number of tourism businesses that are committed to environmental responsibility and application of environmentally sound principles and corporate social responsibility (CSR) programs; (b) lack of incentives to tourism businesses that apply the principles of sustainable tourism development; (c) need for skilled human resources for tourism and development, and limited higher education on tourism; and (d) lack of coordination and synchronization among the different institutions (at national and local levels, and across key sectors) and tourism-related businesses.

Policy response. In the development of national tourism, a policy and plan for the development of long-term national long-term destinations as set forth in the *Government Regulation of the Republic of Indonesia Number 50 of 2011 on the Master Plan of National Tourism Development for 2010-2025*, where there are 50 locations designated as the flagship locations of National Tourism (DPN).

In order to accelerate the implementation of sustainable tourism development nationally, the Indonesian government issued *Minister of Tourism Decree no. 14 of 2016* on **Sustainable Tourism Destination Guidelines**, which is a reference for the Government, Local Governments and other stakeholders in the development of sustainable tourism destinations and schemes for certification of sustainable tourism destinations.

There are 154 marine conservation and protected areas in 2017, of which 14 are marine ecotourism parks (managed by MOEF), and six are marine nature recreation parks (managed by MMAF). These 20 parks create synergy between conservation and tourism. A concrete step implemented by the Indonesian government is the cooperation of the Ministry of Tourism (MoT) with the MOEF in fixing seven national parks using the principles of sustainable tourism development promoted by the United Nations World Tourism Organization (UNWTO). For the Indonesia Tourism Development Program, MoT coordinates with the Ministry of Public Works and Public Housing (MPWH) and other concerned ministries and agencies.

Ports and Shipping

Indonesia is at the crossroads of the world's logistics system connecting the world's two largest oceans, the Indian and the Pacific Oceans. The trade routes and logistics systems of the world use the oceans as transportation routes. More than 80% of the distribution of goods and services trade is through maritime shipping, 40% of which is through the Indonesian territory extending from Sabang to Merauke, transversing Miangas to Rote Island. Exports to China (12.3%), United States (8.5%), Germany (7.9%), Japan (3.6%) and Holland (3.5%) amounted to US$ 19 billion.

Indonesian ports are classified into commercial ports, non-commercial ports, and dedicated/ private ports. The **commercial ports** are managed by four state-owned companies, namely PT Pelabuhan Indonesia (Pelindo) I, II, III and IV. **Non-commercial ports** are under the Directorate General (DGT) of Sea Transportation, Ministry of Transportation, and serve the transport of goods and people, especially in pioneer areas and remote islands. The number of commercial ports in 2016 decreased to 108 units from with 111 units in 2012-2015, while the number of non-commercial ports increased from 574 units in 2015 to 635 units in 2016. There are also 11 container ports.

Navigational lanes

- Indonesia is the first and only archipelagic state which has designated Archipelagic Sea Lanes (ASLs), which are the routes of navigation passing through the archipelagic waters and territorial sea of Indonesia.
- **Strait of Malacca**. Located between Indonesia, Malaysia, and Singapore, the Strait of Malacca is the shortest shipping lane from the Horn of Africa and the Persian Gulf, the Indian Ocean to South China Sea, based on both cost and the navigation aspects. It is the second-largest oil trade chokepoint in the world after the Strait of Hormuz (US-EIA 2017). The Strait of Malacca is the primary chokepoint in Asia, where between 85% and 90% of annual total petroleum flows through this chokepoint were crude oil. Petroleum and other liquids transiting the Strait of Malacca reached 16 million barrels per day in 2016. With growing liquefied natural gas (LNG) demand, the Strait of Malacca is also an important transit route for LNG from Persian Gulf and African suppliers to East Asian countries. At

the Strait of Malacca's narrowest point – a natural bottleneck – there is high potential for collisions, grounding, or oil spills. The coastal areas of the littoral states have mangroves, seagrass beds, mudflats and coral reefs that may be affected if a huge oil spill occurs. Piracy is also a major threat to tankers in the Strait of Malacca.

- **Lombok Strait**. Lombok Strait connects the Java Sea to the Indian Ocean, and is located between the islands of Bali and Lombok. This Strait has an important role, particularly transporting crude oil, LNG, and coal between Australia and East Asia. The Lombok Strait is also notable as one of the main passages for the *Indonesian Throughflow* that exchanges water between the Indian Ocean and the Pacific Ocean. It is also part of the biogeographical boundary known as *Wallace Line* where a striking difference between the fauna on either side of the Lombok Strait is notable.

Ports and shipping performance

- The GVA of marine transportation in 2017 is around US$ 2.39 billion, which is only 0.22% of total GDP (in 2010 constant prices).
- In 2017, there were 842,086 ship calls at the ports in Indonesia, with the Kepuluan Riau Province having the most number of ships calls. This was a decline from the number of ship calls in 2016. There were 882,720 ship calls in 2016.
- There was a decline in the number of passengers (disembarked and embarked) – from 44,117,400 people in 2015 to 42,670,600 people in 2016, a decrease of 3.28%.
- Inter-island cargo unloading was 409 million tonnes in 2017, and increased to 410 million tonnes in 2018. On the other hand, approximately 334 million tonnes of ship freight were loaded at domestic or inter-island ports in 2017.
- The total (inter-island and international) loaded and unloaded cargo in 2017 was 514.8 million tonnes and 606.5 million tonnes, respectively. Kalimantan Selatan has the highest volume of loaded and unloaded cargo.
- The volume of loaded and unloaded cargo at domestic and international ports in Indonesia is affected by the fluctuations in exports and imports and world economic slowdown. However, the container throughput in Indonesia has been increasing since 2010. In 2018, container port throughput was 12,853,000 TEU.

Challenges. Although ports play a very important role for the national economy, Indonesia does not yet have a well-performing port system. Based on the 2015/2016 Global Competitiveness Report, the quality of Indonesia's port infrastructure is ranked 82 out of 140 countries surveyed, quite poor compared to other infrastructure quality ratings, such as road quality (ranked 80), airport infrastructure quality (ranked 66), quality of railway infrastructure (ranked 43). The Quality of Port Infrastructure measures business executives' perception of their country's port facilities. Scores range from 1 (port infrastructure considered extremely underdeveloped) to 7 (port infrastructure considered efficient by international standards). The average score is 3.79 for the quality of port infrastructure in Indonesia from 2000 to 2017. The incidence of oil spills, dumping of waste from ships, energy efficiency, greenhouse gas emissions, and invasive species from ballast water are among the environmental management issues that need to be addressed.

Policy response. The legal framework for ports and shipping in Indonesia is embodied in *Law Number 17 of 2018 on Shipping, and Government Regulation Number 61 of 2009*, and *Government Regulation Number 64 of 2015* on Port.

Indonesia requires inter-island connectivity with adequate provision of sea transportation to meet the national logistics distribution requirements, with the ports serving as basic infrastructure. **Sea toll** is a concept to improve connectivity between islands in Indonesia. The implementation of the "**sea toll**" program began with the establishment of five main ports in Indonesia as regional hub ports. These five ports will serve as the main transit port for commodity distribution around the remote islands.

There are also laws on shipping safety and maritime environment protection. The development of environment-friendly port and green building in Indonesia is currently implemented based on *Government Regulation No. 21 of 2010 on Maritime Environment Protection*. This regulation focuses on pollution control in port and shipping operations. In addition, the government continues to install navigational aids to improve the safety of shipping in Indonesian waters, and prevent collisions that could result in oil spills and damage to property and coastal ecosystems.

The *National Oil Spill Contingency Plan* was given government approval in 2006 and launched in 2007. The lead agency for oil spill preparedness and response is the Directorate General of Sea Transportation (DGST), Ministry of Transportation. The DGST regularly conducts a *National Marine Pollution Exercise*, aiming to test and evaluate oil spill response procedures at local, regional and national levels, and to train and enhance cooperation and capabilities in observation operations, security, search and rescue, fire fighting, oil spill contingency planning and response, and countermeasures for oil spills in the sea. This is a routine activity held every two years as a joint exercise activity between agencies or partners that have duties and functions in the area of waters, seas, shipping and ports.

Based on the *Strategic Plan 2015-2019 of the Directorate General of Sea Transportation*, through one of the targets, which is "Promoting the development of efficient and environment-friendly transport technologies in anticipation of climate change", multiple key performance indicators were assigned, including:

1) Amount of decreased CO_2 emitted in marine transportation;
2) Number of harbors implementing Clean Ports or Green Port
3) Number of IOPP certificate ownership (International Oil Pollution Prevention)
4) Number of SNPP ownership (National Certificate of Pollution Prevention)
5) Total ownership of toxic liquids certificate (Noxious Liquid Substance)
6) Total International Sewage Pollution Prevention (ISPP) certificate ownership

Offshore Oil and Gas

Offshore oil and gas is a resource from the ocean area. However, oil and gas are depletable resources, and their use as fossil fuel has resulted in the greenhouse gas emissions, with consequent effects on the climate, weather patterns and ecosystems.

Indonesia has been active in the oil and gas sector for more than 130 years, after the first oil discovery in North Sumatra in 1885. A member of OPEC from 1961, Indonesia suspended its membership in 2009 after years of declining production.

Indonesia's oil and gas production has been dominated by gas production (60%) since 2002. As of 2015, Indonesia's oil and gas production was 786 MBOEPD for crude oil, and 8,102 MMSCFD for natural gas. In 2018, crude oil production decreased to 772 MBOPD, and natural gas production likewise decreased to 7,760 MMSCFD (SKK Migas 2018). Bank Indonesia notes that oil and gas exports contributed about 8% of total exports in 2016-2018, down from a high 17% share in 2011. Consequently, the State revenue from the oil and gas industry decreased from IDR 216 trillion in 2014 (14% of State revenues) to IDR 143.3 trillion (7.4% of State revenues).

Challenges. Indonesia spent decades relying on the oil and gas sector's contribution to economic growth. However, in recent years, the oil and gas sector's production and revenues have declined. Moreover, there are issues concerning the inclusion of oil and gas in the blue economy due to the negative environmental impacts from this sector. The huge increase in the use of oil and gas as economies expand has consequently increased carbon emissions, and resulted in the changing climate, increasing incidence of extreme or severe weather events, sea level rise, ocean acidification, coral bleaching, etc. The declining revenues from oil and gas sector provide an opportune time to shift towards renewable energy sources. The ocean also provides potential marine renewable energy resources like tidal energy, ocean thermal energy conversion, offshore wind power, etc.

Policy response. Plans related to the mitigation of environmental impacts of oil and gas activities are generally covered by related regulations in the form of Acts, Government Regulation, Presidential Regulation, Ministerial Decree, and Working Guidance Manual (PTK). *Working Procedure Guidelines (PTK) SKK Migas No. 005/2011 on Oil Spill Control* contains obligations for oil and gas companies to have Oil Spill Contingency Plan (OSCP) Document, which contains mapping of environmentally sensitive areas and Oil Spill Trajectory Model (OSTM) or oil spill distribution model.

As oil and gas production and their contribution to State revenues decline, alternative sources of energy are being explored. There are ongoing Research and Development (R&D) projects on different types of ocean energy that have potential applications in Indonesia, although test bedding, environmental impact assessment and financing are needed for their deployment.

6. Ocean Challenge: Changing Directions towards Blue Economy

The concept of blue economy was developed to respond to the challenge of promoting economic growth in the coastal and marine areas while ensuring the sustainability of oceans and the resources therein. In 2012, ministers of the East Asian Seas region adopted blue economy paradigm, and provided the definition in the *Changwon Declaration 2012*. For the application of the Blue Economy concept in the oceans and coastal and marine ecosystems, there are at least three main points underlying its approach: a) marine water and ecosystem health condition; b) ocean-based economic activities that are sustainable, environment-and climate-friendly, people-centered and inclusive; and c) the existence of enabling mechanisms (policies, laws and regulations, strategies and action plans, incentives) and good governance (integrated institutional arrangements, capacity development, science and research support, knowledge management, public awareness, stakeholder participation, sustainable financing, and partnerships). The *National Ocean Policy* includes the following pillars: (a) the marine or ocean economy, infrastructure and welfare (focusing on seven established ocean economic activities or sectors), (b) marine environmental protection and ocean space management, and (c) ocean governance institutionalization. These pillars are also the core components of the Blue Economy concept in Indonesia.

The following are some examples of blue economy initiatives, considering both traditional practices and innovative technologies:

- **Sustainable tuna fisheries**. Using modern technologies, USAID Oceans, SEAFDEC and MMAF have been working with local government, private sector and non-governmental partners to develop and implement the *Electronic Catch Documentation and Traceability System* (eCDT) system. The eCDT is a system of documenting key information about the harvest, processing, and transportation of a fisheries product electronically to enable traceability of the fish or seafood product through each step of its journey— from point of catch to the consumer's plate. Doing so electronically enables this information to be more quickly and easily captured, shared, and managed. In 2018, MMAF launched the *National Fish Traceability and Stock System* (STELINA) to comply with international market requirements, including the US Seafood Import Monitoring Program (SIMP), and the European Union (EU) regulations, which aim to combat IUU fishing and ensure food safety.

  To further support this system, the government is also implementing the *Catch Certificate* program, which involves certifying if the fish and seafood products have not been caught through IUU Fishing. NGOs (e.g., WWF and SFP) are helping local exporters of tuna, snapper, grouper and blue swimming crab to obtain certification from the Marine Stewardship Council (MSC). The *MSC Fisheries Standard* is used to assess if a fishery is well-managed and sustainable.

- **Sustainable aquaculture**. *Silvofisheries* is a form of low input aquaculture integrating mangrove culture with brackishwater aquaculture. This approach to use and at the same time conserve mangroves shows that while mangroves remain healthy, the economic benefits of traditional brackishwater aquaculture can still be realized. The following cases show its viability: "In the empang parit (also tambak tumpangsari) pond in Sinjai, South Sulawesi, the pond is within the planted mangroves. The ponds are stocked naturally with juveniles from incoming tides. The species are siganids, mullets, milkfish, tilapia, shrimp, mangrove crab, and seabass. These are harvested by gill nets during low tide when the fish are concentrated in the perimeter canal. Significant increases have been made in the volume and value of shrimp and fish exports. The *empang parit* in Cikiong and Cibuaya in West Java realized an annual net profit (ha/yr) of $1,367 for mangrove crab, 1,347 for seabass, 2,601 for tilapia and chicken, 2,508 for milkfish and shrimp, and 1,322 for milkfish."[d] These examples show that to prevent uncontrolled destruction of mangroves, silvofishery technology together with protection and replantation of mangroves and pollution reduction could be promoted to coastal communities.

  Indonesia, with support from ADB, has implemented the *Sustainable Aquaculture Development for Food Security and Poverty Reduction Project* in 2007 to 2013 in five districts in four provinces: (i) Langkat district in North Sumatera Province, (ii) Ogan Komering Ilir in South Sumatera Province, (iii) Karawang and Sumedang districts in West Java Province, and (iv) Buton in Southeast Sulawesi Province. It focused on developing small-scale and low-cost aquaculture that was environment friendly and could be easily replicated by fish farmers' organizations and small- to medium-scale private entrepreneurs. Adequate efforts were also made to address the issue of water pollution from intensive culture practices. Mangroves were also planted/restored. At project completion, among the key outcomes were: (a) the production and productivity of fish increased by an average of 60%, and other aquatic products increased by an average of 84%, which exceeded the project's outcome target by 30%; and (b) the project beneficiaries' net income improved by 70%, surpassing the outcome target by 20%. On the social aspects, the project improved food security and nutrition of poor fishing households, increased fish consumption, and improved health through the provision of water supply facilities. Participation of women in training on aquaculture production and processing has significantly improved their opportunities to engage in livelihood enterprises and improve their family income.

- **Sustainable nature tourism**. Indonesia is encouraging the implementation of sustainable tourism, and will issue *sustainable tourism certificates* for areas and destinations applying internationally recognized sustainable tourism standards – ecologically sound in the long term, and ethically and socially equitable.

[d] These examples were from: Surtida, M. B. 2000.

The Government of Indonesia also continues to encourage special nature tourism, by introducing and managing conservation areas as tourist destinations. Based on the *National Tourism Destination Development Plan*, marine conservation and protected areas, such as Marine National Parks, Marine Nature Recreation Parks, and Marine Ecotourism Parks, are directed to become sustainable tourism destinations. Identified sites are Anambas, Tanjung Pinang, Lingga, Karimun Jawa, Lovina, North Bali, Alor, Saumlaki, Wakatobi, Makassar, Tarakan, Bitung, Raja Ampat, Biak, Komodo island and Sawu Sea.

In 2017, MOEF (KLHK) published a book, "*Nature Tourism: 54 Indonesian National Parks*", which contains instructions on proper behavior to avoid damaging the habitats, wildlife, and cultural objects, and how to reach the location of national parks, including seven Marine National Parks. Using modern technologies, this book of guidelines was followed by the launching of "*Wisata Alam Indonesia*" (Indonesia's Natural Wonders), a mobile phone application (app), by the MOEF in 2018. The app aims to help both foreign and domestic tourists seeking to explore the country's vast natural landscapes and seascapes. Similar to the book, the app offers details on Indonesia's 54 national parks and 119 nature tourism parks, including their basic description, attractions, flora and wildlife, as well as advice on the proper behavior while hiking and exploring, such as respecting others, throwing of trash appropriately, and refraining from disturbing the area's flora and fauna.

- **Ecotourism**. Small-scale ecotourism has also been developed by villages independently. The government also encourages villages with natural wealth to develop themselves into ecotourism villages. Examples of villages that develop ecotourism-based tourism activities are the villages on Sumba Island, Komodo, Raja Ampat and Mentawai Islands.

  Ecotourism development and whale shark protection in Cendrawasih Bay and Probolinggo is one of the conservation efforts of these species in Indonesia. Development of ecotourism aims to reduce or even eliminate efforts to hunt these large animals through improving the economy of society, either directly or indirectly. The existence of whale sharks can increase the number of tourists by up to 2 times in Bentar Beach, Probolinggo.

  The Ciletuh-Palabuhanratu Geopark in Sukabumi Regency in West Java is both a conservation and tourism initiative as part of the integrated coastal management (ICM) program in Sukabumi. Within the geopark there are multiple habitat protection, restoration, and management initiatives. Coral reef transplantation has been used to restore denuded reefs. Beaches are rehabilitated through mangrove and coastal vegetation replanting. Sea turtle protection is another initiative. These actions preserve the natural environment while boosting the ecotourism potential of the area.

- **Community-based tourism**. Another example of the implementation of the concept of sustainable development at the local level is community-based tourism, which was implemented in the Nglanggeran Village and Panglipuran Village in Bali. Ngglanggeran village has built a sustainable tourism destination, with management that involves the community, and aligning the tourism sector and environmental conservation. Environmental financing models were developed using fees paid by tourists, and used in activities, such as mangrove planting, fostering trees and coral reefs, release of baby turtles, etc. Panglipuran Village is famous for its Tebersih Traditional Village. Panglipuran village succeeded in implementing the philosophy of *Tri Hita Karana* by maintaining harmony among human beings, human being with environment and human being with God. Through the hard work of the village, this tourist destination is visited by many domestic and foreign tourists, while ensuring the protection of the environment.

- **Green ports**. Indonesian state-owned terminal operator PT Pelabuhan Indonesia III (Pelindo III) inaugurated the **Lamong Bay Terminal** (PT Terminal Teluk Lamong) in Surabaya, East Java on May 2015. It is the first semi-automatic container terminal, and first *green*-concept container terminal in the country. Built since 2010, Lamong Bay Terminal has a masterplan for the most environment-friendly terminal in Indonesia. As a green port, almost all equipment supporting the terminal facilities, operating system, and loading and unloading system are expected to perform efficiently using computerized system, have minimal greenhouse gas emissions, and be safe for the environment. Teluk Lamong Terminal has received certification as **Green Terminal**. The following are its key features:
  - Eco-friendly technology: CNG truck, CNG power plant, LED lighting, solar power cells
  - Recycling, e.g., applying exhaust gas for air conditioner
  - Environment awareness: mangrove planting, not using fossil energy, support for environmental activities
  - Waste management: waste management system, incinerator, oil-water separator, oil spill response

  UNEP partnered with the Gadjah Mada University Center for Transportation and Logistics Studies (known as "Pustral") and developed a project to support development of a **clean ports program** in the Port of Tanjung Priok, Jakarta. The project resulted in the baseline Air Emissions Inventory (AEI). The AEI Report provided a framework to reduce emissions from the port using an ASIF (Activity, Structure, Fuel Intensity, Fuel Type and Emission Factor) approach as well as a business process approach. Moreover, a comprehensive Measurement, Reporting and Verification (MRV) Framework for Greenhouse Gas (GHG) Mitigation of Port-related Emissions in Indonesia was also provided. This is in support of the *Regulation of the President of the Republic of Indonesia Number 71 Year 2011* and *Regulation of Minister of Environment Number 15 Year 2013* regarding MRV activity for GHG mitigation in Indonesia.

- **Ocean energy**. Marine energy is a non-conventional energy and becomes more significant in the future. Types of marine energy that are likely to be developed are kinetic energy from ocean currents, waves and tides, ocean thermal energy conservation (OTEC), and energy conversion from salinity changes.

The potential for marine power generation in Indonesia averages 35 kW per meter of coastline (Bappenas, 2016)[e]. Indonesia has a coastline of 99,000 km; if only 10% of it will be used, this could potentially produce 280 gigawatt (GW) of power. When calculated using electricity prices by PLN in December 2016, acceptance of marine energy IDR 410.84 billion per year, and assuming a profit margin of 75% (based on results of pilot project), the annual profit is IDR 308.13 billion per year. Carbon credits generated is approximately IDR 60 million per year based on the average CO_2 emissions of fossil energy plants with a capacity of approximately 1,000 tonnes of CO_2.

- **Marine biotechnology**. The Indonesian Marine Care Support strongly backs the efforts to improve marine biotechnology whose potential is still hidden. Initial assessment from PKSPL-IPB (2012) showed that the potential of marine biotechnology can reach US$ 800 billion per year. There are around 35,000 species of marine biota that have the potential for the production of medicines. Of these, about 6,000 species are known and can be used for future medicines.

7. Ocean Governance: Gearing Up for the Challenges

National Ocean Policy

The **Global Maritime Fulcrum** (GMF) was launched at the East Asia Summit in 2014. It envisions Indonesia, a maritime country, as a force between the two oceans: the Indian Ocean and the Pacific Ocean, and to become the center of the world's maritime axis. **Presidential Decree no. 16 of 2017: Indonesian Sea Policy** was designed to "facilitate the acceleration" of the GMF doctrine. The Sea Policy has the following seven pillars:

1. Marine and human resource development
2. Naval defense, maritime security, and safety at sea
3. Ocean governance institutionalization
4. Maritime economy, infrastructure, and welfare
5. Environmental protection and ocean space management
6. Nautical culture
7. Maritime diplomacy

These pillars are further broken down into 76 programs spread across dozens of ministries and agencies in charge of 425 activities designed to achieve 330 targets. The ocean policy continues to leave the planning, budgeting, and execution of the various programs to the respective ministries and agencies. However, the Coordinating Ministry for Maritime and Investment Affairs is tasked with monitoring, coordinating, and evaluating how each ministry fits within the ocean

[e] http://perpustakaan.bappenas.go.id/lontar/file?file=digital/110743-%5B_Konten_%5D-L.323.%20Bab.%202%20Perkembangan%20Energi%20Arus.pdf

policy framework. As an inter-agency framework, there are efforts to build institutional change in coastal and marine development. The Ministry of Marine Affairs and Fisheries (MMAF) is the main body for marine and fisheries sector planning.

Ocean in the National Development Plan

The *National Medium-Term Development Plan 2015-2019* identifies six national priorities of development. The marine sector is the third priority, with the aim: "to benefit from and to restore the loss of Indonesia's marine potential from the maritime sector." To achieve this, there are ten policy directions:[f]

1. Complete the boundary line of the continental shelf to 200 nautical miles, including naming and registration of the islands
2. ALKI regulation and control (Indonesian archipelagic sea lane)
3. Strengthen the institution for marine water management and supervision
4. Improve coordination for monitoring and enforcement of laws aimed at violation offenses
5. Improve the construction of multimodal transportation system
6. Balance between national-oriented transportation and local and regional transportation system
7. Accelerate the growth of the marine economy
8. Improve and maintain quality, and support the preservation of the marine environment
9. Enhance maritime knowledge and culture along with strengthening of human resources and science and technology
10. Increase the dignity and livelihood standards of fishing communities

Integrated Coastal Management

Integrated coastal management (ICM) is considered as the key approach for implementing sustainable development in coastal areas. Progress has been made in initiating ICM in Indonesia. It started with Bali ICM Demonstration Site in 2000, and as of 2017, around 46,207 km or 48.54% of coastline is covered by an ICM plan.[g] The Coastal and Marine Strategic Plan (CMSP) covers 44,900 km (47.17%), while the Zoning Plan for Management of Small Islands and Coastal Areas – RZWP3K – covers 1.307 km or 1.37% (Recapitulation ICM Plans Document in Indonesia 2017).

The ICM approach and blue economy development are in line with the national ocean policy as well as the SDGs and other international agreements on marine environmental management and sustainable development of coasts and oceans.

Indonesian Government validated *Law number 27/2007* and *Law number 1/2014* for arrangement

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f Bappenas. RPJMN 2015-2019.

g The percentage of coastline was estimated using the previous estimated total coastline of 95,181 km from the Statistics of Coastal and Marine Resources 2016. In 2018, BPS reported the total coastline to be 99,000 km.

of Strategic Plan for Management of Small Island and Coastal Area, and Zoning Plan for Management of Small Island and Coastal Area, which were signed by Governor Regulation. However, there is a need to develop management and action plans with stakeholders and put in place the necessary institutional arrangements to implement the strategic plan and zoning plan. Thus, the coastal areas covered by the ICM plans (Strategic Plan and Zoning Plan) still have more work to do to ensure an effective and functioning ICM system for the sustainable development of coasts and seas.

Addressing Sustainable Development Aspects to Protect Ocean Health and Support Blue Economy

The concept of blue economy is one that simultaneously promotes economic growth, environmental sustainability, social inclusion and the strengthening of oceans ecosystems. The marine environment is already straining under the weight of pollution, rising sea temperatures, loss of biodiversity, rising sea levels, growing ocean acidification and other impacts associated with climate change, with the result that unsustainable growth in ocean-related economic activity risks yet further undermining the very foundations on which the ocean economy stands (OECD 2019).

The ocean economy is subject to a multi-layer regulatory framework under the United Nations Convention on the Law of the Sea (UNCLOS) and other regional and international conventions as well as national and sectoral governance regimes. Indonesia is a party to a number of multilateral environmental agreements and regional programmes. The UN SDGs (SDG 14 of Life Below Water in particular), Manado Ocean Declaration (MOD), Sustainable Development Strategy for the Seas of East Asia (SDS-SEA) in 2003 and the updated SDS-SEA in 2015, together with the National Ocean Policy provide the guiding principles and course of action to promote blue economy, protect the marine environment, ensure healthy and sustainable marine ecosystems, and conserve fisheries and other natural resources from the oceans. The following initiatives contribute to achieving key targets of SDG 14 as well as the sustainable development aspects in the SDS-SEA.

a. **Pollution reduction**. The Government of Indonesia's *Long-Term National Urban Development Plan, 2015-2045*, sets targets of urban service standards and city waste management – demanding high sector performance. Solid waste management is high on the national agenda, as exemplified by the *National Medium-Term Development Plan*'s (RPJMN) "*100-0-100*" target of eliminating all slums and providing universal access to water and sanitation, including solid waste, by 2019.[h] Indonesian Government adopted *Law number 32/2009 on Protection and Management of Environment*, and *Government Regulation No. 19/1999* on control of pollution and marine environmental damage. However, updated regulations, enforcement, and facilities are needed. A low percentage of the population is served by wastewater management systems. Given the volume of marine debris, especially plastic waste, inadequate solid waste management system is

[h] The "100-0-100" target refers to 100% household access to water supply; zero slums; and 100% household access to sanitation (including wastewater treatment and solid waste collection).

still a major problem. Nevertheless, there are some examples of initiatives on pollution reduction and waste management:

- **Wastewater management**. One example of sustainable tourism implementation in Bali is the wastewater treatment facility in Nusa Dua in Bali. Nusa Dua is a complex of 10 big hotels, with centralized wastewater treatment. Treated wastewater is reused to water the plants and gardens in the hotel complex. The wastewater treatment lagoon is also an *eco-park*, with opportunities for bird watching and recreational fishing. The other wastewater treatment system in Bali is in the area of Denpasar City, Sanur and Kuta, and is done through the Denpasar Sewerage Development Project (DSDP). The project was built in 2008 and started operations in 2009 to treat wastewater from households, commercial and public buildings, tourism establishments, etc.

- **Marine plastic debris management**. In 2017, the Government of Indonesia has just initiated the management of marine debris by issuing Indonesia's *Plan of Action on Marine Plastic Debris 2017-2025*. It reinforces the existing policies and laws, and its expected outcome is 70% reduction of marine plastic debris by 2025. The National Action Plan is led by the Coordinating Ministry for Maritime and Investment. Funds have been made available for R&D of alternatives to plastic. There are also local initiatives on banning use of plastic bags and containers.

- **Solid waste management**. In 2017, the circular economy concept was introduced in Indonesia with three pilot **Zero Waste** project communities: Bandung, Cimahi, and Soreang. Within just the first year, #ZeroWasteCities reached 3,640 households or around 14,560 people. The program was responsible for keeping 950 kg of waste each day out of landfills, saving about IDR 63 million (US$ 4,300) in transportation costs in the pilot sites for that year.

  To reduce the volume of waste going to the disposal sites, the MOEF promotes **Waste Banks** as a strategic program to involve informal community-based efforts to collect sorted inorganic waste that has economic value. Decentralized waste banks are set up in neighborhoods typically with about 1000 residents and are usually run by poorer people who wish to increase their income. The collected inorganic wastes are sold to recycling companies. One example is Citarik village in Palabuhanratu in Sukabumi Regency, which has a community-based waste management bank. Established in 2015, the bank reduces garbage while generating income by converting much of the waste into organic fertilizer and through the sale of recyclable materials. Its aim is to reduce waste by 50% in the next five years. The Regency aims to establish 100 similar waste banks in the next 3 years.

- **Industrial pollution management**. In June 1995, Indonesia launched a program for public disclosure of polluters' environmental performance. This initiative, called the *Program for*

Pollution Control, Evaluation and Rating (PROPER), is an industrial monitoring program that aims to encourage industry compliance with environmental regulations, and expected to serve two objectives: (1) Promote compliance with existing regulations; and (2) Reward firms whose performance exceeds regulatory standards.

It also aims to encourage industry to apply green economy principles with environmental management system performance assessment criteria, energy efficiency, water conservation, emission reduction, biodiversity protection, 3Rs (reduce, reuse, recycle), and reduce economic disparities by implementing community empowerment programs. In 2016, the number of participants to PROPER reached 1930 companies, consisting of 111 types of industries. PROPER's compliance rate in 2016 reached 85% with 12 EMAS (gold) rating companies, HIJAU (green) 172 companies, BIRU (blue) 1422 companies, MERAH (red) 284 companies, BLACK 5 companies, and 35 other companies not announced consisting of 13 companies in law enforcement process and 22 companies closed/not operating. BLACK rating is given to companies that cause environmental pollution, do not have an environmental license or dispose of waste directly into the environment.

b. **Habitat restoration and protection**. Current efforts to restore natural resources and the environment have become a trend of private interest through community development programs and corporate social responsibility in addition to government and civil society efforts. The center of marine conservation area, especially in coral reef conservation, is the center of the Coral Triangle, which includes Raja Ampat, Berau, Wakatobi, Togean Island, Bird Head area as well as others areas that have been established as MPAs, such as Kepulauan Seribu, Karimunjawa Island, and Takabonerate Island. It is essential to promote stakeholder engagement and stewardship, and establish financing mechanisms to sustain habitat restoration and conservation efforts. The management of coastal and marine ecosystems is covered by the following legislation: (a) MMAF Regulation Per.17/Men/2008; (b) MMAF Regulation No. 20/ Men/2008; MMAF Regulation Per.02/Men/2009; (c) MMAF Regulation No. Per.03/Men/2010; and (d) MMAF Regulation No. Per.04/Men/2010. Projects include greenbelt, and mangrove and coral reef rehabilitation.

- One of the recovery efforts whose track record is significant is the coastal recovery program through the rehabilitation of mangrove ecosystems. In 2010-2013, mangrove rehabilitation in Indonesia has reached 35,103 ha, spread over 34 provinces in Indonesia (BPS, 2016).
- Another noteworthy initiative is coral farming, which is an approach to coral restoration through the culture and production of coral fragments on a large scale. It enables the 'farmer' to grow corals which are suited to precise reef habitats. In Indonesia, coral farming has been around for almost two decades. The coral transplantation project in Bali (initially part of ICM activity) resulted in increased fish catch, additional diving sites, promoted ecotourism as supplemental livelihood, and increased incomes of the fishing communities.

c. **Addressing IUU fishing**. Specific to tuna management, a **National Plan of Action** was developed and launched in 2015. The government of Indonesia improved the registration of fishing vessels in the country to help strengthen tuna fisheries management. Indonesia's compliance with measures requirements imposed by the Western and Central Pacific Fisheries Commission (WCPFC), for example on the provision of size-at-capture data for 2013, was classified as "good" by the WCPFC Scientific Committee.[i] Moreover, Indonesia has undertaken research relevant to establishing harvest control rules for its tuna fisheries. The *eCDT and STELINA system* also supports the measures to address IUU fishing from the point of capture to the consumer's plate. To further support this system, the government is also implementing the *Catch Certificate* program, which involves certifying if the fish and seafood products have not been caught through IUU Fishing.

d. **Marine protected areas (MPAs)**. One form of marine protection is done by designating a certain area as a National Park. Under the *Law No.5 of 1990* on the conservation of natural resources and ecosystems, the National Park is defined as a natural area for conservation of the natural landscape, native ecosystems and biodiversity. The protection of the National Park is supported by a zoning system for various purposes, such as research, education, science, aquaculture, and tourism or recreation. Among the 54 national parks, there are 13 national parks with marine ecosystems. There are various types of marine conservation areas in Indonesia. According to *Law No. 5 of 1990*, marine conservation areas are designated into 4 categories: Marine National Park, Marine Nature Tourism Park, Marine Wildlife Sanctuary, and Marine Reserve – these are managed by MOEF. In addition, according to *Law No. 27 of 2007*, there are four more types of conservation areas under the management of MMAF: Marine National Park, Marine Reserve or Sanctuary, Marine Ecotourism Park, and Regional or Local Marine Conservation Area.

   Indonesia targeted 20 million ha as marine conservation area in year 2020. As of 2015, MPAs that have been managed continuously cover a total of 17.3 million ha, spread over 32 provinces and 105 districts/cities – reaching 86.5% of the target. The established marine conservation or protected areas is around 6.4% of EEZ area. MMAF and Local Governments manage 122 MPAs, with a total area of 12.6 million ha. MOEF manages 32 MPAs with a total area of 4.7 million ha. A key issue is the effective and sustainable management of these conservation areas, and protecting key biodiversity areas and particularly sensitive sea areas.

e. **Natural hazard management and climate change mitigation and adaptation**. With its geographic position within the Ring of Fire and the juncture of earth tectonic plates, rapid

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[i] WCPFC, 2017. (https://www.wcpfc.int/conservation-andmanagement-measures).

population growth, increasingly high levels of urbanization, and unequal economic growth means that Indonesia remains at heightened risk of natural hazards, both geological and hydro-meteorological. The climate change-based pressure on coastal ecosystems and communities will affect mostly the Low Elevation Coastal Zone in North of Jakarta, North of Java, Southern Sulawesi and southeast Aceh due to sea level rise. The hydro-meteorological natural hazards faced by coastal areas are extreme weather, catastrophic flooding, landslides, drought, forest fire, and tidal wave. In total, 82% of disasters in 2016 is categorized as hydro-meteorological (BNPB 2016).

- **Policy response**. In addition to the adoption of the the Hyogo Framework for Action (HFA) in 2005 and the Sendai Framework for Disaster Risk Reduction in 2017, there has been the establishment of institutional and regulatory frameworks for DRR at the national and local level, marked through the adoption of the *Law 24/2007 on Disaster Management* and the formation of the National Agency for Disaster Management (BNPB) and BPBDs as the managing agency for DRR and DRM. This law regulates disaster relief and governs the entire disaster management system in Indonesia, from preparedness to response and recovery. Private sector, civil society and other stakeholders at the local level are also playing a key role in enhancing resilience and reducing the risk of disaster and the scale of potential losses and thereby make real progress towards achieving **SDG 11** – to make cities and human settlements inclusive, safe, resilient and sustainable cities.

- **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. It is therefore critical to stop their destruction to ensure their health and functional integrity so they can continue providing the ecosystem services, especially shoreline protection. The restoration of mangroves and coral reefs and establishment of marine protected areas are noteworthy contribution to reduce risks and enhance climate resiliency.

- **Climate change mitigation**. Healthy coastal habitats play an important role in mitigating climate change by sequestering and storing carbon. However, the destruction of coastal habitats poses a great risk. When these habitats are damaged or destroyed, not only is their carbon sequestration capacity that is lost, but the carbon they store in their biomass and underlying sediments and soil is also released, thus, increasing levels of greenhouse gases in the atmosphere. There are projects and initiatives on the protections of mangroves, seagrass, and tidal marshes for blue carbon. The *International Blue Carbon Initiative* is a coordinated, global program focused on mitigating climate change through the conservation and restoration of coastal and marine ecosystems. In Indonesia, this initiative is piloting the project, *Kaimana Coastal Conservation and Community Development* to demonstrate the climate mitigation potential and viability of blue carbon projects, and build capacity of indigenous communities to protect and manage coastal ecosystems.

- **Climate change adaptation**. The *Rancana Aksi National – Perubahan Iklim (RAN-API)* or *Indonesia's National Action Plan on Climate Change Adaptation 2015-2019* describes the impacts of climate change on the fisheries and coastal sectors. It focuses on two key areas of climate change and their impacts on livelihoods: (a) sea level rise, and (b) changes in climate, weather, and rainfall. RAN-API also outlines the coordination among different ministries and with local/regional governments. Working at the regional and village level is crucial in Indonesia's decentralized system. Bappenas – the Ministry of National Development Planning – is the lead agency for the implementation of RAN-API.

  Under RAN-API, a **vulnerability index and evaluation system** was developed to determine what adaptation activity is necessary in each area. Some key adaptation and resiliency strategies include: promoting farming practices that are flexible to changing weather and water conditions; building infrastructure to secure water sources and prevent flooding; developing warning systems for natural disasters; flood-proofing homes; preventing deforestation; and increasing community access to finance, training, and the planning of resiliency programs.

8. Moving Forward

The foundation of a blue economy is sustainable, resilient and inclusive ocean economy, clean oceans, and healthy, productive and resilient coastal and marine ecosystems. The sustainable supply of goods and services from the oceans is central to the country's future well-being and prosperity. Currently, the ocean is under pressure from the diversity and multitude of human activities, driven by our need for food, water, energy, medicines, transportation, trade, and recreation. Habitat destruction, IUU fishing, pollution, and unregulated coastal development threaten the ocean's resources and its life supporting services. These pressures are amplified by loss of biodiversity, declining fish stocks, and climate change. Indonesia is also prone to extreme natural events, such as earthquakes, tsunamis, wildfires, heavy rainfall, flooding, and volcanic eruptions, which affect human life, properties and ecosystems.

The NSOC Report is an important tool to promote good ocean governance and partnerships for blue economy, advance research, education and scientific support, raise public awareness, and foster the development of synergies among the various sectors and stakeholders for integrated coastal and ocean management. This report has been developed through multi-agency and multi-stakeholder collaboration and knowledge sharing.

A significant part of the report is the valuation of the ocean economy and ecosystem services as such information is increasingly called on to assess tradeoffs and facilitate the incorporation of environmental values into the formulation of economic policy for more efficient, equitable and ecologically sustainable coastal and ocean management. Thus, the evidence base provided by the NSOC report is fundamental in informing policy- and decision-makers on a range of ocean-related issues. The report discusses the state of the ocean economy, ocean health and ocean governance, and the pressures and consequences of continuing the business-as-usual mindset. More importantly, the NSOC report draws attention to the opportunities for policy reforms, investments, and partnerships, and highlights the emerging blue economy industries, innovations, and best practices that can be replicated and scaled up.

There are several laws and policies on environmental management, conservation of coastal and marine resources and biodiversity, and fisheries management that support the ocean agenda. Indonesia is also a party to several multilateral environmental agreements or international conventions. The UN SDGs (SDG 14 or Life Below Water in particular), Manado Ocean Declaration (MOD) 2009, Changwon Declaration 2012, Sustainable Development Strategy for the Seas of East Asia (SDS-SEA) in 2003 and the updated SDS-SEA in 2015, and the National Ocean Policy provide the guiding principles and course of action to promote sustainable development, protect the marine environment, ensure healthy and sustainable marine ecosystems, and conserve fisheries and other natural resources from the oceans. It is critical for the various institutions and organizations to study the SDG 14 targets and other related SDGs, and identify the specific coastal and marine issues and actions that would be most substantial to the coastal communities and ocean health.

The ocean GDP growth requires investments and policy support through mix of regulations and incentives that encourage business to invest in the ocean-based economy that is also aligned with sustainable, inclusive and resilient development principles as encompassed in the blue economy paradigm. Improving capacity of state institutions is also needed to achieve clean and effective ocean governance, and ensure a business climate conducive for sustainable and inclusive development.

The developmental perspective must be changed by transforming the established ocean economy into blue economy, and integrating ocean- and land-based economic activities into a unified national economy. Policies on blue economy and integrated ocean management should be pursued in concrete steps, together with capacity development, innovative technologies, improved laws, and plans that consider economic growth, job creation, wages and incomes, financial viability, environmental and ecological sustainability, and natural hazard and climate resiliency, in an integrated way.

Recommendations

Promote blue economy development as a key component of the sustainable and integrated national ocean policy. There is a need to mainstream the blue economy as part of the national ocean policy and overall economic development strategy. The strategies for the economic development of the ocean-based and ocean-related sectors must ensure environmental sustainability, climate resiliency, inclusiveness, and overall well-being of the people, and not just income and economic growth.

- The blue economy approach requires the development of a more coherent, integrated and structured ocean management framework that goes beyond the scope of ICM, covers EEZ areas, and takes into account the economic potential of all marine natural resources, which include seaways, energy, water and genetic resources from the oceans, and their *sustainable* use.
- Blue economy offers significant development opportunities but also raises challenges in sectors, such as sustainable fisheries and aquaculture, marine and coastal tourism, maritime transport and logistics, green ports, marine renewable energy, marine bio-prospecting and biotechnology, ship-building desalination, submarine cables, and marine construction. Regulations, incentives, institution building, stakeholder participation, research and capacity development, and financing mechanisms in these sectors as well as in key environmental service sectors, such as biodiversity conservation, solid waste management, wastewater treatment and remediation services, are the enabling conditions that would support further investments to ensure not only healthy and sustainable oceans, but also sustainable and resilient ocean economy. There is potential for partnerships to access technologies, expertise and financing for these sectors.

Foster blue economy initiatives at the local level as part of ICM strategy and plans.

- While working to cover more coastal areas by ICM system, it would be advantageous to formulate ICM strategies and action plans that incorporate blue economy initiatives at the local level. Opportunities for income generation and job and livelihood creation also exist in ocean-related sectors at the local level like sustainable fisheries and aquaculture, sustainable coastal tourism, marine renewable energy, and seafood processing, as well as synergies with habitat restoration, climate proofing, and water, sanitation and wastewater and solid waste management services. Co-management approaches and benefit-sharing schemes can also enhance the restoration and protection of coastal habitats while allowing for alternative or supplemental livelihood programs to support the coastal communities. Such schemes could ensure social acceptance of ICM, habitat protection and pollution reduction programs, and stakeholder involvement while promoting blue economy businesses and industries.

Support research and information management and develop ocean accounts for evidence-based ocean policy- and decision-making. Several factors make the provision of both up-to-date and accurate information a challenge in Indonesia.

- Environmental data is critical to gauge the impacts of country interventions, trends in marine water quality and condition and utilization of resources over time, and risks and challenges to mitigate and plan for. Regular monitoring of the coastal and marine ecosystems and marine water quality, and making the monitoring data and other scientific research studies available are needed to assess the impacts of human activities and land- and sea-use changes, as well as effectiveness/inadequacy of policies and actions.

- Economic data, particularly, ocean economic sector and valuation of coastal and marine ecosystem services, are also important to show the natural oceanic capital and contribution to incomes, jobs, livelihoods, well-being and resiliency. Currently, Indonesia measures the outputs and gross value added of seven ocean-related sectors, which have been identified in the national ocean policy. However, their sustainability and impacts on the oceans are not part of the accounting system. Data disaggregation to account for key sectors, such as small-scale fisheries, fish and seafood processing, ship-building, marine research and education, submarine cables, maritime services, and other emerging ocean industries, is also one of the challenges in developing the ocean accounts.
- There is a need to develop the ocean accounting system that show the economic-environmental linkage as well as social considerations like subsistence fisheries, small-scale ocean industries, wages, and linkage to poverty reduction and sustainable development. The valuation of coastal and marine ecosystem services also needs further work to get more robust estimates. Likewise, there is a lack of waste accounting, and availability of studies showing the environmental cost and economic losses. Moreover, the role of trade is not deeply considered yet. Backward and forward linkages and multiplier effects of the ocean economy, and the outcomes of multilateral and regional trade that might impact the state of ocean health can be better assessed when ocean accounts are available.
- To support its mainstreaming, the ocean accounts must be disseminated and highlighted at the macro-level planning, and not just at the environmental or maritime sector level, to show the potential returns for harnessing the natural oceanic capital *sustainably* in support of long-term growth, jobs, development, poverty reduction, resiliency, and well-being.

Strengthen knowledge management. It is crucial to strengthen the knowledge base by developing and disseminating new data and other scientific and socioeconomic information as well as existing knowledge, including traditional knowledge, about the ocean upon which life is dependent on. Use best available scientific knowledge on climate change, and apply cost-effective adaptive mechanisms. Utilize also traditional knowledge and grassroots initiatives in developing adaptive management systems. There are also innovative, smart and green technologies that can transform the ocean economy to sustainable and resilient blue economy, but policies and incentives are needed to make them accessible and affordable. In addition, policy and public support for R&D initiatives for such technologies and sustainable solutions, and their actual deployment and use are also crucial in the blue economy transformation.

Improve capacity development. Capacity building is required to provide the knowledge base and technical and managerial skills necessary for blue economy development and sustainable coastal and ocean management. A cadre, consisting of policy-makers, planners, scientists and environmental and resource economists who can formulate the most appropriate strategies for utilizing and managing the ocean and its resources in a sustainable and inclusive way, and leaders and managers who can implement those strategies in collaboration with various stakeholders, is essential to have a sustainable, effective and integrated coastal and ocean management system and move towards blue economy.

Advance investments in environmental services and climate proofing as key components of blue economy development.

- More facilities (e.g., sanitary landfill, recycling facilities, wastewater treatment, etc.) and improved services – from collection to disposal, treatment, recycling and reuse – should be included in the investment priorities as part of the blue economy development agenda given that oceans are mostly affected by land-based activities and pollution. There should also be a regulatory and incentive framework and stakeholder involvement as part of the enabling conditions for environmental investments. Partnerships between national and local governments and between public and private sectors should be encouraged to develop more of these environmental facilities. There should also be collaboration with ocean-related businesses at all scales in developing principles and guidelines for sustainable conduct and production. Public awareness on the importance of waste reduction, water and energy conservation, wastewater and solid waste management, as well as stakeholder support and behaviour change are crucial to effectively reduce pollution, and ensure the viability and sustainability of environmental services and facilities.
- ICM, together with integrated coastal land- and sea-use planning or marine spatial planning that incorporates ecosystem-based disaster risk reduction and management, coastal ecosystem restoration and conservation, and appropriate infrastructure development to combat flooding and erosion and ensure water security, would enhance the sustainability and resiliency of the ocean and coastal economy and ecosystems. However, this requires greater climate change awareness, more capacity development, and financing of habitat restoration and adaptation projects at the local level as well as better coordination between the public and private sectors. Stronger inter-agency and intersectoral coordination and collaboration with communities will enable holistic and flexible responses to climate change.
- A combined protection of mangrove, coral reefs, seagrass beds, tidal marshes, coastal wetlands and coastal forests from destruction, over-exploitation and pollution is particularly more effective given the interconnectivities of these coastal habitats to optimize their various ecosystem services.

Regular updating of the NSOC Report. The report currently provides the baseline for the ocean economy, ocean health and ocean governance and blue economy initiatives, but there are data gaps that can be addressed in future NSOC reports. Regular updating of the NSOC report would help in showing the progress in meeting the targets of the national ocean policy, and in presenting the major outcomes and benefits of blue economy development and integrated coastal and ocean management. To get more support, it is essential to show the linkage of blue economy initiatives to national development and the SDGs, as well as point out the interactions, combined effect, and benefits to accelerate actions and achieve the targets of SDGs, SDS-SEA, and other international agreements. The NSOC Report can be used as a platform to ensure that blue economy and *sustainable oceans for all* would be given a priority in the national and local development plans.

1 Introduction

1.1 Background

The ministers of the East Asian Seas (EAS) Region adopted the Da Nang Compact during the EAS Congress 2015 held in Da Nang, Viet Nam in November 2015. One of its targets is the development of a Regional State of Oceans and Coasts (SOC) report by 2018 to show benefits of oceans and the resources therein, pressures and impacts from unsustainable practices, and progress in ensuring healthy oceans, economies and people, and implementing the *Sustainable Development Strategy for the Seas of East Asia* (SDS-SEA). Indonesia prepared this National State of Oceans and Coasts (NSOC) report as its contribution to the regional report.

The theme of the first NSOC report is **blue economy**. The definition of blue economy is given in the **Changwon Declaration 2012**[1], which was adopted by the ministers of the EAS Region as a way to respond to the challenges of the changing environment and climate as well as foster a sustainable, inclusive and resilient economic development through policies and activities that harness the natural capital of the oceans in a sustainable way and at the same time reduce the negative environmental and socioeconomic impacts.

> "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 blue economy approach is also in line with the 2030 Agenda for Sustainable Development, especially Sustainable Development Goal (SDG) 14 – Life Below Water, and the Oceans Agenda. It is in keeping with other international agreements, such as the Regional Plan of Action on Illegal, Unregulated and Unreported (IUU) Fishing; Convention of Biological Diversity (CBD) and Aichi Biodiversity Targets, Ramsar Convention on Wetlands, International Maritime Organizations

[1] Ministers from 10 countries in 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 on 12 July 2012.

(IMO) Conventions (on marine pollution, ocean dumping, safety, etc.), Convention on Trade of Endangered Species (CITES), Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA); UN Framework Convention on Climate Change (UNFCCC), Kyoto Protocol and Paris Climate Agreement; etc.

1.2 Objectives

Coastal and ocean activities provide sustainable contribution to the economy in East Asia region. The ocean economy covers all activities that are directly related to coastal and ocean resources. This includes extraction of resource (such as fisheries, oil and gas production, etc.) as well as non-extractive utilization (such as tourism, transport, trade, shipping, port, marine construction, marine research, maritime services, etc.). Activities and outputs of public organizations and institutions that have mandates on coastal and ocean management and related responsibilities (such as protection of ocean environment and resources, national defence, coast guard, etc.) are also included in the ocean economy. Oceans drive innovations and new activities, such as biotechnology and ocean energy. Marine and coastal resources have substantial contribution to food security, and protein intake, especially in the coastal communities. They also provide economic values that cannot be directly calculated, such as carbon sequestration, coastal protection, waste cycling, and ocean processes that affect climate and biodiversity.

The SOC report aims to:

- Compile data and information on the country's coastal and marine resources and environment, ocean economy, governance structure, and blue economy initiatives, collected from different concerned agencies to serve as baseline information related to blue economy development and ocean management;
- Contribute to the blue economy assessment and monitoring of the implementation of the National Ocean Policy, SDS-SEA, SDGs, other international agreements, and national laws and policies; and
- Aid policy-making, planning and management of the coastal and marine areas of the country, and monitoring of the country's progress.

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 nuclear testing, dumping of wastes, and exploitation for food, minerals, oil and gas, and other resources. 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 understand that each of our uses of oceans involves real or potential tradeoffs with other uses. This means we need a much better and more detailed understanding of the economic values of oceans and coastal and marine resources, and the state of ocean health underpinning the sustainable development of oceans and coasts.

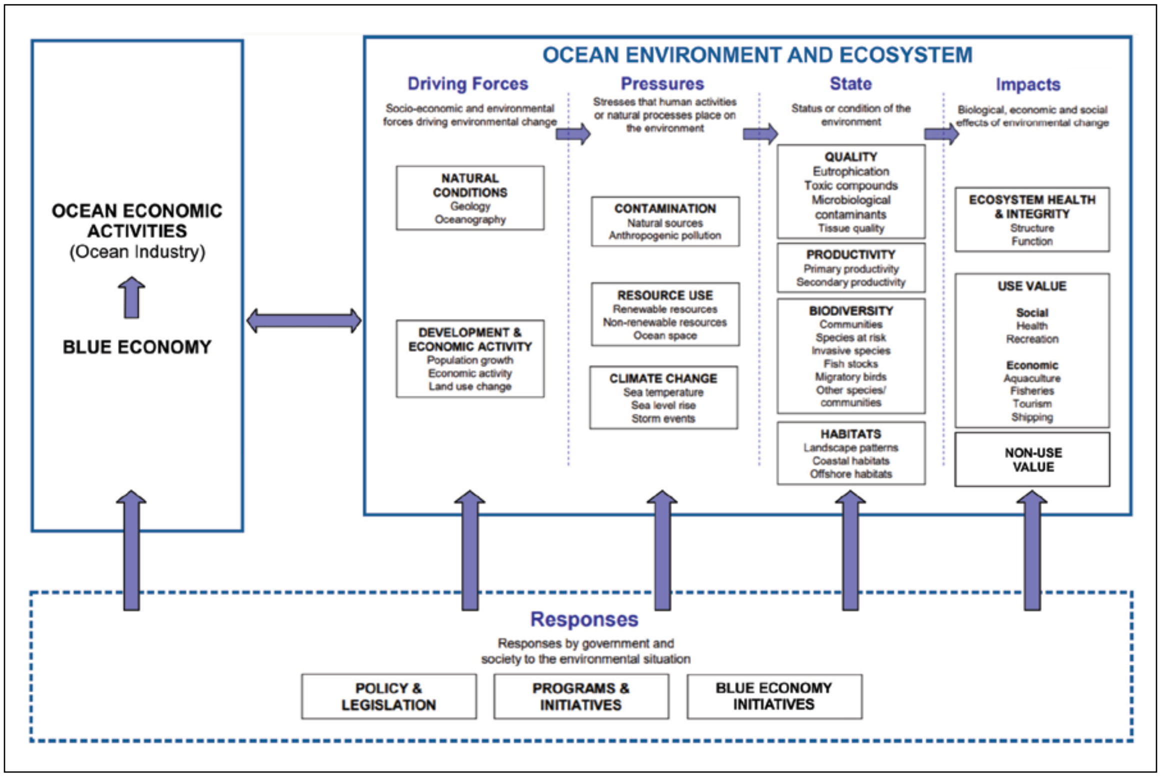
Within this context, the term “blue economy” has entered into the vocabulary of economic development in all parts of the world. But the meaning of “blue economy” is still evolving, with some emphasizing the possibilities of new ocean-based industries, such as renewable energy or bio-pharmaceuticals, and others emphasizing the need to transform the traditional and established ocean economic sector and the emerging ocean industries into a more sustainable and inclusive blue economy, conserving the oceanic natural capital and providing opportunities across the society. 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 such as sea-level rise and ocean acidification are becoming known, uncertainty remains about the extent and timing with which these ocean changes will affect resources and coastal areas.

The blue economy, as discussed during the EAS Congress 2012, 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) protecting the health, livelihoods, and welfare of the people in the coastal zone; and (e) fostering ecosystem-based climate change mitigation and adaptation measures.

1.4 Framework and Scope

The development of the NSOC Report entailed the use of the drivers-pressures-state-impacts-response (DPSIR) framework for the analysis (**Figure 1.1**), as well as the focus on the blue economy theme. It also involved review of literature, existing studies and reports, and consultations with

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



key government agencies and other stakeholders. The scope of the report is at national level, but includes inputs at the local level on good practices, challenges, and governance.

The preparation of NSOC report started with an Inception Workshop inviting relevant Ministries, academic and research institutions, NGOs and development partners that have the data, reports and studies needed for the report. The result of the workshop is then used for the formation of the technical working group (TWG). Data collected by the TWG are integrated and used in drafting the NSOC report. The Draft NSOC Report was subsequently presented by the TWG to various agencies and stakeholders to get their feedback and comments as well as additional data to improve the report. PEMSEA provided technical guidance during the preparation of the NSOC Report, and supported the technical editing of the final draft of the report.

This report seeks to consolidate the best available data and provide analysis on blue economy and ocean-related statistics and trends in ocean economy, ocean health issues, policy, and government response measures and priorities to provide an evidence base for policy-makers and various stakeholders.

The NSOC report provides the description of the status and assessment of the following:

- *Socioeconomic conditions and drivers of blue economy*: population, economy, social features
- *Ocean economy*: gross value added of the ocean economy and contribution to national economy; valuation of ecosystem services; key ocean economic activities (contribution to income and employment, pressures and issues, policy response)
- *Developments in blue economy:*
    - Innovations and sustainable practices that transform the *established* marine economic sectors.
    - *Sustainable development strategy and actions*: habitat and biodiversity conservation, marine protected areas, pollution reduction, natural hazard management and climate change response— to achieve the SDGs, SDS-SEA targets, other international commitments, and national targets to ensure ocean health and sustainable blue economy.
    - *Emerging* industries and opportunities for investments and partnerships for blue economy development.
- *State of ocean health underpinning the blue economy*: natural conditions (oceanography and biophysical features of the seas and coasts); ecosystems and biodiversity; pressures and impacts (risks and threats from human activities, natural hazards, and climate change, impacts on the environment and communities).
- *Governance structure supporting blue economy development*:
    - 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.
    - Supporting mechanisms (capacity development; research and development; financing, stakeholder participation; partnerships, etc.) for the implementation of these policies, laws, and international agreements.
- *Conclusion and recommendations*

1.5 Caveats

Most of the data used in this NSOC report are official data from respective institutions of TWG members. Data presented are in the form of spatial and time series, and there may be different time period used for each economic sector. This report is based on data going no further than December 2018 (submission of final report by IPB). Analysis of the ocean economy was made based on available sectoral data. Valuation and analysis of ecosystem services used results of studies of CCMRS-IPB in several locations for some ecosystems. Examples of blue economy initiatives and governance mechanisms were obtained from both published reports and online reports (websites of agencies, universities, NGOs, international organizations and development partners). Considering that blue economy and integrated ocean management are new concepts, there are only few best practices that can be shown in this NSOC Report. The sprawling archipelago of more than 16,000 islands and remote location of some coastal communities make it difficult for national, regional and provincial managers to comprehensively collect and record cross-sector, spatial and time-series data and trends at different levels, from the community to the national levels.

Mangrove restoration.
(Photo by: MOEF)

PART 1

THE SEAS, PEOPLE AND ECONOMY OF INDONESIA

2 Geography

Indonesia is the largest archipelagic state in the world, with around 16,056 islands, stretching from Sabang (Aceh) to Merauke (Papua), with total land area of about 1,916,906.77 square kilometres (km^2).[2] The coastline of Indonesia reaches 99,093 kilometers (km), the third longest in the world after Canada and Norway.[3] In terms of area, Indonesia is the 15th largest country in the world. Indonesia's area of national jurisdiction is about 7.73 million km^2, which is composed of 1.9 million km^2 of land, 2.8 million km^2 of archipelagic waters, 0.3 million km^2 of territorial sea, and 2.7 million km^2 of exclusive economic zone (EEZ).[4] The ocean waters area is approximately 5.8 million km^2 or equal to around 75% of the total area of Indonesia.

Indonesia is a transcontinental country, located between the two continents of Asia and Australia, and between two oceans – Indian Ocean and Pacific Ocean. It is located between 6° 04′ 30″ North latitude and 11° 00′ 36″ South latitude, and between 94° 58′ 21″ and 141° 01′ 10″ East longitude, and lies on the equator line located at 0° latitude line. In terms of geographic position, Indonesia has boundaries as follows: North - Malaysia, Singapore, Vietnam, Philippines, Thailand, Palau, and South China Sea; South - Australia, Timor Leste and Indian Ocean; West - Indian Ocean; East - Papua New Guinea and Pacific Ocean. The country is strategically located astride or along major sea lanes connecting South Asia, East Asia, Southeast Asia and Oceania.

The global waters are divided into 30 biogeographic realms, consisting of 18 continental-shelves and 12 offshore deep-sea realms.[5] The tropical Indo-Pacific area, called Realm 13, covers Bay of Bengal, Andaman Sea, Malacca Strait, Singapore Strait, eastern part of South China Sea, Java Sea, Flores Sea, Banda Sea, Arafura Sea, Timor Sea, Sulawesi Sea, and Sulu Sea. Realm 13 has relatively shallow waters (continental shelf) and deep sea waters as well as islands connected through straits.[6] This realm has the highest number of species among the 30 realms. Indonesia is located within Realm 13. The biogeographic realms have applications for marine reserves, biodiversity assessments, and as an evolution-relevant context for climate change studies.

Indonesia is geologically and topographically diverse, lying at the global centre of tropical marine biodiversity, with highly significant geographic, oceanographic, demographic and biodiversity

2 BPS. Statistik Indonesia 2018.
3 BPS. Statistics of Coastal and Marine Reources 2016. Based on *Geospatial Information Agency Missive Number B.3-4/ SESMA/IGD/07/2014, the length of Indonesia coastline in 2014 is 99,093 km (KKP, 2015).*
4 Asian Development Bank (ADB). 2014.
5 Costello, M.J., Tsai, P., Wong, P.S. et al. 2017.
6 Dahuri, 2003.

differences within the country. The coastal and marine ecosystems of Indonesia include coral reefs, mangroves, seagrass, estuaries, tidal flats, open sea, and deep sea ecosystems. The high biodiversity is not only due to strategic geographic location, but also due to climate, seawater mass, and types of habitats and ecosystems within.

The **Coral Triangle** is a tropical marine region, which spans the waters of the Philippines, Papua New Guinea, Solomon Islands, Timor Leste and parts of Indonesia and Malaysia that contain at least 500 species of reef-building corals in each ecoregion. The Philippines and Indonesia share the most biodiverse part of Coral Triangle.

Indonesia also lies in the Ring of Fire, and is predominantly mountainous with some 400 volcanoes, of which 100 are active.

There are three Standard Time Zones in Indonesia:
1. Sumatra, Java, and West and Central Kalimantan are 7 hours ahead of Greenwich Mean Time (GMT+7)
2. Bali, Nusa Tenggara, South and East Kalimantan, and Sulawesi: GMT+8
3. Papua, West Papua and Maluku: GMT+9

Figure 2.1: Map of Indonesia.

Table 2.1: Key Geographic Indicators.

Land area (km^2)*	1,916,906.77
Urban land area (km^2)**	42,077
Rural land area (km^2)**	1,838,683
Coastline (km)*	99,093
Archipelagic waters (km^2)***	2.8 million
Territorial sea water area (km^2)***	800,000
Exclusive Economic Zone (EEZ) (km^2)***	2.7 million

Sources: * *BPS. Statistik Indonesia.*
** *World Bank (2018)*
*** *BPS. Statistics of Coastal and Marine Resources 2016.*

Indonesia has 34 provinces spread over five main islands and four archipelagoes.[7] These include:

- Sumatera Island: Aceh, Sumatera Utara, Sumatera Barat, Riau, Jambi, Sumatera Selatan, Bengkulu, and Lampung.
- Java Island: DKI Jakarta, Banten, Jawa Barat, Jawa Tengah, DI Yogyakarta, and Jawa Timur.
- Kalimantan Island: Kalimantan Barat, Kalimantan Tengah, Kalimantan Selatan, Kalimantan Timur and Kalimantan Utara.
- Sulawesi Island: Sulawesi Utara, Gorontalo, Sulawesi Tengah, Sulawesi Selatan, Sulawesi Barat, and Sulawesi Tenggara.
- Papua Island: Papua and Papua Barat.
- Riau Archipelago: Kepulauan Riau.
- Bangka Belitung Archipelago: Kepulauan Bangka Belitung.
- Nusa Tenggara Archipelago (Sunda Kecil): Bali, Nusa Tenggara Barat, and Nusa Tenggara Timur.
- Maluku Archipelago: Maluku and Maluku Utara.

Jakarta, located in the island of Java, is the capital of the country. **Table 2.2** shows the land area and number of islands in each province. Papua is the biggest province, with land area of 319,036.05 km^2, which is 16.64% of the country's total land area. Papua Barat, with 4,108 islands, has the highest number of islands among the 34 provinces.

Table 2.2: Total Area and Number of Islands by Province.

Province	Provincial Capital	Area of Province[1] (km^2)	Percentage to Total Area	Number of Islands
Aceh	Banda Aceh	57,956.00	3.02	331
Sumatera Utara	Medan	72,781.23	3.18	232
Sumatera Barat	Padang	42,012.89	2.19	211
Riau	Pekanbaru	87,023.66	4.54	161
Jambi	Jambi	50,058.16	2.61	15

[7] BPS. Statistik Indonesia.

Table 2.2: Total Area and Number of Islands by Province. (cont.)

Province	Provincial Capital	Area of Province[1] (km²)	Percentage to Total Area	Number of Islands
Sumatera Selatan	Palembang	91,592.43	4.78	23
Bengkulu	Bengkulu	19,919.33	1.04	10
Lampung	Bandar Lampung	34,623.80	1.81	132
Kepulauan Bangka Belitung	Pangkal Pinang	16,424.06	0.86	556
Kepulauan Riau	Tanjung Pinang	8,201.72	0.43	1,994
DKI Jakarta	Jakarta	664.01	0.03	110
Jawa Barat	Bandung	35,377.76	1.85	30
Jawa Tengah	Semarang	32,800.69	1.71	72
DI Yogyakarta	Yogyakarta	3,133.15	0.16	33
Jawa Timur	Surabaya	47,803.49	2.49	431
Banten	Serang	9,661.92	0.50	81
Bali	Denpasar	5,780.06	0.30	33
Nusa Tenggara Barat	Mataram	18,572.32	0.97	407
Nusa Tenggara Timur	Kupang	48,718.10	2.54	532
Kalimantan Barat	Pontianak	147,307.00	7.68	243
Kalimantan Tengah	Palangka Raya	153,564.50	8.01	64
Kalimantan Selatan	Banjarmasin	38,744.23	2.02	172
Kalimantan Timur	Samarinda	129,066.64	6.73	419
Kalimantan Utara	Bulungan	75,467.70	3.94	34
Sulawesi Utara	Manado	13,892.47	0.72	287
Sulawesi Tengah	Palu	61,841.29	3.23	1,632
Sulawesi Selatan	Makassar	46,717.48	2.44	314
Sulawesi Tenggara	Kendari	38,067.70	1.99	527
Gorontalo	Gorontalo	11,257.07	0.59	123
Sulawesi Barat	Mamuju	16,787.18	0.88	41
Maluku	Ambon	46,914.03	2.45	1,286
Maluku Utara	Sofifi	31,982.50	1.67	856
Papua Barat	Manokwari	102,955.15	5.37	4,108
Papua	Jayapura	319,036.05	16.64	556
Indonesia		**1,916,906.77**	**100.00**	**16,056**

Notes:
[1] Based on Minister of Home Affairs Regulation Number 72/2019, October 25, 2019.
[2] Based on information from Ministry of Home Affairs Number 125/2215/BAK of 2018 about Area of Province and Number of Islands
[3] Law of the Republic of Indonesia Number 46 of 1999 about Formation of Maluku Utara Province, Buru Regency, and Maluku Tenggara Barat Regency.
Source: Ministry of Home Affairs; BPS Statistik Indonesia.

The number of villages in each province has been changing through the years. However, from 2011 to 2018, the number of villages that are coastal remained at 15%. In 2018, there were 12,857 coastal villages and 71,074 non-coastal villages (**Table 2.3**).

Table 2.3: Number of Villages[1]/Kelurahan, by Province and Geographical Location, 2011–2018.

Province	Coastal			Non-Coastal		
	2011	2014	2018	2011	2014	2018
Aceh	761	748	723	5,722	5,764	5,785
Sumatera Utara	396	459	423	5,401	5,645	5,709
Sumatera Barat	116	127	132	917	1,018	1,143
Riau	232	271	254	1,423	1,564	1,621
Jambi	29	30	28	1,343	1,521	1,534
Sumatera Selatan	34	29	25	3,152	3,208	3,237
Bengkulu	182	186	184	1,327	1,346	1,330
Lampung	231	241	231	2,233	2,391	2,423
Kepulauan Bangka Belitung	163	166	160	198	215	231
Kepulauan Riau	299	361	355	54	54	61
DKI Jakarta	16	16	15	251	251	252
Jawa Barat	217	227	221	5,688	5,735	5,736
Jawa Tengah	347	357	355	8,230	8,221	8,204
Di Yogyakarta	33	33	33	405	405	405
Jawa Timur	655	678	655	7,847	7,824	7,841
Banten	131	135	133	1,404	1,416	1,419
Bali	177	175	175	539	541	541
Nusa Tenggara Barat	279	301	297	805	840	846
Nusa Tenggara Timur	943	1,011	1,018	2,023	2,259	2,335
Kalimantan Barat	163	161	158	1,804	1,948	1,979
Kalimantan Tengah	45	44	45	1,483	1,525	1,531
Kalimantan Selatan	166	165	165	1,834	1,843	1,843
Kalimantan Timur	218	175	156	1,247	851	882
Kalimantan Utara	-	55	56	-	424	426
Sulawesi Utara	721	778	783	972	1,058	1,055
Sulawesi Tengah	901	1,021	1,011	914	965	1,009
Sulawesi Selatan	504	531	527	2,478	2,499	2,522
Sulawesi Tenggara	813	947	954	1,308	1,325	1,400
Gorontalo	191	203	201	540	533	533
Sulawesi Barat	148	152	152	490	496	498
Maluku	859	914	1,064	165	174	176
Maluku Utara	856	941	934	223	255	262
Papua Barat	536	543	572	903	1,024	1,415
Papua	522	646	662	3,402	4,225	4,890
Indonesia	**11,884**	**12,827**	**12,857**	**66,725**	**69,363**	**71,074**

Note: [1] Villages in this table include Transmigration Settlement Unit which is still fostered by the relevant ministries and the nagari in the Province of Sumatera Barat.
Source: BPS-Statistics Indonesia, Village Potential Data Collection.

3 The People and Economy

3.1 Major Driving Forces

A number of important factors and recent developments have been shaping the coastal and marine areas of Indonesia. In broad terms, the coastal and marine sectors like all other sectors respond to macro-level factors. These include:

- Population growth and changes in demographic attributes (rural/urban balance, dependency on coastal and marine resources, incomes and prosperity, changes in aspirations and expectations, such as greater interest in environmental issues);
- Economic growth (sectoral contributions to GDP, technological developments, increasing per capita GDP and GNI, population settlements, and related changes in personal wealth, prosperity, consumption and production patterns);
- Changes in social dimensions (including changes associated with cultural, ethnic, gender equity issues; social developments due to access to energy, water, other resources and technologies, and improved education, health, welfare, and other social services);
- Coastal land- and sea-use changes (including urbanization, increased settlements in coastal areas, deforestation, conversion of coastal habitats, reclamation, infrastructure developments due to travel and tourism demands);
- Evolution of policies (within and outside the sector); and institutional/policy adaptations (such as economic deregulation, trade liberalization, decentralisation, becoming parties to international agreements and the associated obligations).

This section focuses on the demographic, economic and social factors driving the ocean economy and changes in ocean health. **Table 3.1** shows the key indicators of these driving forces.

Table 3.1: Key Demographic and Socioeconomic Indicators.

Indicators	2015	2018
Population, total	258,383,256	267,663,435
Population growth (annual %)	1.27	1.13
Population density (people per sq. km of land area)	142.63	147.75
Coastal population (% of total population)	65	65
Gross domestic product, GDP (constant 2010 US$)	988,128,596,686	1,146,844,815,417

Table 3.1: Key Demographic and Socioeconomic Indicators. (cont.)

Indicators	2015	2018
GDP (constant LCU)	8,982,517,100,000,000	10,425,316,300,000,000
GDP growth (annual %)	4.88	5.17
GDP per capita (constant 2010 US$)	3,824	4,285
Gross national income, GNI (constant 2010 US$)	956,489,622,343	1,112,082,625,438
GNI (constant LCU)	8,694,905,114,754,280	10,109,312,931,457,200
GNI growth (annual %)	4.94	5.31
GNI per capita (constant 2010 US$)	3,702	4,155
Official exchange rate (LCU per US$, period average)	13,389.41	14,236.94
Inflation, consumer prices (annual %)	6.36	3.20
Trade (% of GDP)	41.94	43.02
Exports of goods, services and primary income (BoP, current US$)	174,167,059,410	218,004,346,645
Imports of goods, services and primary income (BoP, current US$)	197,194,291,873	255,946,216,125
Foreign direct investment, net (BoP, current US$)	(10,704,478,317)	(13,421,979,939)
Portfolio investment, net (BoP, current US$)	(16,182,680,883)	(9,311,908,007)
Unemployment, total (% of total labor force) (modeled ILO estimate)	4.51	4.51
Unemployment, male (% of male labor force) (modeled ILO estimate)	4.57	4.68
Unemployment, female (% of female labor force) (modeled ILO estimate)	4.43	4.25
Self-employed, total (% of total employment) (modeled ILO estimate)	51.00	51.90
Self-employed, male (% of male employment) (modeled ILO estimate)	46.42	47.23
Self-employed, female (% of female employment) (modeled ILO estimate)	58.45	59.12
Human development index (HDI)*	0.696	0.707
GNI per capita, PPP (constant 2011 international $)*	10,029.0	11,256.0
Mean years of schooling*	7.9	8.0
Expected years of schooling*	12.8	12.9
Life expectancy at birth, total (years)	70.77	71.51
Life expectancy at birth, male (years)	68.65	69.38
Life expectancy at birth, female (years)	72.99	73.75
Literacy rate, adult total (% of people ages 15 and above)	95.22	95.66
Literacy rate, adult male (% of males ages 15 and above)	97.11	97.33
Literacy rate, adult female (% of females ages 15 and above)	93.34	93.99
People using at least basic sanitation services (% of population)	69.38	73.13 (in 2017)
People using at least basic drinking water services (% of population)	87.96	89.34 (in 2017)
People with basic handwashing facilities including soap and water (% of population)	63.98	64.20 (in 2017)
Access to electricity (% of population)	97.54	98.14 (in 2017)

Table 3.1: Key Demographic and Socioeconomic Indicators. (cont.)

Indicators	2015	2018
Mobile cellular subscriptions (per 100 people)	131.18	119.34
Fixed broadband subscriptions (per 100 people)	1.54	3.32
Poverty headcount ratio at national poverty lines (% of population)	11.2	9.8
Poverty headcount ratio at $3.20 a day (2011 PPP) (% of population)	33.1	24.2
Poverty headcount ratio at $1.90 a day (2011 PPP) (% of population)	7.2	4.6
GINI index (World Bank estimate)	41	39

Note:
LCU: local currency unit (Indonesian rupiah) GDP: gross domestic product
GNI: gross national income BOP: Balance of Payments
ILO: International Labor Organization PPP: purchasing power parity
Source: World Bank (https://data.worldbank.org/country/indonesia)
* *UNDP (http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/IDN.pdf)*

Economic growth, human development and environmental sustainability

The environmental Kuznets curve suggests that economic development initially leads to deterioration in the environment, but after a certain level of economic growth, a society begins to improve its relationship with the environment, and levels of environmental degradation reduces, especially with increasing awareness and improving education levels. The theory also posits that with higher rates of economic growth and human development, people have more disposable income after paying for basic necessities; therefore, they are more amenable to paying higher prices and taxes in return for better living conditions and environment. However, the link between levels of income and environmental degradation is quite weak. Economic growth has resulted in greater resource use, deforestation, overfishing, and higher levels of CO_2 emissions. It is possible economic growth will be compatible with an improved environment, but it requires a very deliberate set of policies as well as behaviour change and willingness to conserve natural resources, reduce waste, and produce goods and energy sustainably or in the most environmentally and climate-friendly way.

3.2 Demography

3.2.1 Total Population

Indonesia is the fourth most-populated country in the world (265 million people in 2018) after China (1.39 billion people), India (1.35 billion people), and the United States (326.69 million).[8]

Jawa Barat (West Java) is the province with the highest population among the 34 provinces, followed by Jawa Timur (East Java), and Jawa Tengah (Central Java) (**Table 3.2**).

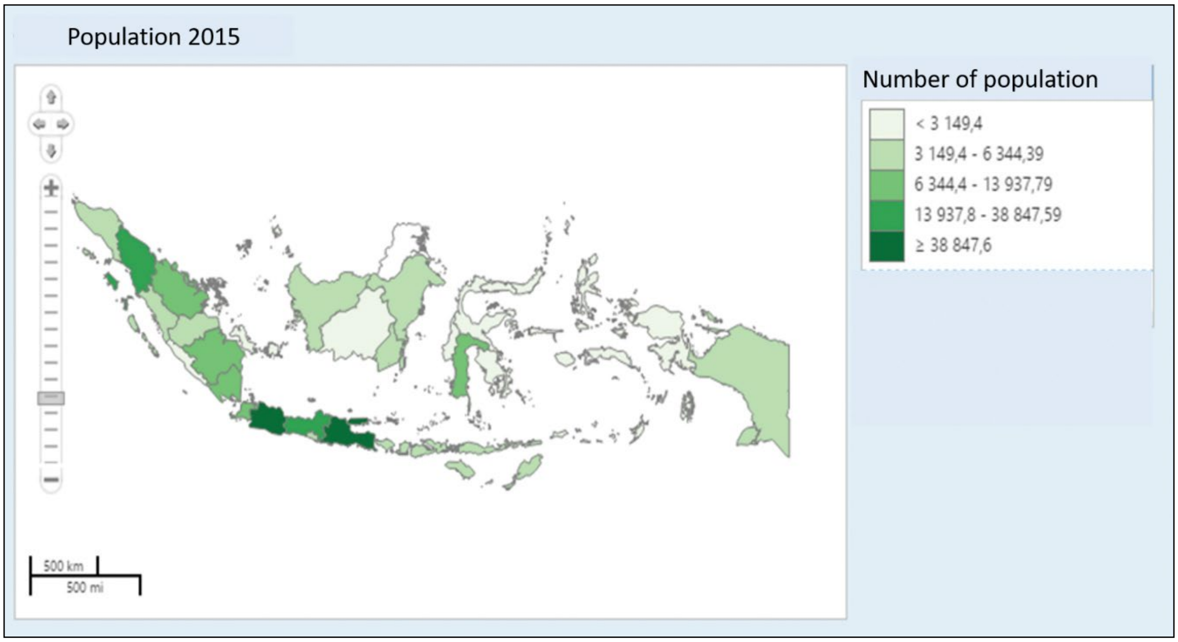
8 https://data.worldbank.org/indicator/SP.POP.TOTL?locations=CN-IN-US&year_high_desc=true

Table 3.2: Indonesian Population by Province.

Province	1971	1980	1990	2000	2010	2018 (in thousands)
Aceh	2,008,595	2,611,271	3,416,156	3,930,905	4,494,410	5,281.3
Sumatera Utara	6,621,831	8,360,894	10,256,027	11,649,655	12,982,204	14,415.4
Sumatera Barat	2,793,196	3,406,816	4,000,207	4,248,931	4,846,909	5,382.1
Riau	1,641,545	2,168,535	3,303,976	4,957,627	5,538,367	6,814.9
Jambi	1,006,084	1,445,994	2,020,568	2,413,846	3,092,265	3,570.3
Sumatera Selatan	3,440,573	4,629,801	6,313,074	6,899,675	7,450,394	8,370.3
Bengkulu	519,316	768,064	1,179,122	1,567,432	1,715,518	1,963.3
Lampung	2,777,008	4,624,785	6,017,573	6,741,439	7,608,405	8,370.5
Kepulauan Bangka Belitung	-	-	-	900,197	1,223,296	1,459.9
Kepulauan Riau	-	-	-	-	1,679,163	2,136.5
DKI Jakarta	45,79,303	6,503,449	8,259,266	8,389,443	9,607,787	10,467.6
Jawa Barat	21,623,529	27,453,525	35,384,352	35,729,537	43,053,732	48,683.7
Jawa Tengah	21,877,136	25,372,889	28,520,643	31,228,940	32,382,657	34,490.8
Di Yogyakarta	2,489,360	2,750,813	2,913,054	3,122,268	3,457,491	3,802.9
Jawa Timur	25,516,999	29,188,852	32,503,991	34,783,640	37,476,757	39,500.9
Banten	-	-	-	8,098,780	10,632,166	12,689.7
Bali	2,120,322	2,469,930	2,777,811	31,51,162	3,890,757	4,292.2
Nusa Tenggara Barat	2,203,465	2,724,664	3,369,649	4,009,261	4,500,212	5,013.7
Nusa Tenggara Timur	2,295,287	2,737,166	3,268,644	3,952,279	468,3827	5,371.5
Kalimantan Barat	2,019,936	2,486,068	3,229,153	4,034,198	4,395,983	5,001.7
Kalimantan Tengah	701,936	954,353	1,396,486	1,857,000	2,212,089	2,660.2
Kalimantan Selatan	1,699,105	2,064,649	2,597,572	2,985,240	3,626,616	4,182.7
Kalimantan Timur	733,797	1,218,016	1,876,663	2,455,120	3,553,143	3,648.8
Kalimantan Utara	-	-	-	-	-	716.4
Sulawesi Utara	1,718,543	2,115,384	2,478,119	2,012,098	2,270,596	2,484.4
Sulawesi Tengah	913,662	1,289,635	1,711,327	2,218,435	2,635,009	3,010.4
Sulawesi Selatan	5,180,576	6,062,212	6,981,646	8,059,627	8,034,776	8,772.0
Sulawesi Tenggara	714,120	942,302	1,349,619	1,821,284	2,232,586	2,653.7
Gorontalo	-	-	-	835,044	1,040,164	1,185.5
Sulawesi Barat	-	-	-	-	1,158,651	1,355.6
Maluku	1,089,565	1,411,006	1,857,790	1,205,539	1,533,506	1,773.8
Maluku Utara	-	-	-	785,059	1,038,087	1,232.6
Papua Barat	-	-	-	-	760,422	937.5
Papua	923,440	117,3875	1,648,708	2,220,934	2,833,381	3,322.5
Indonesia	**119,208,229**	**147,490,298**	**179,378,946**	**206,264,595**	**237,641,326**	**265,015.3**

Source: For data from 1971 to 2010: https://www.bps.go.id/linkTableStatis/view/id/1267. Accessed 9 January 2017.
For 2018 data: BPS, Statistik Indonesia 2019.

Figure 3.1: Total Population in 2015.



The growth of the Indonesian population has changed through the years. Using the 10-year cycle, the average growth of the Indonesian population has decreased significantly. In the period 1971-1980, the growth of Indonesian population had reached 2.31%, then decreased to 1.98% in the decade of 1980-1990, and decreased again to 1.49% in the decades of 1990-2000 and 2000-2010. The average population growth rate declined further to an average 1.40% in the period 2010-2014. **Table 3.3** shows the trend of the Indonesian population growth from 1971 to 2014. The average annual growth rate of population in 2015-2018 is 1.20%.

Table 3.3: Indonesian Population Growth from 1971 to 2014.

Province	Population Growth Rate (%/year)				
	1971-1980	1980-1990	1990-2000	2000-2010	2010-2014
Aceh	2.93	2.72	1.46	2.36	2.06
Sumatera Utara	2.60	2.06	1.32	1.10	1.39
Sumatera Barat	2.21	1.62	0.63	1.34	1.34
Riau	3.11	4.30	4.35	3.58	2.64
Jambi	4.07	3.40	1.84	2.56	1.85
Sumatera Selatan	3.32	3.15	2.39	1.85	1.50
Bengkulu	4.39	4.38	2.97	1.67	1.74
Lampung	5.77	2.67	1.17	1.24	1.26

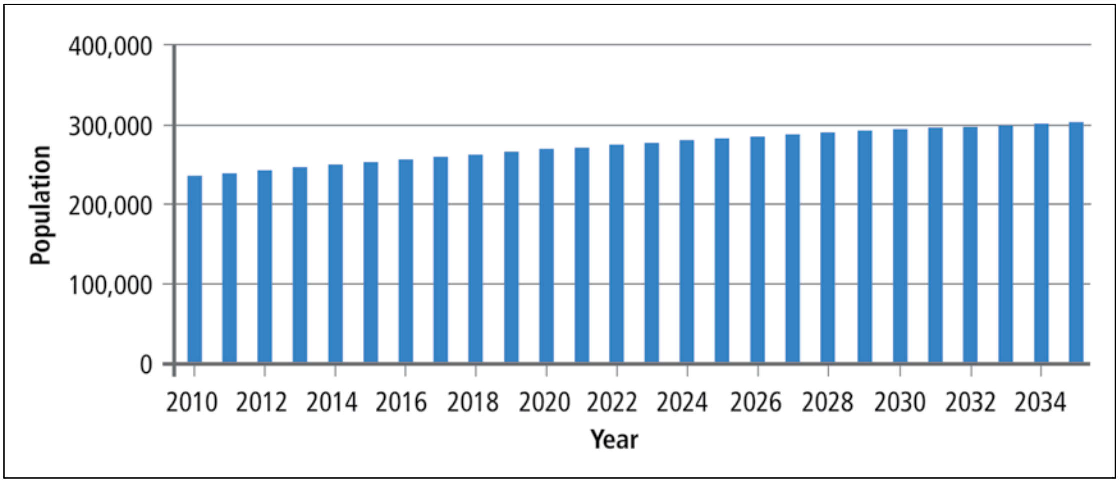
Table 3.3: Indonesian Population Growth from 1971 to 2014. (cont.)

Province	Population Growth Rate (%/year)				
	1971-1980	1980-1990	1990-2000	2000-2010	2010-2014
Kepulauan Bangka Belitung	-	-	0.97	3.14	2.23
Kepulauan Riau	-	-	-	4.95	3.16
DKI Jakarta	3.93	2.42	0.17	1.41	1.11
Jawa Barat	2.66	2.57	2.03	1.90	1.58
Jawa Tengah	1.64	1.18	0.94	0.37	0.82
DI Yogyakarta	1.10	0.57	0.72	1.04	1.20
Jawa Timur	1.49	1.08	0.70	0.76	0.69
Banten	-	-	3.21	2.78	2.30
Bali	1.69	1.18	1.31	2.15	1.24
Nusa Tenggara Barat	2.36	2.15	1.82	1.17	1.40
Nusa Tenggara Timur	1.95	1.79	1.64	2.07	1.71
Kalimantan Barat	2.31	2.65	2.29	0.91	1.68
Kalimantan Tengah	3.43	3.88	2.99	1.79	2.38
Kalimantan Selatan	2.16	2.32	1.45	1.99	1.87
Kalimantan Timur	5.73	4.42	2.81	3.81	2.64
Sulawesi Utara	2.31	1.60	1.33	1.28	1.17
Sulawesi Tengah	3.86	2.87	2.57	1.95	1.71
Sulawesi Selatan	1.74	1.42	1.49	1.17	1.13
Sulawesi Tenggara	3.09	3.66	3.15	2.08	2.20
Gorontalo	-	-	1.59	2.26	1.65
Sulawesi Barat	-	-	-	2.68	1.95
Maluku	2.88	2.79	0.08	2.80	1.82
Maluku Utara	-	-	0.48	2.47	2.21
Papua Barat	-	-	-	3.71	2.65
Papua	2.67	3.46	3.22	5.39	1.99
INDONESIA	**2.31**	**1.98**	**1.49**	**1.49**	**1.40**

Source: https://www.bps.go.id/linkTableStatis/view/id/1268, Accessed 9 January 2017.

Based on the analysis of population growth by Malthusian method, the population grew as much as 1.69% during the period of 1971-2015. The population of Indonesia is estimated to reach 317.25 million people in 2030, 375.66 million people in 2040, and 444.83 million people in 2050. **Figure 3.2** shows the population growth projections.

Figure 3.2: Population Projection for 2010-2035.



Source: BPS-Statistik Indonesia, 2010 Population Census, and Indonesia Population Projection 2010–2035.

3.2.2 Coastal Population

The number of people living in coastal areas in 2010 was estimated at 60% of total population, and 65% in 2015. This is in line with the development of coastal areas indicating the increasing number of Indonesian living and inhabiting coastal areas. **Table 3.4** shows the total and coastal population during the period 1971-2015, and the projected population from 2020 to 2030.

The estimated 166 million people spread across the coasts of large islands and live in the small islands are a source of social capital or as part of the input of the ocean economy production and as beneficiaries and as a companion for the use of natural inputs and capital in the marine sectors.

Table 3.4: Total and Coastal Population.

Year	Population (Million)	Coastal Population (Million)	Coastal Population (% of Total Population)
1971	119.21	71.53	60%
1980	147.49	88.49	60%
1990	179.38	107.63	60%
1995	194.75	116.85	60%
2000	206.26	123.76	60%
2010	237.64	142.58	60%
2015	255.71	166.21	65%
2020*	267.92	174.15	65%
2030*	317.25	206.21	65%

*Source: * Population projection (estimation processed in January 2017).*

3.2.3 Population Density

The population density of Indonesia increased during the period of 2000-2018. The population density of Indonesia reached 107 people/km^2 in 2000, 124 people/km^2 in 2010, and increased further to 138 people/km^2 in 2018.

The population density by province from 2000 to 2018 is presented in **Table 3.5**. In 2018, the provinces with the highest density were DKI Jakarta (15, 764 people/km^2), followed by West Java or Jawa Barat (1,376 people/km^2) and Banten (1,313 people/km^2). Meanwhile, the provinces with lowest density were North Kalimantan or Kalimantan Utara (9 people/km^2), West Papua or Papua Barat (9 people/km^2), and Papua (10 people/km^2). **Figure 3.3** shows the population density in the different provinces.

Table 3.5: Population Density in Each Province in Indonesia.

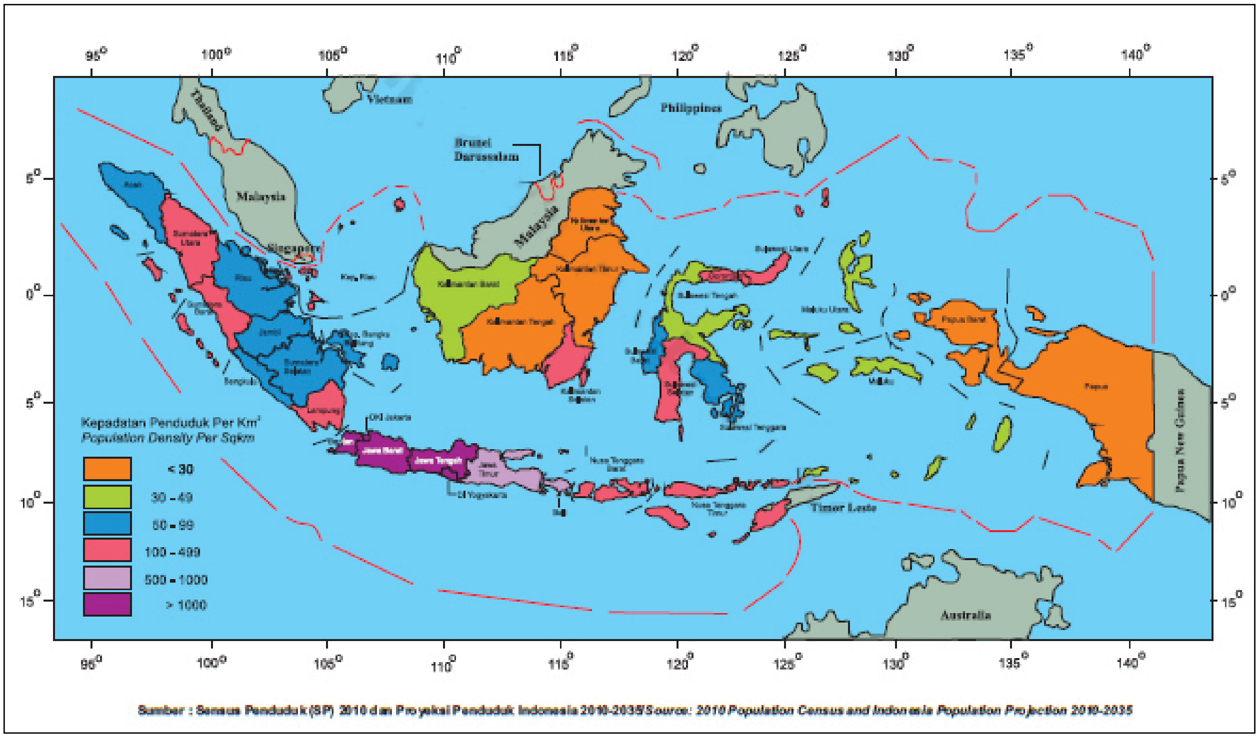
Province	Population Density (Person/km^2)					
	2000	2005	2010	2013	2014	2018
Aceh	68	72	78	83	85	91
Sumatera Utara	160	171	179	186	189	198
Sumatera Barat	101	108	116	121	122	128
Riau	45	55	64	69	71	78
Jambi	48	58	62	66	67	71
Sumatera Selatan	68	113	82	85	87	91
Bengkulu	73	79	86	91	93	99
Lampung	194	188	220	229	232	242
Kepulauan Bangka Belitung	55	65	75	80	82	89
Kepulauan Riau	127	158	206	227	234	260
Dki Jakarta	12592	12012	14518	15015	15173	15764
Jawa Barat	1010	1060	1222	1282	1301	1376
Jawa Tengah	952	972	989	1014	1022	1052
Di Yogyakarta	996	1074	1107	1147	1161	1214
Jawa Timur	727	781	786	803	808	826
Banten	838	1006	1106	1185	1211	1313
Bali	545	625	676	702	710	743
Nusa Tenggara Barat	216	211	243	254	257	270
Nusa Tenggara Timur	78	93	97	102	103	110
Kalimantan Barat	27	34	30	32	32	34
Kalimantan Tengah	12	13	14	16	16	17
Kalimantan Selatan	77	85	94	99	101	108

Table 3.5: Population Density in Each Province in Indonesia. (cont.)

Province	Population Density (Person/km²)					
	2000	2005	2010	2013	2014	2018
Kalimantan Timur	12	15	17	19	26	28
Kalimantan Utara	-	-	-	-	8	9
Sulawesi Utara	144	154	164	170	172	179
Sulawesi Tengah	35	34	43	45	46	49
Sulawesi Selatan	153	162	173	179	180	188
Sulawesi Tenggara	48	53	59	63	64	70
Gorontalo	74	77	93	98	99	105
Sulawesi Barat	53	59	69	74	75	81
Maluku	25	27	33	35	35	38
Maluku Utara	25	23	33	35	36	39
Papua Barat	5	6	8	9	9	9
PAPUA	5	6	9	10	10	10
INDONESIA	**107**	**118**	**124**	**130**	**132**	**138**

Source: 2000-2014: https://www.bps.go.id/linkTableDinamis/view/id/842, Accessed on 9 January 2017.
2018: BPS, Statistik Indonesia 2019.

Figure 3.3: Population Density, 2018.



Source: BPS, Statistik Indonesia 2019.

3.2.4 Urban and Rural Population

The percentage of urban population is increasing as the urban economy grows and attracts rural people to the urban working areas. As a result, rural population is experiencing a decline, creating pressures on both agricultural production and urban infrastructure and services. Urban areas will need more housing, water supply, energy, roads, transportation systems, sanitation, wastewater and solid waste management, etc. These pressures are expected to increase as the population of Indonesia and rate of urbanization increase. In 2010, there were 120.71 million people in urban areas, or 49.9% of total population. The urban population increased to 137.75 million people (53.3%) in 2015, and to 148.08 million (55.3%) in 2018. On the other hand, the share of rural population to total population has been decreasing from 2010 to 2018, and rural population showed negative growth rates in the same period. The population in both urban and rural areas in Indonesia can be seen in **Table 3.6**.

Table 3.6: Indonesian Population by Province.

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Urban population	**120,709,130**	**124,016,544**	**127,396,459**	**130,826,016**	**134,287,151**	**137,751,865**	**141,210,511**	**144,652,795**	**148,084,795**
Urban population (% of total population)	49.91	50.60	51.28	51.96	52.64	53.31	53.99	54.66	55.33
Urban population growth (annual %)	2.91	2.70	2.69	2.66	2.61	2.55	2.48	2.41	2.34
Rural population	**121,125,085**	**121,099,662**	**121,055,954**	**120,980,386**	**120,841,853**	**120,631,391**	**120,343,715**	**119,993,091**	**119,578,640**
Rural population (% of total population)	50.09	49.41	48.72	48.05	47.37	46.69	46.01	45.34	44.68
Rural population growth (annual %)	(0.21)	(0.02)	(0.04)	(0.06)	(0.11)	(0.17)	(0.24)	(0.29)	(0.35)

Source: World Bank, 2019.

3.2.5 Age-Sex Structure

The age-sex structure shows the ratio of males to females by age group (**Table 3.7**). The previous two censuses of SP2000, SP 2010, and SUPAS 2015 appear to have similar patterns. In the young (0-14 years) age group, the sex ratio is more male than female. In the age group of 15 to 64 years old, who are thought to have high mobility, there are slightly more men than women. Meanwhile, the age group of 65 years and above, there are more women. The age group of 15-64 years old -- working age population -- is 67.6% of total population in 2018.

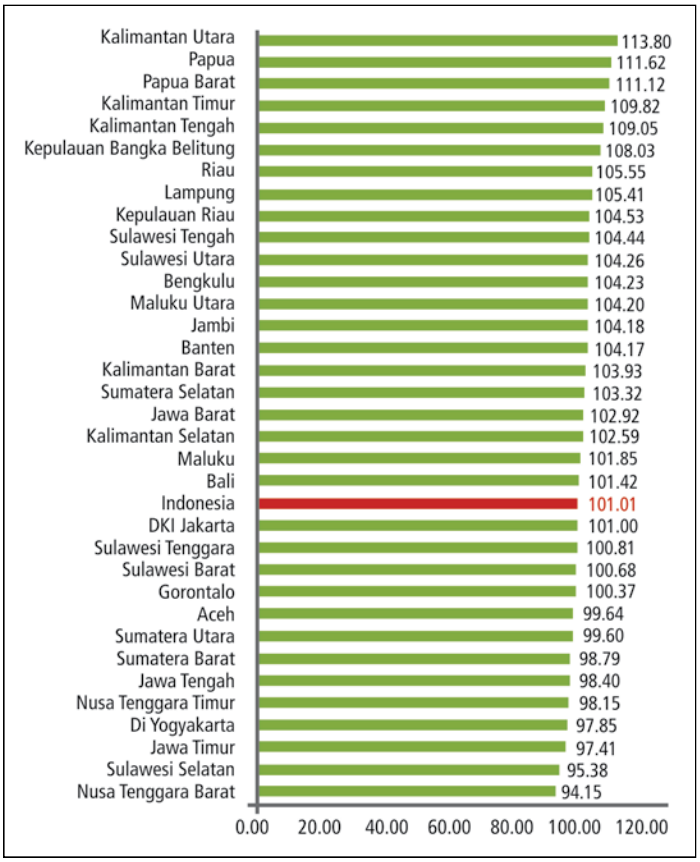
Table 3.7: Population by Age Group and Sex.

	2015	2016	2017	2018
Population ages 65 and above, total	**13,909,895**	**14,449,135**	**15,037,043**	**15,677,491**
Population ages 65 and above (% of total population)	5.38	5.52	5.68	5.86
Population ages 65 and above, male (% of male population)	4.74	4.90	5.07	5.26
Population ages 65 and above, female (% of female population)	6.04	6.16	6.30	6.46
Population ages 15-64, total	**173,544,644**	**175,876,857**	**178,379,664**	**180,918,098**
Population ages 15-64 (% of total population)	67.17	67.24	67.40	67.59
Population ages 15-64, male (% of male population)	67.29	67.38	67.53	67.72
Population ages 15-64, female (% of female population)	67.03	67.11	67.27	67.46
Population ages 0-14, total	**70,928,717**	**71,228,234**	**71,229,180**	**71,067,847**
Population ages 0-14 (% of total population)	27.45	27.23	26.91	26.55
Population ages 0-14, male (% of male population)	27.96	27.73	27.39	27.02
Population ages 0-14, female (% of female population)	26.93	26.73	26.43	26.08

Source: World Bank, 2019

The result of SUPAS 2015 showed that the sex ratio by province is consistent, in general, with the sex ratio at the national level, i.e., the male population is larger than the female population. For example, the sex ratio in Jakarta is 101, which means that there are 101 men per 100 women. Nevertheless, there are some provinces where the female population is larger than male population. These are Aceh, West Sumatra, North Sumatra, Central Java, East Nusa Tenggara, Yogyakarta, East Java, South Sulawesi, and West Nusa Tenggara, where the sex ratios are less than 100. As shown in **Figure 3.4**, the sex ratio in 2015 was highest in the Province of North Kalimantan (Kalimantan Utara), and lowest in West Nusa Tenggara Province (Nusa Tenggara Barat).

Figure 3.4: Sex Ratio by Province in 2015.



Source: SUPAS, 2015.

3.2.6 Dependency Ratio

The age groups of 0-14 years old (young or minors), and 65 years old and above (seniors) are considered to be the dependents of the working age group (15-64 years old). With the proportion of the working age group increasing, while the age group of 0-14 years old declining, and age group of 65 years old and above only slightly increasing, the dependency ratio has been declining since the 1970s (**Figure 3.5**). This is also the trend in 2015 to 2018 (**Table 3.8**).

Figure 3.5: Dependency Ratio by Age Group 1950 - 2020.

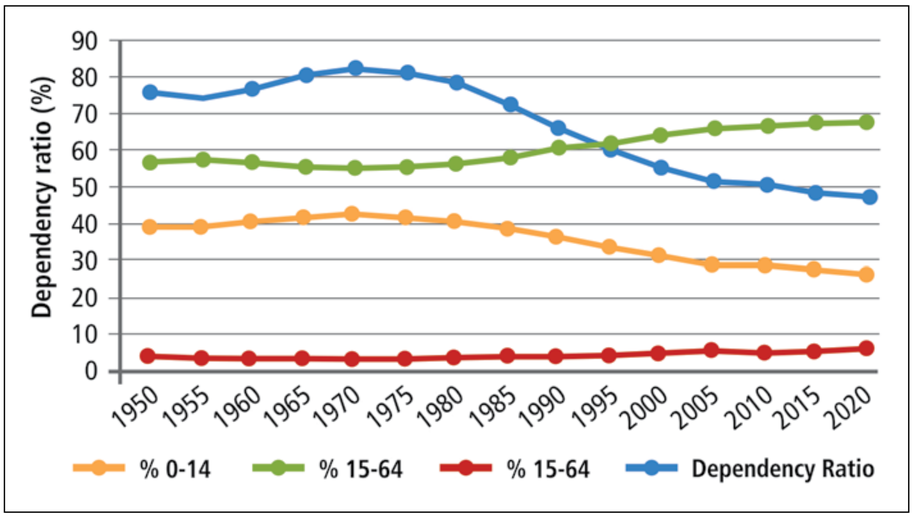


Table 3.8: Working Age Population and Age Dependency Ratios.

	2015	2016	2017	2018
Working age: Population ages 15-64, total	173,544,644	175,876,857	178,379,664	180,918,098
Age dependency ratio (% of working-age population)	48.89	48.71	48.36	47.95
Age dependency ratio, young, ages 0-14 (% of working-age population)	40.87	40.50	39.93	39.28
Age dependency ratio, old, ages 65 and above (% of working-age population)	8.02	8.22	8.43	8.67

Source: World Bank, 2019.

3.2.7 Ethnic Composition

The ethnic composition in Indonesia varies greatly because it has hundreds of groups or tribes with different ethnicities and cultures, but more than half of the population are dominated by the two largest tribes, namely, the Javanese (41% of the total population) and the Sundanese (15%

of the total population). These two tribes are from Java, the island with the largest population in Indonesia covering about 60% of the total population of Indonesia. When combined with the island of Sumatra, they account for 80% of the total population. This is an indication that the population is concentrated in western Indonesia. The most densely populated province is West Java (over 43 million inhabitants), while the least populous is the province of West Papua in eastern Indonesia (with a population of only 761,000 inhabitants). **Table 3.9** shows the population by ethnicity.

Table 3.9: Population by Tribes or Ethnicity.

Group	Percentage to Total Population (%)
Jawa	42.65
Sunda	15.41
Malayu	3.45
Madura	3.37
Batak	3.02
Minangkabau	2.72
Betawi	2.51
Bugis	2.49
Banten	2.05
Banjar	1.74

Source: Statistics Indonesia Population Census 2010.

3.2.8 Language

Bahasa Indonesia is the official language. Kemendikbud recorded at least 442 languages in Indonesia as revealed during the 9th Congress of Language held in 2008. The results of the 2012 study, through sampling in 70 locations in Maluku and Papua regions, indicated that the number of languages and sub-languages across Indonesia reached 546 languages.

3.2.9 Religion

Based on the 2010 Population Census data, around 207.17 million people (87.18% of the population) are Muslims. Indonesia has the world's largest Muslim population. The other religions are Christianity (6.96%), Roman Catholic Christians (2.91%) Hinduism (1.69%), Buddhism (0.72%), Khong Hu Chu (0.05%), and others (0.13%). **Table 3.10** shows the population of Indonesia by religious group.

Table 3.10: Indonesian Population by Religion (2010).

No.	Religion	Population	Percentage (%)
1	Islam	207,176,162	87.18
2	Christianity	16,528,513	6.96
3	Roman Catholic (Christian)	6,907,873	2.91
4	Hinduism	4,012,116	1.69
5	Buddhism	1,703,254	0.72
6	Khong Hu Chu (Confucianism)	117,091	0.05
7	Other	299,617	0.13
8	Not answered	139,582	0.06
9	Not asked	757,118	0.32
	TOTAL	**237,641,326**	

Source: http://sp2010.bps.go.id/index.php/site/table?tid=321, Accessed on 10 January 2017.

3.3 Economic Development

3.3.1 Gross Domestic Product (GDP) and Gross National Income (GNI)

Indonesia is the largest economy in Southeast Asia. The country's gross domestic product[9] (GDP) experienced a substantial increase in the period of 2010-2018. The real GDP (in constant 2010 prices) in 2010 was US$755 billion, and increased to US$1.15 trillion in 2018 (**Table 3.11**). The gross national income or GNI[10] (in constant 2010 prices) was US$1.11 trillion in 2018, slightly lower than the GDP.

Table 3.11: Gross Domestic Product (GDP and Gross National Income (GNI), 2010-2018.

	2010	2011	2012	2013	2014
GDP (constant 2010 US$)	755,094,160,363	801,681,840,622	850,023,661,688	897,261,717,987	942,184,637,117
GDP growth (annual %)	6.22	6.17	6.03	5.56	5.01
GDP per capita (constant 2010 US$)	3,122	3,271	3,421	3,563	3,693
GDP per capita growth (annual %)	4.81	4.75	4.61	4.15	3.64
GNI (constant 2010 US$)	734,988,313,963	779,361,373,566	826,401,760,139	870,943,437,045	911,475,687,951
GNI growth (annual %)		6.04	6.04	5.39	4.65
GNI per capita (constant 2010 US$)	3,039	3,180	3,326	3,459	3,573
GNI per capita growth (annual %)		4.62	4.61	3.99	3.29

9 GDP measures the total value of goods produced and services provided in a country during one year.

10 **Gross national income (GNI)** is defined as gross domestic product (GDP), plus receipts of wages and salaries, property income, and investments (interest and dividends) from abroad, plus net taxes and subsidies receivable from abroad, less similar payments paid out of the country.

Table 3.11: Gross Domestic Product (GDP and Gross National Income (GNI), 2010-2018. (cont.)

	2015	2016	2017	2018	
GDP (constant 2010 US$)	988,128,596,686	1,037,861,792,573	1,090,454,467,115	1,146,844,815,417	
GDP growth (annual %)	4.88	5.03	5.07	5.17	
GDP per capita (constant 2010 US$)	3,824	3,968	4,120	4,285	
GDP per capita growth (annual %)	3.56	3.76	3.84	3.99	
GNI (constant 2010 US$)	956,489,622,343	1,005,917,869,208	1,056,057,419,843	1,112,082,625,438	
GNI growth (annual %)	4.94	5.17	4.98	5.31	
GNI per capita (constant 2010 US$)	3,702	3,846	3,990	4,155	
GNI per capita growth (annual %)	3.62	3.89	3.76	4.12	

Source: World Bank 2019.

GDP growth

The GDP growth rate has been declining since 2010. From 6.22% growth rate in 2009-2010, the GDP increased by only 5.17% in 2017-2018 (**Table 3.11**). However, such growth rate is still good enough amid the global economic slowdown. The economic strategy since 2014 has mainly focused on infrastructure projects, e.g., the building of toll roads, sea and air ports, and power plants, to stimulate growth.

GDP per capita

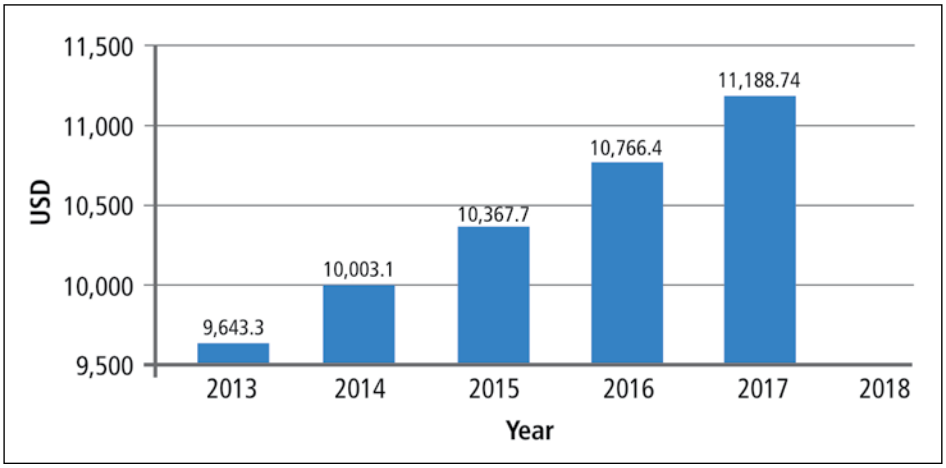
In 1997 to 1999, the Indonesia's per capita income value declined, but, as the national economy improved, it increased substantially, averaging 4.93% per year. The GDP per capita (constant 2010 US$) was US$ 4,285 in 2018. The increase in GDP per capita is presented in **Tables 3.1** and **3.11**.

Using purchasing power parity or PPP (at constant 2011 international $), the Indonesian GDP per capita was US$10367.7 in year 2015. In 2017, it reached US$11,188.7. **Figure 3.6** shows the increase in GDP per capita in PPP terms.

GDP by industrial origin

The share of industry has been declining, from 44.8% of total GDP in 2011 to 41.4% in 2018 (**Table 3.12**). Within industry, the most important is manufacturing, which has been one of the main growth engines (24% of total output). Mining and quarrying sector accounts for 12%, and electricity, gas and water supply for 0.75%. Share of construction increased from 9% in 2011 to 11% of GDP in 2018.

Figure 3.6: GDP per Capita (at contant 2011 PPP) in Indonesia.



Source: https://tradingeconomics.com/indonesia/gdp-per-capita-ppp.

Services sector constituted 54.2% of total GDP in 2018, an increase from 41.4% share in 2011 (**Table 3.12**). Within services, the most important are: trade, transport, hotel and restaurants (22.1%), and and government services (8.3%). Information and communication sector accounts for 3.9%, while finance, insurance and real estate services account for 7.2%. Professional, scientific, support services account for only 1.9% of GDP in 2018.

Agriculture, forestry and fishery (AFF) accounts for the remaining 13.3% of GDP in 2018 – a slight decrease from 13.8% share in 2011 (**Table 3.12**). The share of AFF in the national economy has remained stable in 2011-2018.

Table 3.12: Economic Structure: Percentage Share of Real Gross Value Added (GVA).

Economic Activity or Sector	2011	2012	2013	2014	2015	2016	2017	2018
Agriculture, forestry, fishing (AFF)	13.8	13.7	13.7	13.7	13.9	14.0	13.7	13.3
Industry, including energy	35.5	35.0	34.0	32.9	30.8	30.0	30.2	30.4
Construction	9.3	9.6	9.7	10.1	10.5	10.8	10.8	11.0
Services								
Trade, repairs, transport, accommodation, food services	20.4	20.2	20.7	21.4	22.0	22.1	22.1	22.1
Information, communication	3.7	3.7	3.7	3.6	3.6	3.8	3.9	3.9
Finance and insurance	3.5	3.8	4.0	4.0	4.2	4.3	4.4	4.3
Real estate	2.9	2.8	2.8	2.9	2.9	2.9	2.9	2.9
Professional, scientific, support services	1.5	1.5	1.6	1.6	1.7	1.8	1.8	1.9
Public administration, defence, education, health, social work	8.0	8.3	8.3	8.3	8.6	8.6	8.3	8.3
Other services (ISIC Rev.3 L - P)	1.5	1.5	1.5	1.6	1.7	1.8	1.8	1.9

Source: OECD (Country statistical profiles: Key tables from OECD - ISSN 2075-2288).

In the AFF sector, the sub-category of agriculture, livestock, hunting and agricultural services contributed the most to GDP by 10.28%, followed by fishery (2.53%), and forestry and logging businesses (0.71%) in 2015 (BPS, 2016).

The fisheries sub-category contributed 18.72% of the GVA of the AFF sector (**Table 3.13**). All fishing activities by **capture** and **culture** (marine, ponds, *karamba*, floating net, ponds, etc.) of all kinds of fish, crustaceans, molluscs, seaweeds, seagrasses, and other aquatic biota in freshwater, brackishwater or at sea are included in the GVA of fishery subcategory. Services that support fishing activities on a fee basis or contract are also covered in the activities of this subcategory.

Table 3.13: Gross Value Added of Agriculture, Forestry and Fisheries Sectors (Percentage Share), 2011-2015.

Sector	Year				
	2011	2012	2013	2014	2015
1. Agriculture, farms, plantation and agriculture services	**78.67**	**78.29**	**78.02**	**77.29**	**76.04**
a. crops	25.84	26.53	26.05	24.35	25.21
b. horticulture	11.84	10.86	10.77	11.39	11.23
c. plantation crops	28.67	28.06	28.09	28.25	26.39
d. farm	11.08	11.34	11.61	11.85	11.76
e. agriculture services and hunting	1.47	1.51	1.5	1.45	1.45
2. Forest and logging	**5.88**	**5.72**	**5.45**	**5.29**	**5.24**
3. Fisheries	**15.45**	**15.99**	**15.52**	**17.41**	**18.72**
TOTAL (Agriculture, Forestry and Fisheries)	100.00	100.00	100.00	100.00	100.00
Growth Rate of Fishery Sector (%) (at current prices)	**...**	**12.70**	**14.34**	**16.53**	**19.00**

Source: Perdagangan Nasional Indonesia 2011-2015, BPS.

The province with the highest contribution to the fishery sub-category is Maluku. In 2015, Maluku Province contributed about 13.24% to the GVA of the fisheries sub-sector. On the other hand, the province with the smallest contribution to the fishery sub-category is DKI Jakarta, with only 0.04% contribution.

The GVA of fishery subcategory can be increased by improving the production of capture fisheries and culture, improving the quality of fishery products and derivative products, facilitating investment, and enhancing the role of fishery stakeholders in expanding markets (KKP, 2015).

3.3.2 GDP by Province

The contribution to GDP by each province is very uneven, since 80.5% of the economy is concentrated in Java and Sumatra. During 2011-2015, Java contributed on average around 57% of the national GDP while Sumatra contributed 23%. Around 20% of the GDP came from Bali-Nusra, Kalimantan, Sulawesi, and Maluku-Papua. The contribution of each province to the national GDP can be seen in **Table 3.14**.

Figure 3.7 illustrates the growth rate of the GDP of each province in 2015. Nusa Tenggara Barat had the highest GRDP growth rate (21.76%) in 2015, but had the lowest and negative growth rate (-4.56%) in 2018 among the 34 provinces (**Table 3.15**). Maluku Utara had the highest growth rate among the 34 provinces in 2017 and 2018 (**Table 3.15**).

Table 3.14: Provincial GDP in 2011-2016 (in billion IDR, in current prices).

No.	Province	2011	2012	2013	2014	2015	2016
1	Aceh	108,218	114,552	121,331	127,897	129,093	136,844
2	Sumatera Utara	377,037	417,120	469,464	521,955	571,722	626,063
3	Sumatera Barat	118,674	131,436	146,900	164,944	179,952	196,099
4	Riau	485,649	558,493	607,498	679,396	652,762	681,699
5	Jambi	103,523	115,070	129,976	144,814	155,066	171,199
6	Sumatera Selatan	226,667	253,265	280,348	306,422	331,766	353,867
7	Bengkulu	32,200	36,208	40,565	45,390	50,334	55,384
8	Lampung	170,047	187,349	204,403	230,794	252,883	279,418
9	Kepulauan Bangka Belitung	40,849	45,400	50,388	56,374	60,987	65,048
10	Kepuluan Riau	126,914	144,841	163,262	180,880	199,570	216,008
	Sumatera	**1,789,778**	**2,003,734**	**2,214,136**	**2,458,866**	**2,584,135**	**2,781,629**
11	DKI Jakarta	1,224,218	1,369,433	1,546,876	1,762,316	1,989,089	2,159074
12	Jawa Barat	1,021,629	1,128,246	1,258,989	1,385,825	1,524,975	1,653,238
13	Jawa Tengah	692,562	754,529	830,016	922,471	1,010,987	1,087,317
14	DI Yogyakarta	71,370	77,248	84,925	92,842	101,441	109,962
15	Jawa Timur	1,120,577	1,248,767	1,382,501	1,537,948	1,691,477	1,855,738
16	Banten	306,174	338,225	377,836	428,740	479,300	517,898
	Jawa	**4,436,530**	**4,916,448**	**5,481,144**	**6,130,142**	**6,797,269**	**7,383,227**
17	Bali	104,612	117,987	134,408	156,396	176,413	194,090
18	Nusa Tenggara Barat	68,177	69,022	73,619	81,621	105,665	116,465
19	Nusa Tenggara Timur	48,815	54,893	61,325	68,500	76,121	83,743
	Bali and Nusa Tenggara	**221,604**	**241,903**	**269,903**	**306,517**	**358,199**	**394,298**
20	Kalimantan Barat	96,727	106,959	118,641	132,345	146,654	161,364
21	Kalimantan Tengah	65,871	73,425	81,957	89,890	100,064	111,967
22	Kalimantan Selatan	98,781	106,725	115,858	127,882	137,056	146,090
23	Kalimantan Timur	515,191	550,736	519,132	527,515	505,105	508,880
24	Kalimantan Utara	-	-	52,605	59,184	61,722	66,042
	Kalimantan	**776,571**	**837,845**	**888,193**	**936,816**	**950,601**	**994,343**

Table 3.14: Provincial GDP in 2011-2016 (in billion IDR, in current prices). (cont.)

No.	Province	2011	2012	2013	2014	2015	2016
25	Sulawesi Utara	57,344	63,875	71,097	80,668	91,146	100,514
26	Sulawesi Tengah	60,716	69,638	79,842	90,246	107,573	120,030
27	Sulawesi Selatan	198,289	228,289	258,836	298,034	340,390	377,109
28	Sulawesi Tenggara	55,759	64,694	71,041	78,622	87,714	96,995
29	Gorontalo	17,407	19,670	22,129	25,194	28,493	31,698
30	Sulawesi Barat	20,189	22,626	25,249	29,458	32,988	35,945
	Sulawesi	**409,703**	**468,789**	**528,196**	**602,222**	**688,304**	**762,291**
31	Maluku	21,368	24,662	27,834	31,656	34,346	37,054
32	Maluku Utara	17,078	19,340	21,439	24,042	26,638	29,151
33	Papua Barat	44,255	47,421	52,998	58,181	62,888	66,631
34	Papua	108,189	112,813	122,857	133,330	150,307	173,209
	Maluku and Papua	**190,889**	**204,236**	**225,129**	**247,209**	**274,179**	**306,045**
	TOTAL (34 Provinces)	**7,825,076**	**8,672,954**	**9,606,149**	**10,681,774**	**11,652,686**	**12,621,833**
	Indonesia GDP	**7,831,726**	**8,615,705**	**9,546,134**	**10,569705**	**11,526,333**	**12,401,729**

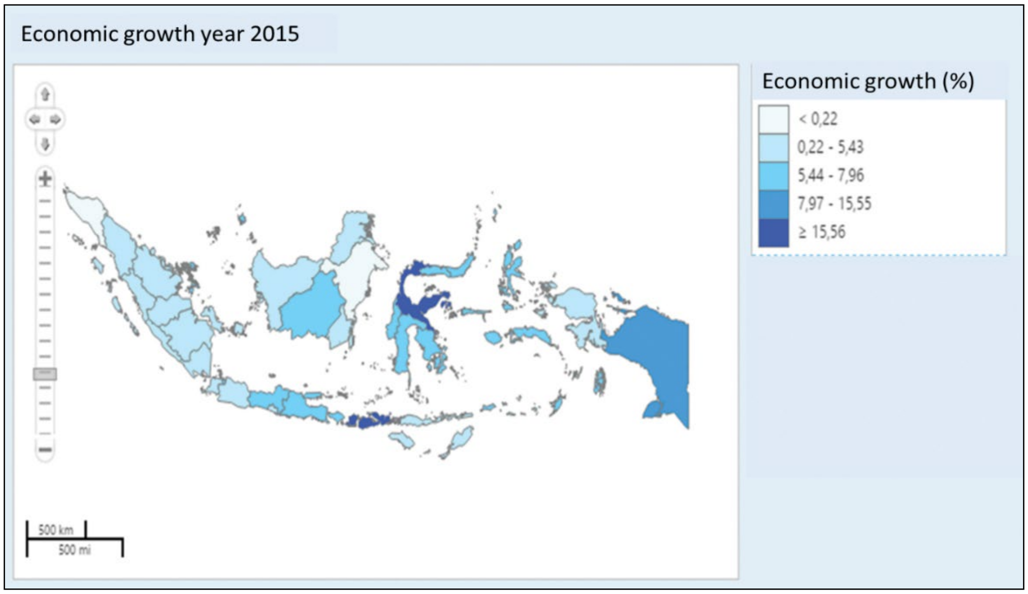
Source: BPS, 2015 and BPS, 2019.

Table 3.15: Provinces with the Highest and Lowest GRDP Growth Rates in 2015-2018.

	2015	2016	2017	2018
Province with highest growth rate	Nusa Tenggara Barat	Sulawesi Tengah	Maluku Utara	Maluku Utara
GRDP growth rate (%)	21.76%	9.94%	7.67%	7.92%
Province with lowest growth rate	Kalimantan Timur	Kalimantan Timur	Nusa Tenggara Barat	Nusa Tenggara Barat
GRDP growth rate (%)	-1.20%	-0.38%	-0.12%	-4.56%

Source: BPS, 2019.

Figure 3.7: GDP Growth Rate, by Province.



3.3.3 Economic Growth, Population and Urbanization Trends

Figure 3.8 shows the upward trend for both population and economic growth. Furthermore, the correlation between population and the national GDP is supported by the high coefficient of determination, which is 98.59%, and illustrated in **Figure 3.9**.

Urbanization has direct effects on biodiversity and the state of the coastal and marine environment. The expansion of coastal urban development places increasing pressure on the natural environment through the effects of land clearing, habitat conversion, groundwater extraction, waste disposal and pollution. Building along the foreshore can affect the coastal landscape and processes.

Figure 3.8: Urban Population and National GDP and Estimations up to 2035.

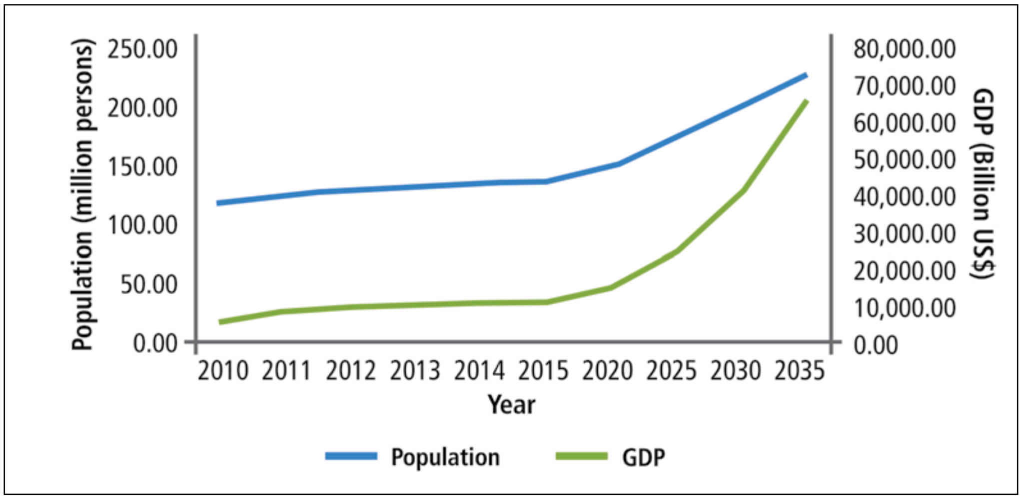
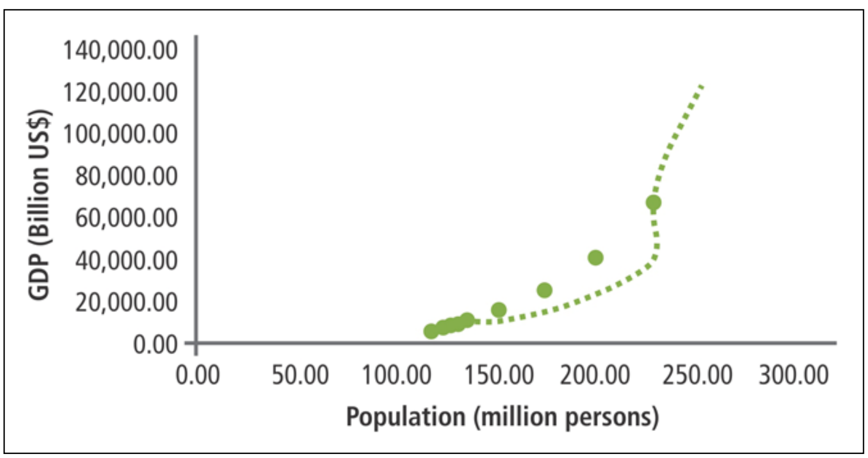


Figure 3.9: Correlation between Population and GDP.



3.3.5 Employment

Unemployment is 4.51% of the total labor force. Indonesia's working population is spread across nine major business fields in line with the GDP accounts. The Agriculture, Forestry and Fishery (AFF) sector is still the dominant source of livelihood and employment, with 38 million people employed in this sector. Around 27 million people are working in the trading, restaurant and accommodation services sector, and 16 million people are employed in the manufacturing industry sector (**Table 3.16**). However, the number of people working in the AFF sector decreased from 42.46 million in February 2011 to 38.29 million in February 2016. Due to job opportunities in the urban areas, there was migration from rural to urban areas. This has consequently resulted in decreasing labor force participation rate and employment in the AFF sector.

Table 3.16: Employment, by Economic Activity, 2011-2016.

No.	Economic Activity	2011		2012		2013		2014		2015		2016	
		Feb	Aug	Feb	Aug	Feb	Aug	Feb	Aug	Feb	Aug	Feb	Aug
1	Agriculture, forestry, hunting, and fisheries	42.46	39.09	41.67	39.59	40.76	39.22	40.83	38.97	40.12	37.75	38.29	37.77
2	Mining	1.36	1.43	1.62	1.60	1.56	1.43	1.62	1.44	1.42	1.32	1.31	1.48
3	Industry	13.88	14.54	14.39	15.62	15.00	14.96	15.39	15.25	16.38	15.26	15.98	15.54
4	Electricity, Gas, and Water	0.26	0.23	0.30	0.25	0.26	0.25	0.31	0.29	0.31	0.29	0.40	0.36
5	Construction	5.65	6.26	6.15	6.85	6.95	6.35	7.21	7.28	7.71	8.21	7.71	7.98
6	Trading, Restaurant and Accommodation	23.48	22.30	24.31	23.52	25.27	24.11	25.81	24.83	26.65	25.69	28.50	26.69
7	Transportation, warehousing and communication	5.65	5.01	5.23	5.05	5.29	5.10	5.32	5.11	5.19	5.11	5.19	5.61
8	Financial, Real Estate, Rent , and services	2.10	2.58	2.81	2.70	3.05	2.90	3.19	3.03	3.64	3.27	3.48	3.53
9	Community services, social and individual	17.22	15.97	17.58	17.33	17.79	18.45	18.48	18.42	19.41	17.94	19.79	19.46
10	Others	-	-	-	-	-	-	-	-	-	-	-	-
11	Not answered	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**112.05**	**107.42**	**114.06**	**112.50**	**115.93**	**112.76**	**118.17**	**114.63**	**120.85**	**114.82**	**120.65**	**118.41**

Source: https://www.bps.go.id/linkTableStatis/view/id/970, Accessed on 10 January 2017.

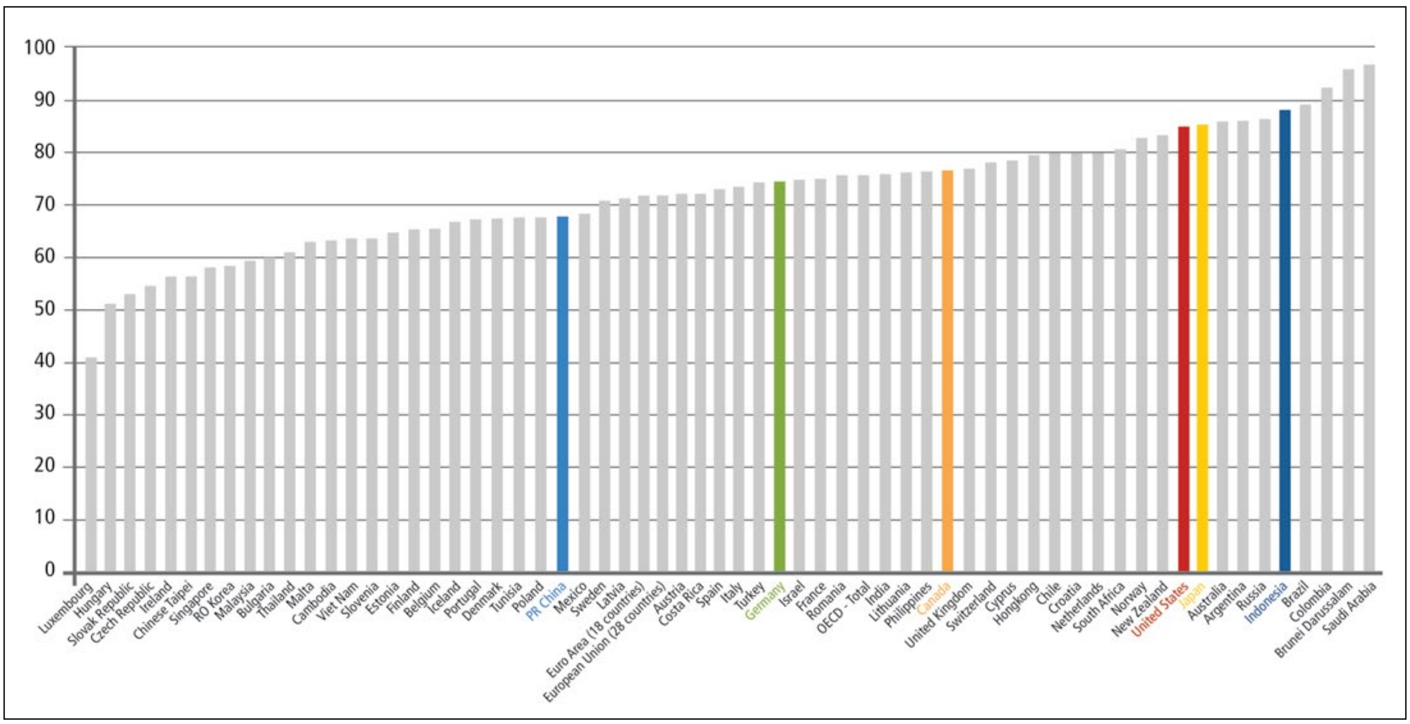
3.3.6 Trade

Based on World Trade Organization (WTO) International Trade Statistics 2015, international export trade reached US$ 19.002 billion, while world import trade reached US$ 19.091 billion. The top five biggest exporter countries in the world are China (12.3%), United States (8.5%), Germany (7.9%), Japan (3.6%) and the Netherlands (3.5%), while the top five largest importer countries are the United States (12.6%), China (10.3%), Germany (6.4%), Japan (4.3%) and the UK (3.6%).

The contribution of Indonesia to the international trade is seen from the value of exports and imports, worth US$ 176 billion and US$ 178 billion, respectively (WTO, 2015). Indonesia is ranked 28th in the world above Vietnam (32) and under Singapore (14), Malaysia (23) and Thailand (22) among the ASEAN countries that are in the top 50 exporting and importing countries in the world.

In 2011, Indonesia (88.0) was the country with the fifth highest domestic value added in gross exports after Saudi Arabia (96.7), Brunei Darussalam (95.7), Colombia (92.3), and Brazil (89.2) to produce export commodities.[11] **Figure 3.10** shows Indonesia's position as an export-oriented country whose domestic component is the fifth highest among exporting countries. This means that trade has a significant role in the economic growth of the country.

Figure 3.10: Domestic Value Added in Gross Exports, 2011 (in %).



Source: OECD.

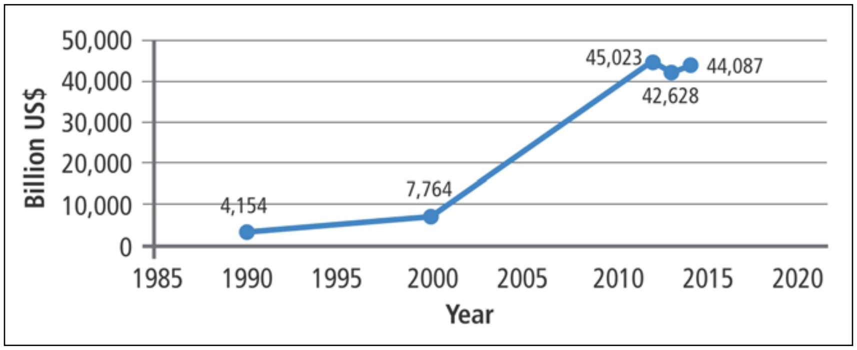
Indonesia is among the top 15 exporters of agricultural products in the world with an export value of US$ 44 billion. It is the 6th largest in the world, the largest in ASEAN, and the second after China (US$74 billion) in Asia. Indonesia is ranked 12th (US$ 22 billion) as the largest agricultural importer in the world, ranked 1st in ASEAN, and ranked 7th in Asia.

During the period of 1990-2014, the agricultural sector contributed quite significantly to Indonesia's export trade in the world, which was 22.8% in 2010, and increased to 25% in 2014.

[11] OECD, 2017.

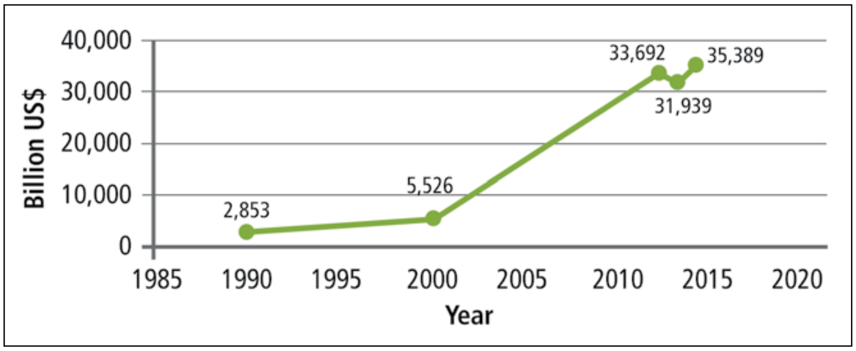
The development of export value of Indonesian agricultural products (in billions of dollars) in the period of 1990-2014 can be seen in **Figure 3.11**.

Figure 3.11: Trend of Agricultural Product Export Values in Indonesia.



The contribution of Indonesia's food exports to international trade also increased during the period of 1990-2014. In 2010, the contribution of food exports to the total Indonesian exports reached 16.2% and increased to 20.1% in 2014. The value of food exports in Indonesia's exports to the world can be seen in **Figure 3.12**. In terms of fishery production, Indonesia is the second highest, after China.

Figure 3.12: Food Values in the Indonesian Exports.



3.4 Social Development

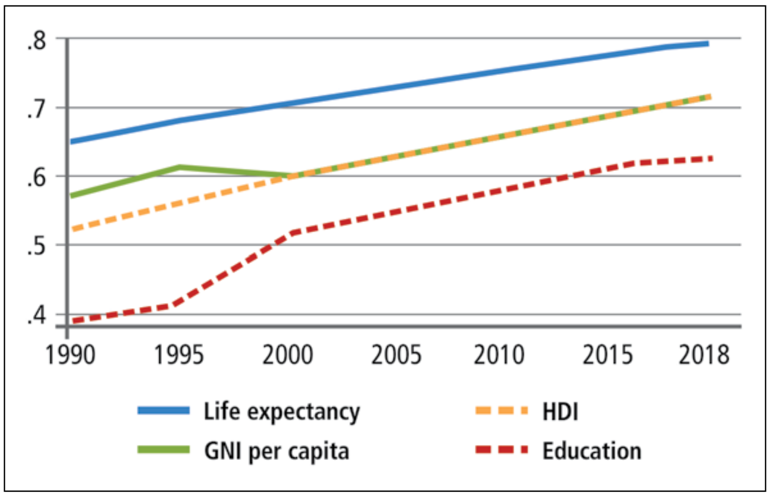
3.4.1 Human development index

Indonesia's human development index[12] (HDI) value for 2017 is 0.694— which put the country in the medium human development category. In 2018, Indonesia's HDI went up to **0.707**, which

[12] The human development index (HDI) is a summary measure for assessing long-term progress in three basic dimensions of human development: (a) a long and healthy life (measured by life expectancy), (b) access to knowledge (measured by mean years of education among the adult population; and access to learning and knowledge by expected years of schooling for children of school-entry age), and (c) a decent standard of living (measured by Gross National Income (GNI) per capita expressed in constant 2011 international dollars converted using purchasing power parity (PPP) conversion rates) (UNDP, 2018).

puts the country in the **high** human development category—positioning it at 111 out of 189 countries and territories. Between 1990 and 2018, Indonesia's HDI value increased from 0.525 to 0.694, an increase of 34.6 percent (**Figure 3.13**). **Table 3.17** reviews Indonesia's progress in each of the HDI indicators. In 2018, Indonesia's life expectancy at birth was 71.5 years while mean years of schooling was eight (8) years and expected years of schooling was 12.9 years. Between 1990 and 2018, Indonesia's GNI per capita increased by about 155.9%. In 2018, the GNI per capita (2011 PPP$) was US$11,256.

Figure 3.13: Trends in Indonesia's HDI Component Indices 1990-2018.



Source: UNDP, 2019.

Table 3.17: Indonesia's HDI Trends.

Year	Life Expectancy at Birth	Expected Years of Schooling	Meany Years of Schooling	GNI per Capita	HDI Value
1990	62.3	10.1	3.3	4,399	**0.525**
1995	64.3	10.1	4.2	5,838	**0.560**
2000	65.8	10.6	6.7	5,422	**0.604**
2005	67.3	10.9	7.4	6,506	**0.633**
2010	69.2	12.2	7.4	8,234	**0.666**
2015	70.8	12.8	7.9	10,029	**0.696**
2016	71.0	12.9	8.0	10,419	**0.700**
2017	71.3	12.9	8.0	10,811	**0.704**
2018	71.5	12.9	8.0	11,256	**0.707**

Source: UNDP, 2019.

Figure 3.14 shows the HDI by province in 2015, while **Table 3.18** shows the HDI by province from 2013 to 2018. Papua province has the lowest HDI, while DKI Jakarta has the highest HDI in 2018.

Figure 3.14: Human Development Index, by Province, in 2015.

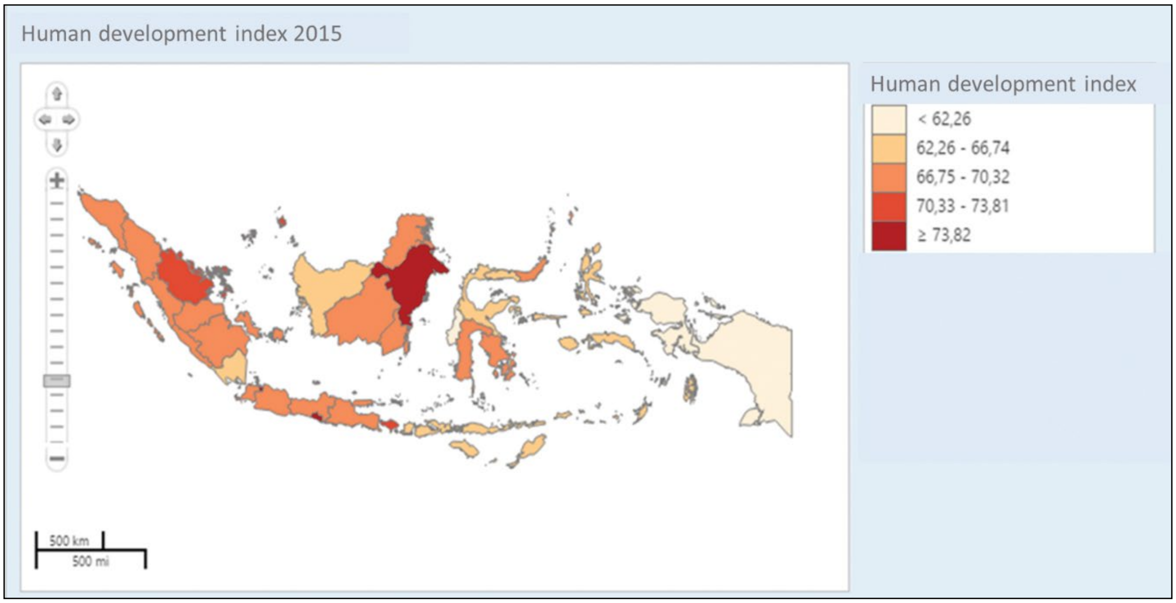


Table 3.18: Human Development Index, by Province, 2013-2018.

Province	2013	2014	2015	2016	2017	2018
Aceh	68.30	68.81	69.45	70.00	70.60	71.19
Sumatera Utara	68.36	68.87	69.51	70.00	70.57	71.18
Sumatera Barat	68.91	69.36	69.98	70.73	71.24	71.73
Riau	69.91	70.33	70.84	71.20	71.79	72.44
Jambi	67.76	68.24	68.89	69.62	69.99	70.65
Sumatera Selatan	66.16	66.75	67.46	68.24	68.86	69.39
Bengkulu	67.50	68.06	68.59	69.33	69.95	70.64
Lampung	65.73	66.42	66.95	67.65	68.25	69.02
Kepulauan Bangka Belitung	67.92	68.27	69.05	69.55	69.99	70.67
Kepuluan Riau	73.02	73.40	73.75	73.99	74.45	74.84
DKI Jakarta	78.08	78.39	78.99	79.60	80.06	80.47
Jawa Barat	68.25	68.80	69.50	70.05	70.69	71.30
Jawa Tengah	68.02	68.78	69.49	69.98	70.52	71.12
DI Yogyakarta	76.44	76.81	77.59	78.38	78.89	79.53
Jawa Timur	67.55	68.14	68.95	69.74	70.27	70.77
Banten	69.47	69.89	70.27	70.96	71.42	71.95
Bali	72.09	72.48	73.27	73.65	74.30	74.77
Nusa Tenggara Barat	63.76	64.31	65.19	65.81	66.58	67.30
Nusa Tenggara Timur	61.68	62.26	62.67	63.13	63.73	64.39
Kalimantan Barat	64.30	64.89	65.59	65.88	66.26	66.98
Kalimantan Tengah	67.41	67.77	68.53	69.13	69.79	70.42

Table 3.18: Human Development Index, by Province, 2013-2018. (cont.)

Province	2013	2014	2015	2016	2017	2018
Kalimantan Selatan	67.17	67.73	68.38	69.05	69.95	70.17
Kalimantan Timur	73.21	73.82	74.17	74.59	75.12	75.83
Kalimantan Utara	67.99	68.64	68.76	69.20	69.84	70.56
Sulawesi Utara	69.49	69.96	70.39	71.05	71.66	72.20
Sulawesi Tengah	65.79	66.43	66.76	67.47	68.11	68.88
Sulawesi Selatan	67.92	68.49	69.15	69.76	70.34	70.90
Sulawesi Tenggara	67.55	68.07	68.75	69.31	66.86	70.61
Gorontalo	64.70	65.17	65.86	66.29	67.01	67.71
Sulawesi Barat	61.53	62.24	62.96	63.60	64.30	65.10
Maluku	66.09	66.74	67.05	67.60	68.19	68.87
Maluku Utara	64.78	65.18	65.91	66.63	67.20	67.76
Papua Barat	60.91	61.28	61.73	62.21	62.99	63.74
Papua	56.25	56.75	57.25	58.05	59.09	60.06
Indonesia	**68.31**	**68.90**	**69.55**	**70.18**	**70.81**	**71.39**

Source: BPS-Statistik Indonesia, Series of Publication of Human Development Index.

3.4.2 Inequality

Like all averages, the HDI masks inequality in the distribution of human development across the population at the country level (UNDP, 2018). The 2010 Human Development Report introduced the **IHDI**, which takes into account inequality in all three dimensions of the HDI by 'discounting' each dimension's average value according to its level of inequality. Indonesia's HDI for 2018 is 0.707. However, when the value is discounted for inequality, the HDI falls to **0.584**, a loss of 17.4% due to inequality in the distribution of the HDI dimension indices (UNDP, 2019).

The **Gini index**, sometimes called **Gini ratio**, represents the income or wealth distribution of a nation's residents, and is the most commonly used measurement of inequality. **Gini ratio** of less than 0.2 represents perfect income equality, 0.2–0.3 relative equality, 0.3–0.4 adequate equality, 0.4–0.5 big income gap, and above 0.5 represents severe income gap. The Gini ratio of Indonesia in 2018 is **0.39**, indicating adequate equality. **Figure 3.15** shows the trend of the Gini ratio in Indonesia from 2007 to 2016, which shows increasing inequality. The level of inequality also varies across provinces. **Figure 3.16** shows the 2016 Gini ratio in each province.

Figure 3.15: Gini Ratio Changes.

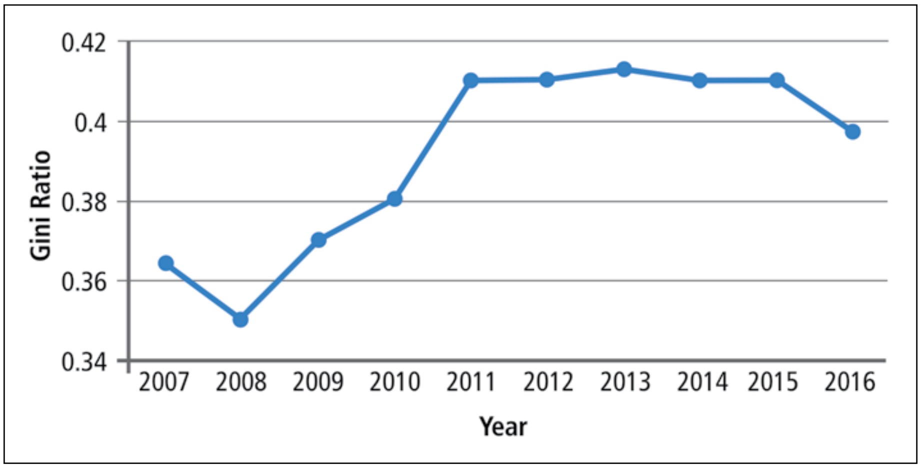
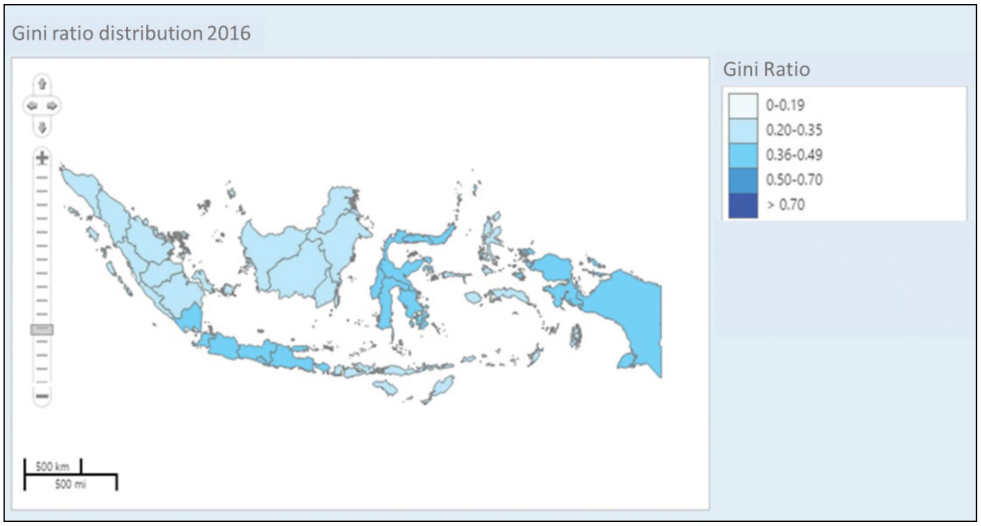


Figure 3.16: Gini Ratio, by Province (in March 2016).



3.4.3 Poverty

The poverty incidence declined during 2010 – 2018. The proportion of poor declined to 9.8% of the total population in 2018, using the poverty headcount ratio at national poverty line, as can be seen in **Figure 3.17**. Poverty headcount ratio is also measured at $5.50 a day (percentage of the population living on less than $5.50 a day at 2011 international prices), at $3.20 a day (percentage of the population living on less than $3.20 a day at 2011 international prices), and at $1.90 (percentage of the population living on less than $1.90 a day at 2011 international prices). Using the poverty headcount ratio at $1.90 per day, the percentage of poor is 4.6% of total population, however poverty incidence goes up to 24.2% of total population at $3.20 per day, and 56% of total population at $5.50 per day.

The poverty incidence by province is shown in **Figure 3.18**. Papua province has the highest percentage of poor.

Approximately, 60%-65% of Indonesians live in coastal areas with an average population growth of two percent (2%) per year.[13] However, the percentage of poor coastal population in 2003 was 32.14% while the total percentage of poor people in Indonesia was 16.8%, which means that the percentage of the poor in coastal areas is almost twice the national total poor population in Indonesia.[14]

Figure 3.17: Poverty Headcount Ratio as Percentage of Population in 2010-2018.

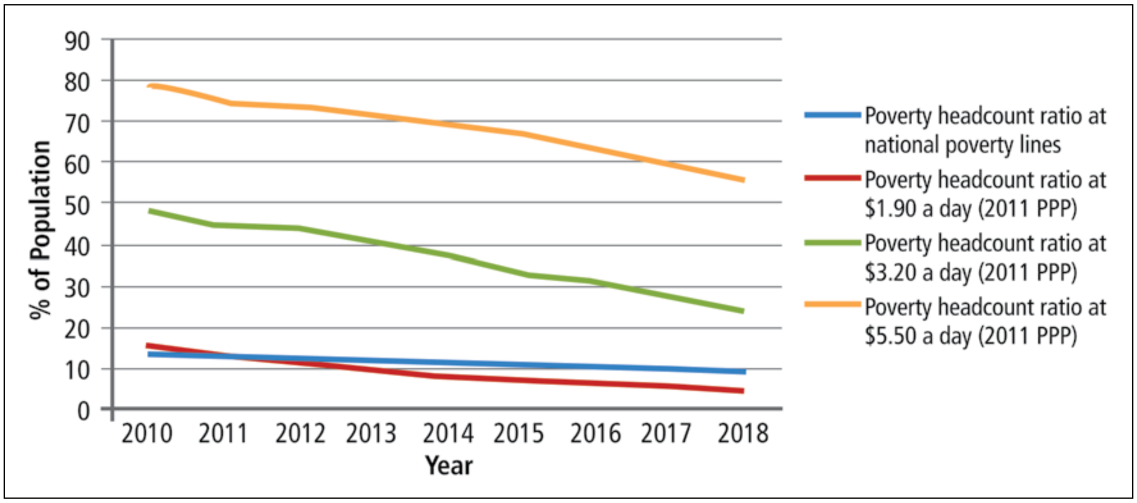
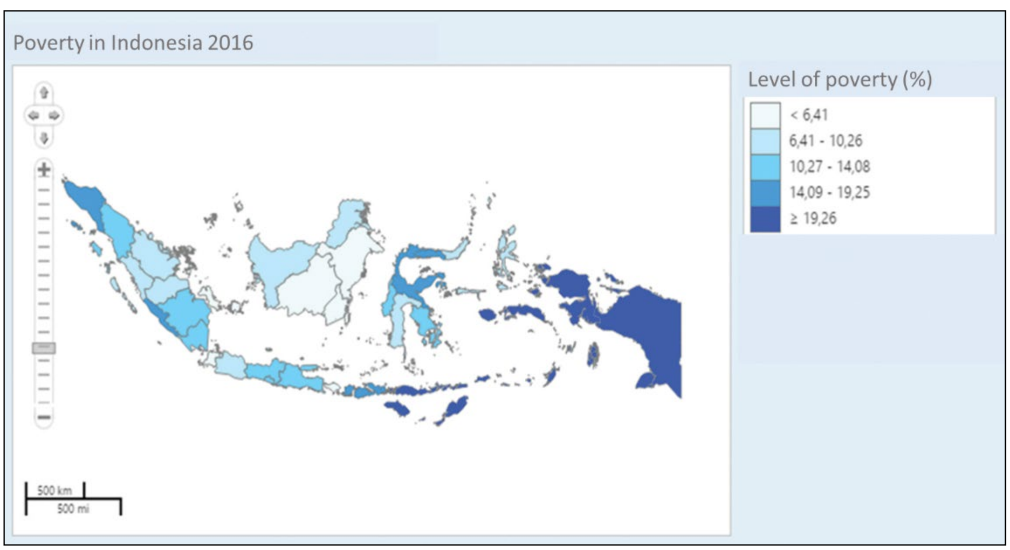


Figure 3.18: Poverty Incidence, by Province (as of September 2016).



[13] https://alsaprudin.wordpress.com, 25 August 2017.
[14] http://ekonomi.kompas.com, 10 February 2015.

3.4.4 Literacy and Education

A measure of the level of knowledge is indicated by the mean years of schooling of the adult population, and the expected years of schooling of children. On average, Indonesian citizens aged 25 years and over have taken 8 years of schooling or have completed the education equivalent of class VIII (8th grade). For children starting to attend school, the expected years of schooling is 12.8 years, i.e., finish Class XII or high school. Both of these indicators (mean years of schooling and expeced years of schooling) showed an increase from year to year (**Table 3.17**). These indicators illustrate the achievement (stock) and the expected addition (flow) of qualified human resources in the country. However, the big difference between the mean years schooling, and expected years of schooling shows that more efforts are needed to improve access to learning and knowledge.

Illiteracy is still high, averaging 22.65% in 2011-2015. In 2011, the number of illiterate in Indonesia was 64.48 million people (28.02%), but decreased to 45.44 million people (17.77%) in 2015. The illiteracy rate shows a decreasing trend along with the increase of average school period and expected years of schooling. The changes in the number and percentage of illiterate people are presented in **Table 3.19**.

Table 3.19: The Number of Illiterate in Indonesia.

Years	Illiterate (million)	Percentage (% of Population)
2011	64.48	28.02
2012	61.39	26.23
2013	54.37	22.84
2014	44.47	18.37
2015	45.44	17.77

Source: https://www.bps.go.id/linkTableDinamis/view/id/1056, Accessed 10 January 2017.

The literacy rate for the population ages 15 years and above has been increasing through the years. In 2018, around 95.66% of the adult population is literate. However, literacy rate for males in this age group is higher than for females in the same age group (**Table 3.20**).

Table 3.20: Literacy Rate for Population Ages 15 and Above (In Percent).

	2011	2014	2015	2016	2018
Literacy rate, adult total (% of people ages 15 and above)	92.81	95.12	95.22	95.38	95.66
Literacy rate, adult male (% of males ages 15 and above)	95.59	96.79	97.11	97.17	97.33
Literacy rate, adult female (% of females ages 15 and above)	90.07	93.45	93.34	93.59	93.99

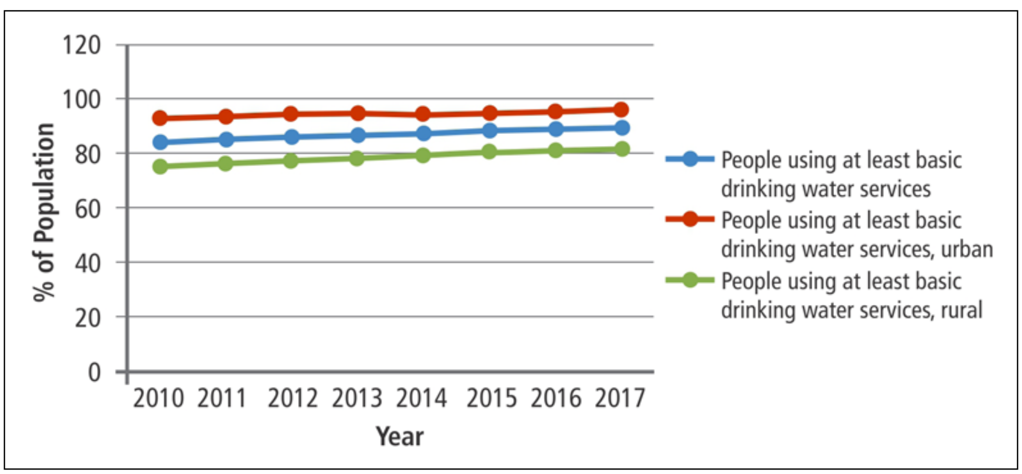
Source: BPS, 2019.

3.4.5 Access to water and sanitation

Water is a basic necessity, and an important resource for sustaining life. Access to clean and safe freshwater is vital for economic growth and sustainable, inclusive and resilient development. Inadequate provision of water and sanitation services has an impact not only on human health, but also on the health of the environment, through pollution of waterways and coasts in particular. In many developing countries, the high rate of urbanisation has not kept pace with the development and improvement in basic urban service delivery. The result is decline in water quality, which endangers the health of humans as well as the coastal ecosystems.

Average income levels have increased dramatically over the last 20 years, yet 28.2 million Indonesians lack safe water, and 193.5 million people lack access to basic sanitation facilities, especially in the rural areas. Around 95.45% of the urban population and 81.98% of the rural population have access to the least basic drinking water services in 2017.[15] In terms of sanitation, access is lower. Around 80.25% of the urban population and 64.54% of the rural population have access to the least basic sanitation services.[16] **Figure 3.19** and **Figure 3.20** show the trends in access to basic water and sanitation services. There are no data available for population using safely managed water services and safely managed sanitation services.

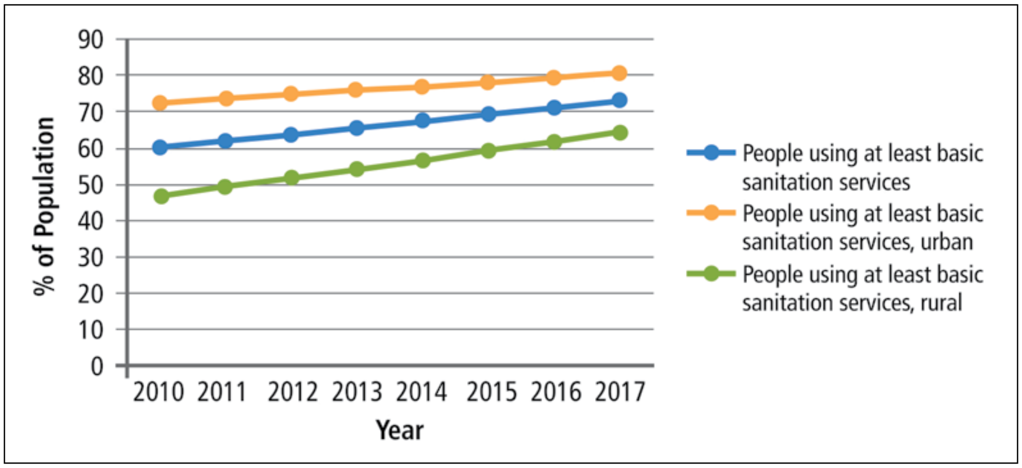
Figure 3.19: Percentage of Population with Access to Least Basic Drinking Water Services.



Source: World Bank, 2018.

[15] World Bank, 2018.
[16] World Bank, 2018.

Figure 3.20: Percentage of Population with Access to Least Basic Sanitation Services.



Source: World Bank, 2018.

Poor water and sanitation provision can affect entire communities: one person's bad sanitation is another's contaminated food or water. Open defecation and untreated wastewater contaminate water resources and facilitate the spread of diseases like diarrhoea and cholera. Water quality in Indonesia is poor regardless of socioeconomic conditions because access to sanitation services is still not universal and only seven percent of wastewater in Indonesia is treated. A 2017 survey of drinking water in Yogyakarta, a well-off urban centre in Java, found that 89% of water sources and 67% of household drinking water were contaminated by fecal bacteria.[17] A World Bank study shows that the high number of people living with unimproved household sanitation is imposing large financial and economic costs to private individuals, public and commercial sectors, and to the whole Indonesian economy. The impacts on health, fisheries, tourism, water-related activities, the external environment, life choices, and population preferences due to poor sanitation and hygiene have resulted in economic losses estimated to be around IDR 56 trillion (US$ 6.3 billion), equivalent to approximately 2.3% of GDP in 2006.[18] Discharges of untreated wastewater to rivers and coasts have affected marine water quality, which have consequent effects on fisheries, habitats and marine life, and recreation and tourism. Safely managed water supply, sanitation and hygiene, and wastewater management – explicit targets of the sixth Sustainable Development Goal (SDG 6) – are recognized as a top priority for improving health, nutrition and productivity of people, and improving environmental and living conditions. Achieving SDG 6 will contribute to achieving SDG 14's target[19] on reducing marine pollution as well.

17 https://www.unicef.org/indonesia/water-sanitation-and-hygiene

18 World Bank, 2008.

19 SDG 14 (Life Below Water) – Target 14.1: By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.

Beach dining.
(Photo by: M. Ebarvia)

Fish Auction Place or TPI.
(*Photo by IPB*)

Saramadu Bridge in Surabaya.
(Photo by: D. Bautista)

Tanah Lot Temple in Bali.
(Photo by: M. Ebarvia)

PART 2

HARNESSING THE OCEANS: BENEFITS AND IMPACTS

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 and well-being rely on.

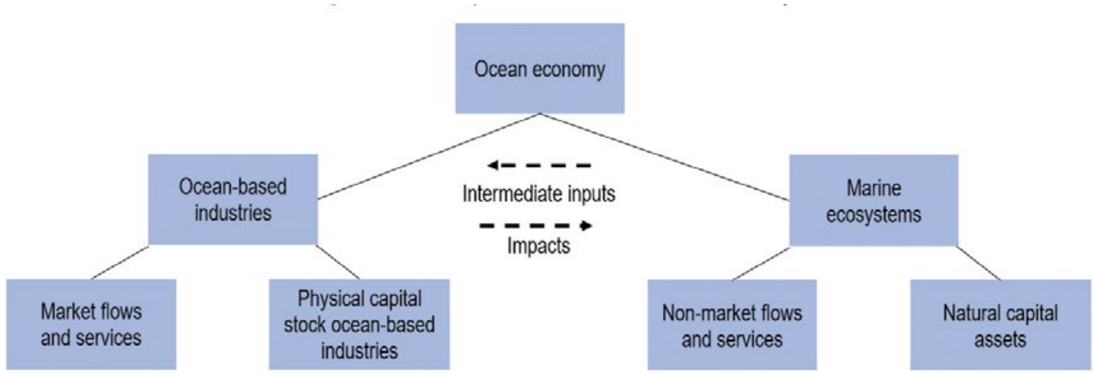
The entire ocean economy is measured as the sum of: (a) the economic activities with dependence on the ocean and coastal and marine resources, and (b) natural assets, goods and services of marine ecosystems upon which these industries depend on, and people rely on for food, income, livelihood, recreation, 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 Approaches to Measuring the Ocean Economy

The National Oceanic and Atmospheric Administration (NOAA) of the Unites States (US) made a report on the ocean and Great Lakes economy, using 2016 data from the Economics: National Ocean Watch (ENOW) of NOAA. The *EU Blue Economy Report* presents data from 2007 to 2018, and utilizes the data collected by the European Commission through Member States and the European Statistical System. There are two key methodological differences between both reports. First, the US includes the Great Lakes. Second, the US uses GDP at market prices whereas the EU uses GVA (at factor costs).

There are also differences in the scope and sectors covered in the two reports. NOAA is under the Department of Commerce, hence, its report focuses on the employment, wages, number of establishments (enterprises), and GDP of six sectors – what the EU considers as the *established* sectors. The EU's report tries to analyze all sectors related to the ocean economy, including *emerging* sectors and ecosystem services. The EU acknowledges the need to ensure that all angles are being considered so economic growth and employment go hand in hand with protecting and restoring nature and fighting climate change. The EU report includes challenges like climate change and marine pollution as well as enabling conditions for blue economy, such as key policy instruments, Marine Spatial Planning (MSP), and financing and investment mechanisms.

The comparison of sectors included in the NOAA report and EU report is as follows:

- **Living resources**: fisheries and aquaculture – included in both reports.
- **Ship and Boat Building and Repair**: The EU includes machinery/equipment in this sector whereas the US includes machinery/equipment under marine transportation sector.
- **Tourism and recreation**: The US does not include related transport as the EU does.
- **Marine Transportation**: The US does not have a separate Port sector, and includes machinery/equipment and warehousing under this sector. For the EU, machinery/equipment is under Shipbuilding while warehousing is under the Port activities.
- **Marine construction**: This sector is not presented as such in the EU Report; instead the marine construction activities are split into other sectors or not included at all.
- **Non-living resources**: Offshore oil and gas and mineral extraction: This sector has a high contribution to the GDP of the US compared to the EU.
- **Marine renewable energy**: EU considers offshore wind power as one of its seven established sectors. This sector is not included in the NOAA report.

Moreover, the EU report includes analysis of *emerging* and innovative sectors: ocean energy, blue bioeconomy and biotechnology, desalination, marine minerals, submarine cables, and maritime defense.

Even though NOAA recognizes the coastal and ocean ecosystem services like carbon sequestration, shoreline protection and other benefits that support human life and well-being, these ecosystem services do not lend themselves to traditional measures of jobs, wages and GDP, and therefore not included in the NOAA report. On the other hand, preserving and increasing the natural capital accumulated in the seas and oceans is considered by the EU as critical to ensure sustainable ecosystem services, and for the EU to achieve the SDGs. Thus, the EU report includes ecosystem services.

The Indonesian ocean economic context follows the economic values like the American concept, and also the spatial element like in Europe. Indonesia's ocean economy, consisting of seven established sectors, is estimated using national income accounts (GDP and GVA figures) and Input-Output tables for the ocean-based and ocean-related sectors in the coastal districts/cities and from the shore baseline up to 200 nautical miles or Indonesia's EEZ. Valuation of ecosystem services, opportunities in emerging ocean sectors, blue economy initiatives to make the established sectors more sustainable and resilient, and actions to protect the coastal and ocean ecosystems are also part of this NSOC report.

4.2 Ocean-based and Ocean-related Industries

4.2.1 Key Ocean Economic Sectors in Indonesia

There are seven *established* economic activities that contribute to the ocean economic sector of Indonesia's national GDP. (Kusumastanto, 2002; Dahuri, 2003; Bappenas, 2008).

a. **Fisheries sector**. This subsector includes capture fishing activities, hatchery, aquaculture of all kinds of fish and other aquatic biota located in coastal/brackishwater and marine water, and fish and seafood processing industry.
b. **Marine and coastal tourism sector**. This subsector includes marine tourism activities, marine tourism support services, such as hotel and lodging, restaurants and dining places, tours, souvenir shops, etc.
c. **Ocean transport sector**, such as from transport of goods and passengers by using ships that operate within (domestic) and outside of Indonesia territory (international).
d. **Energy and mineral resource sector**. This subsector comprises: (a) exploration and exploitation of offshore oil and gas deposits, including drilling, mining, evaporating, and separation as well as storing of mineral substances carried out in coastal area and ocean for marketing; (b) mining and quarrying of sand and rocks from coastal area and ocean; and (c) exploitation and preparation of advanced processing of solid objects from the seabed as well as all other activities that utilize metal ores and other mining products.

e. **Ocean-related or marine industry sector**, such as manufacturing industries that support ocean-based economic activities, e.g., ship-building and dockyard industry and repair services, processing industry for oil and LNG, marine biotechnology, etc.
f. **Marine building and construction sector**, such as land preparation and reclamation, or construction of settlements and non-settlement infrastructure in coastal area and ocean.
g. **Maritime services sector**, such as activities to support and accelerate transport activities, including ports and logistics services, shipping safety services and maritime insurance, and activities that utilize ocean as services, such as trade, marine education and research, etc. The ocean industry also includes the government maritime services, such as marine environmental protection, maritime safety, security and defence.

4.2.2 Contribution to Income and Employment

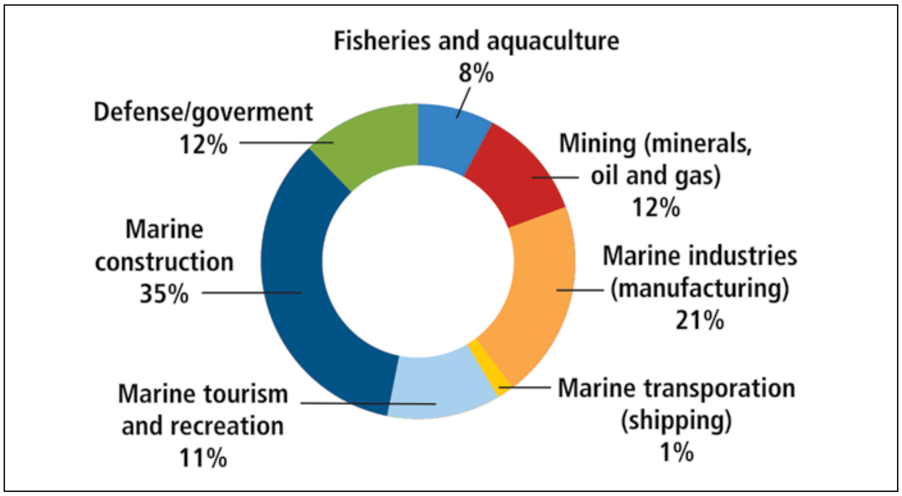
The ocean economic sector was estimated to be US$ 188.5 billion, contributing around 20% to Indonesian GDP based on GDP of seven ocean industries (**Table 4.1**). Note that the GDP of maritime services was not yet included. The highest contribution was from marine construction sector and the lowest was marine transportation, as can be seen in **Figure 4.2**. However, shipping is crucial for trade, commerce, travel and tourism. Indonesia is at the crossroads of the world's logistics system connecting the world's two largest oceans, the Indian and the Pacific. The trade routes and logistics systems of the world use the oceans as transportation routes. More than 80% of the distribution of goods and services trade is through maritime shipping, 40% of which is through the Indonesian territory extending from Sabang to Merauke, traversing Miangas to Rote Island.

Table 4.1: GDP of the Indonesian Ocean Economic Sector.

No.	Ocean economic activities/Sector	GDP (US$, in millions, in constant prices)		
		2013	2014	2015
1	Fisheries and Aquaculture	13,048.10	14,006.64	15,179.24
2	Mining (minerals, oil and gas)	23,209.49	22,721.26	22,759.96
3	Marine industries (manufacturing)	34,020.96	37,248.61	40,057.33
4	Marine transportation (shipping)	2,027.59	2,183.24	2,235.09
5	Marine tourism and recreation	18,055.43	19,097.44	19,929.96
6	Marine construction	57,238.49	61,230.79	65,302.51
7	Defence/Government	21,440.66	21,950.35	22,992.14
	TOTAL	**169,040.72**	**178,438.33**	**188,456.23**
	Contribution to Total GDP (%)	**19.32**	**19.42**	**19.69**

Note: Maritime services sector has not been estimated yet as of 2017.

Figure 4.2: Share of Ocean Economic Activities.



The growth of the Indonesian ocean economic sector is generally positive. The main sub-sectors that had a higher growth rate in 2014-2015 compared to the previous year are fisheries and aquaculture (8.4%), mining and public sector (defense/government) (4.7%).

Table 4.2: Growth Rate of Ocean Economic Sector.

Ocean economic activities	2013-2014	2014-2015
Fisheries and Aquaculture	7.3%	8.4%
Mining (minerals, oil and gas)	-2.1%	0.2%
Marine industries (manufacturing)	9.5%	7.5%
Marine transportation (shipping)	7.7%	2.4%
Marine tourism and recreation	5.8%	4.4%
Marine construction	7.0%	6.6%
Defence/Government	2.4%	4.7%
TOTAL	**5.6%**	**5.6%**

With the GDP that has reached IDR9 trillion in 2015, and being the largest archipelago, Indonesia has an important role in the world economy, yet currently, the role of the ocean economic sector in the Indonesian economy is only about 20%. There are other ocean-related industries that are not still accounted for or are emerging.

The potential marine economic value is estimated to reach around US$8.22 trillion per year (Wahyudin, 2016). The potential of this marine economic business is through fishery and fishery industry business, which could reach US$47.8 billion; marine tourism business based on conservation areas and its derivative industry could go up to US$20 billion; marine transportation business potential, shipbuilding industry and port was estimated to reach US$286.30 billion; as well as offshore oil and gas business (depending on world prices), which could reach US$106.2 billion (Wahyudin, 2016).

Employment in the Ocean Economic Sector

Coastal communities, in general, have become part of a pluralistic society but still have a soul of togetherness, meaning that the average coastal community structure is a combination of urban and rural characteristics. Coastal communities have certain or unique characteristics. This nature is closely related to the nature of business in the field of fisheries itself. Because the nature of fisheries efforts is strongly influenced by factors, such as environment, season and markets, the characteristics of coastal communities are also affected by these factors. Marine economic activity is the basis of livelihood of the people in the coastal areas of Indonesia.

There were 5.2 million people employed in the ocean economic sector in 2013, of which 1.85 million worked in the marine construction sector and 1.69 million people in the fisheries and aquaculture. The share of employment in ocean economic sector to national employment was about 5% in 2013. The largest contribution was marine construction, and fisheries and aquaculture, and the lowest was mining sector, as can be seen in **Table 4.3**.

Table 4.3: Employment in the Ocean Economic Sector (2008).

No.	Sectors	Employment	Share (%)
1	Fisheries and Aquaculture	1,687,560	1.64
2	Mining (minerals, oil and gas)	69,397	0.07
3	Marine industries (manufacturing)	302,201	0.29
4	Marine transportation (shipping)	840,390	0.81
5	Marine tourism and recreation	343,080	0.33
6	Marine construction	1,850,627	1.79
7	Maritime services	190,444	0.18
	Total	**5,283,699**	**5.11**

Source: Indonesian Maritime Council, 2012.

However, another approach to estimating employment in the ocean economic sector is by looking at the working population. BPS data showed that the working population, according to the main business field, has fluctuated in the period of 2011-2016, but still ranged around 115 million people. This situation also impacts on the number of people working in the field of marine or ocean. To determine how much the population working in the ocean economic sector, assumptions were made on the key six marine economic activities (excluding public or government sector) affiliated with seven main sectors in Indonesia. Fisheries subsector covers 30% of the population working in the AFF sector. The marine mining and energy (offshore oil and gas) subsector covers 50% of the population working in the Mining and Quarrying sector; the marine manufacturing industry covers 30% of the population working in the industrial sector; marine construction and buildings sector covers the 20% of the population working in the construction sector; marine tourism covers 30% of the population working in Trade, Restaurant and Accommodation Services; and sea transportation subsector covers 40% of the population working in the sectors of Transportation, Warehouse and Communication. As of 2016, there are 28.58 million people working in the Ocean Economic Sector (**Table 4.4**). This estimate does not include people employed in the maritime services and marine-related public/government sectors.

Table 4.4: Working Population in Ocean Economic Sector in Indonesia.

No.	Economic Activity	2011		2012		2013		2014		2015		2016	
		Feb	Aug	Feb	Aug	Feb	Aug	Feb	Aug	Feb	Aug	Feb	Aug
1	Fisheries (0.3)	12.74	11.73	12.50	11.88	12.23	11.77	12.25	11.69	12.04	11.32	11.49	11.33
2	Marine ESDM / human resources (0.5)	0.68	0.72	0.81	0.80	0.78	0.71	0.81	0.72	0.71	0.66	0.66	0.74
3	Marine manufacturing industry (0.3)	4.16	4.36	4.32	4.68	4.50	4.49	4.62	4.58	4.91	4.58	4.79	4.66
4	Marine construction and building (0.2)	1.13	1.25	1.23	1.37	1.39	1.27	1.44	1.46	1.54	1.64	1.54	1.60
5	Marine Tourism (0.3)	7.04	6.69	7.29	7.06	7.58	7.23	7.74	7.45	7.99	7.71	8.55	8.01
6	Marine transportation (0.4)	2.26	2.00	2.09	2.02	2.11	2.04	2.13	2.05	2.08	2.04	2.08	2.24
	Sub-total	**28.01**	**26.75**	**28.24**	**27.81**	**28.59**	**27.51**	**28.99**	**27.94**	**29.28**	**27.95**	**29.10**	**28.58**
	Total employment	**112.05**	**107.42**	**114.06**	**112.50**	**115.93**	**112.76**	**118.17**	**114.63**	**120.85**	**114.82**	**120.65**	**118.41**
	Percentage (%)	**25.00**	**24.90**	**24.76**	**24.72**	**24.67**	**24.39**	**24.54**	**24.37**	**24.23**	**24.34**	**24.12**	**24.13**

Source: https://www.bps.go.id/linkTableStatis/view/id/970, Accessed 10 January 2017.

Previous estimation, 2004-2013

Previous estimation of the ocean economic sector covered the following sectors: fisheries; oil and gas mining; oil refinery; LNG production; marine transportation and other water transportation, and used GDP at market prices (similar to the US approach). **Table 4.5** shows that in the period 2004 - 2013, the average of fisheries GDP reached IDR192,824 billion, the GDP of oil and gas mining reached IDR311,938 billion, and the marine transportation GDP reached IDR17,651 billion per year. The trend of marine GDP, based on fisheries, oil and gas, and transportation sectors can be seen **Table 4.5**. The percent share of the ocean or marine GDP in total GDP averaged 12% in 2004-2013.

Kusumastanto (2015) concluded that the analysis of economic growth from the GDP accounts shows that the marine sectors are less able to grow optimally, with only the fishery sector relativley growing on average, while the other sectors are less able to grow. This shows that the country's

Table 4.5: Ocean GDP at Current Market Prices (Billion IDR), 2004-2013.

Sectors	2004	2008	2011	2012	2013
Fisheries	53,010.80	137,249.50	226,691.00	255,367.50	291,799.10
Oil and gas mining	118,484.90	283,283.30	370,222.90	386,560.20	401,139.10
Oil refinery	59,062.00	145,942.60	131,482.30	130,273.60	144,559.80
Liquid natural gas (LNG)	35,201.40	91,829.00	121,596.30	124,283.10	122,233.80
Marine transportation	12,328.30	16,019.20	18,589.90	19,661.80	21,656.30
Waters transportation (river and lake)	3,233.00	5,570.30	7,646.20	8,765.70	10,675.90
Total (marine sector)	**281,320.40**	**679,893.90**	**876,228.60**	**924,911.90**	**992,064.00**
National GDP	**2,295,826.20**	**4,948,688.40**	**7,419,187.10**	**8,229,439.40**	**9,083,972.20**
Percent share of marine GDP in total GDP	**12.25%**	**13.74%**	**11.81%**	**11.24%**	**10.92%**

Source: Badan Pusat Statistik 2014 diolah Kusumastanto (2015).

commitment to the ocean economic sector has not been done well in terms of economic and human resource development. With the expansion of Indonesia's economic structure, support for the development of a relatively lagging ocean economic potential is crucial. The ocean GDP growth requires investments and policy support through mix of regulations and incentives that encourage business to invest in the ocean-based economy that is also aligned with sustainable, inclusive and resilient development principles as encompassed in the blue economy paradigm. Improving capacity of state institutions is also needed to achieve clean and effective ocean governance, enhance its integrity with the private sector, and ensure a business climate conducive for sustainable economic growth and inclusive development.

The developmental perspective must be changed by assessing the backward and forward linkages of each ocean economic activity or sector, transforming the ocean economy into blue economy, and integrating marine and land-based economic activities into a unified national economy. Policies on blue economy and ocean management should be pursued in concrete steps, together with capacity development, innovative technologies, improved laws, and plans that consider economic growth, job creation, wages and incomes, inclusiveness, environmental and ecological sustainability, financial viability, and natural hazard and climate resiliency, in an integrated way.

4.3 Coastal and Marine Ecosystem Services

Coastal areas generally have three major interconnected ecosystems, namely coral reef, seagrass and mangrove ecosystems. These three ecosystems provide economic and ecological benefits. The economic benefits to be gained are direct use value (with market prices), while the ecological benefits are indirect use or non-use values.

UNEP defines ecosystem services as benefits derived by humans from ecosystems, including:

(a) Provision of services, such as food and water;
(b) Regulating services, such as nutrient cycling, climate regulation, shoreline protection, flood control and disease control services;
(c) Cultural services, such as spiritual, recreational, and cultural benefits; and
(d) Supporting services, such as habitat for life on earth (United Nations Environment Program, 1993).

Earth Economics defines ecosystem services as a benefit that humans can derive from an ecosystem, including benefits from water, food, raw materials, coastal stabilization, flood and storm protection, water flow regulation, water quality, human disease control, sewage treatment, carbon regulation and nutrient cycles, habitat, primary production, education and science, tourism, aesthetics and recreation (Batker, 2003).

These benefits of ecosystem services are described in **Table 4.6**.

Table 4.6: Definition and Benefits of Ecosystem Services.

No.	Ecosystem Services	Definition
1	Water	Water provided by water cycles, climate, ecology and geology of natural systems
2	Food	Biomass for human consumption which provided by ecosystem function
3	Material	Biological matters for medicine, fuel and building materials
4	Shoreline stabilization	Physical function to stabilize coastal area
5	Storm and flood protection	Reducing the effects of wind, waves, and flood for coastal community
6	Waterflow regulation	Water retention and regulation
7	Water quality	Filtering and purifying of water
8	Human disease control	Controlling the organism that affected human disease
9	Waste management	Detoxification and absorption of contaminants resulting from human activities
10	Carbon stock	Longtime carbon storage as part of global carbon cycles
11	Nutrient cycle and regulation	Regulation of nutrient from one part to other part. Useless nutrient from one part will be transfer to useful nutrient in other part
12	Habitat	Providing space for life cycles of animal and plant
13	Primary productivity	Revising carbon productivity of plant for basic needs of food chain in ecosystems
14	Science and education	Ecosystem as subject for research and education to understand ecosystem function for human welfare contribution
15	Tourism	Natural condition of ecosystem as attractive object for human to visit
16	Aesthetic	The role of ecosystem to inspire human for living, creating and working in certain area; visual and artistic value of view and habitats
17	Recreation	Contribution of the ecosystem uniqueness and biodiversity to attract human for recreation activities

Mangroves, coral reefs and seagrass beds protect the coasts from abrasion, erosion, waves and storm surge. Mangrove forests also provide nutrients for various types of fish and feeding grounds for wildbirds and marine animals. There are other benefits generated by ecosystems and biodiversity, some of which are described in **Table 4.7**.

Table 4.7: Benefits of Biodiversity (IBSAP 2015-2020).

No.	Value of Biodiversity	Empirical Example
1	Traditional medicines	Various types of wild plants from the forest, such as Pasak Bumi (*Euriycoma longifolia*) as well as various types of medicinal plants, eperti ginger (*Zingiber officinale*) are used as traditional medicinal ingredients. The economic value of herbal products circulating in the market can potentially reach up to IDR6 trillion, in addition to employing millions of employees in herbal and herbal factory activities.
2	Fisheries, Tourism, Shoreline protection, Aesthetic value	The potential economic benefits Indonesia can derive from sustainable use of coral reef management for fisheries, tourism, coastal protection and aesthetic value can reach at least USD 16 billion per year.
3	Carbon sequestration	Carbon sequestration of 830 tonnes/ha of seagrass ecosystems while forests in the mainland are capable of storing carbon of 300 tonnes/ha. At the species level, 10 species of plants were recorded to have the highest carbon stocks with a range of 60,159 - 772,624 tonnes of carbon/ha.
4	Production (commercial value)	Some Indonesian botanical gardens have a collection of 3,000 native plant species of Indonesia, of which 50 species of plants in the collection are reported to have contributed significantly to economic growth and commerce, such as sugarcane and coconut. In marine areas, seagrass and seaweeds are harvested for industrial purposes.
5	Existence value	The existence value of the marine conservation area of the Thousand Islands: USD 78,751.03/ha.

4.3.1 Valuation of Coastal and Marine Ecosystems

Using the data collected from several provinces in Indonesia, the values of ecosystem services were estimated by arithmetic mean regardless of the quality of ecosystems. **Table 4.8** shows the value of ecosystems in Indonesia from various scientific research/studies.

Table 4.8: Valuation of Ecosystem Services Based on Various Studies.

Ecosystem	Economic value (US$/ha/year)	Source
Seagrass	11,899.26	Al Hadad (2012); Adrianto et al (2013); Adrianto et al (2014); PKSPL-IPB (2000); PKSPL-IPB (2012)
Mangrove	6,874.81	Siregar (2012); Osmaleli (2014); Ariyanto (2007); Wahyuni (2013); Alfian (2004); Fitrawati (2001); PKSPL-IPB (2005); PKSPL-IPB (2012); Wahyudin & Adrianto (2012); PKSPL-IPB (2013); BBPSE KKP (2009)
Coral reef	28,588.15	Situmorang (2004); Putrantomo (2010); Andalita (2006); Leslahulu (2008); PKSPL-IPB (2005); PKSPL-IPB (2012); Wahyudin & Adrianto (2012)
Marine Waters	547.41	PKSPL-IPB (2005); PKSPL-IPB (2012); Wahyudin & Adrianto (2012)

Remark: Values were calculated for year 2016, using a discount rate of 9.79%/year.

Based on the data of the area and economic value of each ecosystem, it can be observed that the wealth of coastal and marine is very large. Fahrudin (2017) estimated the ecosystem services of mangroves, seagrass, coral reefs, and oceanic waters. The economic value of coastal and marine ecosystem services in Indonesia comes largely from fisheries benefits of about 85%. The value of tourism utilization is still relatively small (about 1%), while the utilization value for new cultivation is about 4%. The values of provisioning and supporting services were estimated using the effect on productivity approach (EOP), while the values of cultural services were estimated using the travel cost method (TCM) for recreation, and willingness-to-pay for existence value. **Table 4.9** shows the area and economic value of coastal and marine ecosystems in Indonesia. The estimated value of ocean and coastal ecosystem services is around **US$ 403-411 billion**.

Table 4.9: Valuation of Ecosystem Services (US$/km^2) in Indonesia.

No.	Ecosystem Service	Coastal Ecosystems			Oceanic
		Mangrove	Seagrass	Coral Reef	
1	**Provisioning**				
	Fisheries	12,444.40	100,313.79	97,877.76	41.97
	Fuelwood/charcoal	125.00			
2	**Cultural**				
	Recreation and tourism	14.00		3,176.88	
	Existence value	33.30	3,932.07	14,643.97	
3	**Regulating**				
	Carbon sequestration	2,923.6	154.48		
4	**Supporting**				
	Aquaculture	10,238.70			
	Mariculture		1,799.25		
	TOTAL (US$/ha)	**25,779.00**	**106,199.59**	**115,698.61**	**41.97**

Source: Fahrudin, 2017.

Table 4.10: Valuation of Ecosystem Services (US$).

Habitat	Area (ha)	Valuation (US$/ha)	Valuation (US$)	Status
Mangroves	2013: 3,989,689.08[20] 2014: 4,418,105.57[21] 2015: 3,668,075.60[22]	25,779.00	**94,559,331,204.00**	Mangrove area has increased, but only 21.48% is in good condition.

[20] BPS. Statistics of Coastal and Marine Resources 2014.
[21] BPS. Statistics of Coastal and Marine Resources 2015.
[22] BPS. Statistics of Coastal and Marine Resources 2016.

Table 4.10: Valuation of Ecosystem Services (US$). (cont.)

Habitat	Area (ha)	Valuation (US$/ha)	Valuation (US$)	Status
Seagrass	2013: 1,496,996.78[20] 2014: 847,385.33[21] 2015: 474,920.93[22] 2017: 150,693.16[23]	106,199.59	**15,993,993,844.7**	The seagrass area has decreased and 20.62% in good condition.
Coral reefs	2013: 2,692,301.69[20] 2014: 3,185,616.85[21] 2015: 2,340,202.66[22] 2017: 2.5 million[24]	115,698.61	**289,246,525,000.0**	The coral reef area is fluctuating, with only 5% in very good condition, and 30% in poor or damaged condition.
Oceanic	Territorial water: 80,000,000 EEZ: 270,000,000	41.97	**3,357,600,000.0 to 11,331,900,000.0**	-
TOTAL			**403,157,450,048.7 to 411,131,750,048.7**	

4.3.2 Blue Carbon

One of the ecosystem services that need further assessment is the value of carbon sequestration and its contribution to climate change mitigation. Indonesia contains the most mangrove area (20% of the world's mangroves) and has the largest annual climate mitigation potential of any one country in the world (almost 30 million tonnes of emissions could be reduced from avoided mangrove conversion in Indonesia). The country's mangroves are being lost at a rate of up to 2% per year, however, mainly due to deforestation for aquaculture and agriculture. Indonesia also has large areas of seagrass beds, which could sequester and store carbon not only in its biomass but also in the underlying sediments and below-ground biomass, and at a much higher rate than tropical rainforest. (*See Section 13 for the status of coastal and marine ecosystems.*)

Box 4.1 Indonesia's Blue Carbon

"The global significance of carbon storage in Indonesia's coastal wetlands was assessed based on published and unpublished measurements of the organic carbon content of living seagrass and mangrove biomass and soil pools.

For seagrasses, median above- and below-ground biomass was 0.29 and 1.13 $Mg.C.ha^{-1}$ (megagram or tonne of carbon per hectare), respectively; while the median soil pool was

[23] Hermawan, et al. 2017.
[24] P2O-LIPI, 2017.

Box 4.1 Indonesia's Blue Carbon (cont.)

118.1 $Mg.C.ha^{-1}$. Combining plant biomass and soil, median carbon storage in an Indonesian seagrass meadow is 119.5 $Mg.C.ha^{-1}$. Extrapolated to the estimated total seagrass area of 30,000 km^2, the national storage value is **358.5 Tg-C** (358.5 teragram or million tonnes of carbon). For mangroves, median above- and below-ground biomass was 159.1 and 16.7 $Mg.C.ha^{-1}$, respectively; while the median soil pool was 774.7 $Mg.C.ha^{-1}$. The median carbon storage in an Indonesian mangrove forest is 950.5 $Mg.C.ha^{-1}$. Extrapolated to the total estimated mangrove area of 31,894 km^2, the national storage value is **3.03 Pg-C** (petagram or billion tonnes of carbon), a likely underestimate if these habitats sequester carbon at soil depths >1 m and/or sequester inorganic carbon.

Together, Indonesia's seagrasses and mangroves conservatively account for **3.4 Pg-C**, roughly 17 % of the world's blue carbon reservoir. Continued degradation and destruction of these wetlands has important consequences for CO_2 emissions and dissolved carbon exchange with adjacent coastal waters. Roughly 29,040 Gg CO_2 (equivalent) is returned annually to the atmosphere-ocean pool. This amount is equivalent to about 3.2% of Indonesia's annual emissions associated with forest and peat land conversion. These results highlight the urgent need for blue carbon and REDD+ projects as a means to stem the decline in wetland area, mangroves and seagrass beds, and to mitigate the release of a significant fraction of the world's coastal carbon stores."[25]

4.3.3 Existence Value

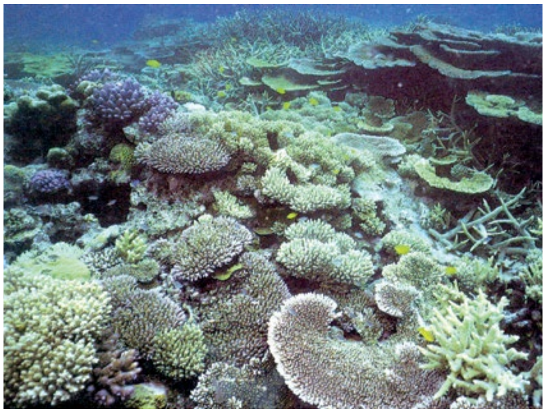
Existence value is the benefit, often reflected as a sense of well being, of simply knowing marine biodiversity exists, even if it is never utilised. It can be motivated by an ecological ethic or bequests to future generations. In line with the improving life and due to decreasing open space, people began to look for natural areas and are willing to spend money to enjoy the beauty of nature or pay for the continued existence of ecosystems and biodiversity. For some people, there is value in just knowing that these ecosystems exist, and are willing to pay for their continued existence.

Currently, the coastal areas of Indonesia have mangrove forest, coral reefs and beaches that can be developed as tourist areas because of good scenery and recreational amenities as well as scientific and educational tourism for the right consumer segment. Coral reefs in Wakatobi, Raja Ampat, and Bunaken are places that utilize the existence value of coral reefs as a source of local and community donations.

[25] Alongi,.et al. 2016.

A study on the public willingness to pay for the conservation of coral reefs, seagrass beds and mangroves in the Thousand Islands Marine Conservation Area shows that the willingness to pay is an average of IDR 146.5 thousand per capita per year or in aggregate amount of US$ 78,751.03. This value is quite feasible to describe the existence value of marine conservation area of Kepulauan Seribu. While the willingness to pay for conservation does not reflect the full perception of the economic value of the region, it can be used as a reference relative to the economic value of a conservation area (Fauzi et al., 2007).

Estimates of the value of coral reefs in larger areas are known to raise the living standards of 120 million people whose lives depend on coastal marine resources and coral reefs in the Coral Triangle. The benefits to be gained from sustainable coral reef management throughout Southeast Asia are valued at US$ 2.4 billion. Meanwhile, income from the extent of nature-based tourism in the Coral Triangle stretching from Tubbataha, Komodo, Sipadan (East Kalimantan) to Raja Ampat reached US$ 12 billion (Bisema 1968; WWF 2013).



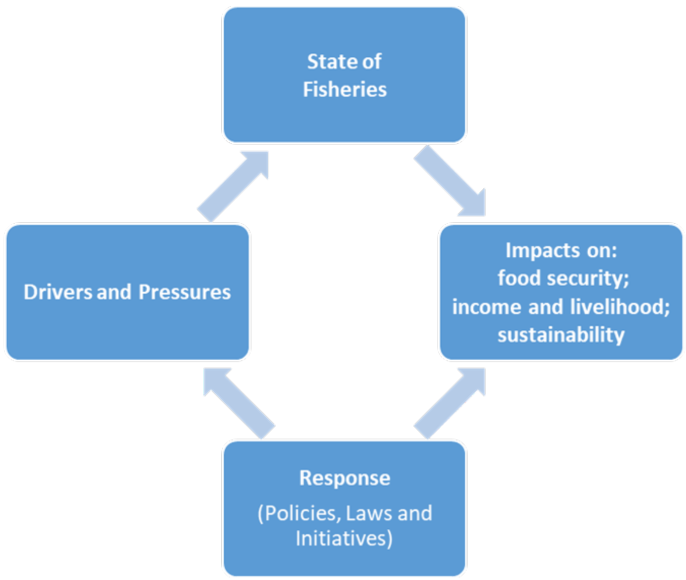
Coral reef *(Photo by: PEMSEA)*

Mangroves *(Photo by: M. Ebarvia)*

Ocean *(Photo by: M.Ebarvia)*

Seagrass *(Photo by: PEMSEA)*

5 Fisheries and Food Security from Coastal and Marine Resources



Fishing boats.
Photo by M. Ebarvia

5.1 Indonesia's Fishery Sector in the Context of World Fishery Production

FAO (2018) reported that in 2017, total world fish production (excuding aquatic plants) reached an all-time high of 171 million tonnes, of which 88% was utilized for direct human consumption. Moreover, this production resulted in a record-high per capita fish consumption of 20.3 kg in 2016.[26]

For capture fisheries, China was the top-ranking fishing country in terms of quantities followed by Indonesia. In 2016, Indonesia's marine capture fishery production accounted for 7.7% of the world capture fisheries production. China's contribution to world capture fisheries production was 19.2%. Nevertheless, the average production of Indonesian capture fisheries during the period of 2005-2015 experienced higher growth rate compared to China (**Table 5.1**).

[26] FAO. 2018.

World capture fisheries in marine waters reached 80.6 million tonnes in 2017, representing an increase of more than 3.2 million tonnes in comparison to 2016.

Table 5.1: Production Volume of 25 Major Producer Countries from Marine Capture Fisheries.

No.	Country	Production Volume (Tonne)			Growth (%)	
		Average 2005–2014	2015	2016	Average (2005–2014)	2015–2016
1	China	13,189,273	15,314,000	15,246,234	15.6	(0.4)
2	**Indonesia**	**5,074,932**	**6,216,777**	**6,109,783**	**20.4**	**(1.7)**
3	United States of America	4,757,179	5,019,399	4,897,322	2.9	(2.4)
4	Russian Federation	3,601,031	4,172,073	4,466,503	24.0	7.1
5	Peru	6,438,839	4,786,551	3,774,887	(41.4)	(21.1)
6	India	3,218,050	3,497,284	3,599,693	11.9	2.9
7	Japan	3,992,458	3,423,099	3,167,610	(20.7)	(7.5)
8	Viet Nam	2,081,551	2,607,214	2,678,406	28.7	2.7
9	Norway	2,348,154	2,293,462	2,033,560	(13.4)	(11.3)
10	Philippines	2,155,951	1,948,101	1,865,213	(13.5)	(4.3)
11	Malaysia	1,387,577	1,486,050	1,574,443	13.5	5.9
12	Chile	3,157,946	1,786,249	1,499,531	(52.5)	(16.1)
13	Morocco	1,074,063	1,349,937	1,431,518	33.3	6.0
14	Republic of Korea	1,746,579	1,640,669	1,377,343	(21.1)	(16.0)
15	Thailand	1,830,315	1,317,217	1,343,283	(26.6)	2.0
16	Mexico	1,401,294	1,315,851	1,311,089	(6.4)	(0.4)
17	Myanmar	1,159,708	1,107,020	1,185,610	2.2	7.1
18	Iceland	1,281,597	1,318,916	1,067,015	(16.7)	(19.1)
19	Spain	939,384	967,240	905,638	(3.6)	(6.4)
20	Canada	914,371	823,155	831,614	(9.1)	1.0
21	Taiwan, China	960,193	989,311	750,021	(21.9)	(24.2)
22	Argentina	879,839	795,415	736,337	(16.3)	(7.4)
23	Ecuador	493,858	643,176	715,357	44.9	11.2
24	United Kingdom	631,398	704,502	701,749	11.1	(0.4)
25	Denmark	735,966	868,892	670,207	(8.9)	(22.9)
	Total 25 Major Countries	**65,451,506**	**66,391,560**	**63,939,966**	**(2.3)**	**(3.7)**
	World Total	**79,778,181**	**81,247,842**	**79,276,848**	**(0.6)**	**(2.4)**
	Share of 25 Major Countries	**82.0%**	**81.7%**	**80.7%**		

Source: FAO, 2018.

In 2017, the top ten aquaculture producers (excluding aquatic plants and non-food products) were: China (46.82 million tonnes), India (6.18 million tonnes), **Indonesia (6.15 million tonnes)**, Viet Nam (3.28 million tonnes), Bangladesh (2.33 million tonnes), Egypt (1.45 million tonnes), Norway (1.31 million tonnes), Chile (1.2 million tonnes), Myanmar (1.1 million tonnes) and Thailand (0.9 million tonnes). The top ten producers collectively produced 71.2 million tonnes, contributing 88.9% to the world total production by quantity in 2017 (FAO, 2018).

The volume and value of fisheries and aquactulture production in Indonesia in 2017 are shown in **Table 5.2**. In 2017, capture fisheries production was seven million tonnes while aquaculture production was 16 million tonnes (including seaweeds and other aquatic plants and non-food products). Aquaculture clearly dominated capture fisheries, which was only 30% of Indonesia's total fisheries and aquaculture production. However, in terms of value, capture fisheries and aquaculture production amounted to US$14.75 billion and US$13.99 billion, respectively, indicating higher-value species for capture fisheries.

Most of the capture fisheries and aquaculture production was done in marine waters. For capture fisheries, 93% is from marine waters. For aquaculture, marine culture accounts for 61% of production, while 17% is culture in brackishwater, and 22% in freshwater.

Table 5.2: Total Fisheries and Aquaculture Production of Indonesia in 2017.

Subsector	Production (tonne)	Production value (000 IDR)	Production value (US$)*
CAPTURE FISHERIES			
Marine capture	6,603,631	184,620,257,512	13,797,365,633.79
Inland open water capture	467,822	12,716,813,706	950,375,277.14
SUB-TOTAL (A)	**7,071,453**	**197,337,071,218**	**14,747,740,910.93**
AQUACULTURE			
Marine floating net	76,175	10,345,561,847	773,162,714.72
Other marine culture	62,450	2,121,546,709	158,551,158.19
Seaweed	9,746,045	21,189,049,472	1,583,537,294.00
Sub-total	**9,884,670**	**33,656,158,028**	**2,515,251,166.90**
Intensive brackishwater pond	39,954	2,381,246,091	177,959,468.94
Traditional brackishwater pond	1,668,700	23,393,404,525	1,748,277,030.92
Semi-intensive brackishwater pond	989,981	46,578,171,318	3,480,961,780.08
Sub-total	**2,698,635**	**72,352,821,934**	**5,407,198,279.93**
Freshwater floating net	353,748	8,111,145,141	606,176,357.50
Freshwater pen culture	25,446	515,554,944	38,529,358.38
Cage	243,728	7,259,567,282	542,534,743.93
Running freshwater pond	70,043	1,713,001,260	128,019,021.50

Table 5.2: Total Fisheries and Aquaculture Production of Indonesia in 2017. (cont.)

Subsector	Production (tonne)	Production value (000 IDR)	Production value (US$)*
Still freshwater pond	2,755,851	61,290,946,399	4,580,502,751.45
Rice fish	82,870	2,249,779,953	168,134,510.40
Sub-total	**3,531,686**	**81,139,994,979**	**6,063,896,743.16**
SUB-TOTAL (B)	**16,114,991**	**187,148,974,941**	**13,986,346,190.00**
TOTAL (A + B)	**23,186,444**	**384,486,046,159**	**28,734,087,100.92**

Note: *Exchange rate in 2017: IDR 13380.83/US$1.
Source: BPS, 2019.

The fisheries and aquaculture sector is not without challenges, including the need to: reduce the percentage of fish stocks fished beyond biological sustainability, currently 33.1%; ensure that biosecurity and animal disease challenges are tackled successfully; and maintain complete and accurate national statistics in support of policy development and implementation (FAO, 2018).

5.2 Fishery Resources

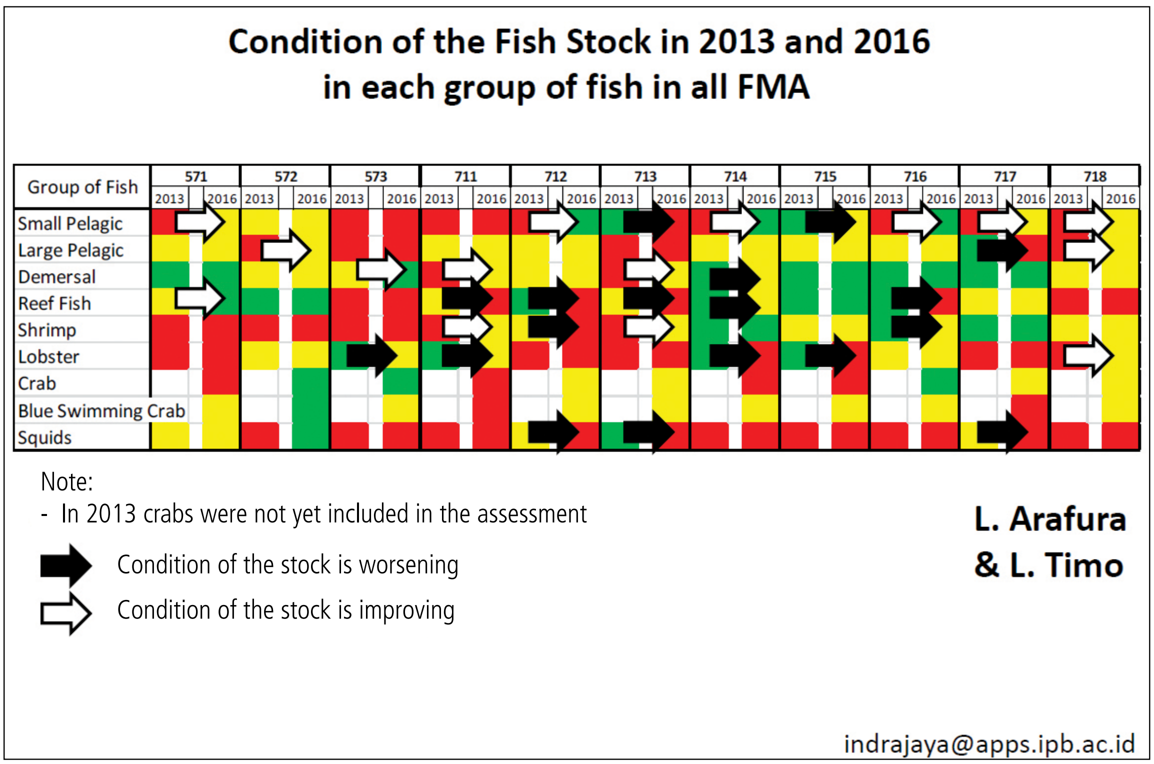
The Republic of Indonesia is the largest archipelagic state in the world, with high potential of income and growth from fishery resources. However, the utilization rate of fish resources is still uneven. Some fisheries management areas (FMAs) have experienced overfishing while some areas are still not utilized optimally.

During the period of 1997-2013, at least 8 (eight) studies of fish resources in Indonesia were conducted. The potential fish resources were estimated at 6.190 million tonnes in 1997, 6.4 million tonnes in 1999, and 6.409 million tonnes in 2001. In 2005, the study of nine WPP (Fisheries Management Areas) and four commodities groups (big pelagics, small pelagics, demersal, shrimp) was conducted. The study was reviewed quantitatively the production surplus method in 2008. In 2009, a qualitative study was conducted and it expanded the scope from 9 WPPs to 11 WPPs. In the 2011 study, fish potential in 11 WPPs was estimated at 6.502 million tonnes, and as much as 7.305 million tonnes in the 2013 study.

Officially, Indonesia's fish resource stock data follow the *Decree of Minister of MMAF No.47/Kepmen-KP/2016 on Potential Estimate, Volume of Allowable Catch, and Level of Fish Resource Utilization in Fisheries Management Area of Republic of Indonesia*. The potential of marine fishery resources is large and spread in 11 fisheries management areas (FMA) or WPPs, with the potential sustainable utilization reaching 9.93 million tonnes per year (Kepmen KP RI No.47 of 2016) or equivalent to the value of US$29.80 billion per year when the price of the fish is averaged at US$3 per kilogram (kg). This value can certainly increase if combined with the potential of fishery production from cultivation activities estimated at 9 million tonnes (an estimated 2 tonnes per ha per year, potential land of 4.5 million ha). This means that the economic potential of aquaculture is estimated to reach US$18 billion per year. The fishery sector mentioned above is only the primary sector (production), while the fishery sector in the broad sense also includes the processing of fishery products.

The estimated potential fish resource in 2016 in 11 FMAs was 9.93 million tonnes while the allowable catch was 7.95 million tonnes (**Table 5.3**). The actual capture fishery production of Indonesia in 2016 was 6,542,258 tonnes.[27] Nevertheless, most FMAs (WPPs) have levels of utilization that indicate that the fishery resources are 'fully exploited' to 'over-exploited'. **Figure 5.1** shows the changes in condition of fish stocks (by fish group) in the different FMAs in 2013 and 2016.

Figure 5.1: Condition of Fish Stocks in Indonesia.



[27] FAO. 2019.

Table 5.3: Potential Yield Estimate, Volume of Allowable Catch, and Level of Fish Resource Utilization in Fisheries Management Area of Indonesia.

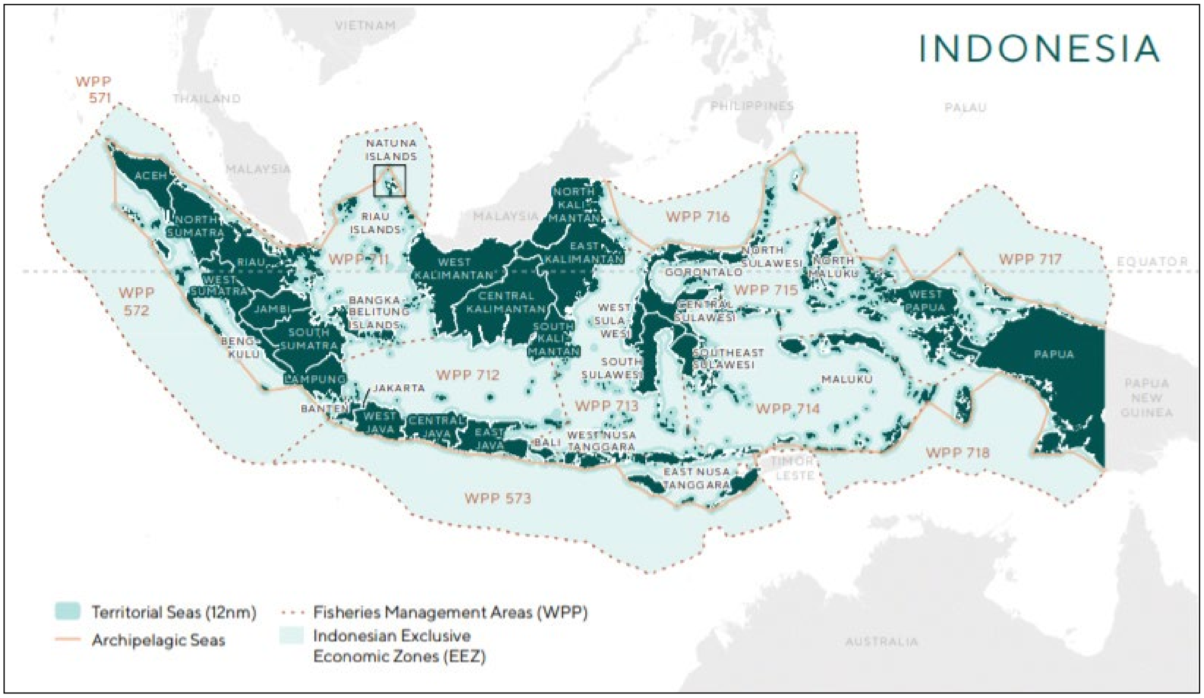
Sectors			Small pelagic fish	Big pelagic fish	Demersal fish	Coral reef fish	Shrimp (Penaeid)	Lobster	Blue Swimming Crab	3-Spot Swimming Crab	Squid	TOTAL
Malacca Strait and Andaman Sea	FMA-RI 571	Potential yield (tonne)	79,008	101,969	102,751	119,756	58,910	711	11,120	3,065	7,125	**484,414**
		Allowable Catch (tonne)	63,206	81,575	82,201	95,805	47,128	569	8,896	2,452	5,700	**387,532**
		Level of Utilization	1.06	0.89	1.05	0.13	1.66	1.26	1.24	0.74	0.5	
Indian Ocean in the west of Sumatra and Sunda Strait	FMA-RI 572	Potential yield (tonne)	412,945	364,830	366,066	48,098	8,249	1,297	11,582	955	14,579	**1,228,601**
		Allowable Catch (tonne)	330,356	291,864	292,853	38,478	6,599	1,037	9,265	764	11,663	**982,879**
		Level of Utilization	0.62	1.29	0.53	0.3	1.6	1.1	0.71	1.06	0.4	
Indian Ocean – Sawu Sea, Southern Nusa Tenggara, and Western Timor Sea	FMA-RI 573	Potential yield (tonne)	294,092	505,942	103,501	8,778	6,854	844	465	659	8,195	**929,330**
		Allowable Catch (tonne)	235,274	404,754	82,801	7,022	5,483	675	372	527	6,556	**743,464**
		Level of Utilization	0.91	0.73	0.96	1.36	1.36	0.54	1.05	0.64	1.4	
South China Sea, Karimata Strait, Natuna Sea	FMA-RI 711	Potential yield (tonne)	395,451	198,994	400,517	24,300	78,005	979	502	9,437	35,155	**1,143,341**
		Allowable Catch tonne)	316,361	159,195	320,414	19,440	62,404	784	402	7,550	28,124	**914,674**
		Level of Utilization	1.64	0.42	0.98	0.88	1.48	1.13	1.36	0.63	2	
Java Sea	FMA-RI 712	Potential yield (tonne)	303,886	104,017	320,432	59,146	58,390	952	10,077	22,637	102,142	**981,680**
		Allowable Catch (tonne)	243,109	83,214	256,346	47,317	46,712	762	8,062	18,110	81,714	**785,346**
		Level of Utilization	0.59	1.16	0.83	0.67	1.21	1.36	1.28	1.05	1.6	
Makassar Strait, Bone Bay, Flores Sea and Bali Sea	FMA-RI 713	Potential yield (tonne)	104,546	419,342	77,238	365,420	37,268	1,020	5,016	6,740	10,010	**1,026,599**
		Allowable Catch (tonne)	83,637	335,474	61,790	292,336	29,814	816	4,013	5,392	8,008	**821,280**
		Level of Utilization	0.61	0.86	1.04	0.34	1.7	1.4	1.59	1.52	1.7	

Table 5.3: Potential Yield Estimate, Volume of Allowable Catch, and Level of Fish Resource Utilization in Fisheries Management Area of Indonesia. (cont.)

Sectors			Small pelagic fish	Big pelagic fish	Demersal fish	Coral reef fish	Shrimp (Penaeid)	Lobster	Blue Swimming Crab	3-Spot Swimming Crab	Squid	TOTAL
Banda Sea anf Tolo Bay	FMA-RI 714	Potential yield (tonne)	116,516	43,062	99,800	164,165	2,252	155	1,151	2,180	1,788	**431,069**
		Allowable Catch (tonne)	93,213	34,450	79,840	131,332	1,802	124	921	1,744	1,430	**344,856**
		Level of Utilization	0.69	0.86	0.54	0.34	0.66	0.96	1.44	1.04	0.7	
Tomini Bay, Maluku Sea, Halmahera Sea, Seram Sea, and Bereau Bay	FMA-RI715	Potential yield (tonne)	378,734	51,394	114,005	69,975	6,089	710	490	643	9,664	**631,703**
		Allowable Catch (tonne)	302,987	41,115	91,204	55,980	4,871	568	392	515	7,731	**505,363**
		Level of Utilization	1.05	1.58	0.51	0.49	1.21	1.23	1.81	1.2	1.8	
Sulawesi Sea and north of Halmahera	FMA-RI 716	Potential yield (tonne)	222,946	154,329	34,650	54,194	8,465	685	1,969	424	1,103	**478,765**
		Allowable Catch (tonne)	178,357	123,463	27,720	43,355	6,772	548	1,575	339	882	**383,011**
		Level of Utilization	0.49	0.74	0.49	1.11	0.75	1.02	0.94	1.09	1.4	
Pacific Ocean	FMA-RI 717	Potential yield (tonne)	391,126	56,067	111,619	32,376	8,669	1,065	620	22	2,124	**603,688**
		Allowable Catch (tonne)	312,901	44,854	89,295	25,901	6,935	852	496	18	1,699	**482,951**
		Level of Utilization	0.73	0.95	0.45	0.81	0.25	1.21	0.9	1.45	0.7	
Arafura Sea–Timor Sea	FMA-RI 718	Potential yield (tonne)	823,328	489,795	586,277	30,555	53,502	386	1,507	1,911	5,470	**1,992,730**
		Allowable Catch (tonne)	658,662	391,836	469,022	24,444	42,802	309	1,205	1,529	4,376	**1,594,185**
		Level of Utilization	0.52	0.65	1.14	0.5	1.3	1.23	0.77	0.17	0.7	
TOTAL		**Potential yield (tonne)**										**9,931,920**
		Allowable Catch (tonne)										**7,945,541**

Note: E: Level of utilization
E < 0.5: Moderate
0.5 ≤ E < 1: Fully-exploited
E ≥ 1: Over-exploited
Source: Decree of Minister of MMAF No.47/Kepmen-KP/2016.

Figure 5.2: Map of Indonesia's Territorial Waters and Fisheries Management Areas (WPP).



Source: California Environmental Associates. 2018.

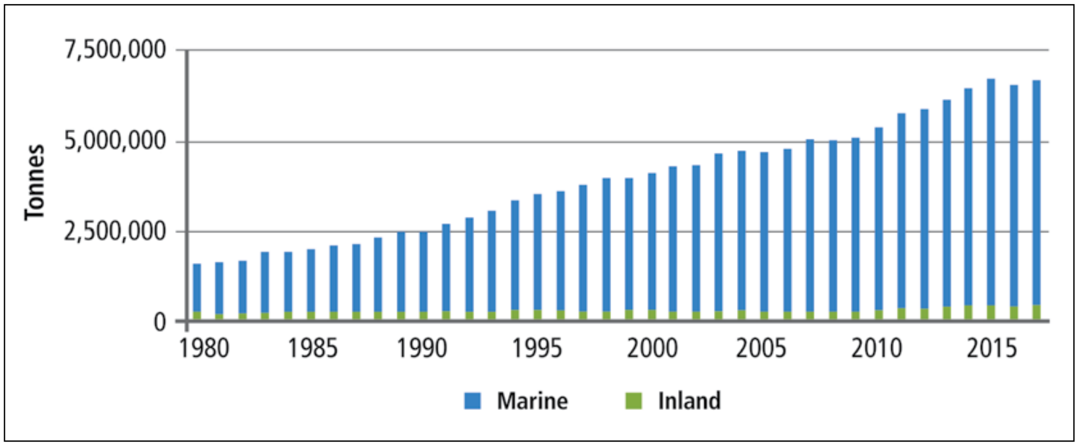
5.3 Marine Capture Fisheries

5.3.1 Capture Fisheries Production

Marine fisheries production in 2015 was 6,216,777 tonnes, and 6,109,783 tonnes in 2016, a decline of 1.7%. It increased again in 2017, with production of 6,603,631 tonnes or an increase of 8.1% in 2016-2017. As shown in **Figure 5.3**, 93% of capture fisheries production is done in marine waters.

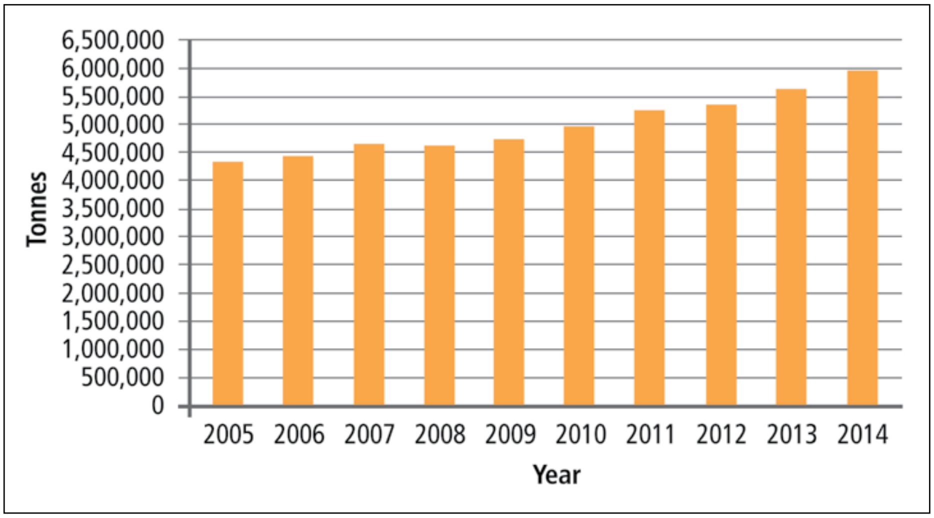
In 2005, marine capture fisheries production was 4.408 million tonnes, and reached 6.037 million tonnes in 2014, an increase of 20.4% (**Figure 5.4**). Annual average growth of marine capture fisheries production during period of 2005-2014 was 3.58%.

Figure 5.3: Capture Production by Marine and Inland Waters in Indonesia (tonnes).



Source: FAO FishStat.

Figure 5.4: Marine Capture Fish Production in 2005-2014.



Source: DJPT KKP, 2015.

The marine fisheries production by province is shown in **Table 5.4**, including the corresponding value in IDR and US$. In terms of quantity produced, Sumatera Utara is the biggest producer (10.8%), followed by Maluku (9.1%), Jawa Timur (8.4%), and Papua Barat (6.4%). The province with the lowest marine fisheries production is DI Yogyakarta, contributing only 0.08% to total production.

Table 5.4: Marine Fisheries Production, by Province, 2017.

No.	Province	Production (tonne)	Production value (000 IDR)	Production value (US$)
1	Aceh	236,061	7,296,405,913	545,287,833
2	Sumatera Utara	715,442	20,780,174,400	1,552,980,523
3	Sumatera Barat	214,144	6,623,112,946	494,970,120
4	Riau	107,843	4,487,148,536	335,341,472
5	Jambi	44,410	1,753,378,893	131,036,594
6	Sumatera Selatan	9,530	196,524,446	14,687,010
7	Bengkulu	65,755	2,145,828,018	160,365,792
8	Lampung	172,277	5,587,514,341	417,575,944
9	Kepulauan Bangka Belitung	217,912	5,568,292,575	416,139,429
10	Kepuluan Riau	112,433	2,831,345,810	211,597,112
11	DKI Jakarta	135,619	3,715,781,712	277,694,331
12	Jawa Barat	231,153	9,684,249,534	723,740,360
13	Jawa Tengah	253,614	8,187,199,607	611,860,194
14	DI Yogyakarta	5,315	298,769,617	22,328,176
15	Jawa Timur	551,925	13,086,882,953	978,031,943
16	Banten	108,703	3,199,294,347	239,095,289

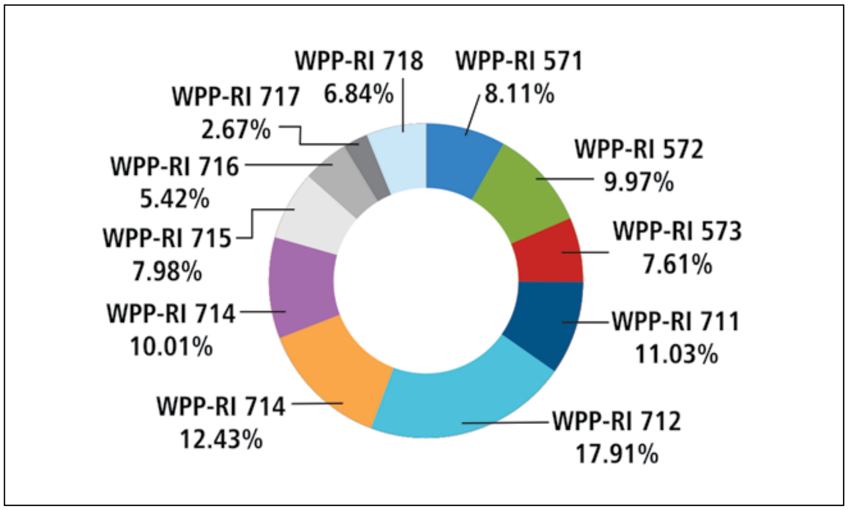
Table 5.4: Marine Fisheries Production, by Province, 2017. (cont.)

No.	Province	Production (tonne)	Production value (000 IDR)	Production value (US$)
17	Bali	111,591	4,326,942,865	323,368,701
18	Nusa Tenggara Barat	179,140	3,312,624,543	247,564,881
19	Nusa Tenggara Timur	72,226	1,840,354,297	137,536,593
20	Kalimantan Barat	128,208	3,726,583,275	278,501,572
21	Kalimantan Tengah	67,384	1,398,344,092	104,503,509
22	Kalimantan Selatan	188,700	3,731,374,234	278,859,619
23	Kalimantan Timur	41,041	1,409,470,131	105,335,000
24	Kalimantan Utara	12,619	710,102,594	53,068,635
25	Sulawesi Utara	393,448	12,402,856,099	926,912,045
26	Sulawesi Tengah	177,517	3,756,939,811	280,770,230
27	Sulawesi Selatan	332,770	9,517,439,011	711,273,983
28	Sulawesi Tenggara	229,328	5,564,777,553	415,876,739
29	Gorontalo	134,889	3,047,677,665	227,764,405
30	Sulawesi Barat	56,100	1,531,583,906	114,461,021
31	Maluku	602,953	13,267,281,901	991,513,834
32	Maluku Utara	96,528	3,468,792,284	259,235,883
33	Papua Barat	421,840	10,392,584,583	776,676,900
34	Papua	175,211	5,772,625,021	431,409,961
	TOTAL	**6,603,631**	**184,620,257,513**	**13,797,365,634**

Source: BPS. Statistik Indonesia.

Based on Fisheries Management Area (FMA) or WPP, marine fisheries production in 2014 is mostly from the Java Sea (**WPP-RI 712**), with 1,081,178 tonnes produced or share of 17.91%. Makassar Strait, Bone Bay, Flores Sea and Bali Sea (**WPP-RI 713**) produced 750,377 tonnes (12.43%), followed by South China Sea (**WPP-RI 711**) with 11.03% contribution. The production and share of other WPPs are as follow: Tolo Bay and Banda Sea (**WPP-RI 714**) with 604,515 tonnes (10.01%); Indian Ocean - West Sumatra and the Sunda Strait (**WPP-RI 572**) with 602,148 tonnes (9.97%); Malacca Strait and Andaman Sea (**WPP-RI 571**) with 489,920 tonnes (8.11%); Tomini Bay, Maluku Sea, Halmahera Sea, Seram Sea and Berau Bay (**WPP-RI 715**) with 482,035 tonnes (7.98%); the Indian Ocean to the south of Java to the South of Nusa Tenggara, Savu Sea and the West Timor Sea (**WPP-RI 573**) with 459,749 tonnes (7.61%); Aru Bay, Arafuru Sea and East Timor Sea (**WPP-RI 718**) with 413,118 tonnes (6.84%); Sulawesi Sea and North Halmahera Island (**WPP-RI 716**) with 327,364 tonnes (5.42%); and Teluk Cendrawasih and the Pacific Ocean (**WPP-RI 717**) with 161.496 tonnes (2.67%). The contribution of marine capture fishery production in 2014, by WPP is shown in **Figure 5.5**.

Figure 5.5: Marine Capture Fisheries Production by FMA (WPP) in 2014.



Source: DJPT KKP, 2015.

The catch of demersal and small-pelagic species as well as shrimps comes largely from fishing on the continental shelf, in the Malacca Strait, the southern part of South China Sea, the Java Sea and in the Arafura Sea. Most of the large pelagic species, such as tuna species (skipjack, bigeye and yellowfin tuna), are caught in the archipelagic waters in the mid and eastern part of the country as well as in the Indonesian EEZ and on the high seas. Indonesia is one of the main producers of tuna in the world.

The marine capture fishery production during the period 2010-2014 experienced the highest growth rate in WPP 716 (Sulawesi Sea and North Halmahera Island) averaging 10.91% per year. The fishery management area with production that declined in this period is WPP 573 (Indian Ocean to the south of Java to the south of Nusa Tenggara, Savu Sea and western Timor Sea), which on average decreased by 0.49% per year. For the period of 2013-2014, Java Sea (WPP 712) had the highest production growth of 17.71%. The marine capture fishery production by FMA or WPP can be seen in **Table 5.5**.

Table 5.5: Marine Capture Fishery Production by Fisheries Management Area (FMA or WPP) in Indonesia in 2009-2014 (in tonnes).

No.	Fisheries management area (FMA or WPP	WPP	Year						2013-2014 (% change)
			2009	2010	2011	2012	2013	2014	
1	Malacca Strait and Andaman Sea	WPP 571	350.130	316.833	461.848	471.106	496.239	489.920	-1,27
2	Indian Ocean – west of Sumatra and Sunda Strait	WPP 572	545.108	541.476	558.592	576.639	632.575	602.148	-4.81

Table 5.5: Marine Capture Fishery Production by Fisheries Management Area (FMA or WPP) in Indonesia in 2009-2014 (in tonnes). (cont.)

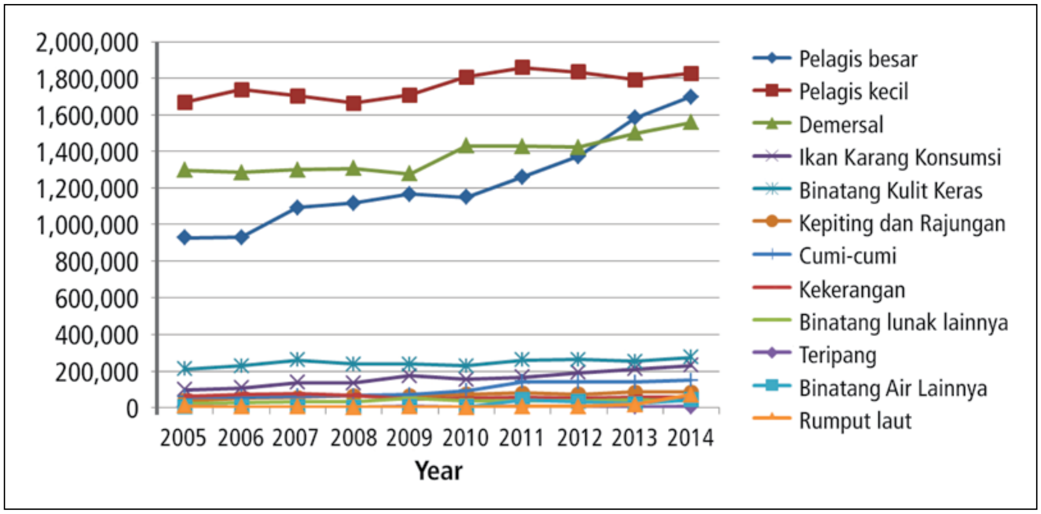
No.	Fisheries management area (FMA or WPP	WPP	Year						2013-2014 (% change)
			2009	2010	2011	2012	2013	2014	
3	Indian Ocean – Sawa Sea, southern Nusa Tenggara, and western Timor Sea	WPP 573	481.361	436.613	506.882	458.752	464.042	459.749	-0.93
4	South China Sea, Karimata Strait and Natuna Sea	WPP 711	572.617	572.209	588.711	598.605	623.937	665.754	6.70
5	Java Sea	WPP 712	793.594	806.420	823.681	909.818	918.504	1.081.178	17.71
6	Makassar Strait, Bone Bay, Flores Sea and Bali Sea	WPP 713	611.453	624.736	614.341	627.209	687.992	750.377	9.07
7	Banda Sea and Tolo Bay	WPP 714	401.691	427.580	536.992	456.303	518.821	604.515	16.52
8	Tomini Bay, Maluku Sea, Halmahera Sea, Seram Sea and Berau Bay	WPP 715	391.710	418.508	443.260	498.336	504.723	482.035	-4.50
9	Sulawesi Sea and north of Halmahera	WPP 716	197.252	214.272	213.294	255.430	301.039	327.364	8.74
10	Pacific Ocean (Teluk Cendrawasih dan Samudera Pasifik)	WPP 717	142.753	142.835	148.942	138.185	143.445	161.496	12.58
11	Arafura Sea–Timor Sea	WPP 718	324.566	537.964	449.186	445.250	415.696	413.118	-0.62
	Total		**4,812,235**	**5,039,446**	**5,345,729**	**5,435,633**	**5,707,013**	**6,037,654**	**5.79**

Source: DJPT KKP, 2015.

Being in the tropics, catches are multispecies in nature comprising demersal and pelagic species, such as: snappers, groupers, sweetlips, mackerels, scads, anchovies, tuna (mostly skipjack, yellowfin, big-eye), penaeid shrimp, squids, and others. The marine capture fisheries production by group of fish is shown in **Figure 5.6**.

Based on the fish species group, it can be seen that during the period of 2005-2014, big pelagic fish (pelagis besar) production increased by an average of 7.12% per year, small pelagic fish (*pelagis kecil*) by 1.05%, demersal fish by 2.13%, and reef fish (*ikan karang*) by 10.76%. In the same period, production of lobsters (*binatang kulit keras*) increased by 3.23%, blue swimming crabs and small 3-spot crabs (*kepiting and rajungan*) by 10.31%, squid (*cumi-cumi*) by 12.19%, other soft-shell animals (*binatang lunak lainnya*) by 8.07%, sea cucumbers (*teripang*) by 0.81%, and other aquatic animals (*binatang air lainnya*) by 106.34%. Seaweed (*rumput laut*) production increased by 53.14% in 2005-2014. Meanwhile, the incidence of losses fell by 0.58%.

Figure 5.6: Marine Capture Fisheries Production, FY 2005-2014.



Source: DJPT KKP, 2015.

5.3.2 Fishing Vessel

In Indonesia, marine fisheries can be grouped into, small-scale and large-scale. Further, small-scale fisheries consist of two major segments, artisanal and commercial, while large-scale fisheries are basically the large commercial and industrial fisheries. Commercial fisheries are characterized by large vessels that employ medium-size purse seines, Danish seines and gillnets. Fishing permit data (SIPI/SIKPI) for the period of August 28 to September 4, 2015 recorded that the number of active permits for overseas-made motor boat was 69 units while for home-made motor boat was 3,271 units. The average size of overseas-made fishing boat was 142.9 GT, and the maximum size recorded was 596 GT. The average size of home-made fishing boat was 79.69 GT, and the maximum size recorded was 512 GT.

In 2017, there were 805,633 fishing vessels, of which 57% were motorized vessels propelled by engines, and 43% were unmotorized vessels propelled by oars or sails (**Table 5.6**). In 2016-2017, there was a slight decline (0.02%) for motorized fishing vessels, while there was a significant increase (109%) of unmotorized boats.

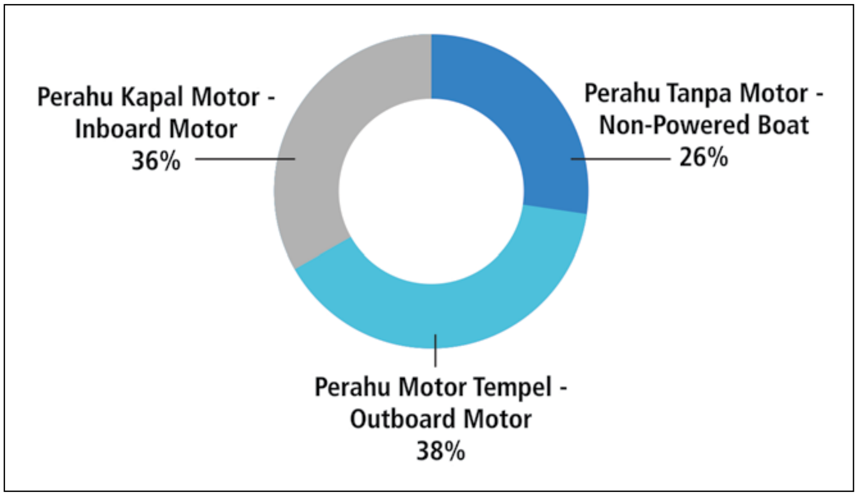
Table 5.6: Number of Fishing Vessels.

	2015	2016	2017
PW	460,658	460,658	460,567
NP	165,050	165,050	345,066
Total	**625,708**	**625,708**	**805,633**

PW: Motorized vessels propelled by engines.
NP: Unmotorized vessels propelled by oars or sails.
Source: FAO, 2019.

In 2014, non-motor boats were 26% of the total number of fishing vessels, while outboard motor boats and inboard motor boats were 38% and 36%, respectively (**Figure 5.7**). In terms of size of motor boats, around 69% are small-scale, i.e., <5 GT (**Table 5.7**).

Figure 5.7: Types of Fishing Vessels in 2014.



Source: DJPT KKP, 2015.

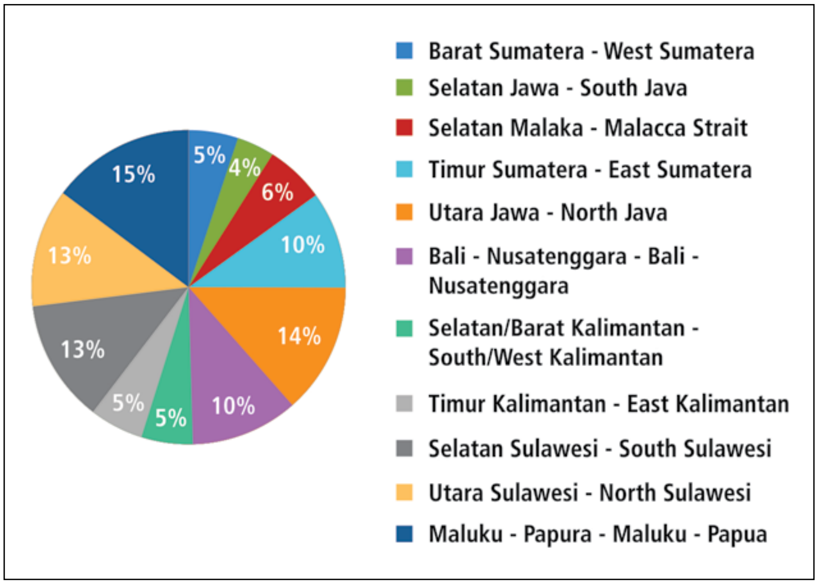
Table 5.7: Number of Fishing Vessel, by Type and Size, 2004-2014.

Category and Size		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Non-motor Boat		256,830	244,471	249,955	241,889	212,003	193,798	172,907	170,938	172,333	175,510	165,066
Outboard Motor Boat		165,337	165,314	185,983	185,509	229,335	236,632	231,333	225,786	245,819	237,625	238,010
Inboard Motor Boat		126,933	145,796	154,379	162,916	154,846	157,211	164,150	185,121	198,538	226,573	222,557
Size of Motor Boat	< 5 GT	90,148	102,456	106,609	114,273	107,934	105,121	110,163	123,748	137,587	151,939	153,493
	5-10 GT	22,917	26,841	29,899	30,617	29,936	32,214	31,460	35,877	37,694	46,358	41,374
	10-20 GT	5,952	6,968	8,190	8,194	7,728	8,842	10,988	13,201	11,583	15,208	14,301
	20-30 GT	3,598	4,553	5,037	5,345	5,200	7,403	7,264	8,022	7,611	8,782	9,578
	30-50 GT	800	1,092	970	913	747	680	857	914	917	1,074	1,029
	50-100 GT	1,740	2,160	1,926	1,832	1,665	1,502	1,747	1,801	1,641	1,727	1,766
	100-200 GT	1,342	1,403	1,381	1,322	1,230	1,135	1,290	1,204	1,167	1,127	840
	> 200 GT	436	323	367,367	420	406	314	381	354	338	358	176

Source : DJPT KKP, 2015.

Regarding the distribution of fishing vessels, in 2014, around 14.57% of fishing vessels are found in the territorial waters of Maluku-Papua; 13.91% in North Java waters; 12.58% in South Sulawesi waters; 9.92% in East waters of Sumatra; 10.04% in Bali-Nusa Tenggara waters area; 12.59% in North Sulawesi waters; 6.45% in the territorial waters of the Straits of Malacca; 5.54% in West Sumatra waters, and the rest are in waters of Eastern Kalimantan, South/West Kalimantan and South Java (**Figure 5.8**). For boats without motor engines, 35.80% are in the region of Maluku-Papua.

Figure 5.8: Distribution of Fishing Vessels according to FMA or WPP in 2014.



Source: DJPT KKP, 2015.

5.3.3 Fishing Gears

On motorized vessels, fishermen use various fishing gears ranging from the traditional ones employed aboard sail boats to mechanized gears, such as trawls, purse seines and longlines. The increased use of modern fishing gears is reflected by the growing number of fishing vessels, in particular the number of motorized vessel. Nonetheless, the number of non-motorized vessels is still high.

Other developments in Indonesian fisheries are the growing number of fish aggregating devices (FAD) used in pelagic fishing, and the increasing popularity of hand line fishing, purse seining and longline fishing for tuna. The number of fishing gears used in marine fisheries in 2014 was recorded at 1,139,795 units, an increase of 164.51% from the number of fishing geas in 2013. Around 37% of fishing gears are hook and line type, 28% are gillnets, 12% are traps, and 11% are purse seine.

The composition of fish according to fishing gear is presented in **Table 5.8**.

Table 5.8: Composition of Fish Catch by Fishing Gear.

Fishing Gear	Fish	Latin Name	Catchment Composition
Pukat Cincin Pelagis Kecil Dengan Satu Kapal (*Purse Seine for small pelagic fish*)	Layang	*Decapterus macrosoma*	40
	Kembung	*Restrelliger brachysoma*	20
	Selar	*Selaroides leptolepis*	15
	Lemuru	*Sardinella longiceps (Sardinella lemuru)*	10
	Tembang	*Sardinella fimbriata*	10
	Ikan Lainnya	others	5
Pukat Cincin Pelagis Besar Dengan Satu Kapal (*Purse Seine for big pelagic fish*)	Cakalang	*Katsuwonus pelamis*	70
	Madidihang	*Thunnus albacares*	20
	Tongkol Krai, Tongkol Komo	*Auxis thazard, Euthynnus affinis*	7
	Ikan Lainnya	others	3
Bouke Ami	Cumi-cumi	*Loligo spp*	80
	Ikan Lainnya	others	20
Bagan Berperahu	Tongkol Krai, Tongkol Komo	*Auxis thazard, Euthynnus affinis*	66.9
	Madidihang	*Thunnus albacares*	2.2
	Cakalang	*Katsuwonus pelamis*	14.9
	Kembung	*Rastrelliger spp*	5.6
	Ikan Lainnya	others	10.4
Jala Jatuh Berkapal (Cast Nets)	Cumi-cumi	*Loligo spp*	85
	Ikan Lainnya	others	15
Jaring Insang Tetap (Fixed Gillnets) Dasar/Liong Bun	Cucut	*Alopias spp, Carcharhinus spp, Eusphyra blochi, Squalus spp*	25
	Pari	*Dasyatis spp, Myliobatus spp, Aetomylaeus spp, Aetobatus spp, Rhina ancylostoma, Rhynchobatus djiddensis*	75
Jaring Insang Hanyut (Drift gill nets)/Jaring Insang Oseanik (oceanic gill nets)	Cakalang	*Katsuwonus pelamis*	40
	Tongkol Krai, Tongkol Komo	*Auxis thazard, Euthynnus affinis*	10
	Madidihang	*Thunnus albacares*	20
	Tenggiri Bulat	*Scomberomorus commersoni*	5
	Cucut	*Alopias spp, Carcharhinus spp, Eusphyra blochi, Squalus spp*	5
	Ikan Lainnya	others	20
Bubu (Pots)	Kakap (putih dan merah)	*Lates calcalifer, Lutjanus malabaricus*	40
	Kerapu	*Cephalophodis boenack, Cromileptes altivelis, Epinephelus merra, Epinephelus tauvina, Plectropomus leopardus*	20
	Kuwe	*Caranx sexfasciatus*	10
	Baronang	*Siganus (Siganus guttatus)*	10
	Lencam	*Lethrinus spp*	10

Table 5.8: Composition of Fish Catch by Fishing Gear. (cont.)

Fishing Gear	Fish	Latin Name	Catchment Composition
	Ikan Lainnya	others	10
Pukat Labuh (Long Bag Set Net)	Teri	*Stolephorus commersonii (Stolephorus spp)*	80
	Ikan Lainnya	others	20
Rawai Hanyut (Drifting Longlines)/ Rawai Tuna (Tuna long line)	Tuna Mata Besar	*Thunnus obesus*	25
	Madidihang	*Thunnus albacares*	32.5
	Albakora	*Thunnus alalunga*	15
	Marlin	*Makaira indica, Makaira mazarra, Tetrapturus audax*	10
	Meka	*Xiphias gladius*	5
	Ikan Lainnya	others	12.5
Rawai Dasar (Bottom Long Lines)	Kakap (putih dan merah)	*Lates calcalifer, Lutjanus malabaricus*	30
	Kuwe	*Caranx sexfasciatus*	3
	Manyung	*Arius thalassinus*	5
	Cucut	*Alopias spp. Carcharhinus spp, Eusphyra blochi, Squalus spp*	15
	Kerapu	*Cephalophodis boenack, Cromileptes altivelis, Epinephelus merra, Epinephelus tauvina, Plectropomus leopardus*	15
	Kurisi	*Nemipterus nematophorus (Nemimterus hexodon)*	10
	Pari	*Dasyatis spp, Myliobatus spp, Aetomylaeus spp, Aetobatus spp, Rhina ancylostoma, Rhynchobatus djiddensis*	10
	Remang	*Congresox talabon*	5
	Ikan Lainnya	others	7
Huhate (Pole and Line)	Cakalang	*Katsuwonus pelamis*	75
	Madidihang	*Thunnus albacares*	20
	Ikan Lainnya	others	5
Pancing Ulur (Hand Line)	Kakap (putih dan merah)	*Lates calcalifer, Lutjanus malabaricus*	19
	Kerapu	*Cephalophodis boenack, Cromileptes altivelis, Epinephelus merra, Epinephelus tauvina, Plectropomus leopardus*	17
	Kurisi	*Nemipterus nematophorus (Nemimterus hexodon)*	25
	Lencam	*Lethrinus spp*	21
	Ikan Lainnya	others	18
Pancing Ulur (Hand Line) Tuna	Cakalang	*Katsuwonus pelamis*	61
	Tongkol Krai, Tongkol Komo	*Auxis thazard, Euthynnus affinis*	10
	Baby Tuna/ Other Tuna	-	29
Pancing Cumi (Squid fishing line)	Cumi-cumi	*Loligo spp*	100

Source : Kepmen KP No.86 tahun 2016.

5.3.4 Productivity of Indonesian Capture Fisheries

Based on the *MMAF Ministerial Decree No.61/2014* on fishing vessel productivity, the highest productivity was recorded for trawl that operated in Arafura Sea, with productivity level of 3.9 tonnes/GT/annum, of which 3.4 tonnes for fish and 0.5 tonne for shrimp. Average productivity of fishing vessel per GT per annum was 1.46 tonnes. Productivity of fishing vessel by fishing gear is shown in **Table 5.9**.

Table 5.9: Productivity of Fishing Vessel by Fishing Gear.

No.	Fishing Gear		Main Catch	Productivity of Fishing Vessels (tonne/GT/year)
1	a. Pukat Cincin Pelagis Kecil (Small Pelagic Purse seine) Dengan Satu Kapal (with one ship)		Ikan (fish)	1.30
	b. Pukat Cincin Pelagis Besar (Large Pelagic Purse seine) Dengan Satu Kapal (with one ship)		Ikan (fish)	1.70
2	2.1. Bouke Ami		Ikan dan Cumi-cumi (fish and squid)	1.00
	2.2. Bagan Berperahu		Ikan (fish)	0.97
3	Jatuh berkapal (Cast Nets)		Ikan dan Cumi-cumi (fish and squid)	1.00
4	Jaring Insang Tetap (Fixed gillnets [anchored])	a. Jaring Liong Bun	Cucut/Pari (shark)	0.68
	Jaring Insang Hanyut (Driftnets)	b. Jaring Insang Oseanik	Ikan (fish)	0.85
5	5.1. Bubu (Pots)		Ikan (fish)	0.51
	5.2. Pukat Labuh (Trawl)		Ikan (fish)	0.85
6	a. Rawai Hanyut (Drifting Long Lines)/Rawai Tuna		Ikan (fish)	0.75
	b. Rawai Dasar (Fixed Long Line)		Ikan (fish)	1.00
	c. Huhate (Pole and Line)		Ikan (fish)	1.80
	d. Pancing Ulur (Hand Line)	i. Pancing Ulur (Hand Line)	Ikan (fish)	1.20
		ii. Pancing Ulur (Hand Line) Tuna	Ikan (fish)	1.75
	Pancing Cumi (Squid fishing line)		Cumi-cumi (squid)	0.75

Source: Kepmen KP No.86 Year 2016.

5.4 Aquaculture and Mariculture

5.4.2 Development of Indonesian Aquaculture Fishery Production

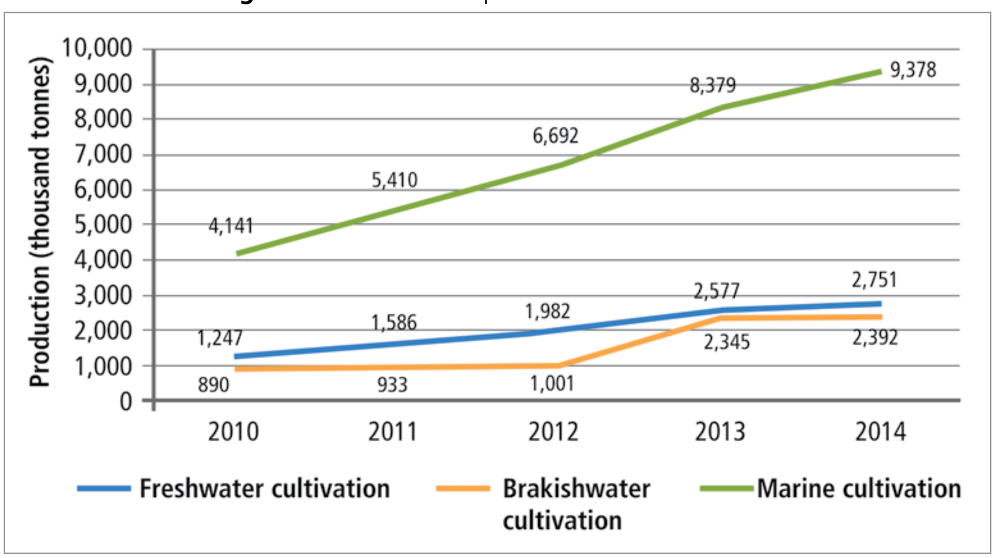
Aquaculture activities in the marine environment started with culture of groupers in the early 1990s as the demand for this species grew. With the increased pressure of fishing in the marine environment, capture fisheries landings are stagnating while a growing share of fish comes from aquaculture.

Currently, Indonesia is the leading country in terms of grouper seed production using artificial propagation. This seed has not only ensured development of grouper culture in Indonesia but seeds have also supported grouper culture in countries of the region. In recent years the culture of seaweeds (mainly *Eucheuma* and *Graciliaria*) has also become popular, especially in the middle and eastern part of the country.

Aquaculture production has been increasing, with an average growth rate of 23.73% per annum in 2010-2014 (Performance Report of Directorate of Production, Directorate General of Aquaculture, 2014). The brackishwater aquaculture sector experienced an average increase of 37.09%. The trend of aquaculture production is illustrated in **Figure 5.9**.

In 2017, total aquaculture production was 16,114,991 tonnes, of which marine culture was 9,884,670 tonnes or 61%; while culture in brackishwater accounted for 17% or 2,698,635 tonnes, and freshwater culture accounted for 22% or 3,531,686 tonnes.[28]

Figure 5.9: Trend of Aquaculture Production.



Source: DJPT KKP, 2015.

The commodity that has the most significant increase during period of 2011-2015 was seaweed with average increase of 21.29% per year, followed by production of *vannamei* shrimp with average growth of 15.98% per year. The farmed fish commodities also increased, averaging 14.28% per year. Shellfish production grew by 9.94% per year. The trend of aquaculture production by fish commodity is presented in **Table 5.10**.

[28] BPS. Statistik Indonesia 2018.

Table 5.10: Aquaculture Production by Commodity, FY 2011-2015.

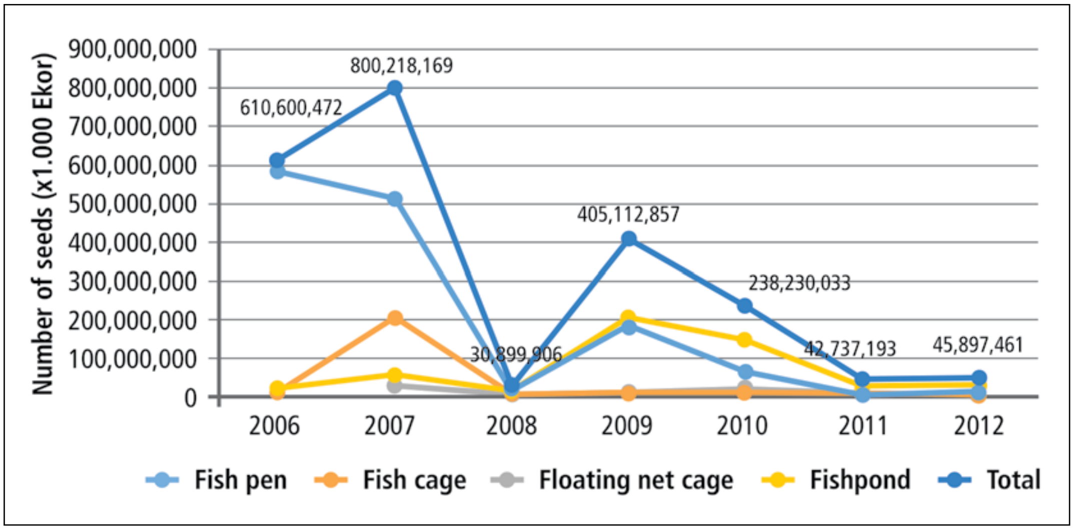
Commodity	2011	2012	2013	2014	2015	Growth 2011-2015 (% per year)
Seaweed*	**5,170,201**	**6,514,854**	**9,298,474**	**10,076,992**	**10,890,326**	**21.29%**
Shrimp*	**372,577**	**415,703**	**642,568**	**639,369**	**605,328**	**15.08%**
Black tiger*	126,157	117,888	178,583	131,809	124,869	3.37%
Vannamei*	246,420	251,763	390,278	442,380	413,079	15.98%
Other shrimp*		46,052	73,707	65,180	67,381	17.29%
Fish	**2,068,472**	**2,550,255**	**3,116,988**	**3,390,080**	**3,486,917**	**14.28%**
Grouper*	10,580	11,950	18,864	13,346	15,638	14.68%
Seabass*	5,236	6,198	6,735	5,447	5,123	0.49%
Milk fish*	467,449	518,939	627,333	631,125	668,262	9.60%
Carp	332,206	374,366	412,703	434,653	461,882	8.63%
Tilapia	567,078	695,063	914,778	999,695	1,068,604	17.59%
Gouramy	64,252	84,681	94,605	118,776	113,258	16.10%
Pangasius	229,267	347,000	410,883	418,002	339,095	13.15%
Catfish	337,577	441,217	543,774	679,379	722,657	21.31%
Pompano*			643	1,367	2,663	103.66%
Silver barb	11,966	19,074	24,107	26,994	24,760	22.37%
Bonylip barb	22,552	25,426	27,668	32,080	29,565	7.42%
Giant snake-head	14,273	19,886	24,642	21,024	28,112	20.57%
Snakehead	6,036	6,455	10,251	8,194	7,298	8.69%
Shellfish*	**48,449**	**19,472**	**29,091**	**44,394**	**43,312**	**9.94%**
Others	269,264	175,269	213,785	208,295	200,351	-4.83%
TOTAL	**7,928,963**	**9,675,553**	**13,300,906**	**14,359,129**	**15,226,234**	

Note : * Aquaculture commodities in coastal area – brackishwater and marine water
Source: DJPB KKP, 2016.

5.4.3 Juvenile Fish or Fish Seed

The success of the aquaculture business depends on the availability and quality of fish seeds. The fish seed must have the criteria of quality, quantity, continuity and timeliness. In terms of quality, it is absolutely necessary to guarantee that the condition of the seeds of a fish is according to quality standards or certified (Husen, 2012).

Figure 5.10: Seed Requirement Development.



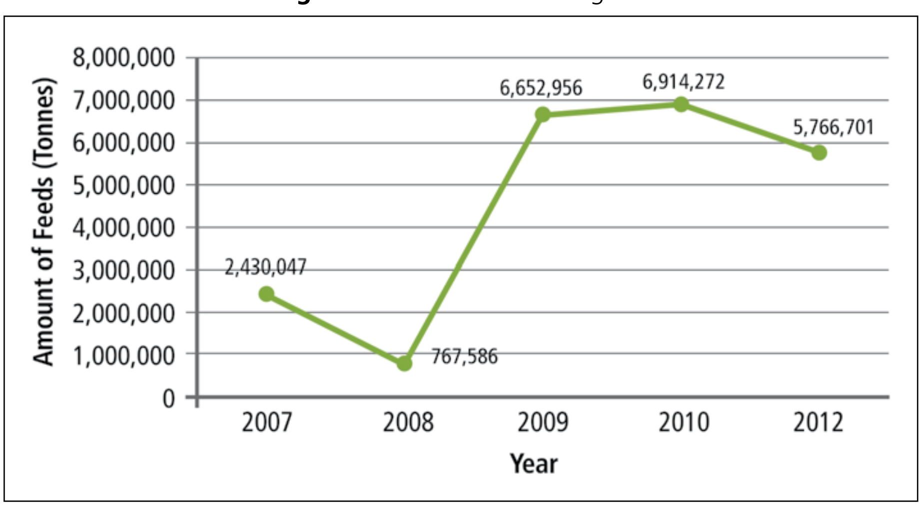
Source: Ditjen Perikanan Budidaya, KKP, 2015.

5.4.4 Feeds

Both quality and quantity of feed must be considered in aquaculture or cultivation activities. Increasingly intensive fish farming requires the availability of food for the fish in sufficient quantities, on time, and on continuous basis for survival and growth. Sufficient nutrient content is the reason fish farmers use feeds to meet harvest targets. The type of feed used is quite diverse. For carnivorous fish species like groupers, cork fish, toman and others, the type of feed is trash fish. For omnivorous fish, pellets are usually used, while for extensive cultivation activities, a makeshift feed of bran is typically used.

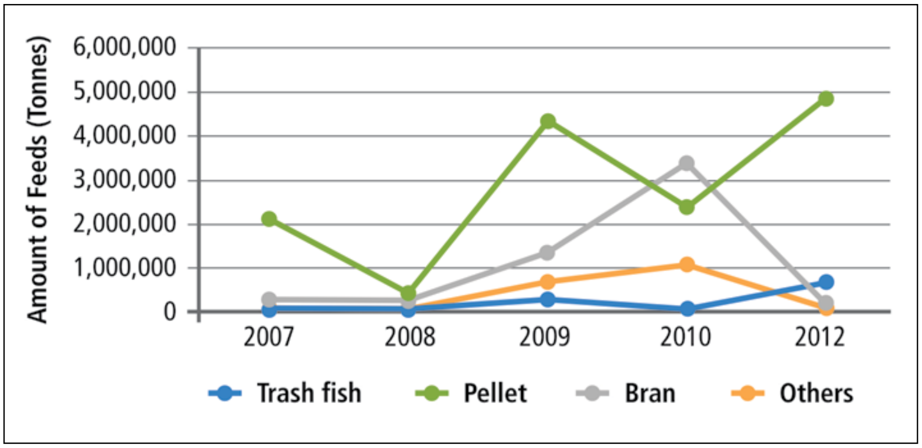
The use of feed in 2007 - 2012 has fluctuated (**Figure 5.11**). Total feed usage in 2012 was 5,766,701 tonnes. The pellet usage was 4,854,836 tonnes in 2012 (**Figure 5.12**).

Figure 5.11: Total Feed Usage.



Source : Ditjen Perikanan Budidaya, KKP, 2015.

Figure 5.12: Feed Usage, by Type of Feed.



Source: Ditjen Perikanan Budidaya, KKP, 2015.

5.4.5 Technology and Productivity of the Indonesian Aquaculture

Fish production technology in Indonesia is divided into 4 (four) major groups based on type of input and management implemented: (1) extensive, (2) semi-intensive, (3) intensive and (4) super-intensive.

1. **Extensive (Traditional)** is a production system characterized by: (i) low level of control (such as against environment, nutrition, predator, disease); (ii) low initial cost, low level of technology, and low level of efficiency (yield not more than 500 kg/ha/annum); (iii) high dependency to climate and local water quality; (iv) using natural water bodies. Production from this system is less than 500kg/ha/annum.
2. **Semi-intensive** is a culture system characterized by level of production from 2 to 20 tonnes/ha/annum, mostly relying on natural food, supported by fertilization and additional artificial feed, seed from hatchery, reguler use of fertilizer, some of them using water exchange or aeration, usually incorporate pumping or gravity for water supply, and generally use modified ponds. Production from this system is about 2,000-20,000kg/ha/annum.
3. **Intensive** is a culture system characterized by: (i) production reaching 200 tonnes/ha/annum; (ii) high level of control; (iii) high initial cost, high level of technology, and high level of production efficiency; (iv) less affected by climate, local water quality; (v) use of artificial production system. Production from this system is about 20,000-200,000 kg/ha/annum.
4. **Super Intensive** is a culture system characterized by average production of more than 200 tonnes/ha/annum, using full artificial feeds to fulfill feeding requirements for cultured organism; seeds are from *hatchery*; not using fertilizer; full prevention against predator and theft; coordinated and controlled; use water supply with pump or gravity; use full water exchange and aeration to improve water quality, can be in the form of running water, cages or tank. Production from this system is more than 200,000 kg/ha/annum.

The results of research conducted by the Center for Social and Economic Research of Marine and Fisheries in 2010 and 2011 show that different areas have varying levels of productivity for various cultivation business, such as catfish culture in Jambi with productivity of around 62.1 tonnes/ha/year, while in Banjar only 11.2 tonnes/ha/year. The cultivation productivity effectiveness of key aquaculture species is presented in **Table 5.11**.

Table 5.11: Actual Productivity of Key Aquaculture Commodities.

No.	Commodity	Productivity (tonne/ha/year)	
		2009	2010
1	Black tiger shrimp in Gresik (Extensive Technology)*	0.25	NA
2	Milkfish in Gresik (Extensive Technology)*	18.78	NA
3	Vannamei (whiteleg shrimp or king prawn) in Lamongan (Traditional Plus)*		
	a. Earthen pond*	0.85	1.47
	b. Rice pond*	1.95	1.47

Remarks: *Aquaculture in coastal area

Pond productivity for *vannamei* shrimp farming is quite varied, but could reach 24 tonnes/ha/annum, and 4.9-6 tonnes/ha/annum for black tiger shrimp farming. Pond productivity with other commodities was around 2.70-3.23 tonnes/ha/annum.

Data analysis results of national aquaculture areas and aquaculture production showed that the highest productivity occurred in fish culture by floating cage and cage systems, and the lowest occurred in fish culture with rice paddy system. The development of aquaculture productivity by type of culture is presented in **Table 5.12**. Marine aquaculture has higher productivity compared to brackishwater culture.

Table 5.12: Productivity of Aquaculture Production by Type of Culture, FY 2009-2012.

Type of Culture	Productivity (Tonne/Ha/Year)				
	2009	2010	2011	2012	Average
Marine Aquaculture	64.4	298.7	27.4	29.2	104.9
Brackishwater Aquaculture	1.4	2.1	2.4	2.7	2.1

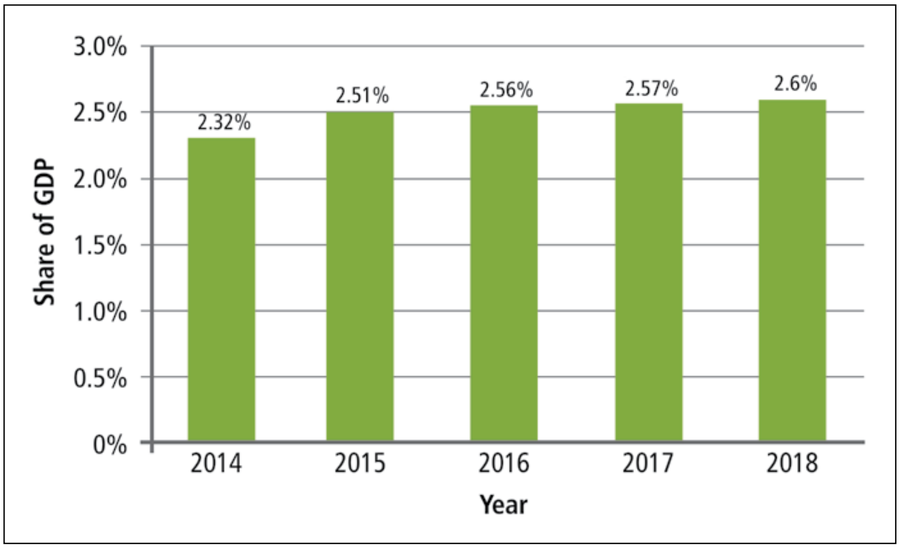
Source: KKP, 2014 (modified).

5.5 Socioeconomic Contribution

5.5.1 Role of Fisheries in the National Economy

Agriculture, forestry and fishery (AFF) accounts for 13.3% of GDP in 2018. The fishery subsector contributed 2.32% to the GDP in 2014, and increased to 2.60% of GDP in 2018 (**Figure 5.13**).

Figure 5.13: Contribution of Fisheries to the Gross Domestic Product (GDP) in Indonesia from 2014 to 2018.



Source: FAO FishStat.

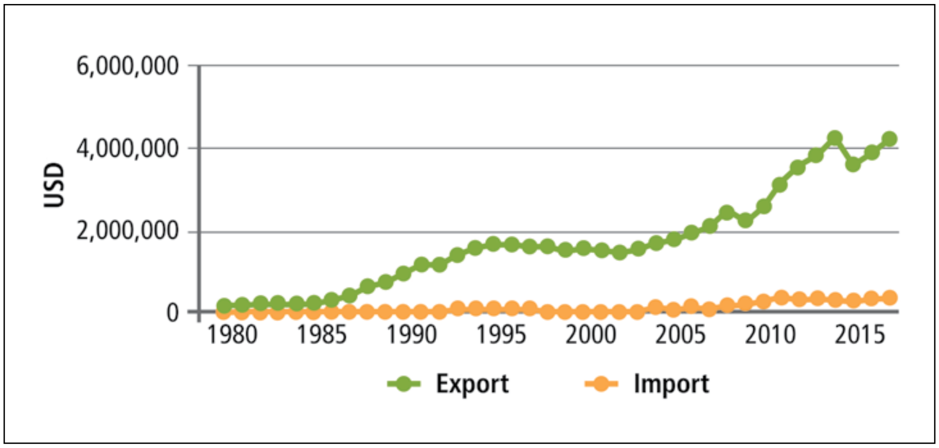
5.5.2 Trade

Around 85% of the fisheries production of Indonesia goes to local market, while the rest are exported, mainly to Asian markets (KKP, 2016).

Since 1986, exports of fish and fishery products by Indonesia have grown dramatically (**Figure 5.14**). There was a slight increase of fish import in recent years from other countries in Asia, especially from India and Vietnam, due to the importation of small pelagic species. The fish is not only for human consumption, but also for bait required in the tuna long line fisheries.

The main markets for Indonesian fishery exports are: Japan, EU, USA, China, Singapore, Hong Kong, Taiwan (Province of China), Vietnam and the Republic of Korea. Tuna, especially fresh tuna, is exported mostly to Japan and the USA. The growing exports to countries in the Middle East have been noted also.

Figure 5.14: Total Exports and Imports of Fish and Fishery Products (thousand US$).



Source: FAO FishStat.

Volume and value of Indonesian exports in 2010-2014 by major type of fishery commodity are presented in **Table 5.13**. Seaweeds comprised 16.3% of total exports in 2014, followed by tuna, skipjack and small tuna (16.2%), and shrimps (15.4%). Pearl culture takes place primarily in the vicinity of the islands in Nusa Tenggara, and plays an important role as a source of pearls for export.

Table 5.13: Export Volume (in tonnes) and Value (thousand US$) of Indonesian Fishery Commodities.

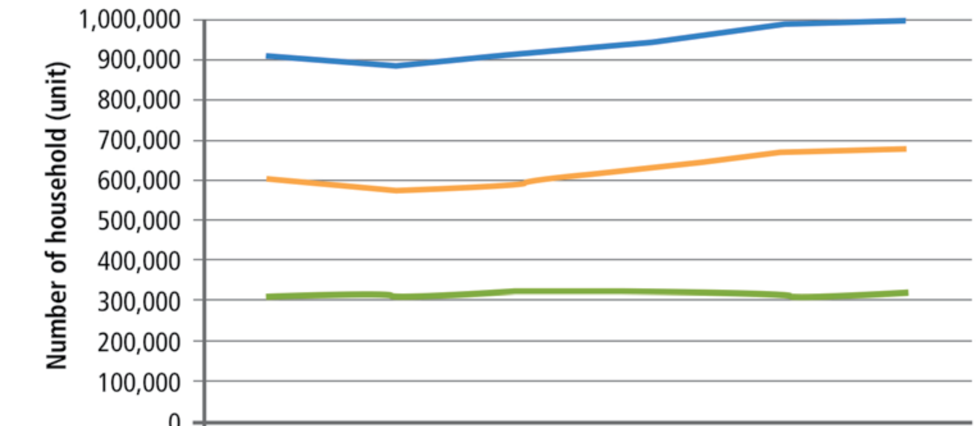
Commodity		2010	2011	2012	2013	2014
Shrimp	Vol (tonne)	145,092	158,062	162,068	162,410	196,623
	Value (000, US$)	1,056,399	1,309,674	1,304,149	1,684,086	2,140,862
Tuna, Skipjack, Small tuna	Vol (tonne)	122,450	141,774	201,159	209,072	206,553
	Value (000, US$)	383,230	498,591	749,992	764,791	692,281
Pearl	Vol (tonne)	9	24	336	315	475
	Value (000, US$)	31,429	31,792	31,186	27,766	31,188
Seaweed	Vol (tonne)	123,075	159,075	174,011	183,075	208,197
	Value (000, US$)	135,939	157,587	177,923	209,975	279,916
Crab	Vol (tonne)	21,537	23,089	28,212	34,173	28,091
	Value (000, US$)	208,424	262,321	329,724	359,304	414,372
Other fishes	Vol (tonne)	622,932	621,632	538,723	519,293	500,384
	Value (000, US$)	898,039	1,100,576	965,062	1,056,117	771,147
Others	Vol (tonne)	68,481	55,693	124,605	149,841	134,660
	Value (000, US$)	150,371	160,550	295,622	79,817	312146
Total	**Vol (tonne)**	**1,103,576**	**1,159,349**	**1,229,114**	**1,258,179**	**1,274,982**
	Value (000, US$)	**2,863,831**	**3,521,091**	**3,853,658**	**4,181,857**	**4,641,913**

Source: BPS, 2016.

5.5.3 Contribution to Household Income and Livelihood

In terms of livelihoods, the wild capture fisheries and aquaculture sectors employ approximately 2.7 million and 3.3 million workers, respectively, and an additional one million workers are involved in the processing and marketing of fisheries products.[29] The average growth in the number of households involved in capture fisheries was 4.06% in 2012-2013, and 1.18% in 2013 to 2014. The number of households in marine capture fishery production is higher than in inland fishery (**Figure 5.15**).

Figure 5.15: Number of Households Involved in Capture Fishery Sector, FY 2009-2014.



	2009	2010	2011	2012	2013	2014
Total	911,070	889,157	920,129	948,484	986,958	998,600
Marine waters	601,138	575,308	595,201	627,416	671,625	678,160
Inland waters	309,932	313,849	324,928	321,068	315,333	320,440

Source: BPS, 2016.

Labor is a very important component in fishery business, both the quantity and quality of human resources. Business actors commonly called fish farming households (RTP) as one of the main indicators that can show improvement of business and investment in the field of aquaculture. There were 1,673,377 RTPs involved in cultivation activities in 2014, with the highest number of RTPs being freshwater aquaculture (1,240,580 RTP). The growth of RTP in 2010 to 2014 is illustrated in **Figure 5.16**.

The number of fishermen in 2014 has grown by 1.14% compared to the year of 2013. In 2014, there were 2.67 million fishermen. The trend since 2009 is a steady increase of 0.24% per year in the number of fishermen. **Figure 5.17** also shows that the number of fishermen in the marine waters is significantly higher than in inland waters.

[29] California Environmental Associates. 2018. Trends in Marine Resources and Fisheries Management in Indonesia: A 2018 Review.

Figure 5.16: Number of Aquafarming Households (RTPs), by Type of Aquaculture.

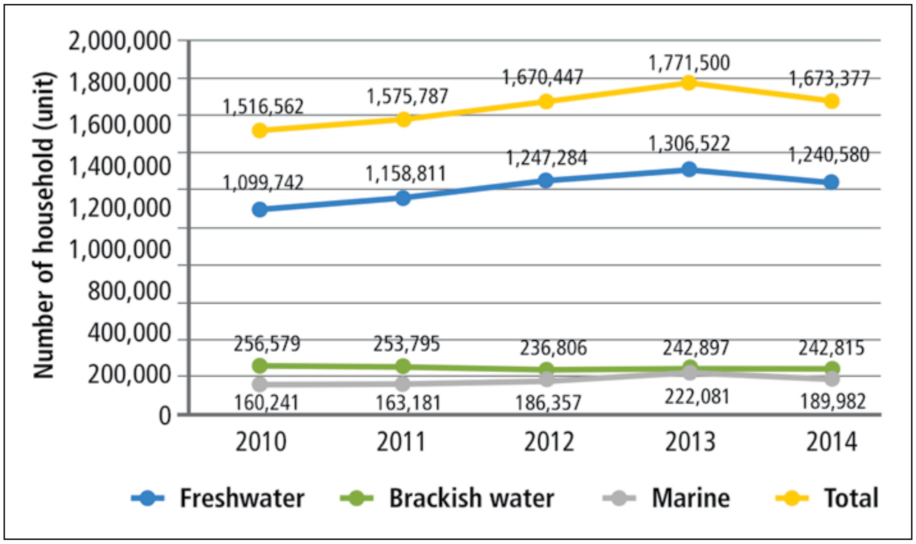
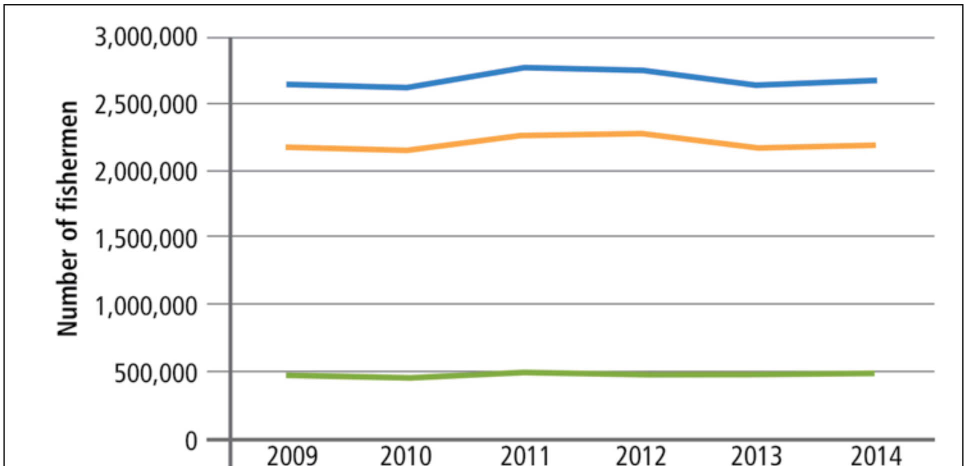


Figure 5.17: Number of Fishermen, FY 2009-2014.



	2009	2010	2011	2012	2013	2014
Total	2,641,967	2,620,277	2,755,178	2,748,908	2,640,095	2,667,440
Marine waters	2,169,279	2,162,442	2,265,213	2,278,388	2,164,969	2,186,900
Inland waters	472,688	457,835	489,965	470,520	475,126	480,540

5.5.4 Demand for Fish and Food Security

For Indonesia, most of its area is waters, both land and sea, and fish is very important as main food source. Marine fish is a major source of protein for coastal population. Note that fish as a source of animal protein is better than other protein sources because fish meat contains omega-3 free fatty acids that are essential for the development and intelligence of children. Omega-3 is also very useful to lower cholesterol in the blood. Although fish can fetch a very high price, like in the case of bluefin tuna, in general fish in Indonesia is a cheap source of animal protein. Poor people can afford to buy dried salted tropical fish, such as salted pony fish and anchovy. Thus, the fishery sector provides a significant contribution to the nutrition and food security of the country. In addition, the fishery sector provides livelihood and employment to many.

During the first decade of the 21st century Indonesia's economic growth was rapid and it outpaced population growth. This led to an increase in the disposable income per person, which in turn, resulted in a growing per capita demand for fish and fish products.

Provision of fish consumption for domestic consumption in 2014 reached 13.07 million tonnes. This is an increase by 10.01% compared to 2013. The increased fish supply corresponded with an increase in fish supply per capita, which reached 51.80 kg/capita/year in 2014 (**Table 5.14**).

Average fish consumption in Indonesia in 2011 was only 32.25 kg/capita, lower than Malaysia's 55.4 kg/capita/year. However, fish consumption in 2015 reached 41.11 kg/capita, exceeding the determined target of 40.90 kg/capita. Domestic fish consumption grew to 47.34 kg/capita in 2017 from 43.94 kg/capita in 2016. According to MMAF, national fish consumption is increasing in every province in Indonesia due to a national campaign called "*Gemar Makan Ikan*," or "Eat Fish." The government has set a target for national fish consumption to reach 54.49 kg/capita in 2019.

Table 5.14: Fish Supply for Consumption and Fish Consumption Per Capita, FY 2010-2017.

No.	Description	2010	2011	2012	2013	2014	2015	2016	2017
1	Total fish supply (million tonnes)	9.119	10.282	11.588	11.882	13.072			
2	Fish supply per capita (kg/capita/annum)	38.39	42.49	47.22	47.77	51.8			
3	Fish consumption per capita (kg/capita/annum)	30.48	32.25	33.89	35.21	38.14	41.11	43.94	47.34

Source: KKP, 2015; BPS, 2019.

5.5.5 Recreational Fishing

Recreational fishing is not common. However, a small number of hobbyists have been fishing for pelagic fish, using trolling and hand lines, in the vicinities of big cities like Jakarta, Surabaya and Bali (FAO 2012).

5.6 Post-harvest

Post-harvest activities range from traditional drying, salting, and smoking, to canning and more modern forms of processing (e.g. production of fish loins).

5.6.1 Fish Ports

The fish port is a fishery infrastructure that serves as a center for coastal community development and fishery economic activities, such as production, processing, and marketing of fishery products.

Thus, the existence of fish port will support all fishery business, including the process of modernization of traditional fishing, and improve the living standards of fisherfolk.

In 2017, there are 601 Fishery Ports spread throughout Indonesia, and divided into four categories as stated in the *Regulation of the Minister of Marine and Fisheries Number: PER.08/MEN/2012*: Class A Ocean Fish Port (Fish Port Samudera/PPS), Class B Archipelagic Fish port (Fish Port Nusantara/PPN); Class C Coastal Fish Port (PPP); and Class D Fish Landing place (PPI). Differences in technical and operational criteria are presented in **Table 5.15**. The *Statistics of Fishing Port, 2017* (BPS) presents data on the number of fish ports by category and province, average catches landed at the fish ports, number of ports that have Fish Auction Place (TPI), fish sold at the TPIs, etc.

Table 5.15: Fish Port Classes based on Technical and Operational Criteria.

Class	Technical Criteria	Operational Criteria	Number of Ports (2017)
PPS	• Able to serve fishing vessels that conduct fishery activities in Indonesian waters, Exclusive Economic Zone (EEZ), and the open seas; • Has mooring facilities for fishing vessels at least 60 GT; • A dock length of at least 300 m, with a pool depth of at least minus 3 m • Capable of accommodating fishing vessels of at least 100 units or a total quantity of at least 6,000 GT; and • Utilize and manage the land of at least 20 ha.	• Partially landed fish for export purposes • There are fish loading and unloading activities and marketing of fishery products averaging 50 tonnes per day; and • There are fish processing industry and other supporting industries.	8
PPN	• Able to serve fishing vessels that conduct fishery activities in Indonesian archipelagic waters and EEZ • Have mooring facilities for fishing vessels of at least 30 GT; • A dock length of at least 150 m, with a pool depth of at least minus 3 m • Able to accommodate fishing vessels of at least 75 units or an aggregate of at least 2,250 GT • Utilize and manage the land of at least 10 ha	• There are fish loading and unloading activities and marketing of fishery products averaging 30 tonnes per day; • There are fish processing industry and other supporting industries	13
PPP	• Able to serve fishing vessels that conduct fishery activities in Indonesian coastal waters • Have mooring facilities for fishing vessels of at least 10 GT; • A dock length of at least 100 m, with a pool depth of at least minus 2 m; • Capable of accommodating fishing vessels of at least 30 units or an aggregate amount of at least 300 GT • Utilize and manage a land of at least 5 ha	• There are fish loading and unloading activities and marketing of fishery products, averaging 5 tonnes per day • There are fish processing industry and other supporting industries	27
PPI	• Able to serve fishing vessels that conduct fishery activities in Indonesian coastal waters; • Have mooring facilities for fishing boats of at least 5 GT; • A dock length of at least 50 m, with a pool depth of at least minus 1 m • Capable of accommodating fishing vessels of at least 15 units or an aggregate of at least 75 GT • Utilize and manage the land of at least 1 ha	• There are fish loading and unloading activities and marketing. • Fishery products at an average of 2 tonnes per day	553

According to MMAF-JICA (2017), there are 22 fish ports under the Technical Implementation Unit (UPT) of Directorate General of Marine Spatial Management (**Figure 5.18**):

- 6 Class A (PPS Nizam Zachman Jakarta, PPS Cilacap, Belawan PPS, Bungus PPS, PPS Bitung, Kendari PPS)
- 15 Class B (VAT Sibolga, VAT Sungailiat, VAT Tanjung Pandan, VAT Karangantu, VAT Palabuhanratu, VAT Kejawanan, PPN Pekalongan, PPN Prigi, VAT Brondong, VAT Pemilih, PPN Pengambengan, PPN Kwandang, VAT Ternate, VAT Ambon, VAT Tual)
- 1 Class C (PPP Teluk Batang)

Figure 5.18: Location of Fish Ports under UPT of DG Marine Spatial Management, MMAF.

Note: blue markers - Class A or PPS Fish Ports; red markers - Class B or PPN Fish Ports.

5.6.2 Fish Markets

Fish markets are concentrated in Java where more than 60% of the Indonesian population live. The largest domestic markets are found in big cities, where restaurants and hotels are significant buyers. Fish auction place (TPI) is a market which is commonly located in fish port/fish landing-bridge, where selling of fish and other marine products takes place. TPIs are commonly managed by fishery agency, cooperative or local government.

5.6.3 Fish and Seafood Processing

In Indonesia, most fish are consumed as food. Fish is consumed fresh, frozen, smoked and canned. As reported by FAO[30]:

- About 55% of fish production is consumed fresh.

[30] FAO. http://www.fao.org/fishery/facp/IDN/en.

- The balance is processed and consumed as dried and salted, smoked, or fermented fish due to limitations in the availability of ice, refrigerated storage and transport facilities. There are about 10,000 small fish processing operations, generally using traditional methods.
- Less than 2% of the catch is canned. The canneries utilize pelagic species, mostly oil sardines and skipjack.
- Some fish, mostly shrimp and tuna, are frozen and exported.
- Only a small proportion is converted into fish oil, fishmeal and silage, that is into products for animal feed or other usages. Production of fishmeal takes place mostly in conjunction with canning of fish.

5.7 Key Issues

The following constraints affect fisheries management in Indonesia: (a) overfishing in both marine and inland fisheries waters; (b) low income and standard of living for fishers and fish farmers; (c) lack of financial support in terms of credit schemes; and (d) illegal, unreported and unregulated (IUU) fishing and weak fisheries management, particularly concerning monitoring, control, and surveillance (MCS) and enforcement.[31]

The ability of capture fisheries to contribute to food security and nutrition security in Indonesia could become significantly compromised by overfishing, fish loss and waste, habitat conversion, climate change, pollution, unregulated coastal development, and associated declines in fish catch.

Aquaculture—which includes the development of sustainable and community-managed freshwater, brackishwater, and marine aquaculture—has become an alternative livelihood for fisherfolk who are usually engaged in open sea fishing, and has helped reduce pressure on marine and coastal resources. However, poor farming practices, environmental degradation and pollution, lack of access to credit by small-scale aquaculture farmers, expensive inputs, problems in marketing, and conflicts in the use of coastal areas have lowered the productivity of the aquaculture subsector[32].

5.8 Response Measures

The main law regulating fisheries in Indonesia is *Law 31 of 2004* and its amendment, *Law 45 of 2009*. These laws concern fishery activities in marine waters and, brackishwater, and public inland waters. These laws provide the legal underpinning for a wide variety of management measures, including effort control (licensing), quotas, gear restrictions (such as mesh size restrictions and outright bans on certain gears), and area restrictions. Derivative regulations have also been developed. Moreover, the National Medium-Term Development Plan or RPJMN 2015-2019 aims at increasing Control of Ship Compliance at Fisheries Ports, and implementing Port State Measures.

[31] FAO. http://www.fao.org/fishery/facp/IDN/en.
[32] ADB. 2015.

The Ministry of Marine Affairs and Fisheries (MMAF) was established in 2000 as an expansion of the former Directorate General of Fisheries, which was part of the Ministry of Agriculture. The number of staff has increased appreciably as a result.

To address the issues in fisheries and aquaculture sector, the **National Mid-Term Priority Framework (2010-2014)** has set the following priorities (which are also pointed out in the *RPJMN 2015-2019*):

- Community development and empowerment through programmes for small-scale fishers and fish farmers in coastal and small island areas;
- Mitigation and adaptation strategies to climate change for the marine and fisheries sector;
- Improvement of the quality and profitability of fish products for small-scale fishers;
- Improvement of fishery-related infrastructure;
- Strengthened MCS systems to improve management and combat IUU fishing;
- Strengthening human resource capacity.

5.8.1 Addressing IUU Fishing

Considering the vast area of its archipelagic waters, Indonesia faces a big challenge in the form of IUU fishing. It has been estimated that annually, more than US$ 1 billion worth of fish is illegally caught and transferred abroad. Indonesia together with Australia has worked to promote regional cooperation in an effort to combat and eliminate IUU fishing. Starting in 2005, Indonesia has developed a *National Plan of Action* as part of the implementation of the International Plan of Action to eliminate IUU Fishing.

The European Community has enacted a regulation concerning the certification of fish to be imported into the EU to ensure that the fish has not been caught through IUU fishing. This regulation came into force in January 2010, and Indonesia has cooperated with the EU in its implementation. Meanwhile NGOs (e.g., WWF and SFP) are helping local exporters of tuna, snapper, grouper and blue swimming crab to obtain certification from the Marine Stewardship Council (MSC). The **MSC Fisheries Standard** is used to assess if a fishery is well-managed and sustainable. Fish from certified fisheries can be sold with the **blue MSC label**.

5.8.2 Fishery Resource Conservation

To prevent the loss of fish resources, *ex situ* fish conservation has been done in BBAT Jambi. Types of fish that are preserved include fish betook, tambak, sepat siam, semah, labi-labi, kapiat, and tilan. In addition, there is also domestication of the rare arowana fish, which has a high demand as an ornamental fish. There are also efforts to mass scale the production of seeds, such as catfish jambal, and baung fish that are more expensive.

The MMAF has a unit responsible for the conservation of fish stocks under the Directorate General of Coastal and Small Island Development. The Conservation Directorate has identified and designated a number of conservation areas as a means to protect important habitats and eliminate destructive fishing.

Specific to tuna management, a **National Plan of Action** was developed and launched in 2015. The government of Indonesia improved the registration of fishing vessels in the country to help strengthen tuna fisheries management. Indonesia's compliance with measures requirements imposed by the Western and Central Pacific Fisheries Commission (WCPFC), for example on the provision of size-at-capture data for 2013, was classified as "good" by the WCPFC Scientific Committee.[33] Moreover, Indonesia has undertaken research relevant to establishing harvest control rules for its tuna fisheries. There is an ongoing project on piloting an electronic Catch Documentation and Traceability (eCDT) system to help in combatting IUU tuna fishing. (*See Section 9.1.1 for details.*)

5.8.3 Membership in Regional Fishery Bodies

In the management of highly migratory species, Indonesia works together with Regional Fisheries Management Organizations (RFMO). Indonesia became a full member of the Indian Ocean Tuna Commission (IOTC) in 2007 and of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) in 2008. Indonesia is also a member of other regional fishery bodies:

- Asia-Pacific Fishery Commission (APFIC)
- Inter-American Tropical Tuna Commission (IATTC)
- Network of Aquaculture Centers in Asia-Pacific (NACA)
- Southeast Asian Fisheries Development Center (SEAFDEC)
- Western and Central Pacific Fisheries Commission (WCPFC)

5.8.4 Stakeholder Collaboration

MMAF recognizes that it is essential to collaborate with stakeholders in fisheries management. This is done through fishery and aquaculture associations, such as: ASTUIN (the Association of Indonesian Tuna Fisheries), and ATLI (the Association of Indonesian Tuna Longliners) for tuna fisheries; HPPI (the Association of Shrimp Trawlers in Indonesia) for the shrimp fishing industry and 'Shrimp Club' for shrimp aquaculture industry; APIKI (the Indonesian Association of Canneries) representing the canning industry; APCI (Association of Cold Storage Owners) representing owners of cold storages; and ASBUMI (the Association for Indonesian Pearl Culture) for the pearl industry. These associations coordinate their activities through an apex association called GAPPINDO (Federation of Indonesian Fisheries Associations). Aquaculture projects have also included women groups to be more active partners. (*See Sections 9.1, 9.2 and 16.5 for examples of community involvement*).

[33] WCPFC, 2017. (https://www.wcpfc.int/conservation-andmanagement-measures).

6 Coastal and Marine Tourism

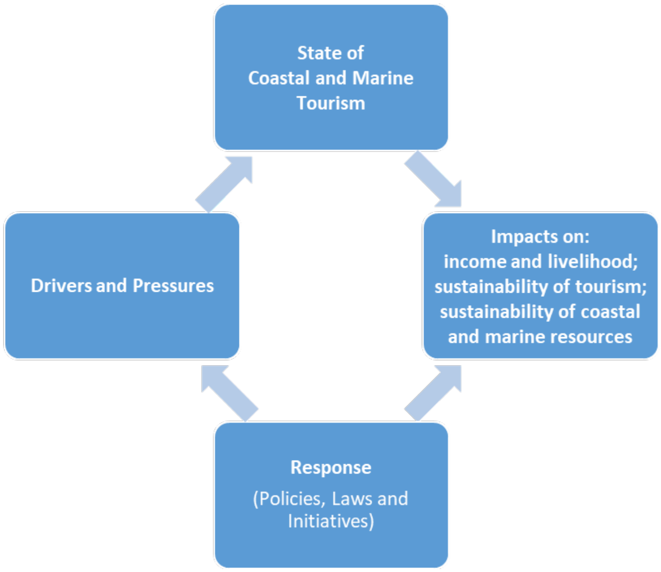


Photo by M. Ebarvia

Tourism is now a leading sector worldwide, especially in Indonesia. Tourism activities are increasing in line with the increase of people's income and the growing awareness toward recreational activities as an effort to relax, increase creativity, eliminate boredom, and study the natural wealth, historical relics and other cultural richness. For Indonesia, the tourism sector is one of the key economic activities to achieve development, prosperity, and well-being of the people. Indonesian tourism has experienced continuous expansion and diversification, becoming one of the largest and fastest growing economic sectors in the world (Ministry of Tourism 2015). With the increase in tourism destinations and investment, tourism has direct impacts on export revenue, job creation, wages and household incomes, business development, and infrastructure development.

There are targets to enhance marine tourism in the country as a critical component of the overall tourism development strategy. To reach its economic potential, marine tourism industry needs support for infrastructure to improve accessibility (air, land and sea transportation, airports, seaports, roads and bridges), and accommodation service (hotels, guest houses, homestays, huts and so on), as well as derivative industries, such as the provision of food services (food and beverages, restaurants), souvenirs, travel support (travel agencies, tour guides), and marketing support (advertising and promotion agencies, mainstream and social media). Marine tourism and derivative activities contribute to improving the local economies, providing sources of income and livelihoods, and increasing foreign exchange earnings or international tourism revenues.

The target to reach 20 million international tourists (Kemenpar, 2016) will have an economic impact for Indonesia, either directly or indirectly, and boost economic growth and local livelihoods. It should be noted, however, that mass tourism can have negative effects on the environment and local people. There will be more pressures on habitats and other tourism destinations as well as on food production (inclusing fisheries), water and energy supply, transportation and other infrastructure and facilities to accommodate and serve the tourists. Thus, the Indonesian government issued *Minister of Tourism Decree no. 14 of 2016* on **Sustainable Tourism Destination Guidelines** for the implementation of sustainable tourism development.

6.1 Marine Tourism Activities

As a tropical country that has abundant natural wealth, many tourists come to enjoy the natural beauty of forests, mountains, lakes, small islands, beach and underwater as well as cultural richness of Indonesia. In particular, marine tourism consists of natural attractions, such as coral reefs, and maritime cultural attractions, such as underwater ancient relics, shipwrecks, and relics of World War II. The marine tourism itself is defined as an activity to take advantage of coastal and marine areas as a tourist attraction by enjoying the beauty, uniqueness, and culture in these areas as well as to understand the benefits of the sea and potential impacts of unsustainable practices, and raise awareness of the importance of maintaining natural ecosystems and oceans.

The types of marine tourism activities that can be developed in Indonesia are:

1. Variety of activities on beaches, such as sunbathing, strolling, swimming or enjoying the view.
2. Diving and Snorkeling. The purpose of these activities is to explore and enjoy the beauty of nature under the sea. In addition to recreation, snorkelling and diving can contribute to the study of the marine biota, underwater features, such as an underwater cave and sea mounts, and cultural heritage, such as shipwrecks and sunken villages.
3. Watersports and beach sports. These include swimming, surfing, kayaking (canoeing), stand-up paddling, jetskiing, beach volleyball, etc.
4. Cruising and sailing. Enjoy cruises with yachts and luxury boats or sailing with smaller, traditional boats like *pinisi* boats.
5. Camping.
6. Enjoy seafood (culinary). Seafood obtained directly from the ocean certainly has a different taste.
7. Marine ecotourism. This is a type of tourism directed toward natural environments, often threatened, and intended to support habitat and wildlife conservation efforts, and provide knowledge to tourists to keep the coastal and marine ecosystems from damage.
8. Enjoy natural phenomena, such as sunrise and sunset or solar and lunar eclipses
9. Small island tour, such as exploring nature and life on Pulau Kecil.
10. MICE (meetings, incentives, conferences, and exhibition) events in a nautical atmosphere
11. Recreational fishing activities

Figure 6.1: Various Activities of Marine Tourism.

Sun bathing

Recreational fishing
(Photo by: spotmancing.com)

Snorkeling
(Photo by: www.bunchybuy.com.au)

Surfing

Speedboat

Diving

Pinisi (traditional boat) Cruising

Shipwreck Diving

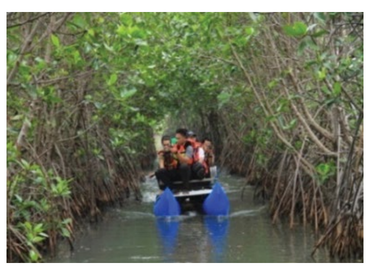
Small island tour (e.g., Resort in Pulau Kecil)

Sunset viewing
(Photo by: indonesia.tripcanvas.co)

Culinary (seafood)
(Photo by: http://panduanwisata.id)

Cruise ship
(Photo by: echnologysot.com)

Food tour



Ecotourism

Meetings, incentives, conferences, and exhibitions (MICE)

Source: berbagai – www.google.com

6.2 Major Tourism Sites

6.2.1 Tourist Destinations

The islands of Bali, Yogyakarta, and Jakarta are the main tourist destinations in Indonesia to date. Along with increasing the number of tourist sites, the government has also developed a marketing strategy, which includes promoting natural attractions, and mainstreaming marine tourism, ecological tourism and adventure tourism as well as cultural tourism. Thus, every year, the government identifies the location of leading tourist destinations.

In the medium term (2015-2019), the government has set ten (10) major tourist destinations, of which seven are based on marine tourism. According to the Ministry of Tourism (MoT), these top 10 tourist destinations have specific performance indicators and targets (**Table 6.1**).

Table 6.1: Performance of 10 Major Tourist Destinations in Indonesia.

No.	Destination	Performance				Projection 2019		
		Number of foreign tourists		Percentage increase in number of foreign tourists	Foreign exchange revenues (US$)	Investment (Million US$)	Foreign Tourist	Foreign exchange revenues (Million US$)
		2012	2013					
1	Borobudur-Prambanan	193,982	227,337	17.19	27,337,000	1,520	2,000,000	2,000
2	Mandalika in Lombok*	121,482	125,307	3.15	125,307,000	3,600	1,000,000	1,000
3	Labuan Bajo*	41,972	54,147	29.01	54,147,000	1,200	500,000	500
4	Bromo-Tengger-Semeru	34,466	33,387	-3.13	33,387,000	1,200	1,000,000	1,000
5	Kepulauan Seribu*	4,627	16,384	254.1	16,384,000	1,020	500,000	500
6	Toba	15,464	10,680	-30.94	10,680,000	1,000	1,000,000	1,000
7	Wakatobi*	2,179	3,315	52.13	3,315,000	1,400	500,000	500
8	Tanjung Lesung*	8,336	1,739	-79.14	1,739,000	5,600	1,000,000	1,000
9	Morotai*	618	500	-19.09	500,000	3,600	500,000	500
10	Tanjung Kelayang*	975	451	-53.74	451,000	1,660	500,000	500

* Coastal and marine tourist destinations
Source: Ministry of Tourism, 2015.

Data from the MMAF show that there are now many marine tourism destinations in Indonesia: 548 spots spread over 29 locations in 15 Provinces, as shown in **Table 6.2**.

Table 6.2: Destinations that provide Marine Tourism Services (Tirta).

No	Province	Regency/City	Location	Destinations (Spot)
1	Aceh	Sabang City	Weh Island	18
2	Lampung	South Lampung	Kepulauan Krakatau	5
3	DKI Jakarta	Kepulauan Seribu	Kepulauan Seribu	13
4	Bali	Klungkung	Nusa Penida	16
		Karangasem	Padang Bai	6
		Karangasem	Amed dan Tulamben	17
		Buleleng	Pulau Menjangan	12
5	West Nusa Tenggara	North Lombok	Gili Matra	18
6	East Nusa Tenggara	Labuhan Bajo	Pulau Komodo	30
		Sikka	Maumere	28
		Alor	Selat Pantar	18
7	East Kalimantan	Berau	Kakaban	28
8	North Sulawesi	Manado City	Bunaken	25
9	Center Sulawesi	Bitung City	Selat lembeh	25
		Donggala	Donggala dan Teluk Palu	20
10	Southeast Sulawesi	Tojo Una-una	Kepulauan Togean	23
11	South Sulawesi	Wakatobi	Wakatobi	30
		Pangkajene Kepulauan	Kapoposang	12
		Bulukumba	Tanjung Bira	17
12	Gorontalo	Kepulauan Selayar	Selayar	16
13	Maluku	Gorontalo	Gorontalo	21
		Ambon City	Pulau Ambon	21
14	North Maluku	Center Maluku	Kepulauan Banda	22
		Morotai	Pulau Morotai	19
		West Halmahera	Halmahera Barat	12
		Kota Ternate	Pulau Ternate	12
15	West Papua	Raja Ampat	Raja Ampat	17
		Raja Ampat	Kepulauan Waigeo	20
		Teluk Cenderawasih	Teluk Cenderawasih	27
			TOTAL	**548**

Source : MMAF, 2016.

6.2.2 National Parks

It is necessary to protect and ensure the sustainability of nature and the ecosystem services, including providing tourist attractions. One form of protection is done by designating a certain area as a National Park. Under the *Law No.5 of 1990* on the conservation of natural resources and ecosystems, the National Park is defined as a natural area for conservation of the natural lansdscape, native ecosystems and biodiversity. The protection of the Natural Park is supported by a zoning system for various purposes, such as research, education, science, aquaculture, and tourism or recreation.

As an archipelago and tropical country, Indonesia has many national parks. As of 2017, 54 parks have been established under the MOEF, with an area of 16,304,707 ha (KLHK, 2017). Of the 54 national parks under MOEF, six are World Heritage Sites, and five are wetlands of international importance under the Ramsar Convention. **Figure 6.2** shows the location of 50 national parks.

Figure 6.2: Location of National Parks in Indonesia.

6.2.3 Marine National Parks

National parks with official status as Marine National Parks (Taman Nasional Laut) are found in seven (7) locations, with a total area of 4,043,541 ha, and managed by MOEF. These include Raja Ampat, Padaido in Biak, Banda in Maluku, Kei Islands in Southeast Maluku, Bintan and Natuna Islands in Riau, Togean Islands and Luwuk in Central Sulawesi, Karimunjawa in Central Java and Sumbawa and Gili Sekotong in NTB, which are all excellent marine tourism locations with superb views and native marine ecosystems. In addition, MMAF manages one Marine National Park (Taman Nasional Perairan) which is the Sawu Sea Waters National Park with an area 3,355,353 ha, and six Marine Nature Recreation Parks.

Some of the national parks with marine ecosystems are:

1. Kepulauan Seribu Marine National Park, DKI Jakarta
2. Karimunjawa National Marine Park of Central Java
3. Wakatobi Marine National Park Southeast Sulawesi Province
4. Bunaken National Marine Park of North Sulawesi Province
5. Cenderawasih Bay National Marine Park, Papua Province
6. Togean Islands Marine National Park Central Sulawesi Province
7. Takabonerate Marine National Park of South Sulawesi Province
8. Komodo National Park of NTT Province
9. Sembilang National Park in South Sumatra Province
10. Ujung Kulon National Park, Banten Province
11. Meru Betiri National Park, East Java Province
12. Alas Purwo National Park, East Java Province, and
13. Sawu Sea National Marine Conservation Area of NTT Province, managed by the Ministry of Marine Affairs and Fisheries

However, marine parks that have become famous in foreign countries, like Bunaken, Raja Ampat, Wakatobi and Thousand Islands, are still not major tourist destinations due to limited infrastructure and weak institutional management.

In view of *Law No. 1 of 2014 on the Management of Coastal Zones and Small Islands*, the national park conservation is limited to the conservation of fish resources, transit shelters of other marine biota, customary territory and unique territories vulnerable to change. Nevertheless, there should be closer collaboration and synergy among relevant ministries, such as MOEF, MMAF and MoT.

For the Sawu Sea National Park in Nusa Tenggara Timur Province, its management is stipulated by MMAF through:

- *KEPMEN-KP No. 5 of 2014 on the National Savu Sea Marine Conservation Area in the Province of East Nusa Tenggara*
- *KEPMEN-KP No. 6 of 2014 on the Management Plan and Zonation of Savu Sea Marine National Park and Surroundings in East Nusa Tenggara Province*

6.2.4 Maritime Cultural and Historical Sites

Coastal areas and small islands are very rich in cultural heritage, but over time many of the cultures began to fade away and are threatened to disappear. Protection of the maritime cultural heritage in Indonesia is still generally not much of a concern, and efforts have not been much promoted.

Maritime cultural heritage has two forms: tangible (e.g., archaeological sites and artifacts, sunken vessels and their contents), and intangible (e.g., traditions, oral history, boat-building technology and traditions, voyages). As a multi-ethnic and multi-cultural country, Indonesia has a lot of tangible and intangible cultural heritage to offer to tourists and historical enthusiasts.

The very long maritime history allows for intensive cultural contact and covers a large geographical space. Mulyadi (2016) states that maritime culture developed through voyages and trade between islands and between continents, and with the assimilation and acculturation resulting in a variety of cultural features in the archipelago. The voyages were supported by navigation knowledge as well as boat-building expertise and traditions. The traditional boat-making can still be seen, such as the making of *pinisi*[34] in Bulukumba. Tourists can visit some of the islands in Indonesia by boarding these *pinisi* boats (**Box 6.1**).

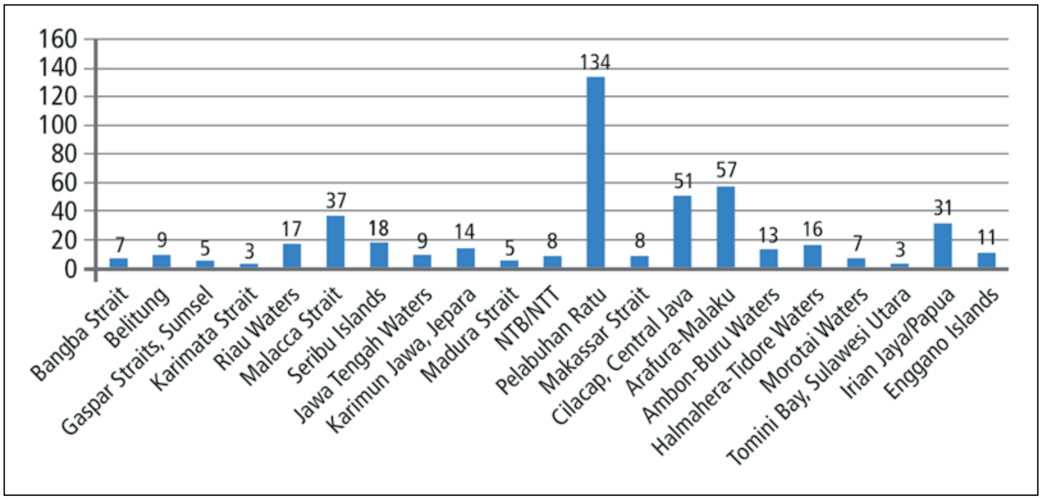
Moreover, the remnants of maritime culture of Indonesia are found not only in indigenous Indonesian cultures, but also in other places around the world since many voyages pass through the Indonesian seas. Evidence of the cultural diversities can be found in archaeological sites and from various sunken ships. The underwater archaeological objects, generally from submerged vessels, are scattered in waters in 21 Provinces (**Figure 6.3**), and are managed as legacy of the maritime culture (Suparmoko, 2011).

One of the important areas of concern is the protection of maritime historical and cultural traditions and heritage sites that are also a focus of marine tourism activities. Culture rooted in hereditary tradition and archeological and historical sites (like shipwrecks) are cultural treasures of the archipelago. Efforts to protect and utilize indigenous traditions and cultural heritage are handled by the Directorate General of Culture, Ministry of Education and Culture. The

[34] **Pinisi** is a traditional Indonesian two-masted sailing ship.

management of underwater cultural heritage sites and objects is managed by two institutions, namely the Directorate General of State Assets Management (under Ministry of Finance), and the interdepartmental National Committee for the Appointment and Utilization of Valuable Goods from Sunken Ships (PANNAS-BMKT).

Figure 6.3: Distribution of Underwater Archaeological Heritage Sites with Sunken Ships.



Box 6.1 Marine Tourism in Eastern Indonesia: Labuan Bajo (in Nusa Tenggara Timur or NTT)

Tour Boats around Labuan Bajo

Pink Beach in Labuan Bajo

One can sail across the eastern part of Indonesia with "KM Komodo Enterprise", "KM Aqua Luna" and "KM Cajoma", two of which are pinisi ships and 1 is a semi-pinisi ship, and go to the beautiful islands in Labuan Bajo, among others.

Pulau Kelor, Padar Island, Komodo Island, Komodo Village, Pink Beach, Gililawa Darat, Manta Point, Taka Island Makassar and Kanawa Island are must-see destinations when tourists come to Labuan Bajo. There is a pink beach as well as beautiful and crystal clear water suitable for snorkeling. Kanawa Island has a stretch of white sand beach, clear sea water, and many marine biotas that are not less beautiful than the pink beach.

Box 6.1 Marine Tourism in Eastern Indonesia: Labuan Bajo (in Nusa Tenggara Timur or NTT) (cont.)

"Labuan Bajo is exotic and the complete holiday destination... A lot of amazement from eastern Indonesia, lots of new experiences, lots of stories, cultural diversity and everyday life of the local people that truly reflect what is my Indonesia, which emits a million beauty not possessed by any other countries. We should be proud of the natural beauty that we have, no need to leave the country because our natural beauty is extraordinary and very indulgent to eyes. The beautiful nature of Indonesia cannot be depicted only with a camera shot because the Indonesian nature will look stunning when we enjoy it directly as a haven for the traveler."

There is one destination that is sought after by local and foreign tourists, **Manta Point**. This spot offers snorkeling tours with large-size manta rays. Manta Point has fairly strong currents, but is the favorite place of the manta rays for feeding.

Pulau Padar and Gililawa Darat in Labuhan Bajo

The island of Komodo is the habitat of the Komodo dragons, which are giant ancient reptiles that can only be found in Indonesia. When traveling around the island, tourists can indeed feel like a minority since many Komodo dragons can be seen at any time from any direction. However, the tour is safe because tourists are accompanied by the rangers from the Komodo National Park. For the Komodo people, the komodo dragons have their own spiritual value. The local people have stories of interesting ancestors that many of us may not know about.

Source: https://kitaina.id/wisata-bahari-indonesia-timur-labuan-bajo-ntt/

6.3 Tourist Arrivals

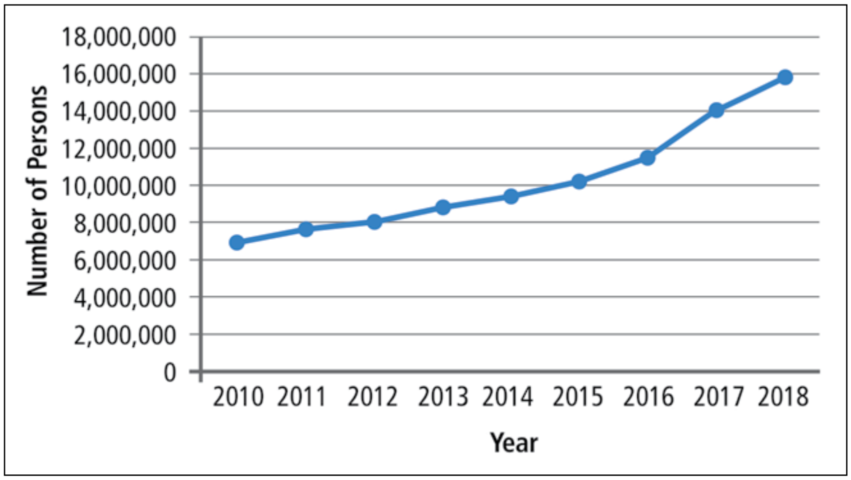
The number of foreign tourist arrivals more than doubled between 2010 and 2018. Consequently, international tourism receipts also doubled. The highest growth rate of international tourism arrivals was in 2016-2017 when the number of arrivals increased by 21.88%. In 2018, around 16 million foreign tourists visited Indonesia. Foreign tourists stayed around eight days on average. **Table 6.3** provides details of tourism arrivals, average length of stay per tourist, average spending per tourist, and total receipts from international tourism.

Table 6.3: Number of Foreign Tourist Arrivals and Foreign Exchange Revenues.

Year	Foreign Tourist Arrival		Average length of stay (day)	Average Spending per Person (US$)*		International Tourism Receipts*	
	Total	Growth		Per day	Per visit	Total (Million US$)	Growth
2010	7,002,944	10.74%	8.04	135.30	1,087.83	7,618	20.73%
2011	7,649,731	9.24%	7.84	150.70	1,181.48	9,038	18.64%
2012	8,044,462	5.16%	7.70	152.77	1,176.34	9,463	4.70%
2013	8,802,129	9.42%	7.65	152.99	1,170.40	10,302	8.87%
2014	9,435,411	7.19%	7.66	160.04	1,225.91	11,567	12.28%
2015	10,230,775	8.43%	8.53	138.13	1,178.21	12,054	4.21%
2016	11,519,275	12.59%	8.42	129.56	1,090.87	12,566	4.25%
2017	14,039,799	21.88%		130.80	1,046.38	14,691	16.91%
2018	15,810,305	12.61%		123.34	986.70	15,600	6.19%

*Source: BPS, 2019; *World Bank, 2019.*

Figure 6.4: International tourism: Number of Arrivals, 2010-2018.



Source: World Bank, 2019.

6.4 Tourist Accommodation and Access

6.4.1 Accommodation

According to BPS (2016), the **business of providing accommodation** is a business that provides specialty services that can be equipped with other tourism services. It includes hotel, villa, cottage, camping, caravan stop, and other accommodations that are used for tourism purposes. A **classified hotel** is the business of providing an accommodation, eating and drinking as well as other services for the public by using a building or a part of a building, and managed commercially, It also meets specified requirements as a star hotel. **Table 6.4** shows that, in 2018, there were 28,230 establishments providing accommodation to tourists, with 712,202 available rooms. Around 12% were classified as star-rated hotels with 314,051 units of rooms, and 454,611 beds. The number of accommodations increased by 76.5% in 2012 to 2018. As shown in **Table 6.5**, majority or 87% of the accommodation are non-stars, mostly dominated by pension establishments (62%).

Table 6.4: Number of Accommodations, Available Rooms, and Beds in Indonesia in 2014-2018.

	2012	2014	2016	2018
Classified/Star-rated Hotels				
Accommodation	1,623	1,996	2,387	3,314
Rooms	155,740	195,886	233,007	314,051
Beds	238.485	295,426	346,959	454,611
Non-classified/Non-star				
Accommodation	14,375	15,488	16,442	24,916
Rooms	250,038	273,391	294,169	398,151
Beds	389,269	411,010	428,284	589,701
TOTAL				
Accommodation	15,998	17,484	18,829	28,230
Rooms	405,778	469,277	527,176	712,202
Beds	627,754	706,436	775,243	1,044,312

Source: BPS-Statistics Indonesia, Hotels Survey.

Table 6.5: Number of Accommodations, Available Rooms, and Beds, By Type of Accommodation in 2016.

No.	Type of Accommodation	Unit	Room	Bed
A	**Classified / Star-rated Hotels**	**2,387**	**233,007**	**346,959**
1	5 Star	183	39,118	55,035
2	4 Star	453	68,425	102,454
3	3 Star	839	72,951	110,268
4	2 Star	528	34,596	52,262
5	1 Star	384	17,917	26,940
B	**Non Star / Non-classified**	**16,442**	**294,129**	**428,284**
1	Pension	10,149	233,390	345,919
2	Cottage or lodge	2,940	24,115	31,720
3	Teenage Inn / hostel	599	8,842	12,578
4	Villa	1,204	8,844	11,030
5	Other hotel service	1,550	18,938	27,037
Total		**18,829**	**527,136**	**775,243**

Source: BPS-Statistics Indonesia, Hotels Survey.

Tourist accommodation is also unevenly distributed among the provinces. Bali and the provinces in Java have the most number of accommodations with complete facilities compared to provinces in eastern Indonesia. In 2018, Bali has the most number of accommodations followed by Jawa Timur, while in terms of the number of rooms and beds, Bali still leads the provinces, followed by Jawa Barat (**Table 6.6**). Classified or star-rated hotels have higher room occupany rate (58.75%) than non-classified accommodation (33.18%).

Table 6.6: Number of Accommodations, Available Rooms, and Beds, By Province in 2018.

Province	Classified Hotel/Star Hotel				Non-classified Accommodation			
	Accommodation	Rooms	Beds	Room Occupancy Rate (%)	Accommodation	Rooms	Beds	Room Occupancy Rate (%)
Aceh	21	1,603	2,654	43.58	10,001	7,127	13,050	28.26
Sumatera Utara	124	10,296	15,509	56.87	20,572	21,368	32,791	35.30
Sumatera Barat	74	4,493	7,717	56.18	8,132	6,262	11,051	32.18
Riau	87	6,988	9,802	48.71	12,104	10,123	16,640	36.70
Jambi	37	2,461	3,780	43.44	5,451	4,288	6,809	33.34
Sumatera Selatan	76	6,161	8,811	58.88	8,820	7,221	9,677	37.76
Bengkulu	9	538	845	58.91	4,074	3,296	5,457	20.11
Lampung	19	1,997	2,477	59.55	7,473	6,475	10,467	32.86
Kepulauan Bangka Belitung	46	2,927	4,426	40.02	2,106	2,105	3,207	24.39

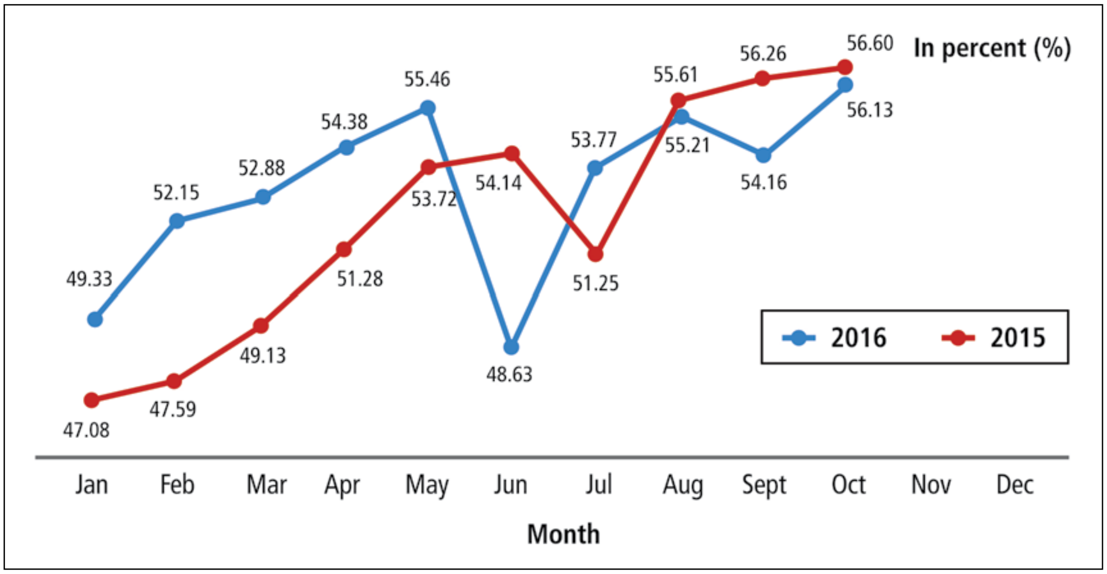
Table 6.6: Number of Accommodations, Available Rooms, and Beds, By Province in 2018. (cont.)

Province	Classified Hotel/Star Hotel				Non-classified Accommodation			
	Accommodation	Rooms	Beds	Room Occupancy Rate (%)	Accommodation	Rooms	Beds	Room Occupancy Rate (%)
Kepuluan Riau	132	13,756	19,425	57.33	9,876	9,241	11,416	40.52
DKI Jakarta	326	46,899	60,849	66.65	10,991	10,986	14,189	74.27
Jawa Barat	463	43,034	62,725	58.76	55,151	46,463	71,955	29.05
Jawa Tengah	291	23,516	33,530	45.49	38,434	30,029	45,504	30.72
DI Yogyakarta	143	14,328	23,477	57.24	20,295	18,541	31,450	28.25
Jawa Timur	231	26,585	38,540	55.82	48,792	44,627	62,646	29.98
Banten	113	10,607	15,507	54.11	7,627	5,390	8,950	25.44
Bali	551	52,927	78,801	64.72	36,513	56,442	78,689	34.67
Nusa Tenggara Barat	83	5,678	8,328	43.85	12,460	13,001	17,440	27.53
Nusa Tenggara Timur	24	1,830	2,541	56.62	9,310	7,401	12,381	24.13
Kalimantan Barat	41	4,269	6,204	53.34	10,317	9,697	14,611	38.22
Kalimantan Tengah	13	968	1,496	59.59	9,865	8,128	12,096	25.20
Kalimantan Selatan	52	4,075	6,488	54.99	7,846	6,175	9,085	33.54
Kalimantan Timur	63	6,438	9,293	51.34	12,512	10,249	13,801	35.81
Kalimantan Utara	1	81	113	43.01	3,634	3,153	4,552	31.08
Sulawesi Utara	35	3,072	3,484	67.51	4,948	4,766	6,946	37.92
Sulawesi Tengah	16	1,492	2,361	47.26	9,465	7,236	10,957	20.80
Sulawesi Selatan	139	10,418	15,757	50.75	13,520	13,028	18,332	28.41
Sulawesi Tenggara	19	1,439	2,122	48.31	6,620	5,434	7,058	23.02
Gorontalo	8	535	804	46.90	2,148	1,681	3,154	20.92
Sulawesi Barat	5	164	260	46.67	3,127	2,060	3,240	23.38
Maluku	22	1,193	1,865	39.21	4,524	4,681	6,062	23.03
Maluku Utara	2	116	116	46.13	3,811	3,644	4,655	27.67
Papua Barat	16	980	1,348	54.20	2,801	2,830	4,526	37.73
Papua	32	2,187	3,156	53.28	4,964	5,003	6,857	38.97
TOTAL	**3,314**	**314,051**	**454,611**	**58.75**	**428,284**	**398,151**	**589,701**	**33.18**

Source: BPS-Statistics Indonesia, Hotels Survey.

There is seasonality factor affecting the occupancy rate of hotels. For example, the monthly room occupancy rates in 2015 and 2016 in Hotel Bintang show monthly fluctuations with peaks in May and October, and lowest rates in June and July (**Figure 6.5**).

Figure 6.5: Room Occupancy Rate in Indonesia (%).



Source: Kemenpar, 2017.

6.4.2 Access and Ports of Entry

The entrance to Indonesia from abroad consists of airports, seaports and landports. As of 2018, there were 16 airports, seven seaports and six landports. The percentage of tourists using the airports as port of entry declined from 74% in 2014 to 64% in 2018, while the use of landports significantly increased from 1% in 2014 to 16% in 2018 (**Table 6.7**). The use of seaports also declined from 26% of tourist arrivals in 2014 to 20% in 2018. Tourism in Indonesia is still facing obstacles, especially the equitable accessibility of tourist activities, and the distribution of the ports of entry, which is still unbalanced between Java and Sumatra, or Java and the other islands.

Table 6.7: International Visitor Arrivals to Indonesia by Port of Entry, 2014–2018.

No.	2014	2015	2016	2017	2018
Airports	**6,944,587**	**7,165,033**	**8,545,300**	**9,657,816**	**10,088,781**
Seaports	**2,435,534**	**3,022,519**	**2,389,138**	**2,869,821**	**3,214,420**
Batam	1,454,110	1,585,719	1,510,203	1,564,717	1,887,284
Tanjung Uban	320,861	305,471	308,964	371,592	522,399
Tanjung Pinang	97,672	91,341	93,924	117,882	140,603
Tanjung Balai Karimun	100,782	97,320	91,811	85,771	84,718
Tanjung Benoa	39,115	45,620	57,861	31,998	31,062
Tanjung Emas	8,506	21,532	33,546	27,073	19,907
Lainnya/Others	414,488	875,516	292,829	670,788	528,447
Landport	**55,290**	**43,223**	**584,837**	**1,512,162**	**2,507,104**

Source: BPS, 2019; Directorate General of Immigration, Mobile Positioning Data.

6.4.3 Cruise Tourism

The development of cruise tourism in Indonesia is relatively low. Cruise tourism is generally done by ships from abroad that enter the territorial waters of Indonesia. Due to lack of supporting facilities, such as special ports for cruise ships, and proper management, Indonesian sites are just stopover points. Currently, the government is building a special cruise port in Bau-Bau City, Southeast Sulawesi.

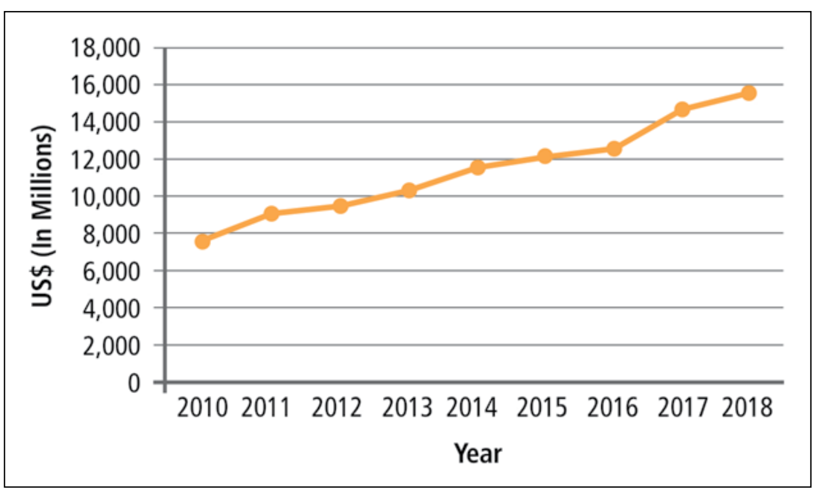
6.5 Socioeconomic Contribution

6.5.1 Tourism Revenues

The tourism industry is a key sector that contributes directly to GDP, foreign exchange earnings, employment and livelihood. Tourism ranked fourth among the national foreign exchange earners, contributing 9.3% of total foreign exchange revenues.

The international tourism receipts (in current US$) doubled between 2010 and 2018 (**Figure 6.6**). In 2018, international tourism receipts reached US$ 15.6 billion. The highest growth rate of international tourism receipts was in 2016-2017 when the revenues increased by 16.9%, and this corresponds to the highest growth rate of international tourism arrivals since 2010 (**Table 6.3**). The growth of tourism's foreign exchange earnings is higher compared to the growth of earnings from natural gas, oil, coal and palm oil sectors. Required marketing for tourism costs only 2% of the projected foreign exchange earnings.

Figure 6.6: International Tourism Revenues, 2010-2018 (in million US$).

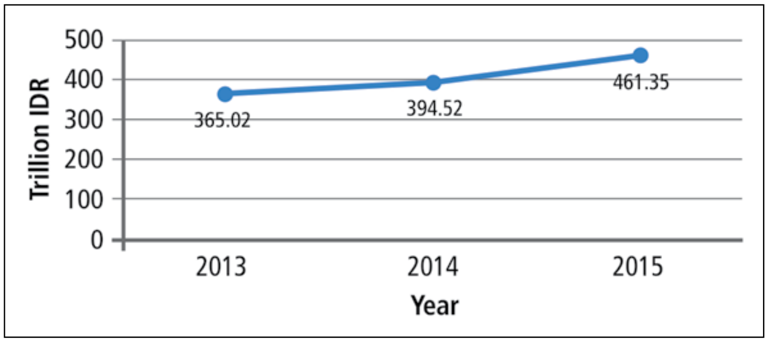


Source: Ministry of Tourism; World Bank, 2019.

6.5.2 Contribution of Tourism to GDP and National Investment

Due to increasing international tourism arrivals and revenues, the contribution of tourism to the national GDP increases every year. The GVA of tourism increased by 16.9% from 2014 to 2015 (**Figure 6.7**). The GVA of tourism in 2015 was IDR 461.36 trillion (US$34.5 billion), contributing 4.23% of the total GDP. The GVA of coastal and marine tourism and recreation in 2015 was US$ 19.9 billion (**Table 4.1**).

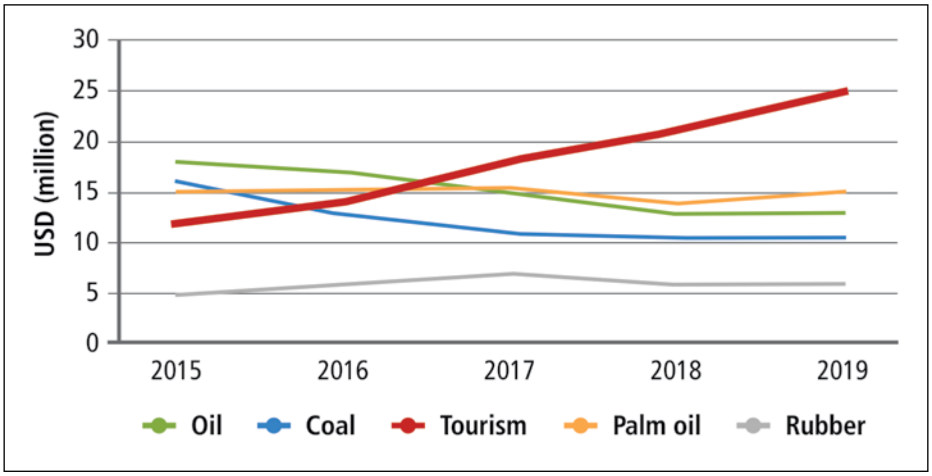
Figure 6.7: GVA of Tourism in 2013-2015 (in trillion IDR).



Source: Kemenpar, 2017.

The growth of GDP of tourism is much higher than agriculture, automotive manufacturing, and mining. According to the Ministry of Tourism (2016), tourism contributes to 10% of national GDP in nominal prices – the highest in ASEAN. In 2019, the tourism industry is projected to earn US$ 24 billion – Indonesia's largest foreign exchange earner, higher than the oil and gas, coal, palm oil and rubber sectors (**Figure 6.8**).

Figure 6.8: Foreign Exchange Revenues of Tourism versus Other Export Sectors.



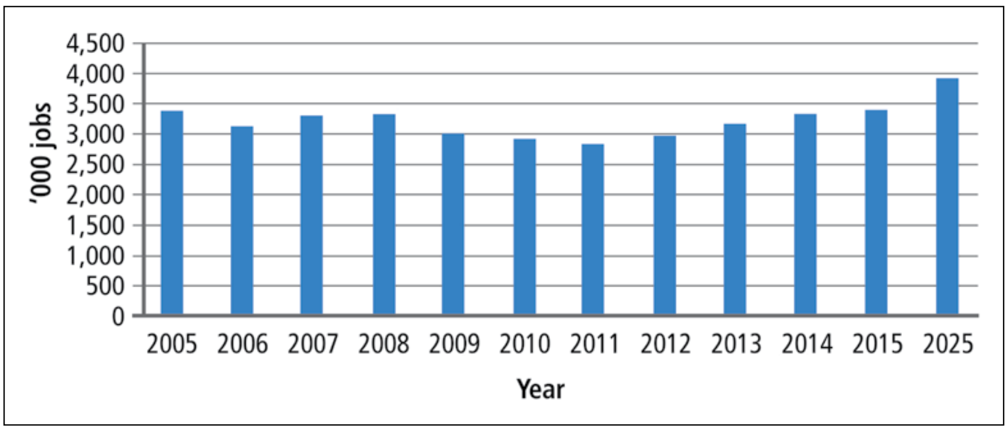
Source: Kemenpar, 2017.

Based on data on investment realization in 2015, tourism investment contribution was 2.4% of the total national investment. However, there was a shortfall as the target was 3.6% contribution. Travel and Tourism investment in 2017 was IDR 160,864 billion, which is 3.7% of total investment (US$ 12 billion).[35] Considering the need to improve tourism facilities and supporting infrastructure, more investments are required to ensure the viability and sustainability of tourism industry.

6.5.3 Employment Generation

Tourism is a dynamic engine of employment opportunity (WTTC, 2018). In addition to income generation, the tourism sector absorbs a lot of manpower. The tourism sector in 2015 employed 3.326 million people or accounted for 2.8% of the total Indonesian workforce.

Figure 6.9: Total Employment in Tourism in 2005-2015 and Projection until 2025.



Source: Kemenpar, 2017.

In 2017, Travel and Tourism directly supported 4,585,000 jobs (3.7% of total employment). This includes employment by hotels, travel agents, airlines and other passenger transportation services (excluding commuter services). It also includes, for example, the activities of the restaurant and leisure industries directly supported by tourists. Thus, the Travel and Tourism sector is an effective contributor to job creation and poverty reduction.

The increasing number of tourist visits must be balanced with the number of facilities, adequate infrastructure as well as quality of service. A professional workforce is needed in the field of tourism because it provides services, such as hospitality, restaurants, business support, tour guides, museums, national parks, etc. Specialized tourism workforce in Indonesia, in 2016, was 340,392 people, an increase of 2.20% compared to 2015. Of these, 209,307 (61.49%) were absorbed

35 World Travel and Tourism Council (WTTC). 2018.

by classified or starred hotels, which are spread over 34 provinces, while the rest (131,085 people) worked in other non-classified accommodation businesses.

6.5.4 Multiplier Effect of Tourism

Tourism is an activity that involves many layers of the society, multi-skill (multidiscipline), and multi-activities, and brings benefits if managed properly. The tourism sector generated the largest foreign exchange receipt in 2016. The impact of foreign exchange earnings can be directly perceived by all levels of society, and can generate multiplier effect in the economy. Tourism business activities are also very broad in terms of categories, and every business community is directly or indirectly associated with tourism, thus, tourism business has the largest multiplier effect.

The multiplier effect of tourism activities can be seen in how it spurs and impacts other activities:
1. *Direct impacts*. Tourism has a direct impact on the local community, in terms of income generation, livelihoods and job creation.
2. *Indirect impacts*. These indirect impacts can be felt by the various industry sectors required during tourism activities, such as farming/plantations and food production, food delivery, water supply, travel/transportation, construction, sanitation, etc.
3. *Derivative Impacts*. There are industries that certainly support tourism activities, such as craft-making, souvenir shop, small stalls, etc.

The current tourism sector has the potential of being the core business of Indonesia. According to the Minister of Tourism of the Republic of Indonesia (2017), the tourism sector has very solid comparative and competitive advantages in the global market, due to the following:
1. Comparative advantage derived from resources owned by a country, such as natural beauty, natural wealth (ecosystems and biodiversity), culture, cheap labor, etc.
2. Competitive advantage gained through the activities undertaken by a company/country, ranging from designing, producing, marketing and delivering to consumers, where the expertise of managing the activity creates cost advantages or differentiation, focus, and speed in entering the market. According to the World Economic Forum (WEF) report, based on the Travel and Tourism Competitiveness Index 2015 from 141 countries, and the Cost Advantages of Indonesia shown by Price Competitiveness, Indonesia ranked 3rd for differentiation and focus aspect and 17th in terms of Cultural and Natural Resources Index.

As a proof of the significant multiplier effect of tourism sector, the research study by Antara (2016) on tourism's contribution to economy of Bali Province, especially from small business, showed that the contribution of the tourism sector to the regional income of Bali (GRDP) amounted to IDR 2,694,049 million (US$ 199,559,185) or 16.3% of Bali's total regional revenue. Primary Input Coefficient (KIP) of small-scale enterprises was 0.618 (> 0.5) as tourism is able to create wages, salary, business surplus and large indirect taxes. This also means that tourism is the engine of the regional economy of Bali, especially community activities which are directly and indirectly related to the small businesses. Secondly, the study also showed that the tourism sector's small business has a larger output multiplier impact than the average multiplier. In effect, small businesses in the tourism sector have the ability to trigger the growth of the Balinese economy. While these small businesses have less revenue multiplier impacts than the average multiplier, these small businesses are capable of generating higher revenues to other economic sectors of every one-in-a-quarter unit spent to meet their final demands. So, it can be concluded that small business tourism has a strategic role and potential to be developed and play a role as a trigger of economic growth. Therefore, the small businesses of the tourism sector should continue to be developed, either through capital assistance, management training, or market access assistance, and make it more empowered and professional.

6.5.5 Travel and Tourism

The total contribution of **Travel & Tourism** to GDP was IDR 787,100.0 billion (US$ 58.9 billion), or 5.8% of GDP in 2017. The direct contribution of Travel & Tourism to GDP reflects the 'internal' spending on Travel & Tourism (total spending within a particular country on Travel & Tourism by residents and non-residents for business and leisure purposes) as well as government 'individual' spending - spending by government on Travel & Tourism services directly linked to visitors, such as cultural (e.g., museums) or recreational (e.g., national parks) (WTTC, 2018).

The total contribution of Travel & Tourism includes its 'wider impacts' (i.e., the indirect and induced impacts) on the economy. The 'indirect' contribution includes the GDP and jobs supported by:

- Travel & Tourism investment spending – an important aspect of both current and future activity that includes investment activity, such as the purchase of new aircraft or ferry, and construction of new hotels;
- Government 'collective' spending, which helps Travel & Tourism activity in many different ways as it is made on behalf of the domestic purchases of goods and services by the sectors dealing directly with tourists – including, for example, purchases of food and cleaning services by hotels, of fuel and catering services by airlines, and IT services by travel agents (WTTC, 2018).

6.6 Major Issues in Tourism

Some of the strategic issues related to tourism development, among others:

1. Some marine tourism destinations are not yet ready to welcome tourists because of the uneven management arrangements, lack of amenities, and inaccessibility.
2. Socially, there are still obstacles related to the attitude of the community in the locations of tourist destinations where there is no public preparedness around tourism destinations. This is due to low education level and minimal coaching from the local government.

3. Many of the identified tourist destinations in Indonesia, especially marine tourism sites, are still natural and untouched, and there are conflicts between local communities and tourism developers from private sector or national government. In some locations that became marine tourism destinations, the potential for land conflicts is a prominent issue, especially the entry of outside investors, which causes local communities to lose access to land. In some locations, there is a tenure conflict between the community and investors or the government. This conflict affects the development of tourism destinations.
4. In terms of tourism destination development, there are several main problems affecting the growth of tourism, such as: (a) synergies between tourism business chains that have not been integrated and optimized. (b) The absence of an integrated operating system of the structure, supply chains and links of tourism businesses (e.g., transportation, accommodation, restaurants, tourist information, tour guides, souvenirs, telecommunications, and other public facilities) as well as inequality of the standards of the quality of the tourism business chain are critical factors affecting affordability and convenience of tourists. (c) The competitiveness of tourism products are not yet optimal. The condition and competitiveness of Indonesian tourism facilities is relatively lower compared to other ASEAN countries, such as Malaysia, Singapore and Thailand.
5. From the aspect of environmental sustainability, the tourists as well as the tourism business circles are still less concerned with environmental responsibility. These caused, in many tourist locations, environmental degradation, pollution, biodiversity loss and damages to nature.
6. Moreover, there is lack of corporate environmental responsibility for the tourism business, whether social, natural or cultural. In order to remain sustainable, there is a need to develop a sustainable tourism business network that can enhance the competitiveness of Indonesia's tourism business. The problems faced in this regard are: (a) the limited number of tourism businesses that are committed to environmental responsibility and application of environmentally sound principles; (b) lack of incentives to tourism businesses that apply the principles of sustainable tourism development; and (c) lack of corporate social responsibility (CSR) programs for tourism and non-tourism businesses for tourism development based on the empowerment of local communities.
7. Within the framework of developing tourism marketing, the problems of national tourism are: (a) regional tourism destination competitiveness, and packaging of Indonesia Tourism image that is not yet optimal; (b) marketing strategy that is not comprehensive, cost-effective, and integrated.
8. In terms of tourism institutions, the main problems faced are: (a) the limited organization in charge of tourism in the region; (b) need for skilled human resources for tourism and development, and limited higher education on tourism; (c) lack of coordination and synchronization, resulting in cross-regional and sectoral development that is not effective.

6.6.1 Supporting Infrastructure: Accommodation and Transportation System

To provide the best service to the tourists, the basic facilities that are required are accommodation services. The availability of accommodation services for tourists needs to be planned with either the construction or the addition of the number of hotel rooms and other accommodation. In line with that, there is also a need to pay attention to the improvement of quality and amount of workforce in accommodation, especially hotel and tourism professionals, given the increasing flow of tourists who come and stay in accommodation facilities.

6.6.2 Environmental Quality and Tourism

The sustainability of the tourism industry is strongly influenced by environmental quality, but tourism activities can also threaten environmental sustainability. For example, waste on the beach has become a problem in some major marine tourism locations, such as in Kuta Beach in Bali. According to Yunanto (2015), garbage comes from tourism activity at Kuta Beach and from the Bali Strait. The impact of garbage at Kuta Beach, in January 2011, has reduced the income of business of up to 71% and increased the cleaning cost by 63% to 75%. Garbage control can be done by increasing cooperation between local governments and communities in Bali Strait watershed, and stakeholders in Kuta Beach.[36] Garbage should be regularly collected and properly disposed in sanitary landfill (not in open dumpsites, beach and mangrove areas), but foremost, garbage generation can also be reduced through responsible consumption, recycling, and reuse.

6.6.3 The Challenge of Sustainable Tourism Development in Indonesia

Indonesia's natural environment, including marine and small island resources is at the core of the overall attractiveness of Indonesian tourism. Exploitation of Indonesia's rich and diverse exotic ecosystem has been widely recognized in various documents, including official reports of the Government of Indonesia (Kemenpar 2012). Referring to the evaluation of the Travel and Tourism Competitiveness Index (TTCI), which includes tourism performance in environmental and natural resource sustainability, the World Economic Forum ranked Indonesia in 42nd position among 136 evaluated countries (WEF, 2017). According to Kemenpar RI (2012), although it can be proved that conditions in some areas are better and in some cases worse, the main challenge of environmental aspect in sustainable tourism development is that environmental sustainability is an issue at all levels of government in Indonesia, not just the tourism ministry. Other more specific challenges include:

- Energy and water consumption as well as waste generation from tourists are almost twice than those of the general population. Tourists consume water and energy more than consumption in their own homes. They also produce more waste left behind in the destinations they visit.

[36] Agung Yunanto. 2015.

- Hotels and restaurants of different operating scales use chemicals and non-biodegradable materials that have polluting effects. Although much remains to be done on a global level, and in Indonesia in particular, the major hotel chains and many independently-owned accommodation providers around the world are meeting the standards for environmentally friendly operations, and improving the environmental performance of the commercial accommodation sector. In general, particularly at the lowest level of accommodation providers, environmental impacts have not been a major concern. Many food stalls, accommodation facilities, and tourist areas in Indonesia are managed without adequate knowledge, especially regarding environmental impacts.

- The large number of domestic visits by private vehicles, especially in densely populated destinations, causes air pollution to be borne by local people and causes unhealthy environments. For example, Bandung, which is a popular urban tourist destination with shopping and culinary facilities as the main attraction, becomes full on weekends. People spend a few days or weekends causing very high traffic densities, especially at toll gates with the queue of vehicles reaching 10 km. There are reports that over the weekend, as many as 200 thousand vehicles entered the city. Heavy traffic and nightlife in the city can cause noise pollution. Destruction of biodiversity and disruption to terrestrial and coastal species can occur due to poor visitation time management. Destruction of coral reefs in various locations is also due to untrained diving tourists. Illegal activities that have taken place in some of the most famous beach destinations are another issue worth noting.

- Tourists can also create an unintentional impact when they visit a place or attraction with a sensitive natural and cultural environment. It is therefore necessary to develop a visitor awareness campaign about the possible impacts that may be caused, such as using signage and interpretable conditions in various languages placed at the entrance gate to various natural or cultural attractions.

- As a human activity, tourism will put pressure on resources in the natural environment. Motivation for short-term gain will be able to override the loss of a clean, healthy and long-lasting natural system. The tourism industry depends on the "health" of the sea and terrestrial environment, so tourism should always be a natural partner for biodiversity conservation in Indonesia. The balance between human, nature and profit through sustainable tourism development for Indonesia needs to be realized.

Box 6.2 Difficulty in implementing sustainable marine tourism in Nusa Penida Islands, Bali.

In the last decade, Nusa Penida Islands were made tourism destinations in addition to Kuta, Ubud and Jimbaran. Tourism has become new livelihood for local people who previously depended on seaweed culture and fishing.

Based on survey conducted by TNC and Agency of Mangrove Management in February 2010, there were 13 species of mangrove and 7 associated mangrove species, 5 species marine birds and 25 species mangrove birds. *Marine Rapid Ecological Assessment* found 296 species of coral reefs, 576 species marine fishes, turtle, shark, dolphins, and rays (manta), which inhabit 230 ha of mangroves, 1,419 ha of coral reefs and 108 ha of seagrass beds.

The Regency government of Klungkung declared sustainable tourism in Nusa Penida.

Nusa Lembongan island, Nusa Penida island, and Nusa Ceningan island are part of tourism area of Nusa Penida Islands, which are known better as *Three Sister Islands*. These islands are also part of the Coral Triangle, and are accessible due to their location near Bali. Tourists can easily visit these islands by speedboat from Sanur or Kusamba Port, and by ferry from Padangbai Port. Unfortunately, the fast development of tourism in Nusa Penida Islands was accompanied by capacity development of the local community, as can be seen in the lack of local tourism management. There is low participation of local people due to inadequate capability.

The challenge of tourism management in Nusa Penida became harder due to the increasing number of tourists. The number of tourists in Nusa Penida was 1,000 to 5,000 tourists per day, while the carrying capacity was about 1,000 tourists per day. Another problem of tourism in Nusa Penida was infrastructure for tourism, such as waste management and avalilability of accommodation, energy and freshwater. Moreover, the sustainability of conservation activities in the marine protected area, which was declared in June 2014, should also be considered.

Source: https://beritabali.com/read/2018/01/23/201801230007/Mimpi-Membangun-Pariwisata-Berkelanjutan-di-Nusa-Penida.html

6.7 Response: Policies, Programs and Plans

6.7.1 Master Plan of National Tourism Development for 2010-2025

Identification of tourism destinations

In the development of national tourism, a policy and plan for the development of long-term national long-term destinations as set forth in the *Government Regulation of the Republic of Indonesia Number 50 of 2011 on the Master Plan of National Tourism Development for 2010-2025*, where there are 50 locations designated as the flagship locations of National Tourism (DPN), namely:

1. DPN. Bali–Nusa Lembongan and surrounding tourism
2. DPN. Komodo–Ruteng and surrounding areas
3. DPN. Borobudur–Yogyakarta and surrounding areas
4. DPN. Lombok – Gili Tramena surrounding areas
5. DPN. Batam–Bintan and surrounding areas
6. DPN. Medan–Toba and surrounding areas
7. DPN. Padang–Bukittinggi and surrounding areas
8. DPN. Bromo–Malang and surrounding areas
9. DPN. Manado–Bunaken and surrounding areas
10. DPN. Sorong–Raja Ampat and surrounding areas
11. DPN. Pangandaran– Nusakambangan and surrounding areas
12. DPN. Toraja–Lorelindu and surrounding areas
13. DPN. Kelimutu–Meumere and surrounding areas
14. DPN. Jakarta–Kep Seribu and surrounding areas
15. DPN. Palembang–Babel and surrounding areas
16. DPN. Palangkaraya–Tanjung Puting and surrounding areas
17. DPN. Makassar–Takabonerate and surrounding areas
18. DPN. Mentawai–Siberut and surrounding areas
19. DPN. Nias–Simeulue and surrounding areas
20. DPN. Kendari–Wakatobi and surrounding areas
21. DPN. Derawan–Kayan Mentarang and surrounding areas
22. DPN. Sentarum–Betung Kerihun and surrounding areas
23. DPN. Ambon–Bandaneira and surrounding areas
24. DPN. Banda Aceh–Weh and surrounding areas
25. DPN. Krakatau–Ujungkulon and surrounding areas
26. DPN. Togean–Gorontalo and surrounding areas
27. DPN. Semarang–Karimunjawa and surrounding areas
28. DPN. Alor–Lembata and surrounding areas

29. DPN. Kupang–Rotendao and surrounding areas
30. DPN. Sumba – Waikabubak and surrounding areas
31. DPN. Moyo–Tambora and surrounding areas
32. DPN. Bandung–Ciwidey and surrounding areas
33. DPN. Solo–Sangiran and surrounding areas
34. DPN. Halmahera–Morotai and surrounding areas
35. DPN. Sentani–Wamena and surrounding areas
36. DPN. Jambi–Kerinci Seblat and surrounding areas
37. DPN. Bogor–Halimun and surrounding areas
38. DPN. Surabaya–Madura and surrounding areas
39. DPN. Pekanbaru–Rupat and surrounding areas
40. DPN. Timika–Lorenzt and surrounding areas
41. DPN. Bengkulu–Enggano and surrounding areas
42. DPN. Natuna–Anambas and surrounding areas
43. DPN. Banjarmasin–Martapura and surrounding areas
44. DPN. Tenggarong–Balikpapan and surrounding areas
45. DPN. Biak–Numfor and surrounding areas
46. DPN. Ijen–Alaspurwo and surrounding areas
47. DPN. Pontianak–Singkawang and surrounding areas
48. DPN. Long Bagun–Melak and surrounding areas
49. DPN. Manokwari–Fak–fak and surrounding areas
50. DPN. Merauke–Wazur.

Among the 50 DPN, 29 (58%) of them are marine-based tourism destinations.

Improving accessibility and transportation system

In the *National Tourism Development Master Plan*, improved accessibility in the long term (2010-2025) is supported by policy directions: (1) the provision and development of road freight transport; river, lake and ocean freight and ferries; air freight; and freight trains; and (2) the provision and development of transport infrastructure, including roads, bridges, airports, seaports, and railways. To realize the above policies, indicators of increased accessibility programs targeting tourism have been developed.

Evidence of efforts to improve the accessibility through accessibility increment in the priority destination areas that have been done until 2015 include:

- Development of 20 airports in 13 national strategic areas of tourism (KSPN) with extension and runway placement, taxiway, apron, fillet and airport facilities,
- Development of 8 seaports in 8 KSPN and 7 docks in 3 KSPN,
- Construction of the terminal/road/railway facilities in 4 KSPN, which received support from the Ministry of Transportation,
- New road construction in 5 KSPN with total 143.72 km, and maintenance, widening, reconstruction and road rehabilitation in 10 KSPN covering 460.29 km

As a maritime country, one of the easiest accessible ways is through the sea. For that, the effort is made to ease the entry of Foreign Tourists to Indonesia in order to increase the number of foreign tourist arrivals as well as realize the vision of Indonesia as a maritime axis of the world through the development of marine tourism. Steps taken through regulatory reform are:

- *Presidential Regulation Number 105 of 2015 On Foreign Tourist Visits (Yacht) to Indonesia* and *Presidential Decree No. 104 on Free Visas* for a visit that provides convenience for foreign tourists/foreign tourist boats (yachts)/cruise ships to visit Indonesia. It includes the removal of Clearance Approval for Indonesia Territory (CAIT), which is considered to be an obstacle for tourist boats. A number of visits of foreign yachts are projected to increase from 750 tourist boats (2014) to 5000 tourist boats (2019), with projected foreign exchange earnings of US$ 500 million.
- *Permenhub No. 121 of 2015 on the Granting of Ease for Travelers Using Cruise Ship Foreign Flags*, which governs the embarkation and/or disembarkation in 5 Indonesian ports. The number of foreign cruise ship visits is projected to increase from 400 (2014) to 1000 cruises (2019), with projected foreign exchange earnings of US$ 300 million.
- *Presidential Regulation no.104 of 2015 on Free Visa* (BVK): the number of the country receiving BVK increased to 90. In 2016, the visit of foreign tourists using the visiting visa (BVK) is projected to increase by 1 million, with corresponding foreign exchange earnings of US$ 1 billion.

6.7.2 Sustainable Tourism

In order to accelerate the implementation of sustainable tourism development nationally, the Indonesian government issued *Minister of Tourism Decree no. 14 of 2016* on **Sustainable Tourism Destination Guidelines**, which is a reference for the Government, Local Governments and other stakeholders in the development of sustainable tourism destinations and schemes for certification of sustainable tourism destinations.

A concrete step implemented by the Indonesian government is the collaboration between the MoT and MOEF in fixing seven national parks, namely Gunung Gede Pangrango National Park, Ujung Kulon National Park, Baluran National Park, Thousand Islands National Park, Way Kambas National Park, Rinjani National Park and Mount Tambora National Park. The aim is to optimize the assets of forests and parks as natural attractions. The restoration works in the parks were based on the principles of sustainable tourism development promoted by the United Nations World Tourism Organization (UNWTO). The upgrading of the national parks includes creating connections within three clusters. The first cluster consists of Lampung and Java, especially West Java and DKI Jakarta. The second cluster is in two areas of East Java, and the third cluster is in West Nusa Tenggara. The three clusters must have integration between nature, culture, and other artificial attractions.

The **Action Plan** for tourism identifies four steps:

- The first step involves strengthening of existing natural tourist destinations by creating clusters (*see Figure 9.1*); developing connectivity of various locations into a cluster and bounded into a single destination; and providing comfort and luxury services for visitors while ensuring conservation in order to obtain higher benefits.
- The second step is to create a new natural tourist destination by developing connectivity of various natural destinations within the cluster.
- The third step is to package and design natural tourism destinations and national parks by taking into consideration their comparative advantages and unique features, as well as the market segments that are going to be developed and integrated into the design of the national strategic areas.
- The fourth step is the realization of PPP (public-private partnership) in the development of nature tourism.

The **Integrated Tourism Master Plans** (ITMPs) aim to avoid the negative impacts of unintegrated tourism development, e.g., degradation of the environmental and cultural resources. For the **Indonesia Tourism Development Program**, MoT coordinates with the Ministry of Public Works and Public Housing (MPWH) and other concerned ministries and agencies.

Indonesia has joined the *UNWTO International Network of Sustainable Tourism Observatories* (INSTO), having five sustainable tourism observatories. This initiative aims to support the continuous improvement of sustainability and resilience in the tourism sector through systematic, timely and regular monitoring of tourism performance and impact, and to connect dedicated destinations to improve destination-wide resource use and foster the responsible management of tourism.

6.7.3 Marine Tourism and Conservation Areas

Marine tourism in Indonesia can have direct economic benefits as well as induced consequences. The tourism industry needs support for improved accessibility (air, land and sea transportation) and the provision of derivative industries, such as: (a) accommodation service industry (hotels, guest houses, homestays, huts, etc.); (b) food industry (food and beverages, including the provision of fish); (c) souvenirs, crafts, etc. The derivative activities of marine tourism also provide sources of income, livelihood and jobs for the local communities as well as increase the country's foreign exchange revenue potential for national development as a whole. The potential foreign exchange earnings from the marine tourism sector can reach US$ 20 billion per year (assuming 20 million tourists and daily expenditures of US$1000 per tourist).

Marine tourism attractions in Indonesia are partly within a marine conservation area that provide various ecosystem services, such as provisioning services (fish), regulating services (climate regulation, carbon sequestration, waste assimilation, protection from waves and storm surge, and coastal erosion prevention), cultural services (recreation, natural aesthetics, spiritual), and supporting services (nutrient cycles, feeding and breeding grounds of marine species). The marine conservation areas destined for tourism activities in Indonesia consist of Marine Ecotourism Park managed by MOEF, and Marine Nature Recreation Park managed by MMAF. There were 55,002 local (Indonesian) visitors and 1,983 foreign visitors to the Marine Ecotourism Parks (Taman Wisata Alam Laut) in 2014 (BPS, 2016).

Indonesia targets 20 million ha of coastal areas, seas and small islands to be established as marine conservation areas. Referring to Costanza et al (2014), the valuation of coastal and marine ecosystem services, is estimated at US$ 575,008/ha/year. Thus, it can be estimated that the potential economic value of ecosystem services from the current marine conservation areas (13.52 million ha) is US$7774.11 billion per year.

Many areas and tourism activities have proven to support the community's economy in a sustainable manner. Good examples in the development of sustainable marine tourism in Indonesia today are Raja Ampat, Wakatobi, Belitung, Labuhan Bajo, Banyuwangi, Lombok, Kepulauan Seribu and Gunung Kidul.

6.7.4 SDGs and Tourism

Tourism has become the fastest growing sector, leading to the growth of the economy and improving the welfare of the people. Tourism has a great potential to accelerate progress across the Sustainable Development Goals (SDGs). It is referenced in three of the Global Goals: SDG 8 (Decent Work and Employment), SDG 14 (Life Below Water); and SDG 12 (Responsible Consumption and Production), and contribute to the achievement of other SDGs, especially SDG 1 (eliminating poverty), SDG 3 (health and well-being), SDG 10 (reduce inequality), SDG 11 (sustainable cities and communities), SDG 15 (Life on Land - maintain the terrestrial ecosystems), and SDG 17 (Partnerships to achieve the goals).

The following are key tourism initiatives to achieve the SDGs:

- Toba Lake Tourism Observatory
- Sanur Tourism Observatory
- Pangandaran Tourism Observatory
- Sleman Tourism Observatory
- Lombok Tourism Observatory
- WISATA Programme Project: establishment of a Destination Management Organisation (DMO) in Flores for sustainable and inclusive ecotourism
- Bali Beach Clean-up
- Educating and empowering local communities for sustainable tourism: The Sumba Hospitality Foundation, Indonesia

7 Ports and Shipping

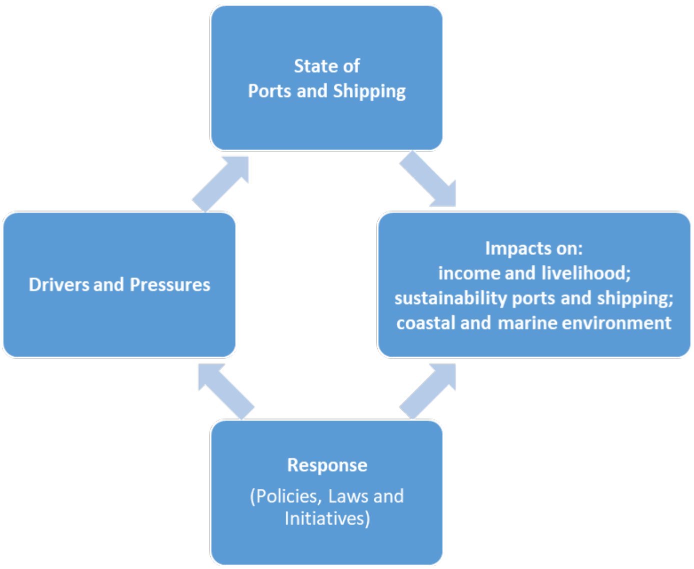



Photo by D. Bautista

Indonesia is an archipelagic country so that the national logistics and shipping system uses the water transportation fleet. KADIN Indonesia (2015) estimated that the potential value of the marine industry business of Indonesia, including the shipping industry, fish processing, the provision of fishing gear, the supply of dive tools and ship engines, would be around US$ 171 billion per year. In particular, the sea transportation business is expected to be worth US$ 20 billion dollars per year.

Both the distribution of fishery products and other goods and tourism require marine transportation. Maritime logistics and connectivity is vital for Indonesia, but the country's ports need improvements in order to reduce the costs associated with moving goods and people.[37] Moreover, adequate shipping safety systems, and ship-building and ship repair industry are essential.

7.1 Navigational Lanes

Indonesia is located in a very strategic position and can serve as a hub in the Asia Pacific region, as can be seen in the important navigational lanes through Indonesian water (**Figure 7.1**).

[37] World Bank. 2015.

Figure 7.1: International Shipping Lines Through Indonesian Waters.

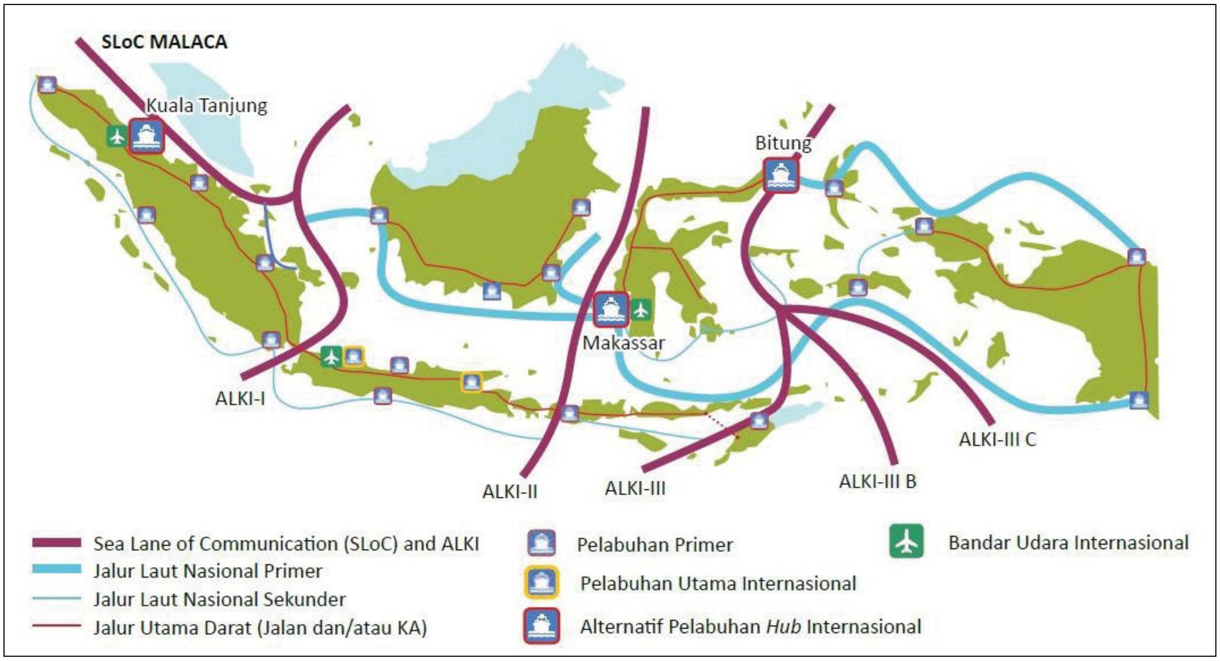
Source: UNCTAD.

Indonesia is the first and only archipelagic state which has designated Archipelagic Sea Lanes (ASLs), which are the routes of navigation passing through the archipelagic waters and territorial seas of Indonesia. Every state has the right of ASL's passage. As it is set out in the United Nations Convention of the Law of the Sea 1982 (UNCLOS), every foreign ship that passes through the ASLs is using the normal mode and unobstructed navigation. However, such ASLs in Indonesia were only considered as 'Partial ASLs' by the International Maritime Organization (IMO). This is due to the lack of the inclusion of all normal passage routes used for international navigation as required by Article 53 (4) of UNCLOS.

Based on the *Government Regulation number 37 of 2002* on the Rights and Obligations of Ships and Foreign Vessels in Implementing the Right of Archipelagic Sea Lane Passage through the Arranged Island Sea Lane, Indonesia established the Indonesian Archipelagic Sea Lane or ALKI, as follows:

1. ALKI I: Voyages from the South China Sea to the Indian Ocean or vice versa, across the Natuna Sea, the Karimata Strait, the Java Sea, and the Sunda Strait
2. AKLI II: Lombok Strait and Makassar Strait
3. ALKI III: Strait Ombai Wetar.

Figure 7.2: Indonesia Archipelagic Sea Lanes (ALKI).



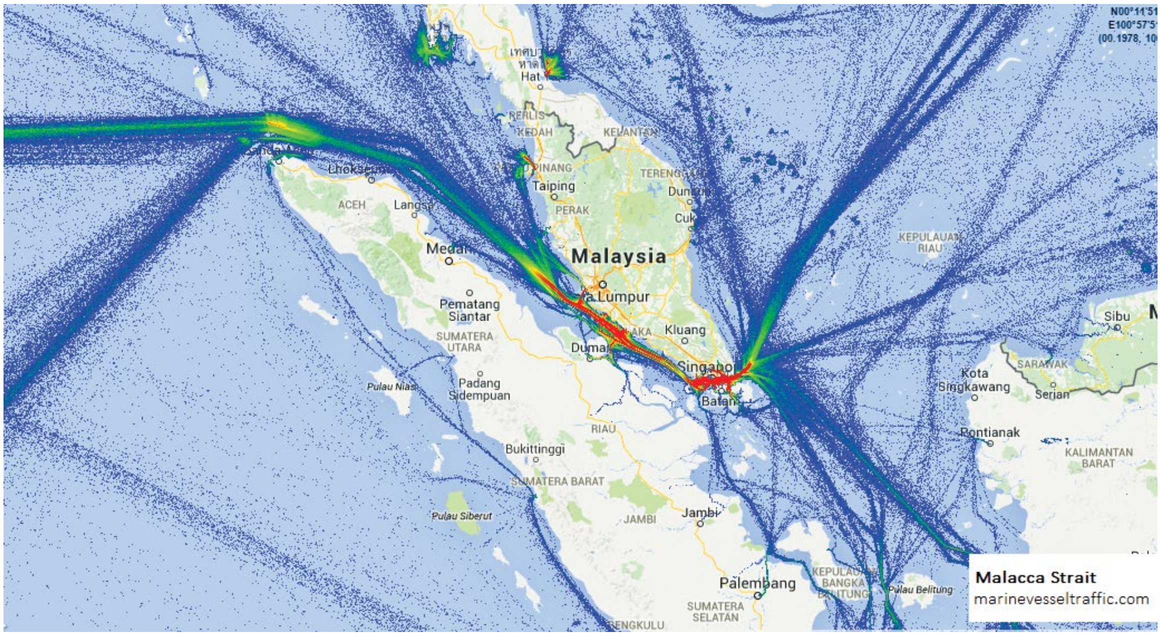
Source: Masterplan of Acceleration and Expansion of Indonesia Economic Development 2011-2025.

7.1.1 Strait of Malacca

The world has three very important and busiest shipping lanes, e.g., the Strait of Malacca, the Panama Canal, and the Suez Canal. The Strait of Malacca, located between Indonesia, Malaysia, and Singapore, connects the Indian Ocean to the South China Sea and the Pacific Ocean. It is the shortest shipping lane from the Horn of Africa and the Persian Gulf, the Indian Ocean to East Asia and the Pacific Ocean based on both cost and the navigation aspects. The Strait of Malacca is also a world oil trade route where approximately 80% of world oil transportation between the Persian Gulf and South China Sea passes through. It is the second-largest oil trade chokepoint in the world after the Strait of Hormuz.[38] The traffic density in the Strait of Malacca is presented in **Figure 7.3**. If the Strait of Malacca were blocked, nearly half of the world's shipping fleet would be required to reroute around the Indonesian archipelago, such as through the Lombok Strait between the Indonesian islands of Bali and Lombok or through the Sunda Strait between the Indonesian islands of Java and Sumatra. Rerouting would tie up global shipping capacity, and result in additional shipping costs, and potentially higher energy prices. At the Strait of Malacca's narrowest point – a natural bottleneck – there is high potential for collisions, grounding, or oil spills. The coastal areas of the littoral states have mangroves, seagrass beds, mudflats and coral reefs that may be affected if a huge oil spill occurs. Piracy is also a major threat to tankers in the Strait of Malacca.

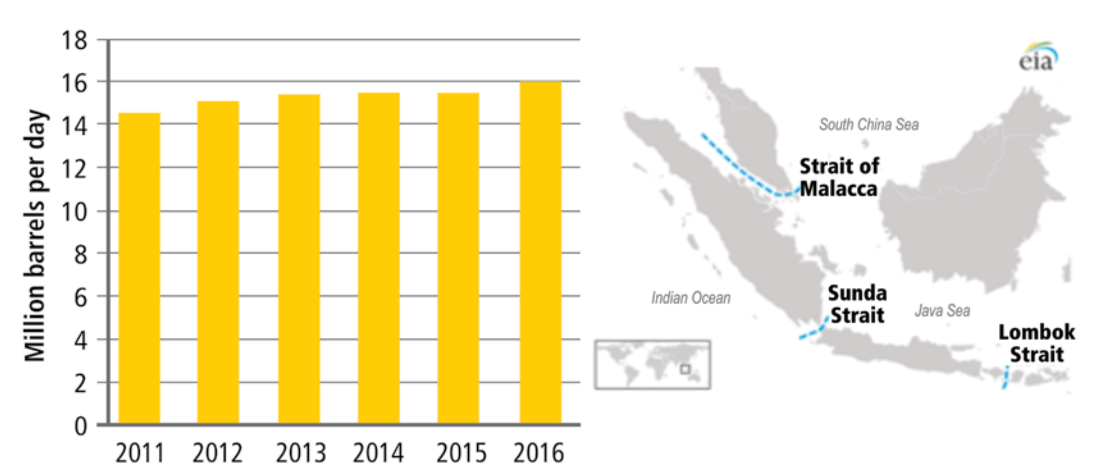
[38] United States Energy Information Administration (EIA). 2017.

Figure 7.3: Traffic Density in Malacca Strait, 2016.



The Strait of Malacca is the primary chokepoint in Asia, where between 85% and 90% of annual total petroleum flows through this chokepoint were crude oil. Petroleum and other liquids transiting the Strait of Malacca reached 16 million barrels per day in 2016 (**Figure 7.4**). With growing liquefied natural gas (LNG) demand, the Strait of Malacca is also an important transit route for LNG from Persian Gulf and African suppliers to East Asian countries. The biggest importers of LNG in the region are Japan and South Korea.

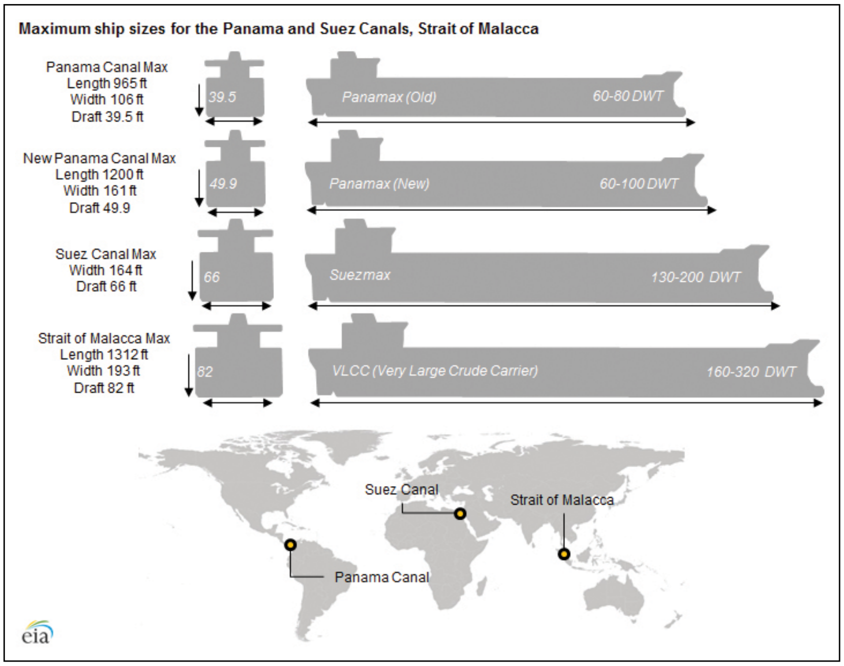
Figure 7.4: Crude Oil and Petroleum Products Transported Through the Strait of Malacca.



Note: Include crude oil and petroleum liquids.
Source: U.S. Energy Information Administration.

The Strait of Malacca is not only the shortest sea lane between Persian Gulf suppliers and Asian markets, it is also capable of transiting the Very Large Crude Carrier (VLCC) ship type – up to 320 deadweight tonnes (DWT), with 82 ft draft, 193 ft width and 1312 ft length (Malacca max), compared to Panama Canal and Suez Canal (**Figure 7.5**). VLCCs have a capacity of 1.9-2.2 million barrels of crude oil. Larger ships, such as Ultra-Large Crude Carriers (ULCC), should use alternative navigation routes with deeper channels, like the Lombok Strait, but this increases the time and cost of shipping.

Figure 7.5: Maximum Ship Size for the Panama Canal, Suez Canal and Malacca Straits.



Source: U.S. Energy Information Administration.

7.1.2 Lombok Strait

Lombok Strait connects the Java Sea to the Indian Ocean, and is located between the islands of Bali and Lombok in Indonesia. As shown in **Figures 7.6a** and **7.6b**, Lombok Strait has an important role, particularly transporting crude oil, LNG, and coal between Australia and East Asia. The narrowest lane of the Lombok Strait is on the southern entrance, approximately 20 km wide between the islands of Lombok and Nusa Penida. The total length of the Lombok Strait is about 60 km, while the depth is approximately 250 m. It will be able to accommodate vessels larger than Malacca max like the ULCCs.

The Lombok Strait is also notable as one of the main passages for the *Indonesian Throughflow* that exchanges water between the Indian Ocean and the Pacific Ocean. It is also part of the biogeographical boundary known as *Wallace Line* where a striking difference between the fauna on either side of the Lombok Strait is notable.

Figure 7.6a: Sea Transport Route for Crude Oil.

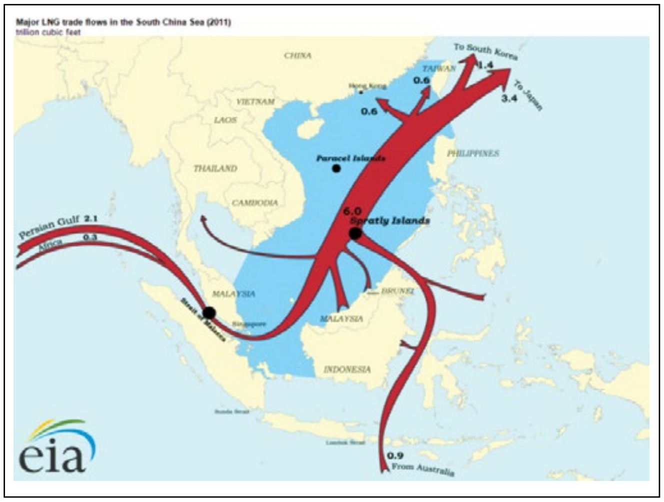
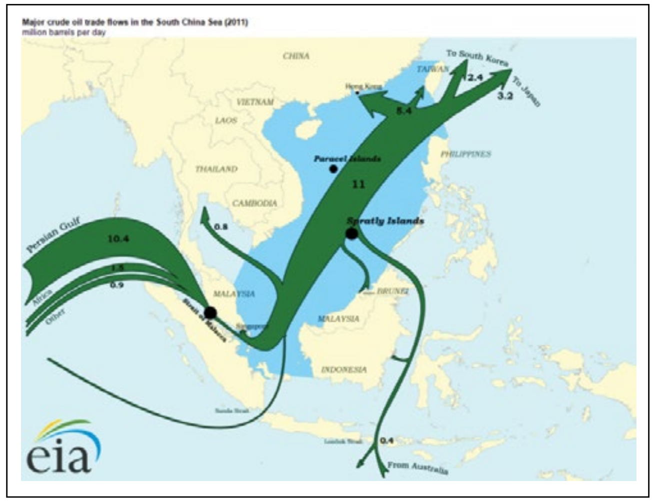


Figure 7.6b: Sea Transport Route for LNG.



Source: U.S. Energy Information Administration.

7.2 Ports

Based on the structure or hierarchy, ports in Indonesia can be classified into three types:

- Main Port (Hub Port - National and International)
- Collector Ports
- Feeder Port (Regional and Local)

The **Main Port** is a hub port whose main function is to serve domestic and international sea transport activities; transfer of domestic and international cargo in large quantities (through container ships), and as the place of origin and/or destination of passengers, goods and ferry transport.

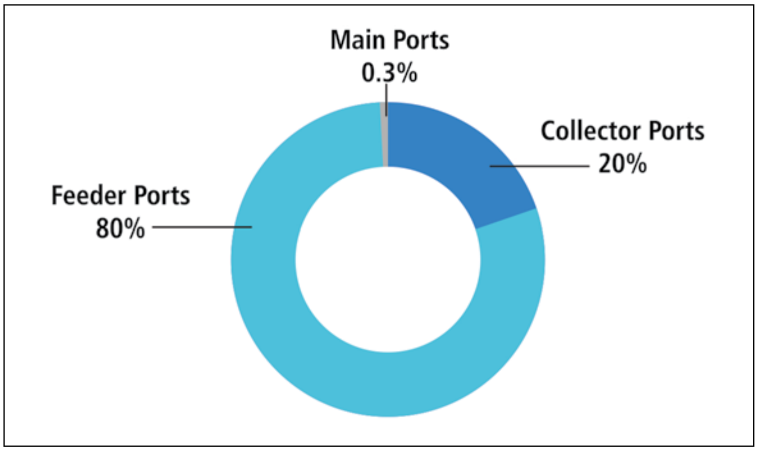
The Collector Port is a port whose main function is to serve domestic sea transport activities only, e.g., transfer of domestic cargo in medium quantities, and as a place of origin or destination of domestic passengers and/or goods, as well as ferry transport with coverage of interprovincial services.

The **Feeder Port** is a port whose main function is to serve the domestic sea transport activities, the restructuring of domestic sea transport in limited quantities, which is a feeder for the main port and collection port, and as the place of origin of the passenger and/or goods destinations, and the ferry transportation with service coverage within the province.

In 2015, there were 1,241 ports, both commercial and non-commercial, which are categorized into three types of ports, as shown in **Figure 7.7**:

- 4 main ports (0.3%)
- 246 collector ports (20%)
- 991 regional or local feeder ports (80%)

Figure 7.7: Port Composition Based on Hierarchy.



Currently, most of the port activities are carried out in 25 strategic ports located in 21 provinces. The strategic port operates freight and passenger activities for both domestic and international shipping. The ports are Lhokseumawe Harbor, Belawan, Teluk Bayur, Dumai, Pekanbaru, Palembang, Panjang, Tanjung Pinang, Batam, Tanjung Priok, Tanjung Emas, Tanjung Perak, Banten, Benoa, Tenau, Pontianak, Banjarmasin, Balikpapan, Samarinda, Bitung, Makassar, Ambon, Sorong, Jayapura, and Biak.

Not all strategic ports are main ports. Officially, Indonesia has four main ports, which are managed by PT Pelabuhan Indonesia (Pelindo) I, II, III, and IV:

- Belawan Port which is handled by PT. Pelindo 1
- Tanjung Priok Port handled by PT. Pelindo II
- Tanjung Perak Port handled by PT. Pelindo III
- Makassar Port handled by PT. Pelindo IV

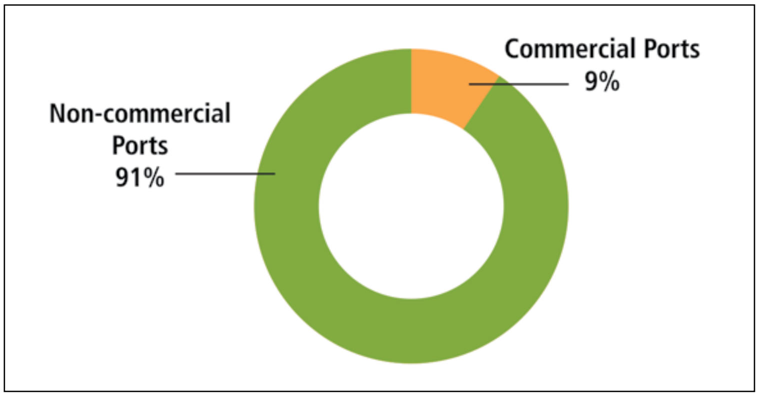
For ports that have only goods traffic and no passengers, Indonesian ports are classified into commercial ports, non-commercial ports, and specialized/private ports:

1. The **commercial ports** are managed by four state-owned companies, namely PT Pelindo I, II, III and IV. Pelindo has a monopoly on main commercial ports as well as regulatory authority over private ports. Virtually, in all of the major ports, Pelindo acts both as a single operator and port authority, dominating the provision of major port services. The commercial ports have facilities for a variety of commodities, including bulk cargo and containers.
2. **Non-commercial ports** are under the Directorate General of Sea Transportation (DGST), Ministry of Transportation. These ports tend to be unprofitable, but they are necessary from the aspect of community need, especially in pioneer areas and remote islands.
3. **Specialized ports** or **private ports** serve the needs of a single company (both private and state-owned) in a number of industries like mining, oil and gas, coal, fisheries, and forestry.

Some of these ports have facilities that are only suitable for one or a group of commodities and have limited capacity to accommodate third party cargo.

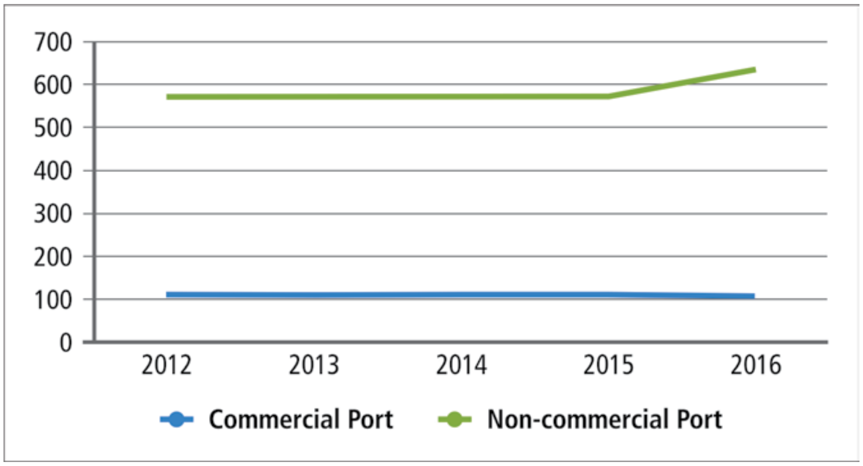
In 2015, there were 1,241 ports, of which 1,130 are non-commercial ports and 111 are commercial ports (**Figure 7.8**). There are also 11 container ports.

Figure 7.8: Commercial and Non-commercial Ports in Indonesia.



The number of commercial ports in 2016 decreased to 108 units from 111 units in 2015, while the number of non-commercial ports increased from 574 units in 2015 to 635 units in 2016 (**Figure 7.9**).

Figure 7.9: Number of Commercial and Non-commercial Ports, 2012-2016.



Source: Dirjen Hubla (DGST). Ministry of Transportation, 2016.

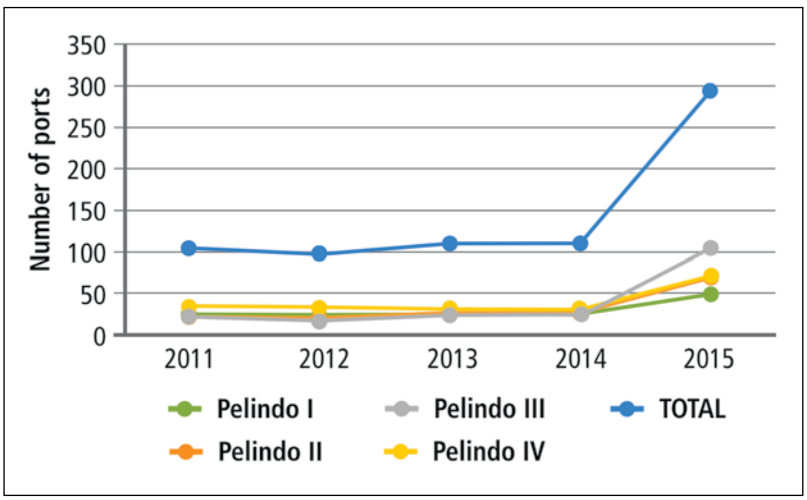
Jakarta's Tanjung Priok port, through which 70% of Indonesia's container exports and imports pass, is the main international gateway as well as a major gateway for domestic trade.

7.3 Port and Shipping Sector Performance

7.3.1 Development of Docks and Piers

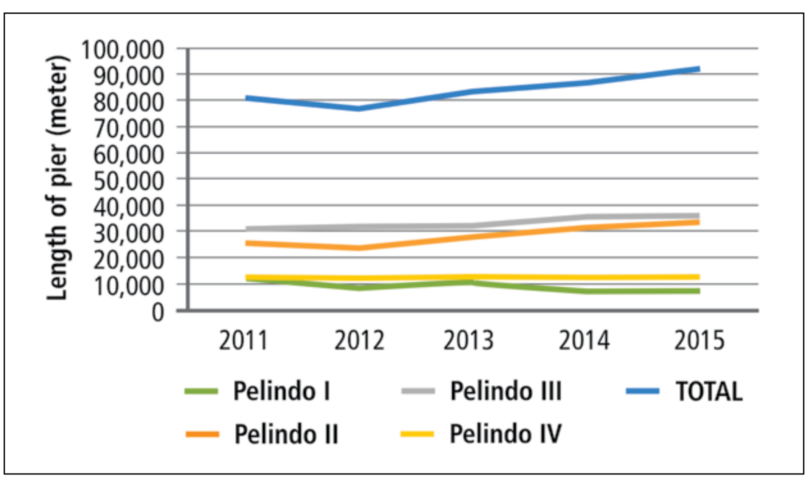
The development of harbour docks and piers is handled by Pelindo I-IV. There seems to be a signficant increase in number of harbour docks and piers in 2015 when compared to the previous year. In 2014, the number of harbour docks was 109, and it increased to 293 in 2015, as can be seen in **Figure 7.10**. This increase, however, is due to the take over of non-commercial seaports by Pelindo and converting them to commercial ports, and not in the sense of new port development or the additional docks and piers. Moreover, the increase of pier length in 2014 to 2015 was not significant as can be seen in **Figure 7.11**. The total length of piers managed by Pelindo I-IV was 91,313 m in 2015, increasing only by about 1% from the previous year (86,651.15 m). Pelindo II has highest increase in the length of the pier compared to other Pelindo ports, while Pelindo III has the longest pier.

Figure 7.10: Total Port Development.



Source: Direktorat Kepelabuhan, Ditjen Hubla (DGST).

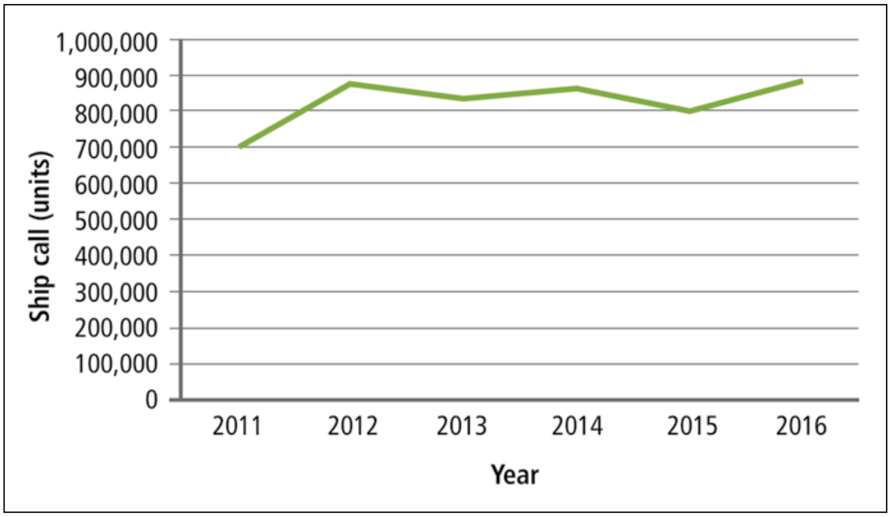
Figure 7.11: Development of Port Docks and Piers Managed by Pelindo I to III.



7.3.2 Number of Ship Calls

In 2017, there were 842,086 ship calls at the ports in Indonesia. This was a decline from the number of ship calls in 2016. There were 882,720 ship calls in 2016, an increase of 11.88% compared to the 2015 (**Figure 7.12**).

Figure 7.12: Number of Ships Call in Indonesia.



The visits of ships in Indonesian ports, reached 798.52 thousand units in 2015, and this was 7.47% lower compared to that of 2014. With a total volume of 1,360.05 million gross tonnage (GT), the average GT vessel visiting the port in Indonesia reached 1.70 thousand GT, which was 8.13% lower than that of 2014.

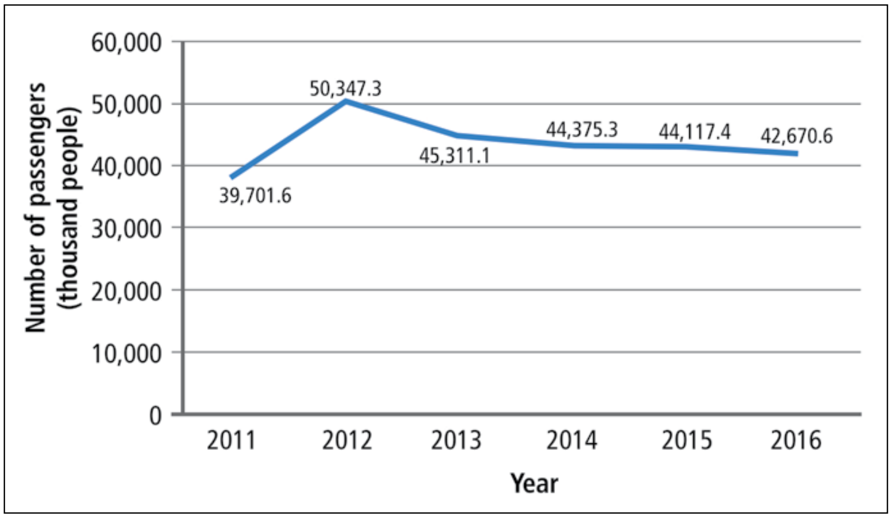
7.3.3 Number of Passengers

There was a decline in the number of passengers (disembarked and embarked) – from 44,117,400 people in 2015 to 42,670,600 people in 2016, a decrease of 3.28% (**Figure 7.13**). The number of passengers, in 2015, was 22.28 million for departing passengers and 21.83 million for arriving passengers. When compared to 2014, the departing and arriving passengers decreased by 0.41% and 0.76%, respectively.

Ferry terminal in Batam.

Ferry terminal in Bintan.

Figure 7.13: Number of Passengers in Indonesia 2011-2016.



7.3.4 Cargo and Containers

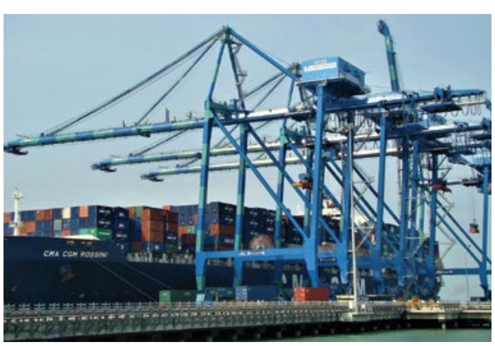
Inter-island cargo unloading was 409 million tonnes in 2017, and increased to 410 million tonnes in 2018. On the other hand, approximately 334 million tonnes of ship freight were loaded at domestic or inter-island ports in 2017.

Table 7.1: Loaded and Unloaded Cargo in 2017 (tonnes).

	Inter-Island	International	Total
Loaded	334,109,441	272,404,192	606,513,633
Unloaded	409,335,297	105,491,266	514,826,563
			1,121,340,196

Source: BPS. Statistik Indonesia.

In 2015, the share of loading and unloading of domestic goods in 25 strategic ports reached 47.69% and 24.18% respectively. Meanwhile, the composition of loading and unloading of international goods in strategic ports reached 61.70% and 44.82%, respectively. **Table 7.2** and **Table 7.3** show the trend of loading and unloading activities in domestic and overseas shipping goods at the ports in 2001-2015.



Belawan Port.

Cargo ships in Port of Tanjung Perak in Surabaya. *(Photo by D. Bautista)*

Table 7.2: Loading and Unloading of Domestic Cargo at Ports, 2001-2015.

Year	Unloaded	Loaded
2001	156,042	135,298
2002	170,201	137,949
2003	178,154	127,305
2004	171,383	129,794
2005	162,533	150,331
2006	151,417	123,135
2007	165,632	161,046
2008	243,312	170,895
2009	249,052	242,110
2010	221,675	182,486
2011	284,292	238,940
2012	327,715	312,599
2013	336,063	303,881
2014	381,602	328,743
2015	296,336	294,309

Source: Port Authority - SIMOPPEL.

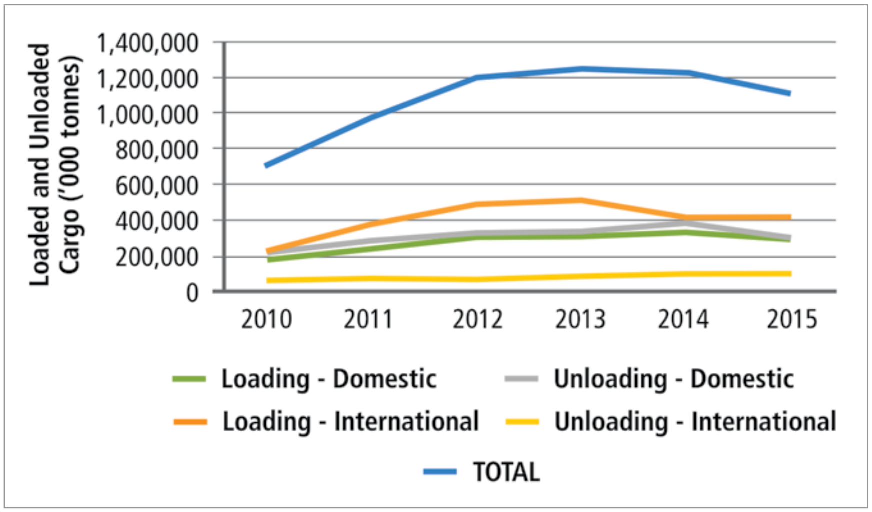
Table 7.3: Loading and Unloading of International Cargo at Ports in 2001-2015.

Year	Unloaded	Loaded
2001	51,660	154,435
2002	53,778	163,340
2003	69,620	153,436
2004	56,864	149,130
2005	50,386	160,743
2006	45,172	145,891
2007	55,347	218,736
2008	44,925	145,120
2009	61,260	223,555
2010	65,641	233,222
2011	78,836	376,652
2012	69,645	488,264
2013	89,512	510,699
2014	100,570	417,155
2015	98,858	340,001

Source: Port Authority – SIMOPPEL.

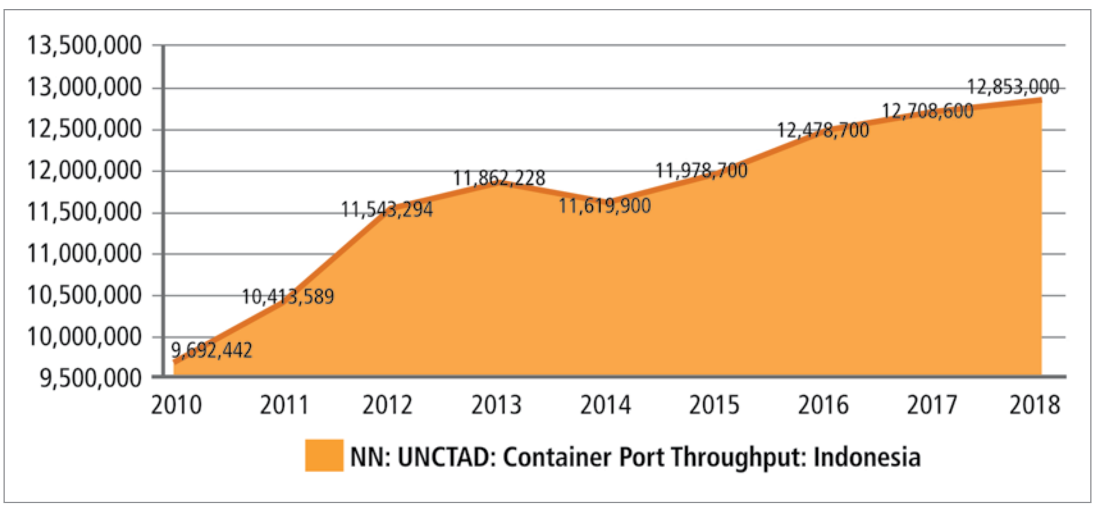
The volume of loaded and unloaded cargo at domestic and international ports in Indonesia (**Figure 7.14**) is affected by the fluctuations in exports and imports and world economic slowdown. However, the container throughput in Indonesia has been increasing since 2010. In 2018, container port throughput was 12,853,000 TEU (**Figure 7.15**).

Figure 7.14: Domestic and International Loaded and Unloaded Cargo, 2010-2015.



Source: Statistik Perhubungan, 2016.

Figure 7.15: Container Throughput (TEU).



Source: United Nations Conference on Trade and Development (UNCTAD).

7.3.5 Ship Turnaround Time

The ship turnaround time—time that is taken between the arrival of a vessel and its departure—is used to measure the efficiency of port operations. The port performance requires a set of measures, such as waiting time for vessels to berth; ratio of Effective Time to Berth Time (ET:BT); berth occupancy rate and vessels stay at port; working time; rate of loading/unloading the cargo;

and quality storage (warehouses) and inland transport. In terms of waiting time of vessels at the main ports, the standard time has been achieved, except in Belawan Port (**Table 7.4**). Only Makassar Port achieved the standard for the Approach Time.

Table 7.4: Performance of the Main Ports, 2014.

Main Port	Waiting Time (hour)		Approach Time (hour)		ET:BT (%)	
	Standard	Achievement	Standard	Achievement	Standard	Achievement
Belawan	1	1.21	2	2.71	70	56.01
Tanjung Priok	1	0.29	2	2.36	80	79.22
Tanjung Perak	2	1.94	4	4.31	80	70.16
Makassar	1	0.48	1	0.79	80	86.27

Source: Dirjen Hubla (DGST), 2015.

Indonesia has standard port performance indicators that are regulated and monitored by the Ministry of Transportation, but different ports have different minimum standards. In 2013, the average waiting time for ships to berth was lower, at around 0.73 hour, compared to 0.83 hour in 2012. This means the port performance in Indonesia is improving in terms of waiting time, but not with the Approach Time (**Table 7.5**).

Table 7.5: Port Performance Indicators 2012-2013 in Indonesia.

Year	2012			2013		
Port performance indicator	Waiting Time (hour)	Approach Time (hour)	ET:BT (%)	Waiting Time (hour)	Approach Time (hour)	ET:BT (%)
Value	0.83	2.32	61.41	0.73	2.31	59.92

Source: Dirjen Hubla (DGST), 2015.

More recent data show that the general picture is of a port sector in which ship turnaround time and cargo handling performance is relatively poor, but within which certain facilities — in particular the main international container terminals at Jakarta and Surabaya — have been able to achieve international performance standards, in partnership with leading global terminal operators (OECD; UNCTAD).

7.3.6 Performance of Ports by Province

The total (inter-island and international) loaded and unloaded cargo in 2017 was 514.8 million tonnes and 606.5 million tonnes, respectively (**Table 7.6**). Kalimantan Selatan has the highest volume of loaded and unloaded cargo. The ship calls by province, in terms of number and gross tonnage (GT) are shown in **Table 7.7**. There were 842,086 ship calls in 2017, with the Kepuluan Riau Province having the most number of ships calls.

Table 7.6: Loaded and Unloaded Cargo by Province and By Type of Voyage, 2017 (tonnes).

No.	Province	Inter-island		International	
		Unloaded	Loaded	Unloaded	Loaded
1	Aceh	3,010,929	1,753,946	99,017	1,037,890
2	Sumatera Utara	7,313,024	1,013,695	4,520,145	3,564,916
3	Sumatera Barat	5,759,718	4,917,022	381,527	3,823,403
4	Riau	15,636,082	16,408,802	2,646,882	10,481,064
5	Jambi	4,258,632	1,140,605	475,298	2,190,196
6	Sumatera Selatan	1,635,237	1,187,189	660,172	1,713,030
7	Bengkulu	379,887	1,292,318	50,631	1,497,074
8	Lampung	4,076,253	15,626,311	3,287,531	5,512,054
9	Kepulauan Bangka Belitung	2,398,598	5,865,273	188,054	321,669
10	Kepuluan Riau	8,879,394	8,623,567	5,243,815	8,388,824
11	DKI Jakarta	12,633,392	15,053,145	15,643,182	4,814,942
12	Jawa Barat	16,503,279	2,079,203	2,639,343	526,711
13	Jawa Tengah	21,687,281	8,462,882	5,012,799	2,093,717
14	DI Yogyakarta	-	-	-	-
15	Jawa Timur	45,611,514	17,522,323	15,966,746	3,788,724
16	Banten	59,794,934	18,657,038	35,150,440	6,889,904
17	Bali	1,933,189	221,727	8,502	1,020
18	Nusa Tenggara Barat	1,724,531	793,676	39,304	0
19	Nusa Tenggara Timur	2,568,076	1,345,984	3,988	0
20	Kalimantan Barat	5,298,612	2,578,301	167,745	1,414,925
21	Kalimantan Tengah	4,961,410	9,261,806	190,795	1,300,610
22	Kalimantan Selatan	105,661,474	134,728,670	1,826,805	126,650,780
23	Kalimantan Timur	17,388,921	27,606,517	5,726,211	71,834,890
24	Kalimantan Utara	1,799,791	6,764,623	137,645	5,417,802
25	Sulawesi Utara	10,612,613	2,550,088	149,983	424,544
26	Sulawesi Tengah	14,176,568	2,998,120	2,272,420	3,219,709
27	Sulawesi Selatan	13,151,101	9,986,307	2,064,680	955,524
28	Sulawesi Tenggara	6,445,237	5,580,592	176,128	1,289,432
29	Gorontalo	1,161,225	474,387	15,309	12,005
30	Sulawesi Barat	416,639	826,384	58,546	354,131
31	Maluku	2,939,011	1,551,200	0	51,674
32	Maluku Utara	1,859,373	3,447,261	371,711	1,784,585
33	Papua Barat	2,940,712	1,619,542	1,000	8,096
34	Papua	4,718,660	2,170,937	314,912	1,040,347
	TOTAL	**409,335,297**	**334,109,441**	**105,491,266**	**272,404,192**

Source: BPS. Statistik Indonesia.

Table 7.7: Number of Calls of Domestic and International Voyage by Province, 2017.

No.	Province	Units	GT
1	Aceh	7,087	11,515,855
2	Sumatera Utara	23,938	38,933,755
3	Sumatera Barat	6,801	13,900,383
4	Riau	90,642	67,404,764
5	Jambi	3,107	3,784,135
6	Sumatera Selatan	4,279	6,828,043
7	Bengkulu	1,421	3,025,734
8	Lampung	5,931	38,126,141
9	Kepulauan Bangka Belitung	10,882	8,262,140
10	Kepuluan Riau	203,844	101,337,015
11	DKI Jakarta	17,704	145,247,354
12	Jawa Barat	6,633	26,767,012
13	Jawa Tengah	17,896	63,520,777
14	DI Yogyakarta	0	0
15	Jawa Timur	50,146	167,055,090
16	Banten	17,494	75,705,672
17	Bali	29,701	7,462,706
18	Nusa Tenggara Barat	4,785	5,669,836
19	Nusa Tenggara Timur	40,921	24,150,341
20	Kalimantan Barat	6,905	9,107,786
21	Kalimantan Tengah	7,971	12,189,496
22	Kalimantan Selatan	76,385	350,333,865
23	Kalimantan Timur	30,667	227,026,210
24	Kalimantan Utara	12,238	29,802,903
25	Sulawesi Utara	12,810	19,420,782
26	Sulawesi Tengah	18,605	33,225,698
27	Sulawesi Selatan	30,791	52,345,530
28	Sulawesi Tenggara	38,363	38,401,339
29	Gorontalo	2,636	2,464,675
30	Sulawesi Barat	3,417	2,081,011
31	Maluku	21,914	30,983,573
32	Maluku Utara	20,171	17,299,754
33	Papua Barat	7,456	22,148,731
34	Papua	8,545	22,618,027
	TOTAL	**842,086**	**1,678,146,133**

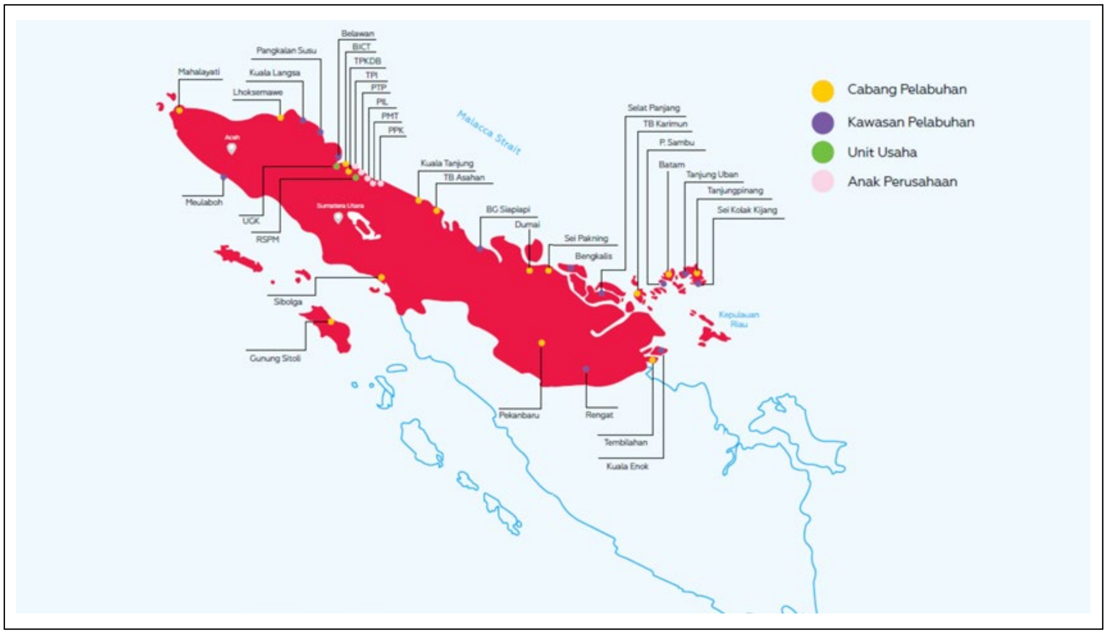
Source: BPS. Statistik Indonesia.

7.3.7 Performance of Ports Managed by Pelindo

Pelindo I

Pelindo I has one main port, three Class I ports, four Class II Ports, three Class III Ports, three Class IV Ports and two Class V Ports, as can be seen in **Figure 7.16** and **Table 7.8**.

Figure 7.16: Port Location Managed by Pelindo I.



Source: Annual Report PT Pelindo I.

Table 7.8: Ports Managed by Pelindo I.

No.	Port Branch	Class Branch	Area
1	Belawan	Primary/Main	Pangkalan Susu/Brandan
2	Dumai	Class I	a. Bagan Siapi-api b. Bengkalis
3	Belawan International Container Terminal	Class I	-
4	Terminal Petikemas Domestik Belawan	Class I	-
5	Tanjung Pinang	Class II	a. Sei Kolak Kijang b. Tanjung Uban
6	Pekan Baru	Class II	Rengat
7	Tanjung Balai Karimun	Class II	Selat Panjang
8	Kuala Tanjung	Class II	-
9	Batam	Class III	Pulau Sambu
10	Sungai Pakning	Class III	-

Table 7.8: Ports Managed by Pelindo I. (cont.)

No.	Port Branch	Class Branch	Area
11	Sibolga	Class III	-
12	Malahayati	Class IV	Meulaboh
13	Lhokseumawe	Class IV	Kuala Langsa
14	Tanjung Balai Asahan	Class IV	-
15	Tembilahan	Class V	a. Kuala Enok b. Rengat
16	Gunung Sitoli	Class V	-

Pelindo I business activities, based on *Minister of Transportation Decree no. KP 133 of 2011* dated March 2, 2011, concerning Granting of Business License to PT Pelabuhan Indonesia I as Business Entity (Persero), are as follows:

- Provision and/or service of the dock for tethering.
- Provision and/or service of refueling oil and water service.
- Provision and/or service facilities up and down passengers and/or vehicles.
- Provision and/or service of the dock for the implementation of loading and unloading activities of goods and containers.
- Provision and/or service of the warehouse, stockpiling, loading and unloading equipment, and port equipment.
- Provision and/or service of the container terminal, bulk liquid, dry bulk, and Ro-Ro.
- Provision and/or service of loading and unloading of goods.
- Provision and/or service of distribution center and consolidation of goods, and/or
- Provision and/or service of ship delays.

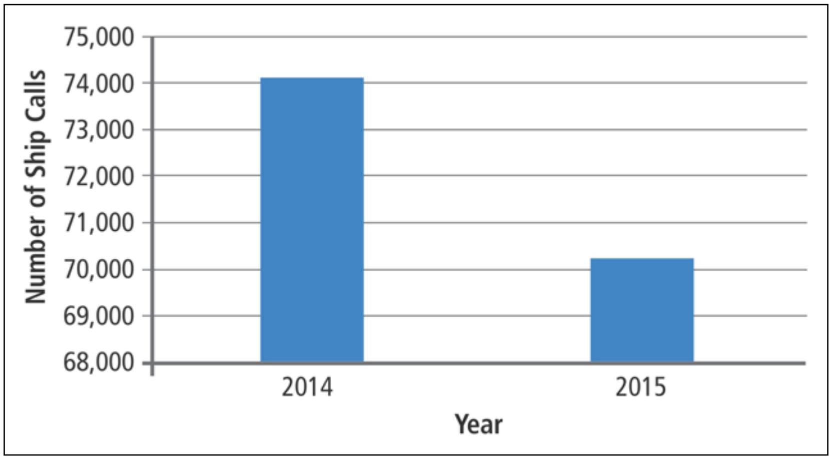
Pelindo I ports that have obtained the International Ship and Port Facility Security (ISPS) Code certificate are:

- Belawan Harbor
- Belawan International Container Terminal
- Dumai Port
- Port of Tanjung pinang
- Port of Lhokseumawe
- Port of Tanjung Balai Karimun
- Sei Pakning Port
- Port of Kuala Tanjung
- Port of Malahayati
- Port of Tanjung Balai Asahan
- Peti Kemas Container Terminal

Ship calls

Ship calls to the ports, which are managed by PT Pelindo I, have increased in 2011 to 2016, but there was a decrease in 2014-2015. As shown in **Figure 7.17**, the number of ship calls decreased from 74,106 calls in 2014 to 70,258 calls in 2015.

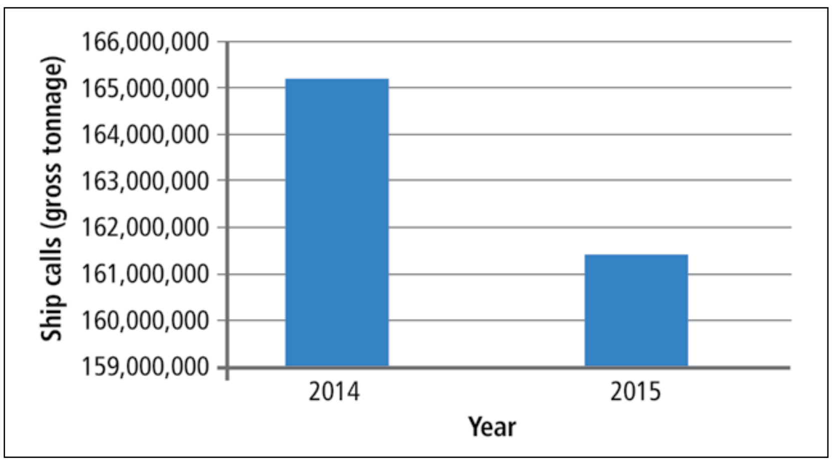
Figure 7.17: Ship Calls at the Ports Managed by Pelindo I.



Source: PT Pelindo I. Annual Report 2015.

Likewise, the gross tonnage of ship calls decreased from 165,179,215 GT in 2014 to 161,401,955 GT in 2015 **Figure 7.18**.

Figure 7.18: Ship Calls at the Ports Managed by Pelindo I, in Gross Tonnage.

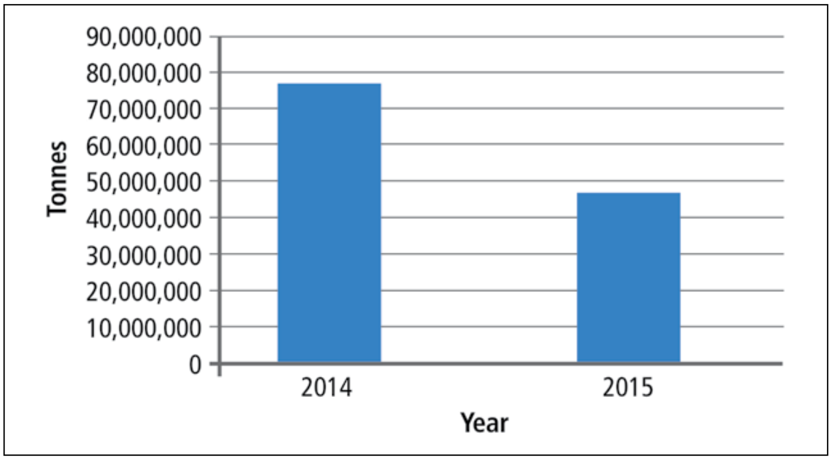


Source: PT Pelindo I. Annual Report 2015.

Cargo loading and unloading

Loading and unloading of cargoes at the ports managed by Pelindo I have decreased from 2011 to 2015 . In particular, the loaded and unloaded cargo decreased from 77,140,809 tonnes in 2014 to 46,906,025 tonnes in 2015 as can be seen in **Figure 7.19**.

Figure 7.19: Loaded and Unloaded Cargo at the Ports Managed by Pelindo I.

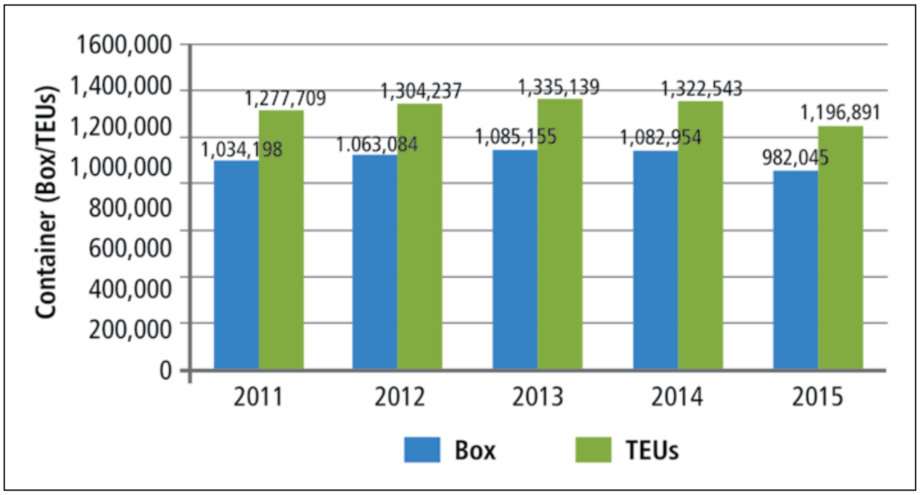


Source: PT Pelindo I. Annual Report 2015.

Container handling

Container stevedoring at Pelindo I have increased in 2011-2013, and decreased in 2014 to 2015 as shown in **Figure 7.20**. In 2014, the number of containers of 1,322,543 TEUs decreased to 1,196,891 in 2015. The volume of containers loaded and unloaded in ports managed by Pelindo I increased from 1,277,709 TEUs in 2011 to 1,335,139 TEUs in 2013, and then decreased to 1,322,543 TEUs in 2014 and 1,196,891 in 2015. Likewise, the number of containers decreased from 1,082,954 boxes in 2014 to 982,045 boxes in 2015.

Figure 7.20: Loading and Unloading of Containers in Ports Managed by Pelindo I.

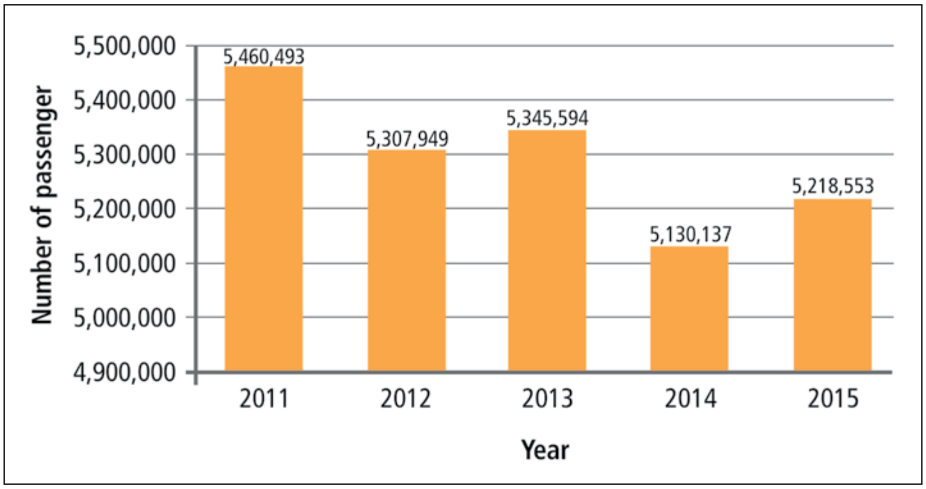


Source: PT Pelindo I. Annual Report 2015.

Passenger flows

Passenger flows at Pelindo I port have decreased in a five-year period, 2011-2015, although there was an increase from 5,130,137 people in 2014 to 5,218,553 people in 2015 as illustrated in **Figure 7.21**.

Figure 7.21: Passenger Flow at the Ports Managed by Pelindo I.



Source: PT Pelindo I. Annual Report 2015.

Pelindo II

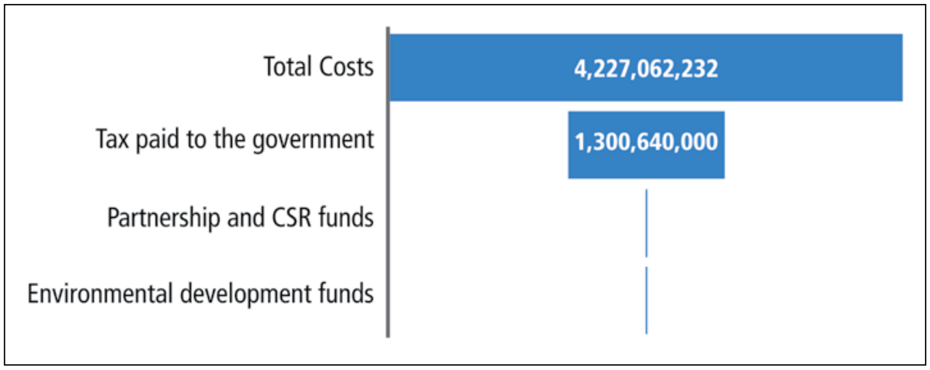
PT. Pelindo II has working port areas on Sumatera Island, Kalimantan Island and part of Java Island with 12 branches, namely:

1. Tanjung Priok Harbour
2. Port of Palembang
3. Long Port
4. Port of Pontianak
5. Teluk Bayur Harbor
6. Port of Banten
7. Port of Bengkulu
8. Port of Cirebon
9. Port of Jambi
10. Port of Pangkal Balam
11. Sunda Kelapa Harbor
12. Port of Tanjung Pandan

Economic Value

The economic contribution of PT. Pelindo II can be observed not only in terms of the direct benefits to its employees (in form of wages) and shareholders, but also from the taxes it paid and contributed to the State revenues, and at a smaller amount, from its Environmental Development and corporate social responsibility (CSR) programs, which contributed to the welfare of the community (**Figure 7.22**).

Figure 7.22: Economic Contribution of PT. Pelindo II in 2016 (thousands IDR).



7.4 Socioeconomic Contribution

7.4.1 Role of Ports and Shipping in National Economy

The GDP of sea transport in 2017 is around 0.23% of total GDP (in 2010 constant prices). Considering the archipelagic nature of the country and its vision to be a center of maritime axis, there is a need to invest in ports and supporting infrastructure, and recognize that the ports and shipping sector is essential in trade, logistics and transport of goods, and inter-island travel and tourism.

Table 7.9: GDP of Sea Transport Industry.

	2014	2015	2016	2017	2018
GDP of Sea Transport (in 2010 constant prices)					
Billion IDR*	**29,473.7**	**30,174.0**	**30,550.9**	**31,969.1**	**34,276.4**
In US$***	**2,202,680,361.1**	**2,255,016,411.8**	**2,283,183,565.1**	**2,389,170,980.6**	**2,561,604,180.3**
GDP (US$, 2010 constant prices)**	942,184,637,117	988,128,596,686	1,037,861,792,573	1,090,454,467,115	1,146,844,815,417
Share of sea transport in total GDP	**0.23%**	**0.23%**	**0.22%**	**0.22%**	**0.22%**

*Source: *BPS. Statistik Indonesia; **World Bank 2019; ***Exchange rate: IDR 13380.83/US$1.*

7.4.2 Employment and Human Resource Development

The workforce (logging workers) at ports managed by Pelindo I decreased in 2015 compared to the previous year by 5.2% (**Figure 7.23**). In 2014, there were 1260 people in the workforce, but declined to 1191 people in 2015. In terms of gender composition, in 2015, the percentage of the female workforce at Pelindo I was 17% compared to 83% for male (**Figure 7.24**).

Figure 7.23: Number of Workers at the Ports Managed by Pelindo I.

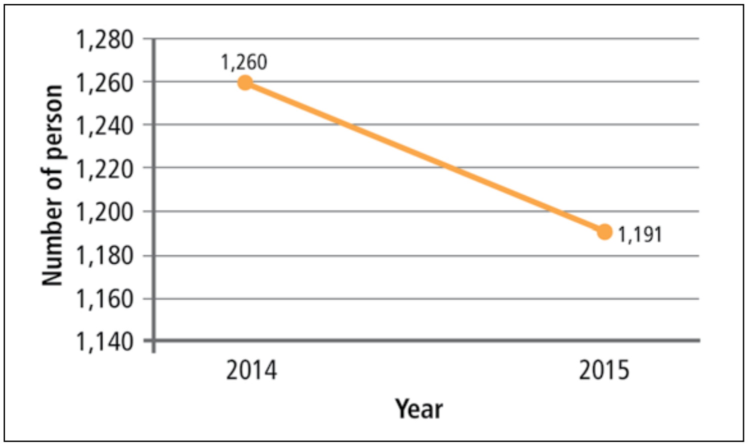
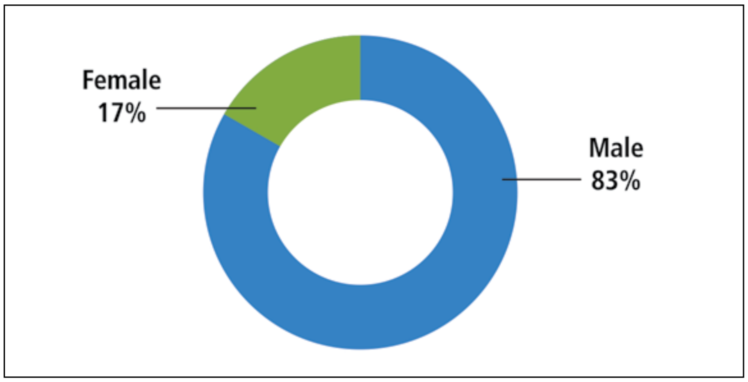


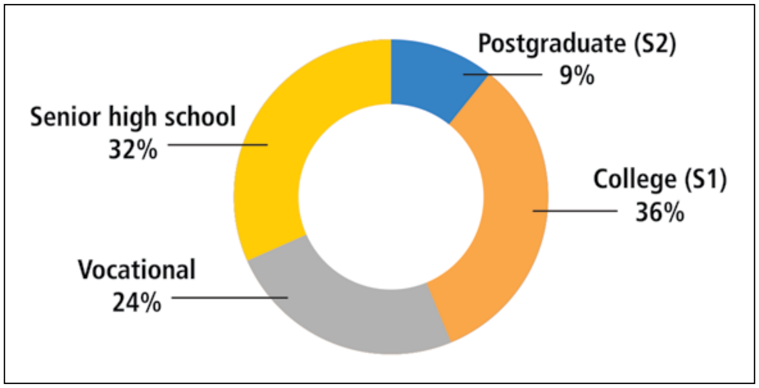
Figure 7.24: Gender Composition of Workers in Pelindo I Ports in 2015.



The composition of the workers at the ports managed by Pelindo I based on educational attainment is as follows: postgraduate (S2, 9%), bachelor's or college degree (S1, 36%), vocational school (24%) and senior high school (32%). As can be seen in **Figure 7.25**, the percentage of the largest workforce in the ports procured by Pelindo I is the undergraduate level (S1), and the smallest percentage is the postgraduate level (S2). In order to improve the quality of port human resources, Pelindo I management will undertake the following activities:

- Application of superior performance culture (implementation of performance management system)
- Application of work culture (internalization of Cipta)
- Implementation of performance-based remuneration system (incentives and bonuses) with the support of ICT-based applications
- Training and analysis-based employee training and development programs, particularly competency improvement on terminal business, marine business, logistics business and other supporting business (Annual Report PT Pelindo I, 2015).

Figure 7.25: Composition of Workers in Pelindo I Ports Based on Educational Level.



7.5 Port Development and Investment

7.5.1 Current Concessions in Indonesia

Based on *Law Number 17 of 2008 on Shipping, Government Regulation Number 61 of 2009* and *Government Regulation Number 64 of 2015*, the port management and investment should be done by concession mechanism. The concession for the seaports shall be implemented based on *PM Number 15 of 2015 and PM number 166 of 2015* on concession and other forms of cooperation between the government and port business entity in the seaport field. The concession is the granting of rights by the Port Operator to the Port Business Entity to perform certain port activities and/or services within a certain period of time and certain compensation. Other forms of cooperation between port operators and port business entities include utilization cooperation, leasing, contract management, and joint operation.

There are two kinds of concession given to business namely:

1. Granting of concessions through bidding and auctions (carried out in accordance with applicable laws) and
2. Granting of concessions through assignments/appointments (initiated by BUP applying for port development with completed pre-feasibility document).

The concession consists of two types of concessions. The concession arrangements at the existing main ports prior to the enactment of *Law number 17 of 2008* are:

1. Belawan Port Authority and PT. Pelindo I
2. Port Authority of Tanjung Priok and PT. Pelindo II
3. Port Authority of Tanjung Perak and PT. Pelindo III
4. Makassar Port Authority and PT. Pelindo IV.

Furthermore, there is another type of concession in 5 locations, as follows:

1. Development and Operation of Kalibaru Terminal of Tanjung Priok Port (Tanjung Priok Port Authority and PT Pelindo II)
2. Belawan Phase II Petroleum Container Terminal 350m (Belawan Port Authority & PT Pelindo I)
3. Pelabuhan bulk liquid port business of Kuala Tanjung Port (Belawan Port Authority and PT Pelindo I)
4. Multipurpose Lamong Bay Terminal Termination in Surabaya (Port of Tanjung Perak Authority and PT Pelindo III)
5. Makassar Petik Container Terminal Termination New Port Phase I in Makassar (Port Authority of Makassar and PT Pelindo IV).

In addition to the concession between the government and Pelindo, there has been a process of concession between the government and other port business entities (other than Pelindo), namely:

1. PT. KRAKATAU BANDAR SAMUDERA (KBS)
2. PT. BERLIAN MANYAR SEJAHTERA (PT. BMS)
3. PT. PELABUHAN TEGAR INDONESIA (PT. PTI)
4. PT. KARYA CITRA NUSANTARA (PT. KCN)
5. PT. WAHYU SAMUDRA INDAH

7.5.2 Major Port Development in Indonesia: Belawan Port

The Belawan port development plan is embodied in the Belawan Port Master Plan as stipulated by the Minister of Transportation, PM 21 of 2012. Belawan Port currently has 6 terminals, and the plan was to develop two more terminals, namely the container terminal phase I and container terminal phase II. The investment cost for the development of Phase I Container Terminal is estimated at US$ 166 million, of which the reclamation and expansion of a cultivation area of 120,000 m^2 costing US$ 73 million, dock construction with a length of 350 m at US$23 million, and equipment procurement of US$ 70 million.

7.5.3 Physical and Non-physical Investments

In 2015, Pelindo I made both physical and non-physical investments, as can be seen in **Figure 7.26**. Physical investments undertaken by Pelindo amounted to IDR 676.948 billion, while non-physical investment amounted to IDR 50.098 billion. Net Return on Investment increased from 15.26% in 2014 to 22.88% in 2015.

The largest physical investment by Pelindo I in 2015 is for subsidiaries (50%), and the smallest investment was for equipment (0.26%). In addition, Pelindo I also made physical investment for roads and buildings (7%), port facility installation (4.24%), port facility investment (10.44%), vessel investment (8.6%), and building facilities (19.63%) (**Figure 7.27**). Non-physical investments made by Pelindo I includes system, organizational and business development as well as environmental protection. The breakdown of non-physical investment made by Pelindo I is shown in **Figure 7.28**.

Figure 7.26: Investments of Pelindo I in 2015.

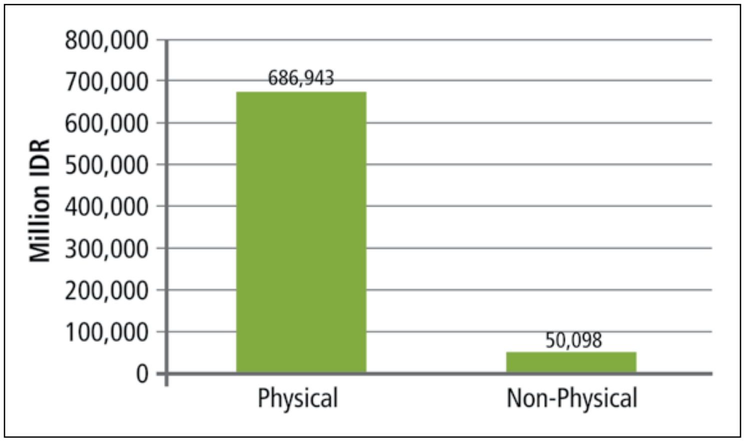


Figure 7.27: Physical Investment of Pelindo I.

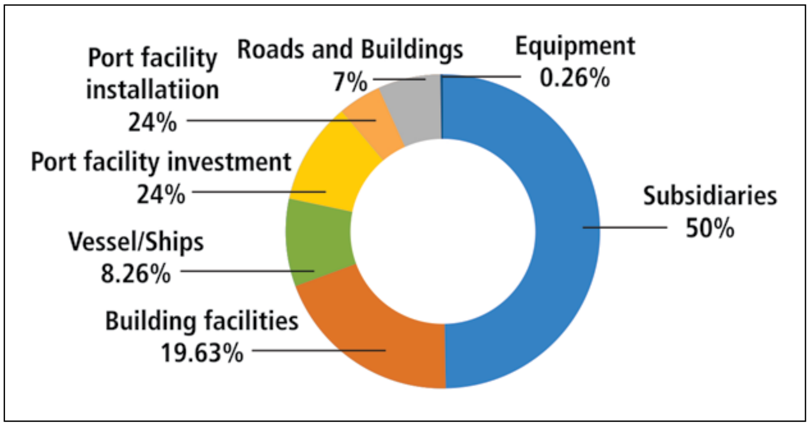
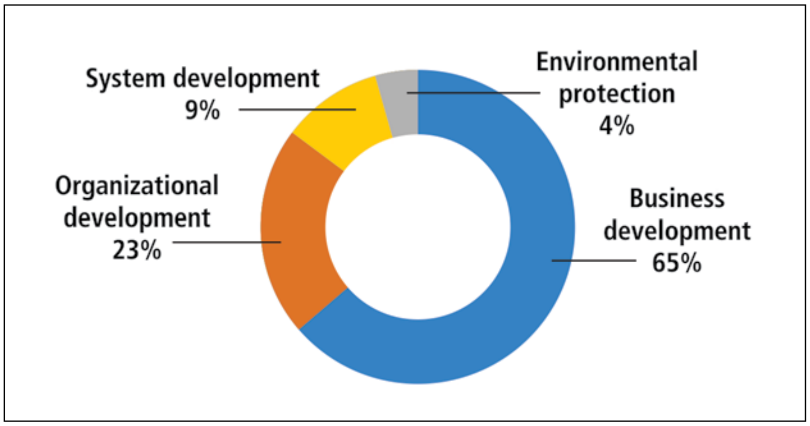


Figure 7.28: Non-physical Investment of Pelindo I.



7.6 Major Issues

Although ports play a very important role for the national economy, Indonesia does not yet have a well-performing port system. Based on the *2015/2016 Global Competitiveness Report*, the quality of Indonesia's port infrastructure is ranked 82 out of 140 countries surveyed, quite poor compared to other infrastructure quality ratings, such as road quality (ranked 80), airport infrastructure quality (ranked 66), quality of railway infrastructure (ranked 43). Overall, the quality of infrastructure in Indonesia is ranked 81 out of 140 countries surveyed. The main problem with the ports in Indonesia is the long dwelling or waiting times and high logistics cost.

The **Quality of Port Infrastructure** measures business executives' perception of their country's port facilities. Data are from the World Economic Forum's Executive Opinion Survey, conducted for 30 years in collaboration with 150 partner institutes (World Bank, 2018). Scores range from 1 (port infrastructure considered extremely underdeveloped) to 7 (port infrastructure considered efficient by international standards). The average score is **3.79** for the quality of port infrastructure in Indonesia from 2000 to 2017 (**Table 7.10**).

Logistics performance improved slightly, with an index score of 2.76 in 2010 to 2.98 in 2016 (**Table 7.10**). **Logistics Performance Index** overall score reflects perceptions of a country's logistics based on efficiency of customs clearance process, quality of trade- and transport-related infrastructure, ease of arranging competitively priced shipments, quality of logistics services, ability to track and trace consignments, and frequency with which shipments reach the consignee within the scheduled time (World Bank, 2018). The index ranges from 1 to 5, with a higher score representing better performance. Data are from Logistics Performance Index surveys conducted by the World Bank in partnership with academic and international institutions and private companies and individuals engaged in international logistics.

Table 7.10: Quality of Port Infrastructure and Logistics Performance Index.

Year	Quality of Port Infrastructure, WEF*	Logistics Performance Index: Overall**
2010	3.62	2.76
2011	3.60	
2012	3.60	2.94
2013	3.90	
2014	4.00	3.08
2015	3.81	
2016	3.80	2.98
2017	4.00	

* 1=extremely underdeveloped to 7=well developed and efficient by international standards
** 1=low to 5=high
Source: World Bank, 2018.

Limited capacities, congestion and low level of productivity at the port hamper exports and the domestic distribution of goods. On environmental issues, the incidence of oil spills, dumping of waste from ships, energy efficiency, greenhouse gas emissions, and invasive species from ballast water need to be addressed more effectively.

7.7 Key Policies and Response Measures

The legal framework for the ports and shipping sector in Indonesia is based on *Law Number 17 of 2018 on Shipping, Government Regulation Number 61 of 2009*, and *Government Regulation Number 64 of 2015 on Port*. Besides that, some other legal rules related to seaport are as follows:

- PP NO 20/2010 jo PP NO 22/2011 on Water Transportation
- PP NO 5/2010 on Shipping Safety
- PP NO 21/2010 on Maritime Environment Protection

In addition to the rules of law at the level of government regulations, ministerial regulations (PM) and or the Ministerial Decree (KP) have also been issued in relation to the ports and shipping sector:

- KP Number 725 of 201 4 concerning Amendment to Minister of Transportation
- Number KP 414 of 2013 on RIPN Determination
- PM Number 74 of 2014 on Amendment to Minister of Transportation
- Number 52 of 2011 About Dredging and Reclamation
- PM Number 75 of 2014 on Amendment to Minister of Transportation
- Number 53 of 2011 regarding Guidance
- PM Number 93 of 2014 on Ship Supporting Instruction and Support Facilities
- PM Number 71 of 2016 on Amendment to Minister of Transportation
- Number 51 of 2011 About Special Terminals and TUKS
- PM Number 23 of 2015 on Improvement of the Function of Port Operators at the Ports that are Managed)
- PM Number 45 of 2015 concerning Capital Ownership Requirements of Enterprises in the Field of Transportation
- PM Number 51 of 2015 on the Implementation of Sea Ports
- PM Number 166 of 2015 on Amendment to Ministerial Regulation PM 15 of 2015 Concerning Concession and Other Forms of Cooperation Between the Government and Port Business Entity in Port Sector

7.7.1 Improving Inter-island Connectivity and Logistics

Sea toll is a concept to improve connectivity between islands in Indonesia. The implementation of the "**sea toll**" program began with the establishment of five main ports in Indonesia as regional hub ports. The role of these five main ports is to also serve as the main transit port for commodity distribution around the remote islands.

Indonesia requires inter-island connectivity that is met with adequate provision of sea transportation to meet the national logistics distribution requirements, requiring the port as its basic infrastructure. This inter-island connectivity needs to be designed with a corridor system and a major hub that will serve as the main port to connect cities in the archipelago. In this context, "Sea Toll" has to be integrated with national road networks and ferry crossings, such as movable bridges. The combination of the concept of "Sea Toll", road network, and ferry crossing is expected to form a network of nautical freeway, which will be the key to domestic connectivity. To support this connectivity implementation, it requires 24 major ports, which will be supported by 36 collection ports and 7 feeder ports (BPIW, 2016).

The Sea Toll Program provides the link between ports located in remote areas, especially those in the eastern region. The government has built ports in 35 locations, increasing port capacity in 6 locations, procuring 85 units of loading and unloading equipment, 86 pioneer routes, 1 unit of operating livestock vessels, and 95 units of pioneer vessels. Of the total 91 non-commercial ports completed in 2015, only 7 ports are located in Sumatra, 2 in Java, 2 in Kalimantan, while the remaining 80 are in eastern Indonesia. The Sea Toll Program was continued in 2016 with ports in 89 locations, increasing port capacity in 6 locations, providing 26 units of loading and unloading equipment, 96 pioneer routes, PELNI 6 stretch freight liners, 5 unit cattle ships, and building 95 units of pioneer vessels.

7.7.2 Environmental Management

The development of environment-friendly port and green building in Indonesia is currently implemented based on *Government Regulation No. 21 of 2010 on Maritime Environment Protection*. This regulation focuses on pollution control in port and shipping operations.

Based on the **Strategic Plan 2015-2019 of the Directorate General of Sea Transportation**, through one of the targets, which is "Promoting the development of efficient and environment-friendly transport technologies in anticipation of climate change", multiple key performance indicators were assigned, including:

1) Amount of decreased CO_2 emitted in marine transportation;
2) Number of harbors implementing Eco-Port or Green Port (waste management and cleanliness of the harbor environment)
3) Number of IOPP certificate ownership (International Oil Pollution Prevention)
4) Number of SNPP ownership (National Certificate of Pollution Prevention)
5) Total ownership of toxic liquids certificate (Noxious Liquid Substance)
6) Total International Sewage Pollution Prevention (ISPP) certificate ownership

7.7.3 Oil Spill Mitigation and Response

The **National Oil Spill Contingency Plan** was given government approval in 2006 and launched in 2007. The lead agency for oil spill preparedness and response is the Directorate General of Sea Transportation (DGST), Ministry of Transportation.

The DGST regularly conducts a **National Marine Pollution Exercise**, aiming to test and evaluate oil spill response procedures at local, regional and national levels, and to train and enhance cooperation and capabilities in observation operations, security, search and rescue, fire fighting, oil spill contingency planning and response, and countermeasures for oil spills in the sea. This is a routine activity held every two years as a joint exercise activity between agencies or partners that have duties and functions in the area of waters and ports, such as the Ministry of Transportation, Ministry of Marine Affairs and Fisheries (KKP), Ministry of Environment and Forestry (KLHK), PT. Pelindo, Terminal For Own Interest (TUKS), Navy, POLAIR, Port Health, SKK Migas, and other relevant agencies. The exercise is an implementation of the following laws:

- *Law No.17 of 2008 on Shipping*
- *Government Regulation no. 21 of 2010 on Maritime Environment Protection*
- *Presidential Regulation no. 109 of 2006 on Emergency Response to Oil Spill at Sea*
- *Minister of Transportation Regulation no. PM 58 of 2013 on Pollution Prevention in Waters and Ports*
- *Decree of the Minister of Transportation no. KP 355 of 2008* on the Establishment of National Command and Control Center for Operation of Emergency Response for Oil Spill at Sea (PUSKODALNAS).

To prevent ship collisions that could result in oil spills and damage to coastal and marine ecosystems, navigational aids (e.g., lighthouses, Marine Electronic Highway for the Straits of Malacca and Singapore) have been put up.

Port of Tanjung Priok in Jakarta. *(Photo by World Bank)*

Boat Quay in Benoa. *(Photo by M. Ebarvia)*

Ferry in Surabaya. *(Photo by D. Bautista)*

Lighthouse and Monjaya statue in Surabaya. *(Photo by D. Bautista)*

8 Offshore Oil and Gas

Offshore oil and gas is a resource from the ocean area. The people and the whole economy, including the spectrum of fisheries, maritime tourism, marine transportation and maritime industry, require energy resources. Energy or fuel is a primary need for the operation of passenger, container and cargo ships as well as fishing vessels scattered throughout the territorial waters of Indonesia. For fishing boats, fuel represents more than 40% of the cost of fishing operations (Wahyudin, 2012). Similarly, the fuel cost of sea transportation is more than 60% of operational cost. Therefore, oil and gas sector is necessary to supply the energy needed for the maritime sectors in the current absence of supply from renewable energy sources.

However, oil and gas are depletable resources, and their use as fossil fuel has resulted in the greenhouse gas emissions, with consequent effects on the climate, weather patterns and ecosystems. In the long term, and in view of transforming to blue economy development and overall sustainable and inclusive economic growth, there is a need to shift towards alternative, renewable energy supply that could be a complement or even a replacement for fossil-based fuels. The ocean also offers potential for marine renewable energy (e.g., offshore wind power; tidal, wave and current energy; etc.).

8.1 Energy Policy and Law

Government Regulation 79/2014 was issued on 17 October 2014 regarding the **National Energy Policy**, as originally formulated by the National Energy Council (DEN - Dewan Energi Nasional). The National Energy Policy covers the overall management of energy and seeks to address issues, such as:

a. The availability of energy to meet the nation's requirements;
b. Energy development priorities;
c. The utilisation of national energy resources; and
d. National energy buffer reserves.

The *Energy Law No. 30/2007* dated 10 August 2007 provides a legal framework for the overall energy sector, with an emphasis on economic sustainability, energy security and environmental conservation (Article 3). Under this Law, the DEN was established in June 2009 with the task of formulating and implementing a House of Representatives-approved National Energy Policy, determining the National Energy General Plan and planning steps to overcome any energy crisis or emergency.

8.2 Proven and Potential Reserves

Indonesia has been active in the oil and gas sector for more than 130 years, after the first oil discovery in North Sumatra in 1885. A member of OPEC since 1961, Indonesia suspended its membership in 2009 after years of declining production. According to the BP Statistical Review of World Energy 2019, Indonesia holds proven oil reserves of 3.15 billion barrels and potential oil reserves of 4.36 billion barrels at the end of 2018 (**Table 8.1**). On the other hand, Indonesia has proven natural gas reserves of 96.06 trillion cubic feet (TCF) and potential natural gas reserves of 39.49 TCF.

The BPPT data (1998) showed that Indonesia has the potential of oil and gas availability from marine areas, estimated to be around 106.2 billion barrels of oil equivalent (BBOE), worth US$5.30 trillion (assuming oil prices at US$50 per barrel, and potential reserves will be exhausted by 2050). It is important to note that oil and gas production has been declining since 1995, along with this sector's contribution to state revenues.

Table 8.1: Key Indicators: Indonesia's Oil and Gas Industry.

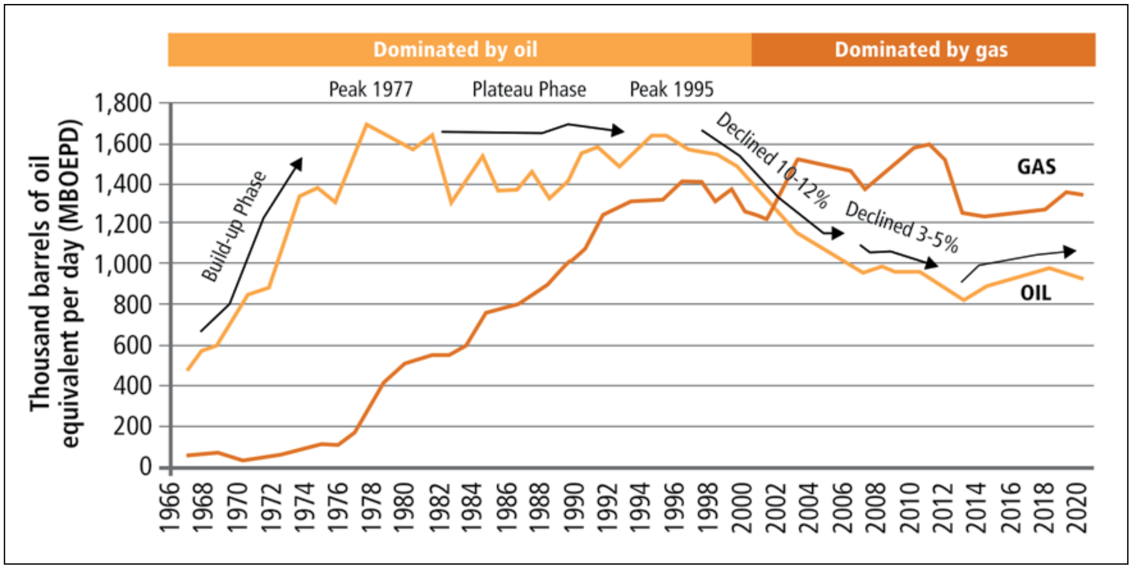
Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Reserves												
Oil (Million Barrels)	8,400	8,220	8,000	7,760	7,730	7,401	7,550	7,370	7,305	7,251	7,535	7,512
Proven	3,990	3,750	4,300	4,230	4,040	3,740	3,690	3,620	3,603	3,307	3,171	3,154
Potential	4,410	4,470	3,700	3,530	3,690	3,670	3,860	3,750	3,702	3,944	4,364	4,358
Gas (TCF)	165.00	170.10	159.63	157.14	152.89	150.70	150.39	149.30	151.33	144.80	143.70	135.55
Proven	106.00	112.50	107.34	108.40	104.71	103.35	101.54	100.26	97.99	102.00	101.40	96.06
Potential	59.00	57.60	52.29	48.74	48.18	47.35	48.85	49.04	53.34	42.80	42.30	39.49
Production												
Crude oil (MBOPD)	972	1,006	994	1,003	952	918	825	789	786	831	804	772
Natural gas (MMSCFD)	7,283	7,460	7,962	8,857	8,415	7,110	6,826	8,218	8,102	7,939	7,621	7,760
New contracts signed*	28	34	34	21	31	39	14	7	12	2	0	11

Source:
Reserves of oil and gas are obtained from DGOG, MoEMR
2007-2012 Crude Oil and Natural Gas Production: BP Statistical Review of World Energy
2013-2015 Crude Oil and Natural Gas Production: SKK Migas Annual Report 2013-2015
2016 Crude Oil and Natural Gas Production: Press release of MoEMR on CNN Indonesia
2017-2018 Crude Oil and Natural Gas Production: SKK Migas Annual Report 2017-2018
New contracts signed: MoEMR, SKK Migas Annual Report

8.3 Oil and Gas Production

Indonesia's oil and gas production has been dominated by gas production (60%) since 2002 (**Figure 8.1**). The condition is expected to continue in the next few years. After reaching a peak in 1995, oil production declined by 10%-12% per annum in the next ten years, and further declined by 27.6% between 2010 and 2015. As of 2015, Indonesia's oil and gas production was 786 MBOEPD for crude oil, and 8,102 MMSCFD for natural gas. In 2018, crude oil production decreased to 772 MBOPD, and natural gas production likewise decreased to 7,760 MMSCFD (**Table 8.1**).

Figure 8.1: Indonesian Oil and Gas Production Profile (MBOEPD).



Source: SKK Migas Annual Report 2018.

8.4 Contribution to Indonesian Economy

Indonesia spent decades relying on the oil and gas sector's contribution to economic growth. However, in recent years, the oil and gas sector's contribution to state revenues has decreased significantly along with the decline in reserves and production. The significant decrease in Indonesian Crude Price (ICP) from US$ 95.57/barrel in 2014 to US$48.26/barrel in 2015 (decrease by almost 50% from 2014) has a direct impact on the decline in the state revenues. By 2015, the average State Revenue (Total GOI Take) to Gross Revenue ratio was 40%. Meanwhile, the average acceptance ratio of PSC Contractors (Net Contractor Take) to gross revenue (Gross Revenue) was 14%.

The state revenue from the oil and gas industry decreased by almost 80% from IDR 216 trillion in 2014 (14% of state revenues) to IDR 44 trillion in 2016 (2.8% of state revenues), before rising oil prices improved the contribution of the oil and gas sector in 2017 and 2018. **Table 8.2** shows the percentage contribution of oil and gas to State revenues from 2004 to 2018. The MoF pointed out the receipt of non-tax oil and gas state income of IDR 143 trillion in 2018.

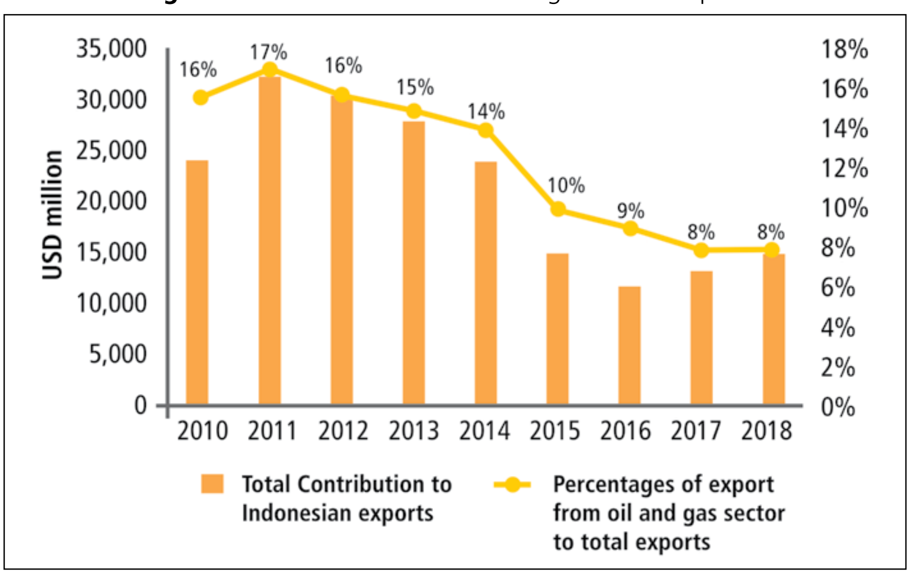
Table 8.2: State Revenues and Oil and Gas Revenues.

Year	State Revenue (Rp Trillion)	Oil and Gas Revenue (Rp Trillion)	% of Contribution
2004	403	85	21.09%
2005	494	104	21.05%
2006	636	158	24.84%
2007	706	125	17.71%
2008	979	212	21.65%
2009	847	126	14.88%
2010	992	153	15.42%
2011	1,205	193	16.02%
2012	1,338	205.8	15.38%
2013	1,438	203.6	12.56%
2014	1,538	216.9	14.11%
2015	1,508	78.2	4.46%
2016	1,555	44.1	2.84%
2017	1,666	81.8	4.91%
2018	1,942	143.3	7.38%

Source: MOF, PWC.[39]

Meanwhile, the oil and gas component of export revenues decreased alongside the oil price, reaching its lowest level in 2016 when the oil price fell below US$ 30/barrel. Bank Indonesia notes that oil and gas exports contributed about 8% of total exports in 2016-2018, down from a high 17% share in 2011. The Indonesian oil and gas imports have exceeded exports since 2012, and this energy trade deficit may exceed the trade surplus generated by other sectors.

Figure 8.2: Oil and Gas as Percentage of Total Exports.



Source: Bank Indonesia (BI). Accessed from https://www.pwc.com/id/en/energy-utilities-mining/assets/oil-and-gas/oil-gas-guide-2019.pdf

[39] PwC Indonesia, 2019.

8.5 Oil and Gas Investments

Investment levels in the upstream sector (i.e., exploration and exploitation) continue to fluctuate. After a period of steady increase in 2009-2013, reaching US$ 19.3 billion in 2013 and 2014, oil and gas investment decreased to US$ 10.3 billion in 2017, the lowest in a decade. Investment grew to US$ 10.9 billion in 2018; although it is still below the target of US$ 14.2 billion, following the rising global oil and gas price throughout 2018.

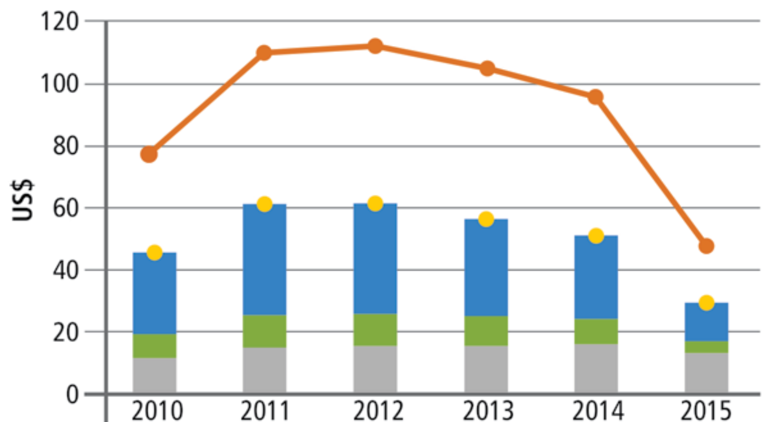
Table 8.3: Upstream Oil and Gas Investment (in million US$).

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Proven	532	633	670	719	1,439	1,877	1,735	1,345	1,078	565	546
Administration	981	730	833	958	1,016	1,199	1,157	1,286	702	944	873
Development	2,523	2,671	2,495	3,149	3,288	4,306	4,048	2,116	1,322	705	1,310
Production	6,579	6,391	7,033	9,196	10,370	11,960	12,336	10,883	8,156	8,053	8,189
Total Expenditure	**10,615**	**10,425**	**11,031**	**14,022**	**16,113**	**19,342**	**19,275**	**15,630**	**11,258**	**10,267**	**10,918**

Source: 2008 - 2018: Calculated by PwC based on BP Migas/SKK Migas Annual Reports.

For upstream business activities, the Government of Indonesia has introduced the new "gross split" PSC model, which should be applied to new PSCs starting 2017/2018. This new regime has fundamentally "shifted" the key principles and regulatory framework of the (conventional) cost recovery model in the upstream sector. **Figure 8.3** shows the cost recovery, gross revenues and sharing of revenues.

Figure 8.3: Distribution of Revenue from the Upstream Oil and Gas Sector, 2010-2015.



	2010	2011	2012	2013	2014	2015
Indonesia share	26.5	35.9	35.4	31.2	26.8	11.9
Net Contractor Share	7.6	10.2	10.3	9.4	8.2	4.1
Cost recovery	11.8	15.2	15.5	15.9	16.3	13.4
Gross Revenue	45.9	61.3	61.2	56.5	51.3	29.4
Average ICP (US$/bbl)	78.87	110.85	112.33	105.02	95.57	48.26

* 2015 data based on FQR Quarter IV 2015 as of 19 April 2016

Source: SKK Migas, 2016.

Upstream business activities are conducted in regions known as "work areas". Working areas (WA) are formalised upon approval from the Ministry of Energy and Mineral Resources (MEMR) in consultation with SKK Migas and the relevant local government authorities and then specified in a Joint Cooperation Contract. A work area can be offered either through a tender or a direct offer. The WA in 2015 show that there are 84 exploitation and 228 exploration WAs (conventional and nonconventional) or a total of 312 WAs. In addition, the Government has approved the termination of 16 WAs, and there are 60 other WAs in the process of termination in 2015. The 2018 map of Oil and Gas WAs in Indonesia is presented in **Figure 8.4**.

Figure 8.4: 2018 Oil and Gas Working Area Map, 2018.

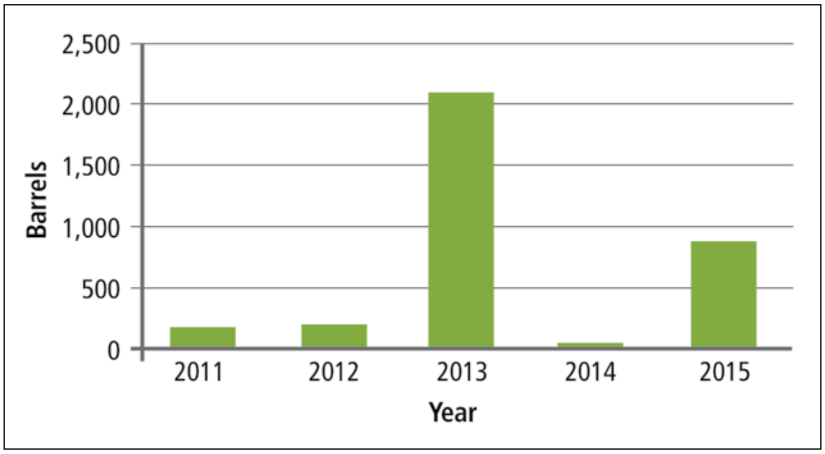
Source: SKK Migas, 2018.

8.6 Environmental Impacts

There are issues concerning the inclusion of oil and gas in the ocean economy due to the negative environmental impacts from this sector. The huge increase in the use of oil and gas as economies expand has consequently increased carbon emissions, and resulted in the changing climate, increasing incidence of extreme or severe weather events, sea level rise, ocean acidification, coral bleaching, etc. The declining revenues from oil and gas sector provide an opportune time to shift towards renewable energy sources. The ocean also provides potential marine renewable energy resources like tidal energy, ocean thermal energy conversion, offshore wind power, etc.

Although there are strict laws, the occurrence of operational and accidental oil spills is one of the issues that need to be addressed by this sector. Oil spills have negative impacts on the marine environment and marine life. The Directorate General of Oil and Gas recorded increasing oil spill volumes: 181.8 barrels in 2011; 197.76 barrels in 2012; 2071.37 barrels in 2013; 46.70 barrels in 2014; and 875.38 barrels in 2015 (**Figure 8.5**).

Figure 8.5: Oil Spill Volumes (2011-2015).



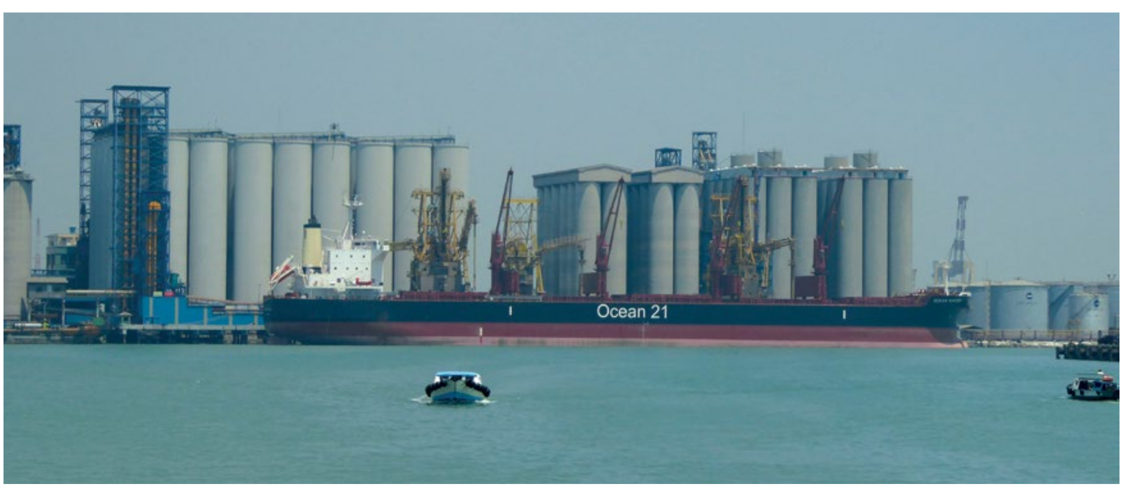
Source: Ditjen Migas, 2015

8.7 Plans and Programs to Mitigate Environmental Impacts

Plans related to the mitigation of environmental impacts of oil and gas activities are generally covered by related regulations in the form of Acts, Government Regulation, Presidential Regulation, Ministerial Decree, and Working Guidance Manual (PTK). There are several regulations related to the mitigation of environmental impacts due to oil and gas activities, such as:

- *Law no. 32/2009 on Environmental Protection and Management*: Issued in October 2009 and entities are required to comply with standard environmental quality requirements and to secure environmental permits before beginning operations. Sanctions can include the cancellation of operating permits, fines, and/or imprisonment. After initially being postponed, Law No. 32 is now operative.
- Government Regulation no. 21/2010 on Maritime Environment Protection
- Government Regulation no. 101/2014 on B3 Waste Management
- Government Regulation no. 27/2012 on Environmental Permits

- Presidential Regulation No.109/2006 concerning the Emergency Response of Oil Spill at Sea
- Regulation of the Ministry of Transportation No. 58/2013 on Pollution Control in Waters and Ports
- Regulation of the Ministry of Environment No.05 / 2012 on the type of business and or activity that must have an Environmental Impact Analysis (AMDAL)
- Regulation of the Ministry of Environment No.16/2012 on Guidelines for the Preparation of Environmental Documents
- Working Procedure Guidelines (PTK) SKK Migas No. 005/2011 on Oil Spill Control in which it contains obligations for oil and gas companies to compile and possess Oil Spill Contingency Plan (OSCP) Document, which contains mapping of environmentally sensitive areas and Oil Spill Trajectory Model (OSTM) or oil spill distribution model.
- Implementation of well development and drilling program, re-work and well treatment as well as seismic survey and exploration drilling
- Efforts to use new methods for the discovery of oil and gas resources and reserves, such as Passive Seismic, Broadband Seismic, AVO Analysis, on-time on-line field project monitoring and maintenance to improve the reliability of production facilities
- *Ministry of Energy and Mineral Resources Regulation No.06 / 2016* Concerning provisions and procedures for stipulating allocation and utilization and natural gas price
- Encouraging improved governance in the upstream oil and gas sector to increase investment attractiveness and business certainty through the improvement of legal umbrella.
- Simplifying the licensing process by removing non-substantial bureaucratic processes, improving coordination between government agencies and local governments.
- Implementation of regulations, licensing processes, and the preparation of more efficient and mutually beneficial Oil and Gas Production Sharing Contract scheme for both government and PSC. Like the Gross Split scheme, the government has issued *EMR Ministerial Decree No. 08 of 2017 on Production Sharing Contracts Gross Split and ESDM Ministerial Decree No. 26 of 2017 on Investment Cost Reversal Mechanism in Upstream Oil and Gas Business Activities*.



Oil Tanker. *(Photo by D. Bautista)*

PART 3

DEVELOPMENTS IN BLUE ECONOMY

9 Sustainable and Innovative Ocean-Related Economic Activities

The concept of blue economy was developed to respond to the challenge of promoting economic growth in the coastal and marine areas while ensuring the sustainability of oceans and the resources therein. In 2012, ministers of the East Asian Seas region adopted blue economy paradigm, and provided the definition in the Changwon Declaration 2012.[40] For the application of the Blue Economy concept in the oceans and coastal and marine ecosystems, there are at least three main points underlying its approach: a) marine water and ecosystem health condition; b) ocean-based economic activities that are sustainable, environment-and climate-friendly, people-centered and inclusive; and c) the existence of enabling mechanisms (policies, laws and regulations, strategies and action plans, incentives) and good governance (institutional arrangements, capacity development, science and research support, public awareness, stakeholder participation, sustainable financing, and partnerships).

Indonesian Marine Council (2012)[41] stated that the development of marine economy with blue economy model as accelerator for the realization of Indonesia as an independent archipelago, developed, strong, and based on national interest. Furthermore, in order to implement this policy further, the strategies to be taken as opportunities for investment, business and partnership are:

1) Economic Development of Fishery Sector
2) Economic Development of Sea Transportation Sector
3) Economic Development of Marine Building and Construction Sector
4) Economic Development of Marine Energy and Mineral Resources Sector
5) Economic Development of the Marine Industry Sector
6) Economic Development of the Marine Tourism Sector
7) Economic Development of Maritime Services Sector
8) Cross-sector Economic Development of Marine Sectors

The strategies for the economic development of the above *established* ocean economic sectors must also ensure environmental sustainability, climate resiliency and inclusiveness, and not just income and economic growth.

[40] "*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.

[41] Dewan Kelautan Indonesia. 2012.

9.1 Sustainable Fisheries

Fish stocks and coral reefs are in danger as a result of unsustainable fishing practices, which threaten biodiversity, food security, and livelihoods. Overfishing combined with illegal, unreported, unregulated (IUU) and destructive fishing are causing fisheries to collapse. IUU fishing on the high seas and within a Coastal State's exclusive economic zone has significant negative ecological, economic, and social impacts. Starting in 2005, Indonesia has developed a National Plan as part of the implementation of the International Plan of Action to eliminate IUU Fishing.

The Oceans and Fisheries Partnership (USAID Oceans) is funded by the United States Agency for International Development (USAID), working in partnership with the Southeast Asian Fisheries Development Center (SEAFDEC), Coral Triangle Initiative for Coral Reefs, Fisheries and Food Security (CTI-CFF), and a wide range of public and private sector partners at regional, national, and local levels, to combat IUU fishing, promote sustainable fisheries and conserve marine biodiversity in the Asia-Pacific region.

An innovation being introduced and piloted in Bitung, Indonesia is the **Electronic Catch Documentation and Traceability System** (eCDT), which is the system of documenting key information about the harvest, processing, and transportation of a fisheries product electronically to enable traceability of the fish or seafood product through each step of its journey— from point of catch to the consumer's plate. Doing so electronically enables this information to be more quickly and easily captured, shared, and managed. The 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;
- Comply with national, regional and international seafood regulations and import requirements.

Using modern technologies, USAID Oceans, SEAFDEC and the Ministry of Marine Affairs and Fisheries (MMAF) have been working with local government, private sector and non-governmental partners to develop and implement the eCDT system. In 2018, MMAF launched the **National Fish Traceability and Stock System** (STELINA) to comply with international market requirements, including the US Seafood Import Monitoring Program (SIMP), and the European Union (EU) regulations, which aim to combat IUU fishing and ensure food safety.

To further support this system, the government is also implementing the **Catch Certificate program**, which involves certifying if the fish and seafood products have not been caught through IUU Fishing. NGOs (e.g., WWF and SFP) are helping local exporters of tuna, snapper, grouper and blue swimming crab to obtain certification from the Marine Stewardship Council (MSC). The **MSC Fisheries Standard** is used to assess if a fishery is well-managed and sustainable.

9.2 Sustainable Aquaculture

Fish contributes to the well-being of Indonesians by offering an affordable source of nutritious animal protein. To combat current high levels of malnutrition and stunting, the Indonesian government has set ambitious targets for aquaculture growth up to 2030. However, meeting the production targets will come at a cost for the environment. According to WorldFish: Research has shown that reaching the proposed production targets will result in widespread negative environmental consequences if current farming practices continue to be used. Consequently, more sustainable farming practices are needed that do not jeopardize the function of Indonesia's valuable coastal ecosystem.[42]

Silvofisheries is a form of low input aquaculture integrating mangrove culture with brackishwater aquaculture. This approach to use and at the same time conserve mangroves shows that while mangroves remain healthy, the economic benefits of traditional brackishwater aquaculture can still be realized. The following cases show its viability: "In the *empang parit* (also *tambak tumpangsari*) pond in Sinjai, South Sulawesi, the pond is within the planted mangroves. The ponds are stocked naturally with juveniles from incoming tides. The species are siganids, mullets, milkfish, tilapia, shrimp, mangrove crab, and seabass. These are harvested by gill nets during low tide when the fish are concentrated in the perimeter canal. Significant increases have been made in the volume and value of shrimp and fish exports. The *empang parit* in Cikiong and Cibuaya in West Java realized an annual net profit (ha/yr) of $1,367 for mangrove crab, 1,347 for seabass, 2,601 for tilapia and chicken, 2,508 for milkfish and shrimp, and 1,322 for milkfish."[43] These examples show that to prevent uncontrolled destruction of mangroves, silvofishery technology together with replantation of mangroves and pollution reduction could be promoted to coastal communities to ensure viable and resilient livelihoods.

Indonesia, with support from ADB, has implemented the **Sustainable Aquaculture Development for Food Security and Poverty Reduction Project** in 2007 to 2013. The project was implemented in five districts in four provinces: (i) Langkat district in North Sumatera Province, (ii) Ogan Komering Ilir in South Sumatera Province, (iii) Karawang and Sumedang districts in West Java Province, and (iv) Buton in Southeast Sulawesi Province. It focused on developing small-scale and low-cost aquaculture that was environment friendly and could be easily replicated by fish farmers' organizations and small- to medium-scale private entrepreneurs. The project had three components: (i) aquaculture production enhancement, (ii) aquaculture support services, and (iii) institutional strengthening and project management. The performance targets were (i) food and nonfood household expenditures,

[42] Henriksson, et al. 2019.
[43] These examples were from: Surtida, M. B. 2000. "Silvofisheries in Indonesia," SEAFDEC Asian Aquaculture, 22(6), 20-21, 28.

and fish consumption to increase by 20% by year 6 from a baseline of about IDR 155,000 in 2004; and (ii) incomes of 14,000 poor households to increase to above the poverty line by year 6.

At project completion, results of the household surveys showed that:

- The production and productivity of fish increased by an average of 60%, and other aquatic products increased by an average of 84%, which exceeded the project's outcome target by 30%.
- The project beneficiaries' net income improved by 70%, surpassing the outcome target by 20%. These were increases from 2004 to 2012.
- The project generated 306,382 person-days of employment consisting of 296,653 person-days in civil works activities for the poor fishing households and 9,729 person-days in aquaculture activities.

The Project Completion Report and Validation Report[44] noted that:

- The project outputs were: (i) completed fish ponds covered 3,277 ha (or 80% achievement); (ii) four mariculture hatcheries were constructed (instead of the seven targeted); (iii) about 38 km of access road and pathways constructed and/or rehabilitated (short of the original target of 60 km); (iv) 139 women's groups participated in the project activities (or 70% of the target); and (v) water quality in aquaculture ponds improved only in the Langkat and Sumedang districts, but deteriorated in Karawang, Ogan Komering Ilir, and Buton. The project still achieved its intended outcomes although it was not able to complete all its planned activities and key outputs.
- There was an increase of fish consumption in the project districts— by 83% on average from 2006 to 2013, exceeding the 20% target. The project contributed significantly to reducing poverty incidence in the five project districts from 15%–25% in 2006 to 10%–16% in 2011. Moreover, the project is reported to have directly benefited 14,585 poor fish farmer households, exceeding the target of 14,000 households.
- The project is *most likely sustainable* based on the strong commitment of the MMAF and district governments to provide continuous financial support. One of the measures agreed upon was the budgetary commitment of the district governments to enable the District Fisheries Services (DFS) to provide continued capacity building for beneficiary groups and extend technical support and production input assistance to these groups. After project completion, (i) the DFS in the entire project areas have continued supporting the project beneficiaries; (ii) most of the beneficiary groups organized under the project are still functioning and active; and (iii) groups have become successful and self-reliant in their business operations, expanding their aquaculture businesses using their own savings.

[44] ADB. 2015.

- Adequate efforts were also made to address the issue of water pollution from intensive culture practices through (i) the design of civil works, and construction and rehabilitation works that minimized the adverse impacts from the project as well as from the surrounding environment, (ii) the provision of environmental management training to Project Management Unit (PMU) and extension staff, (iii) the establishment of laboratory facilities for monitoring water quality and fish diseases in each project district, and (iv) the encouragement of farmers to adopt low-density culture and well-adapted species. As a result of training and extension services, fish farmers adopted the recommended fingerling or seed-stocking rate and appropriate feeding and fertilizer rates to avoid water pollution in their ponds or cages. Besides mitigating adverse environmental impacts from aquaculture, mangroves were planted in 34.4 ha.
- On the social aspects, the project improved food security and nutrition of poor fishing households, increased fish consumption, and improved health through the provision of water supply facilities. Fish farmers and women were also empowered, and gender equality enhanced. Women constituted up to 25% of total project beneficiaries and 92% of the total processing groups. Participation of women in training on aquaculture production and processing has significantly improved their opportunities to engage in livelihood enterprises and improve their family income.

9.3 Seaweed Farming

Indonesia is one of the biggest seaweed producers in the world. In 2012, seaweed farming production hit 6.5 million of tonnes, and increased to 9.7 million tonnes in 2017.[45] Indonesia can produce seaweed by cultivating them in the sea (for *Euchema sp*. and *Kappaphycus sp*.) and in *tambak* or brackishwater pond (for *Gracilaria sp*). Seaweed farming can be found mostly in center and eastern of Indonesia, such as South Sulawesi, West Nusa Tenggara (NTB), East Nusa Tenggara (NTT), Bali, Southeast Sulawesi, Gorontalo, Central Sulawesi, Maluku, East Java, and Banten. Seaweed cultivation has many advantages: (a) needs only low capital; (b) no feeds required; (c) simple technology, (d) easy harvesting method – usually seaweed only need to be washed and dried; (e) short cultivation cycle (45 days only needed). Moreover, seaweed cultivation can be integrated with other cultivation and polyculture (such as Bandeng fish cultivation combined with *Gracilaria sp*.).

Key challenges in seaweed culture are: (a) threat from ice-ice disease; (b) use of improper chemical products; (c) low quality seaweed harvested prematurely; (d) business licensing; (e) low process due to middlemen; (f) interference with water flow; and (g) right farming site selection. Seaweed farming often takes place in areas around coral reefs and seagrass meadows. Thus, care must be taken to ensure that these important ecosystems are not damaged by seaweed farming.

[45] FAO. 2019.

9.4 Sustainable Tourism

Various forms of sustainable tourism, such as nature-based tourism, ecotourism, historical tourism and cultural tourism have been widely promoted in Indonesia. In some of the MPAs that have been established, the provision of conservation-based tourism destinations is allowed. Marine ecotourism parks are being managed based on an environment-friendly approach, especially harvesting, water use, proper waste management, and sightseeing (just enjoy the view). According to Kemenpar RI (2017), the Government of Indonesia is encouraging the implementation of sustainable tourism, and will issue "**sustainable tourism certificates**" for areas and destinations applying internationally recognized sustainable tourism standards – ecologically sound in the long term, and ethically and socially equitable. Along with the increasing awareness of tourists towards the environment, sustainable tourism is expected to bring more 'responsible' foreign tourists to Indonesia.

9.4.1 Ecotourism

The latest trend of tourists since the last decade began to show a shift in the preferences of tourists towards **ecotourism** and in enjoying nature-based tours and cultural riches (See **Box 6.1**). At the policy level, there had been a lot of laws and regulations for the development of ecotourism and protection of vulnerable natural sites and cultural objects. The development of ecotourism is further emphasized by the issuance of *Law of the Republic of Indonesia Number 10 of 2009 on Tourism*, and *Government Regulation of the Republic of Indonesia Number 36 of 2010 on Nature Tourism Exploitation in Wildlife Sanctuary, National Park, and Forest Park*.

In the *Regulation of the Minister of Local Affairs Number 33 of 2009 on the Guidelines for Ecotourism Development in the Region*, nature tourism activity in protected and conservation areas should include elements of education, awareness-raising, and support for natural resource conservation efforts and increasing local people's income.

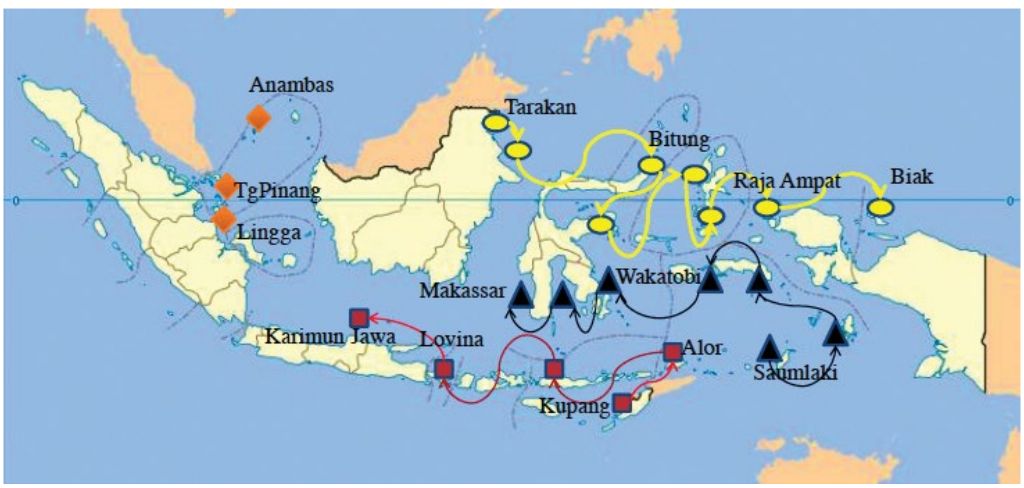
Ecotourism and cultural tourism development strategy is in line with the overall target of the Indonesian government to increase international tourism arrivals for economic growth, jobs and livelihood while protecting natural and cultural treasures. Indonesia is also developing ecotourism as an answer to the demand for nature-friendly tourism environment and environmental conservation in addition to meeting the needs for recreation.

The number of visits for this type of tourism is still very limited given its conservation priority and directed to exclusive tourism. However, for ecotourism and other natural attractions, there are quite a few devotees. According to data from the Passenger Exit Survey (PES) in 2014 (Kemenpar 2016), the largest tourist contribution was from cultural tourism destinations (cultural and historical heritage, shopping and culinary, city and village) at 60%, followed by nature-based tourism (marine tourism, ecotourism, adventure tourism) at 35%, and artificial tourism (MICE tours and events, sports, integrated areas) at 5%.

9.4.2 National Parks: Ecotourism and Conservation

The Government of Indonesia continues to encourage special nature tourism, by introducing and managing conservation areas as tourist destinations. Based on the *National Tourism Destination Development Plan*, the areas that are directed to become sustainable natural tourism destination, such as National Park, Marine Ecotourism Park and Marine National Park, are Anambas, Tanjung Pinang, Lingga, Karimunjawa, Lovina, Tarakan, Bitung, Wakatobi, Alor, Saumlaki, Raja Ampat, Biak, North Bali, Makassar, and Komodo island. Suggested clustering of these natural parks is shown in **Figure 9.1**.

Figure 9.1: Marine Ecotourism Development Areas in Indonesia.

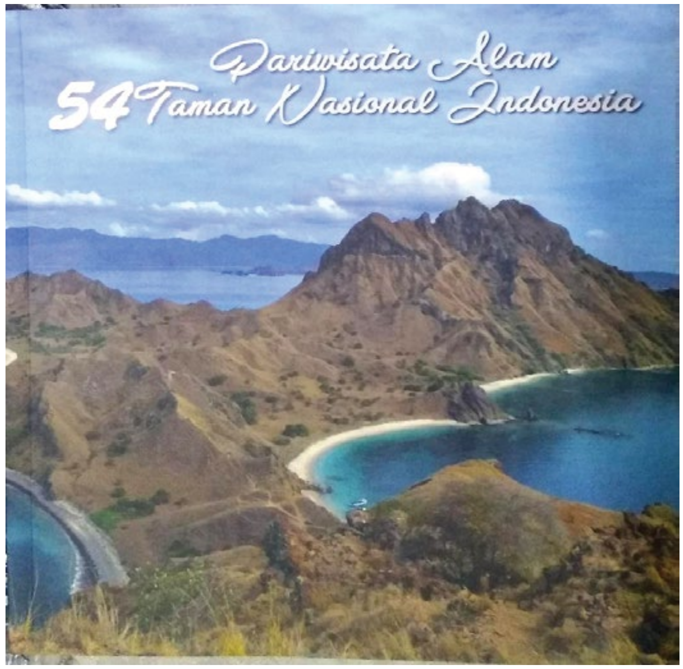


Source: Ministery of Tourism, 2016.

In 2017, the MOEF (KLHK) published a book, "*Nature Tourism: 54 Indonesian National Parks*", which contains instructions on proper benahavior to avoid damaging the habitats, wildlife, and cultural objects, and how to reach the location of national parks throughout Indonesia, including seven Marine National Parks (**Figure 9.2**).

The book of guidelines was followed by the launching of "*Wisata Alam Indonesia*" (Indonesia's Natural Wonders), a mobile phone application (app), by the MOEF in 2018. The app aims to help both foreign and domestic tourists seeking to explore the country's vast natural landscapes and seascapes. Similar to the book, the app offers details on Indonesia's 54 national parks and 119 nature tourism parks, including their basic description, attractions, flora and wildlife, as well as a photo and video gallery. Moreover, it also offers advice on the proper behavior while hiking and exploring, such as respecting others, throwing of trash appropriately, and refraining from disturbing the area's flora and fauna.

Figure 9.2: Book "Nature Tourism: 54 Indonesian National Parks" as a Guide to Travel to the Conservation Area with an Ecotourism Model.



There are local initiatives like the Ciletuh-Palabuhanratu Geopark in Sukabumi Regency in West Java. It is both a conservation and tourism initiative as part of the ICM program in Sukabumi. Within the geopark there are multiple habitat protection, restoration, and management activities that would also boost ecotourism potential. Examples include mangrove restoration, sea turtle protection, and coral reef transplantation. Coastal vegetation replanting restored beaches.

Another example of sustainable tourism implementation is the wastewater treatment facility in the hotel complex, Nusa Dua Bali. The wastewater is reused while the treatment lagoon is also an eco-park, with opportunities for bird watching and recreational fishing. (*See Section 10.2.2 for more details*.)

9.4.3 Community-based Tourism

In addition to the destinations in **Figure 9.1**, small-scale ecotourism has also been developed by villages independently. The government also encourages villages with natural wealth to develop themselves into ecotourism villages. Examples of villages that develop ecotourism-based tourism activities are the villages on Sumba Island, Komodo, Raja Ampat and Mentawai Islands.

Another example of the implementation of the concept of sustainable development at the local level is community-based tourism, which was implemented in the Nglanggeran Village and Panglipuran Village in Bali. Ngglanggeran village has built a sustainable tourism destination managed by the community. Ngganggeran has successfully aligned the tourism sector and environmental conservation. In conservation areas and some coastal villages, environmental financing models were developed using fees taken from tourists, and used to support activities, such as mangrove planting, fostering trees and coral reefs, the release of baby turtles, etc.

Panglipuran Village is famous in the world for Tebersih Traditional Village. Panglipuran village succeeded in implementing the philosophy of *Tri Hita Karana* by maintaining harmony among human beings, human beings with environment, and human beings with God. Due to the hard work of the village community, this tourist destination is visited by many domestic and foreign tourists, while ensuring the protection of the environment.

9.5 Green ports

9.5.1 Lamong Bay Terminal, Port of Tanjung Perak, Surabaya

Surabaya is the second largest city in Indonesia. As a center of business and trade-based industries, the role of port in the movement of goods is essential to the city. The Port of Tanjung Perak has become the lifeblood of Surabaya's economy since the 20th century. This port continues to be the mainstay of trade traffic and distribution that supports Surabaya and East Java and almost the entire eastern Indonesia region.

Indonesian state-owned terminal operator Pelindo III inaugurated the **Lamong Bay Terminal** (**Terminal Teluk Lamong**) on May 2015. It is the first semi-automatic container terminal, and first *green*-concept container terminal in the country. It was projected to increase Port of Tanjung Perak's annual capacity from 1.5 million to 3.5 million TEUs. The depth of the waters that meet the requirements of large ship docks is the main reason for choosing the Lamong Bay as the location of this mega project.

Built since 2010, Lamong Bay Terminal has a masterplan for the most environment-friendly terminal in Indonesia. As a green port, almost all equipment supporting the terminal facilities, operating system, and loading and unloading system are expected to perform efficiently using computerized system, have minimal greenhouse gas emissions, and be safe for the environment. Teluk Lamong Terminal has received certification as **Green Terminal.** The following are its key features: use of eco-friendly technology (CNG truck, CNG power plant, LED lighting, solar power cells); recycling (applying exhaust gas for air conditioner); mangrove planting; pollution reduction (waste management system, incinerator, oil-water separator, oil spill response).

PT Terminal Teluk Lamong. *(Photo: MOEF)*

9.5.2 Port of Tanjung Priok, Jakarta[46]

UNEP partnered with the Gadjah Mada University Center for Transportation and Logistics Studies (known as "Pustral") and developed a project to support development of a clean ports program in the Port of Tanjung Priok, Jakarta. The project resulted in the first ever baseline Air Emissions Inventory (AEI) conducted in Indonesia.

PT.Pelindo II selected Operation Terminal 3 (TO3) to serve as the focus area for the project as TO3 is the busiest cargo terminal under direct management of PT.Pelindo II. TO3 had been designated as a pilot for a modern and green port concept at the Port of Tanjung Priok. PT.Pelindo II indicated that they monitor ambient air quality and water quality as both are required by authorities as a means of environmental quality monitoring and control. In addition, PT.Pelindo II analyzed port business processes to identify bottlenecking activities that cause an increase in air pollutant emission with an aim of reducing emission of air pollutants by improving efficiency.

The AEI Report provided a framework to reduce emissions from the port developed using an ASIF (Activity, Structure, Fuel Intensity, Fuel Type and Emission Factor) approach as well as a business process approach. Moreover, a comprehensive Measurement, Reporting and Verification (MRV) Framework for GHG Mitigation of Port Related Emissions in Indonesia was also provided. This is in support of the *Regulation of the President of the Republic of Indonesia Number 71 Year 2011* and *Regulation of Minister of Environment Number 15 Year 2013* regarding MRV activity for GHG mitigation in Indonesia.

[46] This example is reported by UN Environment (https://www.unenvironment.org/ar/node/578).

10 Best Practices to Protect Ocean Health and Ensure Blue Economy Development

The ocean economy must be aligned not only with plans on economic growth, but also with environmental and biodiversity protection, fisheries, water and energy conservation, natural and man-made disaster risk reduction, and climate change mitigation and adaptation in order to transform to blue economy – an ocean-based economy that is sustainable, inclusive, and resilient. This section provides examples of best practices and innovations that support blue economy development and ensure healthy oceans and communities.

10.1 Coastal and Marine Ecosystem and Biodiversity Conservation

10.1.1 Marine Protected Areas

The Ministry of Marine Affairs and Fisheries (MMAF) continues to encourage marine conservation, by developing a strategy for establishing a region into a marine protected area.

As of 2015, the marine protected areas that have been managed continuously cover 17.3 million ha, spread over 32 provinces and 105 districts/cities. Of these, 112 protected areas, with a total area of 12.6 million ha, are managed by MMAF and Local Government. MOEF manages 32 protected areas, with a total area of 4.7 million ha. (**Table 10.1**). The total marine protected or conservation area (17.3 million ha) is around 21.6% of territorial water area (80,000,000 ha) or 6.4% of EEZ area.

MANGROVE PROTECTION AND ECOTOURISM

Mangrove Ecotourism in Bali

Wonorejo Mangrove Ecotourism in Surabaya

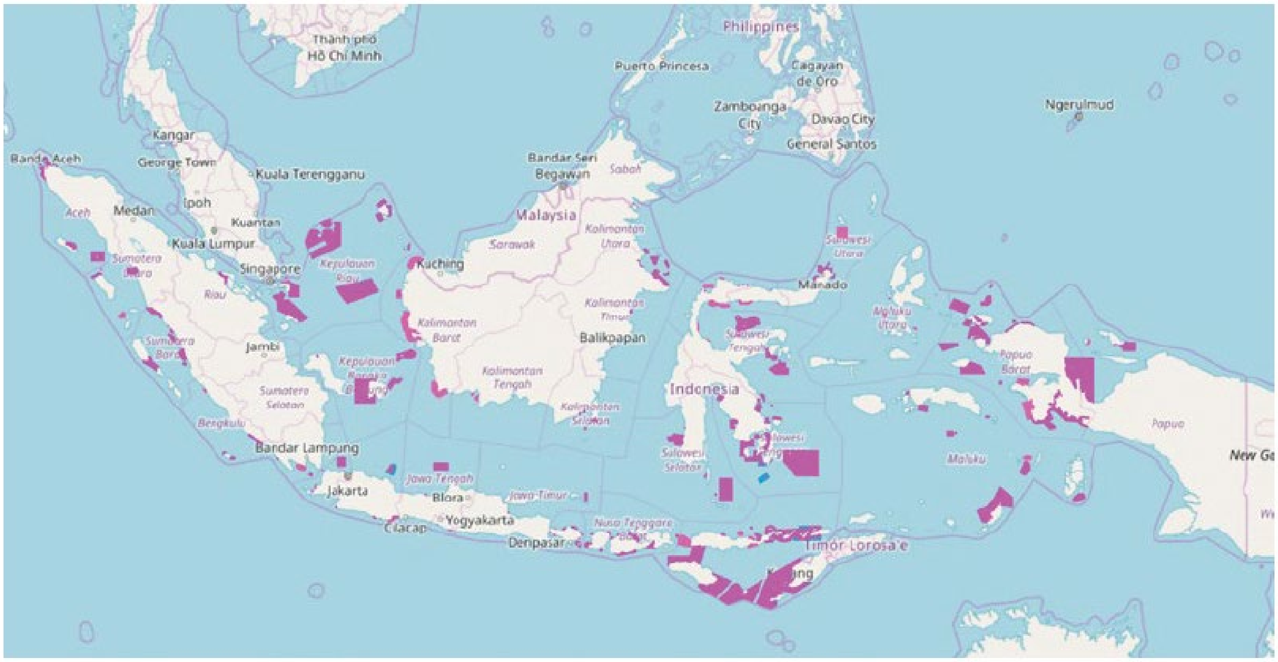
MARINE PROTECTED AREAS AND ECOTOURISM

Wakatobi Marine Ecotourism

Raja Ampat Marine Ecotourism

(Photos: MOEF and IPB)

Figure 10.1: Location of MPAs in Indonesia, 2017.



The total area of conservation is designated into various types of conservation areas. According to *Law No. 5 of 1990*, there are four categories of marine conservation areas managed by MOEF: Marine National Park, Marine Ecotourism Park, Marine Sanctuary, and Marine Natural Reserve. Moreover, according to *Law No. 27 of 2007*, there are additional types of conservation areas that are managed by MMAF: Marine National Park, Marine Nature Sanctuary, Marine Nature Recreation Park, and District Marine Conservation Area (**Table 10.1**).

Table 10.1: Number and Area (ha) of Various Types of Marine Protected or Conservation Areas.

No.	Conservation Areas	Number of MPAs	Area (Ha)
A	**Managed by MoEF**	**32**	**4,694,947.55**
	Taman Nasional Laut (Marine National Park)	7	4,043,541.30
	Taman Wisata Alam Laut (Marine Ecotourism Park)	14	491,248.00
	Suaka Margasatwa Laut (Marine Sanctuary)	5	5,678.25
	Cagar Alam Laut (Marine Natural Preservation)	6	154,480.00
B	**Managed by MMAF and Local Government**	**122**	**12,607,853.61**
	Taman Nasional Perairan (Marine National Park)	1	3,355,352.82
	Suaka Alam Perairan (Marine Nature Sanctuary)	3	445,630.00
	Taman Wisata Perairan (Marine Nature Recreation Park)	6	1,541,040.20
	Kawasan Konservasi Perairan Daerah (District Marine Conservation Area)	112	7,265,830.59
	TOTAL	**154**	**17,302,801.16**

Source: MMAF, 2015.

The coastal and marine areas destined for tourism activities in Indonesia have a total area of 2,032,288.2 ha consisting of Marine Ecotourism Park (491,248 ha) managed by MOEF, and Marine Nature Recreation Park (1,541,040 ha) managed by MMAF.

The Government of Indonesia through the MMAF has adopted the *Regulation on Marine Protected Area*. An MPA is a legally protected marine ecosystem as well as by means of zoning, area for conservation and sustainable utilization of fish resources. MPAs are established in coastal areas and small islands with important and unique biodiversity as well as social, cultural and historical significance. The law prohibits activities, such as oil and gas extraction, fishing and underwater activities, for maximum protection in recognition of the importance of conserving ecosystems to prevent degradation and overfishing.

The target of 10 million ha for the establishment of MPAs was achieved in 2009, and then a target of 20 million ha by Year 2020 was set. In 2011, the Indonesian government has established MPAs with a total area of 15,413,517 ha. In 2012, the extent of MPAs was increased to cover an area of 15,784,129 ha. Further, in addition to having a target coverage of MPAs, the government also provides protection to important habitats: 22.7% (747,190 ha) of coral reefs, 22.0% of mangrove forest (758,472 ha), and 17.0% of seagrass beds (304,866 ha).

The safeguards used to protect marine areas include the District Marine Conservation Areas developed by local governments with MMAF. There is also a conservation area that is relatively smaller and located at the village level called Locally-managed Marine Protected Areas. The Government of Indonesia has two main targets in the development of MPAs: (a) establishment of the MPA in the target area, and (b) enhancing management effectiveness. Nevertheless, even with the success of some areas, there are still limitations due to multiplicity of management institutions, inadequate biophysical design, and the level of awareness and social acceptance of coastal communities.

10.1.2 Mangrove Rehabilitation

Current efforts to restore natural resources and the environment have become a trend of private interest through community development programs and corporate social responsibility that can provide better and long-term benefits compared to other programs. These recovery programs have also been one of the leading programs in several ministry / institutional agencies in recent years. One of the recovery efforts whose track record is significant is the **coastal recovery program** through the rehabilitation of mangrove areas. In 2010-2013, mangrove rehabilitation in Indonesia has reached 35,103 ha spread over 34 provinces in Indonesia, however no activities were reported in 2014 (**Table 10.2**).

Table 10.2: Mangrove Rehabilitation in Indonesia, by Province, 2010-2014.

Province	2010	2011	2012	2013	2014*
Aceh	-	1520	-	650	-
Sumatera Utara	326	100	909	400	-
Sumatera Barat	-	100	-	300	-
Riau	-	500	554	600	-
Jambi	-	200	-	150	-
Sumatera Selatan	-	-	-	400	-
Bengkulu	-	170	-	100	-
Lampung	-	250	-	400	-
Kepulauan Bangka Belitung	-	90	5	193	-
Kepulauan Riau	-	255	360	460	-
DKI Jakarta	-	-	-	-	-
Jawa Barat	-	330	637	240	-
Jawa Tengah	-	290	1323	600	-
DI Yogyakarta	172	381	-	100	-
Jawa Timur	70	280	760	280	-
Banten	-	-	-	-	-
Bali	-	150	-	-	-
Nusa Tenggara Barat	-	150	140	140	-
Nusa Tenggara Timur	-	400	-	150	-
Kalimantan Barat	-	200	-	1000	-
Kalimantan Tengah	-	500	-	-	-
Kalimantan Selatan	-	200	134	300	-
Kalimantan Timur	-	600	1420	800	-
Kalimantan Utara	-	-	-	-	-
Sulawesi Utara	-	150	-	4000	-
Sulawesi Tengah	-	600	-	200	-
Sulawesi Selatan	-	325	520	500	-
Sulawesi Tenggara	-	300	200	460	-
Gorontalo	-	790	135	400	-
Sulawesi Barat	-	330	120	150	-
Maluku	-	200	42	100	-
Maluku Utara	-	270	112	140	-
Papua Barat	-	500	938	1000	-
Papua	-	300	562	1000	-
TOTAL	**568**	**10431**	**6871**	**11403**	**-**

* No activities reported in 2014. – BPS. Statistics of Coastal and Marine Resources 2016.
Source: Statistik Kehutanan Indonesia 2014, Kementerian Kehutanan.

Based on some studies, an investment cost of IDR 175 million is required to rehabilitate and protect 1 ha of mangrove forest in Sedari village of Kerawang Regency, and operational and maintenance cost, including breeding and planting, of IDR 35.69 million every year. Using cost-benefit analysis, the net benefit of mangrove rehabilitation, assuming management duration of 10 years and discount rate of 5%, was estimated to be around IDR 58.04 million, and a net benefit-cost ratio of 1.19. This shows that mangrove rehabilitation generates positive net benefits.

Box 10.1 Rehabilitation of Mangroves

Mangrove rehabilitation activities are often carried out by private agencies, government, and NGOs. The Ministry of Environment and Forestry (KLHK) has been rehabilitating mangroves. In 2015, an area of 430 ha was rehabilitated, and continued in 2016 with an area of 497 ha.

In addition to government agencies, academics and students who are members of the The Mangrove Ecosystem Study Group (KeSEMaT) at Dipenogoro University routinely perform mangrove rehabilitation in Central Java region.

Mangrove rehabilitation in Semarang

Lately, there is public awareness to save mangrove forests. In the city of Semarang, for example, 10 community groups are actively saving the mangrove forest. Among them are students of Marine Science Study Program, Faculty of Fisheries and Marine Sciences, Diponegoro University (UNDIP) in Semarang, and youth group in Tapak, Tugurejo Village, Tugu District. Tapak area is the most affected area of erosion in Semarang city. Dozens of hectares of ponds in this area were developed by cutting down mangrove forests, and are now being lost to abrasion and erosion.

In 2001, while undergoing a lecture in Teluk Awur, Jepara, UNDIP students saw the coastal condition was badly damaged. Mangroves were converted into ponds, which are now exposed to erosion. They then took the initiative to start the mangrove planting movement independently by setting aside their pocket money. From this activity, they developed The Mangrove Ecosystem Study Group called Teluk Awur (KeSEMaT).

In Tapak, Village of Tugurejo, also in year 2001, a group of young people developed the Prenjak community to grow mangrove seeds and replant the mangroves. According to Arifin, the leader of Prenjak community, community was developed to create positive activities for young peoples. They shared the money to buy mangrove seeds and mangrove rehabilitation. Finally, they have ability for seedling the mangrove.

Box 10.1 Rehabilitation of Mangroves (cont.)

In 2017, KeSEMaT conducted Mangrove Restoration (MANGRES) program consisting of a series of mangrove planting activities, training, awareness campaign, and embroidery located in Mangunharjo Village, Semarang. This event is also held to commemorate the Day of Wetlands, National Waste Day, Forestry Day, and World Water Day. In general, this rehabilitation activity aims to restore mangrove functions or ecosystem services, such as as waste assimilation, protection from the intrusion of sea water, and shelter for estuary biota.

Growing

KeSEMaT and Prenjak both see the benefits of mangrove forests for the environment and for life. As a student organization, KeSEMaT aims to develop a mangrove ecosystem research and environmental preservation. In Awur Bay. KeSEMaT study has planted 6.4 ha of land with 17 species of mangrove plants and is now the habitat of various species of primates, birds and reptiles.

This group has been accompanying many people to get the government's attention. They joined the standard working group from the District, City, Provincial levels up to the National level. The group was awarded *Tunas Lestari Kehati*.

The KeSEMaT Mangrove Indonesia alumnus (Kemangi) from the business side, *Prenjak,* also produces mangrove seeds offered to SOEs, government, and society. Furthermore, Prenjak develops milkfish cultivation. After the growth of mangroves, the size of milkfish became bigger. It turns out that mangroves help to restore the water quality.

Ecotourism and other socioeconomic benefits

Not only due to the environmental benefits, the spirit of the youth to rehabilitate the mangroves grows primarily because they derive economic benefits from the sale of seeds and the cultivation of milkfish. These young people aspire to make the location of their village as a mangrove ecotourism destination. Through Prenjak also, many out-of-school youth were able to continue schooling until high school level.

Although efforts to rehabilitate mangrove forests have been carried out by various parties, it is still at a lower rate than the damage rate. Head of the field of damage control and environmental conservation of Central Java Province, Wahjudi Djoko marjanto, mentions, "coastal belt development continues to be done every year, but still very less than what is needed."

Source: Amanda putri, Kompas, Wednesday – 11 February,2015.

10.1.3 Coral Reef Rehabilitation

a. Coral transplantation in Bali

Coral farming is an approach to coral restoration which allows for the culture and production of coral fragments on a large scale, and enables the 'farmer' to grow corals which are suited to precise reef habitats. In Indonesia, coral farming has been around for almost two decades.

The coral transplantation project in Bali (initially part of ICM activity) resulted in increased fish catch, additional diving sites, promoted ecotourism, and increased incomes of the fishing communities (see **Box 10.2**).

Box 10.2 Coral Restoration and Conservation in Serangan Island, Denpasar City, Bali

The Bali ICM Program selected Serangan Island as a site to demonstrate ICM approaches for addressing priority local issues and needs and to empower the community.

Bali's Serangan Island (also known as Turtle Island) increased in size almost five times by land reclamation done in 1994-1997. Meant to support tourism development, which was later abandoned, the reclamation destroyed much of the marine habitats including natural nesting sites of the green turtle, and valuable fishing grounds. More than 75% of the seagrass beds and 50% of mangroves were damaged, which also affected the adjacent coral reefs. In 2002, a monitoring survey of the state of the coral reefs showed that mortality rate of Serangan's coral reefs was at 37.9% (Environmental Management Agency of Denpasar Municipality, 2002). The declining fish stocks forced many of the fishers to engage in destructive fishing and coral mining, earning them the reputation of reef "destroyers".

In 2003, a group of young coral miners became highly motivated to protect coral reefs after learning of reef conservation from environmental campaigns, and organized themselves into the "Coastal Fishers Group of Karya Segara" (CFGKS). However, their expertise, capacity, or facilities to effect change were inadequate. In 2004, through the Bali ICM Demonstration Project, capacity building activities, including training on restoration and conservation of coral reefs, were implemented by the project. CFGKS then became a motivating force in the conservation efforts in the island. Apart from stopping destructive activities, the group restored coral reefs in two hectares of the dredged area. Several sustainable livelihood training programs were also conducted.

Coral reefs take a long time to recolonize naturally, but recovery can be accelerated through coral transplantation techniques. All coral species can be transplanted similar to

Box 10.2 Coral Restoration and Conservation in Serangan Island, Denpasar City, Bali (cont.)

assisted vegetative propagation. Under intensive maintenance, transplantation of corals can effectively restore and rehabilitate reefs. Restoration and rehabilitation efforts, however, cannot succeed without the active participation of people. To strengthen the program, the community group mobilized support from the government, private sector, and nongovernment organizations (NGOs). The environmental management program in Serangan Island was supported at all levels of government: from village level, to Denpasar Municipal Government and Bali Provincial Government, and to national level, through the Ministry of Marine Affairs and Fisheries (MMAF). CFGKS also established partnership with the private sector, such as the PT Bali Tourism Development Center (BTDC), Nusa Dua and PT Indonesia Power, through their corporate social responsibility programs.

Starting in 2008, tourists were encouraged to participate in the restoration of coral reefs through the **coral adoption program**. Transplanting corals became a tourist attraction in the island along with other recreational activities. Tourists learn about marine conservation, at the same time choose tour packages that include transplanting corals, releasing seahorses, swimming, diving, and snorkeling. The seahorses come from the culture farm of the community group. Each tourist was charged a fee for each cutting of coral that she/he transplants, with the fee going to the host community. Experience showed that by participating in the program, tourists were able to identify themselves as part of the community; were proud to be counted as reef protectors and conservationists; and enjoyed benefits derived from the unique and valuable experience of their visit to the island. In 2011, CFGKS began to work with travel agents to bring more tourists to the island, thus contributing to the increasing revenues generated by ecotourism.

The ICM program facilitated the development of the fishers group by building a network of partners to sustain their conservation effort and develop ecotourism services in collaboration with tourism agencies. This complete turnaround saw the transformation of some community fishers from being reef destroyers to active conservation advocates. Their strong conviction on environmental conservation and leadership earned them the respect of the community, and recognition from the country when they received the "kalpataru" award in 2011 – Indonesia's highest award for environmental management programs. Serangan Island became a place of learning for many local governments, NGOs, community groups, and students from universities within and outside Indonesia.

Source: I Ketut Sudiarta. 2018.

Photo by https://reefdivers.io/coral-farming-in-bali-indonesia/7503.

b. Coral Reef Rehabilitation and Management Program (COREMAP)[47]

The Government of Indonesia's Coral Reef Rehabilitation and Management Program (COREMAP), financed by The World Bank and the Global Environment Facility (GEF), has been gradually but significantly building science and management capacity over a period of 21 years.

Beginning in 1998 as a pilot project to test community-based fisheries management, the first stage of COREMAP laid the legislative groundwork for communities to take part in managing their own coastal resources. Having developed a workable model, COREMAP scaled–up with strong results: over 350 collaborative management plans between community and local government; a significant increase in awareness about ocean health; the return of rare species; 17% growth in coral reef cover in six out of seven project districts; and a 20% increase in the incomes of project beneficiaries.[48]

As COREMAP approaches its 21st anniversary, the program is now well into its third phase. Known as the COREMAP-Coral Triangle Initiative (COREMAP-CTI), the project is building on the earlier ground-level successes by strengthening Indonesia's oceans research capacity. Research activities are led by the Indonesian Institute of Sciences (LIPI), and include:

- A nation-wide coral monitoring program: LIPI and university scientists are now systematically tracking the health of Indonesia's precious reefs for the first time, identifying areas in need of

[47] This example is from André Rodrigues De Aquino and David Kaczan. "Marine science for healthy reefs and resilient communities: 21 years of COREMAP in Indonesia". https://blogs.worldbank.org/eastasiapacific.

[48] World Bank. 2012.

attention, monitoring the impacts of pollution and management changes, and making data available via an online data portal.

- Upgraded marine labs: six labs located throughout the archipelago are being upgraded to undertake critical marine research. This includes a bio-industry lab on the island of Lombok which is researching new opportunities to commercialize high-value species, such as sea cucumber and oyster pearls.
- Discoveries in unchartered waters: the project's Nusa Manggala Expedition sent 55 scientists on a two-month voyage around Indonesia's lesser-explored outer islands. The team—from across academia and government—identified candidate areas for marine parks, potential tourism development areas, and rare biodiversity.
- New methods for monitoring seagrass and mangroves: Indonesia is home to the world's largest seagrass and mangrove areas, providing critical economic functions. Increased capacity to monitor and protect these systems will help the country to better harness their worth.
- A new regional training center: An upgraded **Regional Training and Research Center for Marine Biodiversity and Ecosystem Health** (RTRC MarBEST) will train and support young scientists and managers from across the region to address marine threats and collaborate across borders.
- Research that responds to policy and economic needs: COREMAP-CTI is making small grants available to support researchers answer practical questions. Results so far include a skin-care cream based on marine products, new understanding of the impact of tourism on sensitive areas, among others.

Yet COREMAP-CTI's contribution is not limited to science. The project also involves a series of small grants to support two nationally-significant marine protected areas, Raja Ampat and Sawu Sea. The grants aim to provide support for initiatives, such as small infrastructure for ecotourism, community surveillance against illegal fishing, and the implementation of national plans of action for threatened species.

In bringing together robust research and enhanced management capacity, COREMAP is helping Indonesia become a leader in harnessing the benefits of the blue economy. This means managing marine assets for national growth, strengthening rural livelihoods, while protecting the natural environment.

Photo by LIPI.

10.1.4 Protection of Rare, Threatened and Endangered Species

a. Prohibition of Napoleon Fish Trading in Anambas and Natuna

The banning of Napoleon Fish trading in Anambas and Natuna began in 2013 based on *MMAF Decree Number 37/2013 on Determination of Protection Status of Napoleon Fish (Cheilinus undulatus)*. This is because the fish are categorized as threatened species in Appendix II of CITES and endangered species on the IUCN Red List. However, based on the results of the fish stocks study, Napoleon Fish is not actually banned, instead it is allowed to be re-traded with export quota limits of 40 thousand fishes with a size of more than 1 - 3 kg per tail in 2018. In Natuna, the quota is 30 thousand fishes and in Anambas Islands 10 thousand fishes.

b. Ecotourism Development and Whale Shark Protection in Cendrawasih Bay and Probolinggo

Ecotourism development of whale sharks in Cendrawasih Bay, Papua Province and Probolinggo, East Java Province is one of the conservation efforts of species in Indonesia. These locations are the most popular today and the largest whale shark research center in Indonesia. Development of ecotourism aims to reduce or even eliminate efforts to hunt these large animals through improving the economy of society, either directly or indirectly. In Cendrawasih Bay, the whale sharks are always present throughout the year, but the best month to visit is in May and October. In Probolinggo, whale sharks appear in January - March. The existence of whale sharks can increase the number of tourists by up to 2 times in Bentar Beach, Probolinggo.

c. Dugong Conservation in Bintan

The dugong conservation program in Bintan started in 2001, namely TRISMADES Project (Trikora Seagrass Management Demonstration Site) in east beach of Bintan Island, Riau Islands. This program is funded by UNEP/GEF Reducing environmental degradation in the South China Sea and the Gulf of Thailand Project (abbreviated as SCS Project)". This project is not directly for dugong conservation program, but started as rehabilitation of seagrass, which is dugong habitat. This project was carried out by a team of researchers from the Center for Oceanographic Research-Indonesian Institute of Sciences (P2O-LIPI). The specific objective of the activity is to develop an effective and measurable scheme in reducing environmental stresses on seagrass and coastal resources at Trikora Beach, Bintan.

All relevant stakeholders have been involved in the successful management of an integrated seagrass ecosystem through the TRISMADES project, which was effectively implemented from September 2007 to August 2010. In addition to UNEP/GEF, part of the TRISMADES project funding comes from the Indonesian government through a research grant managed by P2O-LIPI. There are three target villages at the implementation site of TRISMADES project in east beach of Bintan Island, namely: the Village of Teluk Bakau, Malang Rapat and Berakit, involving stakeholders from different backgrounds in each village, such as the general public, fishermen, NGOs, resort owners or tour operators, police, village government, Marine Affairs and Fisheries Office of Bintan and BAPPEDA Bintan.

Currently, the dugong conservation program is re-routed through the Dugong and Seagrass Conservation Project (DSCP) with the same funding source, UNEP/GEF for 2016-2018. This project is implemented by four institutions, MMAF, LIPI, IPB and WWF, established as the National Dugong Conservation Committee (NDCC). The main purpose of DSCP's activities in Bintan is to create management mechanisms and incentives for sustainable fisheries through the implementation of CSR and capacity building (local and government communities), and harmonize policies, planning and regulations (conservation of dugong and seagrass).

d. Turtle Conservation in Bali

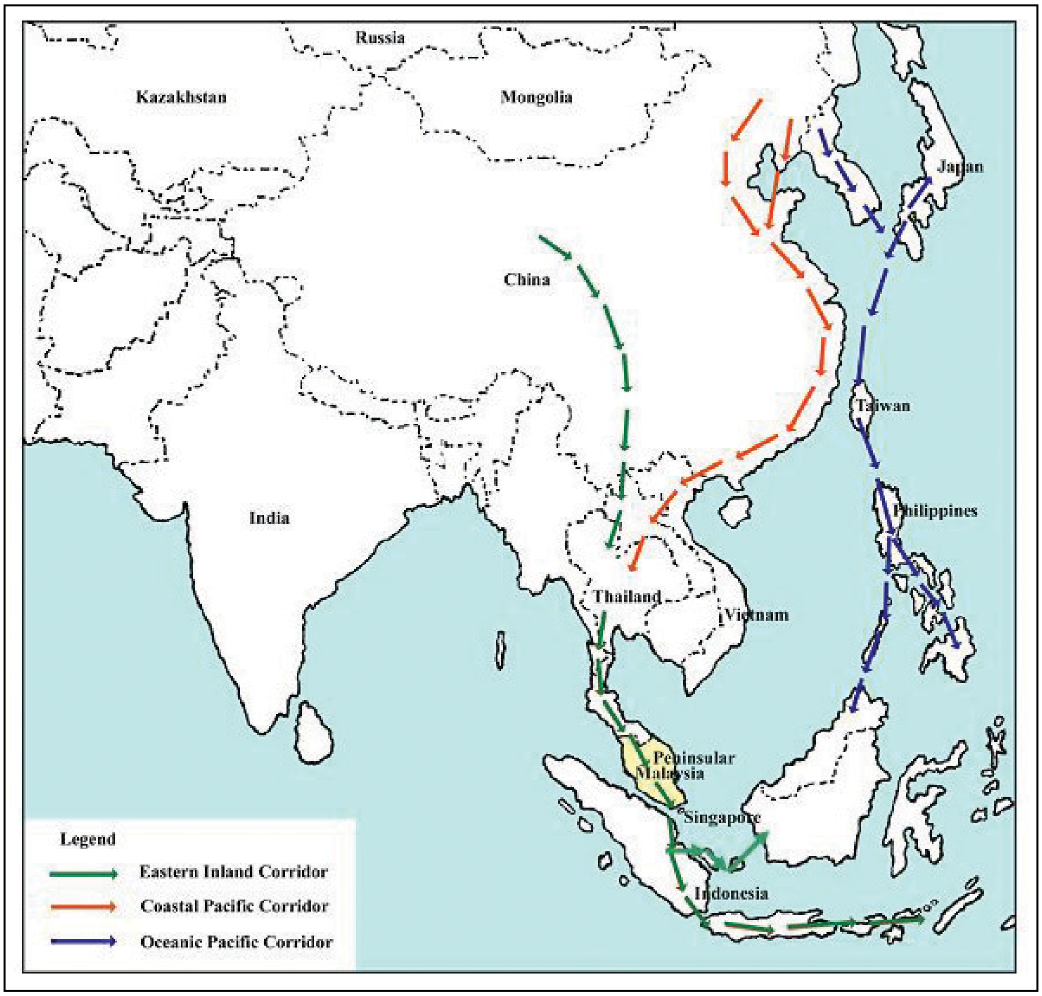
Sea turtle is one of the animals consumed by the people of Bali for traditional ceremonies. The turtle sale occurs at Serangan Island and Tanjung Benoa. This results in the decline of turtle populations, so the effort of turtle conservation in Bali is very intensive. One of the turtle conservation activities considered to be successful until now is the **Turtle Education and Conservation Center** (TCEC) project located in Serangan Village, Denpasar. The conservation project began in 1982, at the initiative of the then Minister of Research and Technology, B.J. Habibie. However, conservation activities were reduced until 2003. Since then, Bali conservation activists, WWF and Bali Provincial Government are supporting the activities of TCEC. Conservation efforts of TCEC include protecting the beach areas where turtles lay their eggs. A number of eggs are hatched on TCEC. Most of the turtles will be released when they are up to 40 cm long, while a few are raised for ceremonial purposes. To be sustainable, educational tourism is developed to support operational costs through a donation system. Currently, the TCEC program also extends to the island of Java.

e. Migratory birds

Beside the marine animals, Indonesia also protects water birds, especially migratory birds. This protection includes supporting habitats, such as wetland and mangrove areas. Indonesia is a migratory flyway of birds divided into two corridors, namely Eastern inland corridor and Coastal Pacific corridor (**Figure 10.2**).

For the Eastern inland corridor, the flyways that the birds pass are from southeastern Siberia through eastern China to peninsular Malaysia, then to Indonesia, namely Java, Bali, and Lombok. While for the Coastal Pacific corridor, the flyways passed by the birds are from eastern Russia, then pass through the Islands of Japan and Taiwan, then to the south of the Philippines and pulled over to the Great Sunda region. In one migration, they can fly up to 15,000 km with a travel time of 50-70 days.

Figure 10.2: Map of the Migration Flyway of Raptors.

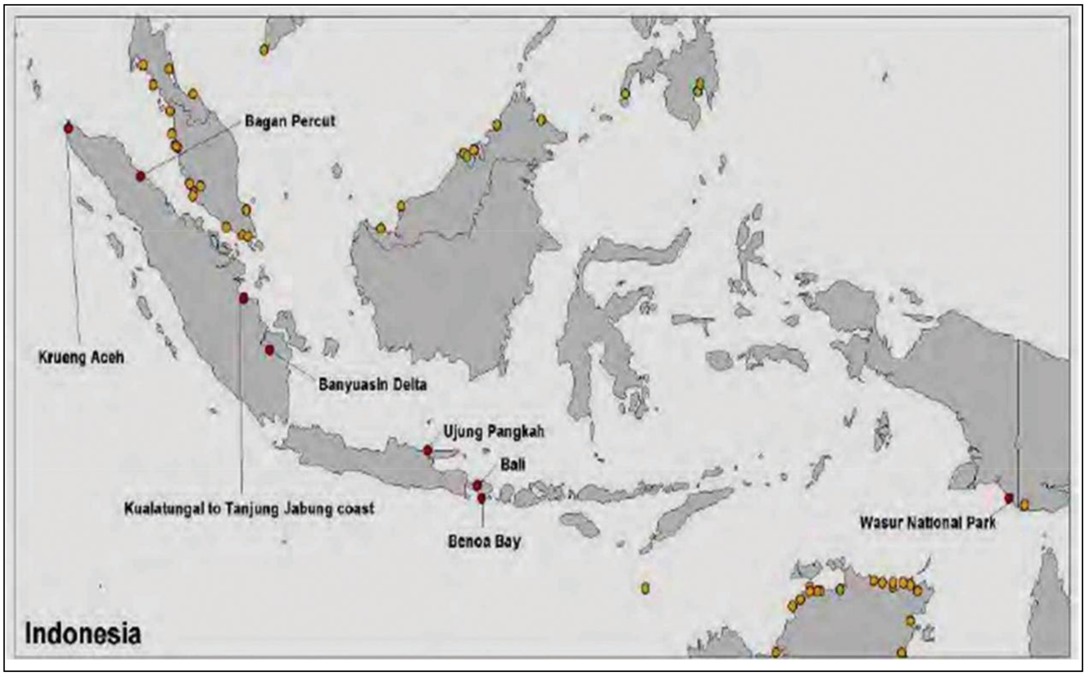


Source: Raptor Indonesia.

During migration, birds usually fly during the day. At night, they look for a place to stop for a break (roosting). At rest areas, they can spend 3 to 14 days in search of food and then go back on their way. These birds then fly to Australia and New Zealand. Some bird migration sites in Indonesia include (**Figure 10.3**):

1. Sumatera: Tanjung Bakung, Tanjung Datuk, Delta Sungai Musi Banyuasin;
2. Java: Muara Gembong, Muara Angke, Kamal Muara, Karang Mulya, Indramayu-Cirebon, Delta Bengawan Solo, Delta Brantas, Perengan, Semangkan;
3. Bali: Suwung;
4. East Nusa Tenggara: Sumba, Kupang Beach;
5. Kalimantan: Pulai Jawa, Muara Ulu, Pulau Berau, Senipah, Pulau Bukuan, Tanjung Sembilang, Pulau Layangan;
6. Sulawesi: Lampiko-Mampie, Lanteboeng, Makassar, Maros, Muara Sungai Salowatu, Pantai Utara Teluk Bone; and,
7. Papua: Pulau Kimaam, Taman Nasional Wasur, Rawa Biru.

Figure 10.3: Bird Migration Sites.



Some threats to migratory birds are that not all birds are in the priority list of protection, and some flyways do not belong to protected areas. Thus, these migratory birds are vulnerable to hunting, and supporting ecosystem damage.

The management of these migration paths is carried out in five ways, namely: creating management system and supporting protection policy, conducting inventory and monitoring periodically, building network, increasing human resource capacity, and doing communication, education, participation and awareness (CEPA) campaign.

10.2 Environmental Management and Pollution Reduction

The Government of Indonesia's **Long-Term National Urban Development Plan, 2015-2045**, sets targets of urban service standards and city waste management –demanding high sector performance. Solid waste management is high on the national agenda, as exemplified by the **National Medium Term Development Plan's** (RPJMN) **"100-0-100" target** of eliminating all slums and providing universal access to water and sanitation, including solid waste, by 2019.[49] This is a bold and ambitious target given the constraints that need to be addressed to achieve this.

[49] The "100-0-100" target refers to 100% household access to water supply; zero slums; and 100% household access to sanitation (including wastewater treatment and solid waste collection).

10.2.1 Corporate Performance Rating Program

In June 1995, Indonesia launched an innovative program for public disclosure of polluters' environmental performance. This initiative, called the **Program for Pollution Control, Evaluation and Rating (PROPER)**, is expected to serve two objectives:

- Promote compliance with existing regulations
- Reward firms whose performance exceeds regulatory standards

PROPER is an industrial monitoring program aims to encourage industry to apply green economy principles and corporate environmental responsibility, and promotes environmental management system performance assessment criteria, energy efficiency, water conservation, emission reduction, biodiversity protection, 3R (reduce, reuse, recycle) of B3 waste and Non B3 solid waste, and reduce economic disparities by implementing community empowerment programs. Indonesia's National Pollution Control Agency (BAPEDAL) is systematically developing and testing the program.

Enforcement of formal regulation in Indonesia is currently weak, and the modest size of BAPEDAL's budget assures that this weakness will persist in the near future. However, the manufacturing sector is growing at over 10% annually, and the Indonesian Government recognizes the mounting risk of severe pollution damage. Under these conditions, the Environment Ministry has decided that a large-scale public disclosure program may induce significant pollution abatement while the formal regulatory system is further developed. The MOEF assigns rankings to each company depending on its compliance or non-compliance. The rating is as follows:

1. **GOLD – Excellent**: Given to businesses and / or activities that have consistently demonstrated environmental excellence in the production and service processes, and conducting ethical and responsible business to the community.
2. **GREEN – Good**: For businesses and / or activities that have undertaken environmental management beyond the required compliance with the implementation of the environmental management system and they have utilized resources efficiently and carried out their social responsibilities well.
3. **BLUE – Adequate**: For businesses and / or activities that have undertaken environmental management efforts, which are required in accordance with applicable laws and regulations.
4. **RED – Poor**: For those who have undertaken environmental management efforts, but not in accordance with the requirements as stipulated in the legislation.
5. **BLACK – Very Poor**: Given to those companies, which, in the conduct of their business and/or activity, have deliberately committed an act or made a negligence resulting in pollution or environmental damage, as well as enacting prevailing laws and / or failing to implement administrative sanctions

Participants in the program are increasing with different ranking results each year (**Table 10.3**). In 2016, the number of participants to PROPER reached 1930 companies consisting of 111 types of industries. PROPER's compliance rate in 2016 reached 85% with 12 EMAS (gold) rating companies, HIJAU (green) 172 companies, BIRU (blue) 1422 companies, MERAH (red) 284 companies, BLACK 5 companies, and 35 other companies not announced consisting of 13 companies under law enforcement process and 22 companies closed / not operating. BLACK rating is given to companies that cause environmental pollution, do not have an environmental license or dispose of B3 waste directly into the environment.

Companies that got GOLD rating in 2016:

- PT. Pertamina (Persero) Refinery Unit VI - Refinery Balongan,
- PT. Pertamina Hulu energi West Madura Offshore,
- PT Badak NGL, Joint Operating Body Pertamina - Talisman Jambi Merang,
- PT. Pertamina EP Asset 1, Field Rantau Aceh, PT. Pertamina Marketing Operation Region IV TBBM Rewulu Regency of Bantul,
- PT. Java Power, Star Energy Geothermal (Wayang Windu) Ltd. Regency of Bandung,
- PT. Medco E & P Indonesia - Rimau Asset, PT. Pertamina Geothermal Energy Area Kamojang,
- PT. Bukit Asam (Persero) Tbk. Tanjung Enim Mining Unit, and
- PT. Bio Farma (Persero) Bandung.

The following companies received the rating of BLACK in 2016:

- PT. Indo Agriculture International Semarang City,
- PT. Waterindex Tirta Lestari Regency of East Lampung,
- PT. Cahaya Cemerlang Kota Makassar,
- PT. Alumunium Indo Jaya Makassar City, and
- PT. Sari Cakalang Bitung City.

Table 10.3: Number of Participating Companies Following PROPER from 2011-2016.

Year Period	Number of Companies
2010-2011	1,002
2011-2012	1,317
2012-2013	1,812
2013-2014	1,908
2014-2015	2,137
2015-2016	1,930

Source: Permen LH Nomor 5 Tahun 2011, Kepmen LH Nomor 273 Tahun 2012, Kepmen LH Nomor 349 Tahun 2013, Kepmen LH Nomor 180 Tahun 2014, Kepmen LH Nomor SK.557/MenLHK-Setjen/2015, dan Kepmen LH Nomor SK.892/Menlhk/Setjen/SID.0/12/2016.

Table 10.4: PROPER Compliance Trends (2011-2016).

Year Period	Rank					Under Law Enforcement	Not Announced
	Gold	Green	Blue	Red	Black		
2011	5	106	552	283	49	-	7
2012	12	119	771	330	79	-	6
2013	12	113	1039	611	17	-	20
2014	9	121	1224	516	21	-	17
2015	12	108	1406	529	21	24	17
2016	12	172	1422	284	5	13	22

Source: Permen LH Nomor 5 Tahun 2011, Kepmen LH Nomor 273 Tahun 2012, Kepmen LH Nomor 349 Tahun 2013, Kepmen LH Nomor 180 Tahun 2014, Kepmen LH Nomor SK.557/MenLHK-Setjen/2015, dan Kepmen LH Nomor SK.892/Menlhk/Setjen/SID.0/12/2016.

10.2.2 Wastewater Management in Tourism Areas

The increasing environmental damage and climate change caused by human activities provide the impetus for making a positive response, either through direct or indirect means, through policy or direct action. The response requires incorporating externalities (environmental) into a business plan, including public planning.

In this context, the extended cost-benefit analysis in the design of business development and regional development should be the main approach so that the development can be declared eligible to be continued or stopped by promoting the principles of sustainable development, ecological sustainability, economic and financial sustainability and social sustainability.

In addition, something must be done to anticipate the flow of all waste from land to sea. It is necessary to standardize wastewater treatment. Wastewater management is one way to internalize externalities which of course require resources to manage them, e.g., financial, human, and technological resources.

There are two examples of wastewater treatment in Bali: area of Nusa Dua complex, and Denpasar Area.

a. Wastewater management in Nusa Dua, Bali

The development and management of Nusa Dua tourism area is conducted by PT. Bali Tourism Development or widely known as Bali Tourism Development Corporation (BTDC), which has now changed its name to Indonesia Tourism Development Corporation (ITDC) since 2014. The company is processing the entire wastewater from the hotel complex in an area known as Lagoon BTDC.

BTDC Lagoon. *(Photo by M. Ebarvia)*

BTDC Lagoon was built in 1976 with a capacity of 10,000 m³/day and began operating in 1980. The area of the lagoon is 30 ha, of which 17 ha are for the installations and pumps. The BTDC Lagoon consists of two installations: (a) primary wastewater treatment (Cell 1, 2a, 2b, and 3) and (b) irrigation processing facilities (aerator ponds, sedimentation and filtration ponds. The wastewater comes from each part of the hotel, such as bathroom, toilet, laundry, swimming pool, air conditioner, kitchen and all hotel activities that use water. BTDC Lagoon uses low-cost technology - Waste Stabilization Pond with physical system (sedimentation) and biological system (aeration).

To know the quality of wastewater from processing, Nusa Dua Bali works with Denpasar laboratory, and applies the Denpasar Local Regulation standard for domestic wastewater.

The treated wastewater is reused, through irrigation water pipes, for watering the landscape and gardens of Nusa Dua tourism area and within the hotels. For watering of the golf course, further processing is done with the addition of rapid sand filter to minimize turbidity and microbes in irrigation water.

This wastewater treatment is very effective and efficient. Lagoon BTDC is capable of processing 4000-6000 m³/hr and producing 1500-2000 m³/month of irrigation water. Moreover, the lagoon provides home to population of fish, which, in turn, become biological indicator and at the same time they will attract flocks of birds. The BTDC Lagoon has become an 'eco-park' - a site for bird-watching, recreational fishing, and study tours.

b. Wastewater treatment in Denpasar City, Sanur and Kuta, Bali

Wastewater treatment in the area of Denpasar City, Sanur and Kuta is done through Denpasar Sewerage Development Project (DSDP). The project was built in 2008 and started operations in 2009 to treat wastewater from household, commercial areas and public buildings, tourism, industry, etc.

Wastewater treatment system is divided into three parts, namely wastewater treatment plant (WWTP), pumping station and sewerage system. The location of WWTP is located in Suwung Kauh Village which occupies an area of 10 ha, with flow design of 51,000 m^3/day (phase I) and 43,000 m^3/day (phase II), so the total flow design is 94,000 m^3/day.

Waste treatment conducted in aeration ponds will result in a processed water output with a Biochemical Oxygen Demand (BOD) of less than 30 mg/L where the standard quality established by the government is 50 mg/L and Chemical Oxygen Demand (COD) to < 10 mg/L. In this DSDP system, there are 2 pump houses located in Sanur and Kuta, with a flowing pump capacity of 12.4 m^3/minute for Sanur pump house and 23.8 m^3/minute for Kuta pump house.

10.2.3 Solid Waste Management

Open dumping is still the most widespread practice for solid waste disposal in Indonesia. The effects of uncollected waste are most prominent along the Citarum River, which has been declared a national strategic area. Citarum River is the longest river in West Java, and is inundated with municipal solid waste that contributes to frequent flooding.

a. Zero waste communities

In 2017, the circular economy concept was introduced in Indonesia with three pilot **Zero Waste** project communities: Bandung, Cimahi, and Soreang (**Box 10.3**). Bandung City is the capital of Indonesia's West Java province, with a population of close to 2.4 million. Cimahi City is located in Bandung Regency, and has a population of over 500,000. Soreang is a subdistrict of the Bandung Regency, with a population of over 100,000.

With Bandung City's *Kurangi* (reduce), *Pisahkan* (segregate), *Manfaatkan* (reuse) or *Kangpisman* program, the city mayor (Oded M. Danial) aimed to set up a new culture. The City is focused on five aspects of *Kangpisman*: regulation, manual, model on a regional scale, facility for waste decentralization system, and information system for waste management. They are also doing massive campaigning, collaborating with the education system involving all government agencies at the city level, and developing a volunteer network for *Kangpisman* work.[50]

Box 10.3 YPBB: Indonesia's Pioneer in Zero Waste

When you talk of Zero Waste communities in Indonesia, three cities come to mind: Bandung, Cimahi, and Soreang. These cities, which used to struggle with managing their waste, have in recent years become leaders in **Zero Waste program** implementation.

These cities' incredible transformation was due in no small part to GAIA member organization, Yayasan Pengembangan Biosains dan Bioteknologi (YPBB). The implementation was so impressive that, just a year after the cities started their pilot, they became proud hosts to the International Zero Waste Cities Conference held in March 2018. Attended by over 300 delegates from different parts of the world, the conference allowed the cities to showcase the communities that have taken the road to Zero Waste.

YPBB is a non-profit environmental organization based in Bandung, Indonesia. Established in 1993, YPBB's vision is to "achieve a high quality of human life through an organic lifestyle." It promotes sustainable living, recycling and composting, waste segregation, and strong involvement of the district government as well as the communities in the implementation and advancement of zero waste policies and programs. YPBB also believes in the importance of practical education to mainstream the concept of Zero Waste in people's everyday lives. This highly cooperative approach—where community members are not just participants but leaders in their neighborhoods' transition to Zero Waste—is the key to YPBB's success.

Through partnerships with government leaders and community members, YPBB has created simple and elegant solutions to the pileup of garbage and fast-growing landfills that are plaguing Indonesian cities. By focusing on reducing the amount of waste generated, together with diligently segregating the waste at source, these cities can get rid of their trash problems once and for all.

[50] https://www.no-burn.org/zero-waste-academy-in-indonesia/.

Box 10.3 YPBB: Indonesia's Pioneer in Zero Waste (cont.)

YPBB found that in Bandung, the third largest city in Indonesia, the 2.5 million people living in the city produce around 1,500-1,600 tons of waste every day. Bandung's local government already allotted IDR 137 billion for waste transportation per year. More than half of household waste in the city, or 63%, is organic waste. Recyclable materials come in second at 23% while the remaining 14% are residual waste. This means that Bandung City can potentially reduce the amount of household waste brought to landfills by as much as 86% and bring down its waste collection, transportation and landfill tipping fee expenses to just USD 17.1 million (IDR 19 billion) per year. Potential savings can later be utilized in hiring more waste workers and in developing more collection, decentralized recycling and composting facilities.

YPBB then developed a decentralized waste management model piloted in Coblong Sub-district, Cibeunying Kaler Sub-district and Babakan Sari in Bandung and all districts in Cimahi City, and in Soreang district in Bandung Regency through the program Zero Waste Cities. The program envisions a "systematic, scalable, thorough, and sustainable waste management system."

Within a short period of time, YPBB was able to deliver transformative results. Within just the first year, #ZeroWasteCities reached 3,640 households or around 14,560 people. The program was responsible for keeping 950 kg of waste each day out of landfills, saving about IDR 63 million (USD 4,300) in transportation costs for that year. While this is already an impressive achievement, YPBB wants to further increase their success rate by working with governments to create conducive regulatory and financing policies for Zero Waste approach.

The current success rate (and the money it saved the city) did not go unnoticed by local officials. The new mayors of Bandung and Cimahi have so much confidence in the program that they want to expand it. Bandung City has committed to doubling the waste management budget of kelurahan to about IDR 200 million per RW (rukun warga or subdivision) per year, while the Cimahi government is also in the process of increasing financial support for decentralized waste management.

The Bandung Regency head recently created a regulation for villages to allocate budget and create local regulation on waste management. With the additional budget, RWs, in cooperation with local leaders, can now invest more resources in additional waste workers and infrastructure.

Box 10.3 YPBB: Indonesia's Pioneer in Zero Waste (cont.)

With the support of local governments and a dedicated group of community leaders, YPBB is leading the way to a Zero Waste Indonesia.

"We see our Zero Waste campaign as a way to contribute towards an ecologically sustainable global civilization. We are very lucky because we are in the moment where we get significant support from many parties to transform the lives of thousands of people towards sustainable Zero Waste system, and hopefully millions of people in near future," said David Sutasurya, Executive Director of YPBB.

"This requires intense work and time, but we know it's worth it since we are in the critical time of saving humankind and our fellow creatures from unbearable climate change. Utilizing this moment to create change in such a short time is key to safeguarding the future of our loved ones and future generations."

Source: https://www.no-burn.org/meetourmembers-ypbb/.

b. Decentralized waste banks

Waste banks are informal community-based establishments for collecting sorted inorganic waste that has economic value. Decentralized waste banks, trash banks, garbage banks or *Bank Sampah* as they are called in Indonesia are a new convincing concept for waste management. Waste banks are set up in neighborhoods typically for about 1000 residents and are usually run by poorer people who wish to increase their income. Bank customers bring all non-organic waste to the banks where it is treated like a deposit. Transactions are recorded preferably in a bank book that the customer holds or alternatively in lists kept by the bank. The waste banks sell the deposited material to mobile agents for reuse or recycling. Thus, the waste deposits are transformed into money that can be withdrawn when needed after a contribution of about 15% is deducted for the bank's operating costs.

The MOEF promotes Waste Banks as a strategic program to involve informal community-based efforts to collect sorted inorganic waste that has economic value. According to MOEF producing 1500-2000 m^3/month of irrigation water. Moreover, the lagoon provides home to population of fish, which, in turn, become biological indicator and at the same time they will attract flocks of birds. The BTDC Lagoon has become an 'eco-park' - a site for bird-watching, recreational fishing, and study tours.the positive impacts of the waste bank development program is inseparable from the participation of people, especially at the grassroots level.

Box 10.4 Good Practice in Makassar: LONGGAR* Program

The City of Makassar launched several interrelated initiatives to improve waste management that build on the success of the city's waste banks.

First, the City of Makassar prohibited private companies and city residents from:

(a) Mixing household waste with hazardous and toxic waste;
(b) Burning plastics waste and waste that contains elements of plastics;
(c) Disposing waste in rivers, ditches, irrigation canals, drainage channels, parks, open spaces, public facilities and roads;
(d) Burning garbage in the open which could cause pollution; and/or
(e) Using unoccupied land as open dumps.

Second, the city eliminated temporary shelters (TPS). In their place, Makassar's Park and Cleansing Department has placed waste containers in every sub-district and district along with provisions to collect waste from households via dump trucks, motorized carts and waste bins.

Third, the Mayor launched the LONGGAR program to promote clean and healthy environments in the city's alleys through alleyway gate cleaning, graffiti removal, installation of pergolas, wall paintings and horticulture plants in addition to siting 90 x 40 cm waste bins with steel stands. The program has been successfully established in 42 alleys in 14 districts since 2015; an additional 28 alleys were under development in 2016 at the time of this assessment.

Fourth, the LONGGAR program is aligned with the city's LISA program (Lihat Sampah Ambil – See Waste Take It). Together, these steps have functioned to promote the Mayor's 'Makassar Tidak Rantasa' – Makassar is Not Dirty program further complementing the efforts promoted by the city's waste banks.

* LONGGAR: City of Makassar "Clean Alley Way" Program.
Source: World Bank. 2018. Indonesia Marine Debris Hotspot: Rapid Assessment Synthesis Report.

10.2.4 Marine Debris Management

In 2017, the Government of Indonesia has just initiated the management of marine debris by issuing Indonesia's **Plan of Action on Marine Plastic Debris 2017-2025**. It reinforces the existing policies and laws, e.g., *Law Number 18/2008 on Waste Management*; *Law Number 30/2007 on Waste Management; Government Regulation Number 81/2012 on Waste Management of Household Garbage and Garbage Similar of Household; Decision of Environmental Ministry Number 13/2012* *on Implementation Guidelines to Reduce, Reduce and Recycle by Waste Bank; and Decision of Transportation Ministry Number 29/2014 on Prevention of Pollution of the Maritime Environment.* The expected outcome is **70% reduction of marine plastic debris by 2025**.

The National Action Plan is led by the Coordinating Ministry for the Ministry of Marine Affairs. There are 5 pillars, namely:

1. **Improving behavioral change**. The awareness of stakeholders helps the efficiency and effectiveness of completing large scale plastic waste management throughout the region.
2. **Land waste reduction**. Plastic waste that comes from the streets of the city or household will go into the ocean. The impact of marine pollution on the ecosystem will be well documented.
3. **Sea waste reduction**. Garbage is found in many oceans that are sourced from various places, namely ships, fishing activities, and cruise ships.
4. **Reduction of plastic production and use**. The design of the action plan can encourage companies to use recyclable plastics and can produce degradable plastics.
5. **Enhancing funding mechanisms, policy reforms and law enforcement**. Funding mechanisms for RANs can be obtained from regional and national budgets supported by programs and innovation.

Strategies for implementing the National Action Plan to reduce plastic waste involve local governments, national government level, donors/international organizations, industry sector, non-government organizations, academia and communities. There are important aspects in managing plastic waste in Indonesia:

- Coordination between agencies in executing waste management
- Apply technology to monitor plastic waste, including scientific applications based on management
- The social aspect is very important to reduce, recycle, and reuse plastic waste at an early age.

Indonesia is also structuring a national program to address the land-based management of waste over a period of four years with financing of up to US$ 1 billion, and welcome collaboration from strategic partners in this regard.

Indonesia also will integrate the issue of Marine Plastic Debris into the curriculum of its national education.

11 Opportunities for Blue Economy Investments, Business and Partnerships

Considering the over-exploitaiton of natural resources, habitat and biodiversity loss, pollution, and climate change issues, it has been argued that the world economic system tends to be environmentally destructive. There are major challenges because there are still many unknowns, such as the potential impact of seabed mining on highly migratory species, such as tuna, and impact of harnessing ocean tidal or wave energy on marine species. Precautionary principles must be considered in the face of uncertainty, and mitigating measures must be put in place to prevent negative environmental consequences. In addition, we need to shift from a fragmented, sectoral development and management approach, which promotes little collaboration across different entities, to a multi-sector, inter-agency approach, and integrated and comprehensive management system. The Blue Economy approach can provide incentives to build and support better cross-sectoral collaboration and relationships and integraged management of the coasts and oceans. Public sector leadership in promoting sustainable coastal and marine development through an adequate ocean governance structure is an important driver in Blue Economy development efforts. This includes institutional arrangements, an effective policy framework developed in collaboration with stakeholders, consistent enforcement of laws and regulations, clear management targets, supporting scientific and economic research, adequate incentives and funding modalities, such as financing performance-based conservation, and partnerships with the private sector, local governments, civil society and communities. Identifying emerging industries and investment opportunities in diversifying and transforming the ocean economy will be one of the key aspects of private sector involvement in the Blue Economy transition.

Pauli (2010)[51] also introduced a new approach through his book "The Blue Economy: 10 years, 100 innovations, and 100 million jobs". The Blue Economy concept in his book is intended to challenge entrepreneurs to adopt the Blue Economy business model. Pauli's concept provides an opportunity to develop more economically and environmentally sound investments and businesses in the coastal and marine areas and in ocean-based industries. Blue economy promotes using natural resources more efficiently by generating more derivative products and other related products, resulting in greater revenue and less damage to the environment; more efficient and cleaner production systems; production of higher economic valued-products; increase in employment; and opportunity to benefit each contributors more fairly (Sharif, 2013).

[51] Pauli, G. 2010.

For example, half of the fish that Indonesians eat today is produced through aquaculture, and it is expected to increase to two-thirds by 2030. It has been shown that supplying these fish sustainably gives producers a long-term revenue stream. As shown in Norway, its large-scale fish cultivation, which is one of the most sustainable in the world, not only provides a great source of food but also generates economic prosperity.

Many businesses have started to invest in environmentally friendly technologies, and sustainable production and service delivery. For example, companies in the fisheries sector are increasingly certifying their products (eg, Marine Stewardship Council, Friends of the Sea), and the global cargo industry has committed to improving the environmental performance of their fleet. Sustainable tourism is another sector that provides jobs and encourages local economic growth, especially in developing countries threatened by high demand for extractive resources. For instance, sharks in living condition are more valuable than dead, as they generate over US$ 300 million per year of ecotourism revenue worldwide. In addition, emerging marine industries, such as marine renewable energy, bioprospecting and biotechnology, and submarine cables can result in alternative energy sources, new medicines, improvements in information technology and communications, etc. to meet the challenges of the current century, and transform the marine economy.

Both the public and private sectors will play an important role in the transformation towards a sustainable Blue Economy. Public-private partnerships (PPPs) can leverage the strengths of each sector. With the ability of the public sector to provide local knowledge and political support, and private sector to provide expertise in trade, management and innovation, PPP can be an effective tool to support Blue Economy development efforts. Indeed, PPP has shown success in delivering projects to improve environmental performance and capacity in the health care, transportation, environment and energy sectors when certain enabling conditions and performance-based contracts are set in place.

The following examples are opportunities for blue economy development based on studies and research and development (R&D) work.

11.1 Fishery Sector

11.1.1 Development of Sustainable Aquaculture

The aquaculture in Indonesia is spread throughout the coastal and marine areas (as well as inland). Marine aquaculture has a protential area of 12,123,383.02 ha, however, only about 325,825.11 ha are utilized, so there is development opportunity in about 11,797,558 ha. Aquaculture in brackishwater has a potential area of 2,964,331 ha, but with utilization rate of 21.94%. Thus, there are opportunities for further developing or implementing sustainable aquaculture in the unutilized areas as shown in **Table 11.1**.

Table 11.1: Potential and Utilization Aquaculture Area in Coastal and Marine Areas in 2014.

Location	Potential Area (ha)	Utilization		Development Opportunity (ha)
		(ha)	Percentage (%)	
Brackishwater	2,964,331	650,509	21.94	2,313,822
Marine	12,123,383	325,825	2.69	11,797,558

Source: DGA, KKP, 2015.

Box 11.1 Management of Seaweed in South Sulawesi Province

Indonesian waters have seaweed germplasm resources of approximately 555 species (Basmal, 2001 in Azis 2011). One developed in South Sulawesi Province is *Kappaphycus alvarezii*. This species has an important economic value, because it is a carrageen producer. In industry and trade, carrageen has the same benefits as agar and alginate, which is used as raw material for pharmaceutical, cosmetic, food, and others (Anonymous 2011: Azis 2011)

South Sulawesi province has a potential of about 600,500 ha of marine cultivation. Of this area, about 250,000 ha can be utilized for seaweed cultivation with production projected to reach 1,250,000 tonne dry weight/year. Type *Pappaphycus alvarezii* is one of the commodities under "seeded fishery" in South Sulawesi Province, which aims to increase production and export volume. In 2003, the export volume reached 15,339 tonnes with value of US$ 5.7 million, and was able to absorb a considerable workforce size in the production, processing and marketing sectors.

Meanwhile, the price of seaweed at the level of seaweed fishermen at this time, reached IDR 12,000/kg dry weight (Azis, 2011). In comparison with its value, in September 2013, the South Sulawesi Governor released 739.5 tonnes of seaweed exports to China with value reaching US$ 720,075. One of the exporters of South Sulawesi Province is PT. Bantimurung in Maros Yang District. It has a relatively small production capacity of around 100 tonnes per month. It can meet the market demand (Wahyudin, 2013).

11.1.2 Energy Efficiency and Clean Energy for Fishing Vessels

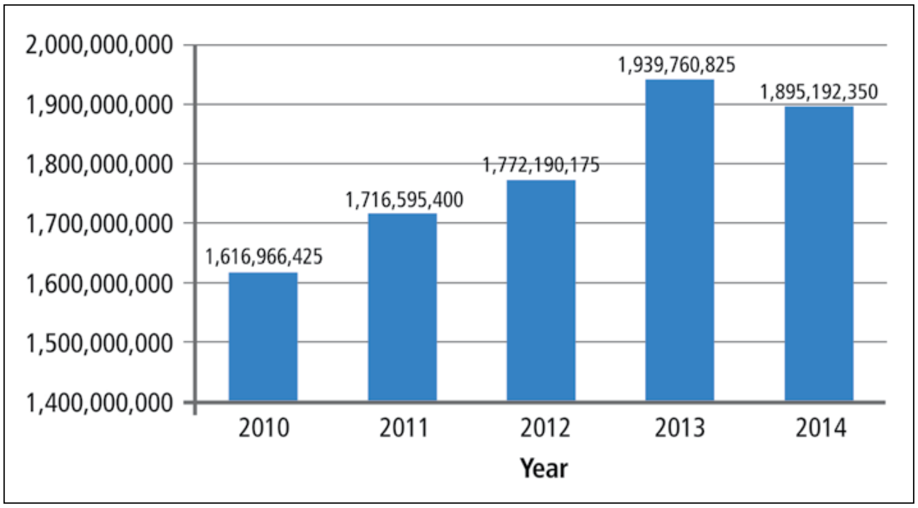
The fishery sector requires enormous energy to fuel fishing vessels. **Table 11.2** shows the fuel consumption by type of fishing vessel, and the number of fishing vessels per type. Assuming 355 fishing days per year, the total fuel demand for the fishery sector in a year is around 1.9 billion liters. The estimated fuel use of fishing vessels in 2010 to 2014 for fishing vessels is presented in **Figure 11.1**.

Table 11.2: Fuel Needs of the Fishery Sector in 2014.

No	Category and Size*	Number of Fishing Vessels*	Fuel Consumption** (liters/day)	Total Fuel Consumption (liters/year)
1	No engine boat	165 066	0	0
2	Small boat, with outboard motor (PMT)	238 010	5	422,467,750
3	Motorized vessel			
	< 5 GT	153 493	10	544,900,150
	5 – 10 GT	46 358	20	329,141,800
	10 – 20 GT	14 301	30	152,305,650
	20 – 30 GT	9 578	50	170,009,500
	30 – 50 GT	1 029	100	36,529,500
	50 – 100 GT	1 766	200	125,386,000
	100 – 200 GT	840	300	89,460,000
	> 200 GT	176	400	24,992,000
	Total			**1,895,192,350**

* *KKP, 2015. Buku Kelautan dan Perikanan dalam Angka Tahun 2015; BPS. Statistik Indonesia 2018.*
** *temporary data*

Figure 11.1: Fuel Consumption of Fishing Vessels, in liters, in 2010–2014.



As shown in **Table 11.2**, there is an opportunity for energy saving and more efficient utilization of alternative energy. Some opportunities that can be done in energy efficiency and alternative energy use of fishing vessels are:

1. The use of natural gas fuel
2. The use of hybrid engines
3. The use of solar cell
4. The use of wind power (screen with additional solar cell fuel)

According to Dahuri (2013)[52], there are opportunities for the development of marine economy and transform it to blue economy. The following are some examples:

1. Natural phenomena where dolphins can catch fish with air bubbles (**Figure 11.2**). However, this needs research to develop innovative and environmentally friendly fishing technology by exploring this natural phenomena.

Figure 11.2: Dolphins Use Air Bubbles to Catch Fish.

2. Use of solar power cells in fishing vessels (**Figure 11.3**). This requires the support of universities and industry actors for the development and wider application. This has been applied in other countries already.

Figure 11.3: The Design of Fishing Vessels that Use Solar Cell.

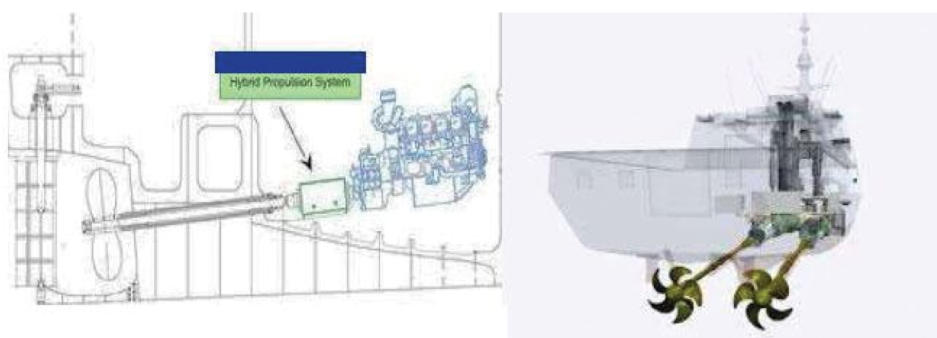
52 Dahuri, R. 2013.

3. Use of flat plate hulls in fishing vessels (**Figure 11.4**). This innovation by Muhammad Faisal (UI students) could reduce ship production costs by 30%.

Figure 11.4: Flat Plate Hull Construction.

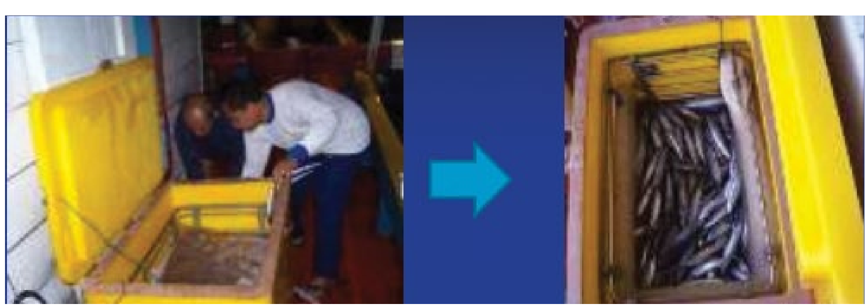
4. Hybrid vessel engines (**Figure 11.5**). The use of hybrid vessel engines in fishing activities can result in fuel saving as well as utilizing waste energy. (*See Section 11.2*.)

Figure 11.5: Hybrid Vessel Engines for Fishing Boats.



5. The use of seawater to cool the fish by RSW (Refrigerated Sea Water) method (**Figure 11.6**). Abundant sea water can be used as a way to cool the fish. Through the RSW method, the quality of fish can be maintained in the ship, and the quality of fish is better than the fish frozen with ice. RSW can be applied to small-scale and large-scale fishing fleets.

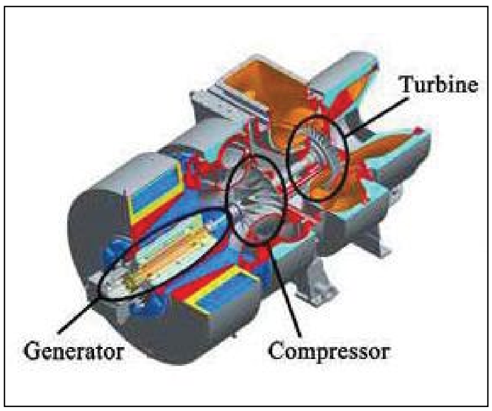
Figure 11.6: The Use of Seawater for Cooling Fish with RSW Method.



11.2 Shipping Sector: Use of Hybrid Engines

Hybrid turbochargers are developed by Misubishi Heavy Industries and are different from other turbochargers in the use of waste energy and in fuel saving. Heat energy in the exhaust is used to rotate the blower, which supplies the rinse air to the host machine and also simultaneously generates electricity through an alternator that blends with the turbocharger known as the MET hybrid turbocharger. Turbines and blowers work as a means of recovering waste heat energy while alternators are used to generate electricity without consuming additional fuel because these alternators are driven by the power present in the turbocharger shaft. The hybrid turbocharger engine is designed to utilize the exhaust gases so as to save energy (**Figure 11.7**).

Figure 11.7: Hybrid Turbocharger Engine Design to Take Advantage of Exhaust Gas that can Save Energy.



A hybrid system on a 9500 kW power supply machine can generate 756 kW of electric power capable of meeting all the electrical needs of a sailing merchant ship at full speed. This means that the use of generator sets powered by fossil fuel can be reduced and even eliminated. The world's first successful commercial ship equipped with hybrid turbocharger technology is the MV SHIN KOHO, a 180,000-tonne bulk carrier ship with a total length of 292 m and a draft of 24.5 m.[53]

The advantages of a hybrid turbocharger compared to the propulsion engines for regular transport vessels include:

1. Only by slightly enlarging the sizes, enough power can be generated from the operation of the parent machine.
2. Fuel savings as a result of utilization of heat of the waste gas (heat recovery) to rotate the alternator.
3. Generator/alternator that can serve as an electric motor

[53] http://www.imare-indonesia.org/?p=611 Accessed January 2017.

4. Eliminatation of the installation of auxiliary blowers.
5. Because it does not require additional fuel consumption, this system helps to cut the amount of emissions from ships.

11.3 Eco-friendly Fish Port with Integrated Waste Management

Fish ports are multiple-use areas and there are multiple interconnected sectors. The concept of environment-friendly fish ports is based on integrated development, eco-fish port culture development, and sustainable management. Thus, there is opportunity for eco-fish ports to be part of the blue economy transformation as shown in **Figure 11.8**.

Figure 11.8: Blue Economy framework for Eco-fish Port.[54]

Source: Dahuri, 2013.

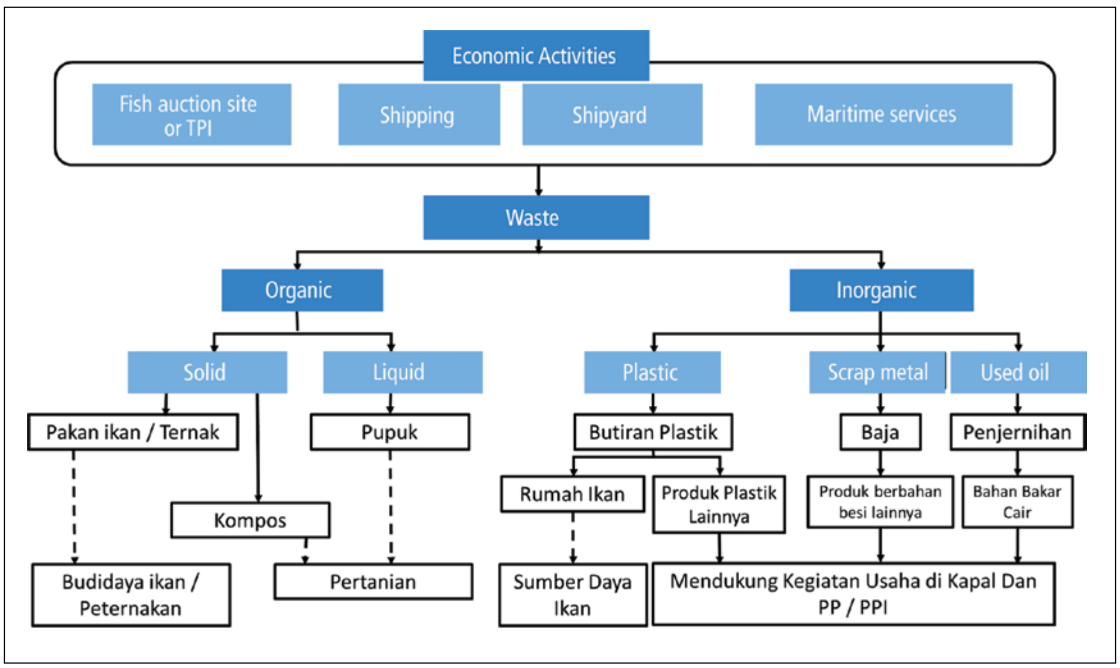
Based on the above framework, there is an opportunity to apply integrated waste management in the fish port to make it more sustainable and environment-friendly. The integrated waste management framework at the fish port is presented in **Figure 11.9**. At the fish port, there are economic activities, such as fish auction place or TPI, shipping, shipyard, and maritime industries and services, which all produce waste, both organic and inorganic.

[54] Dahuri, R. 2013.

The organic solid and liquid wastes are produced in fish ports and related maritime sectors. Utilization of solid waste can be used as fish or livestock feed, such as fish bone processed into fish meal used in aquaculture and livestock breeding. Other biodegradable/organic solid waste can be turned into compost raw material for agriculture. Liquid waste, usually leachate water, which has a fairly expensive price, can be used in the manufacturing of agricultural fertilizers.

Next is inorganic waste, such as plastic, scrap metal and used oil. If ecologically feasible, plastic waste can be processed into plastic granules, which can be designed using the right process into a fish house, and used in the management of fishery resources. In addition, these plastic granules can also be processed into other plastic products by recycling process. Inorganic waste of scrap metal can be melted into steel-making raw material or can also be processed into other iron-based products. Used waste oil is processed through a clarification process so that it can be used as a reusable liquid fuel to support business activities on ships and fish ports.

Figure 11.9: An Integrated Waste Processing Framework for the Fish Port.



Source: Dahuri, 2013.

11.4 Marine Biotechnology

The Indonesian Marine Care Support strongly backs the efforts to improve marine biotechnology whose potential is still hidden. Initial assessment from PKSPL-IPB (2012) showed that the potential of marine biotechnology can reach US$ 800 billion per year. There are around 35,000 species of marine biota that have the potential for the production of medicines. Of these, about 6,000 species are known and can be used for future medicines. The old data from the Economist (1998) reported that world sales for pharmaceutical products reach about US$ 300 billion per year, of which 9% (about US$ 7-16 billion) comes from marine invertebrates.

11.5 Marine Renewable Energy

Marine renewable energy is a non-conventional energy that becomes more significant for climate change mitigation and adaptation. Types of marine energy that are likely to be developed are kinetic energy from ocean currents, waves and tides, ocean thermal energy conservation (OTEC), energy conversion from salinity changes, and offshore wind power.

The potential for marine power generation in Indonesia averages 35 kW per meter of coastline (Bappenas, 2016).[55] Indonesia has a coastline of 99,000 km; 10% of it could potentially produce 280 Gigawatt of power. When calculated using electricity prices by PLN in December 2016, and the acceptance of marine energy IDR 410.84 billion per year and a profit margin of 75%, the annual profit is IDR 308.13 billion per year.

Carbon credits generated is approximately IDR 60 million per year based on the average CO_2 emissions of fossil energy plants with a capacity of approximately 1,000 tonnes of CO_2.

11.5.1 Ocean Energy

a. Current energy

In 2004, BMG and Ristek conducted Kobold marine turbine development in Indonesia to generate clean electric energy exploiting tidal currents. Kobold is a technology from Italy for ocean current power plants with a capacity of 125 kW. The results of the experiment show that for an average current of 3 m/sec, electricity generated is around 4,725 kWh per day or 1,701,000 kWh per year (Bappenas, 2016).[56] The sale of electricity in 2004 from that location amounted to IDR 1,020,600,000 per year. Using the price of PLN IDR 600 per kWh, and the production cost of 25% of the receipts of IDR 255,150,000 per year, the project resulted in a profit of 75% of revenues or IDR 765,450,000 per year. If adjusted to electricity prices by PLN in December 2016 at a price of IDR 1,467.28 per kWh, then the revenue from marine energy would be IDR 2,495,843,280 per year. The details are presented in **Table 11.3**.

Table 11.3: Revenues, Costs and Benefits of Marine Energy in Yogyakarta.

Detail	2004	2016
Revenues (IDR)	1,020,600,000	2,495,843,280
Cost (IDR)	255,150,000	623,960,820
Benefits or Profits (IDR)	765,450,000	1,871,882,460

55 http://perpustakaan.bappenas.go.id/lontar/file?file=digital/110743-%5B_Konten_%5D-L.323.%20Bab.%202%20Perkembangan%20Energi%20Arus.pdf

56 http://perpustakaan.bappenas.go.id/lontar/file?file=digital/110743-%5B_Konten_%5D-L.323.%20Bab.%202%20Perkembangan%20Energi%20Arus.pdf

The results of the survey of ocean current measurement in Indonesia per month throughout the year identified three locations that have relatively constant ocean currents, namely Manado, Gorontalo and Balikpapan, in the range of 4-5 knots.

In 2025, it is expected that sea power energy generated from various power plants (PLTAL) will reach 5% of the energy policy target of 25% of Indonesia's energy mix, in line with the energy mix 25-25 vision. A complete road map[57] to achieve ocean current energy in Indonesia consisting of a R&D phase, a prototype test-bedding phase, and a commercial-scale turbine development phase is shown in (**Figure 11.10**).

Figure 11.10: Roadmap of Ocean Energy R&D in Indonesian Waters.

Source: Direktorat EBTKE, Kementerian ESDM, Tahun 2014.

b. Wave energy

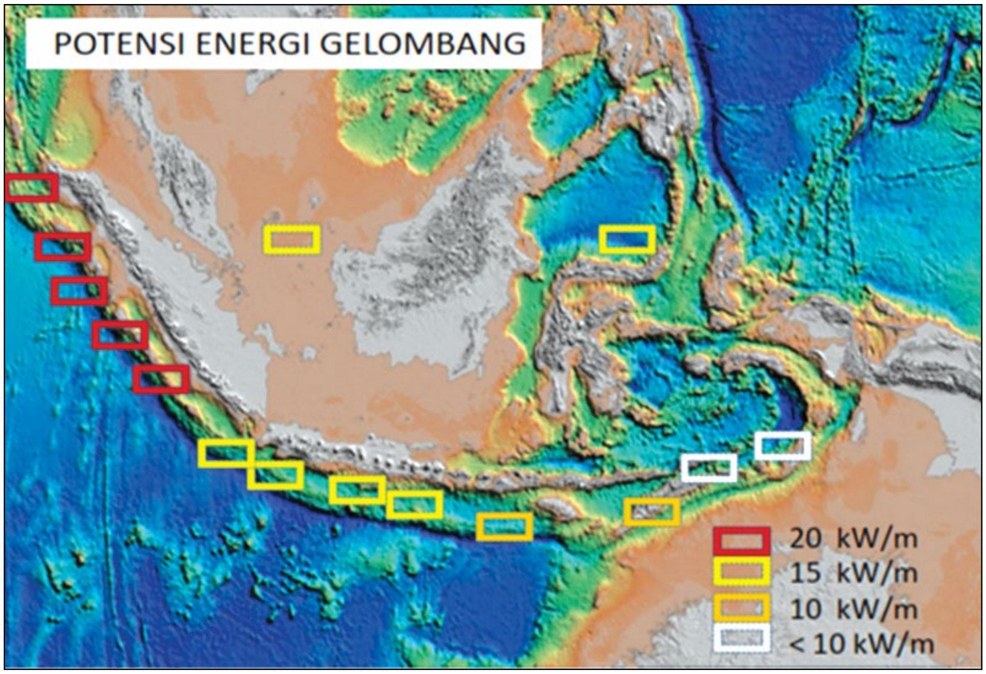
Waves are created mainly due to wind gusts at sea level. The Indonesian Seas region along the southern coast of Java to Nusa Tenggara is a location that has considerable wave energy potential ranging from 10 to 20 kW per wave meter. Even some studies have concluded that wave energy

57 http://www.mgi.esdm.go.id/content/road-map-penelitian-dan-pengembangan-energi-arus-laut.

at some point in Indonesia can reach 70 kW in some locations. The wave energy characteristics are well suited to meet the energy needs of port cities and remote islands in Indonesia.[58]

The wave energy technology in Indonesia is still not developed, but quite promising. Based on the data in **Figure 11.11**, the west coast of southern Sumatra Island and the southern coast of western Java Island potentially have ocean wave energy of around 40 kW/m.

Figure 11.11: Potential Areas for Wave Energy and Annual Wave Strength (kW/m).



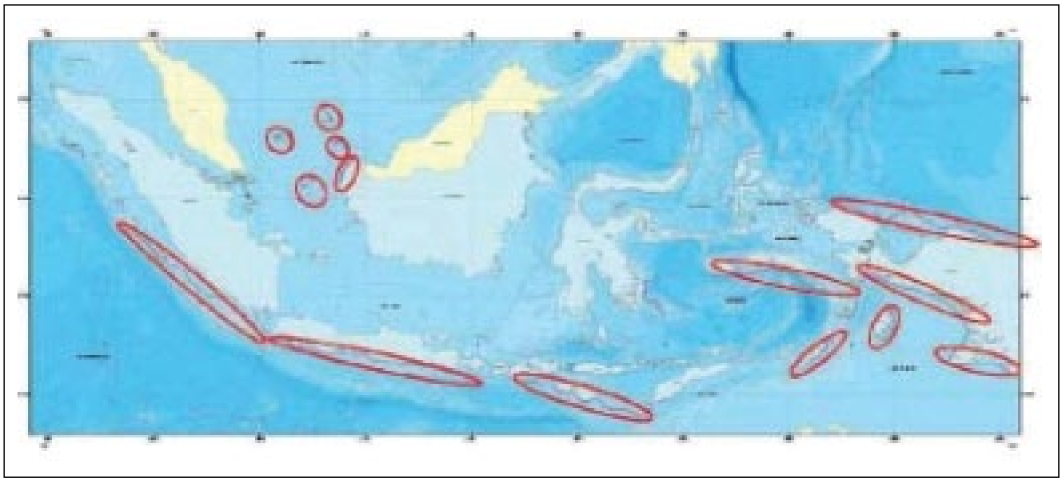
Source : Direktorat EBTKE, Kementerian ESDM, Tahun 2014.

c. Tidal energy

Potential sites for the tidal energy are: the Siapi-Siapi Chart, which has a tidal wave of 7 m; Palu Bay whose geologic structure is a fault (Palu Graben) allowing tidal symptoms; Bima Bay in Sumbawa (West Nusa Tenggara); West Kalimantan; Papua; and the southern coast of Java Island due to the ebb and flow, which can be more than 5 m. The potential sites are shown in **Figure 11.12**.

[58] Dirjen Energi Baru, Terbarukan dan Konservasi Energi. 2014.

Figure 11.12: Potential Sites for Tidal Energy.



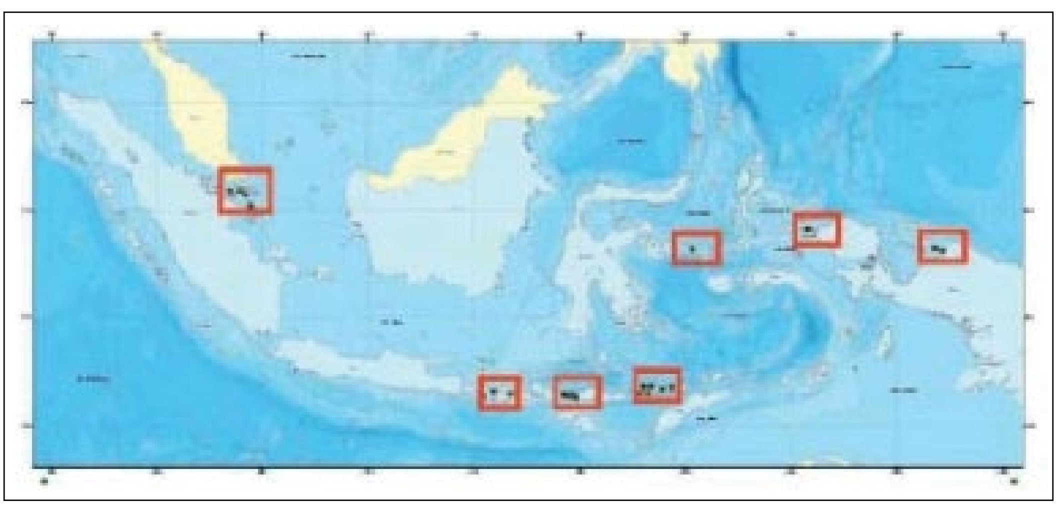
Source: Direktorat EBTKE, Kementerian ESDM, 2014.

d. Ocean thermal energy conservation (OTEC)

Indonesian waters are an ideal water area for developing OTEC energy sources. This is possible because one of the requirements of OTEC is the difference in water temperature (surface with inner layer) of minimum 20°C, and sea wave intensity in Indonesia is very small compared to other tropical regions. From various oceanographic observation sources, it has been possible to map potential Indonesian waters as OTEC development sites (**Figure 11.13**). This is evident from the number of marine waters, bays and straits that are deep enough to have enormous potential for OTEC development.

For the seas in the Indonesian territory, the thermal potential of 2.5 x 1,023 Joules with a thermal energy conversion efficiency of three percent can generate power of approximately 240,000 MW. The potential for good marine heat energy lies in the area between 6-90 LS and 104-1090 BT. OTEC can be used as an alternative to fulfill the needs of electric energy in Indonesia.

Figure 11.13: Potential Sites for OTEC.



Source: Direktorat EBTKE, Kementerian ESDM, 2014.

11.5.2 New and Renewable Energy Source

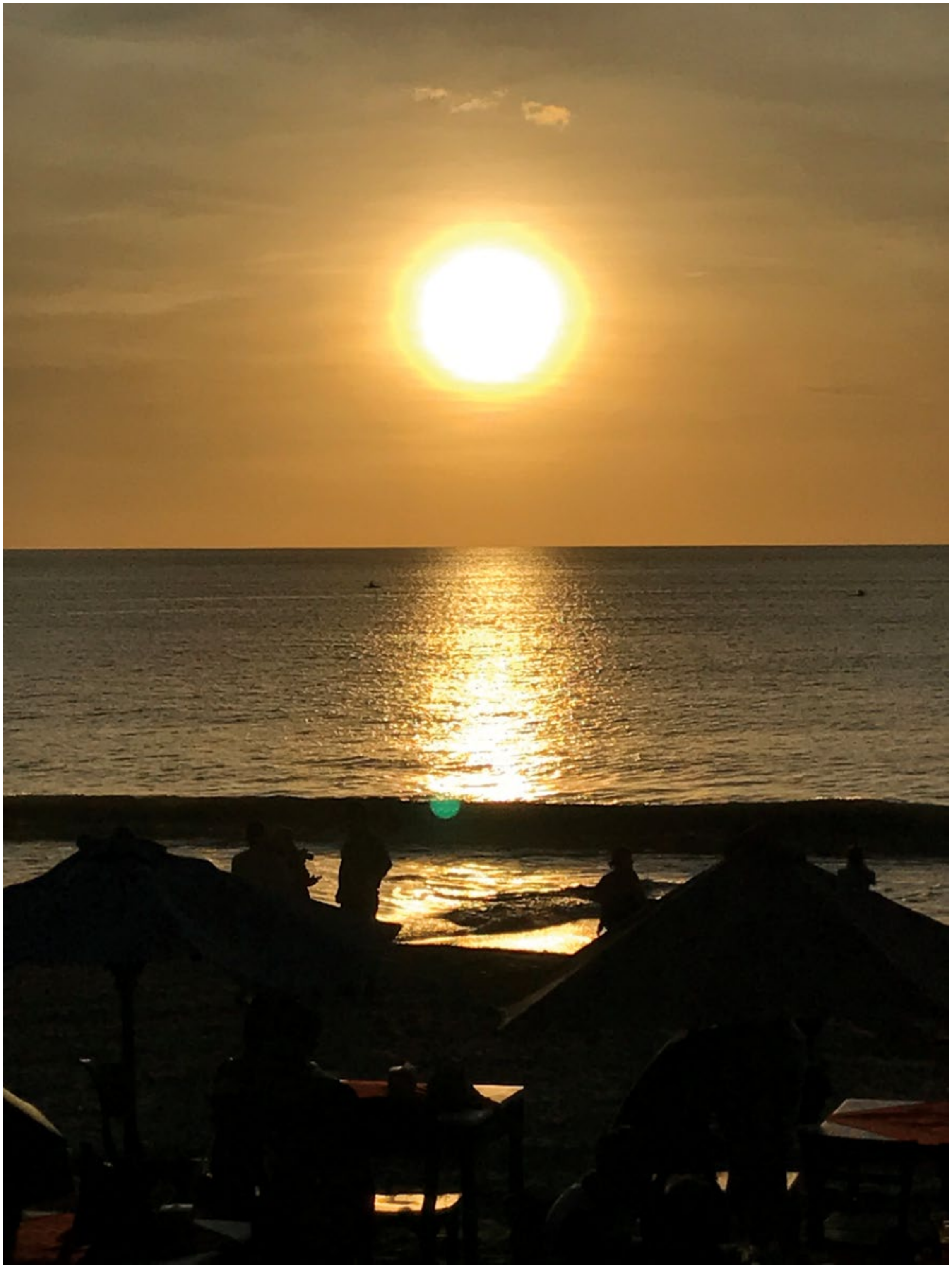
In the future, biofuels from microalgae are very promising because microalgae grow in both fresh and sea waters. *Chlorella sp*. is the highest algae producer, reaching 48.3% (Rachmaniah et al. 2010). Linde (2014) reported that to produce 1 barrel of algae oil (1 barrel equivalent to 159 liters) required 600 kg of CO_2 (from algae). From one commercial production of algae, it is estimated that approximately 10,000 tonnes of CO_2 per day is equivalent to 30% CO_2 in the market.

The results of Nagara research (2011) proved that algae processing on an area of 4.646 000 ha is able to produce biodiesel that can replace all diesel needs in the United States. It is estimated that algae can produce 200 times more oil than other plants capable of producing oil, such as palm oil and jatropha. The chemical composition of cells consisting of proteins, carbohydrates, fats, and nucleic acids are different in each type of algae (**Table 11.4**).

Table 11.4: Algae Chemical Composition as Shown in Dry Dyes (%).

Chemical Composition	Protein	Carbohydrate	Fat	Nucleic Acid
Scenedesmus obliquus	50-60	10-17	12-14	3-6
Scenedesmus quadricauda	47	-	1.9	-
Scenedesmus dimorphus	8-18	21-52	16-40	-
Chlamydomonas rheinhardii	48	17	21	-
Chorella vulgaris	51-58	12-17	14-22	4-5
Chorella pyrenoidosa	57	26	2	-
Spirogyra sp.	6-20	33-64	11-21	-
Dunaliella bioculata	49	4	8	-
Dunaliella salina	57	32	6	-
Euglena gracilis	39-61	14-18	14-20	-
Prymnesium parvum	28-45	25-33	22-38	1-2
Tetraselmis maculata	52	15	3	-
Porphyridium cruentum	28-39	40-57	9v14	-
Spirulina platensis	46-63	8-14	4-9	2-5
Spirulina maxima	60-71	13-16	6-7	3-4.5
Synechoccus sp.	63	15	11	5
Anabaena cylindrica	43-56	25-30	4-7	-

Source: Becker, 1994.



(Photo by M. Ebarvia)

PART 4

STATE OF OCEAN HEALTH UNDERPINNING THE BLUE ECONOMY

12 Natural Conditions and Physical and Biological Features

12.1 Oceanography

This section discusses physical, chemical, and biological features of the seas of Indonesia, including the geological history, and current conditions.

12.1.1 Climate[59]

Straddling the equator, Indonesia is a tropical country with a wet, hot, humid climate the entire year. Moreover, Indonesia is a unique archipelago flanked by two oceans (Pacific Ocean and Indian Ocean) and two continents (Asia and Australia). It is also center of atmospheric circulation activity as well as global ocean circulation. Indonesia is located south of the typhoon belt—which affects the Philippines, Vietnam, China and Japan—and north of the cyclone belt, which affects Australia. With such a large ocean to land ratio, Indonesia's climate is strongly influenced by the seas within the Indonesian archipelago and around its geopolitical territory. Since Indonesia straddles the equator, with thousands of well distributed islands and the flat geographic shape of almost all big islands, and surrounded by so much water, its climate is characterized as **marine equatorial type**.

The main variable in Indonesia's climate is not temperature or air pressure but rainfall, which varies greatly by month and place. Indonesia is one the rainiest places on earth, with light winds and frequent thunderstorms, which in turn are modified by monsoon winds and the mountains. Extreme variations in rainfall are linked with the monsoons, which usually blow in from the south and east between June and September and from the northwest between December and March.

Temperatures and rainfall vary across the archipelago because of elevation and monsoon patterns. Average temperature at or near sea level ranges from 23˚C to 31˚C. Temperatures are determined by elevation and nearness to the sea. The temperatures are generally cooler on the coast and in the mountains than there they are in the interior and in the lowlands. However, the almost uniformly warm waters that make up 81% of Indonesia's area ensure that temperatures on land remain fairly constant. Temperatures average 28˚C on the coastal plains, 26˚C in inland and mountain areas, and 23˚C in the higher mountain regions.

[59] The information on climate, seasons and rainfall in Indonesia is from Jeffrey Hays. 2015. Weather and climate in Indonesia.

Typically, the climate of tropical areas is marked with high rainfall and evaporation; in Indonesia, rainfall is higher than evaporation. Because of both processes, tropical areas have high cloud cover causing low radiation on the surface. Moreover, these processes also result in high humidity. The islands also serve as convection activity center or cloud growth center, particularly in coastal areas. The west coast of Sumatra gets above 400 centimeters (cm) of rain a year. Other places that receive a lot of rain include northwest Kalimantan, West Java, Papua and some parts of Sulawesi. Other islands, such as Sumba and Timor, receive relatively small amounts of rain.

Wet and dry season

There are two major seasons in Indonesia—(1) the hot dry season, and (2) the rainy monsoon season. The Indonesian climate and seasonal pattern is dominated by monsoons. This has caused contrasting values of rain accummulation during peak of rainy season (December to March) and peak of dry season (June to September) (**Figure 12.1**). As per criteria developed by Agency for Meteorology and Geophysics (BMG), if rainfall is above 150 mm per month, it is wet season, and if rainfall is below 150 mm per month, it will be dry season. The dry season is influenced by the Australian continental air masses (Australian monsoon), while the rainy season is influenced by air masses from mainland Asia and the Pacific Ocean (Asian monsoon). During the dry monsoon, high pressure over the Australian deserts moves winds from Australia toward the northwest. As the winds reach the equator, the Earth's rotation causes them to veer off their original course in a northeasterly direction toward the Southeast Asian mainland. During the wet monsoon, a corresponding high-pressure system over the Asian mainland causes the pattern to reverse. The resultant monsoon is augmented by humid breezes from the Indian Ocean, producing significant amounts of rain throughout many parts of the archipelago. This oscillating seasonal pattern of wind and rain is related to Indonesia's geographic location as an archipelago between two continents and astride the equator.

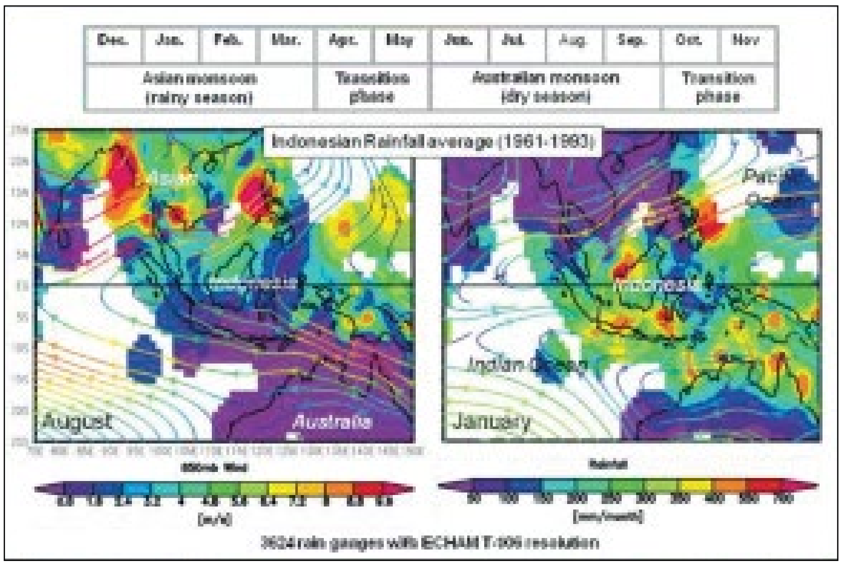
Rainfall

The wet season for most of Indonesia is from September to March and the dry season is from March or June (depending on the area) to September. The average monthly rainfall is shown in **Figure 12.2**. Although influenced by monsoon, not all areas in Indonesia have similar annual climate pattern and rainfall (**Figure 12.3**). The times (months) of these seasons vary across the islands because western Indonesia, eastern Indonesia, and Borneo are all influenced by different monsoon wind patterns. Local conditions in Indonesia can greatly modify these patterns, especially in the central islands of the Maluku group. Prevailing wind patterns also interact with local topographic conditions to produce significant variations in rainfall throughout the archipelago. In general, the western and northern parts of Indonesia experience the most precipitation because the northward- and westward-moving monsoon clouds are heavy with moisture by the time they reach these more distant regions. Western Sumatra, Java, Bali, and the interiors of Kalimantan, Sulawesi, and Papua have rainfall measuring more than 2,000 millimeters (mm) per year. On the other hand, the areas closest to Australia—including Nusa Tenggara, and the eastern tip of Java—tend to be dry, with some areas experiencing less than

1,000 mm of rainfall per year. Some of the islands of southern Maluku experience highly unpredictable rainfall patterns, depending on local wind currents.

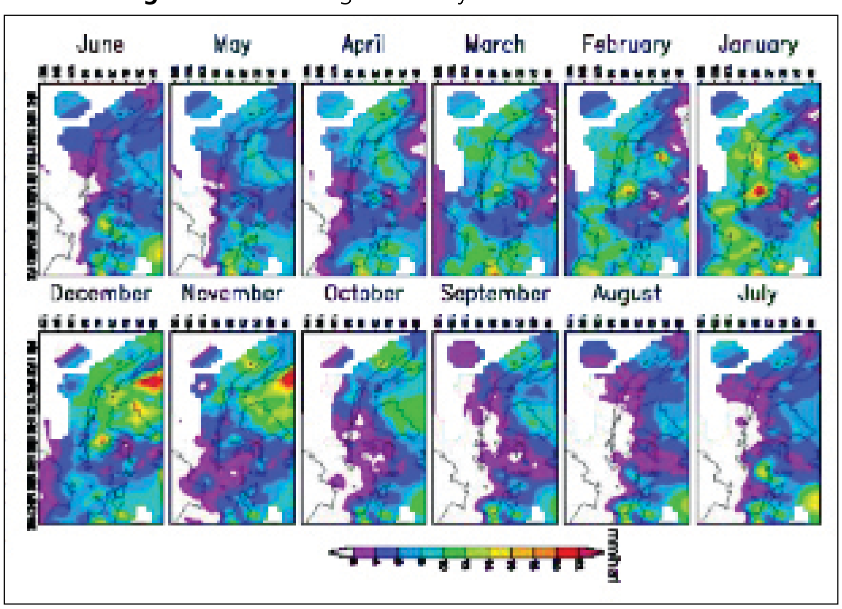
The results of the study of Aldrian and Susanto (2003) showed that there are three climatic regions in Indonesia with their distinct characteristics (**Figure 12.3**). Region A is located in southern Indonesia from south Sumatera to Timor island, southern Kalimantan, Sulawesi and part of Irian Jaya. Region B is located in northwest Indonesia from northern Sumatra to northwestern Kalimantan. Region C encompasses Maluku and northern Sulawesi. Regions B and C show both strong annual and semi-annual variability. Region C shows the strongest El Niño–southern oscillation (ENSO) influence, followed by Region A. In Region B, the ENSO-related signal is suppressed.

Figure 12.1: Maximum Wind and Rainfall Pattern in Indonesia.



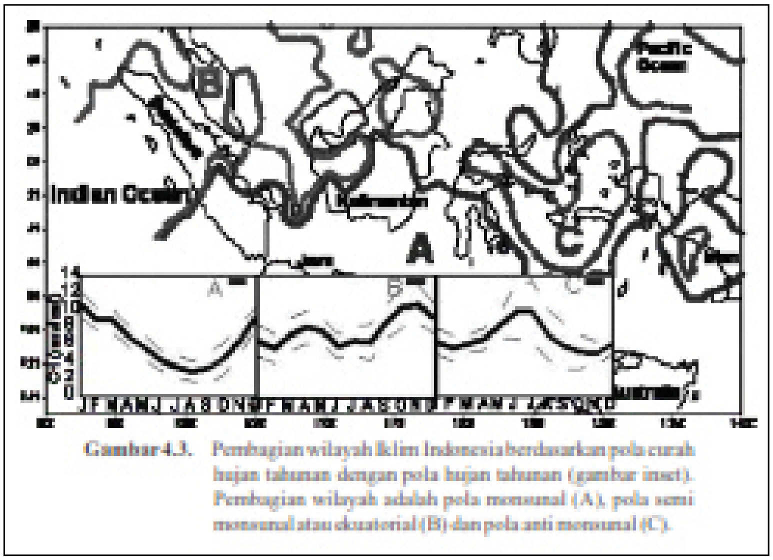
Source: Aldrian, 2008.

Figure 12.2: Average Monthly Rainfall in Indonesia.



Source: Aldrian, 2008.

Figure 12.3: Distribution of Indonesian Climatic Area Based on Annual Rainfall Pattern.



Source: Aldrian and Susanto, 2003.

12.1.2 Tides and Currents

Tides

Tides are the rise and fall of sea levels caused by the combined effects of the gravitational forces exerted by the moon and the sun, and the rotation of the Earth. Tides originate in the oceans and progress toward the coastlines where they appear as the regular rise and fall of the sea surface.

Tidal phenomena in the Indonesian seas are among the most complex in the world. Complicated coastal geometries with narrow straits and myriad small islands, rugged bottom topography next to wide shelves of shallow water, and large quantities of tidal power input from the adjoining Indian and Pacific Oceans—all combine to form a complex system of interfering three-dimensional waves.[60]

Indonesia's tides can be divided into four types: (a) **diurnal tide**—one high and low tide each day; (b) **semidiurnal tides**—two nearly equal high and low tides each day; (c) **mixed tide**—two uneven magnitude tides a day, and (d) **double-dip mixed tide**—semidiurnal and mixed tide (two high and two low tides of different size or magnitude). Diurnal tides are unusually strong and are dominant along some coastlines.

[60] Ray, R.D., G.D. Egbert, and S.Y. Erofeeva. 2005.

Currents

Ocean currents in the waters of Indonesia are very dynamic, and influenced by ***Arlindo***[61]—the **Indonesian throughflow**—the water mass transport from the Pacific Ocean to the Indian Ocean through various straits and channels in Indonesia. Indonesian waters, especially the eastern part of the archipelago, play an important role in the global water mass transport system, in which warm water at the surface conveys heat to the deeper cold water in what is known as the great ocean conveyor belt. The Indonesian archipelago is the only place that connects the Pacific Ocean with the Indian Ocean at lower latitudes.

Current circulation or water mass in Indonesia is generated by differences of ocean surface pressures of the Indian Ocean and Pacific Ocean. Current circulation or main water mass comes from Pacific Ocean entering archipelagic ocean through Lifamatola Strait, Sulawesi Sea and Macassar Strait in the north, and coming out through Lombok Strait, Ombai Strait, Sawu Sea and Timor Sea in the south. Water mass of northen side of Pacific Ocean is predicted entering archipelagic ocean after passing through South China Sea and Karimata Strait. Such circulation has made the waters highly fertile with numerous *upwelling* zone and high abundance of chlorophyll.[62]

The Indonesian Seas are important in terms of both local and larger scale ocean phenomena. Indonesia's throughflow movement, also known as Arlindo, influences global climate change, triggering extreme climate variability, such as ENSO, with impacts on coral reefs, fisheries, agriculture, and forest fires. The magnitude and variations of the Pacific to Indian Ocean throughflow is considered a key element in the thermohaline balance of the Indian and Pacific Oceans, and perhaps even to the global climate system, and provides an interactive link between the warm tropical water of these oceans.[63] Indonesian oceanographic features may influence ENSO by governing the the transfer of the warm tropical water from the western Pacific Ocean to the Indian Ocean.

Under normal conditions, the Arlindo moves from the Pacific Ocean to the Indian Ocean with an average water mass volume of about 10.5 million m^3/sec. The mass of sea water moves from the Pacific Ocean to the Indian Ocean through the straits in the waters of the archipelago. Arlindo's mass passing through Makassar Strait reaches 9 million m^3/sec. The water mass then moves south to the Lombok Strait. However, not all water masses can directly break through the narrow Strait of Lombok. Only 1.7 million m^3/second of water mass from Makassar Strait can pass directly. The rest of 7.3 million m^3/sec, must first turn to the East, towards the Banda Sea. Here, the mass of sea water is mixed again with the Pacific Ocean water mass arriving in the Banda Sea through the

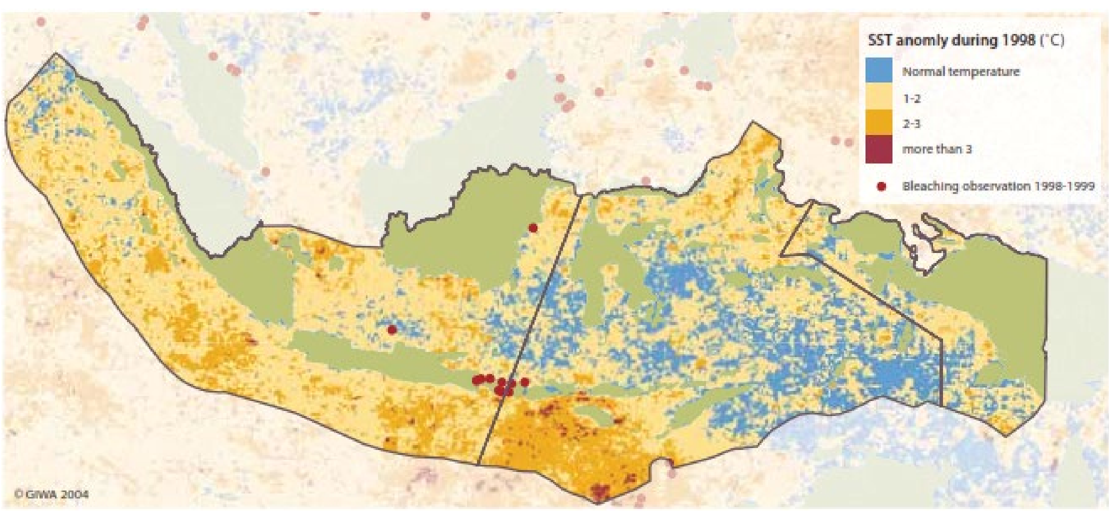
61 "Arlindo" is an acronym for *Arus Lintas Indonen*, meaning 'Indonesia Throughflow' in Bahasa Indonesia.
62 KLH. 2013.
63 Garzoli, Silvia L. 1998.

Halmahera Sea and Flores Sea. The water mass then passes through the Flores Sea and Timor Sea to the Indian Ocean. In total, there are 4.5 million m^3/sec of water mass passing through Flores Sea, while 4.3 million m^3/sec pass through the Timor Sea.

12.1.3 Sea Surface Temperature

From 1957 to 2012, the Indonesian Sea LME #38 has warmed by 0.54°C, thus belonging to Category 3 (moderate warming LME).[64] Changes in sea surface temperature (SST) had moderate environmental impact in Sunda and Wallacea, with changes in the structure of coral reef communities during coral reef bleaching events in 1983, notably in Pulau Seribu (Sunda area) (Brown & Suharsono 1990, Glynn 1996), and severe and widespread impact during the El Niño in 1997-1998 (Suharsono 1997, 1999, and reviewed in Wilkinson 2000, 2002, Wilkinson et al. 1999, Goreau et al. 2000).[65] The 1998 all-time maximum of >29.1°C recorded SST was likely caused by the El Niño in 1997-98. Changes in SST have had slight impact in Sahul area, where the scant anecdotal information suggests that reefs have been less affected than in other parts of Indonesia (Veron and Turak pers. comm.)[66] **Figure 12.4** shows the higher SST in the Sunda area (western Indonesia) compared to the Sahul areas (eastern Indonesia) during the 1998 El Niño.

Figure 12.4: Sea Surface Temperature Anomalies in 1998 in the Indonesian Seas Region.



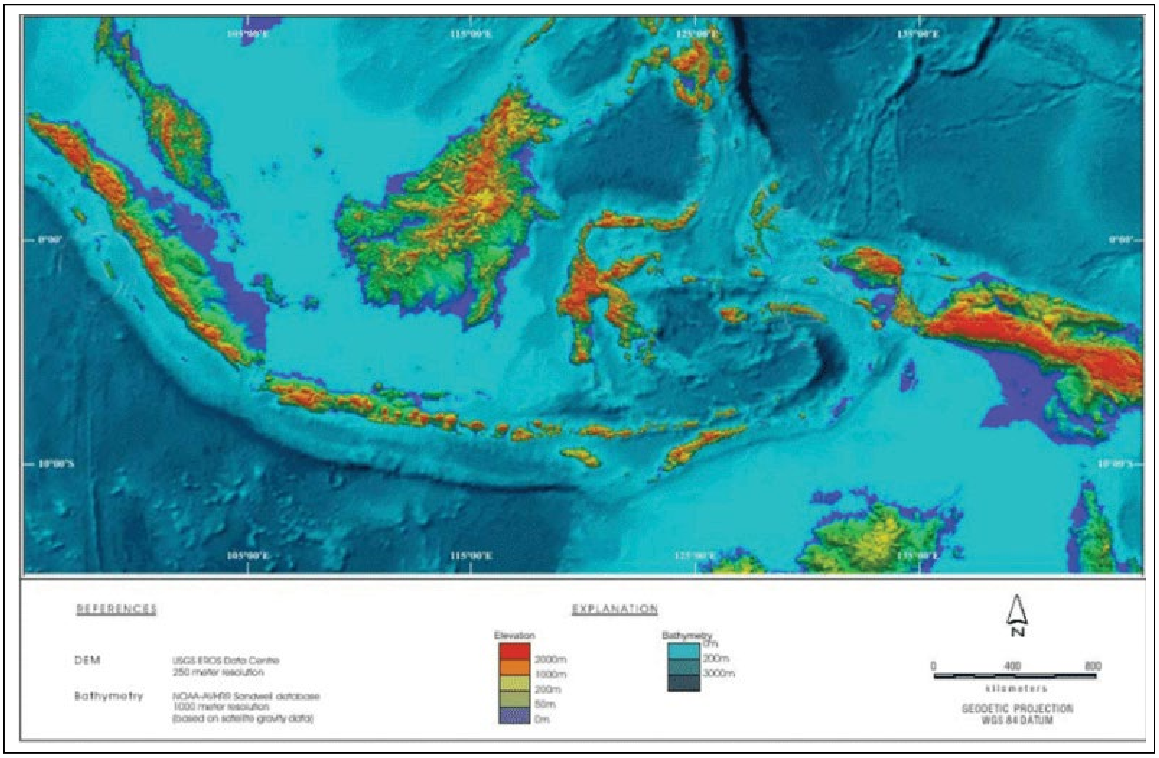
Source: GIWA, 2004.

[64] Transboundary Waters Assessment Programme. 2015. Factsheet: LME 38 – Indonesian Sea.
[65] UNEP, 2005. Vantier, L., Wilkinson, C., Lawrence, D., and D. Souter (eds.) Indonesian Seas, GIWA Regional assessment 57.
[66] UNEP, 2005. Vantier, L., Wilkinson, C., Lawrence, D., and D. Souter (eds.) Indonesian Seas, GIWA Regional assessment 57.

12.1.4 Bathymetry

Indonesia has several deep seas, such as Arafura Sea (3.6 km), Flores Sea (5.1 km), Savu Sea (3.4 km), and Flores Sea and Banda Sea (5 km). Based on the bathymetry map, the eastern Indonesia (KTI) had the biggest depth, ranging from 2 km (Timor Trough) to over 7 km (Weber Basin), while Java Sea averages 130 m (Chase et al. 1994; Hardjawidjaksana and Kristanto 1999, Salahuddin et al., 2001).

Figure 12.5: Bathymetry and Elevation (NOAA-AVHRR).[67]



12.1.5 Geology

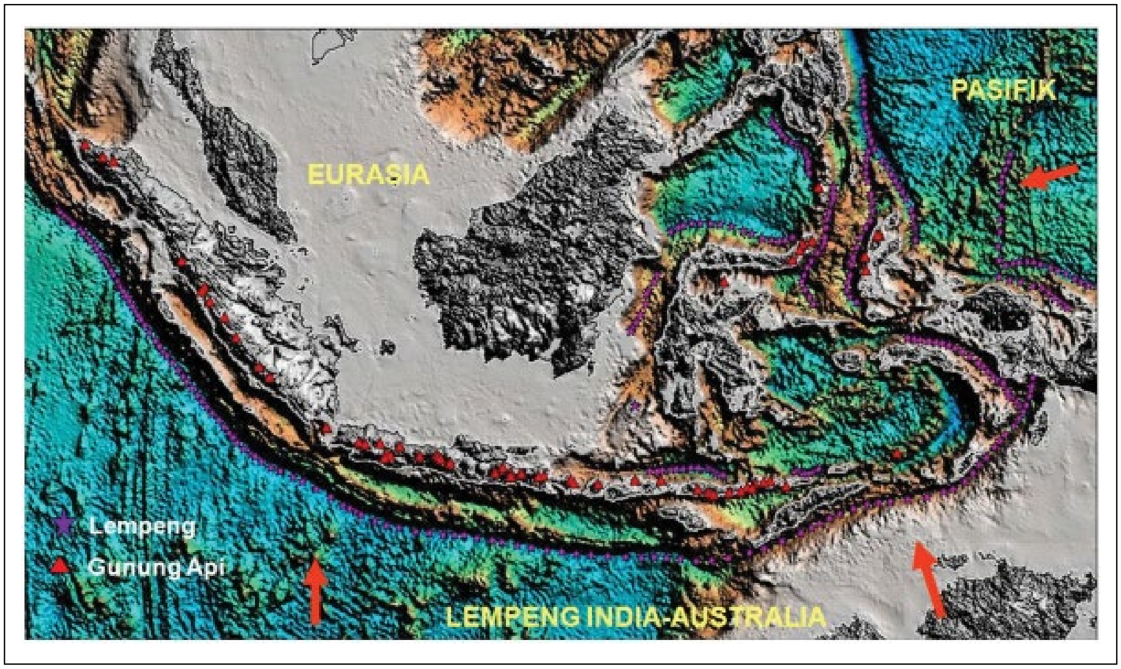
Indonesia is located between two continental plates: the Eurasian Plate (Sunda Shelf) and Australian Plate (Sahul Shelf); and is also located between two ocean plates: the Philippine Sea Plate - Pacific Plate, and Indian Ocean plate. The Sunda Shelf covers islands like Sumatera, Kalimantan, and Java, and characterized by shallow waters with depth less than 200 m. The Sahul Shelf is mostly the eastern part of Indonesia, such as Sulawesi, Ambon and Papua, and characterized by deep seas with depth of more than 200 m (KLH, 2013).

[67] Source of elevation and bathymetry map: Jaswar Koto. 2012.

The subduction of the Indian Ocean plate under the Eurasian continental plate forms a volcanic arc in the western part of Indonesia, which is one of the most seismically active regions on the planet with a long history of powerful eruptions and earthquakes. Active volcano chains form Sumatra, Java, Bali, and the islands of Nusa Tenggara, most of which, mainly Java and Bali, emerged 2-3 million years ago (**Figure 12.6**).

The movement of the Indian-Australian plate and the Pacific plate controls the tectonics in Eastern Indonesia (**Figure 12.6**). Usually, the epicenter of earthquake is located along tectonic plate collision course.

Figure 12.6: Eurasia, Indian Ocean Plate and Pacific Plate.



Source: http://file.upi.edu/Direktori/FPIPS/JUR._PEND._GEOGRAFI/195502101980021DADANG_SUNGKAWA/letak_ Indonesia.pdf

The Indonesia mountain system is part of two global mountain systems, namely: Alpine-Himalayan System and the Circum-Pacific System. The mountains in western Indonesia or Sunda shelf is part of the Alpine-Himalayas system. On the other hand, the mountain chains in eastern Indonesia are part of the Circum-Pacific system.

There exist two very long mountain systems where a series of convergent plate boundaries continue from one to the next. First is a nearly continuous chain of mountain ranges and volcanoes surrounding most of the Pacific basin—the so-called Circum-Pacific System. The chain passes along the west coast of North and South America to the Aleutian Islands, then to Japan, the

Philippines, eastern Indonesia, Papua New Guinea, Tonga, and to New Zealand (**Figure 12.7a**). This Circum-Pacific chain of volcanoes (often called the *Ring of Fire*) and the mountain ranges associated with it owe their formation to the repeated subduction of oceanic lithosphere beneath the continents and the islands that surround the Pacific Ocean.

A second nearly continuous chain of mountains can be traced from the Atlas Mountains in Morocco in North Africa through the Alps in Europe, across Turkey, Iran and Caucasus, through the Himalayas to Indochina peninsula and western islands of Indonesia (part of the Sunda shelf) (**Figure 12.7b**). This chain, the Alpine-Himalayan (or Tethyan) System, has formed as a result of Mesozoic-to-Cenozoic-to-recent closure of the Tethys Ocean and process of collision between the African, Arabian, and Indian plates and the Eurasian Plate.

Figure 12.7a: Circum-Pacific Sytem.

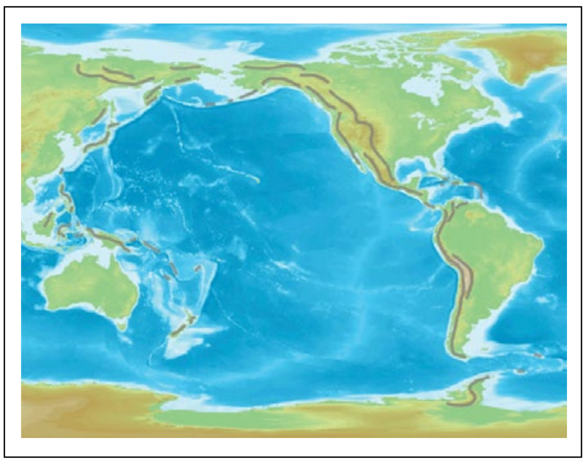


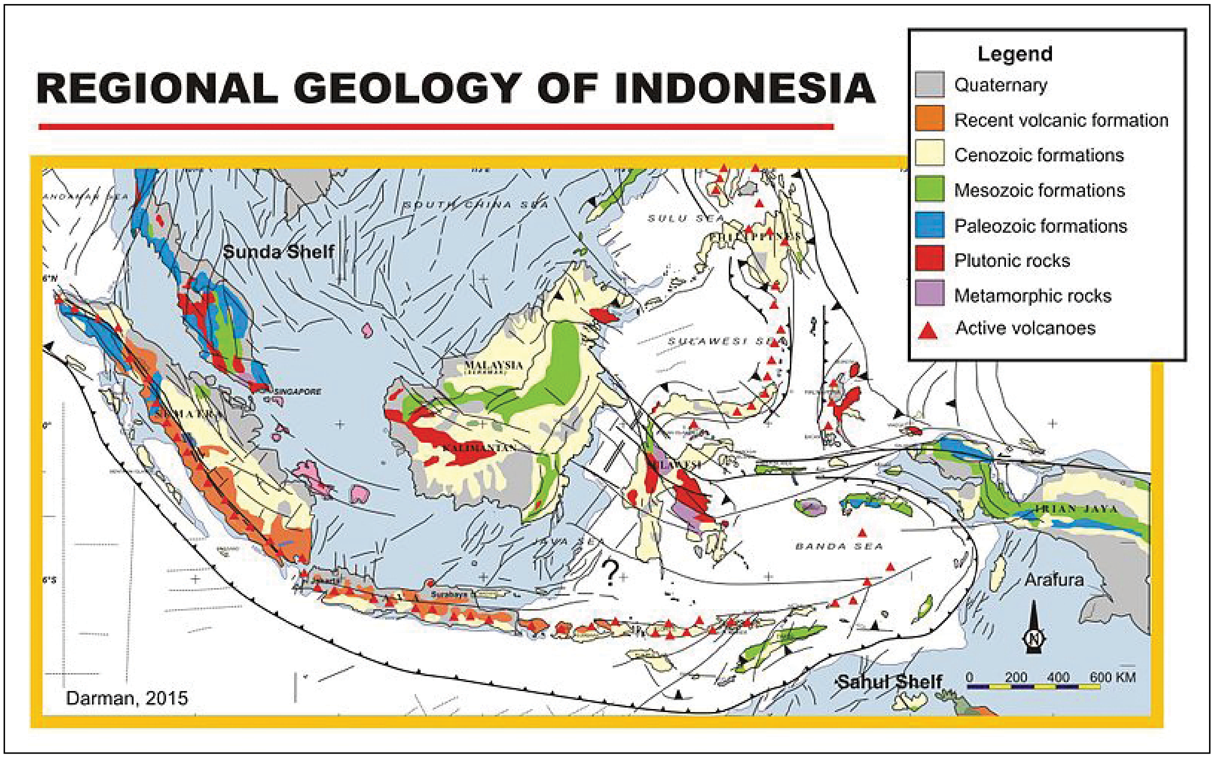
Figure 12.7b: Alpine-Himalayan System.

Source: Wikimedia Commons

Stratigraphy, the Indonesian western region is dominated by Cenozoic-aged formation, ranging from Paleogene to Quaternary. The Mesozoic and Minor Paleozoic formations are found in there. Devon-aged limestone is found in Telen River, East Kalimantan, as fragments in Paleogene Clastic Sediment.

Indonesia's eastern region generally has an older stratigraphy when compared with western region of Indonesia. Its stratigraphy is ranging from Permian to Tertiary. The Ichthyosaurus fossil was found in the flood of hot mud on Kai Island, indicating Mesozoic sedimentation under the surface (Charlton,1992). Macrofossil from Mesozoic period was studied on Misool Island by Fauzie Hasibuan (1986).

Figure 12.8: Indonesian Regional Geology.



Source : Darman, H. & Sidi, H. (eds.). 2000.

12.1.6 Chlorophyll-A and Primary Productivity

Light and chlorophyll are the major components in photosynthesis. The primary productivity level can be determined by the abundance of phytoplankton and the chlorophyll-A concentration in these waters and the process of photosynthesis that occurs.[68]

Phytoplankton is called the primary producer because it is able to form organic substances from inorganic substances. The distribution and concentration of phytoplankton are strongly associated with oceanic conditions, such as light intensity, temperature, salinity, flow, dissolved oxygen and nutrients. Generally, high phytoplankton concentration in coastal waters is due to high nutrient supply coming from the mainland through river runoff. Primary productivity in the open sea is relatively low because inorganic nutrients, especially nitrogen and phosphorus, are limited in availability at sea level. However, the mass water circulation process that allows the transport of nutrients results in some sites in the offshore areas to have a high enough phytoplankon concentration.

[68] Abigail, dkk. 2015.

According the the Transboudary Waters Assessment Programme,[69] the Indonesian Sea Large Marine Ecosystem (ISLME) has a high primary productivity. The average primary productivity is 380 g.C.m^{-2}.yr-1. The annual Chlorophyll-A concentration (CHL) cycle has a maximum peak (0.369 mg.m^{-3}) in August and a minimum (0.205 mg.m^{-3}) during April. The average CHL is 0.256 mg.m^{-3}. There is a statistically significant decreasing trend in CHL of -15.8% from 2003 to 2013.

Nutrients and light intensity affect the level of chlorophyll-A, and phytoplankton abundance. Large amounts of nutrients (in particular *nitrogen load*) entering coastal waters of LMEs, however, can result in high biomass algal blooms, leading to hypoxic or anoxic conditions, increased turbidity and changes in species or community composition, among other effects.

12.2 Marine Eco-regions

According to *GoI Law No. 32/2009 on Environmental Protection and Management*, an **ecoregion** is a geographical area that has similar characteristics of climate, soil, water, indigenous flora and fauna, as well as human interaction pattern with the nature. Ecoregion is one of principles in the implementation of environmental protection and management, and encompasses ecosystems, geographic condition, marine waters, local community culture and local wisdom (KLH, 2013).[70]

Table 12.1 enumerates the 18 marine ecoregions of Indonesia, and corresponding area (KLH, 2013). Tomini Bay Ecoregion is the smallest ecoregion with an area of 70,020 km^2, while the Indian Ocean ecoregion in West Sumatra has the largest area of 782,861 km^2.

The objective of delineating Indonesian marine ecoregions is to give directions on the establishment of **Environmental Protection and Management Plan** (RPPLH) that is suitable to the characteristics of the area, and achieve balance between utilization and conservation.

The process of delineation of marine ecoregion is done based on the following four parameters (KLH, 2013):

- Ocean floor morphology: geomorphology and bathymetry
- Oceanography: ocean currents, tides, upwelling, temperature, salinity, degree of acidity, and chlorophyll
- Biodiversity: mangrove, seagrass, coral reef, fish, other marine species
- Boundaries: Unitary State Republic of Indonesia (NKRI), world marine ecoregions, fishery management areas and marine toponymy.

[69] Transboundary Waters Assessment Programme (TWAP). 2015. Factsheet: LME 38 - Indonesian Sea.
[70] Ministry of Environment. 2013.

In terms of management, each ecoregion is characterized according to six aspects:

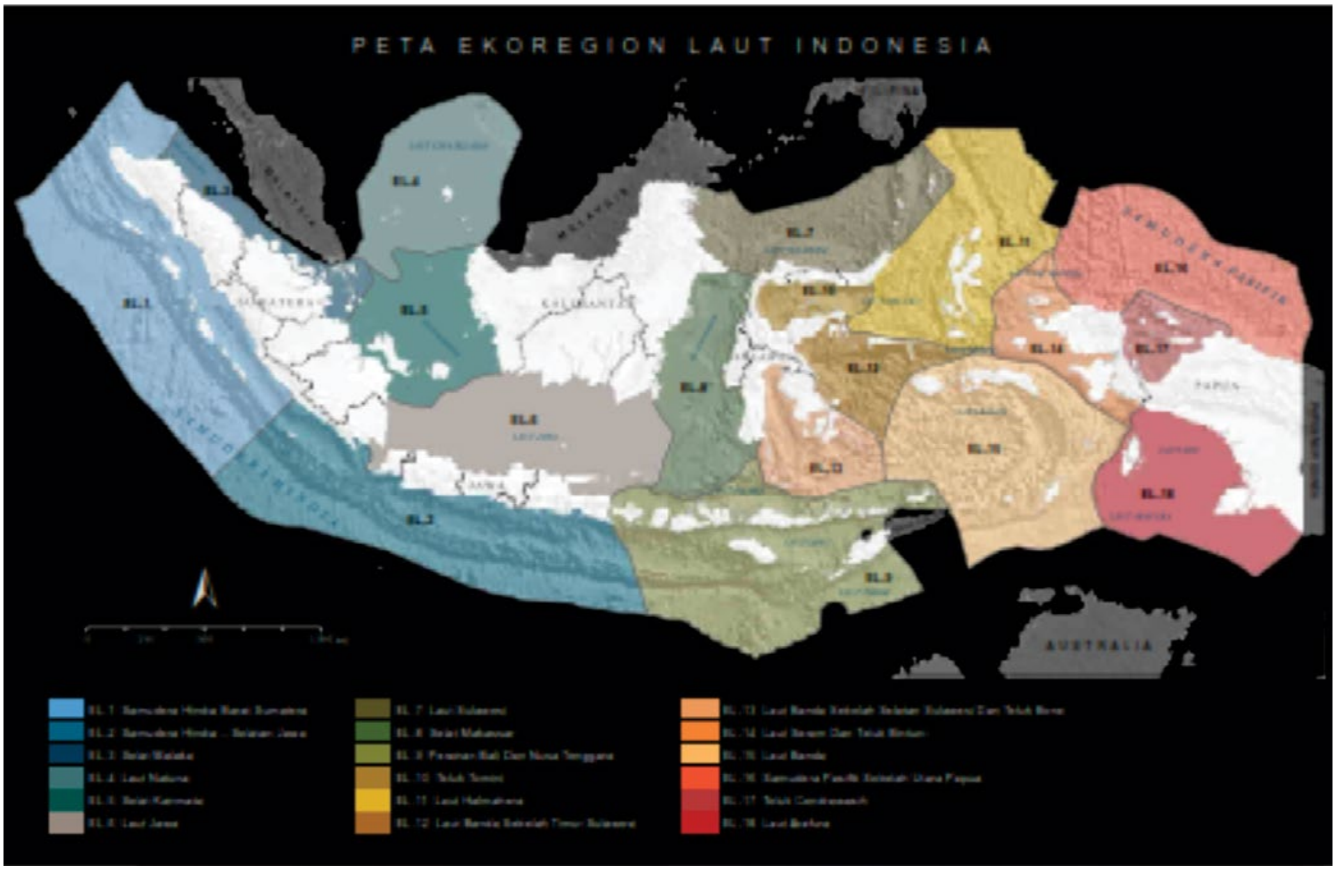
- Geology and morphology of ocean floor
- Oceanography
- Biodiversity
- Utilization
- Disaster vulnerability
- Pollution

The management of ecoregions involves optimizing marine resource productivity while protecting the integrity of the natural system and environment, and eventually reach sustainable development.

Table 12.1: Marine Ecoregions in Indonesia.

No.	Marine Ecoregion	Area (km^2)
1	Indian Ocean west side of Sumatera	782,861
2	Indian Ocean south side of Java	655,549
3	Malacca Strait	111,343
4	Natuna Sea	360,402
5	Karimata Strait	270,859
6	Java Sea	437,978
7	Sulawesi Sea	323,866
8	Macassar Strait	288,005
9	Bali and Nusa Tenggara waters	625,018
10	Tomini Bay	70,020
11	Halmahera Sea	451,955
12	Banda Sea east side of Sulawesi	160,361
13	Banda Sea south side of Sulawesi	169,160
14	Seram Sea and Bintuni Bay	140,040
15	Banda Sea	583,096
16	Pacific Ocean north side of Papua	459,857
17	Cendrawasih Bay	93,369
18	Arafura Sea	326,793

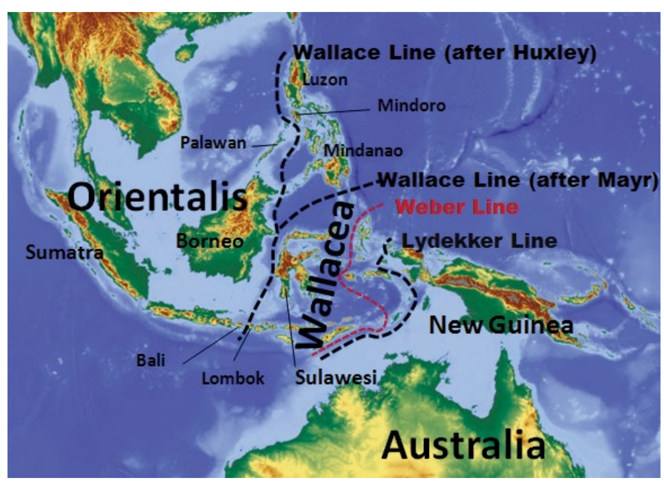
Figure 12.9: Marine Ecoregions in Indonesia.



Wallacea

The Wallace Line is a faunal boundary line drawn in 1859, that separates the ecozones of Asia and Wallacea, a transitional zone between Asia and Australia.[71] West of the line are found organisms related to Asiatic species; to the east, a mixture of species of Asian and Australian origin is present. Wallace noticed this clear division during his travels through the East Indies in the 19th century. The Wallace's Line is visible geographically when the continental shelf contours are examined (**Figure 12.8**). It can be seen as a deep-water channel that marks the southeastern edge of the Sunda Shelf which links Borneo, Bali, Java, and Sumatra underwater to the mainland of southeastern Asia. Australia is likewise connected by the Sahul Shelf to New Guinea. The biogeographic boundary known as Lydekker's Line, which separates the eastern edge of Wallacea from the Australian region, has a similar origin to the Wallace Line.

Figure 12.10: The Wallacea Region.



Source: https://en.wikipedia.org/wiki/Wallace_Line.

[71] https://en.wikipedia.org/wiki/Wallace_Line.

12.3 Marine Water Quality

Pollution is a major problem, considering its impacts on human health, water, fisheries, recreation and tourism, marine life and biodiversity, and aesthetics. As shown in **Table 12.2**, coastal waters in many provinces have levels of nitrate and phosphate that are higher than water quality standards for these parameters. High levels of nutrients can result in eutrophication and algal bloom. Rivers in each province are also polluted, with 25 provinces having rivers with *heavy polluted* status (entire river or part of the river) (**Table 12.4**).

Table 12.2: Nitrate and Phosphate Values in Selected Locations.

Municipality and Province	Nitrate (mg/L)				Phosphate (mg/L)			
	2016		2015		2016		2015	
	Min	Max	Min	Max	Min	Max	Min	Max
Pidie Jaya, Aceh	0	0	1.2	1.2	NA	NA	0.7	0.7
Teluk Bayur, Padang, Sumatera Barat	0.50	2.60	0.48	1.18	<0.013	0.21	0.02	0.02
Sungsang, Banyuasin, Sumatera Selatan	0.10	0.19	3.0	3.0	NA	NA	0.05	0.05
Laut Sinaboi, Riau	NA	NA	NA	NA	0.03	0.03	0.03	0.03
Teluk Lampung, Bandar Lampung,	1.00	3.60	NA	NA	NA	NA	NA	NA
Demak, Jawa Tengah	<0.005	<0.001	NA	NA	0.52	0.03	NA	NA
Glagah 1, Yogyakarta	0.00	-	0.07	0.07	0.03	0.03	0.02	0.02
Padangbai, Bali	< 0.05	-	0.05	0.05	NA	NA	NA	NA
Muara Jungkat,	0.07	0.71	0	0.27	<0.0001	0.17	0.01	0.01
Kalimantan Barat	NA	NA	NA	NA	NA	NA	0.04	0.04
Pelabuhan Manggar, Balikpapan, Kalimantan Timur	0.08	0.54	0.08	0.54	0.04	0.12	0.04	0.12
Pantai Talise, Palu, Sulawesi Tengah	<0.01	-	0.16	-	<0.01	<0.01	0.82	0.82
Palabusa, Bau-Bau, Sulawesi Tenggara	NA	NA	0.18	-	NA	NA	9	9
Teluk Ambon, Maluku	<0.01	1,75	0.03	0.88	NA	NA	NA	NA
Teluk Kao, Maluku Utara 1	0.02	0.05	0.02	0.05	0.02	0.04	0.02	0.04
Jayapura, Papua 1	0.00	3.10	3.1		0.11	1.94	0.11	1.94

Note: Marine water quality standards for **Nitrate = 0.008 mg/L** and **Phosphate = 0.015 mg/L**.

Table 12.3: River Water Quality, 2017.

No.	Province	River Name	Sampling	Range of River Water Quality Status Pursuant to Water Quality Criteria Regulation Government 82/2001 Class II
1	Aceh	Tamiang	7	polluted
2	Sumatera Utara	Batahan	6	polluted
3	Sumatera Barat	Batang Hari	10	heavy polluted
4	Riau	Kampar	17	polluted-heavy polluted
5	Jambi	Batang Hari	16	lightly polluted-polluted-heavy polluted
6	Sumatera Selatan	Musi	21	heavy polluted
7	Bengkulu	Musi	15	lightly polluted-polluted
8	Lampung	Mesuji	7	heavy polluted
9	Kepulauan Bangka Belitung	Buding	8	lightly polluted-polluted-heavy polluted
10	Kepuluan Riau	Dam Diruangkang	6	polluted-heavy polluted
11	DKI Jakarta	Ciliwung	13	heavy polluted
12	Jawa Barat	Ciliwung	5	heavy polluted
13	Jawa Tengah	Bengawan Solo	5	polluted-heavy polluted
14	DI Yogyakarta	Opak	10	heavy polluted
15	Jawa Timur	Bengawan Solo	16	heavy polluted
16	Banten	Cidurian	6	polluted
17	Bali	Tukad Ayung	6	polluted
18	Nusa Tenggara Barat	Jangkok	8	polluted-heavy polluted
19	Nusa Tenggara Timur	Noelmina	6	heavy polluted
20	Kalimantan Barat	Kapuas	6	polluted-heavy polluted
21	Kalimantan Tengah	Jelai	6	lightly polluted-polluted
22	Kalimantan Selatan	Barito	6	heavy polluted
23	Kalimantan Timur	Mahakam	9	polluted-heavy polluted
24	Kalimantan Utara	Sesayap	-	-
25	Sulawesi Utara	Sangkup	7	heavy polluted
26	Sulawesi Tengah	Lariang	6	heavy polluted
27	Sulawesi Selatan	Sa'dan	7	lightly polluted-polluted
28	Sulawesi Tenggara	Lasolo	6	lightly polluted-polluted-heavy polluted
29	Gorontalo	Andagile	7	polluted-heavy polluted
30	Sulawesi Barat	Lariang	6	heavy polluted
31	Maluku	Batu Gajah	6	polluted-heavy polluted
32	Maluku Utara	Tabobo	6	polluted-heavy polluted
33	Papua Barat	Remu	6	polluted-heavy polluted
34	Papua	Fly	4	polluted

Source: BPS, Statistik Indonesia 2019.

13 Coastal and Marine Ecosystems and Biodiversity

13.1 Key Habitats

The coastal zone as the boundary between the land and the oceans has its own community of living creatures and productivity sources, and is very important for the constituents in the coastal regions of Indonesia.

The coastal zone is an area consisting of land and sea, where each of these areas has influence on one another. The coastal areas of Indonesia have a wealth of ecosystems. Coastal ecosystems, such as mangroves, coral reefs, seagrasses, tidal swamps and small islands, are habitats for diverse living creatures. In addition, the biodiversity richness of the coastal areas is also found in sandy shores and mudflats, although there is still a lack of information related to the richness of biodiversity in these habitats because it has not been explored and documented (Hutomo and Moosa 2005).

Indonesia has wide distribution of mangrove ecosystem, even the largest in world (FAO, 2007). According to Spalding *et al*. (2010), it was estimated that total area of mangrove in Indonesia was around 3,189,359 ha, reaching more than 60% of total mangrove area in Southeast Asia, and 20% of total mangrove cover in the world. According to FAO, there are 48 mangrove species in Indonesia, making Indonesia the center of mangrove biodiversity in the world.

In 2017, the total area of coral reef in Indonesia is around 2.5 million ha or about 18% of total global coral reef area, and found in areas that are part of the Coral Triangle region, which contains the richest marine biodiversity on earth. The archipelago is estimated to harbor over 75% of the world's coral species. Most of these coral reefs are located in the eastern region of Indonesia. At least 553 species of Scleractinian corals are found in Raja Ampat, which has one of the world's richest coral reef fish fauna, consisting of at least 1,320 species, the highest count in the world for an area of that size.[72]

[72] ADB. 2012.

There are currently 13 species of seagrass recorded in Indonesia, spread around 25,000 km² throughout the country.

Table 13.1 provides a summary matrix of the status of key coastal and marine habitats, the pressures and threats they face, the response measures in terms of policies, laws, and action plans as well as examples of best practices on conservation.

Table 13.1: Status of Habitats, Pressures and Response Measures.

Habitat	Area (ha); Length (km)	Condition	Value (US$/ha)	Pressures, threats and impacts	Response	
					Policies, laws	Actions, best practices/ case studies
Mangroves	2013: 3,989,689.08 2014: 4,418,105.57 2015: 3,668,075.60	Good: 21.48% Fair: 8.55% Poor: 7.01% Unidentified: 48.43%	25,779.00	• Harvesting for fuelwood; • Harvesting for housing; • Conversion to prawn farms; • Convertion to salt pond; • Reclamation; • Area decrease 16.98%; • Condition decrease 11.90%.	**a. Key policies/laws** 1) Law Number 5/1990 on the Conservation of Biological Natural Resources and Its Ecosystem 2) Law Number 5/1994 on the Ratification of the United Nations Convention on Biological Diversity (United Nations Convention on Biodiversity) 3) Law Number 6/1994 on the Ratification of the United Nations Framework Convention on Climate Change (United Nations Framework Convention on Climate Change) 4) Law Number 1/2004 on Amendment of Law Number 41/1999 on Forestry 5) Law Number 26/2007 on Spatial Planning 6) Law Number 27/2007 on the Management of Coastal and Small Islands Areas as amended by Law Number 1/2014 7) Law Number 32/2009 on Environmental Protection and Management 8) Government Regulation Number 45/2004 on Forest Protection 9) Government Regulation Number 26/2008 on National Spatial Plan 10) Government Regulation Number 76/2008 on Forest Rehabilitation and Reclamation	Mangrove rehabilitation and conservation: • Program of Integrated Community Based Disaster Risk Reduction in Aceh Jaya, Batang, Demak, Lombok Barat and Cilacap • Mangrove Conservation in Nusa Dua, Bali • Mangrove ecotourism in Tarakan City and Surabaya City

Table 13.1: Status of Habitats, Pressures and Response Measures. (cont.)

Habitat	Area (ha); Length (km)	Condition	Value (US$/ha)	Pressures, threats and impacts	Response: Policies, laws	Response: Actions, best practices/ case studies
					11) Presidential Regulation number 73/2012 on National Strategy of Mangrove Ecosystem Management 12) President Decision Number 51/2016 on Coastline Limit 13) One Map Policy **b. National action plan** Indonesian Biodiversity Strategy and Action Plan (IBSAP) 2015-2020	
Coral reefs	2013: 2,692,301.69 2014: 3,185,616.85 2015: 2,692,302.00 2017: 2.5 million	Very good: 5.00% Good: 27.01% Moderate: 37.97% Damaged: 30.02%	115,698.61	• Dynamite fishing; • Pollution; • Reclamation; • Erosion and sedimentation; • Harvesting for aquarium and trade; • Rising sea temperature; • Coral bleaching; • Ocean acidification; • Direct/indirect impact of marine tourism activities; • Condition decrease 1.09%	**a. Key policies/laws** 1) Law Number 5/1990 on the Conservation of Biological Natural Resources and Its Ecosystem 2) Law Number 5/1994 on the Ratification of the United Nations Convention on Biological Diversity (United Nations Convention on Biodiversity) 3) Law Number 6/1994 on the Ratification of the United Nations Framework Convention on Climate Change (United Nations Framework Convention on Climate Change) 4) Law Number 1/2004 on Amendment of Law Number 41/1999 on Forestry 5) Law Number 27/2007 on the Management of Coastal and Small Islands Areas as amended by Law Number 1/2014 6) Government Regulation Number 60/2007 on Fish Resources Conservation 7) MMAF Decree Number 38/2004 on the General Guidelines for Coral Reef Management 8) MMAF Decision Number 17/2008 on Konservation Area in Coastal and Small Islands Area	Coral reef restoration with alternative livelihood: • COREMAP I Program Site • COREMAP II Program Site • Coral transplantation in Bali and Sukabumi

Table 13.1: Status of Habitats, Pressures and Response Measures. (cont.)

<table>
<tr><th rowspan="2">Habitat</th><th rowspan="2">Area (ha); Length (km)</th><th rowspan="2">Condition</th><th rowspan="2">Value (US$/ha)</th><th rowspan="2">Pressures, threats and impacts</th><th colspan="2">Response</th></tr>
<tr><th>Policies, laws</th><th>Actions, best practices/ case studies</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>9) MMAF Decission Number 2/2009 on Procedure for Determination of Marine Conservation Area
10) MMAF Decision Number 3/2010 on Procedures for Determination of Fish Species Protection Status
11) MMAF Decission Number 4/2010 on Procedures for Utilization of Fish and Genetic Fish
12) MMAF Decision Number 30/2010 on Zonation an Management Plan of Marine Conservation Area
13) One Map Policy

b. National action plan
1) Nationa Action Plan for Coral Reefs Conservation
2) Indonesian Biodiversity Strategy and Action Plan (IBSAP) 2015-2020</td><td></td></tr>
<tr><td>Seagrass</td><td>2013: 1,496,996.78
2014: 847,385.33
2015: 474,920.93
2017: 150,693.16</td><td>Good: 20.62%
Moderate: 6.14%
Damaged: 4.43%
Unidentified: 68.81%</td><td>106,199.59</td><td>• Conversion;
• Reclamation;
• Pollution;
• Oil spill;
• Sedimentation;
• Area decrease 43.95%
• Condition decrease 62.81%</td><td>a. Key policies/laws
1) Law Number 27/2007 on the Management of Coastal and Small Islands Areas as amended by Law Number 1/2014
2) One Map Policy

b. National action plan
1) National Action Plan for Dugong Conservation and Its Habitat (Seagrass) in Indonesia
2) Dugong and Seagrass Conservation Program (DSCP)
3) The establishment of a National Dugong Conservation Committee (NDCC)
4) Indonesian Biodiversity Strategy and Action Plan (IBSAP) 2015-2020</td><td>Seagrass conservation and public awareness with alternative livelihood:
• Trismades Program (Trikora Seagrass Management Demonstration Site) in east beach of Bintan Island, Kepulauan Riau
• Conservation and community assistance program in DSCP site (Alor, Kota Waringin Barat, Toli-toli and Bintan)</td></tr>
</table>

Table 13.1: Status of Habitats, Pressures and Response Measures. (cont.)

Habitat	Area (ha); Length (km)	Condition	Value (US$/ha)	Pressures, threats and impacts	Response	
					Policies, laws	Actions, best practices/ case studies
Beach	99,093 km		NA	• Coastal erosion; • Overdevelopment and construction; • Sedimentation/ coastal accretion.	**a. Key policies/laws** 1) President Decision Number 51/2016 on Coastline Limit 2) Law Number 27/2007 on the Management of Coastal and Small Islands Areas as amended by Law Number 1/2014 3) One Map Policy **b. National action plan** There is no specific national action plan, because it is contained in existing policies and laws	a. Coastal erosion: 1) Jembrana, Bali[73] 2) East Surabaya and Sidoarjo[74] 3) Seribu Islands[75] b. Sedimentation: 1) Jembrana, Bali 2) Subang, West Barat 3) Segara Anakan, Cilacap, Central Java c. Beach and coastal forest restoration in Sukabumi
Estuaries	NA		NA	• Erosion and sedimentation; • Pollution; • Construction; • Reclamation	**a. Key policies/laws (not specific but related)** 1) President Decision Number 121/2016 on Rehabilitation of Coastal and Small Islands Areas 2) Law Number 27/2007 on the Management of Coastal and Small Islands Areas as amended by Law Number 1/2014 3) MMAF Decision Number 24/2016 on Procedures for Rehabilitation of Coastal and Small Islands Areas **b. National action plan** There is no specific national action plan, because it is contained in existing policies and laws	NA
Salt marshes	NA		NA	• Conversion for plantation, settlement area; • Reclamation	NA	NA
Benthic	NA		NA	• Erosion and sedimentation; • Pollution; • Trawls; • IUU fishing	NA	NA

[73] Suniada K I. 2015.
[74] Moko G I and Wiweka W. 2012.
[75] Farhan A R and Lim S. 2011.

13.1.1 Mangrove Forests

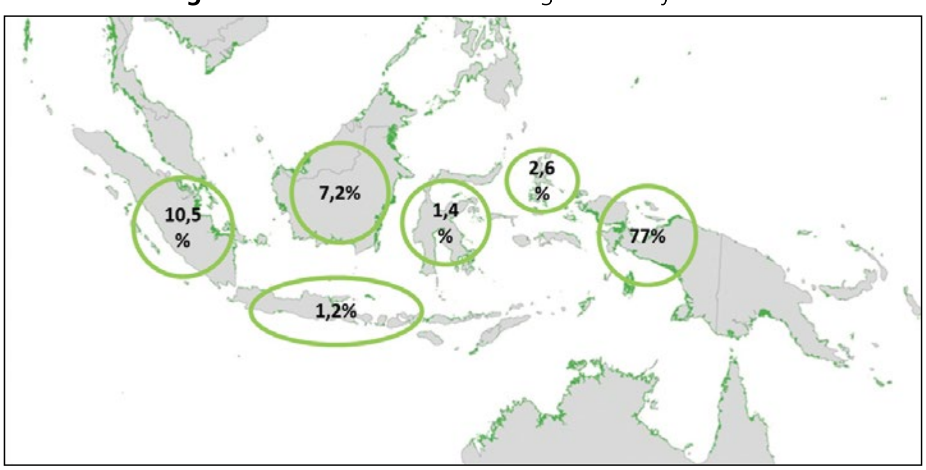
The mangrove ecosystem in Indonesia is the largest mangrove forest in Southeast Asia, about 76% of the total mangrove forest in this region. Areas that are dominated by mangrove forests are Sumatra, Kalimantan and Papua. Around 77% of the mangroves in Indonesia are found in Papua, followed by Sumatra (10.5%), Sulawesi (1.4%), Kalimantan (7.2%), Maluku (2.6%), and Java and Nusa Tenggara (1.2%) (Hutomo and Moosa 2005).

The mangrove forest in Indonesia is about 36,680.76 km^2 in 2015.[76] **Figure 13.1** shows the location and distribution of mangroves. In addition to having large area of mangroves, species diversity of mangroves in Indonesia is also high, reaching 243 species belonging to 197 genera and 83 families out of 268 species in Southeast Asia (Giesen et al., 2007). However, the dominant mangrove species were found to contain 47 true mangrove species (**Table 13.2**) and 22 associated species of mangroves (**Table 13.3**) (Noor et al., 2006).

The mangrove area with *good* quality decreased by 11.90%, while *moderate* condition increased by 0.70% and *damaged* condition increased by 2.58% (**Table 13.4**). The area of mangrove ecosystem damaged inside the forest area is about 0.017 million km^2 or 44.73% while around 0.042 million km^2 or 87.50% is outside forest area, and between 1982 and 1993, there has been a reduction of 513,670 ha of mangrove forest or 46,697 ha per year (Gunawan and Anwar, 2005).

The mangrove ecosystem is a very complex ecosystem in Indonesia because each region has different ecosystem depending on the physiography and tidal dynamics. In the coastal areas, mangrove ecosystems only grow at a distance of 25 m to 50 m from the lowest retreat to the mainland, while in the river area it will be found along the river flow as long as the food source supports (Hutomo and Moosa, 2005).

Figure 13.1: Distribution of Mangrove Ecosystems.



Source: https://photos.mongabay.com/j/seasia_tm5_mangroves_lrg.png.

[76] BPS. Statistics Indonesia. 2016.

Table 13.2: True Mangrove Species in Indonesia.

No.	Mangrove Species	Local Name	Distribution
1	*Acanthus ebracteatus*	Jeruju putih	whole Indonesia
2	*Acanthus illicifolius*	Jeruju hitam, daruyu darulu	whole Indonesia
3	*Acrostichum aureum*	Piai raya, mangrove varen, hata diuk, paku cai, kala keok, wikakas, krakas, wrekas, paku laut	whole Indonesia
4	*Acrostichum speciosum*	Piai lasa	whole Indonesia
5	*Aegialitis annulata*		Kepulauan Sunda Kecil, Maluku
6	*Aegiceras corniculatum*	Teruntun, gigi gajah, perepat tudung, perepat kecil, tudung laut, duduk agung, teruntung, kayu sila, kacangan, klungkum, gedangan, kacang-kacangan	whole Indonesia
7	*Aegiceras floridum*	Mange-kasihan	Kalimantan Utara, Jatim, Bali, Maluku, Sulawesi
8	*Amyema anisomeres*		Kampung Lato-u dekat Malili Sulsel (mungkin endemik di Sulawesi)
9	*Amyema gravis*		Kalimantan, Kepulauan Kangean, and Jatim
10	*Amyema mackayense*		dekat Merauke in Irian Jaya (Papua and West Papua)
11	*Avicennia alba*	Api-api, mangi-mangi putih, boak, koak, sia-sia	whole Indonesia
12	*Avicennia eucalyptifolia*		Irian Jaya (Papua and West Papua)
13	*Avicennia lanata*	api-api, sia-sia	Kalimantan, Lombok, and Bali
14	*Avicennia marina*	api-api putih, api-api abang, sia-sia putih, sie-sie, pejapi, nyapi, hajusia, pai	whole Indonesia
15	*Avicennia officinalis*	api-api, api-api daun lebar, api-api ludat, sia-sia putih, papi, api-api kacang, merahu, marahuf	whole Indonesia
16	*Bruguiera cylindrica*	burus, tanjang, tanjang putih, tanjang sukim, tanjang sukun, lengadai, bius, lindur	whole Indonesia
17	*Bruguiera exaristata*		Irian Jaya Selatan
18	*Bruguiera gymnorrhiza*	pertut, taheup, tenggel, putut, tumu, tomo, kandeka, tanjang merah, tanjang, lindur, sala-sala, dau, tongke, totongkek, mutut besar, wako, bako, bangko, mangi-mangi, sarau	whole Indonesia
19	*Bruguiera hainessii*	berus mata buaya	whole Indonesia
20	*Bruguiera parviflora*	langgade, mengelangan, lenggadai, tanjang, bius, mou, paparoti, sia-sia, tongi	whole Indonesia
21	*Bruguiera sexangula*	busing, busung, mata buaya, tumu, bakau tampusing, tanjang, lindur, ting, tongke perempuan, ai bon, tancang sukun, mutut kecil, sarau	whole Indonesia
22	*Comptostemon phillippinense*		Kalimantan and Sulawesi

Table 13.2: True Mangrove Species in Indonesia. (cont.)

No.	Mangrove Species	Local Name	Distribution
23	*Comptostemon schultzii*		Kalimantan, and Maluku
24	*Ceripos decandra*	tengan, tengar, tingi, tinci, palun, parun, bido-bido, kenyonyong, luru	Bangka, Jawa, Kalimantan, Sulawesi, Maluku
25	*Ceriops tagal*	tengar, tengah, tangar, tingih, tingi, palun, parun, bido-bido, lonro, mentigi, tengar, tinci, mange darat, wanggo	whole Indonesia
26	*Excoecaria agallocha*	buta-buta, menengan, madengan, kayu wuta, sambuta, kalapinrang, mata huli, makasuta, goro-goro raci, kalibuda, betuh, warejit, bebutah	whole Indonesia
27	*Gymnanthera paludosa*		Jawa and Madura
28	*Heritiera globosa*	dungun	Kalimantan
29	*Heritiera littoralis*	dungu, dungun, atung laut, lawanan kete, rumung, balang pasisir, lawang, cerlang laut, lulun, rurun, belohila, blakangabu, bayur laut	whole Indonesia
30	*Kandelia candel*	berus-berus, beras-beras, beus, pulut-pulut, pisang-pisang laut	Timur laut Sumatera, Kalimantan Barat and Utara
31	*Lumnitzera littorea*	teruntum (merah), api-api uding, sesop, sesak, geriting, randai, riang laut, teruntung, duduk agung, duduk gedeh, welompelong, posis-posi, ma garogo, kedukduk	Indonesia
32	*Lumnitzera racemosa*	api-api balah, susup, lasi, duduk laki-laki, api-api jambu, teruntum, adu-adu, duduk, knias, saman-sigi, kedukduk, truntun	whole Indonesia
33	*Nypa fruticans*	nipah, tangkal daon, buyuk, lipa	whole Indonesia
34	*Osbornia octodonta*	baru-baru	Irian Jaya (Papua and West Papua), Sulawesi, Jatim, Kep. Sunda Kecil, Kalimantan Utara
35	*Phemphis acidula*	sentigi, centigi, mentigi, cantinggi	whole Indonesia (Bali and Lombok)
36	*Rhizophora apiculata*	bakau minyak, bakau tandok, bakau akik, bakau puteh, bakau kacang, bakau leutik, akik, bangka minyak, donggo akit, jankar, abat, parai, mangai-mangai, slengkreng, tinjang, wako	Indonesia
37	*Rhizophora mucronata*	bangka item, dongoh korap, bakau hitam, bakau korap, bakau merah, jankar, lenggayong, belukap, lolaro	whole Indonesia
38	*Rhizophora stylosa*	bakau, bako-kurap, slindur, tongke besar, wako, bangko	Jawa, Bali, Lombok, Sumatera, Sulawesi, Sumba, Sumbawa, Maluku, Irian Jaya (Papua and West Papua)
39	*Sarcolobus globosa*		Jawa
40	*Scyphiphora hydrophyllacea*	perapat lanang, cingam, duduk perempuan, duduk rayap, duduk rambat, dandulit	whole Indonesia
41	*Sonneratia alba*	pedada, perapat, pidada, bogem, bidada, posi-posi, wahat, putih, beropak, bangka, susup, kedada, muntu, sopo, barapak, pupat, mange-mange	whole Indonesia

Table 13.2: True Mangrove Species in Indonesia. (cont.)

No.	Mangrove Species	Local Name	Distribution
42	*Sonneratia caseolaris*	pedada, perapat, pidada, bogem, bidada, rambai, wahat merah, posi-posi merah	Indonesia
43	*Sonneratia ovata*	bogem, kedabu	Kep. Riau, Sumatera, Jawa, Sulawesi, Maluku, Sungai Sebangau/Kalimantan Tengah
44	*Xylocarpus granatum*	Niri, nilih, nyireh, nyiri, nyuru, jombok gading, buli, bulu putih, buli hitam, inggili, siri, nyireh bunga, nyiri udang, nyiri hutan, pohon kira-kira, jomba, banag-banag, nipa, niumiri-kara, kabau, mokmof	Jawa, Madura, Bali, Kep. Karimun Jawa, Sumatera, Sulawesi, Kalimantan, Maluku, Sumba
45	*Xylocarpus makongensis*		Irian Jaya
46	*Xylocarpus moluccensis*	niri/nyirih batu, nyirih, siri, jombok, miumeri-mee, parasar, kabau, raru, nyiri gundik, nyuru, mojong tihulu, pamuli, loleso, banang-banang	Jawa, Bali, Maluku, NTT, Sulawesi, Kalimantan, and Irian Jaya (Papua and West Papua)
47	*Xylocarpus rumphii*	nyirih, banag-banang, siri, nyirih batu, jombok, niri	Jawa and Bali

Source: Noor et al. (2006).

Table 13.3: Associated Mangrove Species in Indonesia.

No.	Mangrove Species	Local Name	Distribution
1	*Barringtonia asiatica*	sea putat, bogem, butong, butun, pertun, putat laut, bitung, talise, hutun	Sumatera, Kalimantan, Jawa, Bali, Sulawesi, Sunda Kecil and Maluku
2	*Calophyllum inophyllum*	camplung, nyamplung, bintanguru, benaga, bintagur laut, menaga, naga	Sumatera, Bali, Jawa, Kalimantan and Irian Jaya (Papua and West Papua)
3	*Calotropis gigantea*	biduri, modori, menori, widuri, mendori	Bali and Jawa
4	*Cerbera manghas*	bintan, badak, goro-goro, kayu susu, kayu kurita, bintaro, kenyeri putih, kadong, koyandan, mangga brabu, waba, jabal, kenyen putih, bilu tasi	Bali, Jawa, Sumatera Barat, Sulawesi Utara, Maluku, Irian Jaya (Papua and West Papua)
5	*Clerodendrum inerme*	kayu tulang, kwanji, keranji, dadap laut	Jawa and Bali
6	*Derris trifoliata*	ambung, kambingan, tuba laut, areuy ki tonggeret, tuwa areuy, gadel, toweram, kamulut, tuba abal	whole Indonesia
7	*Finlaysonia maritima*	basang siap	whole Indonesia
8	*Hibiscus tiliaceus*	waru laut, waru langit, waru langkong, siron, waru lot, waru lenga, waru lengis, baru, kabaru, bahu, molowahu, fau, ksjanaf, iwal, wakati	whole Indonesia

Table 13.3: Associated Mangrove Species in Indonesia (cont.)

No.	Mangrove Species	Local Name	Distribution
9	*Ipomoea pes-caprae*	batat pantai, daun katang, tapak kuda, katang-katang, dalere, watat ruruan, alere, andali arana, daredei, dolodoi, tilalade, mari-mari, wedor, tati raui, wedule, bulalingo, loloro, balim-balim, kabai-kabai, ketepeng, daun kacang, daun barah	whole Indonesia
10	*Melastoma candidum*	senduduk, kluruk, senggani, harendong, kemanden	whole Indonesia
11	*Morinda citrifolia*	mengkudu, eodu, eoru, keumudee, lengkudu, bangkudu, pamarai, mangkudu, neteu, kudu, cangkudu, pace, tibah, ai kombo, bakulu, wangkudu, labanau	whole Indonesia
12	*Pandanus odoratissima*	pandan	whole Indonesia
13	*Pandanus tectorius*	pandan	whole Indonesia
14	*Passiflora foetida*	gegambo, lemanas, remugak, kacemprek, kileuleur, permot, pacean, rajutan, ceplukan blungsung, bungan pulir, moteti, buah pitri, kaap	Indonesia
15	*Pongamia pinnata*	kacang kayu laut, ki pahang laut, bangkong kranji, asawali, awakal, marauwen, tangi, klengkeng	whole Indonesia
16	*Ricinus communis*	Gloah, lulang, dulang, jarak, kalikih alang, jarag, dulang jai, lana-lana,lafandru, jarak jawa, jarak jitun, kaliki, kaleke, kalalei, alale, malasai, kolonyan,kohongiang, kilale, tetanga, luluk, paku penuai, paku ton, ketowang, balacai,lutur bal.	whole Indonesia
17	*Scaevola taccada*	Bakung-bakung, bako-bakoan, babakoan, gegabusan	whole Indonesia
18	*Sesuvium portulacastrum*	Gelang (-laut), saruni air, krokot, gelan-pasir, sesepi.	Jawa, Madura, Sulawesi, Sumatera
19	*Stachytarpheta jamaicensis*	Pecut kuda, jarongan, jarong lalaki, ngadi rengga, rumjarum, remek getih,jarong, biron, sekar laru, laler mengeng, ki meurit beureum	whole Indonesia
20	*Terminalia catappa*	Ketapang, beowa, kilaula, ketapas, klihi, lisa, wewa, sabrise, sarisei, talisei, dumpajang, luumpoyang, sadina, sarisa, sirisal, lisa, tasi, klis, tiliho, indian or singapore almond	whole Indonesia
21	*Thespesia populnea*	waru laut, waru pantai, waru lot, slimuli	whole Indonesia
22	*Wedelia biflora*	Sernai, pokok serunai, serunai laut, seremai, seruni, bunga batang.	whole Indonesia

Source: Noor et al. (2006).

Table 13.4: Area and Condition of Mangrove in Indonesia.

Condition (%)	2011	2012	2013	2014	2015
Good	56.91	57.09	47.71	37.03	25.13
Moderate	10.69	8.26	15.52	9.30	10.00
Damaged	7.21	11.13	7.94	5.62	8.20
Unidentified	25.20	23.53	28.82	48.05	56.67
Area (ha)	**5,543,012.08**	**5,094,132.84**	**3,989,686.08**	**4,418,105.57**	**3,668,075.60**

Note: The area of condition is calculated from percentage of condition to total mangrove area in each year.
Source: BPS. Statistics of Coastal and Marine Resources. 2012, 2013, 2014, 2015, 2016.

13.1.2 Coral Reefs

There are various estimates of the area of coral reefs in Indonesia: 75,000 km² (Burke et al. 2002, Hutomo and Moosa 2005; Spalding et al. 2001), or 85,000 km² (Tomascik et al., 1997). BPS reported that the coral reef area in Indonesia was 23,402.03 km² in 2015.[77] In 2017, the Center for Oceanographic Research (P2O-LIPI) released its estimate of Indonesia's coral reef cover: total of **2.5 million ha** (25,000 km²), of which: Bali (8.8 ha), Java (67.8 ha), Kalimantan (119.3 ha), Maluku (439.1 ha), Nusa Tenggara (272.1 ha), Papua (269.4 ha), Sulawesi (862.6 ha), and Sumatra (478.5 ha). **Figure 13.2** shows the location of coral reefs.

Figure 13.2: Distribution of Coral Reefs in Indonesia.

Source: P2O-LIPI. Status Terumbu Karang Indonesia 2017, P2O – LIPI.

[77] BPS. 2016.

The diversity of coral species in Indonesia is very high, with 76 genera and over 350 species having been reported, and dominantly found in eastern Indonesia. Tomascik et al. (1997) has reported about 452 species of hermatipic corals collected from Indonesian waters. A study reported by Suharsono (2004) mentioned that Indonesia has 590 species of 82 coral genera, with three important genera of Indonesian coral reefs: *Acropora* (104 species), *Montipora* (39 species), and *Porites* (24 species).

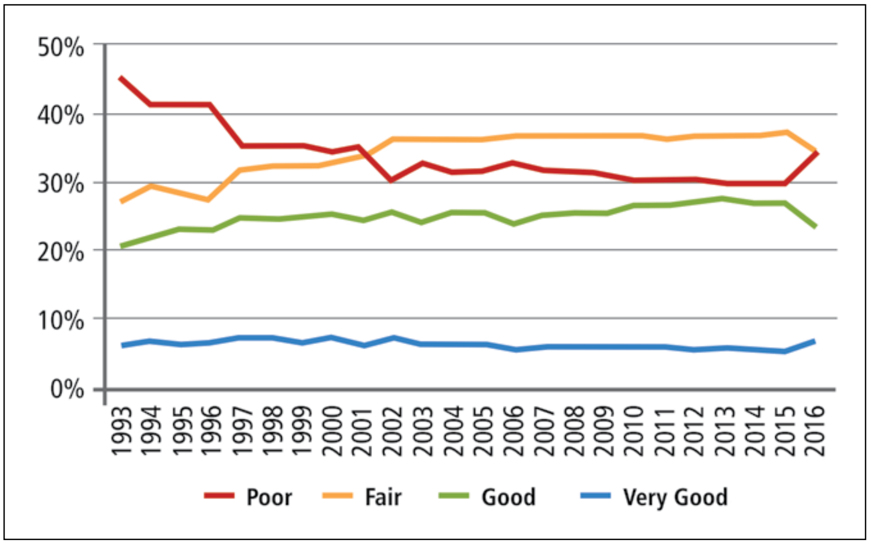
The distribution of coral genus in Indonesia is as follows: Sumatra (49 genus), Java Sea (63 genus), South Sulawesi (75 genus), Sumbawa Island (63 genus) and Manado/North Sulawesi (63 genus). P2O-LIPI also reported that there are 569 hard coral species (Indonesian Scleractinia order) or about 67% of the total coral species in the world.

Based on the monitoring of 1064 stations in 108 locations spread throughout Indonesian waters, P20-LIPI reported the following condition of coral reefs in 2016: very good (6.39%), good (23.40%), fair (35.06%), and poor (35.15%) (**Figure 13.3**). There was a slight increase of coral reef area in very good condition from 5% in 2015 to 6.39% in 2016. Coral reefs in good condition declined from 27% in 2015 to 23.4% in 2016. Likewise, coral reefs in fair or moderate condition declined from 38% in 2015 to 35% in 2016. With the decline of coral reefs in good and fair conditions, coral reef in poor or damaged condition increased from 30% in 2015 to 35% in 2016. **Figure 13.4** shows the trend of the condition of coral reefs in Indonesia from 1993 to 2016. **Table 13.5** provides details on area (km^2) and percentage for each type of condition of coral reefs in 2013 to 2015.

Figure 13.3: Status of Coral Reefs in Indonesia.

Note: Sangat Balik – very good; Baik – good; Cukup – fair; Jelek – poor; damaged
Source: P2O – LIPI. Status Terumbu Karang Indonesia, 2017.

Figure 13.4: Trend of Coral Reef Condition in Indonesia.



Source: P2O – LIPI. Status Terumbu Karang Indonesia, 2017.

Table 13.5: Area and Condition of Coral Reefs in Indonesia.

Condition (%)	2009	2010	2011	2012	2013	2014	2015
Very good	5.56	5.43	5.58	5.30	5.41	5.32	5.00
Good	25.89	26.67	26.95	27.18	27.66	27.20	27.01
Moderate	37.10	37.14	36.90	37.25	37.00	37.42	37.97
Damaged	31.45	30.76	30.76	30.45	29.93	30.07	30.02
Area (ha)	**2,262,880.63**	**803,735.72**	**1,293,624.66**	**5,106,790.51**	**2,692,301.69**	**3,185,616.85**	**2,517,857.90**

Note: Very Good: 75-100% the living surface of coral reef ; Good: 50-74%; Moderate: 25-49%; Damaged: 0-24%
Source:
Condition of coral reefs: www.coremap.or.id,downloaded on November 19, 2015.
Area of coral reefs: MMAF; Department of Marine Affairs and Fisheries Province, 2013, 2014, 2015, 2016.
BPS. Statistics of Coastal and Marine Resources. 2010, 2011, 2012, 2013, 2014, 2015, 2016.

13.1.3 Seagrass

Seagrass ecosystems have a high biodiversity and act as a contributor of nutrients for productivity of coastal waters. Seagrass is a flowering plant found only in coastal area that is able to live submerged in water. Seagrass is very important for a number of threatened organisms, including dugongs, turtles and seahorses.

In 2017, the P2O LIPI reported that the extent of the seagrass ecosystem is **150,693.16 ha**. The area of seagrass is 4,409.48 ha in western Indonesia, and 146,283.68 ha in eastern Indonesia.

Based on **Indonesia Biodiversity Strategy and Action Plan** (IBSAP) in 2015, the spread of seagrass ecosystem can be found in all Indonesia's bioregions: Sumatera, Java-Bali, Kalimantan, Sulawesi, Sunda Kecil, Maluku and Papua.

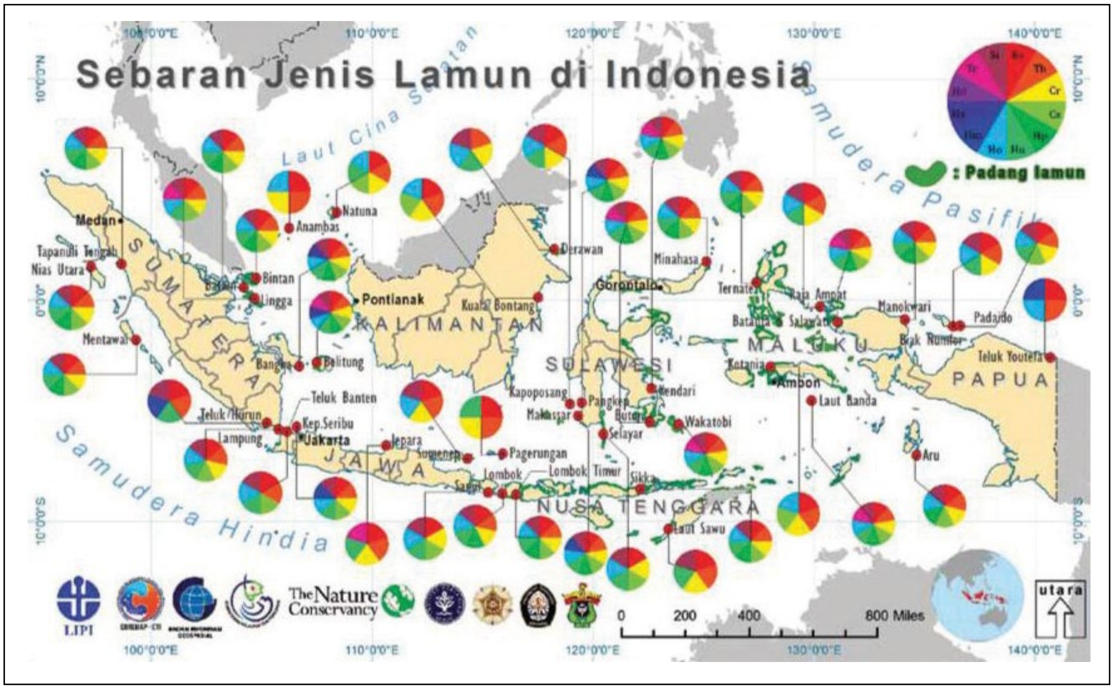
There are 15 seagrass species in Indonesia, and two species in the form of specimen (**Table 13.6**). 24 out of 60 species of seagrasses are found in the tropical Indo-Pacific region. *Ruppia maritima* was reported to be found in Ancol, North Jakarta and Pasir Putih, and East Java, whereas *Halophila spinulosa* and *Halophila decipiens* are found only in a few locations (Hutomo and Moosa 2005). To date, no one has reported the discovery of species of seagrass that are stored as specimens (*Ruppia maritime, Halophila becarii, Halophila major*). **Figure 13.5** shows the species distribution for seagrass in Indonesia.

Table 13.6: Species of Seagrasses found in Indonesian Waters.

No.	Seagrass Species	Distribution
1	*Cymodocea rotundata*	Seluruh Indonesia
2	*Cymodocea serrulata*	Seluruh Indonesia
3	*Enhalus acoroides*	Seluruh Indonesia
4	*Halodule uninervis*	Seluruh Indonesia
5	*Halodule finifolia*	Seluruh Indonesia
6	*Halophila minor*	Seluruh Indonesia
7	*Halophila ovalis*	Seluruh Indonesia
8	*Halophila spinulosa*	Seluruh Indonesia
9	*Halophila decipiens*	Seluruh Indonesia
10	*Syringodium isoetifolium*	Seluruh Indonesia
11	*Thalassia hemprichii*	Seluruh Indonesia
12	*Thalassodendron ciliatum*	Seluruh Indonesia
13	*Halophila sulawesii*	Sulawesi
14	*Ruppia maritima*	Ancol, Jakarta Utara dan Pasir Putih, Jawa Timur*
15	*Halophila becarrii*	Kalimantan *
16	*Halophila major*	Sumbawa **

Note:
* These seagrass specimens are stored in Herbarium Bogoriense in Cibinong, Bogor, Jawa Barat, and have not been reported or published.
** Specimen. Lectotype: Indonesia, Sumbawa, Kambing in the Bay of Bima, October 1847, H. Zollinger 3430 (P, Lectotype here designated; BO L59 90515349; D60 905170100; U Z-ISO)
Source: Hutomo dan Moosa (2005); Kuo (2007).

Figure 13.5: Distribution of Seagrass Species in Indonesia.



Source: P2O – LIPI. Status Padang Lamun 2017.

In general, the seagrass ecosystem has decreased by as much as 58% in the world. The rate of decline in seagrass ecosystems, which was only 1% per year in the 1940s, has now become 7% since the 1990s. Based on the results of 215 studies and 1,800 observations from 1879, it appears that the extent of damaged seagrass ecosystems is proportional to the rate of degradation of coral reefs and tropical forests. In 2015, only 20.62% of seagrass beds were found to be in good condition, and 68.8% remains unidentified (**Table 13.7**). A significant decline in seagrass area was also observed - from 14,969.97 km^2 in 2013 to 4,729,21 km^2 in 2015 (BPS, 2016), and further down to 1,569.3 km^2 in 2017 (Hermawan, et al. 2017), with 41.76% of total seagrass beds in less healthy condition (based on 166 observation stations throughout Indonesia). The seagrass ecosystems in some parts of Indonesia are under threat from pollution, tourism activities, ports, boating traffic, aquaculture, reclamation, dredging and sand mining.

Table 13.7: Area and Condition of Seagrass in Indonesia.

Condition (%)	2011	2012	2013	2014	2015
Good	11.30	45.31	79.08	83.43	20.62
Moderate	4.13	3.17	12.75	3.96	6.14
Damaged	3.12	2.86	8.85	7.15	4.43
Unidentified	81.45	48.65	2.34	5.46	68.81
Area (ha)	**813,645.13**	**2,016,728.46**	**1,496,966.78**	**847,385.33**	**474,920.93**

Source: BPS. Statistics of Coastal and Marine Resources. 2012, 2013, 2014, 2015, 2016.

Figure 13.6: Condition of Seagrass Ecosystem in Indonesia in 2017.

Source: P2O – LIPI. Status Padang Lamun, 2017.

13.1.4 Beaches

The beaches in Indonesia are of various types, such as muddy beaches, sandy beaches with sand dunes, coral beaches, volcanic coral beaches and coral reef beaches. These different types of beaches have benefits as a source of life (food production, water supply and energy), and as location for settlement, recreation, transportation, industry, etc.

One of the common vegetation in Indonesia's beaches is *Ipomea pes-caprae*, a common pantropical creeping vine belonging to the family Convolvulaceae. It grows on the upper parts of beaches and endures salted air. Other plants that often dominate the type of grasses are *Cyperus*, *Fimbristylis*, and *Ischaemum*. In addition, there are other plants like *Barringtonia*. In the animal category, in the coastal communities are often found crab species, such as the genus *Ocypode*, *Donax* mollusk and some types of gastropod and starfish (*Archaster typicus*). The beach is also very important for sea turtles and birds as a place of nesting and feeding (Hutomo and Moosa, 2005).

13.1.5 Estuaries

Estuaries are components of the coastal ecosystems that are known to be very productive and most easily disturbed by environmental stresses caused by human activities or by natural processes (Dahuri 1992). Many species of plants can be found in this estuary area, such as *Rhizophora mucronata, R. apiculata, Avicennia alba, A. marina, A. acida, sonneratia alba, Ceriops tagal, Candelia candoleana*, and *Xylocarpus sp*. Animals found in estuaries include crustaceans (*Stomatopoda, Brachyura, Paguridae, Cirripedia, Isopoda*), Mammalia (*Lutra lutras*), Primates (*Macaca fascicularis, M. nemestrina*), and Reptile (*Crocodylus porous, Tomistoma schlegelii, Hydrosaurus amboinensis, and Phyton spp.* (Hutomo and Moosa, 2005).

The estuary community is close to communities of endemic species derived from marine ecosystems and a small number of biota species that can enter/exit freshwater environments, i.e., biota with good osmoregulatory capabilities. The estuary is the most productive environment, and the most important is the tidal and shallow water zone, which is usually also the primary area of concern due to human activities. In general, components of meroplanktonic organisms (plankton temporal) dominate estuary waters compared to holoplanktonic organisms (permanent plankton). This trend can be seen from the diversity of higher types of meroplankton organisms, indicating the high diversity of habitat of benthic biota. The mullet (*Mugilidae* family) is a type of fish often found in estuaries around the world, because of the level of flexibility in high eating behavior (Rositasari and Rahayu 1994).

Species found in estuary environment include crabs (*Scylia serrata*), oysters (*Crassostrea cucullata*), *Nereis diversicolor, Crassostrea, Ostrea, Scrobicularia plana, Macoma balthica, Rangia flexuosa, Hydrobia*, and *Palaemonetes*. There are also marine animals, such as salmon (*Salmo, Onchorhynchus*) and sea eels (*Anguilla*), which use estuaries as temporary migration areas. Estuaries also serve as a larval care area for the shrimp family *Penaeidae* (*Penaeus setiferus, P. aztecus, P. duorarum*) (Nybakken, 1988).

13.1.6 Salt Marshes

Salt marshes, also known as the saltwater swamp, have a pool of high salinity and strongly influenced by sea tides. These swamps are generally located in the land area that connects with the sea, especially at the estuary of large rivers, and delta islands in the area near the estuary of a large river. The high influence of the tides makes this swamp highly dynamic, especially for the volume or region of water immersion.

In terms of Indonesian agriculture, saltwater swamp area is categorized as Zone I (tidal /brackish tidal swamp areas). Behind the beach area or coastal dunes, a kind of narrow lake called lagoon may be formed. The area behind the coastal lagoon can be overgrown with mangrove forests (*Rhizophora sp., Bruguiera sp.*), and is still influenced by the tide through small rivers (creeks). Behind the mangrove forest, there are brackishwater areas, and overgrown nipah vegetation (*Nipa fruticans*). Behind the nipah forest are salt marshes or backswamp landform which is influenced by freshwater (Ministry of Agriculture, 2006).

If located in an estuary or sheltered bay, salt marshes are usually located on higher land behind tidal flats or mudflats. The exterior is still influenced by the tides and is usually dominated by vegetation rambai (*Sonneratia sp.*), mangroves (*Avicennia sp.*), and jeruju (*Acanthus licifolius*), and behind it towards the land overgrown by mangroves with underneath plants (*Excoecaria agallocha* and *Acrostichum aureum*) (Ministry of Agriculture, 2006).

In Indonesia, salt water swamps are found around the east coast of Sumatra Island, such as in South Sumatra, Jambi, and Riau. Generally, they enter into the mainland Delta Island along a great river as far as several hundred meters to about 6 km. Due to the influence of saline or brackishwater, this swamp area contains high salts, categorized as typology of saline land, and unsuitable for agricultural land.

13.1.7 Deep Sea and Offshore/Pelagic Habitats

The deep ocean, also known oceanic zone, is a marine ecosystem with a depth that cannot be reached by sunlight (the base), so the bottom is very dark. Communities and diversity in deep-sea ecosystems have not been widely explored, but the Indonesian Institute of Sciences has conducted research on several marine animals found stranded on shore. Inadequate marine biodiversity information is caused by limited expertise and technology to reach the seafloor.

Indonesia has several deep seas, such as Arafura Sea (3.6 km), Flores Sea (5.1 km), Savu Sea (3.4 km), and Flores Sea and Banda Sea (5 km). Based on the bathymetry map, the Eastern Indonesia (KTI) had the biggest depth, ranging from 2 km (Timor Trough) to over 7 km (Weber Basin) (Chase et al. 1994; Hardjawidjaksana and Kristanto 1999, Salahuddin et al., 2001). There are animals that live in conditions in the deep sea, such as those shown in **Table 13.8**.

Table 13.8: Some Fauna Found in the Indonesian Deep Sea.

No.	Scientific name	Local name	English name
1	*Latimeria chalumnae*	Raja Laut	Coelacanth
2	*Tridacna gigas*	Kima raksasa	Giant clams
3	*Pagurites antenarius and P. aciculus*	Kelomang	Hermit crab
4	*Antiphates spp*	Akar Bahar	

Source: LIPI (2014).

13.1.8 Benthic or Sea Floor

There is also high biodiversity at benthic level in Indonesian seas. Hutomo and Moosa (2005) have summarized the number of species found: sponges (830 species), gastropod (1500 species) bivalve (1000 species) stomatopods (112 species), brachyuran (1400 species) crinoids (91 species) asteroids (87 species), ophioroids (142 species), Echinoids (284 species), and holothuroids (141 species).

IBSAP 2015 reported that the number of identifiable marine fauna reached 5,319 species. The most common types are fish followed by Echinodermata, and polychaeta. Indonesia has currently 557 types of echinodermata species consisting of 60 families and 4 classes. The types of Echinoderms are: sea star (*Linckia sp.*), sea urchins (*Diadema sp.*), sea cucumbers (*Holothuria sp.*), sea lilies (*Lamprometra sp.*), snake stars (*Ophiothrix sp.*), and Crown of Thorns (*Acanthaster sp.*) (Lilley, 1999).

The diversity of species in marine crustaceans in Indonesia is represented by 118 species of shrimp pengko (*Stomatopda*), which is the most common. Six types of crustaceans in Indonesia have high economic value, such as lobster and shrimp, but the population has declined. Mimi (*Tachypleus gigas*) is approaching extinction (Moosa, 1984; Moosa and Aswandy, 1984). The type of sea worms in Indonesia is quite complete, i.e. 43 groups and 527 species. There is high sponge diversity in Indonesia, with no more than 850 species of sponge (Nontji 1999). Rachmat (2007) found 441 types of sponges consisting of 339 species in the class Demospongiae and 2 types in the class of Calcarea, which is found in eastern Indonesia.

(Photos by IPB)

13.2 Rare, Threatened and Endangered Species

Biodiversity in Indonesia is very high, with many species that are endemic and rare. This uniqueness is one of the major factors driving the exploitation, poaching and trade. The International Union for Conservation of Nature (IUCN) is an institution that has been collecting data on species extinction, vulnerability, endangered, etc. **Table 13.9** provides the number of species in the IUCN Red List. In 2016, endangered species in Indonesia are 188 species of mammals, 131 species of birds, 158 species of fish, and 427 types of high-level plants (World Bank, 2018). The list of protected animals is shown in **Table 13.10**.

Table 13.9: Number of Species in the Red List Category in Indonesia.

Categories	Animal	Plant
Extinct	2	1
Extinct in the Wild	0	1
Critically Endangered	83	126
Endangerd	193	88
Vulnerable	579	213
Lower Risk/Conservation dependent	4	9
Near Threatened	565	98
Data Deficient	939	83
Least Concern	4786	633

Source: IUCN (2016). Red List.

Napoleon Wrasse. (*Photo by IPB*)

Corals and ornamental fish reefs are among the export commodities with high economic value. However, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) categorizes species that cannot be exploited for trade purposes. The categories are presented in Appendix I (forbidden to trade), Appendix II (if continuously traded will be extinct), and Appendix III (protected in certain areas, and may at times increase to Appendix I or II). Some species in Appendix I are Pesut (*Orcaella brevirostris*), Chinese white dolphin (*Sousa chinensis*), Sperm whale (*Physeter macrocephalus*), northern minke whales (*Balaenoptera acutorostrata*), southern minke whales (*Balaenoptera borealis*), blue whales (*Balaenoptera musculus*), Fin whales (*Balaenoptera physalus*), humpback whales (*Megaptera novaeangliae*), Dugong (*Dugong dugon*), dolphins without fins (*Neophocaena phocaenoides*), and dwarf bryde (*Balaenoptera edeni*).

Coral Reef with fish. (*Photo by PEMSEA*)

Coral. *(Photo by PEMSEA)*

Table 13.10: Protected Animals in Indonesia.

No.	Fauna	Common Name	Latin name	Status		
				IUCN	CITES	UU (Law)
1	Dugong	Dugong	*Dugong dugon*	Vulnerable	Appendix I	PP 7/99
2	Ikan Napoleon	Napoleon wrasse	*Cheilinus undulatus*	Endangered	Appendix II	Kepmen Pertanian No. 357/Kpts/ IK.250/5/95; SK Dirjen Perikanan No. HK.330/Dj.8529/95; Kepmen KP 37/2013
3	Ikan Terubuk	tropical shad fish	*Tenualusa macrura*			Peraturan Bupati Bengkalis No. 15/2010; Kepmen KP 59/2011
4	Banggai Cardinal Fish	Cardinal fish	*Pterapogon kauderni*	Endangered		
5	Lola	sea snails	*Trochus niloticus*			PP 7/99; Kepmenhut 385/Kpts-II/1999
6	Arwana Super Red	Arwana	*Scleropages formosus*	Endangered	Appendix I	PP 7/99
7	Arwana Jardini	Arwana	*Scleropages jardini*			PP 7/99; Kepmenhut No. 2091/kpts-II/2001
8	Bambu Laut	Sea bamboo	*Isis hippuris*			
9	Penyu Hijau	Green turtle	*Cheyolenia mydas*	Endangered	Appendix I	PP 7/99
10	Hiu Gergaji	largetooth sawfish	*Pristis microdon*	Critically Endangered	Appendix II	PP 7/99
11	Hiu Paus	Whale shark	*Rhincodon typus*	Vulnerable	Appendix II	Kepmen KP 18/2013
12	Hiu Martil	scalloped hammerhead shark	*Sphyrna leweni*	Endangered		
13	Hiu Marti	great hammerhead shark	*Sphyrna mokarran*	Endangered		
14		smooth hammerhead shark	*Sphyrna zygaena*	Vulnerable		
15	Cucut Lanjaman	sandbar shark	*Chacharhinus plumbeus*	Vulnerable		
16	Hiu Koboy	oceanic whitetip shark	*Carcharhinus longimanus*	Vulnerable		
17	Hiu Layan	Dusky shark	*Carcharhinus obscurus*	Vulnerable		
18	Kuda Laut	seahorse	*Hippocampus barbouri*	Vulnerable	Appendix II	
19		seahorse	*Hippocampus comes*	Vulnerable	Appendix II	
20		seahorse	*Hippocampus histrix*	Data Deficient	Appendix II	
21	Kuda Laut Ekor Duri	seahorse	*Hippocampus kellogi*			
22	Kuda Laut Kuda	seahorse	*Hippocampus kuda*	Vulnerable	Appendix II	
23	Kuda Laut Bargibanti	seahorse	*Hippocampus bargibanti*			
24	Kuda Laut Trimaculatus	seahorse	*Hippocampus trimaculatus*	Vulnerable	Appendix II	
25	Kuda Laut Spinosisimus	seahorse	*Hippocampus spinosisimus*	Vulnerable	Appendix II	
26	Kuda Laut Denise	seahorse	*Hippocampus denise*			
27	Paus Biru	blue whale	*Balaenoptera musculus*	Endangered	Appendix I	PP 7/99

Table 13.10: Protected Animals in Indonesia. (cont.)

No.	Fauna	Common Name	Latin name	Status		
				IUCN	CITES	UU (Law)
28	Paus Bersirip	fin whale	*Balaenoptera physalus*	Endangered	Appendix I	PP 7/99
29	Paus Bongkok	humpback whale	*Megaptera novaeanglia*	Least Concern	Appendix I	PP 7/99
30	Kima Tapak Kuda	bear paw clam or horse's hoof clam	*Hippopus hipspopus*	Lower Risk	Appendix II	PP 7/99
31	Kima Cina	china clam	*Hippopus porcellanus*	Lower Risk	Appendix II	PP 7/99
32	Kima Kunia	crocea clam; boring clam	*Tridacna crocea*	Lower Risk	Appendix II	PP 7/99
33	Kima selatan	southern giant clam or smooth giant clam	*Tridacna derasa*	Vulnerable	Appendix II	PP 7/99
34	Kima Raksasa	giant clams	*Trdacna gigas*	Vulnerable	Appendix II	PP 7/99
35	Penyu Tempayan	Loggerhead turtle	*Caretta caretta*	Endangered	Appendix I	PP 7/99
36	Penyu Sisik	Hawksbill turtle	*Eretmochelys imbricate*	Critically Endangered	Appendix I	PP 7/99
37	Penyu ridel	olive ridley turtles	*Lepidochelys olivacea*	Vulnerable	Appendix I	PP 7/99
38	Penyu Pipih	Flatback turtle	*Natator depressus*	Data Deficient	Appendix I	PP 7/99
39	Penyu Belimbing	leatherback turtle	*Dermochelys coriacea*	Critically Endangered	Appendix I	PP 7/99
40	Karang	coral	*Acropora rudis*	Endangered	Appendix II	
41	Karang	coral	*Acropora suharsonoi*	Endangered	Appendix II	
42	Karang	coral	*Acropora aspera*	Vulnerable	Appendix II	
43	Karang	coral	*Acropora caroliniana*	Vulnerable	Appendix II	
44	Karang	coral	*Acropora donei*	Vulnerable	Appendix II	
45	Karang	coral	*Acropora echinata*	Vulnerable	Appendix II	
46	Karang	coral	*Acropora elegans*	Vulnerable	Appendix II	
47	Karang	coral	*Acropora horrida*	Vulnerable	Appendix II	
48	Karang	coral	*Acropora speciosa*	Vulnerable	Appendix II	
49	Karang	coral	*Acropora jacquelineae*	Vulnerable	Appendix II	
50	Karang	coral	*Acropora loisetteae*	Vulnerable	Appendix II	
51	Karang	coral	*Acropora multiacuta*	Vulnerable	Appendix II	
52	Karang	coral	*Acropora solitaryensis*	Vulnerable	Appendix II	
53	Karang	coral	*Acropora carduus*	Near Threatened	Appendix II	
54	Karang	coral	*Acropora digitifera*	Near Threatened	Appendix II	
55	Karang	coral	*Acropora divaricata*	Near Threatened	Appendix II	
56	Karang	coral	*Acropora florida*	Near Threatened	Appendix II	
57	Karang	coral	*Acropora formosa*	Near Threatened	Appendix II	
58	Karang	coral	*Acropora granulose*	Near Threatened	Appendix II	
59	Karang	coral	*Acropora humilis*	Near Threatened	Appendix II	
60	Karang	coral	*Acropora grandis*	Near Threatened	Appendix II	
61	Karang	coral	*Acropora loripes*	Near Threatened	Appendix II	
62	Karang	coral	*Acropora monticulosa*	Near Threatened	Appendix II	
63	Karang	coral	*Acropora tenuis*	Near Threatened	Appendix II	

Table 13.10: Protected Animals in Indonesia. (cont.)

No.	Fauna	Common Name	Latin name	Status		
				IUCN	CITES	UU (Law)
64	Karang	coral	*Acropora clathrata*	Least Concern	Appendix II	
65	Karang	coral	*Acropora gemmifera*	Least Concern	Appendix II	
66	Karang	coral	*Acropora millepora*	Least Concern	Appendix II	
67	Karang	coral	*Acropora nobilis*	Least Concern	Appendix II	
68	Karang	coral	*Acropora pulchra*	Least Concern	Appendix II	
69	Karang	coral	*Acropora robusta*	Least Concern	Appendix II	
70	Karang	coral	*Acropora samoensis*	Least Concern	Appendix II	
71	Karang	coral	*Acropora sarmentosa*	Least Concern	Appendix II	
72	Karang	coral	*Acropora subglabra*	Least Concern	Appendix II	
73	Karang	coral	*Acropora valencennesii*	Least Concern	Appendix II	
74	Karang	coral	*Acropora yongei*	Least Concern	Appendix II	
75	Siput Batu Laga	green turban	*Turbo marmoratus*			PP 7/99
76	Troka, Susur bundar	commercial top shell	*Trochus niloticus*			PP 7/99
77	Ketam tapak kuda	Indo-Pacific horseshoe crab	*Tachipleus gigas*			PP 7/99
78	Nautilus berongga	Nautilus	*Nautilus popillius*			PP 7/99
79	Triton terompet	Triton's trumpet	*Charonia tritonis*			PP 7/99
80	Kepala kambing	horned helmet	*Cassis cornuta*			PP 7/99
81	Ketam kelapa	coconut crab	*Birgus latro*	Data Deficient		PP 7/99
82	Akar bahar	black coral	*Anthiphates spp*			PP 7/99
83	Pari Sentani	sawfish	*Pritis spp.*			PP 7/99
84	Belida Jawa	bronze featherback fish	*Notopterus spp.*	Least Concern		PP 7/99
85	Ikan raja laut	Coelacanths	*Latimeria chalumnae*	Critically Endangered	Appendix II	PP 7/99
86	Selusur Maninjau	Lizard Fish	*Homaloptera gymnogaster*			PP 7/99
87	Pari manta oseanik	giant oceanic manta ray	*Manta birostris*	Vulnerable	Appendix II	Kepmen KP 4/2014
88	Pari Manta Karang	reef manta ray	*Manta alfredi*	Vulnerable	Appendix II	Kepmen KP 4/2015
89	Tuntong	northern river terrapin; riverine turtle	*Batagur baska*	Critically Endangered	Appendix I	PP 7/99
90	Kura-kura Irian	pig-nosed turtle	*Carettochelys insculpta*	Vulnerable	Appendix II	PP 7/99
91	Kura Irian leher panjang	Papua snake-necked turtle	*Chelodina novaeguineae*	Lower Risk	Appendix II	PP 7/99
92	Labi-labi besar	Indian narrow-headed softshell turtle	*Chitra indica*	Endangered	Appendix II	PP 7/99
93	Buaya air tawar Irian	Freshwater crocodiles Irian	*Crocodylus novaeguineae*	Lower Risk	Appendix II	PP 7/99
94	Buaya muara	Estuarine crocodile	*Crocodylus porosus*	Lower Risk	Appendix I	PP 7/99
95	Buaya siam	Siamese crocodile	*Crocodylus siamensis*	Critically Endangered	Appendix I	PP 7/99
96	Kura Irian leher pendek	New Guinea snapping turtle	*Elseya novaeguineae*	Lower Risk		PP 7/99
97	Kura-kura gading	Bornean giant turtle	*Orlitia borneensis*	Endangered	Appendix II	PP 7/99

Table 13.10: Protected Animals in Indonesia. (cont.)

No.	Fauna	Common Name	Latin name	Status		
				IUCN	CITES	UU (Law)
98	Senyulong, Buaya sapit	Sunda gharial crocodile	*Tomistoma schlegelii*	Vulnerable	Appendix I	PP 7/99
99	Paus minke	minke whale	*Balaenoptera acutorostrata*	Least Concern	Appendix I	PP 7/99
100	Paus sei	sei whale	*Balaenoptera borealis*	Endangered	Appendix I	PP 7/99
101	Paus bryde	Bryde whale	*Balaenoptera brydei*			PP 7/99
102	Paus bryde kecil	small Bryde whale	*Balaenoptera edeni*	Data Deficient	Appendix I	PP 7/99
103	Paus biru kecil	Small blue whale	*Balaenoptera m. brevicauda*			PP 7/99
104	Paus omura	Omura whale	*Baleanoptera omurai*			PP 7/99
105	Lumba-lumba moncong panjang	Dolphins, long snout	*Delphinus capensis*	Data Deficient	Appendix II	PP 7/99
106	Lumba - lumba moncong pendek	Dolphins, short snout	*Delphinus delphis*	Least Concern	Appendix II	PP 7/99
107	Paus pembunuh kerdil	pygmy killer whale	*Feresa attenuata*	Data Deficient	Appendix II	PP 7/99
108	Paus pemandu sirip pendek	short-finned pilot whale	*Globicephala macrorhynchus*	Data Deficient	Appendix II	PP 7/99
109	Lumba - Lumba riso	Risso's dolphin	*Grampus griseus*	Least Concern	Appendix II	PP 7/99
110	Paus hidung botol selatan	southern bottlenose whale	*Hyperoodon planifrons*	Least Concern	Appendix I	PP 7/99
111	Paus sperma palsu	false sperm whale	*Kogia breviceps*	Data Deficient	Appendix I	PP 7/99
112	Paus sperma kerdil	dwarf sperm whale	*Kogia sima*	Data Deficient	Appendix II	PP 7/99
113	Lumba - lumba fraser	fraser dolphins	*Lagenodelphis hosei*	Least Concern	Appendix II	PP 7/99
114	Paus paruh Blainville	Blainville's beaked whale	*Mesoplodon densirostris*	Data Deficient	Appendix II	PP 7/99
115	Paus berparuh bergigi ginkgo	Ginkgo-toothed beaked whales	*Mesoplodon ginkgodens*	Data Deficient	Appendix II	PP 7/99
116	Lumba - lumba tanpa sirip	Finless porpoise	*Neophocaena phocaenoides*	Vulnerable	Appendix I	PP 7/99
117	Pesut mahakam	Irrawaddy dolphin	*Orcaella brevirostris*	Vulnerable	Appendix I	PP 7/99
118	Paus pembunuh	killer whale or orca	*Orcinus orca*	Data Deficient	Appendix II	PP 7/99
119	Paus kepala melon	melon-headed whale	*Peponocephala electra*	Least Concern	Appendix II	PP 7/99
120	Paus spermaseti	sperm whale	*Physeter macrocephalus*	Vulnerable	Appendix I	PP 7/99
121	Paus pembunuh palsu	false killer whale	*Pseudorca crassidens*	Data Deficient	Appendix II	PP 7/99
122	Lumba - Lumba bungkuk Indo-Pasifik	Indo-Pacific dolphins	*Sousa chinensis*	Near Threatened	Appendix I	PP 7/99
123	Lumba - lumba pemintal	spinner dolphins	*Stenella longirostris*	Data Deficient	Appendix II	PP 7/99
124	Lumba - lumba garis	striped dolphin	*Stenella coeruleoalba*	Least Concern	Appendix II	PP 7/99
125	Lumba - lumba pemintal kerdil	dwarf spinner dolphins	*Stenella l. roseiventris*		Appendix II	PP 7/99
126	Lumba - Lumba bercak	spotted dolphins	*Stenella attenuata*	Least Concern	Appendix II	PP 7/99
127	Lumba - lumba gigi kasar	rough-toothed dolphin	*Steno bredanensis*	Least Concern	Appendix II	PP 7/99
128	Lumba - lumba hidung botol Indo-Pasifik	Indo-Pacific bottlenose dolphins	*Tursiops aduncus*	Data Deficient	Appendix II	PP 7/99
129	Lumba - lumba hidung botol	bottlenose dolphins	*Tursiops truncatus*	Least Concern	Appendix II	PP 7/99
130	Paus moncong cuvier	muzzle cuvier whale	*Ziphius cavirostris*	Least Concern	Appendix II	PP 7/99

Source: IUCN; CITES; UU (laws).

14 Risks and Pressures

14.1 Ocean Health Index of Indonesia

One of the greatest challenges for natural resource and environmental management, including for oceans and LMEs, is to understand the conditon of human and natural systems, the pressures affecting that condition, and the impacts, and make informed decisions about the best way to improve that condition and address the pressures and impacts. Too ofen, monitoring, assessments, indicator choice, and decisions are made within a single sector or aimed at a single objectve, without adequate consideraton of the broader implicatons of proposed actions.[78] Using a common framework, the Ocean Health Index (OHI) measures progress towards achievement of ten widely-agreed public goals for healthy oceans, including food provision, carbon storage, coastal livelihoods and economies, and biodiversity (**Table 14.1**). Progress towards each goal is assessed against the optimal and sustainable level that can be achieved. OHI allows the tracking of the current status and expected future conditon of human benefts (expressed as goals and sub-goals) from ocean ecosystems. OHI assesses the cumulative stressors on ecosystem services, tracks the resulting status of the sustainable delivery of services to people, and incorporates measures of governance to quantify the potental resilience of the system.[79]

Table 14.1: Goals and Sub-goals of the Ocean Health Index (OHI).

Goal	Sub-goal	Definition
1. Food provision	Mariculture	Production of sustainably cultured seafood
	Fisheries	Harvest of sustainably caught wild seafood
2. Artisanal fishing opportunity		Opportunity to engage in artisanal-scale fishing for subsistence and/or recreation
3. Natural products		Sustainable harvest of natural porducts, such as shells, algae, and fish oil used for resons other than food provision
4. Coastal protection		Conservation status of natural habitats affording protection of the coast from inundation and erosion
5. Carbon storage		Conservation status of natural habitats affording long-lasting carbon storage

78 Halpern, B., et al. 2016.
79 Halpern, B., et al. 2012.

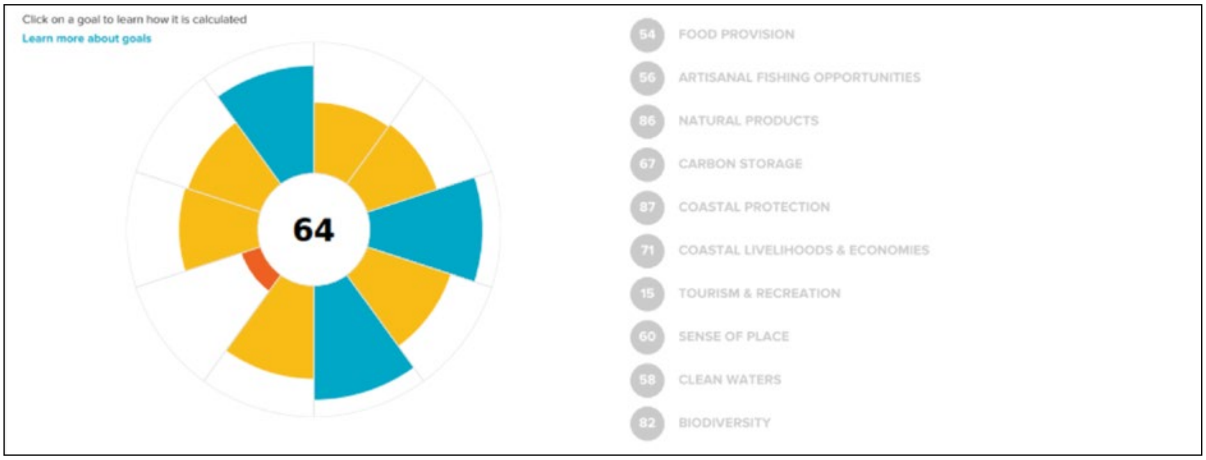
Table 14.1: Goals and Sub-goals of the Ocean Health Index (OHI). (cont.)

Goal	Sub-goal	Definition
6. Coastal livelihoods and economies	Coastal livelihoods	Jobs and wages from marine-related sectors
	Coastal economies	Revenues from marine-related sectors
7. Tourism and recreation		Opportunity to enjoy coastal areas for recreation and tourism
8. Sense of place	Lasting special places	Cultural, spiritual, or aesthetic connection to the environment afforded by coastal and marine places of significance
	Iconic species	Cultural, spiritual, or aesthetic connection to the environment afforded by iconic species
9. Clean waters		Clean waters that are free from nutrient and chemical pollution, marine debris, and pathogens
10. Biodiversity	Species	The existence value of biodiversity measured through the conservation status of marine-associated species
	Habitats	The existence value of biodiversity measured through the conservation status of habitats

Source: Halpern, B., et al. 2016.

The OHI score of Indonesia in 2018 is **65** (closer to 100 the better) and is ranked at 145 among 221 EEZs.[80] The OHI score of Indonesia is lower than the global OHI score of 70. In 2012, OHI score was 64, and from 2013 to 2015, it was 65. In 2016, it increased to 66, but dropped back to 65 in 2017 and 2018. The score remains far from 100, indicating that the oceans and marine life would fare better, and more benefits would be gained if the ocean is used in more sustainable ways. Looking at the evaluation of each goal, Indonesia scored lowest in terms of food provision and tourism and recreation goals, but got the highest score for natural products goal (92), followed by coastal protection (88) and biodiversity goals (85) (**Figure 14.1**).

Figure 14.1: Goal Evaluation, Indonesia.



Source :http://www.oceanhealthindex.org/region-scores/scores/indonesia.

[80] http://www.oceanhealthindex.org/region-scores/annual-scores-and-rankings.

The extent, condition and integrity of the coastal and marine ecosystems need to be maintained to continue getting benefits of coastal protection, carbon storage, natural products and biodiversity. The low score for food provision shows the need to make harvest more sustainable by improving the fishing and culture practices, and increasing sustainable mariculture producton and management of wild-caught stocks.

Ocean health assessment was also done in Bali in 2016-2018 as a pilot site to measure ocean health at a smaller scale or at the local level. Bali's OHI score was 51 – a lower score than the national average.[81] The assessment showed that the level of nutrients and chemical pollutants continues to increase in Bali's waters, at an annual increase of 4%, indicating the need for more wastewater treatment in the island. For the carbon storage goal, Bali got a score of 24. This low score could be a reflection of massive infrastructure development in coastal areas, which have reduced mangroves and seagrass areas. Bali scored highest in terms of the biodiversity goal. However, if the pollution and habitat loss are not addressed, this will affect biodiversity condition as well as the other goals. ICM in Bali therefore needs to be strengthened.

14.2 Human Activities and Environmental Damage

"Changes in marine ecosystem dynamics are influenced by socioeconomic activities (for example, fishing, pollution) and human-induced biophysical change (for example, temperature, ocean acidification) and can interact and severely impact marine ecosystem dynamics and the ecosystem services they generate to society. Understanding these **direct**—or **proximate**—interactions is an important step towards sustainable use of marine ecosystems. However, proximate interactions are embedded in a much broader socioeconomic context where, for example, economy through trade and finance, human migration and technological advances, operate and interact at a global scale, influencing proximate relationships. These **indirect**—or **distal**—interactions add dimensionality and complexity to the global marine social-ecological system."[82]

Indonesia's geography leaves the nation vulnerable to severe flooding, unpredictable drought and plant pest attacks, volcanic activity, and earthquakes, which are sometimes associated with tsunami. The most important environmental issues associated with human activities are forest degradation (unregulated cutting, fires, smoke and haze, and erosion); water pollution from industrial wastes and sewage; air pollution from motor vehicles and industry in urban areas, and generally from smoke and haze caused by forest fires; and threats to coastal and marine ecosystems, biodiversity and rare plant and animal species.[83]

[81] http://www.oceanhealthindex.org/news/bali-ocean-health-index.
[82] Henrik Österblom, Beatrice I. Crona, Carl Folke, Magnus Nyström and Max Troell. "Marine ecosystem science on an intertwined planet". *Ecosystems*, 19 (1): 1–8.
[83] World Bank, United Nations Office for Disaster Risk Reduction (UNISDR), National Hydrological and Meteorological Services (NHMS) and World Meteorological Organization (WMO). 2013.

14.2.1 Drivers/Pressures

The marine environment is already straining under the weight of pollution, rising water temperatures, loss of biodiversity, rising sea levels, growing acidification and other impacts associated with climate change, with the result that unsustainable growth in ocean-related economic activity risks yet further undermining the very foundations on which the ocean economy stands.[84]

a. Population Growth and Coastal Development

Globally and looking at the history of world migration, the coastal areas are the primary choice for residential and urban development. Until 2000, an estimated half of the world's population or about 3.2 billion people live on the coast (Hinrichson 1998[85]; Creel 2003[86]). However, the problem is not just the population growth, but also the inability to manage and protect the coastal ecosystems. This issue is more pronounced in developing countries that generically lack the capacity to manage rapid population growth and the political motivation, expertise and funding for comprehensive coastal planning (Hinrichson, 1998). There is a strong relation between coastal socioeconomic development and environmental change[87, 88, 89], and this is in line with the global trend wherein coastal areas have higher density level than non-coastal areas.[90]

The demographic factors that could contribute to degradation of coastal resources are: (a) population density; (b) migration to coastal areas, and (c) urbanization in coastal areas.

The non-demographic socioeconomic factors are: (a) tourism, since it drives development of mass tourism-support infrastructure, which could affect coastal habitats and endemic species; (b) marine fisheries and aquaculture that trigger overfishing, overcrowding of fish pens and fishponds, or degradation of mangroves, estuaries and water condition; (c) agriculture and industries with untreated wastewater discharges and runoff, which could affect health, food safety, freshwater availability, and water quality of rivers and coasts.

As shown in Section 3 of this report, the population of Indonesia is 267.66 million as of 2018, and mostly concentrated in the island of Java. Jawa Barat (West Java) is the province with the highest population among the 34 provinces. The provinces with the highest population density are DKI Jakarta (15,764 people/km^2), followed by Jawa Barat (1,376 people/km^2) and

84 OECD (2019).
85 Hinrichson, D. 1998. Coastal Waters of the World: Trends, Threats and Strategies, Island Press: Washington DC.
86 Creel, L. 2003. (Accessed from https://pdf.usaid.gov/pdf_docs/Pnadd169.pdf)
87 Guo L, Ma H. 2008.
88 Lal Mukherjee, Abir. 2013.
89 Lanfranchi M, Gianetto C, De Pascale A. 2015.
90 Neumann, B, et al. 2015.

Banten (1,313 people/km^2). Although the trend of population growth is declining, the average population density is increasing in these provinces since 2000. Urban population has been also increasing while rural population has been decreasing. In 2017-2018, urban population grew by 2.34%, while rural population growth was negative or declined by 0.35% (World Bank, 2019). The concentration of population in coastal areas has created numerous economic benefits in transportation sector, urban development and industrialization, income from tourism, and improvement in food production. On the other side, rapid population growth and unregulated development also threaten the ecosystems, the phenomenon called by Creel (2003) as "ripple effect" where ecosystems experienced shrinkage or pressure due to increased human activities. Some of the impacts occurred were loss of water area; saltwater intrusion due to over-extraction of groundwater; deforestation; degradation of mangroves and other coastal ecosystems; coastal erosion; industrial, agricultural and domestic pollution; increased marine debris; etc.

Capacity development is critical in most villages

Different approaches were applied in the development of urban and rural areas. The acceleration of development in Indonesia focused on rural areas since 2014. Previously, from 1980 to 2000, villages were peripheral areas and served as sources of resources for urban areas while decision makers were in urban areas and biased towards urban development. The *Law No. 06 of 2014* has implications for changing villages into centers of growth and social activities, as well as in allowing villages to manage its resources. This decentralization legislation provides an opportunity for villages to manage their own resources and aim for the welfare of the community; however, it presents a managerial challenge to ensure the sustainability of their resources. In 2018, there were 12,857 coastal villages (15% of total number of villages), and 71,074 non-coastal villages but higher population density in coastal areas (BPS, 2019). Balancing sustainable economic growth and environmental protection requires careful planning, reinforced by appropriate policies, regulations, scientific inputs, public awareness and support, and adequate capacity to implement policies and plans, manage the coastal area and its resources, and enforce laws.

Environmental safeguards in coastal planning and development

A major issue is the coastal planning that is not in line with carrying capacity, sustainable use of natural resources, and consideration for coastal habitats that are vulnerable to changes. Although every map of National or Regional Spatial Planning has already determined coastal zone as ecosystem buffer and protection zone, the growth of population and supporting facilities and infrastructure pushed the limits of coastal sustainability. Improper development plan as well as biased implementation of spatial planning could result in disregarding environmental carrying capacity and environmental impacts. This issue stretches from upstream to downstream and to the coastal waters. In the upstream, the issues, such as loss of forest cover, loss of river buffer zone, high runoff, and pollution, have brought negative impacts downstream. Flooding, sedimentation and transport of garbage, heavy metals and organic pollutants have caused degradation of coastal water quality. One of the best examples is Jakarta Bay in DKI Jakarta and Citarum River mouth in Karawang, West Jawa. Jakarta Bay experienced serious sedimentation, solid waste accumulation and water pollution by hazardous heavy metals;[91] while Citarum River mouth always experiences heavy flooding due to reduced carrying capacity to absorb water.[92] In the coastal areas, cutting of mangroves, establishment of large-scale aquaculture ponds, as well as development of infrastructure resulted in ecological imbalance, as well as coastal vulnerabilities.

Social safeguards in coastal planning and development

Another issue in the coastal areas is the dualism of coastal land and water tenurial regime, and the coastal and small island management regime, including matters on transfer of ownership of small islands from the state to individual or private sectors. Land tenurial regime is under the authority of Ministry of Spatial Planning/National Land Registration Agency while water tenurial regime is under authority of Ministry of Marine Affairs and Fisheries.[93] Land tenurial regime follows the Regional Spatial Planning (RTRW) document while water tenurial regime uses Coastal and Smalls Island Zoning Plan (RZWP3K).

According to Koalisi Rakyat untuk Keadilan Perikanan (KIARA), as of 2015, 16 islands were owned by foreign private sectors covering 5 islands in Sumatera, 4 islands in Java, 1 island in Kalimantan, and 9 islands in Nusa Tenggara[94] while around more than 65 small islands in Seribu Islands are owned by individual and domestic private sector (Utomo 2015) excluding other small islands, such as Tojo Una-una Island, Kumbang Island and Ajab Island.[95] In some small islands (such as on Seribu Island), there is reclamation activity. There were also reports of conflicts between foreign private owners and the fishing communities in these islands.

b. Conversion and destruction of habitats and loss of biodiversity

Marine biodiversity faces serious threat from humans, environmental changes and climate change impacts.

Excessive exploitation is a source of pressure on Indonesia's biodiversity. Exploitation of trees that have economic value can cause damage to the forest ecosystem, and will eventually lead to loss of biodiversity, especially endemic species. Mangroves and seagrass are also exploited or destroyed due to conversion to other uses. In addition, water, soil, and air pollution can also cause the

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91 Sindern S, et al. 2016
92 Cavelle, J. 2013.
93 Arif Satria. 2017.
94 See http://lestaripost.com/2015/12/16-small-islands-privatized-to-foreign-interests-archipelago-day-celebrated/.
95 See http://privateislandsonline.com/areas/indonesia downloaded 8 December 2016.

loss of Indonesia's biodiversity. Wastewater discharges, irrigation drains, and urban and agricultural runoff can lead to the death of fish, other marine animals, and aquatic plants (LIPI 2014).


Mangrove deforestation. (*Photo by MOEF*)

For example, the region of Sulawesi with endemic species has experienced a decrease of species between 83-94% (LIPI 2014). The case studies in each province show declines that are quite drastic, e.g., 88% for West Sulawesi, 94% for Central Sulawesi, 83% for South Sulawesi and 84% for North Sulawesi. The loss of species is caused by human activities, such as habitat conversion, shrimp ponds, plastic and cans waste, pesticides, excessive exploitation of natural resources, etc.

Box 14.1 Habitat degradation

The loss of biodiversity can be attributed to habitat changes causing stress to the biota inhabiting it. Ecosystems provide habitats for marine life, as feeding, spawning or breeding areas. Excessive and uncontrolled human activities, pollution and habitat conversion are the main causes of degradation of habitats, and further aggravated by climate change impacts like rising sea temperature and ocean acidification.

Conditions of concern occurred in coastal areas of South Kalimantan. The degradation of the coastal environment has been relatively rapid and has been affected by the destruction of settlements, gardens and ponds as well as damages to provincial road shoulders between districts by coastal abrasion covering almost all coastal areas of South Kalimantan. Iriadenta (2001) and Arifin et al. (2006) showed that the destruction of coastal vegetation, especially the most severe mangroves, is commonly found around the estuaries of the coastal rivers of South Kalimantan. Exploitation activities of mangrove for various purposes without regard to conservation value (Iriadenta, 2003).

The condition of the coastal area in Tegal City is not much different from South Kalimantan. The potential in this area is very much but its utilization to develop the area still causes problems for environment like fishery, settlement, port, industry, and others. Diananto's research (2006) showed that the results of environmental degradation of 2 (the good condition scale turns into bad condition) and the percentage of environmental quality decrement that is equal to 36.34%. The average mangrove cover rate is 19.67%, the abrasion

Box 14.1 Habitat degradation (cont.)

area is 23.96 ha and the water pollution level is, on average, 2 times the normal threshold. The most affected environment is the mangrove ecosystem with the environmental degradation scale of 3 (a good quality condition scale becomes very bad). The most impactful activity is fishery that converts mangrove land into pond land.

The above case is another example of environmental degradation caused by human activities from regional development activities that do not pay attention to environment and ecology. If environmental quality declines along with the habitat degradation, then all biotic components of the ecosystem and biodiversity would be lost.

c. Overfishing and Illegal, unreported and unregulated (IUU) fishing

Overfishing is prevalent throughout the FMAs (or WPP) of Indonesia. IUU Fishing activities reach 30% of the total catch (Gallic, 2004). In addition, as shown in **Table 14.2**, most of the fishery resources are 'fully exploited' to 'over-exploited' in all FMAs. Regulation of the number of fishing vessels and type of fishing gear used; capacity development and incentives for sustainable fishing practices; and supplemental livelihood opportunities are critical elements to address overfishing. The Catch Documentation and Traceability system (STELINA) and Catch Certificate program are among the measures being implemented to address IUU fishing.

Table 14.2: Level of Utilization of Fish Resources in Fishery Management Areas of Indonesia.

FMA or WPP		Small Pelagic Fish	Big Pelagic Fish	Demersal Fish	Coral Fish	Penaeid Shrimp	Lobster	Blue Swimming Crabs	Rajungan crabs	Squid
571	Malacca Strait and Andaman Sea	1.64	0.42	0.98	0.88	1.48	1.13	1.36	0.63	2.00
572	Indian Ocean, west of Sumatra, and Sunda Strait	0.59	1.16	0.83	0.67	1.21	1.36	1.28	1.05	1.60
573	Indian Ocean – Sawa Sea, southern Nusa Tenggara and west-ern Timor Sea	0.61	0.86	1.04	0.34	1.70	1.40	1.59	1.52	1.70
711	South China Sea, Karimata Strait and Natuna Sea	0.69	0.86	0.54	0.34	0.66	0.96	1.44	1.04	0.70
712	Java Sea	0.59	1.16	0.83	0.67	1.21	1.36	1.28	1.05	1.60

Table 14.2: Level of Utilization of Fish Resources in Fishery Management Area of Indonesia. (cont.)

FMA or WPP		Small Pelagic Fish	Big Pelagic Fish	Demersal Fish	Coral Fish	Penaeid Shrimp	Lobster	Blue Swimming Crabs	Rajungan crabs	Squid
713	Makassar Strait, Bone Bay, Flores Sea and Bali Sea	0.61	0.86	1.04	0.34	1.70	1.40	1.59	1.52	1.70
714	Banda Sea and Tolo Bay	0.69	0.86	0.54	0.34	0.66	0.96	1.44	1.04	0.70
715	Tomini Bay, Maluku Sea, Halmahera Sea, Seram Sea, Berau Bay	1.05	1.58	0.51	0.49	1.21	1.23	1.81	1.20	1.80
716	Sulawesi Sea	0.49	0.74	0.49	1.11	0.75	1.02	0.94	1.09	1.40
717	Pacific Ocean	0.73	0.95	0.45	0.81	0.25	1.21	0.90	1.45	0.70
718	Arafura–Timor Sea	0.52	0.65	1.14	0.50	1.30	1.23	0.77	0.17	0.70

Note:
$E < 0.5$ = **Moderate**, upaya penangkapan dapat ditambah
$0.5 \leq E < 1$ = **Fully-exploited**, upaya penangkapan dipertahankan dengan monitor ketat
$E \geq 1$ = **Over-exploited**, upaya penangkapan harus dikurangi
Source: Kepmen KP No. 47/Kepmen-KP/2016.

IUU fishing has far-reaching consequences for the long-term sustainable management of capture fisheries. In extreme cases, IUU fishing can lead to the collapse of a fishery stock or seriously affect efforts to re-build stocks that have already been depleted.[96] The practice is problematic in both marine capture fisheries zones of national jurisdiction as well as on the high seas and areas beyond national jurisdiction (ABNJ). There are several reasons for IUU fishing.

First, in large-scale industrial or commercial fisheries, the problems of IUU fishing are exacerbated by weak flag State control by some States. Long-term sustainable fisheries, as envisaged in Agenda 21 and subsequent international fishery instruments as well as SDG 14, therefore require a high degree of international cooperation to deter and to prevent actions that adversely impact the productive capacity of fish stocks.

Second, due to the large area of Indonesia's territorial seas and EEZ, it is difficult to conduct monitoring, control and surveillance (MCS), and enforce laws. Although the eradication of IUU fishing is encouraged, the limited facilities, inadequate supervision structure, lack of human resources, and poor coordination between law enforcement agencies have resulted in continuing incidences of IUU fishing.

Third, the increasing world demand for fish protein as world population increases and economies grow also drives IUU fishing.

[96] Doulman, D.J. 2000.

Table 14.3: Population and Fish Consumption Availability.

Details	Year				
	2010	2011	2012	2013	2014
The world population (billion)*	6.9	7.0	7.1	7.2	7.3
Supply of fish for world consumption (kg/capita/year)*	18.5	18.6	19.3	19.7	20.1
Level of domestic fish consumption (kg/capita/year)**	30.48	32.25	33.89	35.21	37.89

*Source: * FAO (2016)*
*** KKP (2014)*

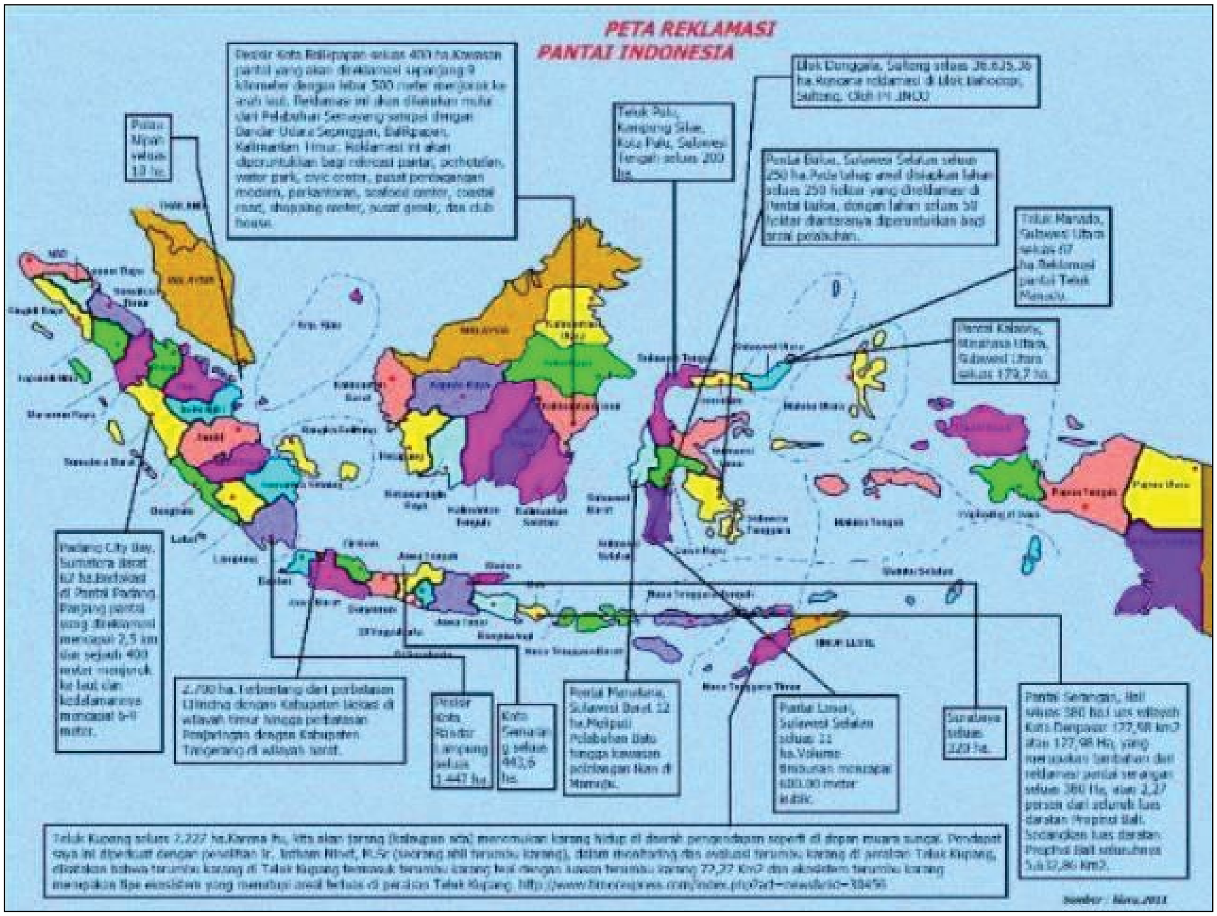
According to Wahyuni (2007), the causes of the increasing world fish demand are: (a) increasing population and increasing incomes of the world community; (b) improved quality of life followed by shifting food composition and demand for healthy foods characterized by low cholesterol content (red meat pattern changing to white meat); (c) people are increasingly busy (people on the run) so they need healthy and ready food; (d) the impact of globalization leads fisheries activities beyond state boundaries; and (e) fear of contracting foot and mouth disease, mad cow, swine flu, anthrax, and avian influenza due to the consumption of beef, pork and poultry further reinforces the assumption that the best alternative can be the consumption of fish.

d. Land reclamation

According to *GoI Law No. 1/2014 on Management of Coastal and Small Islands*, reclamation is, from environmental and socioeconomic points of view, defined as human activities in order to improve benefit of land resources through land fill, land drying or drainage. In Indonesia, reclamation practices have been on-going in many locations, particularly on Sumatera Island, Java Island, Bali Island and Sulawesi Island. From KIARA's records in 2011, there were at least 16 locations of coastal reclamation, and all of them changed the initial condition of coast (**Figure 14.2**).

Land reclamation: PPS Bitung (fish port). *(Photo by IPB)*

Figure 14.2: Reclamation in Indonesia in 2011.



Source: KIARA, 2011.

Figure 14.3: Reclamation in Indonesia, 2016.

Source: KIARA, 2016.

During 2011-2016, reclamation cases at Benoa Bay in Bali and Jakarta Bay in DKI Jakarta became major issues and created public discussions. According to Koropitan (2016), reclamation of Jakarta Bay would exacerbate Jakarta Bay degradation since the presence of reclaimed islands on Jakarta Bay would reduce its *flushing* capacity, i.e., flush out from the bay the pollution load coming from 13 rivers. Moreover, there will be increased sedimentation and siltation, as well as flooding since the water flow is blocked. Even before the reclamation, the sedimentation rate of Jakarta Bay was already high, around 50 cm per annum.[97]

There are also socioeconomic impacts related to eviction, relocation and loss of community living space due to reclamation. **Table 14.4** shows the number of fisherfolk who have been displaced due to reclamation projects in 2013.

Table 14.4: Some Cases of Evictions due to Reclamation Projects in Indonesia.

No.	Reclamation Areas	Number of Fisherfolk Families Displaced
1	Jakarta Bay	7,000
2	Pantai Marina, Semarang	1,370
3	Balikpapan Bay	1,800
4	Manado, North Sulawesi	1,500
5	Teluk Palu, Sulawesi Tengah	500
6	Kenjeran beach, Surabaya	600
7	Losari beach, Makassar	4,690
8	Serangan island , Bali	691
	Total	**18,151**

Source: Pusat Data and Information from KIARA (June, 2013).

e. Discharges of untreated wastewater and stormwater runoff

Municipal wastewater is increasing due to the growing population in Indonesia and economic activities. Uncollected and untreated wastewater degrades groundwater, rivers and seas, and impacts both human life and aquatic life.

The main source of municipal wastewater is from residential and commercial areas, offices or institutions as well as recreational facilities. Waste from household industries, such as tofu industry, restaurant, etc., are also included in the category of municipal waste. Household wastewater

[97] Statement of Alan Koropitan, 2016.

could contaminate water sources from shallow groundwater (Wild 1993). The Board of Science Development Strategies conducted a survey of shallow wells in Jakarta, and the survey results showed that groundwater contamination with fecal coliform has occurred at a very large scale; around 85% of the samples indicated the presence of such contamination. Household waste in the form of detergent is the most polluting waste. Detergents contain a lot of phosphate, so the increased phosphate loading into coastal waters could lead to eutrophication due to algal bloom, some of which could be harmful (Red Tide) and cause paralytic shellfish poisoning.

In terms of pollution by industry, it is estimated the contribution of organic pollution of industrial waste on water bodies was 25-50% on average.

Box 14.2 shows the results of the MOEF study on point and non-point sources of pollution in Jakarta, Semarang and Bali.

Box 14.2 Pollution in Jakarta, Semarang, and Bali

Pollution, from waste that is not well managed, is common in some parts of Indonesia. DKI Jakarta, Semarang (Central Java) and Benoa (in Bali) are densely populated by people, and industries. MOEF (KLHK) conducted a study in 2015 on the pollution sources in these three areas for the point source category, and in Jakarta and Semarang for non- point sources.

Non Point Source

DKI Jakarta

According to the North Jakarta Environmental Management Agency (BPLHD), there are at least 14,000 m^3 of garbage that daily covers 514 km^2 of area around the Jakarta Bay. The garbage comes from 13 river estuaries located in the area. According to available data, about 54% of the waste in Jakarta Bay is plastic, 24% wood, 14% plants and leaves, and the remainder (8%) are rubber, glass/glass bottles, and cork. Using the estimated wastewater discharge of 120 L/person/day based on *Jakarta Governor Regulation No. 122 of 2005 about Domestic Wastewater Management,* the amount of domestic wastewater is 56,333.116 m^3/day. Source of pollutants from agricultural waste in Jakarta has increased along with the increase of agricultural land, this is based on SLHD Jakarta Province (2014). The fishing sector is also a source of environmental pollutants, especially activities conducted at the fish port. DKI Jakarta has three types of ports, namely: Tanjung Priok Port, Nizam Zachman Ocean Fishing Port (PPS), and Muara Angke and Sunda Kelapa Tourism Harbor. The estimated volume of solid waste in the three ports is 17.30 m^3/day.

Box 14.2 Pollution in Jakarta, Semarang, and Bali (cont.)

Semarang

Based on the KLHK study in 2015, non-source pollutants in Semarang city coming from agricultural areas, such as rice fields, are significant. This can be seen from the agricultural pollutant load on the use of N, P, pesticide and fertilizers. The pollution load from livestock activity: coliform (1,82 x 10^{11}/day), N (42kg/day), P (11.32 kg/day), BOD (2,544,4 kg/day), COD (21,118,80 kg/day), NO_2 (0.06 kg/day), NO_3 (5.41 kg/day), and NH_4 (33.35 kg/day). Poultry wastes provide the greatest potential pollution from total coliform, P total and COD parameters. Goat livestock waste provides the greatest potential contamination of N total and NOx parameters. Cattle farming wastes provide the greatest potential loading of BOD. Moreover, aquaculture activities (ponds) result in organic material along with the amount of nitrogen that goes into the KJA system. Waste from the human settlements also has a significant impact on the environment in Semarang City.

Point Source

Based on a particular source of pollutant (point source), the Ministry of Environment has conducted a study in 3 areas:

Jakarta

Around 31% of pollutants are from chemical industry and other industries, 27% from offices/warehouses/shops/housing/apartments; 14% from food industry/fish processing; and 10% each from the activities of services/tours/hospitals/clinics. The rest of the 6% and 2% comes from the type of storage activities, such as for fuel/oil and fish farms.

Semarang

The main types of industries that are point sources of pollution in Semarang Bay are: furniture industry with 33 units of business/activity (32%), followed by plastics industry with 14 business units/activities (14%), and apparel industry and printing industry with 7 business units/activities each (7%).

Box 14.2 Pollution in Jakarta, Semarang, and Bali (cont.)

Benoa (Bali)

In general, the types of businesses/activities in coastal areas that contribute directly to pollution of point sources in Benoa Bay are classified into two groups, namely (a) tourism and (b) industrial fields. Tourism sector includes star or unclassified hotel, villa cottage, and restaurant, while industry includes (1) printing industry, (2) furniture industry, (3) home industry, (4) craft jewelry industry (5) industrial goods of leather, shoes, sandals, (6) energy industry, (7) pharmaceutical industry/health services, (8) industrial building materials, (9) manufacturing of finished goods from cement or stone; (10) Shipping industry, (11) packaging industry, (12) baking industry, (13) meat industry, (14) food and beverage industry, (15) wine industry, (16) textile and garments industry, (17) batik industry, (18) fish processing industry, (19) tempe-tofu industry, (20) laundry business, (21) work shops, (22) car wash business, (23) supermarket/ distributors/suppliers, (24) office centers, and (25) industries in the field of television and communications.

f. Marine debris

Marine debris is a national issue that needs attention given Indonesia's position as one of the top five countries in the world with the most marine debris. The largest marine waste in Indonesia is in the form of plastic about 0.48-1.29 million tonnes (Jambeck, 2015). Evans et al. (1995) conducted a study on 21 beaches and found waste presence at an average of 460 items/100 m^2. Research on a specific location in Ambon conducted by Uneputty and Evans (1997) showed that the marine waste at this location is > 4 items/m^2, so it can be predicted to reach 4000 items/km^2 into the category of floating waste in the ocean. At the same location, the amount of marine waste located on the seabed is between 0.05-0.69 item/m^2 (Uneputty and Evans, 1997). Coastal sea waste has been reported by Willoughby et al. (1997) from research sites on

(Photos by MOEF and IPB)

several islands of Jakarta Bay (23 islands): 29.1 items/m, consisting of 80% plastic bags, polysterine, and sandals.

One of the beaches that became a national issue is Kuta beach in Bali. In normal conditions, the marine debris in Kuta is 130-144 m^3/month, but during peak season, this will reach 630 m^3/month. Sources of marine debris at this location come from ships, trash left behind by tourists, waste carried by river runoff. The lack of solid waste management system – waste segregation, recycling and reuse, regular collection of garbage and disposal in sanitary landfill – is one of the major causes of river pollution and marine debris.

g. Oil spills

Increased tanker and container traffic has the potential for spills to occur, damaging oceanic and coastal habitats like mangroves and coral reefs. There is also chronic pollution from oil and gas production facilities and oil refineries in the Sunda area. Blowouts have occurred at offshore platforms near Balikpapan in East Kalimantan. Most production is exported and tanker traffic is concentrated in three major shipping lanes: Malacca Strait, Makassar Strait and Lombok Strait.

Box 14.3 Example of Oil Spill Incident

"Indonesia has declared a state of emergency to help stop a deadly oil spill spreading off the coast of the island of Borneo. At least four fishermen in the port city of Balikpapan were killed over the weekend when the fuel ignited. Hundreds of people have reported health issues since the spill. It is not clear what caused the oil spill. As it continues to spread, the risk of further fires is increasing, the authorities said on Tuesday. The Balikpapan environmental agency has warned members of the local community to avoid any activities "that could spark fires". The spill, which threatens to further contaminate the fishing waters along the coast, covered an area of 12 km^2. In addition to the four reported deaths, local health officials have said that hundreds of people in the area have experienced difficulty breathing, nausea and vomiting since the oil fires broke out. Issuing a state of emergency allows for the release of government funds to aid local authorities in their efforts to contain the spill and for any subsequent clean-up operations. Balikpapan, which is in East Kalimantan province, is home to a large oil refinery belonging to the state-owned company Pertamina. As investigations continue into how the oil escaped into the sea, Pertamina says its underwater pipeline has not leaked.

A general manager at the refinery told the Jakarta Post on Saturday that the spill was marine fuel oil, not crude. Fishermen in Balikpapan say they will take part in a protest on Wednesday to hold the Indonesian government and Pertamina to account for the spill. Pertamina has denied responsibility for the disaster."

Source: BBC News, 3 April 2018.

h. Population in the low elevation coastal zone (LECZ)

According to CIESIN (2007), the most vulnerable areas due to climate change are those at low elevation geographic location, i.e., elevation of below 10 m above sea level. In Indonesia, areas located in the north coast of Jakarta are the most vulnerable as well as north coast of Java, South Sulawesi, and Aceh, due to their low elevation as well as high population density (more than 1,000 people per km^2). The east coast of Sumatera, South Kalimantan and East Kalimantan also have population density between 100-500 people per km^2.[98] The dynamics in the coastal area include high tide, storms, abrasion, erosion as well as seawater intrusion.

According to CIESIN,[99] the percentage of population in Indonesia living in areas below 5 meters remained relatively unchanged: 7.36% in 1996, 7.30% in 2000, and back to 7.37% in 2010. Rural areas are more vulnerable, with 48,064.53 km^2 of rural land area (2.56% of total land area) located below 5 m compared to 4,193.4 km^2 for urban areas (0.22% of total land area) (**Table 14.5**).

Table 14.5: Population and Land Area where Elevation is Below 5m, Year 2010.

Land area where elevation is below 5 meters (% of total land area)	2.78
Urban land area where elevation is below 5 meters (% of total land area)	0.22
Urban land area where elevation is below 5 meters (km^2)	4,193.40
Rural land area where elevation is below 5 meters (% of total land area)	2.56
Rural land area where elevation is below 5 meters (km^2)	48,064.53
Population living in areas where elevation is below 5 meters (% of total population)	7.37
Urban population living in areas where elevation is below 5 meters (% of total population)	3.76
Rural population living in areas where elevation is below 5 meters (% of total population)	3.61

Source: World Bank, 2018.

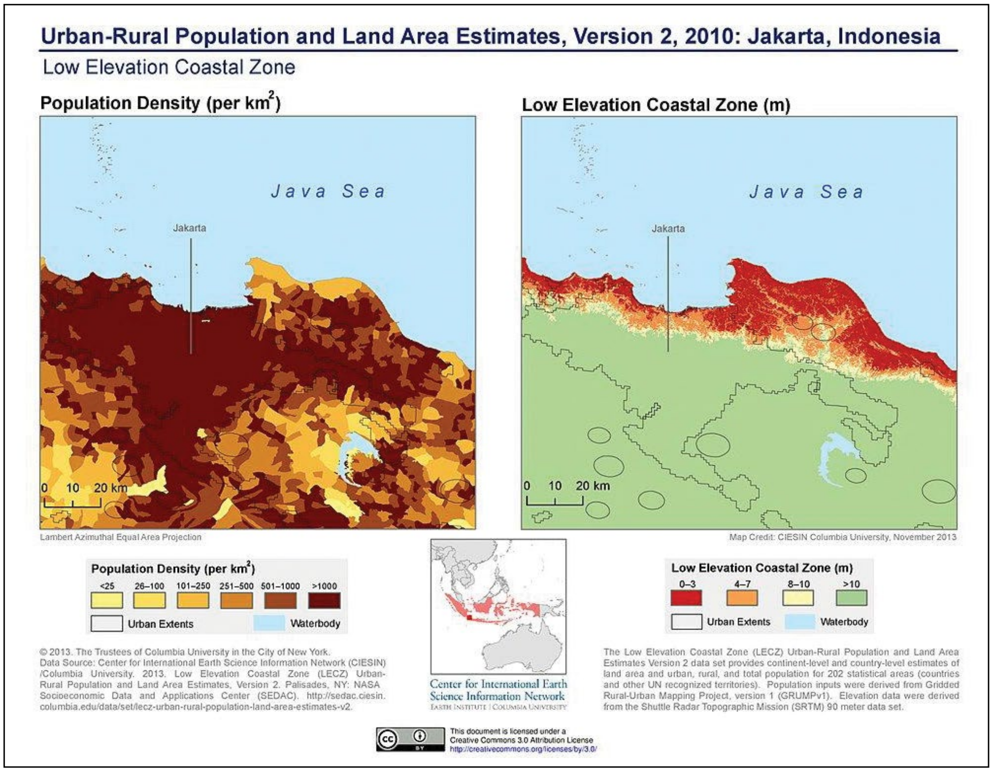
In 2015, the occurrence of hydrometeorological disasters was relatively dominant in the coastal areas (BNPB 2016). The vulnerability, according to Adger (2006), is defined as a vulnerable condition due to exposure to risks associated with changes in the environment as well as social aspects and from the absence of the capacity to adapt.[100] Coastal changes and hydrometeorological hazards become disasters when there are direct impacts on highly vulnerable coastal ecosystems and on the socio-economic system of the coastal communities, which are reliant on these ecosystems for food, livelihood, and natural shoreline protection, and their lack of capacity to respond and adapt.

98 CIESIN, 2007. Low Elevation Coastal Zone, Urban-Rural Population, and Land Area Estimates.
99 CIESIN)/Columbia University. 2013. Urban-Rural Population and Land Area Estimates, Version 2. Palisades, NY: NASA
100 Adger, W.N. 2006. Vulnerability. Global Environmental Change 16 (2006) 268-281

The poor population bears the brunt of the impacts of loss of ecosystems, and natural disasters. Thus, coastal planning must also consider planning for climate change, ensuring the integrity and resiliency of coastal ecosystems as well as developing resiliency of coastal communities, especially the poor.

Jakarta is an example of having high population density in most of its northern region, which also has an elevation of below 5 meters above sea level (mdpl). **Figure 14.4** shows the population density and the low elevation coastal zone (LECZ) areas in DKI Jakarta.

Figure 14.4: Population Density in Low Elevation Coastal Zone in Jakarta.



Source: Center for International Earth Science Information Network (CIESIN), Columbia University, 2013.

14.2.2 Other Issues and Impacts

a. Contamination of fish and seafood

Issues of seafood safety and quality are of serious concern in some of Indonesia's destination market countries. According to Irianto and Poernomo (2000), the cause of the unsafe fishery product for consumption is the presence of harmful chemical compounds and pathogens, and physical contamination, which are within the stipulated standards. One problem is the contamination with pathogens like *E. coli* and *salmonella* bacteria. The contamination may occur during the process of harvesting, distribution, preparation or cross-contamination (Amagliani et al., 2011). *E. coli* can cause diarrhea, abdominal pain, dehydration, fever, and damage to the kidneys. *Salmonella* can cause diarrhea, fever, and sometimes even death.

Shellfish harvested in areas affected by harmful algal blooms (Red Tide) can cause paralytic shellfish poisoning when contaminated seafood like mussels and oysters are eaten.

Another problem that threatens fish food security in Indonesia is pollution from heavy metals and persistent organic pollutants (POPs). Aquatic organisms are often subject to **bioaccumulation** because they absorb contaminants like heavy metals and pesticides from the water around them faster than their bodies are able to excrete them. Untreated wastewater and runoff containing coliform, heavy metals and POPs can be addressed by investing in wastewater and stormwater management systems – drainage, sewerage and treatment facilities.

b. Marine debris and impacts on marine life

Sea waste can have an impact on the ecological (biodiversity), fisheries and aquaculture, social, and economic environment of the maritime sectors. Marine debris – macroplastic and microplastic – are often found within the body of marine animals (**Table 14.6**). Microplastics are found in, bivalves and molluscs (5 μm-5 mm), and crustaceans and echinoderm (200-1000 μm).

Table 14.6: Types of Marine Waste Found in Some Living Creatures.

Item	Mean	Bird	Turtle	Mammal
Buoyas/traps/pots	1	1	1	1
Monofilament line	2.3	3	2	2
Fishing nets	2.7	2	3	3
Plastic bags	5.7	4	9	4
Plastic utensils	5.7	7	4	6
Balloons	6.7	8	5	7
Cigarette butts	7.3	5	12	5
Caps	7.7	9	6	8
Food packaging	8.7	10	7	9
Othe EPS packaging	9.7	11	8	10
Hard plastic containers	11.3	6	13	15
Plastic food lids	11.3	13	10	11
Straws/stirrers	12.3	14	11	12
Takeout containers	15.3	15	18	14
Cans	15.7	17	14	16
Bevarage bottles	16	12	17	19
Unidentified plastic fragment	16.3	16	19	14
Cups & plates	16.7	18	15	17
Glass bottles	17.7	19	16	18
Paper Bags	20	20	20	20

Source: Wilcox et al. (2016).

c. Coastal erosion

Many coastal areas in Indonesia are used for activities, such as ports and harbors, recreation, government offices, industry, etc. Such activities may result in changes in land cover and coastal land and sea use, thus altering oceanographic dynamics and causing coastal erosion. This erosion is the long-term impact of loss of forests and coastal ecosystems, waves, and sea level changes. Although the rate of erosion is not rapid, it can lead to loss of some coastal land area and shoreline changes.

Deforestation in the upland watershed areas and coastal mangrove areas is one of the causes of erosion and accretion in coastal areas. In general, based on deforestation figures in 2013-2014 in Indonesia, the rate is 0.4 million ha/year (inside and outside forest areas). The figure is the same as the gross deforestation rate of 0.57 million ha/year, lower than the reforestation rate of 0.17 million ha/year. Deforestation of mangrove forests in Indonesia's primary forest in 2013-2014 was 898.0 ha/year, whereas in secondary forests, it was 9,325.1 ha/year. The mangrove forest reforestation in the secondary forest was only 1,054,0 ha/year (2013-2014). The change in forest cover is caused by several factors, including: (1) change of function and change of forest area designation; (2) utilization of forest area; (3) hotspot spreading; (4) planting, commercial tree plantations, and land activities; and (5) settlements.

The development and/or expansion of ports also cause erosion due to dredging, reclamation, and conversion of habitats.

(Photos by MOEF and IPB)

Box 14.4 Erosion and Accretion in Indonesia

Central Java, Semarang, Tegal, and Demak are the areas most affected by erosion (Marfai 2011). Marfi et al. (2008) reported that in 1937-1972, the worst erosion incidence occurred, affecting about 461 m. Bapedalda Tegal (2002) reported that it has lost part of its land, around 2,910 ha, due to erosion in 5 years. However, Demak is an area of erosion that is a national issue. This erosion impacted 14 sub-districts and 249 villages, leading to the relocation of 200 families (Murfi 2011).

Box 14.4 Erosion and Accretion in Indonesia (cont.)

The Regency of Kendal, since 1972-1991, is facing abrasion and accretion that reached 765.14 ha and 356.00 ha, respectively. From 1991 to 2001, abrasion and accretion occurred on 90.64 ha and 261.89 ha, respectively, while from 2001 to 2008, there was abrasion and accretion of 111.67 ha and 80.37 ha, respectively. The causes of accretion and abrasion condition are the process of expanding pond area and sedimentation process from material carried by river or by wave, while abrasion is caused by strikes of waves (Arief et al., 2011).

It is estimated that land use change of coastal ecosystems involved conversion into cultivated areas, fisheries, housing, industry, public facilities, etc. are the main factors of erosion, in addition to natural drivers of erosion such as sea water dynamics, waves, tides, and global warming. These triggers have not been considered in controlling the utilization of land in coastal areas (Murfi, 2011).

Land use function is indeed a driver of erosion and abrasion problems. As the population grows, the increasing need for settlements also increases, requiring empty space to build houses, etc. Siregar et al. (2015) indicated that the Lhoknga Beach, Lhoknga Sub-district, Aceh Besar District, had the largest increase in land cover after the tsunami, from 2000 to 2005, with an open land of 716.95 ha, while bush had the largest decrease of area to 1,658.98 ha. The largest increase in land cover from 2005 to 2013 was shrubs (1,078.22 ha), and the largest decrease was 823.01 ha.

Kurniawan et al. (2016) reported that land use for tourism activities on small islands can change the initial shape of the land where changes occur in coastlines, docks, public services, commercial locations, tourist accommodation, and changes in coral reef ecosystem conditions.

Box 14.5 Coastline Changes

The sea level rise is the most visible impact of climate change. Naturally, sea level rise can cause abrasion or accretion, resulting in shoreline changes. In addition, coastline changes can also be caused by uncontrolled human activities, such as the addition of coastal settlements, dock development, and exploitation of coastal ecosystems.

For example, Suniada (2015) showed the results of coastline changes in Jembrana Regency: (a) 673,600 m^2 caused by abrasion, with the biggest area observed in Perancak Village, about 228,500 m^2, and (b) 851,500 m^2 caused by sedimentation, with the biggest area observed in Pengambengan Village, about 544,100 m^2.

Box 14.5 Coastline Changes (cont.)

Moko and Wiweka (2012) reported that the shoreline changed in the coastal areas of East Surabaya and Sidoarjo, affecting about 51.01 ha in 2006-2008, while in 2008-2009, it was about 18.92 ha.

According to Farhan and Lim (2011), significant coastline changes are occurring on the Thousand Islands, in particular, the islands of Hope and Coconut, due to increased housing and infrastructure. The land area of Pulau Tidung Besar was 683,537 m^2 in 1913, and decreased to 670,197 m^2 in 1999 and to 619,444 m^2 in 2007.

Abrasion is an indicator of the impact of regional development, infrastructure, and population growth. It occurs in Pulau Tidung Besar and Pulau Panggang due to mangrove logging, while in Pulau Tidung Kecil, it is due to mining of coastal areas, including harvesting of coral as building material. These activities not only destroy important habitats, but also increase the vulnerability of the coastal areas and small islands, and result in no continuous development.

d. Impacts of IUU fishing

Impacts caused by the IUU fishing include the reduced effectiveness of fisheries management, the loss of economic opportunities for legally licensed fishing communities, decreased food security, habitat and biodiversity loss, and potential conflicts between countries (Balton, 2004).

First, the practice of IUU Fishing covers a wide area, both in national and international contexts. In the sea that is under the national jurisdiction, IUU Fishing is done by both small and industrial fishermen, whereas in the high seas, it is done by distant-water fishing vessels. IUU Fishing practices can threaten fisheries management efforts, both in national and international waters (Bray, 2004).

Secondly, IUU Fishing often leads to a decrease in fish stock resources and the loss of social and economic opportunities of fishermen operating legally. The decreasing of fish stocks could be related to the utilization level as determined by *Minister Decree No. KP. 47/Kepmen-KP/2016* (**Table 14.2**). The decline in fish stocks due to IUU Fishing practices is exacerbated by inaccurate recording of fishery statistics. This condition creates uncertainty in the formulation of appropriate policy and management rules and guidelines.

Thirdly, IUU Fishing can damage relations between neighboring countries. This is because the perpetrators tend to cross state boundaries to avoid tracking or detention and to avoid legal consequences.

Fourthly, IUU Fishing practices pose a major threat to the sustainability of marine fisheries and marine biodiversity management, both at sea under national and offshore jurisdiction (Sumalia, 2004). IUU fishing practices result in damaging important marine ecosystems that also serve as fish habitats and spawning and feeding grounds. Damage to marine ecosystems, including biodiversity and fish resources, has become a global concern. This is because the disruption of fish resources in one part of the ocean will affect the condition of the fishery in other parts of the ocean, especially migratory species and straddling fish stock. Destruction of coral reefs and benthos also affects fishery resources beyond the reef area.

e. Biodiversity Loss

Activities like habitat destruction, over-exploitation, poaching, and illegal wildlife trade have an impact on the state of biological resources and biodiversity. Human activities are also causng climate change, which also affects the condition of habitats, fisheries and other marine species. Habitat loss is caused by deforestation, mining, and land use changes due to development of infrastructure, industry, and human settlements (IBSAP 2015-2020).

One example of the effect of habitat change is the impact on green turtles (*Chelonia mydas*). Green turtles look for seaweed in the deep subtropical seas and lay eggs on several sandy beaches, including Pangumbahan Beach, and Merubetiri National Park in Indonesia. It is important to preserve these beaches where turtles return after twenty years to lay their eggs. Habitat changes will affect the migration, and ultimately affect the population of green turtles.

There are also several types of marine fish that migrate to the river to hatch or spawn, or vice versa. An example is the eel fish (*Anguila spp*) that reaches adulthood from headwaters to the deep sea. In the sea, the eel fish lay eggs, and then die. The offspring will then travel upstream again. If one of these eel fish habitats is subject to destructive activity, the eel population will decrease (Indonesian Biodiversity, 2014).

14.3 Tranboundary Issues and Large Marine Ecosystems

As a country bordering 10 countries, Indonesia has a very serious problem, especially in terms of transboundary issues, and cross-border issues related to economic, socio-cultural, infrastructure, defence and national security, and environmental aspects as conveyed by the National Border Management Agency (BNPP).

The LMEs that are found within or around Indonesia are: Bay of Bengal Large Marine Ecosystem (BOBLME), Sulu-Celebes Sea Large Marine Ecosystem, South China Sea Large Marine Ecosystem (SCSLME), and Indonesian Sea Large Marine Ecosystem (ISLME). A summary of the key features, transboundary issues and strategic plans in each LME is shown in **Table 14.7**.

Table 14.7: Key Features of the Large Marine Ecosystems in Indonesia.

LME	Area (km²)[a]	Average Depth[b]	Habitats and biodiversity[c]	Transboundary issues[d]	Response
Bay of Bengal	3,657,502			• Excessive utilization of marine biological resources • Damage of critical habitats • Water quality and pollution	• National and transboundary Strategic Action Plan for Bay of Bengal LME • Sustainable Management of the Bay of Bengal Large Marine Ecosystem (FAO/GEF)
Sulu-Celebes Sea	1,015,737	1,570	• 400 species of reef-building corals • 2,500 species of fish • 5 species of marine turtles • 22 species of marine mammals	• Unsustainable exploitation of fish • Habitat loss and community modification • Climate change • Marine pollution • Freshwater shortage • Alien and invasive species	• Strategic Action Plan of the Sulu-Sulawesi Marine Eco-region • Regional and National Plan of Action in Sulu-Sulawesi Seascape (under the Coral Triangle Initiative or CTI) • Regional Strategic Action Programme (RSAP) on Fisheries Management • Sub-Regional Plan for Managing Transboundary Fisheries In The Sulu-Sulawesi Seascape: Taking an Ecosystem Approach to Fisheries Management (EAFM) • Sustainable Development Strategy for the Seas of East Asia (SDS-SEA)
South China Sea	5,660,985	1,024	• 45 species of mangroves • 50 genera of corals • 500 species of reef-building corals • 20 species of seagrass • 2,500 species of fish • 6 species of marine turtles • 7 species of giant clams	• Coastal habitat degradation and loss • Management of critical habitat for transboundary fish stocks • Plastic/marine debris	• Strategic Action Programme for the South China Sea (to be implemented starting in 2018, by UN Environment with GEF support) • Sustainable Development Strategy for the Seas of East Asia (SDS-SEA)
Indonesian Seas	2,289,597	2,935	• 47 species of mangroves • 13 species of seagrass • 500 species of reef-building corals • 2,500 species of fish	• Unsustainable exploitation of fish • Pollution: nutrients; plastic/marine debris • Habitat and community modification	• SDS-SEA Implementation Plan 2018-2022 • Sustainable Development Strategy for the Seas of East Asia (SDS-SEA) Implementation Plan 2012-2016 • Eco-system Approach to Fisheries Management (EAFM) in Eastern Indonesia (FMA 715, 717 & 718) – Active (Project Approved) • Enabling Transboundary Cooperation for Sustainable Management of the Indonesian Sea –Active (Project Approved)

Source: [a] UNEP, 2016. TWAP; [b] UNEP, 2005. GIWA; UNEP, 2016. TWAP; [c] UNEP, 2005. GIWA; UNEP, 2016. TWAP; [d] UNEP, 2005. GIWA IW-Learn.

14.3.1 Bay of Bengal Large Marine Ecosystem (BOBLME)[101]

The Bay of Bengal Large Marine Ecosystem (BOBLME) covers the Bay of Bengal, Andaman Sea, Malacca Strait and the Indian Ocean. The BOBLME region includes the high seas, continental shelf, and coastal waters of Sumatra, Indonesia (Aceh province, Riau, North Sumatra, and West Sumatra); the western coast of Peninsular Malaysia; West coast of Thailand, Myanmar, Bangladesh; east coast of India; Andaman and Nicobar Islands of India; Sri Lanka; and Maldives. The bay and associated coastal systems cover approximately six million km^2.

The countries involved in BOBLME programme are Indonesia, Malaysia, Thailand, Myanmar, Bangladesh, India, Sri Lanka and Maldives. Of the BOBLME area, 31.5% is high seas, while for the countries with the biggest area in the BOBLME are India (21.2%), Maldives (14.7%) and Indonesia (11.5%) (**Table 14.8**).

Table 14.8: Coastline and Area of EEZ in BOBLME.

Country	Coastline (km)	EEZ area (km^2)	Percentage of area (%)
Bangladesh	710	78,540	1.3
India	4,645	1,326,510	21.2
Indonesia	**~ 2,000**	**719,300**	**11.5**
Malaysia	1,110	68,740	1.1
Maldives	n/a	916,190	14.7
Myanmar	3,000	520,260	8.3
Sri Langka	1,770	530,680	8.5
Thailand	740	118,600	1.9
High Seas	-	1,972,170	31.5
Total	**~ 14,000**	**6,251,000**	**100.0**

Source: FAO, 2012.

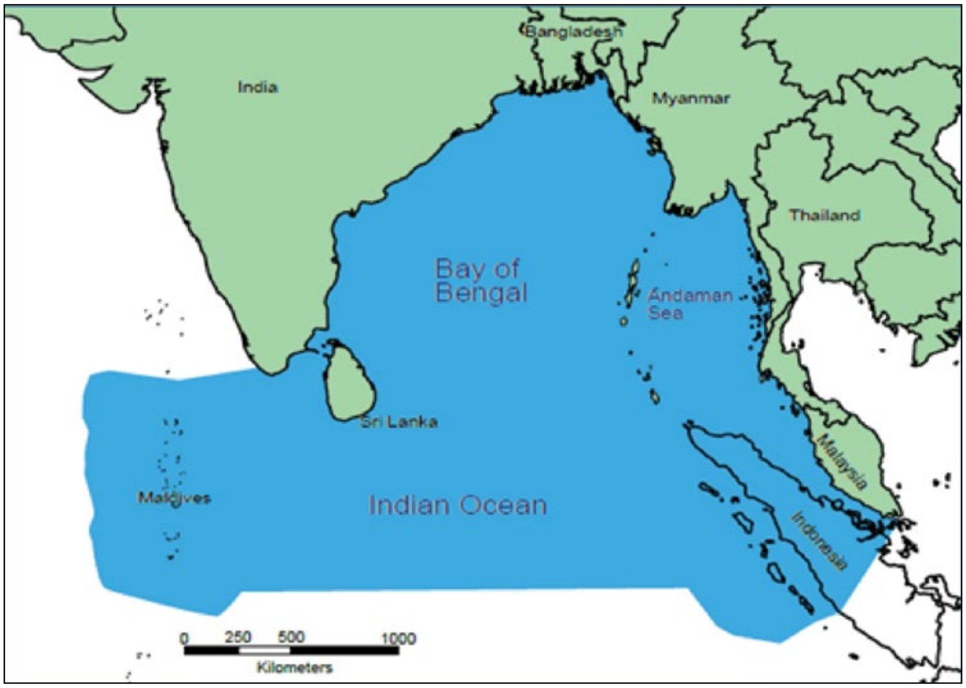
The Bay of Bengal is classed as a moderately productive ecosystem. Although it lacks the nutrient upwelling characteristic of some major LMEs, it is relatively well mixed by a combination of currents, tides, coastal currents, cyclones and storm surges. Inshore habitats in the inner part of the bay are dominated by estuarine habitat, brackishwater wetlands and mangroves. Further out can be found seagrass beds and coral reefs. BOBLME is home to 12% of the world's mangroves,

[101] Information on BOBLME in this section comes from: (a) FAO. 2012.; (b) TWAP. 2015. Factsheet LME 34 – Bay of Bengal; and (c) FAO. 2016.

and 8% of global coral reefs. These are of substantial importance to the functioning of the wider ecosystem, and provide spawning and nursery areas for some fish and prawn species. Six areas are of substantial significance in terms of biodiversity: the Sundarbans, one of the world's most extensive mangrove systems; Palk Bay; the Gulf of Mannar; the Marine (Wandur) National Park in the Andaman and Nicobar Islands; the Maldives Atolls; and Mu Ko Similan National Park and Mu Ko Surin National Park in Thailand.

In its inner reaches, the BOBLME is heavily influenced by the inflow from the Ganges/Padma, Jamanu/Brahmaputra, and Irrawaddy river systems. These are all associated with large populations, major cities and intensive agricultural activity, resulting in significant nutrient inputs as well as chemical pollution.

Figure 14.5: Bay of Bengal LME.



Source: FAO 2012; Sea Around Us Project and the BOBLME RCU.

Ocean Health Index (OHI). The OHI score of 62 for the Bay of Bengal LME scores below average compared to other LMEs. This score indicates that the LME is well below its optimal level of ocean health, although there are some aspects that are doing well. This LME scores lowest on food provision, coastal protection, tourism & recreation, and sense of place goals, while highest on artisanal fishing opportunities, coastal economies, and habitat biodiversity goals.

Transboundary issues. Based on the BOBLME Transboundary Diagnostic Analysis report, there are three important transboundary issues to consider:

1. Excessive utilization of marine biological resources

a. Main issues

- Decrease in fish resources
- Change of catch type composition
- Domination of juvenile catch
- Changes in marine biodiversity, especially the loss of rare and vulnerable species.

b. Main transboundary issues

- Many stocks (shared stocks) between BOBLME member states, including fish or larval migration.
- Overlapping fishing jurisdictions, both legal and illegal
- All States have difficulties in applying fisheries management, especially the ecosystem approach in fisheries management (EAFM).
- BOBLME member countries contribute significantly to the global problem of the loss of rare and vulnerable species.

c. Causes

- High consumption demand for fish, including seeds and feed for cultivation
- The catchment area is open access.
- Government pressure to increase fish catch
- Government subsidies, which are not feasible for fisheries
- Increased catch effort, particularly from trawling and purse seine fishing gear
- Ineffective fisheries management
- Illegal fishing and destructive fishing
- Most living marine resources are over-exploited because they are open access

2. Damage of critical habitats

a. Main issues

- Degradation and loss of mangrove habitat
- Degradation of coral reefs
- Damage and loss of seagrass beds

b. Main transboundary issues

- Critical habitats like mangroves, coral reefs and seagrass beds in all BOBLME member states
- Coastal development for multiple land and sea utilization in all BOBLME member countries

- Trade of products from all transboundary habitats
- Impacts of climate change that occur in all BOBLME member countries

c. Causes

- Poor coastal communities need food security
- Coastal development planning gap.
- Increased trade in products from coastal habitats.
- Coastal development and industrialization.
- Ineffective marine protected areas and gaps in law enforcement.
- Upper regional development (upstream) impacts on water flow.
- Agricultural activities in the upstream areas are intensive.
- Increased tours.

3. Water quality and pollution

a. Main issues

- Carried pathogenic waste and organic loads
- Solid waste/marine waste.
- Increased nutrient input.
- Oil pollution.
- Persistent organic pollutants (POPs) and persistent toxic substances (PTSs)
- Sedimentation
- Heavy metals

b. Main transboundary issues

- Discharge of untreated or general problem of waste management; waste and organic extraction from the cross-border Ganges-Brahmaputra-Meghna River.
- Disposable plastic and fishing gear are carried across the state boundaries.
- The high intake of nutrients from rivers intensify on a large scale across national borders.
- Differences in regulations and enforcement of laws between States are related to waste disposal of vessels that cross the borders of the State.
- POPs/PTSs and mercury,
- Sedimentation and heavy metal contamination at local level and cross-border dimension gaps.

c. Causes

- Excessive consumption, produced by everyone.
- Increased population density and urbanization of coastal communities.
- The limitations of the allocation of funds for waste management.
- Industrial migration to BOBLME member countries.
- Proliferation of small-scale industries.

Socioeconomic implications

- **Economic dependence on coastal ecosystems**. Fish protein accounts for 32% of the total animal protein consumption of the coastal population. This LME ranks in the very high-revenue category in fishing revenues. On average, LME-based tourism income contributes 15% to the national GDPs of the LME coastal states.
- **Coastal poor**. The indigent population makes up 25% of the LME's coastal dwellers. This LME places in the very high-risk category based on percentage and in the very high-risk category using absolute number of coastal poor

LME overall risk. This LME falls in the cluster of LMEs that exhibit low to levels of economic development (based on the night light development index) and high pollution from plastic debris. Based on a combined measure of the Human Development Index and the averaged indicators for fish & fisheries and pollution & ecosystem health modules, the overall risk factor is very high.

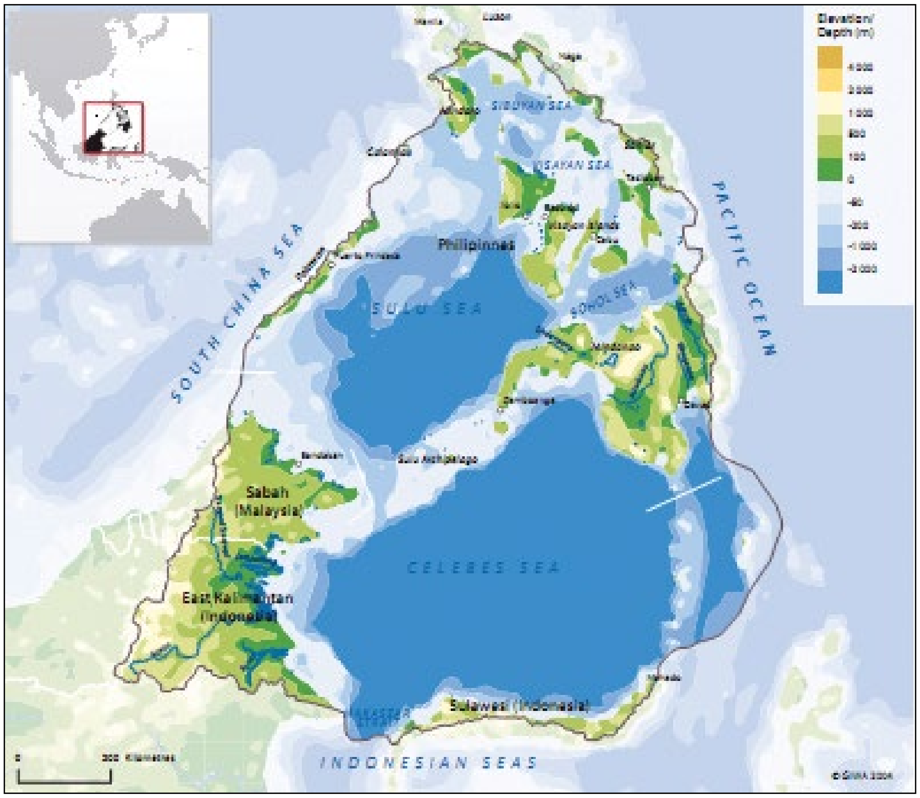
14.3.2 Sulu-Celebes (Sulawesi) Seas Large Marine Ecosystem[102]

Sulu-Celebes Seas Large Marine Ecosystem is an integral part of the western Indo-Pacific region (Briggs, 1999). The Sulu-Celebes Seas LME, also called Sulu-Sulawesi Marine Ecoregion (SSME) and Sulu-Sulawesi Seascape (under the Coral Triangle Initiative) includes the Philippine Islands (including Southern Luzon, Northern and Eastern Samar, islands in the Visayas, and Mindanao east of Diuata Mountain), north of the Indonesian archipelago (Sangihe Islands, North Sulawesi and East Kalimantan), and Sabah, Malaysia (UNEP, 2005).

This region has complex oceanographic conditions, and long tectonic history. Spanning 900,000 km^2 of waters between Indonesia, Malaysia and the Philippines, the Sulu-Sulawesi Seascape provides food, shelter, livelihoods and recreation to 40 million people. Being part of the Coral Triangle and at the heart of the most bio-diverse marine area in the world, with many species of global significance, this LME is also a very rich fishing ground for large and small pelagic fish as well as bay and coral reef fishes, providing livelihoods to the coastal inhabitants and food for the entire region and beyond. Reef fisheries provide essential sustenance to artisanal fishers and their families throughout the region while high value fish products are exported to expanding international, national as well as local markets. The fishery sources, however, have declined due to various threats.

[102] Information on Sulu-Celebes (Sulawesi) Seas LME in this section comes from: UNEP. 2005. De Vantier, L., Wilkinson, C., Souter, D., South, R., Skelton, P. and D. Lawrence. GIWA Regional Assessment 56; and. TWAP. 2015. Factsheet LME 37 – Sulu-Celebes Seas.

Figure 14.6: Sulu-Celebes Sea LME Area.



Source: UNEP, 2005.

OHI. The OHI score for Sulu-Celebes Sea LME is 62 (out of 100), which is below average compared to other LMEs. This score indicates that the LME is well below its optimal level of ocean health, This LME scores lowest on mariculture, coastal protection, carbon storage, coastal livelihoods, tourism and recreation, sense of place, and clean waters goals and highest on artisanal fishing opportunities.

Transboundary issues. The following key issues are considered to have the most severe transboundary environmental and socio-economic impacts in the region (TWAP, 2015):

1. **Unsustainable exploitation of living resources**
    - The Stock-Catch Status Plots indicate that about 27% of the stocks in the LME have collapsed or are currently overexploited, and that the reported landings are largely supplied – almost 70% – by fully exploited stocks.
    - The percentage of catch from the bottom-impacting gear type to the total catch decreased from 70% in the early 1950s to 12% in late 1950s. Then, this percentage fluctuated around 17% in recent decade.

2. **Habitat and community modification.**
   - 29% of coral reefs cover is under very high threat, and 34% under high threat. 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
   - The Sulu-Celebes Seas LME experienced an increase in MPA coverage from 615 km^2 prior to 1983 to 27,582 km^2 by 2014. This represents an increase of 4,387%, within the medium category of MPA change.

3. **Pollution**. This LME has minimal risk from nutrient and POPs. However, this LME is in the group with the highest plastic concentration.

4. **Global climate change**. This LME is most vulnerable to climate change. Of the 19 individual stressors, three connected to climate change have the highest average impact on the LME: ocean acidification, UV radiation, and sea surface temperature.

5. **Other key stressors**: demersal destructive commercial fishing and demersal non-destructive high bycatch; pelagic low-bycatch commercial fishing, and demersal non-destructive low-bycatch commercial fishing, commercial shipping, ocean-based pollution, and sea level rise.

Socioeconomic implications:

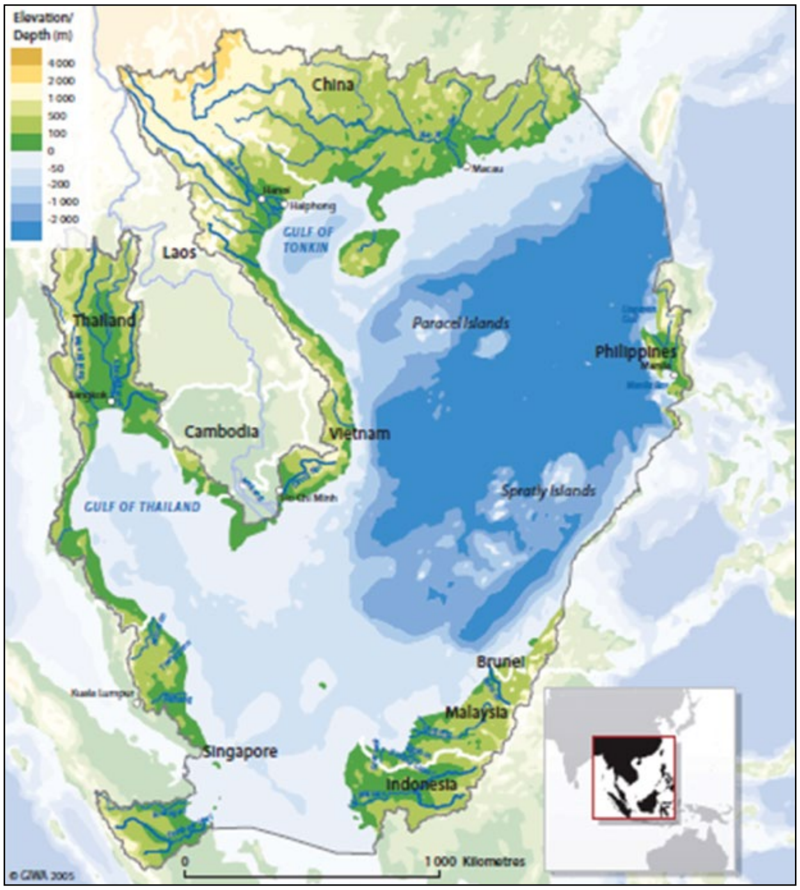
1. **Economic dependence on coastal ecosystems**. Fish protein accounts for 39% of the total animal protein consumption of the coastal population. Fishing and tourism depend on ecosystem services provided by LMEs. This LME ranks in the high-revenue category in fishing revenues. On average, LME-based tourism income contributes 12% to the national GDPs of the LME coastal states. Destructive fishing practices and loss of coastal and marine habitats will impact revenues from fisheries and tourism, which are the major sources of income and livelihoods in coastal communities.
2. **Coastal poor**. The indigent population makes up 25% of the LME's coastal dwellers. This LME places in the very high-risk category based on percentage, and in the very high-risk category using absolute number of coastal poor.

Overall risk level: According to TWAP (2015): "This LME exhibits low levels of economic development (based on the night light development index) and high pollution from plastic debris. Based on a combined measure of the Human Development Index and the averaged indicators for fish & fisheries and pollution & ecosystem health modules, the overall risk factor is very high."

14.3.3 South China Sea Large Marine Ecosystem[103]

The South China Sea (SCS) is a very strategic water body for the surrounding nations, especially in terms of the rapid economic growth and industrialization of the Asia-Pacific region (Talaue-McManus, 2000). The South China Sea region contains nine nations; China, Vietnam, Cambodia, Thailand, Malaysia, Singapore, Indonesia, Brunei and the Philippines. This LME and its catchments are bounded to the west by the Mekong River (GIWA region 55), north by East China Sea (GIWA region 36), east by the Sulu-Celebes (Sulawesi) Sea (GIWA region 56) and Small Island States (GIWA region 62), and south and southeast by Indonesian Seas (GIWA region 57). The South China Sea is considered a semi-enclosed sea by the UN Convention on the Law of the Sea (UNCLOS): "A gulf, basin or sea surrounded by two or more States and connected to another sea or the ocean by a narrow outlet or consisting entirely or primarily of the territorial seas and exclusive economic zones of two or more coastal States" (Article 122 UNCLOS, 1982).

Figure 14.7: South China Sea LME.



Source: UNEP, 2005. GIWA Regional Assessment 54.

[103] Information on South China Sea LME in this section comes from: UNEP. 2005. South China Sea, GIWA Regional Assessment 54; and TWAP. 2015. Factsheet LME 36 – South China Sea.

The South China Sea LME lies within the global centre of biodiversity for marine species. The coastal area includes low-lying areas composed of sandy beaches and dune systems, mudflats, swamps and marshes, seagrass beds and mangroves and lake systems, to gravel/rocky coasts. Fringing coral reefs are developed in areas away from major rivers or areas of terrestrial run-off. There are approximately 125 major rivers in the South China Sea region, draining 2.5 million km^2. Six species of marine turtles, all considered either endangered or vulnerable by the World Conservation Union (IUCN) can be found, as does the dugong (*Dugong dugon*) and many other species of marine mammals also included in the IUCN's Red List of Threatened Animals.

The South China Sea is also an area of great multilateral importance, being one of the world's busiest sea-lanes. The region spans the full gamut of economic activities, from subsistence agriculture and artisanal fi sheries to light and heavy manufacturing and high technology industrie

OHI. The OHI score of 63 for South China Sea LME is below average compared to other LMEs. This score indicates that the LME is well below its optimal level of ocean health, although there are some aspects that are doing well. This LME scores lowest on food provision, coastal protection, carbon storage, tourism & recreation, sense of place, and clean waters goals, while highest on artisanal fishing opportunities.

Transboundary issues. The GIWA assessment in 2005 determined that the most severe environmental issues facing the South China Sea include: (a) suspended solids resulting from deforestation and agriculture in hundreds of watersheds; (b) habitat loss and modification, through massive deforestation and associated siltation, conversion to agriculture and other land uses (freshwater, coastal and estuarine habitats), and destructive fishing practices (coastal, estuarine and marine habitats); and (c) overexploitation and destructive fishing practices. Togther with the TWAP report in 2015, the following risks and environmental and socio-economic impacts in this LME include:

1. **Pollution**
   - Suspended solids from deforestation and agricultural runoff
   - Very high nitrogen loading
   - POPs: Average concentrations ($ng.g^{-1}$ of pellets) were high for DDT (176, range 1-558 $ng.g^{-1}$), moderate for PCBs (97, range 8-757 $ng.g^{-1}$), and minimal for HCHs (1.2, range 0.2-208 $ng.g^{-1}$).
   - Plastic debris: Modelled estimates of floating plastic abundance (items km_{-2}), 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.

2. **Habitat changes and loss**
   - Loss and fragmentation of mangrove forests from development, including massive conversion for aquaculture

- Loss and fragmentation of coral reefs from coastal development, sedimentation and destructive fishing (TWAP 2015 reported that: 12% of coral reefs cover is under very high threat, and 17% under high threat. 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.)
- Loss and fragmentation of seagrass areas
- Reclamation of wetlands for urbanisation, industry and agriculture
- Habitat loss due to destructive fishing practices
- Conflicts among villagers and outside fishers
- Injuries to fishers
- Changes to market prices

3. Destructive fishing practices and overfishing

- The Stock-Catch Status Plots indicate that almost 40% of the stocks in the LME are collapsed or overexploited. Majority of the catches are supplied by fully exploited stocks.
- The percentage of catch from the bottom-impacting gear type to the total catch fluctuated between 12 and 24% from 1950 to 2010. This percentage fluctuated around 22% in the recent decade (2005-2015).

Socioeconomic impacts:

1. **Economic dependence on coastal ecosystems**. Fish protein accounts for 28% of the total animal protein consumption of the coastal population. This LME ranks in the very high-revenue category in fishing revenues. On average, LME-based tourism income contributes 12% to the national GDPs of the LME coastal states.
2. **Coastal poor**. The indigent population makes up 14% of the LME's coastal dwellers. This LME places in the low-risk category based on percentage and in the very high-risk category using absolute number of coastal poor

Oveall risk level. This LME exhibits low level of economic development (based on the night light development index) and high pollution from plastic debris. Based on a combined measure of the Human Development Index and the averaged indicators for fish & fisheries and pollution & ecosystem health modules, the overall risk factor is very high.

14.3.4 Indonesian Sea Large Marine Ecosystem[104]

Indonesian Sea Large Marine Ecosystem (ISLME) is situated at the confluence of the Pacific and Indian Oceans, and is bordered by Indonesia and Timor Leste. The LME area covers 2,289.597 km^2, with

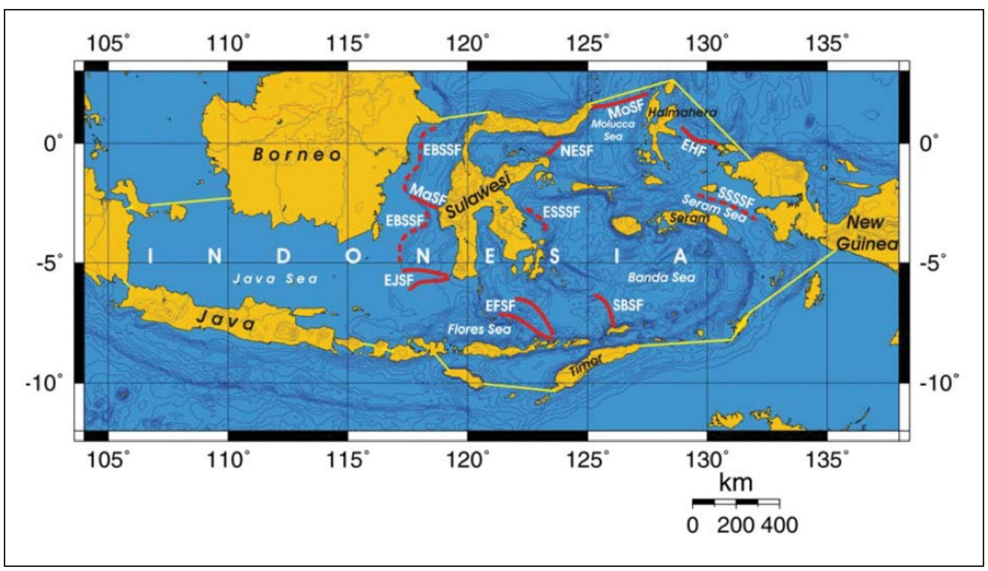
[104] Information on ISLME in this section comes from: UNEP. 2005. Vantier, L., Wilkinson, C., Lawrence, D., and D. Souter (eds.) Indonesian Seas, GIWA Regional Assessment 57; and TWAP. 2015. Factsheet LME 38 – Indonesian Sea.

98% within Indonesia's territorial waters, and approximately 2% located within the territorial waters of Timor Leste. Geologically, the ISLME lies at the confluence of three tectonic plates: the Eurasian Plate, the Indo-Australian Plate, and the Pacific Plate.

The ISLME is globally important in terms of biodiversity, fisheries production (representing more than 1% of the global fisheries production), and global climate regulation, and considered as a Class I ecosystem with high productivity. Around 0.49% of this LME is covered by mangroves (US Geological Survey, 2011) and 1.13% by coral reefs (Global Distribution of Coral Reefs, 2010). The ISLME is located in the heart of the western Indo-Pacific marine biogeographical region, where species richness is greater than in any other location on Earth, supporting more than 500 species of reef-building corals, 2,500 species of marine fish, 47 species of mangroves and 13 species of seagrasses. The ISLME has complex and rapid currents owing to energetic tides over rough topography and owing to the Indonesian Throughflow, which affects the global climate. A recently discovered climate feature, the Indian Ocean Dipole (IOD), is linked with fluctuations in sea surface temperature (SST) within the region.[105]

Within the ISLME, 1.49% of the area is officially protected. The ISLME experienced an increase in MPA coverage from 2,016 km^2 prior to 1983 to 75,423 km^2 by 2014. This represents an increase of 3,641%; however, this is still not enough to reach the Aichi Biodiversity Target of protecting at least 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, by 2020.

Figure 14.8: Indonesia Sea Large Marine Ecosystem (ISLME).



Source: hhtp:/www.lme.noaa.gov.

[105] UNEP, 2005. Vantier, L., Wilkinson, C., Lawrence, D., and D. Souter (eds.) Indonesian Seas, GIWA Regional assessment 57.

Ocean Health Index (OHI). The Indonesian Sea LME score of 67 is below average compared to other LMEs. This score indicates that this 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 & recreation, and iconic species goals, while highest on artisanal fishing opportunities, and coastal economies goals.

Transboundary issues

1. **Unsustainable exploitation of fish and other living resources**
    - The Stock-Catch Status Plots indicate that about 30% of the stocks in the LME are either overexploited or have collapsed, with 55% of the catch from fully exploited stocks.
    - The percentage of catch from the bottom-impacting gear type to the total catch increased from 14% in the 1950s to its first peak at around 35% in 1980. Then, this percentage fluctuated between 16% and 20% in recent decade.

2. **Pollution**
    - Modelled estimates of floating plastic abundance (items km_{-2}), 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. The abundance of floating plastic in this category is estimated to be on average over 400 times higher than other LMEs.
    - The risk level for nutrients (nitrogen load) is moderate (risk level is 3, on the scale of 1 to 5).
    - There are threats from oil and chemical spills in some areas.

3. **Habitat modification**. In the ISLME as a whole, coral reefs and associated habitats of mangroves and seagrasses have experienced major declines in the past several decades. 15% of coral reef cover is under very high threat, and 27% under high threat. By year 2030, 34% of coral cover in this LME is predicted to be under very high to critical level of threat from warming and acidification.

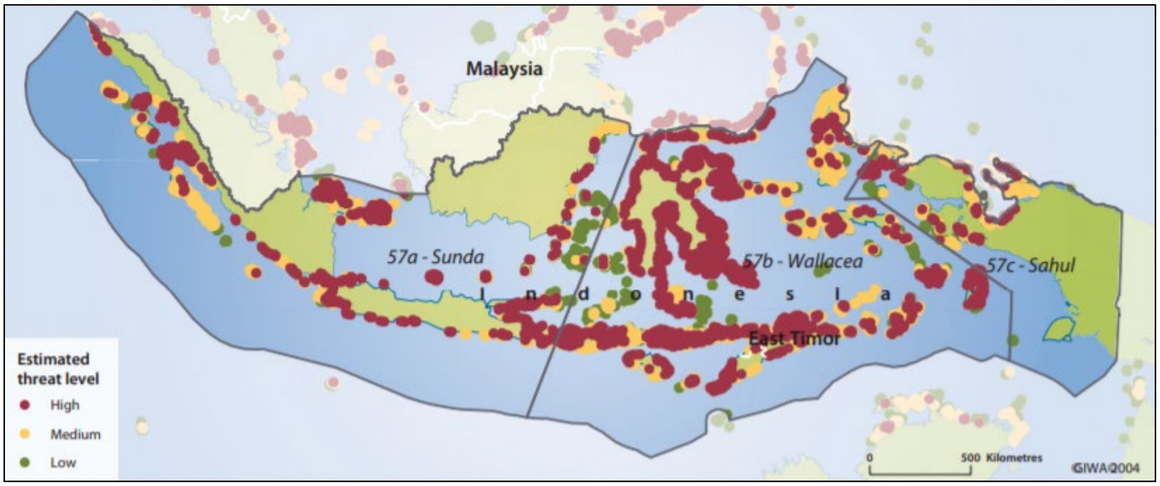
4. **Other key stressors**. Other key stressors include commercial shipping, ocean-based pollution, pelagic low-bycatch commercial fishing, and all three types of demersal commercial fishing (demersal destructive, non-destructive low-bycatch, and non-destructive high-bycatch).

Socioeconomic impacts:

1. **Economic dependence on coastal ecosystems**. Fish protein accounts for 54% of the total animal protein consumption of the coastal population. This LME ranks in the high-revenue category in fishing revenues. On average, LME-based tourism income contributes 10% to the national GDP of Indonesia.
2. **Coastal poor**. The indigent population makes up 14% of the LME's coastal dwellers. This LME places in the low-risk category based on percentage and in the very high-risk category using absolute number of coastal poor.

LME overall risk. This LME exhibits low levels of economic development (based on the night light development index) and high pollution from plastic debris. Based on a combined measure of the Human Development Index and the averaged indicators for fish & fisheries and pollution & ecosystem health modules, the overall risk factor is very high.

Figure 14.9: Reefs at Risk in the Indonesian Sea LME.



Source: Burke et al., 2002; UNEP, 2005 (GIWA 57).

14.3.5 Arafura and Timor Seas

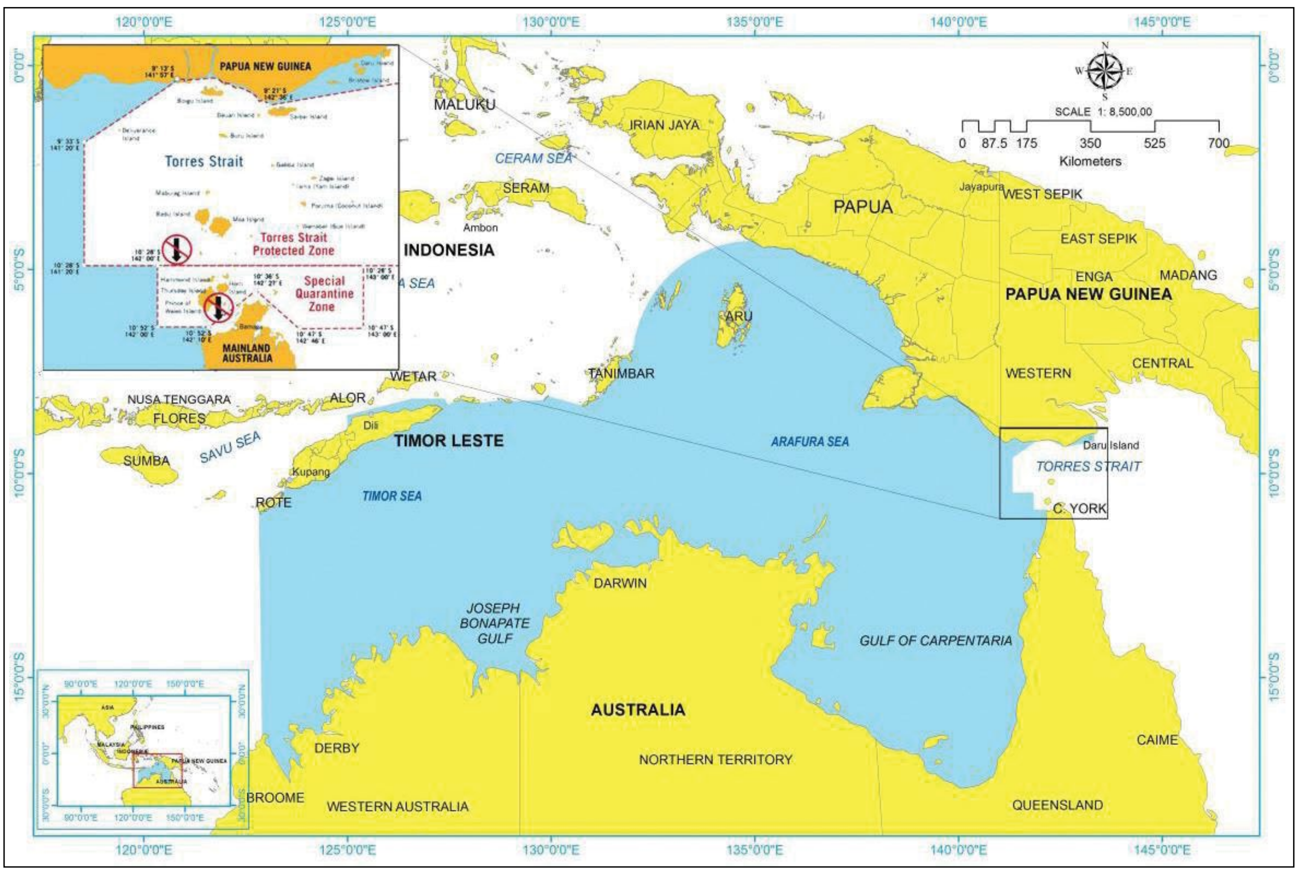
As the waters warm, the Timor and Arafura Seas (ATS) play an important role in world ocean circulation, as it is situated between the Indian Ocean and Pacific Ocean. The world's climate is greatly influenced by the ENSO phenomenon and the Indian-Pacific Warm Pool that exists in these seas. At the regional scale, the ecosystems of both seas play an important economic and ecological role in the four littoral nations: Indonesia, Timor-Leste, Australia, and Papua New Guinea. A key feature of the ATS is the diversity of seascapes due to the interplay between the complex geography and the biophysical processes in the region (Tomascik et al. 1997).

The ATS region is extremely rich in living and non-living marine resources, including major fisheries and oil and gas reserves. Reef fisheries are important to subsistence and artisanal fishers in some parts of the region. While small-scale fishing predominates in the ATS region, industrial fisheries contribute considerably more in terms of economic value since they target high-value shrimp and demersal fish species.

These seas contain pristine and some of the most highly threatened coastal and marine ecosystems in the world, and sustains several high-value transboundary fish stocks, underscoring the urgent need for transboundary management. Based on the Transboundary Diagnostic Analysis report for ATS, the major concerns are:

1. Unsustainable fisheries and decline and loss of living coastal and marine resources;
2. Decline and loss of biodiversity and key marine species;
3. Modification, degradation and loss of coastal and marine habitats;
4. Marine and land-based pollution, and
5. Impacts of climate change.

Figure 14.10: Arafura-Timor Sea Area.



Source: ATSEA.

Coral Reefs. *(Photos by PEMSEA)*

15 Natural Hazards and Climate Change

15.1 Natural Hazards

15.1.1 Disaster Risk in Indonesia

According to the records of National Agency for Disaster Countermeasures (Badan Nasional Penanggulangan Bencana or BNPB), from 2000 to 2015, about 81% of the natural disasters were hydrometeorologic-related. These include flooding, tornado, rain-induced landslides, and drought.

Table 15.1: Percentage of Disaster Occurrence 2000-2015.

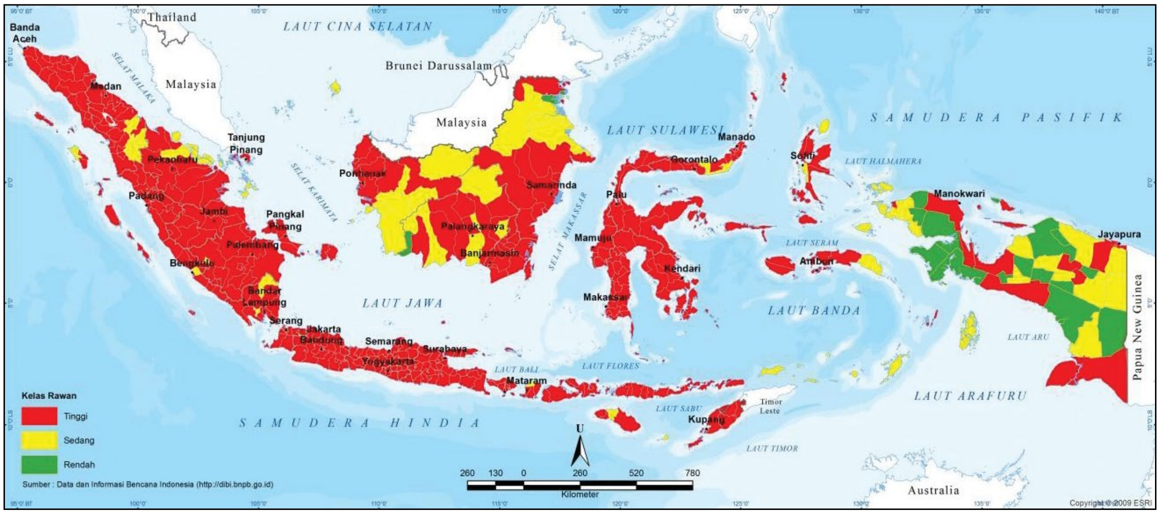
Disaster	Percentage
Flood and landslide	2.31
Fire	13.09
Land/forest fire	1.58
Flood	31.65
Landslide	16.55
Tornado	19.77
Drought	9.26
Others	5.81

Source: BPS, 2015, BNPB, 2015.

The different types of natural hazards, and the corresponding risk maps and priority areas for each type of hazard are described in the **National Action Plan for Disaster Mitigation 2015-2019** drawn up by the National Disaster Management Agency as mandated by *Law No. 24 of 2007 on Disaster Management*.

Using the disaster records in Indonesia, and vulnerability and risk maps, a composite **Disaster Risk Index** was developed. **Figure 15.1** shows the areas with highest risk for natural disasters.

Figure 15.1: Disaster Risk Index in Indonesia, 2012.



Note: *Tinggi* – high (red); *Sedang* – moderate (yellow); *Rendah* - low (green)

Of the 33 provinces (not including North Kalimantan as 34th province), 30 provinces have high-risk class index, and only 3 are categorized as medium-risk areas in 2013 (**Table 15.2**).

Table 15.2: Disaster Risk Index by Province in 2013.

No.	Province	Score	Class of Risk
1	Sulawesi Barat	202	High
2	Maluku	187	High
3	Sulawesi Tenggara	177	High
4	Sulawesi Selatan	176	High
5	Maluku Utara	175	High
6	Sulawesi Tengah	168	High
7	Sulawesi Utara	158	High
8	Bengkulu	156	High
9	Gorontalo	148	High
10	Kalimantan Timur	147	High
11	Riau	145	High
12	Sumatera Selatan	145	High
13	Sumatera Utara	137	High
14	Nusa Tenggara Timur	135	High
15	Kep. Bangka Belitung	131	High
16	Kepulauan Riau	127	High
17	Kalimantan Barat	122	High
18	Kalimantan Tengah	116	High
19	Nusa Tenggara Barat	113	High

Table 15.2: Disaster Risk Index by Province in 2013. (cont.)

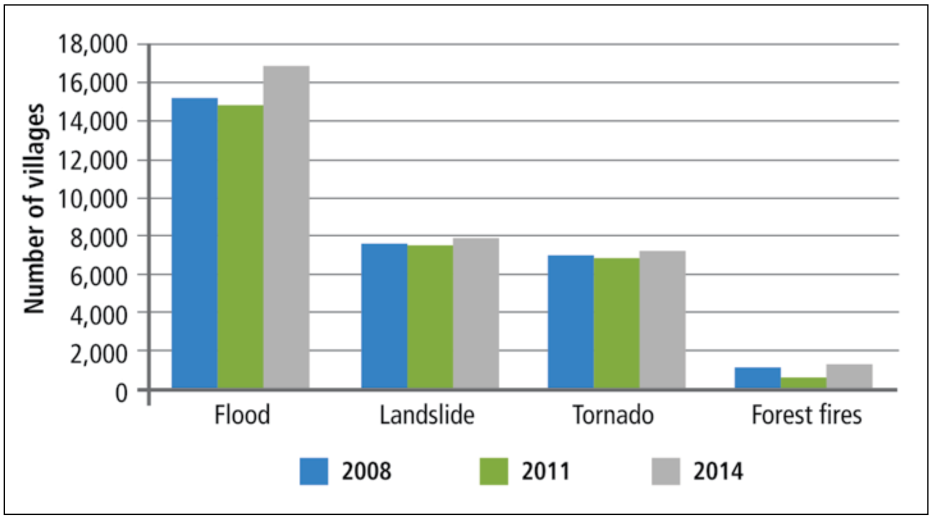
No.	Province	Score	Class of Risk
20	Jambi	113	High
21	Jawa Timur	110	High
22	Aceh	107	High
23	Jawa Barat	101	High
24	Jawa Tengah	100	High
25	Lampung	97	High
26	D.I. Yogyakarta	97	High
27	Banten	88	High
28	Sumatera Barat	86	High
29	Papua Barat	82	High
30	Bali	75	High
31	Papua	67	Medium
32	Kalimantan Selatan	64	Medium
33	DKI Jakarta	54	Medium

Source: IRBI-2013, BNPB, 2013.

15.1.2 Impacts of Natural Disasters

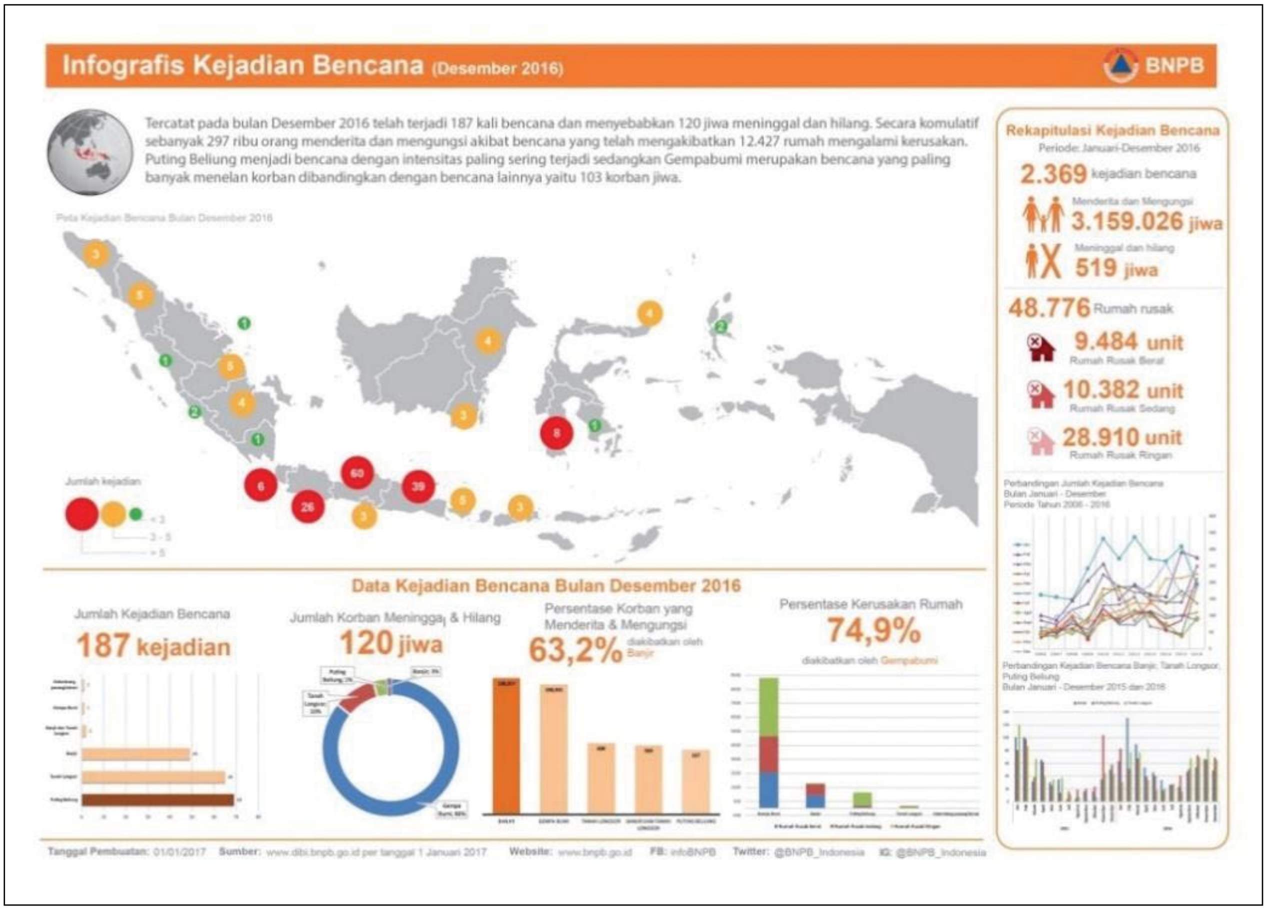
There was an increase in the number of villages where flooding became the dominant disaster based on records from 2008, 2011 and 2014, followed by landslides, tornadoes and forest fires (**Figure 15.2**). The type and number of disasters in 2016 are illustrated in **Figure 15.3**.

Figure 15.2: Number of Villages Affected by Hydrometeorological Disaster 2008-2014.



Source: Potensi Desa 2008, 2011, 2014; BPS 2015.

Figure 15.3: Disaster Events, 2016.



Source: DIBI.BNPB 2017.

The intensity of hazardous events and the number of affected people and properties has been increasing (**Table 15.3**). Given their location, the coastal population, which is 65% of total population, is highly vulnerable to natural hazards. Human lives, natural assets, agricultural areas, livelihoods, physical assets and infrastructure, are at high risk in coastal areas.

Table 15.3: Comparison of the Number of Disaster Events.

Year	Event	Impacts
2012	1,811	320 died, 0,9 million evacuate
2013	1,674	461 died, 1,6 million evacuate
2014	1,967	490 died, 2 million evacuate
2015	1,482	278 died, 1,1 million evacuate, 20.681 broken house
2016	2,342	522 died/loss, 3.05 million evacuate, 62.287 unit of broken house, 2.311 public facilities broken

Source: UNOCHA 2015; BNPB, 2017.

15.1.3 Geological Risks

Mount Merapi. *(Photo by M. Ebarvia)*

Mount Batur. *(Photo by M. Ebarvia)*

(a) Earthquake

Indonesia is on four active tectonic plates and contributes to 90% of the earthquakes of the world. Indonesia is located between two continental plates: the Eurasian Plate (Sunda shelf) and Indo-Australian Plate (Sahul Shelf), and between two oceanic plates: the Philippine Sea-Pacific Plate and the Indian Ocean Plate. The subduction of the Indian oceanic plate beneath the Eurasian continental plate formed the volcanic arc in western Indonesia, one of the most seismically active areas on the planet with a long history of powerful eruptions and earthquakes.

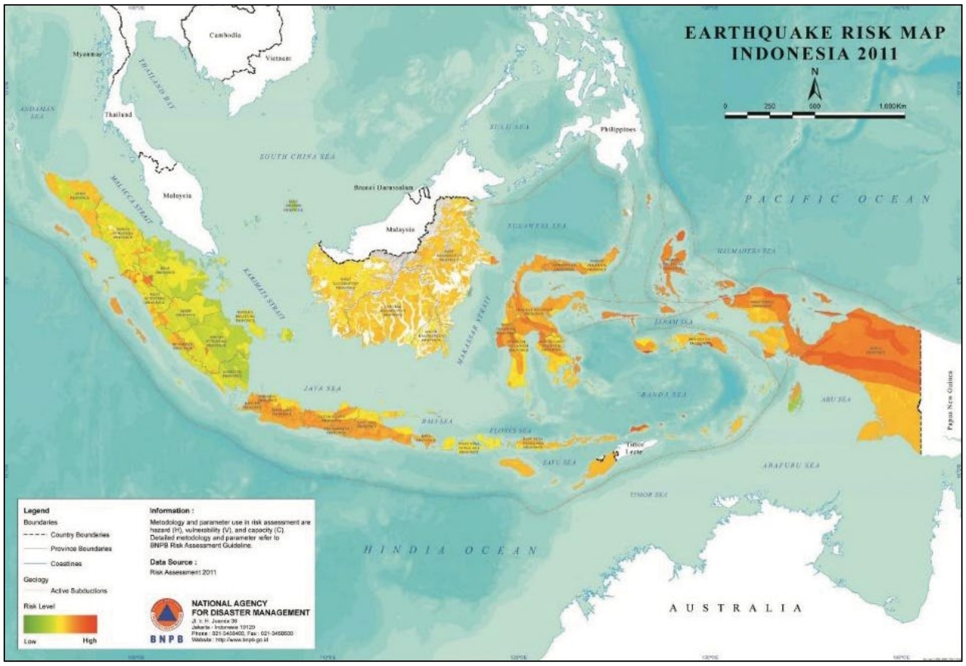
Moreover, Indonesia has many faults that provide the potential for earthquakes:

- The most prominent fault in the west of Indonesia is the **Semangko Fault** or the **Great Sumatran Fault**, a dextral strike-slip fault along Sumatra Island (about 1900 km). The formation of this fault zone is related to the subduction zone in the west of Sumatra.
- **Palu-Koro Fault** is another major structural feature formed in the central part of Indonesia. This fault runs across the central part of Sulawesi Island and extends offshore to the west across Makassar Strait to the Mangkalihat Peninsula in the island of Borneo. The fault is named after the capital city of Central Sulawesi, Palu, on the west coast of Sulawesi and the Koro River, which is formed by the fault zone.
- **Sorong Fault** is a significant left lateral fault in the eastern part of Indonesia, named after Sorong City. It has east-west orientation and extends from the northern part of West Papua to East Sulawesi for about 2000 km.

Figure 15.4 shows the earthquake risk map of Indonesia. Ten provinces are prioritized for earthquake preparation and response: (1) West Java; (2) Central Java; (3) East Java; (4) North Sumatra; (5) Banten; (6) West Sumatra; (7) Lampung; (8) Aceh; (9) DI Yogyakarta; and (10) Bali.

The number of earthquakes in 2018 is shown in **Table 15.4**. There were a total of 242 earthquakes with a magnitude of 5 and higher, 65 of which occurred in Maluku.

Figure 15.4: Indonesian Earthquake Risk Map.



Source: BNPB, 2015.

Table 15.4: Number of Earthquakes Based on Depth and Magnitude, by Island, 2018.

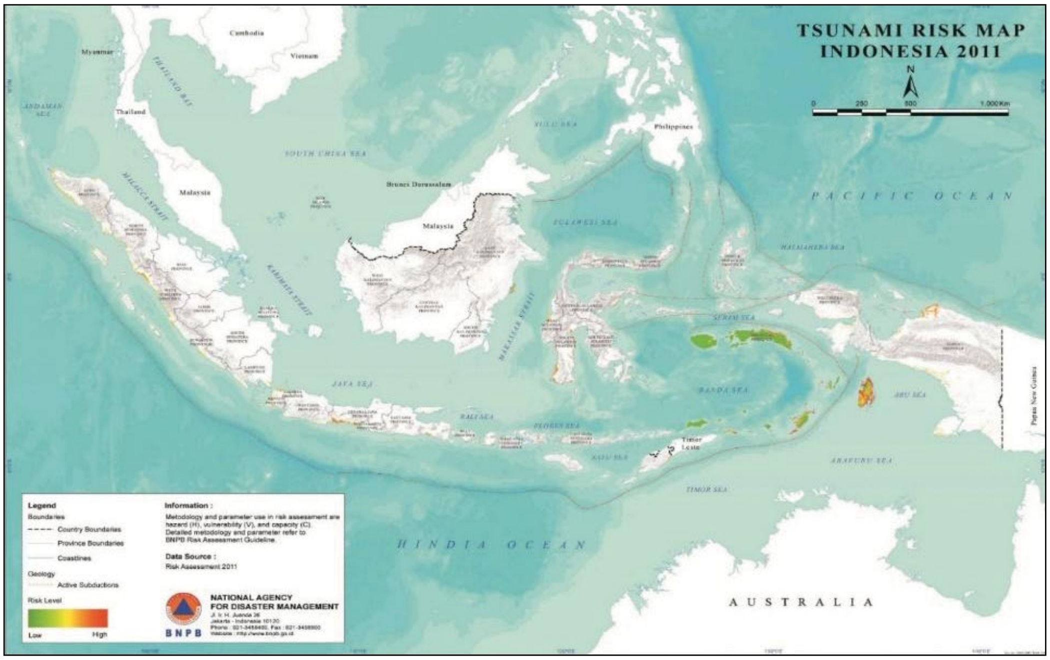
Island	Depth (km)			Magnitude (SR)		
	Shallow (<60)	intermediate (60-300)	Deep (>300)	Small (<4,0)	Medium (4,0-5,0)	Large (>5,0)
Sumatera	849	195	4	667	346	35
Jawa	1,082	132	9	964	246	13
Bali	319	43	3	323	38	4
Nusa Tenggara	3,203	383	18	3,098	454	52
Kalimantan	14	-	-	7	4	3
Sulawesi	2,636	605	35	2,698	534	44
Maluku	1,196	557	76	1,020	744	65
Papua	444	41	-	301	158	26
Indonesia	**9,743**	**1,956**	**145**	**9,078**	**2,524**	**242**

Source: BPS. Statistics Indonesia 2019 (Data cited from http://dataonline.bmkg.go.id, Meteorology, Climatalogy and Geophysics Agency)

(b) Tsunami

From the records of the National Disaster Management Authority (BNPB), tsunami is a very common natural hazard in Indonesia. Not only is Indonesia on four active plates, it is also surrounded by two oceans and inner seas. This combination is what causes the frequent tsunami in Indonesia. The tsunami risk map is shown in **Figure 15.5**.

Figure 15.5: Indonesian Tsunami Risk Map.



BNPB assesses that there are 10 (ten) priority provinces for the focus of tsunami disaster management activities, namely: (1) Central Java, (2) West Sumatra, (3) Aceh, (4) Banten, (5) West Java, (6) Java East, (7) Bali, (8) Nusa Tenggara Barat, (9) Maluku and (10) North Maluku (BNPB 2015).

The most common type of tsunami in Indonesia is caused by seabed earthquake, with vulnerable coastal areas located along the west coast of Sumatra, the southern coast of Java, throughout Bali and Nusa Tenggara, almost all coastal areas of Sulawesi and Maluku, northern East Kailimantan and north coast of Papua. **Table 15.5** provides the BNPB's record of the earthquake-induced tsunami occurrences, which have a scale above 7 SR.

Table 15.5: Tsunami Incident due to Earthquake Above 7 SR Recorded in Indonesia.

No.	Location	Year	Earthquake (Mw)	As a result of the Tsunami			Maximum Wave (m)
				Died	Injuries	Broken	
1	Aceh	2004	9.2	22,898	125,000	NA	50.9
2	Nias	2005	8.7	10	NA	NA	3
3	Bali	1818	8.5	NA	NA	NA	3.5
4	Bengkulu	2007	8.4	0	0	0	1
5	Laut Sulawesi	1918	8.3	6	-	-	7.2
6	Papua	1996	8.2	110	100	-	7.7
7	Sunda	1997	8.0	189	75	-	15

Table 15.5: Tsunami Incident due to Earthquake Above 7 SR Recorded in Indonesia. (cont.)

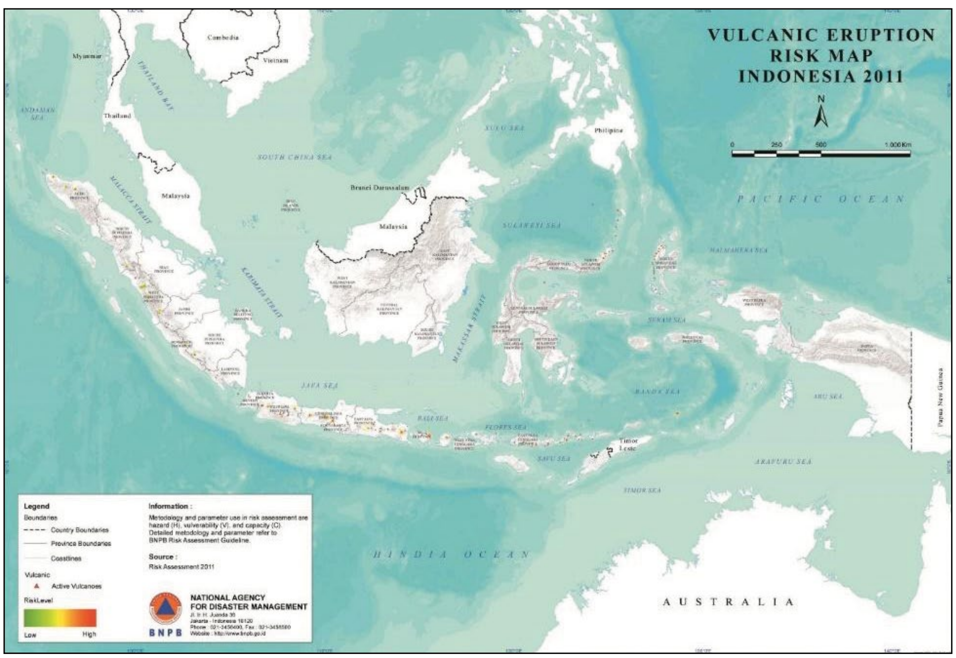
No.	Location	Year	Earthquake (Mw)	As a result of the Tsunami			Maximum Wave (m)
				Died	Injuries	Broken	
8	Laut Banda	1996	7.9	9	63	283	3.4
9	Laut Andaman	1881	7.9	-	-	-	-
10	Laut Flores	1992	7.8	2,500	500	31,765	26.2
11	Laut Jawa	1994	7.8	250	233	1,500	13.9
12	Kep. Mentawai	2010	7.7	485	-	-	-

Note: Mw - moment magnitude
Source: BNPB, 2015.

(c) Volcanic eruption

Located in the active Pacific Ring of Fire, Indonesia has a total of 127 active volcanoes. Areas that are at risk from volcanic eruption are shown in the Volcanic Eruption Risk Map (**Figure 15.6**).

Figure 15.6: Volcanic Eruption Risk Map.



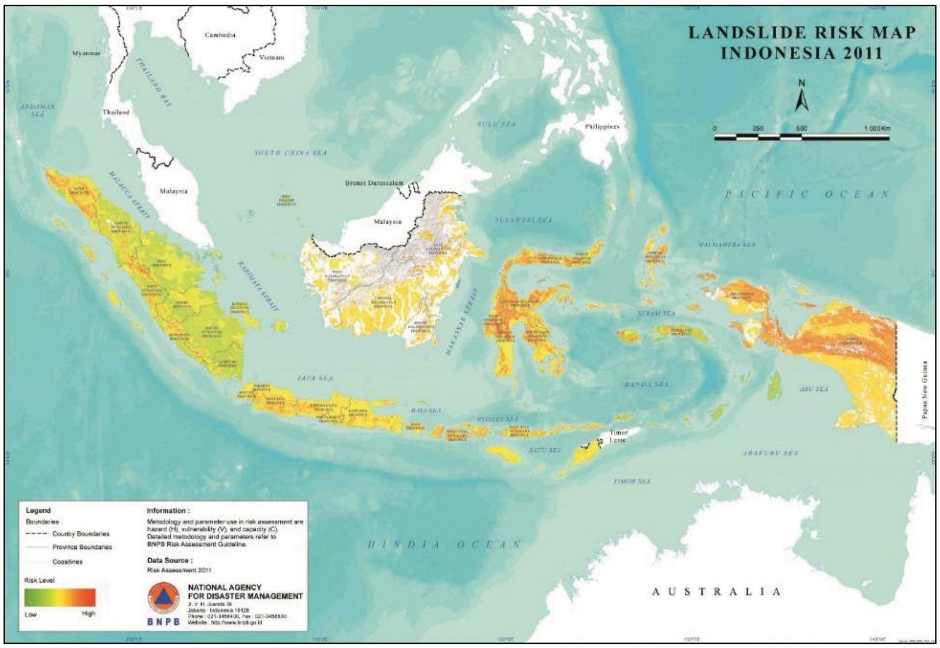
Source: BNPB, 2012.

From the number of active volcanoes, BNPB identified 17 volcanoes and adjacent areas for disaster mitigation and response actions, namely: (1) Gunung Agung, (2) Mount Batur, (3) Mount Merapi, (4) Mount Kelud, (5) Mount Ijen, (6) Mount Salongan, (7) Mount Salak, (8) Mount Galunggung, (9) Mount Gede, (10) Mount Talang, (11) Mount Marapi, (12) Mount Burnitelong, (13) Mount Rinjani, 14) Mount Keibesi, (15) Mount Gamalama, (16) Mount Rokatenda, and (17) Mount Karangetang.

(d) Landslide

Based on the assessment of landslide risk (land movement) conducted by BNPB, ten priority provinces have been identified for the implementation of the 2015-2019 landslide disaster management, namely: (1) West Java, (2) Central Java, 3) East Java, (4) East Nusa Tenggara, (5) West Sumatra, (6) North Sumatra, (7) South Sulawesi, (8) Papua, (9) Central Sulawesi and (10) Bali. The landslide risk map is shown in **Figure 15.7**.

Figure 15.7: Landslide Risk Map.



Source: BNPB, 2012.

15.1.4 Hydro-meteorological Hazards

(a) Flood/flash flood/rob flood

Considering the fact that meteorological disasters constitute 80% of the disasters, and of the overall meteorological disasters, flooding is getting more intense, and increasing in frequency. The combination of regional/global climate change, local rain patterns, weather anomalies, and decreasing carrying capacity and environmental quality contributes to the risk of flooding. The flood risk map is shown in **Figure 15.8**.

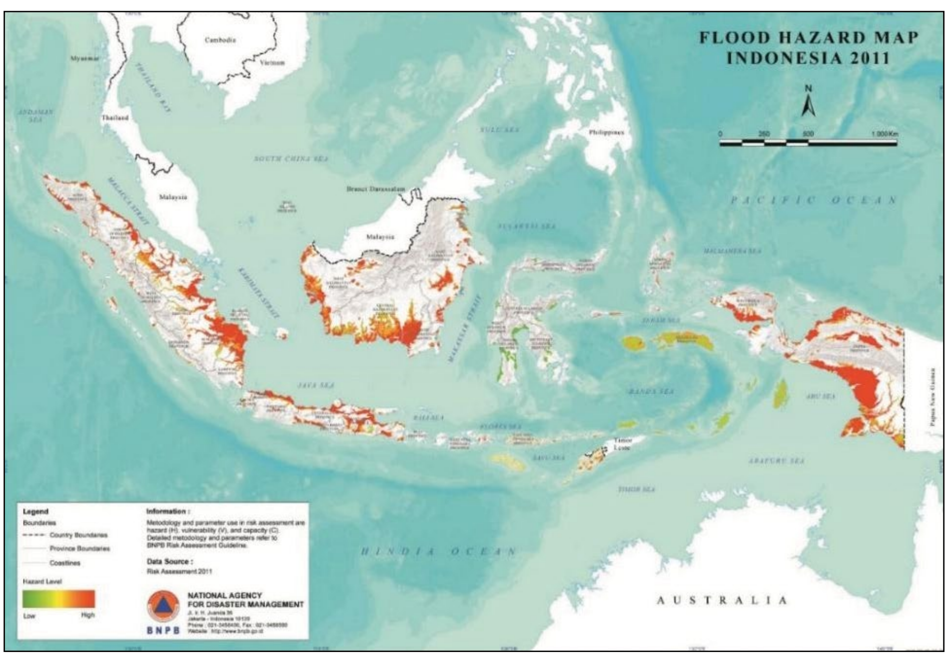
Floods can be caused by (a) static natural conditions (e.g., geography, topography, elevation, and river flow geometry), (b) dynamic natural events (e.g., high rainfall, storm surge, tide inflow into main rivers, land subsidence, and sedimentation), (c) anthropogenic activities, such as the establishment of settlements on riverbanks and coasts (near the water), as well as lack of flood control infrastructure, and (d) the decrease in the surface of the land due to sea level rise and climate change (BNPB, 2015).

Based on the results of flood risk assessment conducted by BNPB (2015), ten priority provinces were identified for the flood disaster management 2015-2019, namely: (1) East Java: Bengawan Solo River Basin, (2) Banten: Ciunjung Watershed, Cisadane Watershed , and Ciliman Basin, (3) Central Java: DAS Bengawan Solo, (4) DKI Jakarta: Ciliwung Watershed, (5) West Java: Citarum Watershed and Cimanuk Watershed, (6) Nusa Tenggara Timur: Benain Watershed, (7) Kalimantan South: Sepapah Basin, (8) North Sumatra: Wampu Basin, (9) South Sumatra: Batanghari Watershed, and (10) Aceh: Krueng Aceh Tamiang Watershed.

Flash flooding occurrence is due to a large flow of river water from the upstream (as the sender) to downstream (as the receiver) at a high speed. It is distinguished from other types of floods because it has a very fast flow current, has a large destructive force, rapidly disappearing water puddles and carrying a lot of mud materials (high viscosity), and often accompanied by stones and tree materials. The main factors of the occurrence of flash flood are: 1) the formation of weir (dam) in the upstream river flow, (2) heavy rain with high intensity and long duration (usually >2 days) upstream, (3) supporting watershed geometry (narrow valley, steep river gradient) between upstream and downstream.

For the flash flood risk, BNPB (2015) identified the following ten provinces as priority areas: (1) East Java, (2) West Java, (3) West Sumatra, (4) West Nusa Tenggara, (5) North Sumatra, 6) Maluku, (7) Gorontalo, (8) Central Sulawesi, (9) North Sulawesi and (10) South Sulawesi.

Figure 15.8: Flood Hazard Map.



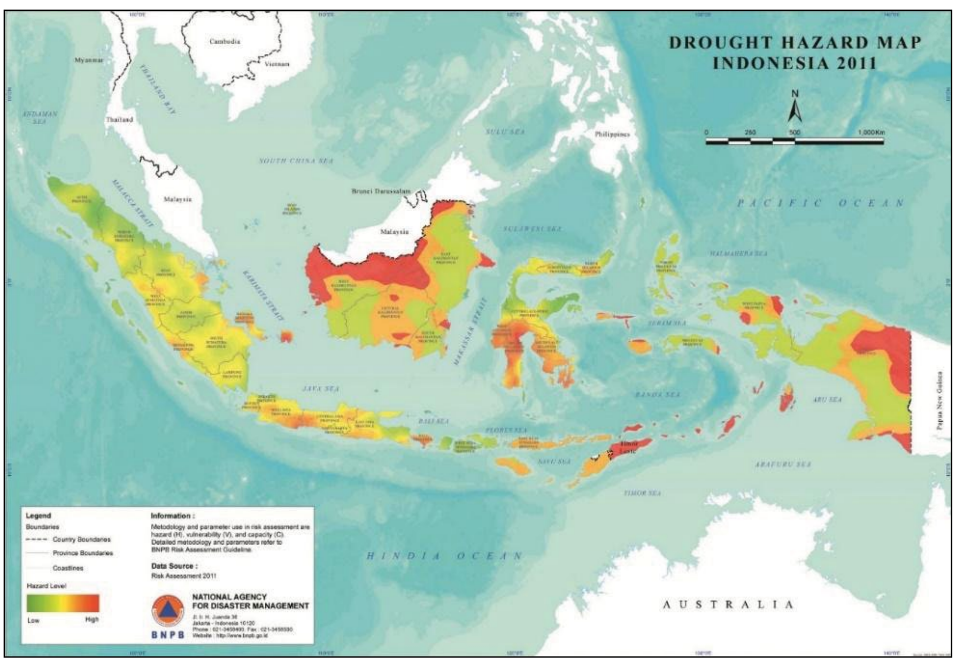
Source: BNPB, 2012.

(b) Drought

Drought is a type of natural disaster that occurs slowly, and lasting usually until the rains arrive. It has a very wide impact and has cross-cutting effects (economic, social, health, and education). The cause of the drought is the long period of decline in rainfall caused by the interaction of the atmosphere and the sea, and irregularities in sea surface temperature occurring in Indonesia and surrounding areas, as consequence of ENSO (El Niño and La Niña), IOD (Indian Ocean Dipole), and the monsoon cycle. The incidence of El Niño and positive IOD resulted in reduced production of clouds and the amount of rainfall over the Indonesian territory, leading to the drought. Consequently, prolonged drought results in the decline in rice production, especially rainfed rice; decrease of water debit in lakes, rivers and dams; and often forest fires in areas where forests are used as plantations or used by communities. **Figure 15.9** shows the areas that are prone to drought.

BNPB identified the following top ten priority provinces for the implementation of the Destructive Drought Management Plan 2015-2019: (1) West Java, (2) Central Java, (3) South Sulawesi, (4) West Kalimantan, (5) Bali, (6) Riau Islands, (7) Southeast Sulawesi, (8) West Sulawesi, (9) Bangka Belitung Islands and (10) Papua.

Figure 15.9: Drought Hazard Map in Indonesia.



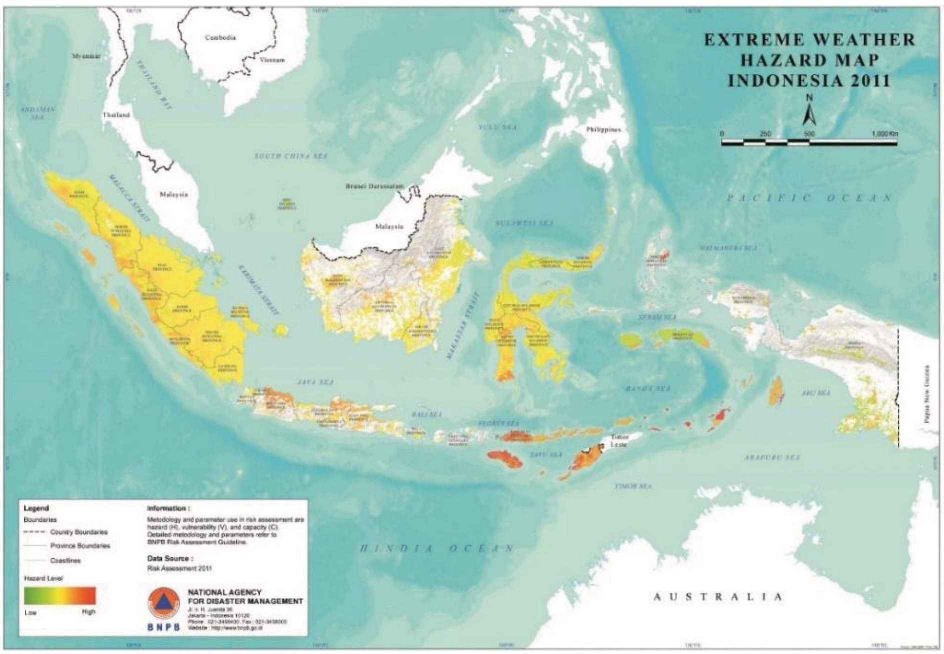
Source: BNPB, 2012.

(c) Extreme weather

The Meteorology, Climatology, and Geophysical Agency (BMKG) defines extreme weather as stated in BMKG Rule No. Kep. 009 of 2010 on *Standard Operating Procedures for Implementation of*

Early Warning, Reporting and Dissemination of Extreme Weather Information as "unusual weather events that can result in losses of lives and property." BMKG further states that extreme weather events in the mainland include: tornado, strong wind, heavy rain, heavy rain with lightning/strong wind, hail, and poor visibility due to fog or smoke. The extreme weather events in the oceans are tropical cyclones, extreme sea waves, tidal waves, heavy rain, heavy rains accompanied by strong winds/lightning, and horizontal clearance due to fog or smoke. **Figure 15.10** shows the extreme weather hazard map of Indonesia. The areas where these extreme weather events occur are the priority sites of BNPB for the implementation of extreme weather disaster management plan, namely: (1) West Java, (2) East Nusa Tenggara, (3) Central Java, (4) East Java, (5) Sumatra North, (6) South Sulawesi, (7) DKI Jakarta, (8) Maluku, (9) West Sumatra and (10) Central Kalimantan.

Figure 15.10: Extreme Weather Hazard Map.



Source: BNPB, 2012.

(d) Abrasion and Extreme Waves

There are two factors that cause abrasion i.e. natural factors and human factors. Natural factors that cause abrasion are triggered by weather or climate change, such as weathering of rocks, changes in global currents, vegetation cycles, changes in sediment supply and changes in direction and wave height. Human factors include damage to natural shoreline, land use change, coastal border development and material retrieval resulting in reduced sediment supply downstream or upstream (BNPB 2015). To mitigate this abrasion disaster, there are top ten priority areas: (1) Bangka Belitung Islands, (2) DKI Jakarta, (3) East Nusa Tenggara, (4) Central Java, (5) East Java, (6). Banten, (7) North Sumatra, (8) Central Sulawesi, (9) Aceh; and (10) South Kalimantan.

Figure 15.11 shows the wave and abrasion risk map that was launched by BNPB in 2012. From abrasion and tidal maps, the high risk generally occurs in the waters of Sawu Nusa Tenggara Timur, while moderate scale for those on the west coast of Sumatra, south and north of West Java, north of Central Java, a small part of West Kalimantan, the northern side and west of Sulawesi, north of North Maluku, almost all of Maluku and most of Nusa Tenggara.

Figure 15.11: Wave and Abrasion Tide Risk Index.

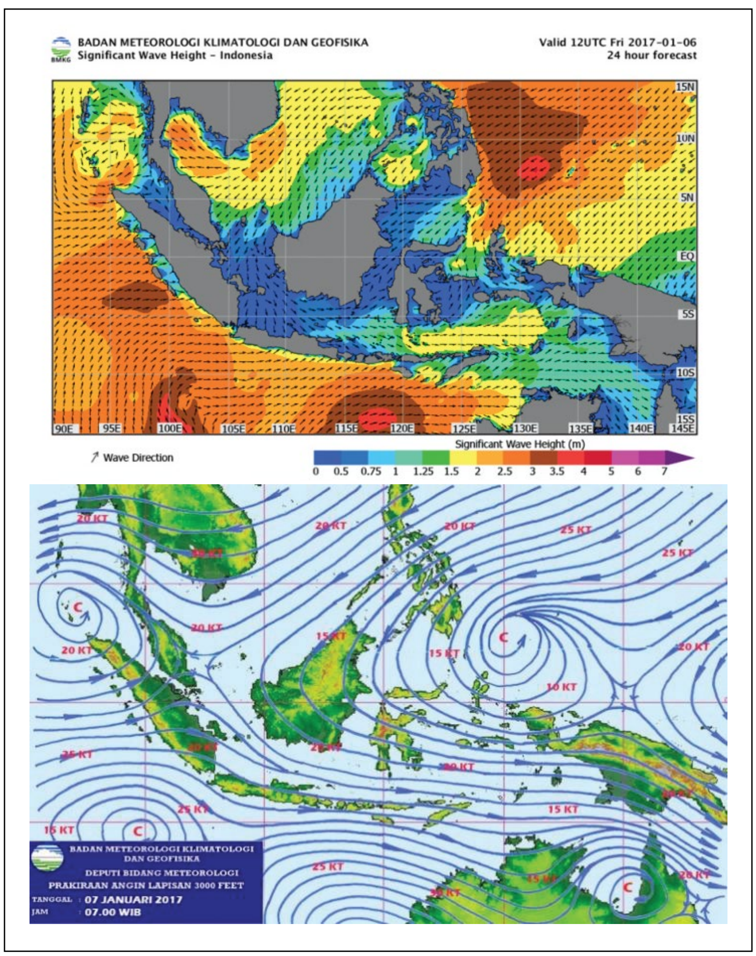
Source: BNPB, 2012.

The areas at risk from extreme waves and storm surge are shown in **Figure 15.12**. In addition to abrasion, other impacts caused by the extreme weather events are large waves in the sea that can jeopardize sea travel. For fishermen, if the extreme weather continues to occur, then this will affect their fishing activities, livelihood and flow of income as well as cause fear of losing their land and houses as nearshore coasts are taken away by the extreme waves. BMKG regularly publishes data on predicted wave height and wind directions (**Figure 15.13**).

Figure 15.12: Extreme Wave Risk Map in Indonesia.

Source: BNPB, 2012.

Figure 15.13: Predicted Wave Height and Wind Directions Published Regularly by BMKG.



Source: BMKG, 2017.

15.2 Climate Change

In the coastal areas of Indonesia, the threats that often come are floods associated with events, such as storms, heavy and prolonged rainfall, tsunamis, and rising sea levels. These conditions increase the threat level in archipelagic country like Indonesia, especially coastal areas with land elevation below 10 m and high population density in those areas. In a study conducted by Climate Central (2015) in 20 megacities in the world, assuming that global temperatures would rise by 2°C, Jakarta is one of the areas threatened by rising sea levels, which, if adaptation solutions are not immediately put in place or climate change is not mitigated, then in 2200, the city will be affected by sea level rise of up to at least 20 feet or 6 meters, (Strauss, 2015). The top 20 cities that will be affected by sea level rise are presented in **Table 15.6**, and Jakarta is the seventh in terms of population that will be affected.

Table 15.6: 20 Major Cities of the World to be Affected and the Estimated Population Affected.

No.	Big City	Population affected	% of the current population
1	Shanghai, China	11,500,000	39%
2	Hong Kong, China	6,200,000	28%
3	Taizhou, China	6,100,000	67%
4	Mumbai, India	5,900,000	27%
5	Calcutta, India	5,800,000	25%
6	Tanjin. China	5,100,000	12%
7	**Jakarta, Indonesia**	**4,900,000**	**11%**
8	Nantong, China	4,700,000	72%
9	Ho Chi Minh City, Vietnam	4,400,000	44%
10	Osaka, Japan	4,100,000	25%
11	Chittagong, Bangladesh	4,000,000	44%
12	Tokyo, Jepang	3,800,000	15%
13	Hanoi, Vietnam	3,800,000	30%
14	Huaiyin, China	3,400,000	43%
15	Shantou, China	3,100,000	23%
16	Nan Dihn, Vietnam	3,100,000	74%
17	Jiagmen, China	3,000,000	51%
18	Khulna, Bangladesh	2,900,000	22%
19	Barisal, Bangladesh	2,800,000	40%
20	Lianyunggang, China	2,800,000	92%

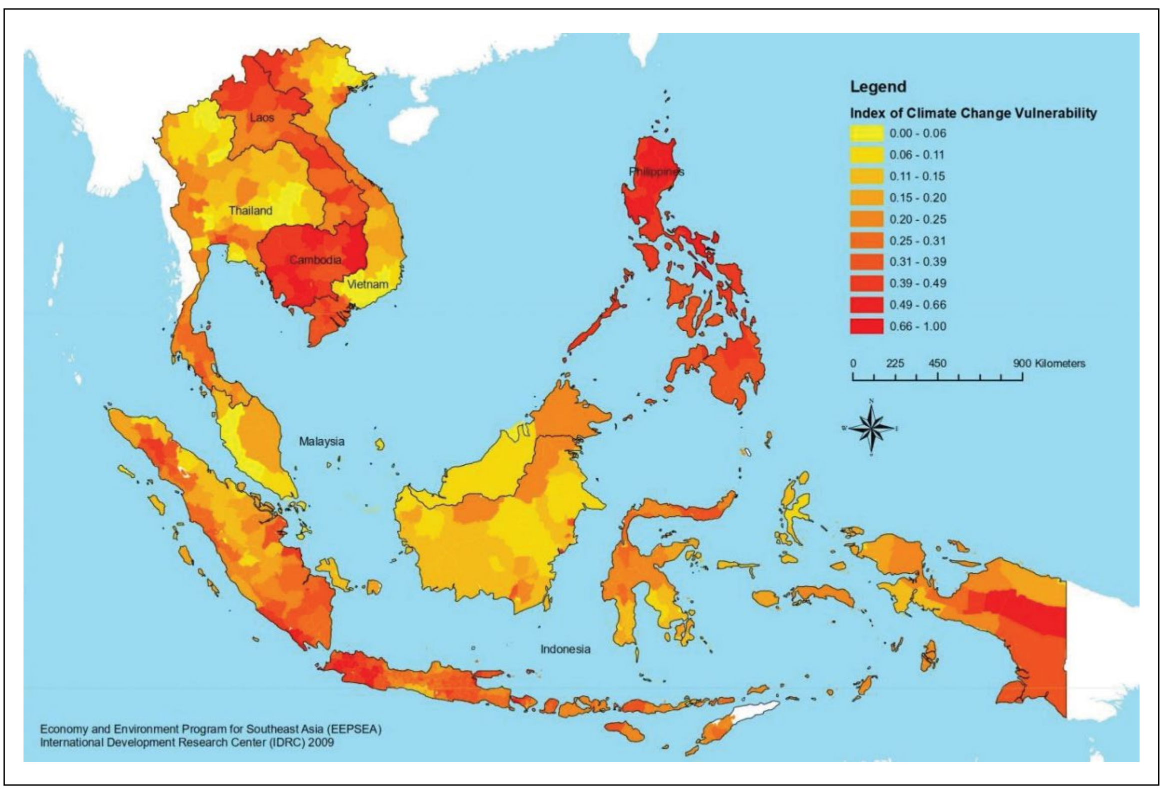
Source: Climate Central, 2015.

Climate risk refers to risks resulting from the effects of global warming due to increasing greenhouse gas emissions. For Southeast Asia, the Index of Climate Change Vulnerability is illustrated in **Figure 15.14**. It shows the areas that are at high risk from climate change.

Ongoing effects of climate change include rising sea levels due to thermal expansion and melting of glaciers and ice sheets, and warming of the ocean surface, leading to increased temperature stratification. Other possible effects include large-scale changes in ocean circulation. Effects on weather encompass increased heavy precipitation, reduced amounts of cold days, increase in heat waves and various effects on tropical cyclones.

Geochemical cycles are also impacted, with absorption of CO_2 causing ocean acidification, and rising ocean water decreasing the ocean's ability to absorb further carbon dioxide.More acidic ocean waters impede coral growth and warmer waters cause coral bleaching. When corals are stressed by changes in conditions, such as temperature, light, or nutrients, they expel the symbiotic zooxanthellae algae living in their tissues, causing them to turn completely white. Thus, coral bleaching events not only whitewash corals, but can also reduce the variety of fish that are dependent on these highly valued ecosystems. Thousands of marine animals depend on coral reefs for survival, including some species of sea turtles, crabs, shrimp, jellyfish, starfish, sea birds, etc.

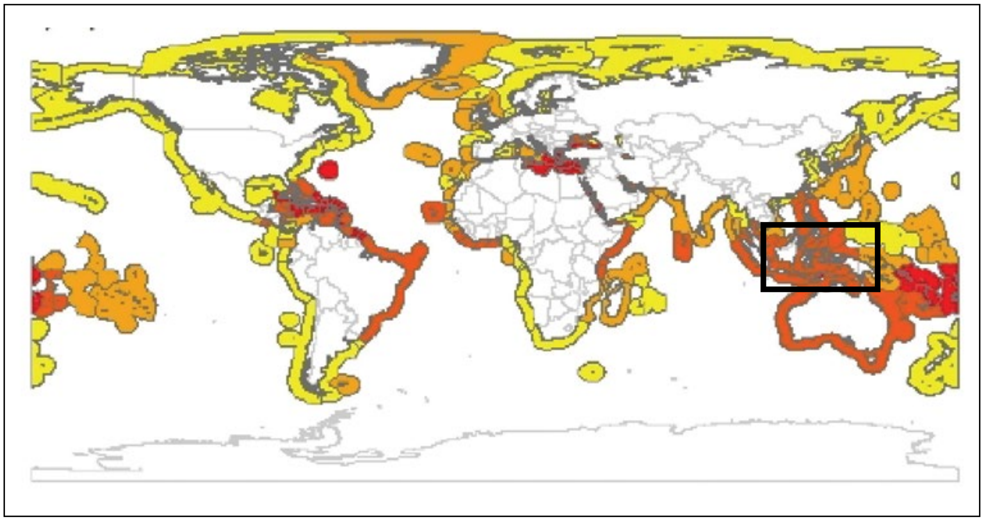
Figure 15.14: Vulnerability Index on Climate Change in Southeast Asia.



Source: EEPSEA-IDRC (2009).

From **Figure 15.15**, the level of marine vulnerability in Indonesia remains at moderate levels but this condition is expected to have a wide impact as acidity levels increase. This is related to the fisheries sector.

Figure 15.15: Exposure to Climate Change Vulnerability.



Note: **yellow** = low vulnerability; **orange** = moderate vulnerability; **red** = high vulnerability
Source: Monnerau et al., 2012.

15.2.1 Sea Level Rise

The impact of climate change and unplanned changes caused by disasters that are gradual but systemic changes, such as the threat of rising sea levels, anomalies of weather and wind in the sea and drought on land, are also important. According to IPCC (2007), globally the sea level rises by an average 2.5 mm annually. According to Bappenas (2010) on *Indonesia Climate Change Sectoral Roadmap*, the average sea level rise of Indonesia is 3.1 mm annually, doubled from 1.7 mm/year in 20th century, and this condition put Indonesia, which has 99000-km coastline and >16000 islands, as highly vulnerable. That means, 65% of population of Indonesia who lives near the coast wil be impacted. The socioeconomic impact will also be high since a large part of Indonesia's population, industries, infrastructure, and most fertile agricultural lands are located in low-lying coastal areas.[106] From the research in 2009-2012 at four locations – Medan (North Sumatera), Pemangkat, Ambon (Maluku), and Manokwari (West Papua) – Mankokwari will have the highest sea level rise, at 14.1 mm/year, while Ambon the lowest, at 1.75 mm/year.[107]

[106] Case, M., Ardiansyah, F., and Spector, E. 2007.
[107] Zikra, M, Suntoyo, Lukijanto. 2015.

An estimated 41.6 million Indonesians live in areas located at 10 mdpl or in the low elevation coastal zone (IIED 2007 in Radjawane dkk 2010), such as areas are in the north of Jakarta, Surabaya and Semarang. According to Hadi et al. (2005), sea level rise in Tanjung Priok was 0.57 cm/year in the 1925-2002 intervals, while according to Sutina et al. (2002), sea level rise in Tanjung Priok, Semarang and Surabaya ranges from 5-8 mm per year during the period 1984-2002 (in Radjawane et al. 2010). If it is assumed that the coastline will advance by 50 m due to rising sea level, Indonesia will lose 400,000 ha of its coastal area – where 65% of people live, and where 70% of fish come from, and 90% of marine biomass is produced (Diposaptono 2008; Hadi et al., 2005).

15.2.3 Rising Sea Temperature and Coral Bleaching

Climate change parameters include not only temperature, but also other parameters, such as precipitation, cloud conditions, wind, solar radiation, sea surface temperature, and ocean acidification. Global warming, which is due to the increasing amount of greenhouse gas emissions, is important to examine, as temperature changes will have a significant impact on life on earth and human activities. IPCC (2013) reports that in the long run climate change can change the surface temperature of the earth. The warmer regions will increase and cold temperatures will be impacted by the rise in global average temperatures. Climate change will also alter atmospheric circulation, the average sea level, water cycle, and carbon cycle system. Climate change also affects the oceans where the sea temperature could becomes hotter by 2°C - 6°C, affecting marine life.

One of the long term impacts of climate change is the effect on the remaining coral reefs in Indonesia. According to Indonesian Institute of Sciences/ LIPI (2015), around 73.91% of coral reefs in eastern Indonesia were damaged mainly due to human activities, compared to 66.13% in western of Indonesia. This situation will further worsen if the sea is warming as coral bleaching could destroy the rest of excellent coral reefs. Coral bleaching occurs when water is too warm, and corals expel the algae (zooxanthellae) living in their tissues causing the coral to turn completely white. The bleaching event is actually not a new case in Indonesia. In 1983, bleaching struck almost 90% of the coral reefs in South China Sea, Sunda Strait, Java Sea, Bali and Lombok Sea. In 1997-1998, at least 80% of coral reef in West Sumatera, South China Sea, Java, Bali and Lombok were affected by bleaching. The latest event happened in 2010, when bleaching affected around 30% of coral reef in North and West Sumatera, Bali, Lombok and Wakatobi.[108] In a separate report in 2010, the Wildlife Conservation Society found 60% of coral in Aceh water were bleached as the temperature was 4 degrees higher at average 34° C.[109] In Bunaken Marine National Park, one of the most popular for diving spots, it was reported that 85% coral reef in

[108] Jong, Hans Nicholas. 2016.
[109] Wildlife Conservation Society. 2010.. <www.sciencedaily.com/releases/2010/08/100816170839.htm>.

Bunaken were destroyed due to the El Niño event.[110] As sea temperature rises, more coral reefs will be damaged due to coral bleaching. Bleached corals are likely to have reduced growth rates, decreased reproductive capacity, increased susceptibility to diseases and elevated mortality rates.

15.2.4 Impacts and Economic Costs of Climate Change

The *Rancana Aksi National – Perubahan Iklim* (RAN-API) or Indonesia's **National Action Plan on Climate Change Adaptation 2015-2019** describes the impacts of climate change on the fisheries and coastal sectors (**Table 15.7**).

Table 15.7: Impacts of Climate Change on Fisheries and Coastal Areas.

No	Categories of Dangers from change climate	Impact on coastal areas
1	Surface temperature	Expanding deployment disease through the air medium
		Increase in pest insect populations, harming yields of staple crops like wheat, soybeans, rice and corn
2	Changes in rainfall (CH)	Decrease availability of water due precipitation deficit
		Increasing mosquito population due to puddles
		Increasing spread of diseases through the air medium and puddle
3	Changes in sea surface temperature	Changes in fish migration patterns caused by changes in sea current circulation due to distribution of the increase in sea surface temperature
		Damage to coral reefs (coral bleaching)
4	Changes in sea levels	Expanding sea water levels (inundation) in the coastal area could cause the retreat of beach line
		Expanding sea water levels result in saltwater intrusion in groundwater quifers and river
5	Changes in extreme climate Changes in extreme weather	Occurrence of consecutive drought
		Increasing fire frequency and intensity
		Increasing frequency and intensity of storms and tornadoes, which result in erosion and abrasion affecting coastlines
		Increasing incidence of flood events due to storms, tropical cyclones, storm surge and extreme high waves
		Increasing damage on public infrastructure, housing, schools, and buildings of government institutions, industries and commercial establishments

Source: RAN API 2015-2019.

[110] Ampou, et al. 2017.

Based on Worldfish study (2013),[111] there are some general conditions of vulnerability from a hydro-meteorological disaster that Indonesia has to face due to climate change (**Table 15.8**). Islands and low-lying coastal areas have high exposure to sea level rise and changes in weather and rainfall. Increasing sea level rise impacts fisheries, marine economies, and agriculture. Changes in weather, climate, and rainfall impacts health (vector-borne disease, and respiratory illness from fire), and water availability, and intensifies flooding and drought.

Table 15.8: Physical and Socioeconomic Impacts of Climate Change in Indonesia.

Main impact	• Flood and Rob
Most risky sectors	• Fisheries and settlement
Other risks	• Abrasion, erosion, salt water intrusion, abnormal tide, sea level rise
Environmental issues	• Loss of marine ecosystems and mangroves • Habitat degradation and the loss of biodiversity • Reduce economic profit and social problems • Degraded water quality and abnormal river systems • Overlapping jurisdiction in fisheries management
Significant impacts	• Abrasion, erosion, saltwater intrusion, abnormal tide, sea level rise • Degraded water quality and abnormal river systems • Disruption to marine transportation , damage to houses and infrastructure • Change of bathymetry, waves and shoreline • Sediment accumulation

Source: WorldFish, 2013.

There are also studies, which show that the retreat of glaciers and ice caps due to climate change can cause increased volcanism.[112] Numerical models including one or more faults in a rheologically stratified lithosphere show that climate-induced variations in ice and water volumes on Earth's surface considerably affect the slip evolution of both thrust and normal faults. In general, the slip rate and hence the seismicity of a fault decreases during loading and increases during unloading, such as that due to the removal of ice.[113] Shrinkage of the modern ice sheets in Greenland and Antartica owing to global warming may ultimately lead to an increase in earthquake frequency in these regions. Studies are needed to assess if there will be more volcanic eruptions and earthquakes in Indonesia.

The challenge of realizing blue economy development is exacerbated by climate change. There will be potential losses and costs to be incurred for adaptation and rehabilitation. Compared with developed countries, there is a limited understanding of the potential market sector impacts of

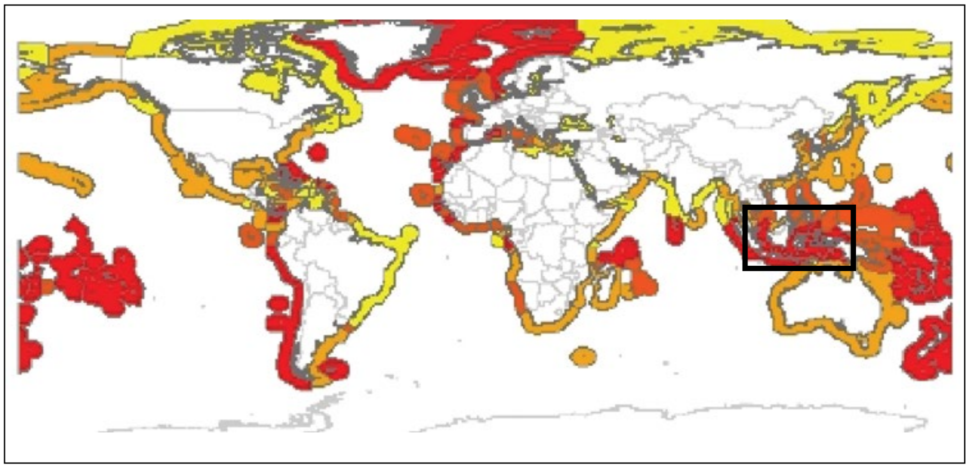
[111] Perez, et al. 2013.
[112] Pagli, Carolina; Sigmundsson, Freysteinn. 2008.
[113] Hampel, A.; Hetzel, R.; Maniatis, G. 2010.

climate change in Indonesia. The economic sectors that will be potentially impacted by climate change and should be of concern are:

a) Fisheries and coastal agriculture
b) Coastal tourism
c) Offshore energy (wind, current/tidal/wave energy, OTEC, offshore oil and gas)
d) Shipping
e) Pharmaceutical and genetic industries
f) Blue carbon sinks and market opportunities.

Figure 15.16 shows that the sensitivity of Indonesia's fishery sector is categorized as "Very sensitive". Climate change will certainly harm and hinder the development of fisheries in Indonesia, which until now has not been optimally done within the framework of sustainable fisheries development or ecosystem approach to fisheries management. The major issues affecting local fisheries – lack of human resources and technical capacity for climate change mitigation and adaptation and in handling the impacts of climate change; development of complementary industries and capital intensive maritime industries; high water pollution; and overfishing in almost all FMAs of Indonesia – will be magnified by climate change effects like ocean acidification, warmer sea waters, coral bleaching, higher intensity and frequency of storms, etc.

Figure 15.16: Sensitivity of the World's Fisheries Sector from Climate Change.



Note: **yellow** = low vulnerability; **orange** = moderate vulnerability; **red** = high vulnerability
Source: Monnerau et al., 2012.

Southeast Asia is projected to suffer more from climate change, and if not adequately addressed, it could seriously hinder the gains from the economic growth and poverty reduction efforts. If no action is taken, four counries in Southeast Asia (Indonesia, Philippines, Thailand and Viet Nam) could suffer a loss equivalent to **6.7% of GDP annually** by 2100 – more than the global average loss.[114] The region has great potential to contribute to global climate change mitigation actions given its large areas of mangroves and seagrass or blue carbon sinks. There are also ongoing natural hazard management and climate change adaptation measures being undertaken in the region.

15.2.5 Role of Coastal and Marine Ecosystems

In addition to their provisioning services (food, water, wood, medicines, etc.), coastal and marine ecosystems play an essential role in protecting coastal communities from flooding, erosion, waves and storm surge, in providing breeding, nursery and feeding grounds for fish and marine species as well as in climate change mitigation due to their carbon sequestration and storage services. For the poor who are highly resource dependent, ecosystems essentially provide them with food, livelihoods, and shoreline protection.

Coastal ecosystems lessen erosion and flood exposure, support coastal water quality, and serve as natural coastal infrastructures by reducing wave height and strength, dampening wind, retaining sediments, and providing additional protection against storm surge and tsunami.

Blue carbon is the carbon captured by coastal ecosystems, such as mangrove forests, seagrass meadows, tidal or salt marsh, and potentially macroalgae. These ecosystems play an important role in sequestering the greenhouse gas CO_2 from the atmosphere and storing it in plant biomass (leaves, stems, branches, and roots), their underlying sediments, underground and below-ground biomass. IUCN studies have shown that for each hectare of mangrove replanted, the CO_2 removal from the atmosphere is estimated to be between 1,500 and 2,000 tonnes – this is more than a tropical rainforest. Moreoever, coastal ecosystems can store carbon for thousands of years, but when the ecosystem is damaged, they can release the stored CO_2 in biomass, sediments and soil.

15.2.6 Response

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. It is therefore critical to stop their destruction to ensure their health and functional integrity so they can continue providing the ecosystem services, like food provision, habitat for fish, waste assimilation, shoreline protection, and carbon sequestration. Integrated coastal land- and sea-use planning or marine spatial planning that incorporates ecosystem-based disaster risk reduction and management, appropriate infrastructure development to combat flooding and erosion and ensure water security, and coastal ecosystem restoration and conservation would enhance climate resiliency.

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[114] ADB. 2009.

(a) Climate change mitigation

Healthy coastal habitats play an important role in mitigating climate change by sequestering and storing carbon. 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 in their biomass and underlying sediments and soil is also released.

The *International Blue Carbon Initiative* is a coordinated, global program focused on mitigating climate change through the conservation and restoration of coastal and marine ecosystems. In Indonesia, this initiative is piloting the project, *Kaimana Coastal Conservation and Community Development* to demonstrate the climate mitigation potential and viability of blue carbon projects, and build capacity of indigenous communities to protect and manage coastal ecosystems.

Other examples of restoring and protecting ocean health are described in *Part 3 – Developments in Blue Economy* of this report. More habitat areas need to be restored considering the huge losses in the past decades. A combined protection of mangrove, coral reefs, seagrass beds, tidal marshes, coastal wetlands and coastal forests is particularly more effective given the interconnectivities of these coastal habitats to optimize their ecosystem services.

(b) Climate change adaptation

The RAN-API or Indonesia's **National Action Plan on Climate Change Adaptation** focuses on two key areas of climate change and their impacts on livelihoods: (a) sea level rise, and (b) changes in climate, weather, and rainfall. Bappenas – the Ministry of National Development Planning – implements RAN-API.

Under RAN-API, a vulnerability index and evaluation system was developed to determine what adaptation activity is necessary in each area. Some key adaptation and resiliency strategies include: promoting farming practices that are flexible to changing weather and water conditions; building infrastructure to secure water sources and prevent flooding; developing warning systems for natural disasters; flood-proofing homes; preventing deforestation; and increasing community access to finance, training, and the planning of resiliency programs.

RAN-API also outlines the coordination among different ministries and with local/regional governments. Working at the regional and village level is crucial in Indonesia's decentralized system. However, greater climate change awareness, more capacity development, and increasing financing of adaptation projects at the local level as well as better coordination between the public and private sectors are needed to achieve the objectives set out in the action plan. Stronger inter-agency and intersector coordination and collaboration with communities will enable holistic and flexible responses to climate change.

There are several possible approaches to adaptation to climate change that can be applied on the coast (**Table 15.9**).

Table 15.9: Approaches to Climate Change Adaptation.

Level	Hazard-based approach	Vulnerability-based approach	Adaptation-capacity Approach	Policy-based approach
National	Increasing resilience to severe flooding and future climate risks How can national meteorological services be improved to better monitor the evolution of future hazards?	Improving access to new markets and supporting livelihood diversification under future climate. How will recent changes in world markets affect aquaculture for example in Indonesia under future climate?	Improving awareness in and the resilience of the entire country to climate change, through soft approaches (communication, education, capacity building) and hard approaches (climate-proofing infrastructure).	Reducing vulnerability to storm surges and sea level rise induced by climate change
			Which business sectors will be most affected by climate change and why? What awareness raising is needed, and for whom? What fora should be involved?	What incentives or disincentives should be used to discourage the development of coastal zones vulnerable to sea level rise and storm surges induced by climate change?
Regional	How can flood early warning systems be made more effective under future climate for hard-to-reach communities?	How can access to new markets required by livelihood diversification activities be facilitated to moderate future climate?	How can regional businesses most effectively support livelihoods identified as being vulnerable to climate change, including variability?	Realignment or retreat? How to decide which areas are protected and which will become submerged under future climate?
Local	What techniques are most appropriate for effective local-level disaster preparedness planning under future climate?	How can credit schemes best support livelihood diversification in rural areas to reduce climate risks?	Which participatory visioning processes are most appropriate to identify threats and potential opportunities resulting from scenarios of climate change for members of local trade associations and businesses?	What stakeholder-led projects are most appropriate for investigating ways to mitigate flood damages in an urban area under future climate?

Source: Lim and Sigfried, 2004.

PART 5

GOVERNANCE STRUCTURE SUPPORTING BLUE ECONOMY

16 Enabling Conditions and Governance Mechanisms

16.1 Policies, Legal and Regulatory Framework

16.1.1 National Ocean Policy

The **Global Maritime Fulcrum** (GMF) was launched at the East Asia Summit in 2014. It envisions Indonesia, a maritime country, as a force between the two oceans: the Indian Ocean and the Pacific Ocean, and to become the center of the world's maritime axis.

Presidential Decree no. 16 of 2017: Indonesian Sea Policy was designed to "facilitate the acceleration" of the GMF doctrine. The **Sea Policy** (a term rooted in the United Nations Convention on the Law of the Sea) codifies the GMF as part of Indonesia's regulatory hierarchy, and integrates and coordinates maritime-related policies and programs across different ministries and agencies into a single framework.

The GMF is now defined as the vision for a "sovereign, developed, and strong maritime state capable of positively contributing to the peace and security of the region and the world, according to its national interests." As policy guidance, this vision is further detailed in two appendices containing a long-term framework (spelled out in a 37-page National Document) and a short-term scheme (detailed in the Action Plan 2016-2019).

The GMF's original pillars were expanded in the Sea Policy into:
1. Marine and human resource development
2. Naval defense, maritime security, and safety at sea
3. Ocean governance institutionalization
4. Maritime economy, infrastructure, and welfare
5. Environmental protection and ocean space management
6. Nautical culture
7. Maritime diplomacy

These pillars are further broken down into 76 programs spread across dozens of ministries and agencies in charge of 425 activities designed to achieve 330 targets.

The policy continues to leave the planning, budgeting, and execution of the various programs to the respective ministries and agencies. However, the Coordinating Ministry for Maritime and Investment

Affairs is tasked with monitoring, coordinating, and evaluating how each ministry fits within the Sea Policy framework.

As an inter-agency framework, efforts to build institutional change in coastal and marine development are to optimize the role of MMAF as the main body for marine and fisheries sector planning.

Similarly, at the regional level, the Department of Marine and Fisheries, especially in the provinces, (according to the mandate of Law No. 23 of 2014 on local government) exercises autonomous regional autonomy without CTF technical assistance. For that reason, several national regulations can be used as the main reference to the governance in sustainable maritime-based economic development:

1. Law no 31 of 2004 on fisheries and Law no 45 of 2009 on amendment to Law no 31 of 2004 concerning fisheries
2. Law no 1 of 2014 on the management of coastal areas and small islands
3. Law no 23 of 2014 on local government
4. Law no 7 of 2016 on protection and empowerment of fishermen, fish cultivators and salt farmers
5. Law No. 32 of 2009 on the management of natural resources
6. Law no 6 of 2014 about the village
7. Law no 32 of 2014 on maritime

The *National Medium-Term Development Plan 2015-2019* identifies six national priorities of development. The marine sector is the third priority, with the aim: "to benefit from and to restore the loss of Indonesia's marine potential from the maritime sector." To achieve this, there are ten policy directions:[115]

1. Complete the boundary line of the continental shelf to 200 nautical miles, including naming and registration of the islands
2. ALKI regulation and control (Indonesian archipelagic sea lane)
3. Strengthening the institution for water management and supervision
4. Improve coordination for monitoring and enforcement of laws aimed at violation offenses
5. Improve the construction of multimodal transportation system
6. Balancing between national-oriented transportation and local and regional transportation system
7. Accelerate the growth of the marine economy
8. Improve and maintain quality. support and preservation of aquatic environments
9. Enhance maritime knowledge and culture along with strengthening of human resources and science and technology
10. Increase the dignity and livelihood standards of fishing communities

[115] Bappenas. RPJMN 2015-2019.

16.1.2 International Agreements

Indonesia is party to various International conventions related to coastal and ocean management. **Table 16.1** shows which international conventions Indonesia has signed, acceded to or ratified, and the year. Indonesia also ratified some IMO Conventions related to shipping and marine environmental management (**Table 16.2**).

Table 16.1: International Conventions on Environmental and Biodiveristy Protection and Climate Change.

	Multilateral Agreements	Year Ratified by Indonesia
Ocean	UN Convention on the Law of the Sea 1982 (UNCLOS)	1986 r
Biodiversity	Convention on Biological Diversity 1992 (CBD)	1994
	Cartagena Protocol on Biosafety	2004
	Nagoya Protocol on Access and Benefit-Sharing	2013
	Convention on International Trade in Endangered Species 1973 (CITES)	1978 a
	Convention on Migratory Species 1979 (CMS)	1979
	Convention on Wetlands 1971 (RAMSAR)	1992
	World Heritage Convention 1972 (WHC)	1989
	Convention for the Regulation of Whaling 1946	
	Treaty on Plant Genetic Resources for Food and Agriculture 2006	2006 a
Fisheries	Convention for the Conservation of Southern Bluefin Tuna	2007
	Fisheries Convention on Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean 2004	2013
	Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing	2016
Pollution and waste management		
Marine pollution	UNCLOS (Part XII : Protection and Preservation of the Marine Environment)	1986
	London Convention - Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter	
	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto and by the Protocol of 1997 (MARPOL) 73/78	1987
	Global Programme of Action for the Protection of the Marine Environment from Land-based Activities 1995 (GPA)	** Y
Toxic and hazardous waste	Basel Convention 1989	1993
Air pollution	Vienna Convention (Ozone layer)	1992 a
	Montreal Protocol 1987	1992
Land degradation	UNCCD 1994	1998
Climate change	UNFCCC 1992	1994

Table 16.1: International Conventions on Environmental and Biodiveristy Protection and Climate Change. (cont.)

	Multilateral Agreements	Year Ratified by Indonesia
	Kyoto Protocol 1997	2004
	Paris Agreement on Climate Change 2016	2016
Disaster risk management	Hyogo Framework for Action	2005 Ad
	Sendai Framework for Disaster Risk Reduction 2015-2030	2017

Legend:
Y - Participated in the Conference
a - Accession
A - Acceptance
d - Succession
r - Ratification
** - Only at the conference; does not indicate status of current participation

Source:
PEMSEA, 2015.
SEAFDEC (http://www.seafdec.org/fisheries-country-profile-indonesia/).
FAO (http://www.fao.org/port-state-measures/background/parties-psma/en/).

Table 16.2: IMO Conventions.

Convention establishing IMO		Status
Convention on the International Maritime Organization	IMO Convention 48	x
Conventions relating to maritime safety and security and ship/port interface		
International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended	SOLAS Convention 74	x
	SOLAS Protocol 78	x
	SOLAS Protocol 88	x
	SOLAS Agreement 96	
International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) as amended, including the 1995 and 2010 Manila Amendments	STCW Convention 78	x
International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel (STCW-F), 1995	STCW-F Convention 95	x
Convention on the International Regulations for Preventing Collisions at Sea (COLREG), 1972	COLREG Convention 72	x
Convention on Facilitation of International Maritime Traffic (FAL), 1965	FACILITATION Convention 65	x
International Convention on Load Lines (LL), 1966	LL Convention 66	x
	LL Protocol 88	x
International Convention on Maritime Search and Rescue (SAR), 1979	SAR Convention 79	x
Convention for the Suppression of Unlawful Acts Against the Safety of Maritime Navigation (SUA), 1988	SUA Convention 88	
Protocol for the Suppression of Unlawful Acts Against the Safety of Fixed Platforms located on the Continental Shelf	SUA Protocol 88	
	SUA Convention 2005	
	SUA Protocol 2005	

Table 16.2: IMO Conventions. (cont.)

Conventions relating to maritime safety and security and ship/port interface (cont.)		
International Convention for Safe Containers (CSC), 1972	CSC Convention 72	x
	CSC amendments 93	
Convention on the International Maritime Satellite Organization (IMSO C), 1976	IMSO Convention 76	x
	INMARSAT OA 76	x
	IMSO amendments 2006	
	IMSO amendments 2008	
The Torremolinos International Convention for the Safety of Fishing Vessels (SFV), 1977; Superseded by the The 1993 Torremolinos Protocol	SFV Protocol 93	
Cape Town Agreement of 2012 on the Implementation of the Provisions of the 1993 Protocol relating to the Torremolinos International Convention for the Safety of Fishing Vessels	Cape Town Agreement 2012	
Special Trade Passenger Ships Agreement (STP), 1971	STP Agreement 71	x
Protocol on Space Requirements for Special Trade Passenger Ships, 1973	Space STP Protocol 73	x
Conventions relating to prevention of marine pollution		
International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto and by the Protocol of 1997 (MARPOL)	MARPOL 73/78 (Annex I/II)	x
	MARPOL 73/78 (Annex III)	x
	MARPOL 73/78 (Annex IV)	x
	MARPOL 73/78 (Annex V)	x
	MARPOL Protocol 97 (Annex VI)	x
International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969	INTERVENTION Convention 69	
	INTERVENTION Protocol 73	
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (LC), 1972	London Convention 72	
	London Convention Protocol 96	
International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), 1990	OPRC Convention 90	
Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances, 2000 (OPRC-HNS Protocol)	OPRC-HNS 2000	
International Convention on the Control of Harmful Anti-fouling Systems on Ships (AFS), 2001	AFS 2001	x
International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004	BALLAST WATER 2004	x
The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009	HONG KONG CONVENTION	
Conventions covering liability and compensation		
International Convention on Civil Liability for Oil Pollution Damage (CLC), 1969	CLC Convention 69	x
	CLC Protocol 76	
	CLC Protocol 92	x

Table 16.2: IMO Conventions. (cont.)

Conventions covering liability and compensation (cont.)		
1992 Protocol to the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND 1992)	FUND Protocol 76	
	FUND Protocol 92	
	FUND Protocol 2003	
Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material (NUCLEAR), 1971	NUCLEAR Convention 71	
Athens Convention relating to the Carriage of Passengers and their Luggage by Sea (PAL), 1974	PAL Convention 74	
	PAL Protocol 76	
	PAL Protocol 90	
	PAL Protocol 02	
Convention on Limitation of Liability for Maritime Claims (LLMC), 1976	LLMC Convention 76	
	LLMC Protocol 96	
International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (HNS), 1996 (and its 2010 Protocol)	HNS Convention 96	
	HNS Protocol 2010	
International Convention on Civil Liability for Bunker Oil Pollution Damage, 2001	BUNKERS Convention 01	x
Nairobi International Convention on the Removal of Wrecks, 2007	NAIROBI WRC 2007	
Other subjects		
International Convention on Tonnage Measurement of Ships (TONNAGE), 1969	TONNAGE Convention 69	x
International Convention on Salvage (SALVAGE), 1989	SALVAGE Convention 89	

Note: x - Ratified by Indonesia
Source: http://www.imo.org/en/About/Conventions/StatusOfConventions/Pages/Default.aspx.

16.1.3 Policies and Laws on Marine Resource Conservation and Environmental Protection

Several policies were created to address the problems in managing coastal and marine resources, such as:

- Supporting coastal and marine zoning,
- Developing the new conservation zone to support the target of conservation area by 2025.
- Combating IUU Fishing by creating the special taskforce to combat illegal fishing,
- Prohibiting the use of trawling fishing gear
- Addressing marine plastic debris

In the management of watershed and coastal areas and small islands, several laws and regulations form the basis of policies in Indonesia as shown in **Table 16.3**.

Table 16.3: Legal Basis and Policy of Conservation and Environmental Management.

No.	Legal Basis	Settings / Policy About	Linkages with Marine Conservation
1	Law No. 25/2005	Long Term Development Plan (RPJP) (2004-2025)	Basic policy for development in coastal areas and small islands, including its protection and development of marine tourism. It includes the mission to build Indonesia as an archipelago country (*archipelagic state*)
2	Government Regulation No. 26-2008	National Territorial Layout Plan (Spatial Planning) [RTRWN]	Basic policy for spatial planning including coastal space
3	Government Regulation No. 13 of 2017 ("Regulation 13") regarding Amendment to Government Regulation No. 26 of 2008 regarding National Spatial Plan	National Spatial Plan	Basic policy for spatial planning including coastal space
4	Law No. 27/2007 as amended by Law no.45 of 2009	Coastal Management and Small Islands	A policy base for sustainable development of coastal and small island islands
5	Law No 23/2014	Local government	Roles, authorities and responsibilities of provincial government) coastal in participating in the management of conservation areas
6	Law No. 5/1990	Conservation of Biological Natural Resources and its Ecosystem	Basis for policies for the management of biological natural resources and their ecosystems, including regulation of natural reserve areas and conservation areas
7	Law No 32/2009	Management of the environment	The regulation of the environment as a national asset includes the importance of conservation of marine resources with the concept of *Ecoregion*
8	UU no. 32/2009	Marine	Determination of marine conservation policies as an integral part of the Marine Environment Protection
9	Law No. 31/2004 as amended by Law No. 45/2009	Fishery	The policy base for fishery resource management includes the conservation of fish resources and their habitats
10	Law No 10/2009	Tourism	Tourism development includes marine tourism that considers cultural protection and environmental quality
11	Government Regulation No. 7/1999	Preservation of Plant and Animal Species	Basis for the protection of certain types of aquatic biota and fishery resources
12	Government Regulation No. 8/1999	Utilization of Plant and Animal Species	Basis for the utilization of the types of aquatic biota and protected fisheries resources
13	PP No. 19/1999	Marine Pollution and/or Degradation Control	Protection of marine quality; prevention, mitigation of degradation and pollution; and restoration of marine resources.

Table 16.3: Legal Basis and Policy of Conservation and Environmental Management. (cont.)

No.	Legal Basis	Settings / Policy About	Linkages with Marine Conservation
14	PP No 54/2000	Service Provision for Environmental Problem Solutions	Dispute or conflict resolution in coastal areas
15	Government Regulation No. 82/2001	Water Quality Management and Pollution Control	Coastal water quality control and pollution
16	PP No 60/2007	Conservation of Fish Resources	The regulation and mechanism of protection of fishery resources including its ecosystem
17	Presidential Instruction No. 16/2005	Policy of cultural and marine tourism development	Support the development of marine tourism and enrich the management and control of marine national park sustainability
18	Kepmen KP No.KEP.10 / MEN / 2002	General guidelines Integrated coastal management planning	Technical guidelines for integrated coastal management planning
19	Permen KP No.PER.17 / MEN / 2008	Conservation Areas in Coastal Areas and Small Islands	Technical guidance in the management of Conservation Areas in coastal areas and small islands
20	Permen KP N o. PER.02 / MEN / 2009	Procedure for Determination of Marine Conservation Area	Technical guidance in the setting up of Conservation area in coastal areas and small islands
21	Ministerial Decree No. KP. KEP.64 / MEN / 2009	Determination of Raja Ampat National Marine Watershed Area and the surrounding Sea in West Papua Province	Establishment of Raja Ampat as a national conservation area
22	Permen KP. PER.03 / MEN / 2010	Procedures for Determining the Protection of Fish Types	Technical guidance on the procedures for establishing protected species of fish
23	Permen KP. PER.04 / MEN / 2010	Utilization of Fish Type and Genetics	Technical guidance in the method of utilization of species and genetics of fish
24	Permen KP. PER.30 / MEN / 2010	Management Plan and Zonation of Marine Conservation Area	Technical guidance in the preparation of Management Plan and Zoning in Conservation Area
25	Permen KP. 35 / Permen -KP / 2013	Procedures for Determination of Status of Fish Type Protection	Establishment of fish species protection status aims to maintain and ensure the existence, availability, and sustainability of fish species while maintaining and improving the quality and value of fish resources and the environment in a sustainable manner
26	Permen KP. 13 / Permen -KP / 2014	Marine Conservation Area Network	Establishment of marine conservation area networks at local, national levels

(a) National Spatial Plan

"In an effort to harmonize the spatial planning regulations with the national strategic projects, the Indonesian government issued, on 12 April 2017, **Government Regulation No. 13 of 2017** ("Regulation 13") regarding Amendment to Government Regulation No. 26 of 2008 on National Spatial Plan."

Notable features of Regulation 13:

- Consideration of the location and utilisation purposes in the determination of zoning policies for (i) forestry zones, (ii) coast, river, and dam demarcation zones, greenery open space zones, (iii) sea, nature, wildlife reserve zones, (iv) mining zones, and other zones;
- Designation of maritime-based areas, climate change risk areas, and geothermal designated areas;
- Specifications of the toll roads, railways, sea lanes and (sea, river, lake and air) ports, agricultural designated areas as well as the national energy network system (oil and gas and electricity infrastructure);
- Expanded scope of the considerations in the determination of spatial planning policies and strategies and adjustments and revisions to be made on the provisions of previous regulations;
- Provisions on the restoration, optimum utilisation, and control of cultivation areas (*kawasan budi daya*) for the purpose of environmental balance and formation of environment control strategies which include strategies for (i) controlling cultivation activities in locations with high conservatory value, (ii) determining restoration of damaged and polluted locations, (iii) balancing the carrying capacity of a buffer area with the environmental capacity, (iv) controlling conversion of forestry areas, (v) reinforcing a community forestry development, and (vi) advancement of cultivation activities by taking into account the bio-ecoregion within 1 or more watershed areas;
- Determination of geothermal designated areas as cultivation areas by ensuring the carrying out of the geothermal business activities in accordance with sustainable and conservation principles and prohibiting the conversion of the area into another cultivation area;
- Mandatory issuance of permits for the use of spaces not covered in the regional spatial plan for strategic activities and/or activities with significant impact on the spatial conditions. In this case, the Minister of Agrarian Affairs and Spatial Planning (Menteri Agraria dan Tata Ruang) is authorised to issue the recommendation for the permit. In the absence of its definition in the regulation, it is generally assumed that what is meant by 'space utilisation permit' is permit for the utilization of a certain area, which could be a location permit (izin lokasi), a building construction permit (izin mendirikan bangunan), or another type of space utilisation permit stipulated in and governed by other regulatory regimes.
- Addition of maritime-based zones to the spatial plan, such as 'maritime city' (kota maritime), which is defined as city located on a coast having the function of or potentially functioning as an international port hub or an export gate for sea and maritime products. Other added zones include the maritime conservation zone (kawasan konservasi maritim) and the climate change vulnerable zone (kawasan risiko perubahan iklim). The foregoing has apparently been prompted by Indonesia's maritime development in the recent years.
- Removal of the provisions on national disaster prone zones, such as provisions on areas prone to landslide, high tide, flooding, volcanic eruption, earthquake, soil movement, active fault, tsunami,

abrasion, and toxic gas, although these areas must still be considered in the determination of strategies for the development of cultivation zones (kawasan budi daya).

- To promote environment sustainability, Regulation 13 stipulates the following minimum protected area (kawasan lindung) allocation percentages:[116]
  - For Sumatera: 40% of the total area;
  - For Java and Bali: 30% of the total area;
  - For Kalimantan: 45% of the total area;
  - For Sulawesi: 40% of the total area;
  - For Papua: 70% of the total area;
  - For Maluku: 30% of the total area;
  - For Nusa Tenggara islands: 30% of the total area.
- The attachments to the previous regulation (Regulation No. 26 of 2008) are replaced with a new set of attachments. The attachments to Regulation 13 of 2017 provides detailed specifications of the national spatial plan, including, among others, the national spatial plan map, the city/municipality system, the electricity power grid system, and the plans for toll roads, (sea, river, lake and air) ports, reserve areas, national strategic areas and terminals for cross border transportation purposes - all of which were not in the previous regulation. (http://www.conventuslaw.com/report/indonesia-new-national-spatial-plan-regulation/)

(b) Environmental protection and management

- **Law No. 32 (2009) on Environmental Protection and Management**: The purpose of this law is to create an environmentally sustainable development through an environmental planning policy, and the rational exploitation, development, maintenance, restoration, supervision and control of the environment. The other key provisions of the law are:
  - Environmental protection and management shall be planned through the following phases: environmental inventorying to obtain data and information on natural resources; stipulation of ecoregions; and the formulation of environmental protection and management plans.
  - The Government shall be responsible for: controlling natural resources; controlling environmental pollution and damage; making strategic environmental assessments; providing quality standards of the environment; regulating legal actions and legal relations between persons and/or other legal subjects; controlling activities which have social impact; developing a funding system for efforts to preserve environmental functions; etc.
  - Every business and/or activity having substantial impact on the environment is subject to an environmental impact analysis in order to obtain a licence to conduct such business or activity as discussed in detail in the Law. Requirements and procedures for obtaining an environmental permit are set out in the Law.

[116] The percentages were determined by considering the respective local ecosystem conditions, characteristics, and functions.

- The Law also makes provision for the management of hazardous and toxic materials as well as hazardous and toxic waste.
- Particular attention should be paid also to the importance given by the Law to the role that communities should play in the environmental protection and management.
- The Law further provides for: development of an environmental information system to support the implementation and development of environmental protection and management policies; rights, obligations and prohibitions of the people; settlement of environmental disputes; investigation powers of the police of the Republic of Indonesia; offences and penalties; etc.

The other major laws and ministerial decrees on environmental protection and management are:

- Law No. 18 (2008) on Solid Waste Management
- Law No. 19 (2009) on Ratification of Stockholm Convention On Persistent Organics Pollutants
- Law No. 7 (2004) Integrated Water Resources Management (IWRM) at the Basin Level
- Government regulation No.19 (1999) on control of pollution and marine damage
- Ministerial Decree No. 51 (2004) on Marine Water Quality Standard
- Ministerial Decree No. 75 (2004) on Organization and Management of National Cleaner Production Center
- Ministerial Decree of MOE No 31 (2009) on Extension and Control of the implementation of Systems of Environmental Management, Eco-labeling, Clean Production, and Environmental-based Technology in Local Government
- Ministerial Decree of MOE No. 18 (2009) on Permits on Hazardous Substances Management
- Ministerial Decree of MOE No. 02 (2010) on The Use of Electronic System of Hazardous Substances Registration in the frame of Indonesia National Single Window within Ministry of Environment
- Regulation No. 16 (2008) on the National Policy and Strategy for the Development of Domestic Wastewater Management
- Ministerial Decree of MOE No. 05 (2009) on Waste Management in Port Area
- Ministerial Decree of MOE No. 01 (2010) on Water Pollution Management
- Ministerial Decree of MOE No. 03 (2010) on Wastewater Standard for Industrial Area

(c) Marine conservation areas and marine protected area

- **Law No. 27 of 2007** mandates local governments to manage coastal areas and small islands, including planning, utilization, supervision and control activities, including by reserving marine conservation areas. The management of coastal areas and small islands requires a systematic and measurable effort in order to optimize the potential of the region for the welfare of the community.
  - Policies on MPAs are set forth in *Article 28 of Law no.27*. According to Article 28: (a) safeguard the preservation of Coastal Ecosystems and Small Islands; (b) protect the

migratory flow of fish and other marine biota; (c) protect marine habitats, and (d) protect traditional cultural sites.

- Determination of Conservation Areas in Coastal Areas and Small Islands is issued in the form of *Ministerial Regulation* (Article 28 paragraph (4)). Meanwhile, to achieve conservation objectives, the Minister shall determine: (a) Category of Conservation Areas; (b) National Conservation Area; and (c) Patterns and procedures for the management of the Conservation Area, and other matters deemed important in the achievement of the intended objectives (Article 28 paragraph (6)).

- **Regulation of the Minister of Marine Affairs and Fisheries No. PER.30 / Men / 2009** concerning the **Management Plan and Zonation of Marine Conservation Area** mentioned among others:
    - In *Chapter III on Water Basin Conservation Management Plan*, Article 4 states that the plan for management of marine conservation area consists of: long-term plan, medium, and annual work plan.
    - *Article 5 paragraph (1)* states that the **long-term plan for the management of the marine conservation area** shall be valid for 20 years from the date of stipulation and may be reviewed at least once in 5 years. Subsequently, paragraph (2) states that the long-term plan includes the management policy of the marine conservation area, which includes: vision and mission, management objectives and targets, and management strategies.
    - *Article 6* describes that the **strategy for managing a marine protected area** includes: (a) institutional strengthening; (b) strengthening the management of regional resources; and / or (c) social, economic, and cultural strengthening. Article 7 outlines the medium-term plan for the management of marine protected areas for a period of 5 years which describes the vision, mission, objectives, management objectives and strategies for the management of marine conservation areas.
    - *Article 7 paragraph (4)* mentions the **strategy of watershed area management for social, economic, and cultural strengthening** through programs such as: (a) socio-economic development of the community; (b) community empowerment; (c) the preservation of customs and culture; and (d) monitoring and evaluation.
    - The **strategy for institutional strengthening for the management of marine conservation areas** is through programs such as: a) improvement of human resources; (b) institutional management; (c) capacity building of infrastructure; (d) drafting of regulation of coastal area management; (e) establishment of a network of marine conservation areas; (f) development of community organizations; (g) partnership development; (h) the development of a sustainable funding system; and (i) monitoring and evaluation.
    - The **strategy for the management of marine conservation area** for strengthening management of area resource, conducted through program, among others: (a) protection of habitat and fish population; (b) habitat rehabilitation and fish populations; (c) research and development; (d) utilization of fish resources; (e) natural tourism and environmental services; (f) supervision and control; and / or (g) monitoring and evaluation.

- The regional authority in the conservation of coastal areas and small islands is described in **Law No. 32 of 2014 on Regional Government**, *Article 27*, where the state authorizes the provincial government to manage resources in marine areas, including exploration, exploitation, conservation and management of marine resources up to 12 nautical miles measured from the coastline toward the high seas and / or towards the archipelagic waters.

- In **Government Regulation (PP) no. 60/2007 on Conservation of Fish Resources**, *Article 1 paragraph (8)*: states that the Marine Conservation Area is a protected water area, managed through the zonation system, to realize the sustainable management of fish resources and the environment.

- **Government Regulation No. 60/2007**, *Article 15* states that:
  - The marine conservation areas which have been determined are managed by the Government or regional government in accordance with their authority.
  - The management of marine conservation areas shall be carried out by the units of the management organization in accordance with the laws and regulations.

- **Government Regulation 60/2007**, *Article 17* states that:
  - The management of marine conservation areas shall be conducted based on the plan for the management of the marine conservation area.
  - A plan for the management of a marine conservation area shall be prepared by a unit of the organizational unit of management.
  - Every marine conservation area management plan shall contain zoning of such area.
  - Zoning of marine conservation area consists of: core zone, sustainable fishery zone, utilization zone, and other zone.

(d) Conservation of fishery resources

- **Law no. 31/2004 as amended by Law 45/2009** describes the protection of fish resources as follows:

- *Article 1, point 8*: Conservation of Fish Resources shall be Efforts to Protect, Conserve and Utilize fish resources, including ecosystems, species and genetics to ensure their availability, availability and sustainability while maintaining and improving the quality and value of fish resources.
- *Article 13*, *paragraph (1)*: The context of the management of fish resources shall be carried out through conservation of ecosystems, fish species and fish genetics.
- *Article 13*, *Paragraph (2)*: states that further provisions on ecosystem conservation, fish species conservation and fish genetic conservation as referred to in paragraph (1) shall be regulated by Government Regulation. Therefore, the Government may stipulate conservation areas in areas that are deemed necessary, among others, as marine nature reserves, waters national parks, marine tourism parks and / or fishery sanctuaries.

- Furthermore, **Government Regulation 60/2007**, *Article 47* states that in the framework of conserving fish resources:
  - Supervision of the conservation of fish resources as referred to in paragraph (1) can be done through: (a) guarding and patrolling the marine conservation area; and (b) supervision of the use of fish and genetic species of protected fish;
  - Supervision should be carried out by fishery supervisor, consisting of Fisherman, Civil Fisheries Investigator and Non-Civil Fisheries Fisheries Investigator; and
  - Communities may be involved in supervising the conservation of fish resources.

(e) Habitat and biodiversity protection

Recognizing that the full potential of the country's biodiversity is undervalued and decreasing, a mix of synchronized polices, supporting laws and regulations, appropriate instititution for biodiversity management, proactive measures, and sustainable financing mechanisms is crucial.

The following are the key laws and ministerial decrees on the protection of ecosystems and biodiversity:
- Ministerial Decree (MOE) No 200 (2004) on the Standard Criteria for Seagrass Ecosystem
- Ministerial Decree (MOE) No 201 (2004) on the Standard Criteria for Mangrove Ecosystem
- MMAF Ministerial Decree No 04/ 2013 on Declaration for Full Protection of Manta Ray Fish
- MMAF Ministerial Decree No 07/ 2013 on the Certification of the Origin of the Seaweed
- MMAF Ministerial Decree No 18/ 2013 on Declaration for Full Protection of Whale Shark (*Rhincodon typus*)
- MMAF Ministerial Decree No 35/ 2013 on Procedures for the Declaration of the Protection Status of Fish Species
- Law No 11 (2013) on the Ratification of Nagoya Protocol on Access to Genetic Resources and The Fair and Equitable Sharing of Benefits Arising from Their Utilization to The Convention on Biological Diversity

16.2 Institutional Arrangements

To realize sustainable marine-based economic development, all parties and stakeholders are required to play their respective roles in several priorities in coordination and partnership with each other. The following were pointed out by the Bruntland Commission in the document "Our Common Future":[117]

1. Establish national regulations and regulations and their institutions as the primary basis for institutional change in sustainability building.
2. Building regional and interregional actions within a framework of mutual responsibility, accountability and transparency.
3. Development of global institutions in institutional capacity development programs.

[117] United Nations. "Our Common Future" Chapter 12: Towards Common Action: Proposal for Institutional and Legal Change. A/42/427 Annex.

The **National Ocean Council** was established in 2007 to coordinate ocean-related affairs. In addition, **Sea Partnerships** was also established by the 2007 Law Concerning the Management of Coastal Zones and Small Islands (PEMSEA 2015). However, state institutions with an interest in the sea still make policy in a sectoral way. These institutional mechanisms should be strengthened, capable of synergizing and integrating marine development policies, crafting cross-sector solutions, and implementing actions. The Coordinating Ministry for Maritime Affairs was established in 2015 and is currently the Coordinating Ministry for Maritime and Investment Affairs.

Table 16.4: Marine-related Institutions.

No.	Legal basis	Settings / Policy	Main Duties and Functions	Area Jurisdiction and Restrictions
1	Ministry of Marine Affairs and Fisheries	• Law (UU) no. 31/2004 on Fishing amended by Law no. 45/2009 • UU no. 27/2007 on Coastal Area Management and Small Islands • Law no. 32/2014 • Law no. 7 Year 2016 on protection and empowerment of fishers, aquaculturists, and salt farmers. • Government Regulation no. 60 of 2007 on fishery resource conservation. • Ministerial Decree no, 75-85 of 2016 on fisheries management plan	• Fishery catch • Fishery cultivation (sea and inland) • Institutional arrangements for fisheries (laws, policies, plans, implementing institutions, coordination with other agencies, institutions and partners) • Management of coastal areas and small islands	• Inland Waters • Archipelagic Waters • Territorial Sea • EEZ • high seas
2	Ministry of Home Affairs	UU no. 32/2004 on Local Government	• Implementation of autonomy area in the regional sea • Set up institutional arrangement in the area • Set up monitoring and enforcement system in repeated problem border area in the region sea	• District / City that has jurisdiction over the regional sea; • Provinces that have jurisdiction over the regional sea
3	Ministry of Foreign Affairs	UU no. 24/2000 about International Agreements	• The border area of NKRI • Ratification of international conventions and agreements • Path of international cruise • Border arrangements with neighboring countries	• Inland waters • Archipelagic waters • Territorial Sea • Additional Zones • EEZ • Continental Shelf • High seas • Oceanic region
4	Ministry of Defense	Act. No.3 of 2002 on State Defense	Defense Policy in the islands, territorial seas, EEZ and continenetal shelf	• Inland waters • Archipelagic waters • Territorial Sea • Additional Zones • EEZ • Continental Shelf
5	Ministry of Transportation	UU no. 17/2008 on Shipping Government Regulation No. 64 of 2015 on Port	• Ships and navigation • Ports • Seafarers • Marine environment protection • Safety and security at sea	• Inland waters • Archipelagic waters • Territorial Sea • Additional Zones • High seas

Table 16.4: Marine-related Institutions. (cont.)

No.	Legal basis	Settings / Policy	Main Duties and Functions	Area Jurisdiction and Restrictions
6	Ministry of Energy and Mineral Resources	No. 22/2001 on Oil and Gas; No. 30/2007 on Renewable Energy; No. 4/2009 on Mineral and Coal Mining	• Offshore Oil and Gas • Mining and class C Minerals on the beach areas	• Inland Waters • Archipelagic Waters • Territorial Sea • Continental Shelf • High seas • Oceanic region
7	Ministry of Finance	Act. No. 17/2006 on Customs	Formulation of policy and financing marine development	• Inland Waters • Archipelagic Waters • Territorial Sea • Additional Zones • EEZ • Continental Shelf • High seas • Oceanic region
8	The Ministry of Education and Culture	UU no. 5/1992 About the Objects of Culture	• Inclusion of environment, ecosystems, biodiversity, oceans, pollution, and conservation in school curricula; • Student activities on environmental management, and participation in coastal and ocean management	• Inland Waters • Archipelagic Waters • Territorial Sea • Additional Zones • EEZ • Continental Shelf • High seas • Oceanic region
9	Ministry of Tourism	Law no. 10/2009 About Tourism	Tours Bahari (diving, snorkeling, surf, sea attractions, etc.)	• Inland Waters • Archipelagic Waters • Territorial Sea • Additional Zones • EEZ • Continental Shelf
10	Ministry of National Development Planning	UU no. 17/2007 on National Long-Term Development Plan	Planning development: national, cross sectoral, and institutional	• Inland Waters • Archipelagic Waters • Territorial Sea • Additional Zones • EEZ • Continental Shelf • High seas • Oceanic region
11	Ministry of Environment and Forestry	UU no. 32 of 2009 T Entang Environmental Protection and Management	• Coastal EIA and small islands • Formulation of Policy and environmental management of national parks, coast, sea and small islands	• Inland Waters • Archipelagic Waters • Territorial Sea • Additional Zones • EEZ • Continental Shelf • High seas • Oceanic region
12	Ministry of Research and Technology	Act. No. 18/2002 on National System of Research, Development, and Application Science and Technology	• Research and studies onmarine resource • Research and development of new technologies • Review of technology for application and deployment (e.g., marine biotechnology, ocean energy, sea water utilization)	• Inland Waters • Archipelagic Waters • Territorial Sea • Additional Zones • EEZ • Continental Shelf • High seas • Oceanic region

Table 16.4: Marine-related Institutions. (cont.)

No.	Legal basis	Settings / Policy	Main Duties and Functions	Area Jurisdiction and Restrictions
13	Indonesian National Police	UU no. 2/2002 on Police of the Republic of Indonesia	• Security of territorial waters • Patrolling and enforcement	• Inland Waters • Archipelagic Waters • Territorial Sea
14	Navy	Act. No. 34/2004 on The Indonesian National Armed Forces - Navy	• Security of territorial sea, EEZ and border of NKRI • Patrolling and enforcement of law at sea • Marine management • Marine development • Marine environmental protection	• Inland Waters • Archipelagic Waters • Territorial Sea • Additional Zones • EEZ • Continental Shelf • High seas • Oceanic region
15	Coast guard	UU no. 32/2014 about the sea	• Patrol security and safety in the region waters and region Indonesian jurisdiction • Compile national Policy on security and safety in the Indonesian waters and under Indonesian jurisdiction • Organize early warning system, security and safety in the waters under Indonesian jurisdiction • Guarding, supervision, prevention, and action against violation of laws in the waters under Indonesian jurisdiction • Synergize and monitor implementation patrol waters by agency related • Give technical and operational support to related agency • Provide search and rescue in the regions and waters under Indonesian jurisdiction • Doing other tasks within national defense system	• Inland Waters • Archipelagic Waters • Territorial Sea • Additional Zones • EEZ • Continental Shelf • High seas • Oceanic region
16	Coordinating Ministry for Maritime and Investment Affairs	Presidential Regulation Number 10 of 2015 established the Coordinating Ministry for Maritime Affairs. The coordinated ministries are Maritme Affairs and Fisheries, Tourism, Transportation, and Energy and Mineral Resources.	• Coordination and synchronization of formulation, determination, and implementation of ministries' policies and plans related to maritime affairs • Control policy implementation of the Ministries/Institutions related to maritime affairs • Coordination and synchronization of maritime state resilience development and marine resources management • Coordination of policy for the development of marine infrastructure • Implementation of other functions provided by President	• Inland Waters • Archipelagic Waters • Territorial Sea • Additional Zones • EEZ • Continental Shelf

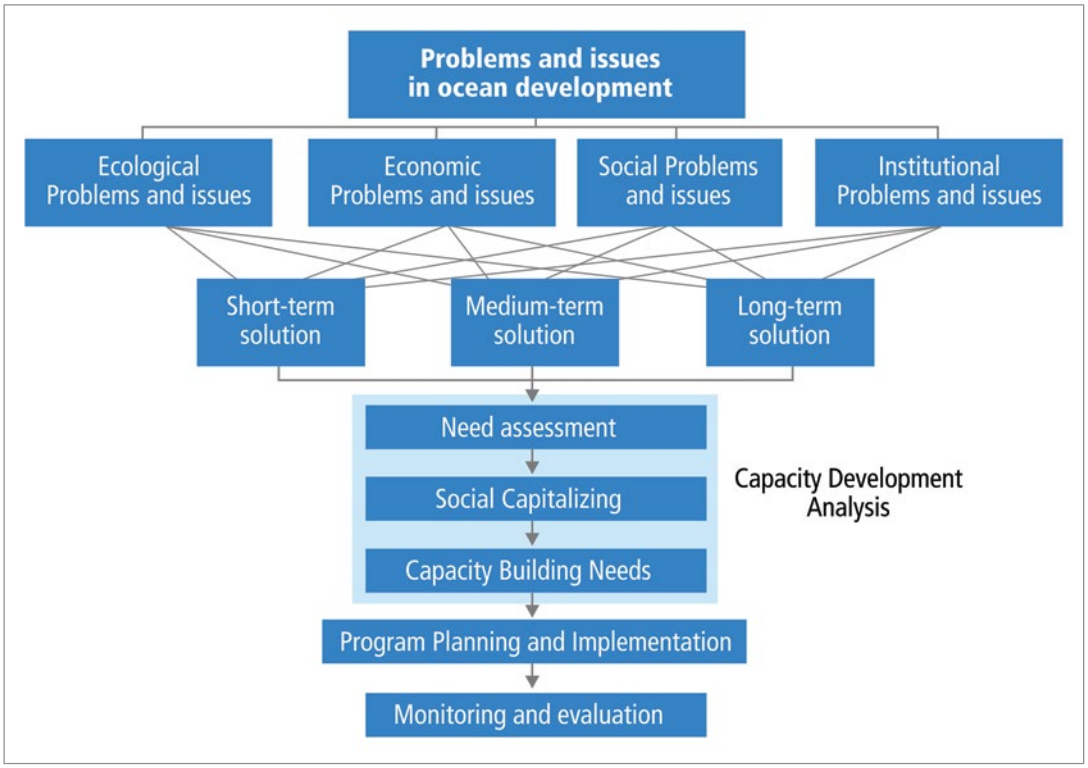
Source : Kusumastanto, 2003. Names of ministries have been updated.

16.3 Capacity Development, Research and Development (R&D), and Knowledge Management

Capacity development is the process through which individuals, organizations, and societies obtain, strengthen and maintain the skills, knowledge, tools, equipment, and other resources to enable and empower them to identify and assess the issues, formulate plans and strategies, set and achieve objectives, perform jobs and functions, solve problems and address issues, monitor and evaluate outcomes and gaps, and improve performance. Capacity development is very important because it is related to the process of building the capability needed to solve the complex issues in ocean management, ranging across ecological, economic, social and institutional aspects, and developing the means and conditions required to enable this process (**Figure 16.1**).

As pointed by FAO, past approaches to capacity development (in fisheries and other sectors) have tended to focus primarily on technical support through skill-based training to individuals and through institutional strengthening; while less attention had been paid to non-sector specific knowledge and skills, such as business management, socio-economics and good governance.[118] For more effective ocean management, and sustainable blue economy development, it is essential to have ex-ante and ex-post evaluation of capacity development needs and outcomes, and assess the gaps, success and sustainability of capacity development initiatives.

Figure 16.1: Marine Capacity Enhancement Scheme.



[118] http://www.fao.org/tempref/docrep/fao/007/y5613e/y5613e02.pdf

Governments, academe, international/regional organizations should develop national and regional plans for improving human capacity development at all levels in society and in a wide range of technical, managerial and enabling roles.

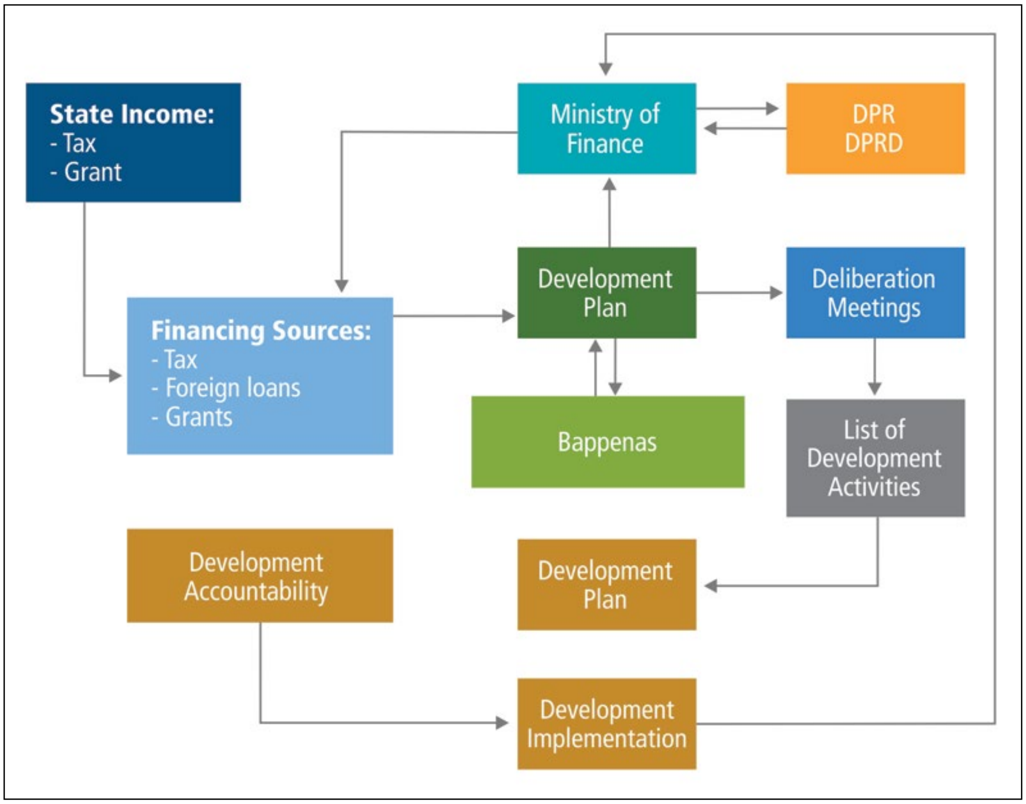
Research and development (R&D) programs are directed toward the innovation, introduction, and improvement of products, services and processes. In ocean and coastal management, it is essential to recognize the importance of science and technology in managing the economic development of our seas and ocean responsibly, and introducing innovative technologies and processes to support sustainable, inclusive and resilient blue economy. With the help of scientific and technological innovation, the development of economic activity in the ocean and sustainability of marine ecosystems can go hand in hand with one another. In Part 3 of this report, the opportunities for blue economy have been described, but there are capacity development and R&D initiatives that are called for to realize the potential of seas while ensuring ocean health and integrity of coastal and marine ecosystems. It is important to support R&D programs and advance innovations that may benefit both economic growth and environmental sustainability. Although science has led to many of the actual developments and innovations, there are still major gaps on knowledge about marine ecosystems' biophysical characteristics and impacts of new, emerging industries that exist today, which constrain future developments and call for precautionary approaches.

Knowledge management is important because it supports capacity development, and boosts the efficiency in problem solving, strategic planning, decision-making, and implementation ability. It helps in raising awareness of different stakeholders and understanding about environmental issues, new technologies, and innovative and sustainable practices they can apply. Knowledge Management involves a set activities of discovering, capturing, sharing and applying knowledge, and has the following major components: (1) people, who gather, process, apply and keep the knowledge and share them; (2) processes, with which people create, capture, store, organize, and distribute knowledge; and (3) information, which are the pieces of facts and data that people convert into and apply as knowledge.

16.4 Financing Mechanisms and Modalities

Another enabling factor for ocean governance is sustainable financing. The financing scheme to support ocean management is shown in **Figure 16.2**. Ocean management and marine development is one of the key priorities in the national development agenda. Bappenas overseas the development planning while financing in the form of taxes, grants, foreign loans would come from the Ministry of Finance and State income. Through consultations and deliberation meetings, the development activities are identified.

Figure 16.2: Sustainable Financing Arrangements for the Ocean Management.



16.4.1 Financing Fisheries Management[119]

The Government of Indonesia provides support to the fisheries sector via a number of channels. The main ones include MMAF, the MOEF, and loan subsidy programs.

The initial budget plan for the last several years shows declines in MMAF's allocation: the allocation was US$ 790.56 million in 2015, US$ 786.28 million in 2016, US$ 688.87 million in 2017, and US$ 539.83 million in 2018. Taken alone, this trend would imply a de-prioritization of the fisheries sector. However, this is due to MMAF's inability to spend its allocated budget in prior years, resulting in a ratcheting down of its planned budget over time. Most of this funding was provided in the form of capital assets (e.g., boats) rather than for developing governance or sustainable fisheries management components.

There are two sources of government revenue from the fisheries sector: non-tax state revenue (Penerimaan Negara Bukan Pajak, or PNBP) and tax revenue.

[119] The information in this sub-section is from: California Environmental Associates. 2018.

In 2015, MMAF issued **Regulation No. 75/2015** to increase PNBP tariffs. As a result, fisheries sector PNBP from the MMAF Directorate General (DG) Capture Fisheries, DG Aquaculture, and DG Business Competitiveness rose from US$ 5.86 million in 2015 to US$ 26.82 million in 2016. In 2016, US$ 26.80 million, or 99.9% of the total, originated from DG Capture Fisheries. In 2017, fisheries PNBP amounted to US$ 36.38 million, the highest level in the last ten years. While the increase in fisheries sector PNBP is notable, the fisheries sector's contribution to overall PNBP remains very low compared to other sectors. It increased from 0.03% of total PNBP in 2015 to 0.14% in 2016.

Tax revenue from the fisheries sector is quite small. In 2016, approximately US$ 62.19 million was collected from the sector, with a subsector breakdown of 5.84% from capture fisheries, 9.15% from aquaculture, and 85.01% from others (e.g., fish processing and trading). In 2017, tax revenues from the fisheries sector amounted to US$ 80.15 million. As a result of the low tax collection, the fisheries sector tax-to-GDP ratio is significantly below the national level. From 2011 to 2016, the average fisheries sector tax-to-GDP ratio was only 0.26%. This means that the tax collected from the sector did not even extend to 1% of the overall sector, as measured by GDP.

16.4.2 Financing the Management of MPAs and Marine Conservation Areas

The MOEF, which holds management authority for the national parks (Balai Taman Nasional) in Indonesia, spent US$ 42.28 million for management of national parks in 2016, or about half of the Natural Resources and Ecosystem Conservation Program expenditures of US$ 83.47 million. This included US$ 8.29 million for the ten national parks with significant marine areas.

16.4.3 Financing Biodiversity Protection[120]

During the period 2006-2016, the total biodiversity budget of the central government reached US$3.5 billion, fluctuating annually, and amount of 0.87% of the annual central government budget. A Finance Needs Assessment was conducted (through the UNDP Biodiversity Finance Initiative or BIOFIN) to measure financial need and and identify the gaps constraining the achievement of the targets of the Indonesian Biodiversity and Strategic Action Plan (IBSAP) and Aichi targets. A closer look into activities under the MOEF reveals that many of projects that support biodiversity conservation often have minimal underlying assets.

The Biodiversity Finance Plan (BFP) proposes steps to implement a mix of financial solutions in order to expand and improve the country's biodiversity financing and achieve national biodiversity targets. Considering that the budget from the national government and regional income sources are not enough to meet the financing needs and biodiversity targets, the following biodiversity

[120] https://www.biodiversityfinance.net/country/indonesia.

finance solutions, including focusing on prioritized strategies/actions, acquiring non-fiscal resources, and engaging with a broader group of stakeholders, have been prioritized:

1. Strategizing Islamic Fund and Matching Private Fund for Marine Protected Areas (MPA)
2. Green/Blue Islamic Bond (Sukuk)
3. Crowdfunding
4. Ecological Fiscal Transfer (EFT)
5. Corporate Social Responsibility for Biodiversity

One of the above financing solutions is to mobilise finance from the Green/Blue Islamic Fund or Sukuk issued by the Government of Indonesia to fund biodiversity-related projects. Bappenas or Ministry of Planning also proposed the use of Global Climate Fund, among others, to help fund the proposed projects. Additionally, projects coming from other ministries were considered, such as those under the Ministry of Public Works and MMAF.

16.4.4 Alternative Models

At the regional level, modalities for the sustainable financing of the marine sector can use two approaches, both of which involve collaboration and partnership with private sector and communities. First is the **public-private partnership model** (**Figure 16.3**). The existence of partnerships between the public and private will actually encourage the integrated development of marine areas. The integrated development approach essentially considers the management of various influential components, whether directly related to marine or not, and interconnected actions to achieve the development goals in a sustainable and coherent manner. The advantage of this model is the interaction between public and private parties and the partnership relationship that is developed for collaboration, joint implementation, capacity building, and financing.

Second is the **collaborative model** (**Figure 16.4**). The institutional structure of the collaborative model is more complex, as it involves all stakeholders, such as the communities, private sector, and government. Collaborative management is defined as a form of partnership in which the community as a beneficiary of local resources, government, other stakeholders (boat owners, fish traders, boat makers, employers), and external actors (e.g., NGOs) share responsibility and authority over fisheries management.[121] In the current era of autonomy and decentralization, local authorities and central authorities have a coordinating relationship in management activities, and both have the right to conduct monitoring and evaluation. Local and regional governments have the authority to issue local regulations (legislation) against collaborative management bodies, while the central government only has the right to consult. In the governance space, all three stakeholders (government, private and community) are jointly responsible for the collaborative management body. The main stream of finance flows from resource utilization activities to collaborative management bodies.

[121] Pomeroy R, Guieb R.R. 2006.

Figure 16.3: Public-Private Partnership Model.

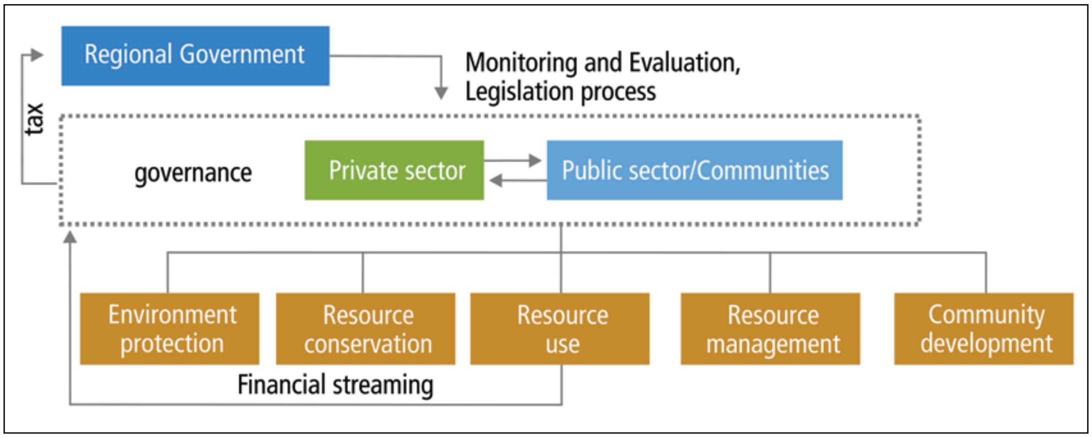
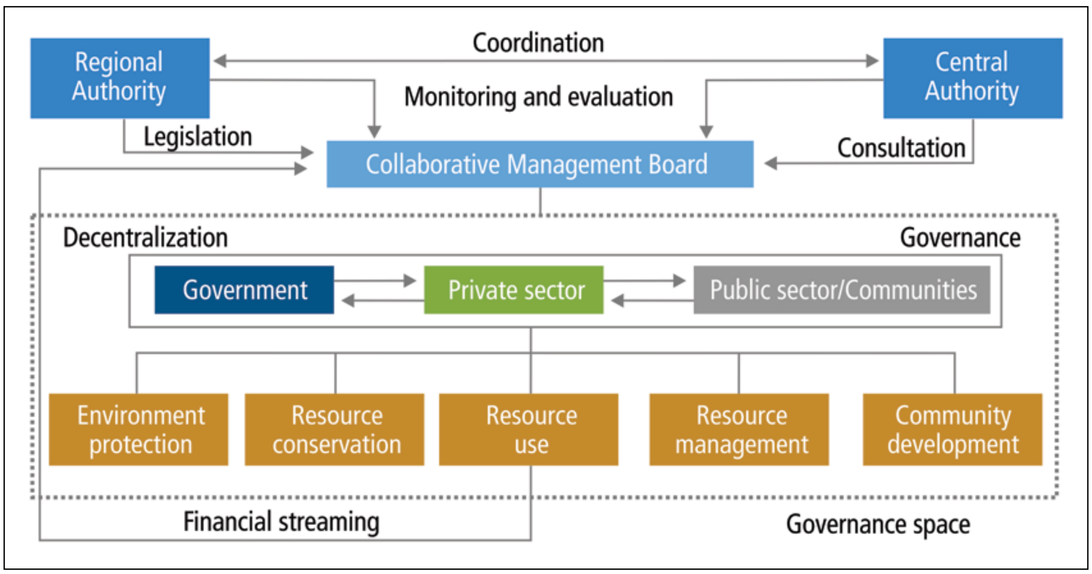


Figure 16.4: Collaborative Model.



16.5 Stakeholder Participation Mechanisms

Fisheries and coastal resource management experts accept that resources can be better managed and resource use conflicts reduced, when fisherfolk and other stakeholders are more involved in management. After Reform Era, devolution form of decentralization has been implemented due to the enactment of the Local Autonomy Law. With policies of decentralization, programs using community-based management and co-management approaches are increasing, but require the development of new legal and institutional arrangements at national, sub-national or local levels to complement existing political, economic, social and cultural structures.

Within the framework of coastal management and development, the role of stakeholders is essential. Stakeholders here are defined as individuals, groups or oganizations that have a direct interest in the land, resource or organization, and would be impacted by the outcome of a policy, plan or project.

Table 16.5: Stakeholders in Coastal and Ocean Management.

1	Marine and Fisheries Ministry	Regulation and coordination
2	Ministry of Environment and Forestry	Regulation and coordination
3	Ministry of Agriculture	Regulation and Technical
4	Ministry of Information	Regulation and Technical
5	Ministry of Public Works	Regulation and Technical
6	Ministry of Internal Affairs	Regulation and Technical
7	Ministry of Agriculture and Spatial Planning	Regulation and Technical
8	Ministry of Transportation	Technical Supporting
9	National Development Planning Agency	Policy / baseline / coordination
10	Navy	Security/supporting
11	Center for Coastal and Marine Resources Studies (based in Bogor Agricultural University (IPB)	Scientific data; research and planning support
12	Indonesian Institute of Sciences (LIPI); Agency for the Assessment and Application of Technology (BPPT)	Scientific data; research support
13	Local Fishermen Organization	Knowledge, mobilization, implementation; Users and beneficiaries
14	National Fishermen Organization	Knowledge and mobilization, implementation
15	Fisheries NGOs	Monitoring and mobilization
16	Environmental NGOs	Monitoring and mobilization
17	Fisherfolk and coastal households	Users and beneficiaries

16.5.1 Community-based Fisheries Management

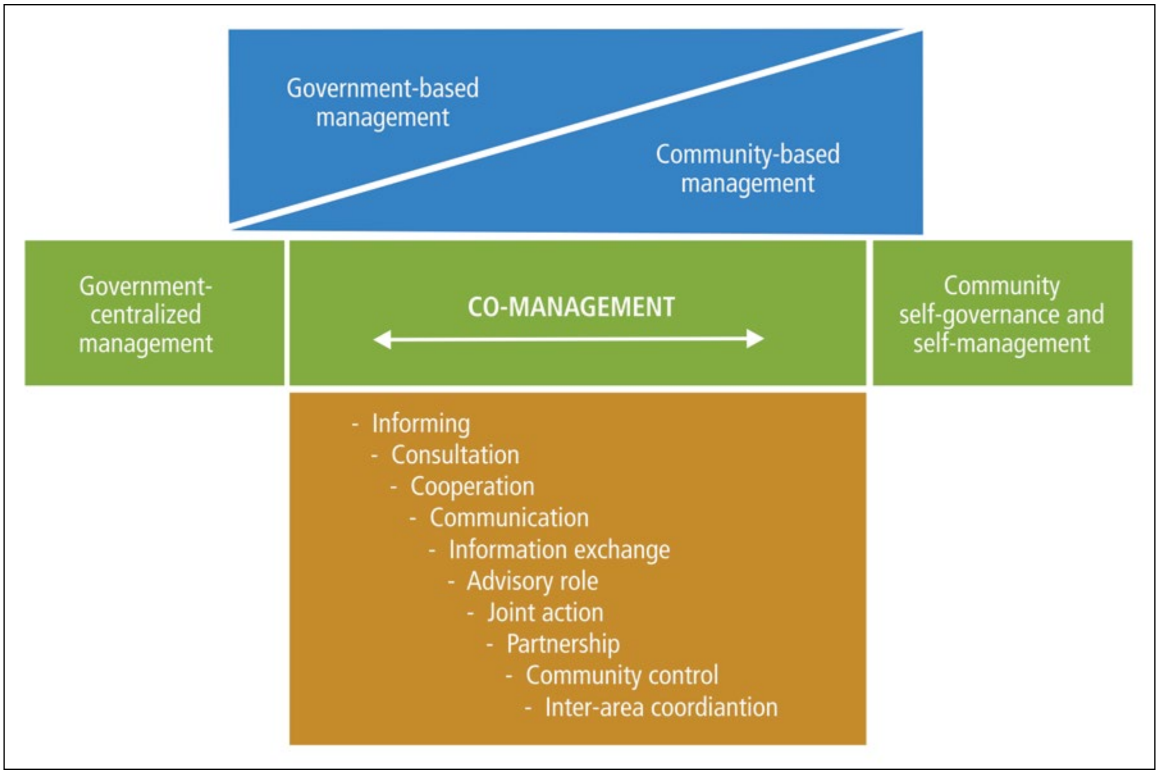
Fisheries management is often assumed to be the responsibility of the government. In Indonesia, with 14,000 islands and fishing grounds scattered over a wide area, the effective capacity of the government to monitor, regulate and manage is limited. **Community-based fisheries management** (CBFM) may be viewed as a process by which fishers are given the opportunity and responsibility to manage their own resources; define their needs, goals, and aspirations, and make decisions affecting their well-being. In many cases of coastal water management, there is rarely a space where people can become drivers in wates and coastal management, even if there are marine rights. From studies conducted by various parties, these traditional rights could decay and even disappear without a trace. Thus, the degree of collaborative-management as described by Pomeroy and Guieb (2006) may not reach the degree where people can exercise self-governance and self-management over their resources. In eastern Indonesia, there are traditional arrangements, such as *Sasi* in Maluku and Papua, *Awig-awig* in Lombok, *Panglima Laot* in Aceh, Pahawang in Lampung or *Seke* in Sangihe and Talaud. Community-based fisheries management using local knowledge and consensus among the community members has proven to be effective in both managing fishery resources on a sustainable basis and allocating fairly the access to these resources among the local users. The collective participation of fishers or coastal residents as stewards in marine fisheries resource management brought out a sense of unity of purpose, and has shown to be effective, sustainable and inclusive. Working in partnership with local community-based management systems, the government can focus more on providing technical assistance and capacity development on sustainable and cost-effective fishing practices, processing, access to markets, and protection of coastal habitats.

16.5.2 Co-Management of Fishery Resources and Coastal Habitats

The problem is that conflicts occur in the dimensions of authority and policy because there is no nomenclature for the management of coastal and marine natural resources that empowers communities to manage their resources using traditional instruments or pre-existing governance system, such as in fisheries (Ruddle and Satria 2010). The implementation of collaborative-management will depend on the level of political will of the state, in this case the MMAF, to share the functions and responsibility with the fisherfolk, coastal communities, and small islands, and work with them to manage their own resources. One issue that has been raised is that the so-called devolution is more common when the state transfers its power to private parties through the Hak Guna Usaha and Hak Pakai regimes but which often lead to the exclusion of fishermen and coastal communities.

Co-management, or the joint management of the coastal and marine habitats, is often formulated in terms of some arrangement of power sharing between the State and a community of resource users. In the fisheries sector, co-management involves cooperative management of the aquatic resources by the user groups and the government, where both parties have joint responsibility for the management and ensuring sustainability of the resource, and are involved during the planning, decision-making, implementation and enforcement processes. In co-management, the user group and the government develop rules and regulations together, and work towards implementing them as a unit. Co-management is different from community management as the government plays an important part in the decision-making process. Mutual trust is very important in co-management arrangement, as functions and responsibilities are divided between government and community, and all coastal stakeholders are involved to contribute to the management of coastal and marine resources.

Figure 16.5: The Degree of Power Distribution in Co-management.



Source: Pomeroy and Guieb, 2006.

Establishment of a fishery co-management system between the local government and fisher community may become yet an alternative to empowering local fishery services and to build a sound fishery management regime. One example is the direct involvement of fishers in coral reefs management in the Jemluk village in Bali (**Box 16.1**).

Box 16.1 Co-management Arrangement for Coastal Resource Management in Bali

The artificial reefs deployed by the local government are managed by fishers. Fishers are benefiting from the installation of artificial reefs by generating income through fishery and tourism activities.

As the management tasks were delegated to villagers and village government, the villagers of Jemluk developed their own management mechanism. Under the supervision of the Provincial Fisheries Service, Tourism Department and the local police station, villagers and the village government established co-management mechanism for coastal waters. A fisher association named the Tunas Mekar Fisher Association (TMFA), whose members consist of fishers who also work in tourism, was established. The objective of the TMFA is to manage

Box 16.1 Co-management Arrangement for Coastal Resource Management in Bali (cont.)

Jemluk waters as a source of people's livelihood. In addition to fishing, the TMFA members bring tourists for snorkeling and diving in both coral and artificial reefs. The TMFA has an executive board consisting of one coordinator, one secretary, and one treasurer. **Table 16.6** shows the basic rules or regulations initiated by the villagers for the purpose of managing Jemluk waters. The rules are applied to both members and nonmembers of the TMFA.

Table 16.6: Basic Co-management Rules on Utilization of Jemluk Coastal Areas.

Objective of the rules	To manage Jemluk waters as a source of people's livelihood Rules
Rules	• Unlawful to dump garbage at sea.
	• Prohibition to extract corals, and catch ornamental fish.
	• Ban the use of cyanide, other poisons, dynamite, bombs, and destructive fishing gears and methods.
	• Area under the co-management is the water from the coastline until 35m deep
	• The rules are stipulated by community convention under supervision of the Provincial Fisheries Service, Tourism Department and the local police.
Roles and responsibilities	• Monitoring of the rules and patrolling are performed by villagers.
	• Enforcement of the rules is under the auspices of the local police.
	• Users and beneficiaries

Under the coastal waters co-management measures, pressure on the resources seemed to be reduced. The construction of the artificial reefs made the resource more productive. The pristine condition of beaches was gradually regained. The new approach to resource management, based on village participation, has been effective. The artificial reefs, which were developed to replace destroyed coral reefs and provide fish habitats, have also functioned as fishing grounds for small-scale fishers, ecotourism and recreational areas, as well as the entry point for co-management.

Source: Nikijuluw, Victor P.H. "Establishment of a Local Fishery Co-Management: Lessons Gained from Bali Island," Proceedings of the International Workshop on Fisheries Co-management.

16.6 Integrated Coastal Management

Integrated coastal management (ICM) is considered the key approach for implementing sustainable development in coastal areas. The SDS-SEA, Convention on Biological Diversity, and other international programmes have recommended this approach.

According to Cicin-Sain and Knecht (1998), there are at least five dimensions of the key word **integrated**:

- *Intersectoral integration*, which involves both horizontal integration among different coastal and marine sectors, and integration between coastal and marine sectors and land-based sectors that affect the coastal and ocean environment;
- *Intergovernmental integration*, i.e. integration among different levels of government (national, provincial, local);
- *Spatial integration*, or integration between the land and the ocean sides of the coastal zone;
- *Science-management integration*: integration among the different disciplines important in coastal and ocean management; access to and use of scientific information, including socioeconomic data, is important in evidence-based policy- and decision-making;
- *International integration*, i.e. integration among nations.

ICM has been defined as "a dynamic process in which a coordinated strategy is developed and implemented for the allocation of environmental, socio-cultural and institutional resources to achieve the conservation and sustainable multiple use of the coastal zone" (Sorensen, 1993). The coordinated strategic planning is at the core of ICM. It involves the five dimensions of integration mentioned above. Engaging the different stakeholders in ICM planning and implementation of action plans and projects is crucial. The dynamic process suggests adaptive management as needs, environmental and socioeconomic issues and priorities may change over time. This requires regular monitoring and evaluation of the ICM plan, and assessment of the effectiveness of management interventions and actions, and their outcomes and impacts on the coastal environment and communities. The governance mechanisms discussed in previous sections – policies, laws and institutional arrangements; capacity development and knowledge management; financing mechanisms; stakeholder participation and partnerships – together with committed leadership are essential to realize the aims of ICM and the goal of achieving sustainable and inclusive development in the coastal areas. The ICM approach and blue economy development are in line with the Indonesia national ocean policy as well as the SDGs and other international agreements on management of oceans, environment, water resources, biodiversity and fisheries, and on climate change mitigation and adaptation.

Progress has been made in initiating ICM in Indonesia. Bali is the first ICM site established in 2000 by PEMSEA. As of 2017, around 46,207 km or 48.55% of coastline[122] is covered by an ICM plan (**Table 16.7**). The Coastal and Marine Strategic Plan (CMSP) covers 44,900 km (47.17%), while the RZWP3K (Zoning Plan - ZP) covers 1.307 km or 1.37% (Recapitulation ICM Plans Document in Indonesia 2017).

Indonesian Government validated *Law number 27/2007* and *Law Number 1/2014* for arrangement of Strategic Plan for Management of Small Island and Coastal Area, and Zoning Plan for Management

[122] The percentage of coastline was estimated using the previous estimated total coastline of 95,181 km from the *Statistics of Coastal and Marine Resources 2016*. (46,207÷95,181=48.55%) In 2018, BPS reported the total coastline to be 99,000 km.

of Small Island and Coastal Area, which were signed by Governor Regulation. However, management and action plans as well as institutional arrangements are needed to implement the strategic plan and zoning plan, focusing on the key areas of concern in each ICM site. Thus, the coastal areas covered by the ICM plans (CMSP and Zoning Plan) still have more work to do to put in place an effective and functioning ICM system. As part of developing action plans and implementing the ICM strategy, blue economy opportunities should be incorporated to promote sustainable economic activities, encourage innovations, stimulate investments in climate resiliency and environmental management facilities, and generate incomes and jobs, while protecting water resources, habitats, and biodiversity.

Table 16.7: Recapitulation ICM Plans Document in Indonesia 2017.

No.	Province	Coastline (km)	ICM plans (by MMAF)		PEMSEA ICM Sites
			CMSP	ZP	
1	Aceh	2,666.29	3	1	
2	Sumatera Utara	1,299.50	3	1	
3	Riau	2,078.15	1	1	
4	Sumatera Barat	2,009.23	3	2	
5	Bengkulu	625.35	3	1	
6	Jambi	236.00	3	1	
7	Sumatera Selatan	570.14	0	1	
8	Lampung	962.17	3	2	
9	Kepulauan Riau	5,807.51	0	1	
10	Bangka Belitung Kepulauan	2,295.08	3	1	
11	Banten	876.13	1	2	Tangerang
12	DKI Jakarta	214.97	3	2	
13	Jawa Barat	814.82	3	1	Sukabumi
14	Jawa Tengah	741.49	3	2	Semarang
15	DI Jogyakarta	129.60	3	1	
16	Jawa Timur	3,263.09	3	2	
17	Bali	630.17	2	1	Bali (whole province)
18	Nusa Tenggara Barat	2,543.59	3	2	East Lombok
19	Nusa Tenggara Timur	6,273.18	2	2	
20	Kalimantan Barat	1,439.57	3	1	
21	Kalimantan Tengah	769.39	3	2	
22	Kalimantan Selatan	1,271.00	1	1	
23	Kalimantan Timur	1,169.81	3	1	Bontang
24	Kalimantan Utara	751.10	1	2	
25	Sulawesi Utara	1,306.94	3	3	

Table 16.7: Recapitulation ICM Plans Document in Indonesia 2017. (cont.)

No.	Province	Coastline (km)	ICM plans (by MMAF)		PEMSEA ICM Sites
			CMSP	ZP	
26	Gorontalo	655.80	3	1	
27	Sulawesi Tengah	6,310.15	3	2	
28	Sulawesi Barat	629.52	3	2	
29	Sulawesi Selatan	1,983.70	3	2	
30	Sulawesi Tenggara	3,147.82	3	1	
31	Maluku	9,685.94	3	1	
32	Maluku Utara	6,626.05	1	1	
33	Papua	10,120.05	0	0	
34	Papua Barat	11,743.19	0	0	
Total (km)		**91,646.47**	**44,900**	**1,307**	

Source: Recapitulation ICM Plans Document in Indonesia 2017.

16.7 Partnerships in Ocean Stewardship

16.7.1 Partnership for Maritime Safety

Marine Electronic Highway

The International Maritime Organization (IMO) commenced implementation of the Marine Electronic Highway (MEH) Demonstration Project in the Straits of Malacca and Singapore (SOMS) following the signing of a grant agreement between the Global Environment Facility (GEF)/World Bank and IMO in 2005. The MEH Demonstration Project was a collaborative agreement between IMO and the littoral States of Indonesia, Malaysia and Singapore, and in partnership with the Republic of Korea, International Hydrographic Commission, the International Chamber of Shipping, and the International Association of Independent Tanker Owners. The regional demonstration project aimed to link shore-based marine information and communication infrastructure with the corresponding navigational and communication facilities aboard transiting ships, while being also capable of incorporating marine environmental management systems. The overall objectives were to enhance maritime services, improve navigational safety and security, and promote marine environment protection and the sustainable development and use of the coastal and marine resources of the Straits' littoral States.

A national component of the MEH Demonstration Project was also implemented in Indonesia. It consisted of the procurement, installation and management of the marine information equipment that will provide maritime information to the MEH from the Indonesia part of the SOMS.

The regional component of the Project administered by IMO also received additional grant from the Republic of Korea, and was utilized to develop and install an internet-based MEH system in Batam, Indonesia.

The MEH Demonstration Project was closed in 2013 with the completion of the Indonesian national component of the project, and with the following results:

- An operational MEH Data Center in Batam, Indonesia, which was handed over to Indonesia's Directorate General of Sea Transportation (DGST) in 2012 by IMO's Secretary-General;
- All Project assets installed at the Project Management Office in Batam were transferred to DGST as the beneficiary, including a hydrodynamic-coupled oil spill modelling software (DGST), and a suite of ENC Production tools to both Indonesia (DISHIDROS) and Malaysia (National Hydrographic Centre); and
- Trained IT staff to operate the MEH Data Center in Batam, and hydrographers on hydrographic survey techniques in all three littoral States.

The three littoral countries have made cooperation efforts by establishing the following mechanisms, and conducting regular (annual) meetings to discuss safety of shipping and protection of the marine environment in SOMS:

- Tripartite Technical Expert Group (TTEG)
- Cooperation Forum (CF)
- Project Coordination Committee (PCC)

IMO has transferred the responsibility of continued development and operation of the Batam MEH Data Center directly to DGST under the guidance of the TTEG and the Co-operative Mechanism of SOMS. It is located at the Vessel Traffic Services (VTS) Batam. Malaysia and Singapore have established backup systems which will operate during downtime of the Batam MEH Data Center to ensure that transmitted data are not lost. For Malaysia, the backup system is also linked to the Marine Department's database system, and is being accessed by various agencies in Malaysia including the MEH Data.

At the 10th meeting of the Marine Electronic Highway Working Group (MEHWG), and Session 6 Hydrographic Survey Technical Working Group (HSTWG) in July 2017 in Singapore, the three countries have agreed to increase shipping traffic services safety in the SOMS. This will be done through the reinforcement of the role and service of the Batam MEH Data Center, which integrates various meteorological, hydrographic and oceanographic data from each of the 3 State MEH Stations that are connected to a number of sensors and surveillance devices along the Traffic Separation Scheme (TSS) of SOMS.

In the 10th MEHWG meeting, the following points were agreed upon:

- The formulation of MEH's future concepts is related to technological developments, standards, and regulations in the field of shipping safety.
- Encouraging participation of the shipping industry and associations in the MEH
- Optimizing meeting facilities of CF and TTEG

In addition, the MEH HSTWG meeting discussed the memorandum of continuity plan of Joint Resurvey in Malacca Strait and Singapore Strait. This survey is for the updating of nautical charts and electronic nautical charts along the waters of the Malacca Strait and the Singapore Strait for 550 nautical miles.

The Guided Malacca Strait

The implementation of integration in the waters of SOMS has been agreed upon by the three littoral States at the Intersessional Meeting of The Working Group on Voluntary Pilotage Services in Straits of Malacca and Singapore held in January 2017.

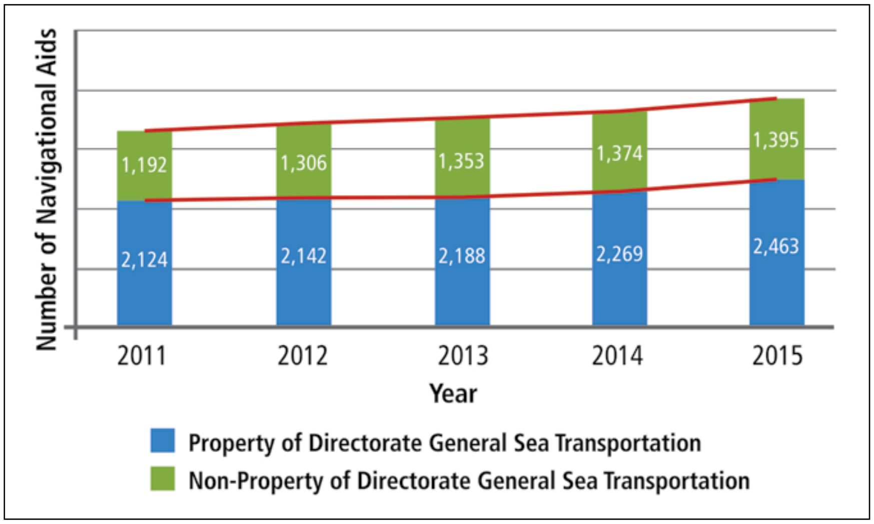
The Government of Indonesia, in 2017, formally provides voluntary pilotage services in SOMS. In case of extraordinary condition of the waters, the skipper can apply for guidance services. DGST has issued *Regulation of the Director General of Transportation Number HK.103 / 2/4 / DJPL-17* concerning System and Procedure of Scouting Services and Ship Delays on Extraordinary Scout Waters in SOMS, and *Decree of Director General of Sea Transportation Number PU.63 / 1/8 / DJPL.07* on the Determination of Exceptional Scout Waters in SOMS.

The Ministry of Transportation also appointed PT. Pelindo I as the operator providing guidance services for foreign and domestic vessels in the Malacca Strait through *Decree of the Director General of Sea Transportation Number. BX.428 / PP 304* dated November 25, 2016, concerning Granting of Licenses to PT. Pelabuhan Indonesia I (Persero) to carry out Scouting Services and Ship Delay on Extraordinary Scout Waters in SOMS.

Navigation Aid Facilities

In order to improve the safety of shipping in Indonesian waters, the government continues to increase the number of auxiliaries and navigational aids (**Figure 16.5**).

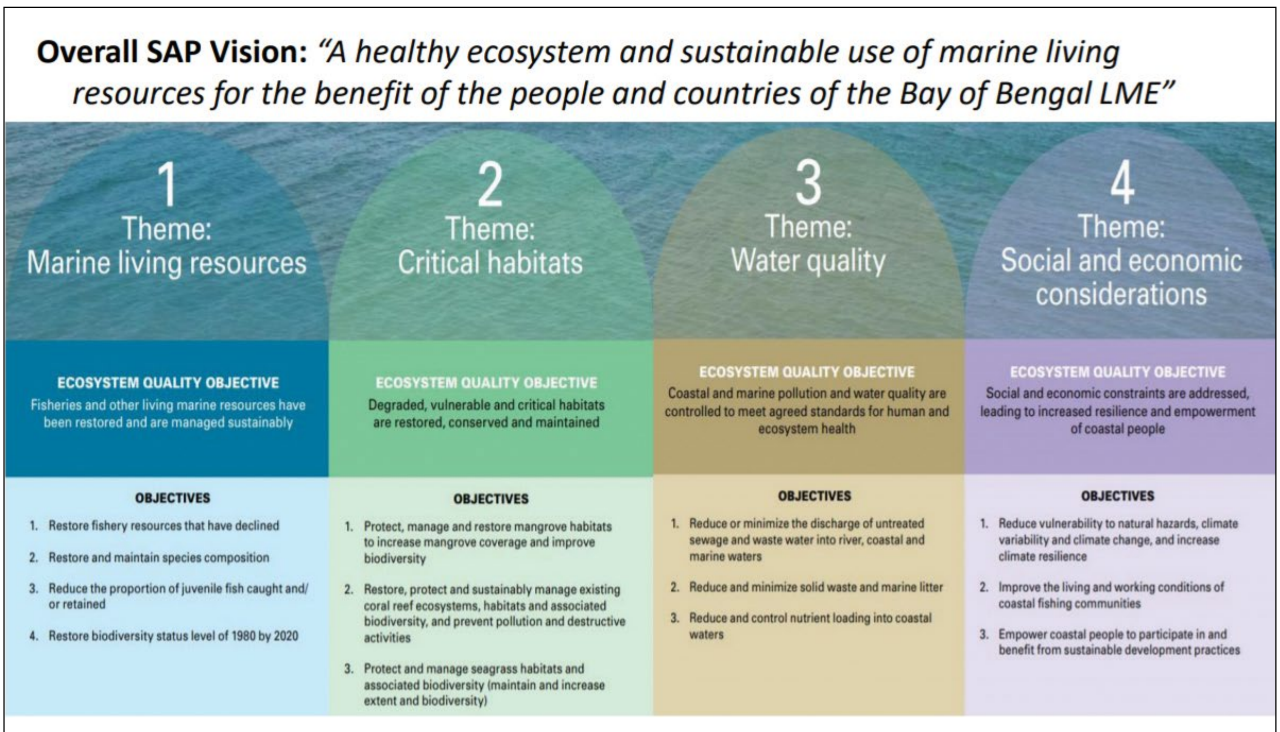
Figure 16.6: Navigational Aids.



16.7.2 Partnerships for Management of LMEs

BOBLME Strategic Action Programme (SAP). The Strategic Action Programme (SAP) is based on the Transboundary Diagnostic Analysis (TDA), which was endorsed in March 2012 by the eight countries of the BOBLME. The SAP is a negotiated policy document that sets out a programme of actions, which address the causes of the major issues of fisheries, habitat loss, pollution, and social and economic concerns.

Figure 16.7: Strategic Action Program for BOBLME.



Sulu-Celebes (Sulawesi) Sea LME. The Sustainable Fisheries Management Project for the Sulu-Celebes Sea Large Marine Ecosystem (SCS-LME) is the first regional collaborative project of the Sulu-Sulawesi Marine Ecoregion (SSME) Program under the stewardship of the Tri-National Committee (Tri-Com) and is implemented with direct guidance from its Sub-Committee on Sustainable Fisheries. The Strategic Action Program (SAP) for the SCS-LME is the result of the 3-country discussions on the follow-up actions to be undertaken on the issues and problems identified during the review and update of the Transboundary Diagnostic Analysis of the SCS-LME in 2015. Focusing on fisheries as the top priority problem, key stakeholders, experts, and focal governments of Indonesia, Malaysia, and Philippines have formulated the *Regional Strategic Action Program on Sustainable Fisheries Management*, which contains solutions and approaches to improve and sustain the small pelagic fisheries of the region using the Ecosystem Approach to Fisheries Management (EAFM) framework. The Sulu-Sulawesi Seascape is currently a priority transboundary seascape under the broader Coral Triangle Initiative (CTI).

South China Sea LME. A Transboundary Diagnostic Analysis (TDA) of the issues and problems and their societal root causes was prepared by the countries around this LME, with the assistance of UNEP and the GEF. The TDA became the basis for development of a Strategic Action Programme (SAP) by 2008. 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 maximize 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 into the South China Sea. With support from GEF and UN Environment, there is an on-going 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.

Mangrove nursery at Patramanggala in Tangerang Regency.

Coral monitoring. *(Photo by PEMSEA)*

Fish Port: PPS *Cilicap. (Photo by IPB)*

PART 6

SUMMARY, CONCLUSION AND RECOMMENDATIONS

17 Summary, Conclusion and Recommendations

17.1 Ocean Economy, Ocean Health, and Ocean Governance: Where Are We Now?

17.1.1 The People and Economy of Indonesia

Indonesia's population was 265 million people in 2018, and expected to reach as many as 267.92 million people by 2020. The population density of Indonesia increased from 107 people/km^2 in 2000 to 138 people/km^2 in 2018. The province with the highest density in 2018 were DKI Jakarta (15,764 people/km^2), while the province with lowest density were North Kalimantan or Kalimantan Utara (9 people/km^2) and West Papua or Papua Barat (9 people/km^2). The coastal population is around 65% of the total population.

Indonesia is the largest economy in Southeast Asia. The real GDP (in constant 2010 prices) was US$1.15 trillion in 2018. The gross national income or GNI (in constant 2010 prices) was US$1.11 trillion in 2018, slightly lower than the GDP. More than 80% of the economy is concentrated in Java and Sumatra. The GDP growth rate has been slightly declining since 2010. From a high 6.22% growth rate in 2009-2010, the GDP increased by only 5.17% in 2017-2018. However, GDP per capita (constant 2010 US$) increased from US$ 3122 in 2010 to US$ 4285 in 2018. Likewise, Indonesia's human development index improved from 0.694 in 2015 to 0.707 in 2018–moving the country from medium to high human development category.

17.1.2 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 on. 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.

The first component of the ocean economy–**ocean economic sector**–was estimated to be **US$ 188.5 billion**, contributing around 20% to the Indonesian GDP in 2015 based on the GDP of seven established ocean economic activities or industries.[123] The highest contribution was from marine construction and the lowest was marine transportation. However, shipping is crucial for trade, commerce, travel and tourism. The sector with a higher growth rate in 2015 compared to the previous year was fisheries and aquaculture sector. There were 5.2 million people employed in the ocean economic sectors in 2008, of which 1.85 million worked in the marine construction sector and 1.69 million people in the fisheries and aquaculture. An alternative estimate showed that there were 28.58 million people working in the ocean economic sector in 2015. In addition, there were 78,000 seafarers in 2016, mostly working in international vessels, according to the Human Resource Development of Ministry of Transportation (2017).

The second component of the ocean economy—**coastal and marine ecosystems and oceanic waters**—was estimated at **US$ 403-411 billion** based on the valuation of ecosystem services. The major ecosystem services of mangroves, coral reefs, seagrass and oceans that were estimated are the provisioning services (fisheries); cultural services (recreation and tourism, and existence value); regulating services (carbon sequestration); and supporting services (habitat, supporting aquaculture and mariculture).

Note that the valuation of ecosystem services includes the provisioning services that are already captured in the ocean economic sector above while the ocean economic sector accounts do not include nonmarket ecosystem services. Moreover, the sustainability of the ocean economic sectors and ecosystem services has not been considered in this straightforward estimation as well as equity and inclusiveness considerations.

Among the seven ocean economic sectors, four—marine fisheries and aquaculture, coastal and marine tourism, ports and shipping, and offshore oil and gas—are directly related to use of ocean resources. The following are their contribution to the economy, jobs and livelihood as well as the pressures and constraints they face.

a. Fisheries and aquaculture

Indonesia is the second-largest fish producer in the world after China, accounting for 8% of the world capture fisheries production. Wild capture fisheries and aquaculture (including seaweeds and other aquatic plants and non-food products) production was seven million tonnes and 16 million tonnes, respectively in 2017. However, in terms of value, capture fisheries and aquaculture production amounted to US$14.75 billion and US$13.99 billion, respectively, indicating higher-value species for capture fisheries. The annual average growth rate of wild catch or capture fisheries in Indonesia was 3.1% from 2000 to 2015, while aquaculture production has more than

[123] The seven ocean economic activities or industries are: (a) fisheries and aquaculture; (b) mining (minerals; oil and gas); (c) marine industries (manufacturing); (d) marine transportation; (e) marine and coastal tourism; (f) marine construction; and (g) public/government. There are no estimates yet for maritime services as of writing this NSOC Report.

quadrupled, with annual average growth rate of 20.2% during the same period (World Bank, 2017). Notable also is the seaweed production, which increased by 53.14% between 2005 and 2014. Most of the capture fisheries and aquaculture production was done in marine waters. For capture fisheries, 93% is from marine waters. For aquaculture, marine culture accounts for 61% of production, while 17% is culture in brackishwater, and 22% in freshwater.

Although the fisheries sector contributed only 2.6% to GDP in 2018, this sector is an important contributor to national food security and employment in Indonesia. A recent study ranked Indonesia as the eighth-most fish-dependent nation in the world, measured by dependence on fish-derived animal protein.[124] The fisheries sector plays a particularly valuable role in coastal communities, where people are likely to engage in fishing as a form of subsistence, and as a primary or secondary source of employment. The majority of Indonesian fishers are small-scale fishers, with vessels under 10 gross tonnes (GT). The wild capture fisheries and aquaculture sectors employ approximately 2.7 million and 3.3 million workers, respectively, and an additional one million workers are involved in seafood processing and marketing of fisheries products.

Pressures and constraints. Like many other countries, Indonesia's marine and fisheries sector faces urgent issues. The ability of capture fisheries to contribute to food and nutrition security in Indonesia could become significantly compromised by overfishing, climate change, unregulated coastal development, pollution, and associated declines in fish catch. For the aquaculture sub-sector, poor farming practices, environmental degradation and pollution, habitat conversion, financing and marketing issues, and multiple-use conflicts have lowered the productivity of this subsector.

b. Coastal and marine tourism

The number of foreign tourist arrivals more than doubled between 2010 and 2018. Consequently, international tourism receipts also doubled. The highest growth rate of international tourism arrivals was in 2016-2017 when the number of arrivals increased by 21.88%. In 2018, around 16 million foreign tourists visited Indonesia. Foreign tourists stayed around eight days on average. Due to increasing international tourism arrivals and revenues, the contribution of tourism to the national GDP increases every year. The GVA of tourism increased by 16.9% in 2014-2015. The GVA of tourism in 2015 was US$34.5 billion, contributing 4.23% of the total GDP. In particular, the GVA of coastal and marine tourism and recreation in 2015 was US$ 19.9 billion.

In addition to income generation, the tourism sector absorbs a lot of manpower. The tourism sector in 2015 employed 3.326 million people or accounted for 2.8% of the total Indonesian workforce. In 2017, Travel and Tourism directly supported 4,585,000 jobs (3.7% of total employment). This includes employment by hotels, travel agents, airlines and other passenger transportation services

[124] California Environmental Associates. 2018.

(excluding commuter services). It also includes, for example, the activities of the restaurant and leisure industries directly supported by tourists. Thus, the Travel and Tourism sector is an effective contributor to job creation and poverty reduction.

Pressures and constraints. The problems that need to be addressed include: (a) the limited number of tourism businesses that are committed to environmental responsibility and application of environmentally sound principles and corporate social responsibility (CSR) programs; (b) lack of incentives to tourism businesses that apply the principles of sustainable tourism development; (c) need for skilled human resources for tourism and development, and limited higher education on tourism; and (d) lack of coordination and synchronization among the different institutions (at national and local levels, and across key sectors) and tourism-related businesses.

c. Ports and shipping

Indonesia is at the crossroads of the world's logistics system connecting the world's two largest oceans, the Indian and the Pacific. The trade routes and logistics systems of the world use the oceans as transportation routes. More than 80% of the distribution of goods and services trade is through maritime shipping, 40% of which is through the Indonesian territory extending from Sabang to Merauke, traversing Miangas to Rote Island. Located between Indonesia, Malaysia, and Singapore, the Strait of Malacca is the shortest shipping lane from the Horn of Africa and the Persian Gulf, the Indian Ocean to South China Sea, based on both cost and the navigation aspects. It is the second-largest oil trade chokepoint in the world after the Strait of Hormuz.[125] The Strait of Malacca is the primary chokepoint in Asia, where between 85% and 90% of annual total petroleum that flows through this chokepoint were crude oil. With growing liquefied natural gas (LNG) demand, the Strait of Malacca is also an important transit route for LNG from Persian Gulf and African suppliers to East Asian countries.

Ports and shipping performance

- The GDP of marine transportation in 2017 is around is only 0.23% of total GDP (in 2010 constant prices).
- In 2017, there were 842,086 ship calls at the ports in Indonesia, with the Kepuluan Riau Province having the most number of ships calls. This was a decline from the number of ship calls in 2016. There were 882,720 ship calls in 2016.
- There was a decline in the number of passengers (disembarked and embarked) – from 44,117,400 people in 2015 to 42,670,600 people in 2016, a decrease of 3.28%.
- Inter-island cargo unloading was 409 million tonnes in 2017, and increased to 410 million tonnes in 2018. On the other hand, approximately 334 million tonnes of ship freight were loaded at domestic or inter-island ports in 2017.

[125] United States Energy Information Administration (EIA). 2017.

- The total (inter-island and international) loaded and unloaded cargo in 2017 was 514.8 million tonnes and 606.5 million tonnes, respectively. Kalimantan Selatan has the highest volume of loaded and unloaded cargo.
- The volume of loaded and unloaded cargo at domestic and international ports in Indonesia is affected by the fluctuations in exports and imports and world economic slowdown. However, the container throughput in Indonesia has been increasing since 2010. In 2018, container port throughput was 12,853,000 TEU.

Pressures and constraints. Although ports play a very important role for the national economy, Indonesia does not yet have a well-performing port system. The quality of Indonesia's port infrastructure is relatively poor compared to other infrastructure quality ratings, such as roads, airport, and railway infrastructure. The incidence of oil spills, dumping of waste from ships, energy efficiency, greenhouse gas emissions, and invasive species from ballast water are among the environmental management issues that need to be addressed.

d. Offshore oil and gas

Offshore oil and gas is a resource from the ocean area. However, oil and gas are depletable resources, and their use as fossil fuel has resulted in the greenhouse gas emissions, with consequent effects on the climate, weather patterns and ecosystems.

Indonesia spent decades relying on the oil and gas sector's contribution to economic growth. However, in recent years, the oil and gas sector's contribution to state revenues has decreased significantly along with the decline in reserves and production. Indonesia's oil and gas production has been dominated by gas production (60%) since 2002. As of 2015, Indonesia's oil and gas production was 786 MBOEPD for crude oil, and 8,102 MMSCFD for natural gas. In 2018, crude oil production decreased to 772 MBOPD, and natural gas production likewise decreased to 7,760 MMSCFD.[126] Bank Indonesia notes that oil and gas exports contributed about 8% of total exports in 2016-2018, down from a high 17% share in 2011.

Moreover, there are issues concerning the inclusion of oil and gas in the ocean economy due to the negative environmental impacts from this sector. The huge increase in the use of oil and gas as economies expand has consequently increased carbon emissions, and resulted in the changing climate, increasing incidence of extreme or severe weather events, sea level rise, ocean acidification, coral bleaching, etc. The declining revenues from oil and gas sector provide an opportune time to shift towards renewable energy sources. The ocean also provides potential marine renewable energy resources like tidal energy, ocean thermal energy conversion, offshore wind power, etc.

[126] SKK Migas Annual Reports.

17.1.3 Ocean Health

Using a common framework, the Ocean Health Index (OHI) measures progress towards achievement of ten widely-agreed public goals for healthy oceans: food provision, artisanal fishing opportunities, coastal livelihoods and economies, natural products, recreation and tourism, carbon storage, coastal protection, clean waters, biodiversity, and sense of place. The OHI score reflects the impacts of human activities, policies and interventions on ocean health. The OHI score of Indonesia in 2018 is **65** (closer to 100 the better) and is ranked at 145 among 221 EEZs.[127] The OHI score of Indonesia is lower than the global OHI score of 70. The score remains far from 100, indicating that the oceans and marine life would fare better, and more benefits would be gained if the ocean is used in more sustainable ways. The extent, condition and integrity of the coastal and marine ecosystems need to be maintained to continue getting benefits of coastal protection, carbon storage, natural products and biodiversity. The low score for food provision shows the need to make harvest more sustainable by improving the fishing and culture practices, and increasing sustainable mariculture production and management of wild-caught stocks.

The mangrove ecosystem in Indonesia is the largest mangrove forest in Southeast Asia, about 76% of the total mangrove forest in this region. The mangrove forest in Indonesia is about 36,680.7560 km^2 in 2015 (BPS, 2016). Mangrove species diversity is also high, with the dominant mangrove species found to contain 47 true mangrove species, and 22 associated species of mangroves. However, the mangrove area with good quality decreased by 11.90%, while moderate condition increased by 0.70%, and damaged condition increased by 2.58%. Conversion of mangroves to aquaculture farms and encroachment of human settlements in mangrove areas have resulted in the significant decrease of mangrove areas in Indonesia.

BPS reported that the coral reef area in Indonesia was 26,923.02 km^2 in 2015. In 2017, the Center for Oceanographic Research (P2O-LIPI) released its estimate of Indonesia's coral reef cover: total of 2.5 million ha (25,000 km^2). The diversity of coral species in Indonesia is very high, with 590 species of 82 coral genera, with three important genera of Indonesian coral reefs, *Acropora* (104 species), *Montipora* (39 species), and *Porites* (24 species). Based on the monitoring of 1064 stations in 108 locations throughout Indonesian waters, P20-LIPI reported the following the condition of coral reefs in 2016: very good (6.39%), good (23.40%), fair (35.06%), and poor (35.15%). Destructive fishing; siltation and sedimentation due to deforestation and mining activities in the watershed areas; unregulated coastal developments; loss of mangroves; pollution; and coral bleaching due to warmer sea temperature are among the key factors that affected the condition and areal coverage of coral reefs.

In 2017, the Center for Oceanographic Research (P2O LIPI) reported that the extent of the seagrass ecosystem is 150,693.16 ha. There are 15 seagrass species in Indonesia, and two species in the form

[127] http://www.oceanhealthindex.org/region-scores/annual-scores-and-rankings.

of specimen out of 24 species of seagrasses found in the tropical Indo-Pacific region. In 2015, only 20.62% of seagrass beds were found to be in good condition, and 68.8% remains unidentified. The decrease in seagrass area and deteriorating condition are caused by both natural (e.g., waves, strong currents, storms, earthquakes, and tsunami), and man-made factors (pollution, siltation and sedimentation, tourism activities, ports, boating traffic, aquaculture, reclamation, dredging, sand mining, and loss of mangroves).

Generally, marine water quality in Indonesia is in good condition and complying with the water quality standards, which refers to *Decree of Environment Ministry Number 51/2004*. However, some sample coastal locations (e.g., several big ports) are already in fair condition for DO parameter, and poor condition for nitrates and phosphates parameters. Coastal waters in many provinces have levels of nitrate and phosphate that are higher than water quality standards for these parameters. Rivers in each province are also polluted, with 25 provinces having rivers with *heavy polluted* status (either entire stretch of the river or part of the river).

17.1.4 Ocean Governance

a. National ocean policy

The **Global Maritime Fulcrum** (GMF) was launched at the East Asia Summit in 2014. It envisions Indonesia, a maritime country, as a force between the two oceans: the Indian Ocean and the Pacific Ocean, and to become the center of the world's maritime axis. **Presidential Decree no. 16 of 2017: Indonesian Sea Policy** was designed to "facilitate the acceleration" of the GMF doctrine. The Sea Policy has the following seven pillars:

1. Marine and human resource development
2. Naval defense, maritime security, and safety at sea
3. Ocean governance institutionalization
4. Maritime economy, infrastructure, and welfare
5. Environmental protection and ocean space management
6. Nautical culture
7. Maritime diplomacy

These pillars are further broken down into 76 programs spread across dozens of ministries and agencies in charge of 425 activities designed to achieve 330 targets.

The policy continues to leave the planning, budgeting, and execution of the various programs to the respective ministries and agencies. However, the Coordinating Ministry for Maritime Affairs is tasked with monitoring, coordinating, and evaluating how each ministry fits within the Sea Policy framework. As an inter-agency framework, there are efforts to build institutional change in coastal and marine development. MMAF is the main body for marine and fisheries sector planning.

There are several laws and policies on environmental management, conservation of coastal and marine resources and biodiversity, fisheries management that support the sea policy. Indonesia is also a party to several multilateral environmental agreements or international conventions.

b. Ocean in the national development plan

The *National Medium-Term Development Plan 2015-2019* identifies six national priorities of development. The marine sector is the third priority, with the aim: "to benefit from and to restore the loss of Indonesia's marine potential from the maritime sector." To achieve this, there are ten policy directions:[128]

1. Complete the boundary line of the continental shelf to 200 nautical miles, including naming and registration of the islands
2. ALKI regulation and control (Indonesian archipelagic sea lane)
3. Strengthening the institution for water management and supervision
4. Improve coordination for monitoring and enforcement of laws aimed at violation offenses
5. Improve the construction of multimodal transportation system
6. Balancing between national-oriented transportation and local and regional transportation system
7. Accelerate the growth of the marine economy
8. Improve and maintain quality. support and preservation of aquatic environments
9. Enhance maritime knowledge and culture along with strengthening of human resources and science and technology
10. Increase the dignity and livelihood standards of fishing communities

c. Integrated coastal management

Integrated coastal management (ICM) is considered as the key approach for implementing sustainable development in coastal areas. Progress has been made in initiating ICM in Indonesia. Indonesian Government validated *Law number 27/2007* and *Law number 1/2014* for arrangement of Strategic Plan for Management of Small Island and Coastal Area, and Zoning Plan for Management of Small Island and Coastal Area, which were signed by Governor Regulation. As of 2017, around 46,207 km or 48.54% of coastline is covered by an ICM plan.[129] The Coastal and Marine Strategic Plan (CMSP) covers 44,900 km (47.17%), while the Zoning Plan for Management of Small Islands and Coastal Areas – RZWP3K – covers 1.307 km or 1.37% (Recapitulation ICM Plans Document in Indonesia 2017). However, management and action plans and institutional mechanisms to implement the strategic plan and zoning plan are needed. Thus, the coastal areas covered by the ICM plans (Strategic Plan and Zoning Plan) still have more work to do to put in place an effective and functioning ICM system.

d. Actions to protect ocean health and support blue economy

The marine environment is already straining under the weight of pollution, rising sea temperatures, loss of biodiversity, rising sea levels, growing ocean acidification and other impacts associated with climate

[128] Bappenas. RPJMN 2015-2019.
[129] The percentage of coastline was estimated using the previous estimated total coastline of 95,181 km from the Statistics of Coastal and Marine Resources 2016. In 2018, BPS reported the total coastline to be 99,000 km.

change, with the result that unsustainable growth in ocean-related economic activity risks yet further undermining the very foundations on which the ocean economy stands.[130] The following actions are related to the sustainable development aspects referred to in the SDS-SEA as well as SDGs, CBD, etc.

Marine protected areas. Indonesia targeted 20 million ha as marine conservation area in year 2020. The marine protected areas cover a total area of 17.3 million ha in 2015, spread across 32 provinces and 105 districts / municipalities. Of these, 112 water conservation areas with a total area of 12.6 million ha are managed by the MMAF and Local Governments. There are 32 MPAs with an area of 4.7 million ha managed by the MOEF. The total marine protected or conservation area (17.3 million ha) is around 21.6% of territorial water area (80,000,000 ha) or 6.4% of EEZ area.

Habitat restoration and protection. Current efforts to restore natural resources and the environment have become a trend of private interest through community development programs and corporate social responsibility. One of the recovery efforts whose track record is significant is the coastal recovery program through the rehabilitation of mangrove ecosystems. In 2010-2013, mangrove rehabilitation in Indonesia has reached 35,103 ha, spread over 34 provinces in Indonesia (BPS, 2016). This has contributed to the increase in the area of mangroves, from 39,896.89 km^2 in 2013 to 46,680.76 km^2 in 2015. Another noteworthy initiative is coral farming, which is an approach to coral restoration through the culture and production of coral fragments on a large scale. It enables the 'farmer' to grow corals which are suited to precise reef habitats. In Indonesia, coral farming has been around for almost two decades. The coral transplantation project in Bali (initially part of ICM activity) resulted in increased fish catch, additional diving sites, promoted ecotourism as supplemental livelihood, and increased incomes of the fishing communities.

Addressing IUU fishing. Specific to tuna management, a **National Plan of Action** was developed and launched in 2015. The government of Indonesia improved the registration of fishing vessels in the country to help strengthen tuna fisheries management. Indonesia's compliance with measures requirements imposed by the Western and Central Pacific Fisheries Commission (WCPFC), for example on the provision of size-at-capture data for 2013, was classified as "good" by the WCPFC Scientific Committee.[131] Moreover, Indonesia has undertaken research relevant to establishing harvest control rules for its tuna fisheries.

Universal access to safe water and sanitation services. The Government of Indonesia's Long-Term National Urban Development Plan, 2015-2045, sets targets of urban service standards and city waste management – demanding high sector performance. Solid waste management is high on the national agenda, as exemplified by the *National Medium-Term Development Plan*'s (RPJMN) "**100-0-100**" **target** of eliminating all slums and providing universal access to water and sanitation, including

[130] OECD (2019).
[131] WCPFC, 2017. (https://www.wcpfc.int/conservation-andmanagement-measures).
[132] The "100-0-100" target refers to 100% household access to water supply; zero slums; and 100% household access to sanitation (including wastewater treatment and solid waste collection).

solid waste, by 2019.[132] There are constraints that need to be addressed to achieve this bold target.

Marine plastic debris management. In 2017, the Government of Indonesia has just initiated the management of marine debris by issuing Indonesia's *Plan of Action on Marine Plastic Debris 2017-2025*. It reinforces the existing policies and laws, and its expected outcome is *70% reduction of marine plastic debris by 2025*. The National Action Plan is led by the Coordinating Ministry for the Ministry of Maritime and Investment Affairs.

Industrial pollution management. In June 1995, Indonesia launched a program for public disclosure of polluters' environmental performance. This initiative, called the *Program for Pollution Control, Evaluation and Rating (PROPER)*, is an industrial monitoring program that aims to encourage industry compliance with environmental regulations. It also aims to encourage industry to apply green economy principles with environmental management system performance assessment criteria, energy efficiency, water conservation, emission reduction, biodiversity protection, 3Rs (reduce, reuse, recycle), and reduce economic disparities by implementing community empowerment programs. In 2016, the number of participants to PROPER reached 1930 companies, consisting of 111 types of industries. PROPER's compliance rate in 2016 reached 85% with 12 EMAS (gold) rating companies, HIJAU (green) 172 companies, BIRU (blue) 1422 companies, MERAH (red) 284 companies, BLACK 5 companies, and 35 other companies not announced consisting of 13 companies in law enforcement process and 22 companies closed/not operating.

Climate change response. The Government has also formulated the *2015 National Plan of Action on Climate Change Adaptation* (RAN-API) directed to: (a) minimize the impact of climate change, (b) increase the resilience and/or reduce the vulnerability of a natural system, programs or activities from the impacts of climate change. Under RAN-API, a **vulnerability index and evaluation system** was developed to determine what adaptation activity is necessary in each area. Some key adaptation and resiliency strategies include: promoting farming practices that are flexible to changing weather and water conditions; building infrastructure to secure water sources and prevent flooding; developing warning systems for natural disasters; flood-proofing homes; preventing deforestation; and increasing community access to finance, training, and the planning of resiliency programs. RAN-API also outlines the coordination among different ministries and with local/regional governments.

17.2 Blue Economy: Where Are We Heading?

17.2.1 Blue Economy Initiatives

The concept of blue economy was developed to respond to the challenge of promoting economic growth in the coastal and marine areas while ensuring the sustainability of oceans and the resources therein. In 2012, ministers of the East Asian Seas region adopted blue economy paradigm, and provided the definition in the *Changwon Declaration 2012*. For the application of the Blue Economy concept in the oceans and coastal and marine ecosystems, there are at least three main points underlying its approach: (a) marine water and ecosystem health condition;(b) ocean-based economic activities that are sustainable, environment-and climate-friendly, people-centered and inclusive; and (c) the existence of enabling mechanisms (policies, laws and regulations, strategies and action plans, incentives) and good governance (institutional arrangements, capacity development, science and research support, public awareness, stakeholder participation, sustainable financing, and partnerships). The strategies for the economic development of the ocean-based and ocean-related sectors must also ensure environmental sustainability, climate resiliency, inclusiveness, and overall well-being, and not just income and economic growth.

There are on-going innovations, blue economy initiatives and emerging industries in Indonesia, and these are transforming the economic development paradigm in the coasts and oceans towards more sustainable and inclusive development (**Table 17.1**).

Table 17.1: Transforming towards Blue Economy.

Ocean economy	Blue Economy Initiatives
Fisheries and aquaculture • Contributed **US$15.2 billion** in gross value added (GVA) in 2015. • Approximately 2.7 million people in capture fisheries and 3.3 million workers in aquaculture, and an additional 1 million workers in the processing and marketing of fisheries products. • **Pressures:** Overfishing, destructive fishing and IUU fishing; habitat loss; sedimentation and pollution; low income and standard of living for fishers and fish farmers; poor aquaculture practices and expensive inputs	**Sustainable fisheries and aquaculture** • Selection and application of appropriate technology for fishing • eCDT (STELINA), MCS, and catch certification to address IUU fishing **Sustainable aquaculture** • Silvofisheries: marine aquaculture with mangrove restoration and protection • Small-scale, low-cost and environment-friendly aquaculture, with appropriate culture practices, water pollution control, mangrove planting and capacity development for fisherfolk and women **Opportunities** • Sustainable seaweed culture at scale • Eco-fish ports: fishery waste utilization in fish port • Green fishing technologies (appropriate fishing gear, solar cell use designs on lights for fishing, flat plate hull construction)
Coastal and marine tourism • In 2015, the coastal tourism had a value added of **US$19.9 billion**. • 3.326 million people employed in (total) tourism sector in 2015 • **Pressures:** Increasing number of tourists, but lack of capacity among local communities; increase in traffic load, and energy and water consumption, but inadequate infrastructure; increasing waste generation, but lack of facilities for solid waste and wastewater management and environmental awareness among tourism establishments and communities	**Ecotourism** • The Government of Indonesia also continues to encourage special nature tourism, by introducing and managing conservation areas and marine parks as tourist destinations. • Ecotourism development is one of the conservation efforts for whale sharks in Cendrawasih Bay, Papua Province and Probolinggo, East Java Province. Ecotourism aims to reduce and eliminate hunting of these large animals through improving the economy of society and providing alternative livelihood opportunities. • Development of the Ciletuh-Palabuhanratu Geopark in Sukabumi Regency through ICM **Tourism establishment with waste management** • Nusa Dua in Bali has connected the hotels in the complex to a wastewater treatment facility, which has become a site for bird watching and recreational fishing (eco-lagoon), and educational tours

Table 17.1: Transforming towards Blue Economy. (cont.)

Ocean economy	Blue Economy Initiatives
Ports and shipping • The GVA (in 2010 constant prices) of marine transportation contributed **US$2.26 billion** to Indonesia's GDP in 2015, and **US$ 2.56 billion** in 2018. • Around 2 million people are working in the ports and marine shipping sector in 2015. • **Pressures:** Inadequate port infrastructure; oil spills, greenhouse gas emissions and waste from ships; invasive species from ballast water	**Environment-friendly/green ports and safe shipping** • Teluk Lamong Terminal – green terminal award • Ship Certification on maritime protection • National Oil Spill Contingency Plan and regular National Marine Pollution Exercises • Navigational aids • Marine Electronic Highway for the Straits of Malacca and Singapore • Sea Toll program

Oil and gas
• Crude oil production decreased from 786 MBOEPD in 2015 to 772 MBOEPD in 2018.
• Natural gas production decreased from 8,102 MMSCFD in 2015 to 7,760 MMSCFD in 2018.
• **Pressures:**
  ◦ Declining production and contribution to state revenues
  ◦ operational and accidental oil spills
	Oil and gas
	• Use of new methods for the discovery of oil and gas resources and reserves, and application of environmental impact assessment (EIA) for new projects
	• Oil Spill Contingency Plan and Oil Spill Control
	
	Renewable energy
	• **Marine renewable energy**: Sites for tidal energy, ocean thermal energy conversion, and wave or current energy have been identified, and R&D initiatives are on-going.
	• Other alternative energy: biofuel from macroalgae and microalgae is being explored

Electricity, gas, water supply, sewerage, waste management, and remediation
• **Pressures:**
  ◦ Inadequate solid waste, wastewater and stormwater management facilities
  ◦ Inadequate access to safely managed drinking water and safely managed sanitation services
  ◦ Eutrophication, algal blooms and fish kills in coastal waters due to nutrient loading
  ◦ Clogged waterways and marine debris affecting fish and other marine life, recreation opportunities, flood control, etc.
	Pollution reduction
	• **Wastewater management**: Examples from Bali: Centralized sewerage system in Sanur, Denpasar; community-based decentralized sewage treatment system in a community in Denpasar; Eco-lagoon (waste stabilization ponds) in Nusa Dua.
	• **Solid waste management**: community-based waste banks; zero-waste communities
	• **Marine debris management**: National Action Plan; coastal cleanup; ban on plastic use and promotion of use of recyclables instead; R&D on alternatives to plastics
	• **Industrial waste management**: PROPER is an industrial monitoring program that aims to encourage industry compliance with environmental regulations. It also aims to encourage industry to apply green economy principles with environmental management system performance assessment criteria, such as energy efficiency, water conservation, emission reduction, biodiversity protection, waste reduction and management

Table 17.1: Transforming towards Blue Economy. (cont.)

Ocean economy	Blue Economy Initiatives
Public/government services (coast guard; marine environment protection; monitoring, control and surveillance, etc.)	**Habitat and biodiversity conservation** • Marine protected areas (MPAs): Indonesia has 154 MPAs, of which 8 sites are National Marine Parks. MPAs identified for tourism consist of MOEF's Marine Nature Tourism Parks (491,248 ha) and MMAF's Marine Ecotourism Parks (1,541,040 ha). • Mangrove restoration: In 2010-2013, mangrove rehabilitation covered 23,273 ha across 34 provinces. • Coral reef rehabilitation: coral transplantation in Bali – resulted in increase in fish stocks and fish catch, additional diving sites, and increased incomes for fishing communities. • Coral Reef Rehabilitation and Management Program (COREMAP): over 350 collaborative management plans between communities and local governments; a significant increase in awareness about ocean health; the return of rare species; 17% growth in coral reef cover in six out of seven project districts; and a 20% increase in the incomes of project beneficiaries **Ecosystem-based natural disaster risk management** **Blue carbon initiative**

17.2.2 Drivers of Future Growth, Innovations, Resiliency and Sustainability

Today's economic growth has moved from a rural-based economy to an urban-based economy that tends to be based on secondary and tertiary production. Due to urbanization and land-use changes, pollution, habitat and biodiversity loss, climate change and other environmental pressures, and increasing human activities in the oceans, there is a call for an alternative growth paradigm, especially in coastal and marine areas. The development approach with the Blue Economy model can synergize with the implementation of pro-poor, pro-growth, pro-job and pro-environment programs. Based on this, the Marine Economy with Blue Economy model should encompass the following:

(1) Integration of land and marine development,

(2) Development that is clean, inclusive, and sustainable;

(3) Increasing the added value and competitiveness of products through innovation; and

(4) Increasing the income of a fair, equitable and appropriate society.

a. International agreements

As a party to various multilateral environmental agreements, there are international obligations to achieve the targets set forth in these agreements. The blue economy approach is in keeping with various international agreements, such as the Convention of Biological Diversity (CBD) and Aichi Biodiversity Targets, Ramsar Convention on Wetlands, Convention on Trade of Endangered Species

(CITES), International Maritime Organizations (IMO) Conventions, Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA); Regional Plan of Action on Illegal, Unregulated and Unreported (IUU) Fishing; Kyoto Protocol; UN Framework Convention on Climate Change (UNFCCC), and Paris Climate Agreement; etc.

The UN SDGs (SDG 14, SDG 12, SDG 6, SDG 13, etc.), Manado Ocean Declaration (MOD), Sustainable Development Strategy for the Seas of East Asia (SDS-SEA) in 2003 and the updated SDS-SEA in 2015, together with the National Ocean Policy provide the guiding principles and course of action to promote blue economy, protect the marine environment, ensure healthy and sustainable marine ecosystems, and conserve fisheries and other natural resources from the oceans.

Box 17.1 SDG 14 – Life Below Water

There is optimism with the latest dedicated goal of ocean conservation under the Sustainable Development Goals. In particular, SDG 14 – Life Below Water – seeks the conservation and sustainable use of marine resources, seas, and oceans. The following targets were agreed upon by the UN member states to help guide decision-making with regards to oceans:

- SDG 14.1: Prevent and considerably reduce all kinds of marine pollution, including nutrient pollution and marine debris.
- SDG 14.2: Sustainably protect and manage coastal and marine ecosystem to prevent considerable adverse effects, including through fortifying their resilience as well as taking restorative actions to attain productive and healthy oceans.
- SDG 14.3: Address and minimize ocean acidification through increased scientific cooperation from all levels.
- SDG 14.4: Effective regulation of harvesting and stopping overfishing, unregulated, unreported and illegal fishing and also detrimental fishing practices. Implement effective, science-based plans for restoring fish stocks within a short timeframe.
- SDG 14.5: Conserve roughly 10% of marine and coastal areas, in agreement with international and national law and using the latest scientific information.
- SDG 14.6: Prohibit certain types of fisheries subsidies that support overfishing and overcapacity, abolish subsidies that support unregulated and illegal fishing and desist from the introduction of such subsidies in future.
- SDG 14.7: Increase the financial benefits to least developed nations and Small Island countries from using marine resources sustainably, including through better management of aquaculture, tourism, and fisheries.

Box 17.1 SDG 14 – Life Below Water (cont.)

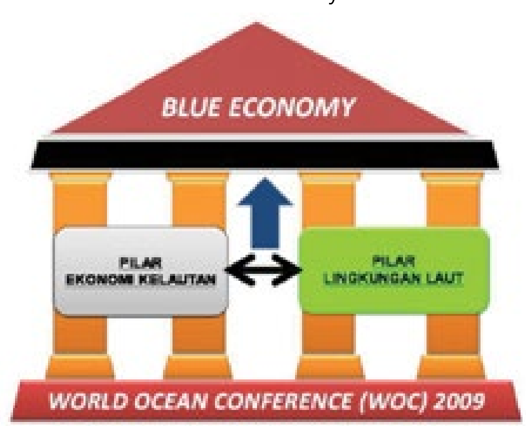
- SDG 14.a: Improve research capacity, scientific knowledge, and share marine technology to not only enhance ocean health but also to improve the role of marine biodiversity in developing countries.
- SDG 14.b: Ensure easy access for the small-scale fishers to markets and marine resources.
- SDG 14.c: Improve the sustainable use and conservation of oceans through implementing the necessary international law, in agreement with the UNCLOS, which sets out the legal outline for these efforts.

b. Marine environment and marine economic policies

Indonesia does not yet have a specific regulation related to the blue economy. However, the blue economy concept can be implemented as a mixture of Indonesian marine policies – national ocean policy, marine economy policy and marine environment policy. This is as reported by Dekin (2012), and the World Ocean Conference in 2009 (WOD2009) succeeded in issuing the Manado Ocean Declaration (MOD). The MOD includes agreement of participating countries to: implement integrated coastal and ocean management, including marine and coastal land use planning, to minimize and reduce the risk and vulnerability of coastal communities and critical infrastructure; create a healthy and sustainable marine ecosystem; strive to reduce pollution of ocean, coastal and land areas; promote sustainable management of fisheries in accordance with relevant international agreements and codes of conduct; promote gathering and exchange of information related to climate change impacts on marine ecosystem, communities, fisheries and other industries; and implement sustainable development strategies.

In Indonesia, the MOD is linked to two major pillars of national ocean policy: the marine economy, and the marine environment. These two pillars are actually the core components of the Blue Economy concept, since in essence Blue Economy is an economic development paradigm that is grounded in the principles of healthy ecosystems (Dekin, 2012). Diagrammatically, the WOC's linkage to the marine environment and marine economy pillars, and Blue Economy is shown in **Figure 17.1**.

Figure 17.1: The World Ocean Conference (WOC) 2009 linkage with the Pillars of Marine Economic Policy, Marine Environment Policy and Blue Economy.



The Indonesian Marine Council (2012)[133], stated that the development of marine economy with blue economy model as accelerator for the realization of Indonesia as an independent archipelago, developed, strong, and based on national interest. Furthermore, in order to implement this policy, the strategies to be taken as opportunities for investment, business and partnerships are as follows:

(1) Economic Development of Fishery Sector
(2) Economic Development of Transportation/Sea Transportation Sector
(3) Economic Development of Marine Building Sector
(4) Economic Development of Marine Energy and Mineral Resources Sector
(5) Economic Development of the Marine Industry Sector
(6) Economic Development of the Maritime Tourism Sector
(7) Economic Development of Marine Services Sector
(8) Cross-sector Economic Development of Marine Sectors

Table 17.2: Policies, Strategies and Efforts needed for the Development of Blue Economy.

Policy	Effort	Key Agencies and Stakeholders
Development of Blue Economy Model as Accelerator for the Realization of Indonesia as an Independent Island Country, Advanced, Strong and Based on National Interest	Fisheries and aquaculture	Ministry of Marine Affairs and Fisheries, Ministry of Transportation ,Ministry of Industry, Ministry of Environment and Forestry, State Ministry of Research and Technology , Ministry of the Interior State , POLRI, and Navy, Ministry of Education and Culture , and Higher Education, Private
	Marine Transportation	Ministry of Transportation, Ministry of Industry, State Ministry of Research and Technology, Ministry of Environment and Forestry, Ministry of Foreign Affairs State, National Police, and Navy), Ministry of Education and Culture, Higher Education, Private
	Marine Industry (Manufacturing – seafood processing, ship-building, marine biotechnology, etc.)	State Ministry of Research and Technology , Ministry of Industry, Ministry of Transportation, Ministry of Marine Affairs and Fisheries, Ministry of the Interior Affairs, Ministry of Environment and Forestry, Ministry of Defense, Ministry of Education and Culture, Higher Education, Private sector
	Coastal and marine tourism	Ministry of Tourism and Economics Creative , Ministry of Transportation , Ministry of Foreign Affairs Affairs, Ministry of Environment and Forestry, Ministry of the Interior State, POLRI, Navy, Ministry of Education and Culture, and Higher Education, Private
	Marine renewable energy, and deep sea minerals using Blue Economic Model	Ministry of Energy and Resources, Marine Minerals, State Ministries, Research and Technology, Ministry of Industry, Ministry of Education and Culture, Ministry of Environment and Forestry, Ministry of the Interior State, POLRI, and Navy, Private, and Higher Education

[133] Dewan Kelautan Indonesia. 2012. Kebijakan Ekonomi Kelautan dengan Model Ekonomi Biru. Kementerian Kelautan dan Perikanan. Sekjen.

Table 17.2: Policies, Strategies and Efforts needed for the Development of Blue Economy. (cont.)

Policy	Effort	Key Agencies and Stakeholders
Development of Blue Economy Model as Accelerator for the Realization of Indonesia as an Independent Island Country, Advanced, Strong and Based on National Interest (cont.)	Marine Building (Marine Construction) using Blue Economic Model	State Ministry of Research and Technologist, Ministry of Public Works, Ministry of Transportation , Ministry of Industry, Ministry of National Development Planning/Bappenas , Ministry of Education and Culture , Ministry of Environment and Forestry, Ministry of the Interior Affairs , Ministry of Defense , Private , and Higher Education
	Maritime Services (including marine research and education; maritime insurance; maritime monitoring, surveillance and enforcement; etc.)	Ministry of Education and Culture , State Ministry of Research and Technology , Ministry of Trade , Ministry of Industry, Ministry of Finance , Ministry of Internal Affairs State, Private, and Higher Education
	Cross-Sector Development Strategy - Marine Areas, using Blue Economic Model	Ministry of National Development Planning/Bappenas, Ministry of Finance, Ministry of Public Works, Ministry of Industry, Ministry of Education and Culture , Ministry of the Interior State, POLRI, and Navy, Private, and Higher Education

Source: Dekin, 2012.

c. Increasing Pressure on Water, Energy and Natural Resources

In the last two decades there has been an increase in the intensity of issues related to water shortage, contaminated water supply, limited energy, declining oil and gas production, and natural resource degradation. These pressures can drive blue economy investments and innovations in water and energy sector, and changing consumption and production patterns towards for sustainable ways.

There are several strategic issues related to water resources problems faced by Indonesia (kemenPU, 2015). First, global climate change has changed the pattern and intensity of rain, and increased sea level, thus, increased the vulnerability to drought and flooding. Second, damage to the catchment area is still occurring; changes in rainfall pattern; erosion and sedimentation are very high; increased incidence of floods and drought; high pollution and low water quality. Third, the irrigation network is still damaged. Fourth, there are obstacles in the construction of reservoirs and embankments as an effort to increase the capacity of water sources.

According to the Ministry of Public Works (2014), the potential of Indonesia's water resources is very large, namely 3.9 trillion m^3, but only utilized ~13.8 billion m^3 or ~58 m^3 per capita. This figure is much lower than Thailand (1,277 m^3 per capita) and one level above Ethiopia (38 m^3/capita). In anticipation of the problem of water resources, the Government has issued a series of policies and regulations on water resources, among others: (1) *Act No. 7 of 2004 on Water Resources*, which is supported by: (2) *Government Regulation No. 42/2008 on Water Resources Management* and (3)

Government Regulation No. 121 of 2015 on Water Resources Management. In principle, Water Resources Management is intended as an effort to plan, implement, monitor and evaluate the implementation of conservation of water resources, sustainable utilization of water resources, and control of water- damaged power. Desalination is an emerging ocean industry and has potential to provide alternative water supply, but its environmental impacts and costs and brine management have to be addressed first before the wider deployment of desalination plants can take place.

Indonesia also faces an energy crisis. Although Indonesia has abundant renewable energy sources, their utilization is still very minimal. In RAN-API 2014, the following strategies related to energy independence have been formulated: (a) improvement and conservation of rain catchment areas in watershed and geothermal resources, and (b) optimizing the utilization of organic and biomass wastes as well as development of energy sources from biofuels. These strategies are realized through four Main Programs (Cluster).

(1) Improvement and Conservation of Rain Catchment Area. The action plan of this cluster is aimed at accelerating the following: (a) establishment of forest areas, especially in the catchment areas that will be the location of hydropower and geothermal development, and (b) rehabilitation of watersheds in hydropower and geothermal area through community participation.
(2) Expansion of Renewable Energy Source Utilization
(3) Innovative and Adaptive Technology Development for Plant Cultivation as Source of Biofuels and Plantation Forest for Energy (Energy Plantation).
(4) Cluster Support Program. The action plan of this cluster is aimed at conducting scientific studies on the vulnerability of watershed systems to the impacts of climate change and research on the development of biofuel cultivation technology.

These strategies and cluster programs do not include marine renewable energy, which has the potential to supply alternative energy source. Similar to desalination, environmental impacts of ocean energy also need to be assessed first. Support for R&D of new technologies to improve ocean energy, and financing and incentives for deployment are crucial.

Indonesia also faces the problem of the loss and destruction of so many natural resources and biodiversity, including unique and rare biota due to the clearance of forests and land, and conversion of coastal habitats. To address this, the Government of Indonesia, through Agenda 21 and Sustainable Development Goals (SDGs), committed to implement sustainable development mechanism, and signed the declaration and is an active member of PEMSEA. Blue economy relies on healthy ocean.

In the Indonesian National Plan of Action on Climate Change (RAN-PI), the Government of Indonesia has formulated strategies in ecosystem resilience to secure water resources, save natural resources, and establish community resilience. The action plan was developed taking into account the conservation and welfare principles of forest communities (including indigenous peoples) and Indonesia's role in climate change mitigation. The challenge is how to adapt to the changes that occur, e.g., extreme drought that causes water limitations, changes in vegetation types due to changes in weather patterns, and sea level rise covering settlements and ponds and farm areas. Strategies include:

(1) Security of water availability and protection of extreme climates (Securing Water Availability and Protecting from Extreme Weather),
(2) Prevention of loss of ecosystems and biodiversity (Avoiding Ecosystems and Biodiversity Loss), and
(3) Safeguarding the sustainability of water availability and conservation of ecosystems and biodiversity (Sustainable Water Supply and Conservation of Ecosystems and Biodiversity).

d. Supply Chain Trends and New Technologies

The development of the value of supply chain and the development of the latest technology becomes one of the biggest attractions in order to produce primary and/or processed product innovation directed to the development of blue economy in Indonesia. There are blue economic trends that can be done used by Indonesia, such as:

(1) Development of intermediary services and distribution technology of products produced from processed marine products
(2) Every seafood processing company needs a report on the externalities of the company's operations
(3) Marine product supply chain should be designed to meet the needs of pyramid-based products
(4) Knowledge of marine work and labor must be based on global knowledge of nature
(5) Capacity and capabilities of marine human resources should have the same standards in the development of marine industry including the development of marine processed products
(6) Intermediate product development or alternatives in supporting the sustainability of input supply for the development of marine processed products
(7) The development of micro segmentation should be put forward to achieve global success
(8) Technology development in line with the capacity and capabilities of marine human resources
(9) Knowledge leaders from various operational levels and production management based on blue economy must update with information technology and social media
(10) Knowledge and intelligence engineering should be in line with the development needs of the marine product value chain system.

e. Climate Change

In relation to the blue economy, the biggest obstacle and challenge today is climate change. Changes in climate and weather patterns lead to seasonal uncertainty and vulnerability to disasters. Rising sea surface temperatures are suspected to have direct effect on the marine and fisheries sector, such as coral bleaching, and alter ocean currents, which result in the pattern of fish migration, which in turn, will affect the livelihood of fishermen. Meanwhile, rising sea levels resulted in widespread sea water pools, erosion and abrasion in coastal areas and increased sea water intrusion in the mainland. Blue economy initiatives address both climate change mitigation and adaptation objectives and efforts.

Blue economy focuses on not only on the productivity of the oceans, but also in ensuring that every stakeholder benefits from healthy, resilient and sustainable marine ecosystems. Blue economy is very compatible with the issues targeted in the Paris Climate Change Agreement and SDG 14, such as:

- Achieve justice for all actors and each country to utilize and manage healthy and sustainable oceans.
- Strengthening of local fishermen, fishermen, women and local industry in running the fisheries industries (local ownership)
- Creation of sustainable livelihoods, improving food security, improving the quality of human life and social equality while reducing ecological crisis as part of the overall poverty reduction agenda

f. Capacity Development – Ensuring the Right Skills

Capacity building involves the development of human resources needed to answer the challenges of the present, and meet required availability of a competent workforce, especially in the seven ocean economic sectors, emerging ocean industries, as well as in ecosystem conservation, environmental management and climate change response. New knowledge, and enhanced capacity and skills would greatly support the momentum towards blue economy initiatives.

g. Transformational Engagement of Stakeholders

The success of the Blue Economy model requires the commitment of stakeholders, especially in relation to implementing various policies, both local and national, as well as human resources, technology, financial access, proper industrialization (upstream and downstream), education, and community collective awareness of marine potential and sustainable use. Each one has a role to play, but there should be coordination and cooperation among them. Governments should engage communities and various stakeholders in planning, managing wastes, habitats and fishery resources, cleaning up waterways and coasts, identifying suitable blue economy initiatives and developing innovative approaches to meet the challenges of poverty, inequality, and environmental and climate change impacts.

h. Young Entrepreneurs

The number of young Indonesian entrepreneurs is estimated to grow by 1.36% per year, although their percentage share in the total number of entrepreneurs could decrease. Efforts to engage them should be made to promote among them investments in more sustainable ocean economic industries and transform Indonesia's economy towards blue economy.

17.3 Conclusion and Recommendations for Blue Economy Development and Integrated Ocean Management

The foundation of a blue economy is sustainable, resilient and inclusive ocean economy, clean oceans, and healthy, productive and resilient coastal and marine ecosystems. The sustainable supply of goods and services from the oceans is central to the country's future well-being and prosperity. Currently, the ocean is under pressure from the diversity and multitude of human activities, driven by our need for food, water, energy, medicines, transportation, trade, and recreation. Habitat destruction, IUU fishing, pollution, and unregulated coastal development threaten the ocean's resources and its life supporting services. These pressures are amplified by loss of biodiversity, declining fish stocks, and climate change. Indonesia is also prone to extreme natural events, such as earthquakes, tsunamis, wildfires, heavy rainfall, flooding, and volcanic eruptions, which affect human life, properties and ecosystems.

The NSOC Report is an important tool to promote good ocean governance and partnerships for blue economy, advance scientific support, raise public awareness, and foster the development of synergies among the various sectors and stakeholders for integrated coastal and ocean management. The report has been developed through multi-agency and multi-stakeholder collaboration and knowledge sharing.

A significant part of the report is the valuation of the ocean economy and ecosystem services as such information is increasingly called on to assess tradeoffs and facilitate the incorporation of environmental values into the formulation of economic policy for more efficient, equitable and ecologically sustainable coastal and ocean management. Thus, the evidence base provided by the NSOC report is fundamental in informing policy- and decision-makers on a range of ocean-related issues. The report discusses the state of the ocean economy, ocean health and ocean governance, and the pressures and consequences of continuing the business-as-usual mindset. More importantly, the NSOC report draws attention to the opportunities for policy reforms, investments, and partnerships, and highlights the blue economy initiatives, innovations and best practices that can be replicated and scaled up.

Recommendations

Promote blue economy development as a key component of the sustainable and integrated ocean policy. There is a need to mainstream the blue economy as part of the national ocean policy and overall economic development strategy. The strategies for the economic development of the ocean-based and ocean-related sectors must ensure environmental sustainability, climate resiliency, inclusiveness, and overall well-being of the people, and not just income and economic growth.

- The blue economy approach requires the development of a more coherent, integrated and structured framework that takes into account the economic potential of all marine natural resources, which include seaways and energy sources from the oceans, and their sustainable use.
- The blue economy offers significant development opportunities but also raises challenges in sectors, such as sustainable fisheries and aquaculture, marine and coastal tourism, maritime transport and logistics, green ports, marine renewable energy, marine bio-prospecting and biotechnology, ship-building and marine construction. Regulations, incentives, institution building, capacity development, and financing mechanisms in key environmental services sectors, such as biodiversity conservation, solid waste management, wastewater treatment and remediation services, can support further investment in these sectors to ensure healthy and sustainable oceans. There is potential for partnerships to access technologies, expertise and financing for these sectors.

Foster blue economy initiatives, environmental investments and ecosystem-based climate resiliency as part of ICM strategy.

- ICM strategies and action plans should incorporate blue economy initiatives at the local level. Opportunities for income generation and job and livelihood creation also exist in ocean-related sectors at the local level like sustainable fisheries and aquaculture, sustainable coastal tourism, marine renewable energy, and seafood processing, as well as synergies with habitat restoration, climate proofing, and water, sanitation and wastewater and solid waste management services. Co-management approaches and benefit-sharing schemes can also enhance the restoration and protection of coastal habitats while allowing for alternative or supplemental livelihood programs to support the coastal communities.
- More facilities (e.g., sanitary landfill, recycling facilities, wastewater treatment, etc.) and improved services – from collection to disposal, treatment, recycling and reuse – should be included in the investment priorities. There should also be a regulatory and incentive framework and stakeholder involvement as part of the enabling conditions. Partnerships between national and local governments and between public and private sectors should be encouraged to develop more of these environmental facilities. There should also be collaboration with ocean-related businesses at all scales in developing principles and guidelines for sustainable conduct and production. Public awareness on the importance of waste management, stakeholder

support and behaviour change are crucial to effectively reduce pollution, and ensure the viability and sustainability of environmental services and facilities.

- ICM, together with integrated coastal land- and sea-use planning or marine spatial planning that incorporates ecosystem-based disaster risk reduction and management, appropriate infrastructure development to combat flooding and erosion and ensure water security, and coastal ecosystem restoration and conservation, would enhance climate resiliency. However, greater climate change awareness, more capacity development, and increasing financing of habitat restoration and adaptation projects at the local level as well as better coordination between the public and private sectors are needed to achieve the objectives set out in the action plan. Stronger inter-agency and intersectoral coordination and collaboration with communities will enable holistic and flexible responses to climate change.

Support research and information management and develop ocean accounts for evidence-based ocean policy- and decision-making. Several factors make the provision of both up-to-date and accurate information a challenge in Indonesia.

- Environmental data is critical to assess impacts of country interventions, trends in marine water quality and condition and utilization of resources over time, and risks and challenges to mitigate and plan for. Regular monitoring of the coastal and marine ecosystems and marine water quality, and making the monitoring data and other scientific research studies available are needed to see the impacts of human activities and land- and sea-use changes, as well as effectiveness/inadequacy of policies and actions.
- Economic data, particularly, ocean economic sector and industries and valuation of coastal and marine ecosystem services, are also important to show the natural oceanic capital and contribution to incomes, jobs, livelihoods, well-being and resiliency. Currently, Indonesia measures the outputs and gross value added of seven established ocean-related sectors, which have been identified in the national ocean policy and economic development plan. However, their sustainability and impacts on the oceans are not part of the accounting system. Data disaggregation to account for key sectors, such as small-scale fisheries, fish and seafood processing, ship-building, maritime services, and emerging ocean industries, is also one of the challenges in developing the ocean accounts.
- There is a need to develop the ocean accounting system that show the economic-environmental linkage as well as social considerations like subsistence fisheries, small-scale ocean industries, wages and linkage to poverty reduction and sustainable development. The valuation of coastal and marine ecosystem services also needs further work to get more robust estimates. Likewise, there is a lack of waste accounting, and availability of studies showing the environmental cost and economic losses. Moreover, the role of trade is not deeply considered yet. Backward and forward linkages and multiplier effects of the ocean economy, and the outcomes of multilateral and regional trade that might impact the state of ocean health can be better assessed when ocean accounts are available.

- To support its mainstreaming, the ocean accounts must be highlighted at the macro-level planning, and not just at the environmental or maritime sector level, to show the potential returns for harnessing the natural oceanic capital sustainably in support of growth, jobs, development, resiliency, and well-being.

Strengthen knowledge management. It is crucial to strengthen the knowledge base by developing and disseminating new data and other scientific and socioeconomic information as well as existing knowledge, including traditional knowledge, about the ocean upon which life is dependent on. Use best available scientific knowledge on climate change, and apply cost-effective adaptive mechanisms. Utilize also traditional knowledge and grassroots initiatives in developing adaptive management systems. There are also innovative, smart and green technologies that can transform the ocean economy to sustainable and resilient blue economy, but policies and incentives are needed to make them accessible and affordable. Support for R&D efforts on innovative solutions is an essential pillar of blue economy development.

Improve capacity development, and ensure the right skills. Capacity building is required to provide the knowledge base and technical and managerial skills necessary for blue economy development and to have a sustainable, effective and integrated coastal and ocean management system. A cadre, consisting of policy-makers, planners, scientists and environmental and resource economists who can formulate the most appropriate strategies for utilizing and managing the ocean and its resources in a sustainable and inclusive way, as well as leaders and managers who can implement those strategies in collaboration with various stakeholders, is essential. Moreover, it is important to have the capacity to use new technologies and innovative systems.

Regularly update the NSOC Report. The report currently provides the baseline for the ocean economy, ocean health and ocean governance and blue economy initiatives, but there are data gaps that can be addressed in future NSOC reports. Regular updating of the NSOC report would help in showing the progress (and hopefully not lack of it) in meeting the targets of the national ocean policy, and in presenting the major outcomes and benefits of blue economy development and integrated coastal and ocean management.

Connect blue economy, ICM and ocean management to the SDGs. To get more support, it is essential to show the linkage of blue economy initiatives to national development plan and the SDGs, as well as the interactions, combined effect, and benefits to accelerate actions and achieve the targets of SDGs, SDS-SEA, other international agreements, and related national plans. The NSOC Report can be used as a platform to ensure that *sustainable oceans for all* is given a priority in the national and local development plans.

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