WRI INDONESIA

TRENDS IN MARINE RESOURCES AND FISHERIES MANAGEMENT IN INDONESIA

A Review

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TABLE OF CONTENTS


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FOREWORD

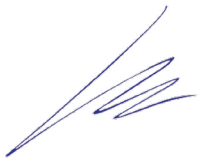
As the largest archipelagic state in the world, Indonesia is blessed with vast oceans home to one of the most diverse tropical marine ecosystems and resources. It is indispensable to acknowledge that the ocean has become a living force for our country and its people. The ocean is an essential provider of protein, nutrients, and livelihoods for local communities; serves as a crucial method for transportation and access to remote areas; acts as a buffer against the full effects of climate change; and is a staple of Indonesia's economy, and identity.

Today, Indonesia's marine and fisheries sector faces pressures and challenges that we have not seen before. Climate change, loss of biodiversity, and the unprecedented increase of human activity have led our oceans into troubled waters. As we rely on the ocean to support our existence, knowing how to utilize the ocean's resources in a sustainable way is crucial, which is why WRI Indonesia joined hands with the Packard Foundation to share this report, titled "Trends in Marine Resources and Fisheries Management in Indonesia: A 2021 Review".

Through this report, we seek to aggregate the best available data and provide an in-depth analysis of marine fisheries statistics, ecological performance, trends in politics, policy, and government priorities to provide support for decision-making by stakeholders in the sector.

This report presents the most recent data and information, and analyses gaps, and identifies challenges in marine and fisheries management. It aims to inform relevant government officials, the business sector, civil society, and other stakeholders that efforts are needed from each of them to ensure and encourage the long-term sustainable management of fisheries. We hope this report will help streamline collaboration across partners and push for evidenced-based policies to ensure Indonesia's marine and fisheries resources are managed sustainably.

We are excited to share this report and would like to express our appreciation for our partnership with the Packard Foundation. We hope this collaboration will significantly contribute to bringing Indonesia's vision of a sustainable and fisheries sector closer to reality.



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EXECUTIVE SUMMARY

Climate crisis and unsustainable activities in Indonesia's marine and fisheries sector have led the ocean into troubled waters. The country must strengthen their commitments to ensure ocean resources are managed sustainably and equitably. This report aggregates the best available data and provide in-depth analysis on marine and fisheries issues to encourage evidence-based approach in decision-making processes.

Highlights

- Indonesia plays a critical role in ensuring a continued prosperous global ocean economy. It is the world's largest archipelagic nation, a member of the Group of 20 (G20), and possesses the world's richest marine biodiversity.
- Indonesia is also the world's second-largest seafood producer (after China), but this is not reflected in the sector's economic performance, with fisheries contributing 2.8 percent of the country's gross domestic product (GDP) in 2020.
- In many cases, Indonesia's fish stocks are fully exploited or overexploited, as problems in collecting, analyzing, and using data in management continue to challenge management and law enforcement.
- Shrimp is Indonesia's most important aquaculture commodity by value. Indonesia exported 197,000 metric tons (t) of shrimp in 2018, representing 45 percent of the value of all seafood exports. Seaweed is the largest seafood commodity by volume—11.3 million t in 2019—but economic returns are low.
- Significantly less than 20 percent of Indonesia's marine protected areas (MPAs) are covered by essential ecosystems: mangrove forests, seagrass beds, and coral reefs.

Introduction

Indonesia plays a critical role in ensuring a continued prosperous global ocean economy. It is the world's largest archipelagic nation, possesses the world's richest marine biodiversity and is one of the world's 20 largest economies. Indonesia is surrounded by a water area nearly four times larger than its land area and is endowed with vast marine resources and fisheries. The Indonesian ocean compromises a large part of the Coral Triangle, an area containing 76 percent of the world's coral species (Veron et al. 2009) and 37 percent of the world's coral reef fish species (Hoegh-Guldberg et al. 2009). With the world's second-longest coastline and vast marine waters, Indonesia is one of the most fertile fishing grounds in the world. It is the world's second-largest producer of marine wild-capture fish (Tran et al. 2019) and meets about 25 percent of global fisheries demand (BKPM 2018).

Indonesia has put pressure on its ocean and fisheries resources and areas, and now faces the challenge of managing these effectively and investing appropriately to protect its essential ecosystems and ensure the longevity of its seas. Indonesia is the world's second-largest seafood producer (after China). Wild-capture fisheries and aquaculture production increased in the decade to 2018, with wild capture growing about 16

percent and aquaculture about 34 percent (BPS 2018). However, many of Indonesia's fish resources are fully exploited, while some species are subject to overfishing (KKP 2017a). Production in the fisheries sector depends on small-scale fisheries, which account for at least 90 percent of production, getting more and more costly in more and more exploited waters. In 2019, Indonesia established 23 million hectares (ha) of MPAs, but there is a gap in financing, staff training, and capacity building, and a gap in measures to protect essential ecosystems, such as mangroves, seagrass beds, and coral reefs.

Urgent action is needed to ensure the sustainability of production and conservation of marine resources, both in Indonesia and globally, given the rising demand for seafood from a growing population, competition in the use of ocean resources and coastal areas, and climate change. This report provides a review of evidence to help policymakers, nongovernmental organizations (NGOs), private sector actors, experts, and other stakeholders improve decision-making around the management of Indonesia's marine resources and fisheries.

About this Report

This report describes trends and issues affecting the status and management of wild-capture fisheries, aquaculture, and marine and coastal resources in Indonesia. It presents recent data and information, analyzes gaps, and identifies challenges. It is meant to inform the government, the business sector, and civil society on efforts to encourage the long-term sustainable management of fisheries. The authors also analyze the links between wild-capture fisheries, aquaculture, and marine and coastal protection. This majority of this report was prepared in November 2021, with information added through early 2022. It is supported by the David and Lucile Packard Foundation.

The quality and quantity of data on fisheries in Indonesia are limited and fragmented (Anticamara et al. 2011; Carruthers et al. 2014; Chrysafi and Kuparinen 2016). The data in this report was sourced from literature, focus group discussions, and in-depth interviews. Data was also sourced from the Government of Indonesia's publicly available databases, including fisheries statistics from the Ministry of Maritime Affairs and Fisheries (Kementerian Kelautan dan Perikanan/KKP). Geospatial data was sourced from the Ministry of Environment and Forestry (Kementerian Lingkungan Hidup dan Kehutanan/KLHK), and other statistics from the Food and Agriculture Organization (FAO), and from international open-source trade data platforms (such as Trendmap). The literature review covers peer-reviewed journals, gray literature (information produced by government agencies, academic institutions, and the private sector), and newspaper articles. Focus group discussions and interviews were conducted with stakeholders involved in fisheries policy and management and included policymakers and representatives from businesses, trade organizations, civil society organizations, and academia.

Key Findings

In his second term, President Joko "Jokowi" Widodo is focusing on economic growth and investment, which influence decisions made in the already complex marine and fisheries sector. He has indicated his intention to increase investment in the marine resources and fisheries sector and eliminate regulations that could hamper entrepreneurs and fishers. He has renamed the Coordinating Ministry of Maritime Affairs (Kementerian Koordinator Kemaritiman [KEMENKOMAR]) as the Coordinating Ministry of Maritime Affairs and Investment (Kementerian Koordinator Kemaritiman dan Investasi [Kemenkomarves]) and selected a new minister to lead the KKP.

The KKP reviewed 29 regulations in an effort to increase production. The Ministry suggested these regulation hindered business and investment in the sector. Reforms made since the review include allowing the use of *cantrang* (destructive trawl nets); prohibiting the sinking of illegal, unreported, and unregulated (IUU) ships; and allowing the export of lobster larvae, and they undo many other regulations intended to protect Indonesia's marine and fisheries resources. In October 2020, Indonesia's parliament passed the Omnibus Law on Job Creation (UU Cipta Kerja 11/2020). The law is intended to strengthen the economy by increasing competitiveness, creating jobs, and stimulating domestic and foreign investments, but it further marginalized some groups of society, particularly small-scale fishers, local and Indigenous communities.

Indonesia is the world's second-largest seafood producer (after China), but the size of the sector is not reflected in its economic, social, and environmental performance. Indonesia accounts for about 7 percent of global production from capture fisheries (FAO 2020b), but fisheries accounted for less than 2.8 percent of Indonesia's GDP in 2020 (BPS 2021). About 75 percent of Indonesia's fish resources are fully exploited or subject to overfishing (KKP 2017a), and 96 percent of Indonesia's fishers are small-scale, operating in increasing cost of production in overexploited waters (KKP 2019g).

Indonesia has been unable to meet its production, export, and growth targets because of depleted fish stocks, data deficiencies, and lack of coordination between agencies. Despite the slowing growth of wild-capture fisheries, seafood production is expected to continue growing over the next decade due to growth within aquaculture.

The growth rate of Indonesia's wild-capture fisheries production is slowing, consistent with global trends. Production from wild-capture fisheries in inland and marine waters makes up 57 percent of Indonesia's total seafood production. Growth has remained below 6 percent since 2017 (KKP 2017a, 2018a, 2019b, 2019c). To help safeguard the long-term performance of capture fisheries, adequate data is required; for example, on stock status and fisheries efforts (i.e., vessel capacity, number of hours or days spent fishing, fishing gear used).

In 2022, nearly half of Indonesia's wild fish stocks were overfished, reducing their current and future productivity. Many species are fully exploited (with an exploitation rate between 0.5 and 1) and even overexploited (with an exploitation rate above 1). Indonesia is experiencing problems in managing the sector due in part to data deficiencies and gaps. Fisheries data is of insufficient quality, as there are discrepancies in the accuracy of catch or effort statistics, population dynamics of target species, and vessel catches.

Indonesia's fishing fleet is dominated by small-scale fishers, who account for 96 percent of the total number of vessels (KKP 2019g). These consist of nonmotorized vessels, vessels with inboard engines, and vessels below 10 gross tons (GT). This large proportion of small-scale fishers affects productivity because of the density of fishing activities in coastal areas, the limited capacity to reach fishing grounds further away, and the many conflicts over resource use. Significant effort is needed to manage these issues.

In 2018, women represented 42 percent of the workforce of the fisheries sector and 74 percent of the workforce of the aquaculture subsector (KKP 2019g). Barriers exist preventing women from participating in the sector and accessing economic opportunities due to the lack of recognition of the key role women play.

Fish contribute 50 percent or more of total animal protein intake to the average Indonesian's diet and provides an affordable protein source for marginalized households (FAO 2017). Despite the fact that fish accounts for 50 percent of total animal protein consumed in Indonesia, statistics show that the average protein intake of Indonesians is low and does not meet national dietary guidelines, especially when compared to the consumption of carbohydrates. This, among other factors is why Indonesia is one of the largest countries in the world to face both sides of malnutrition, both under- and over-nutrition; that is, stunting and obesity.

Aquaculture production has grown rapidly, but it presents challenges because of its requirements for space, water, and feed, the threat of disease it presents, and the low labor productivity in the sector. Average production in Indonesia was less than 1 t per fish farmer in 2019—far less than the per fish farmer output in Vietnam (1.4 t), China (10 t), or Norway (165 t) (FAO 2020b).

Shrimp is the most important aquaculture commodity for Indonesia by value and its most important fisheries export commodity, while seaweed is the largest mariculture commodity by volume. Indonesia exported 197,000 t of shrimp in 2018 (KKP 2018a), representing 45 percent of the total value of Indonesian fisheries exports (BKPM 2018). However, brackish water shrimp aquaculture is one of the largest drivers of mangrove conversion in Indonesia. Seaweed is the largest commodity by production volume at 11.3 million t in 2019, but it provides low economic returns.

The seaweed industry is a potential growth sector and could provide livelihoods for middle- to low-income communities as it requires low levels of capital investment. However, this is also one of the reasons that policymakers have paid little attention to the sector, and because it provides low economic returns (Neish 2013). The productivity of seaweed has been declining (see Table 1.1), including from 2017 to 2019, especially when compared to the productivity of brackish water shrimp aquaculture, which increased by about 15 percent in 2017 (KKP 2019g).

The effectiveness of the MPAs falls short because of many obstacles, including the limited availability of staffing and budgets, the complexity of governance, and low compliance. Indonesia has established 23 million ha of MPAs.

Today, another 19.3 percent of Indonesia's total mangrove cover is in a precarious state, facing, for example, conversion to aquaculture ponds. Since 2000, Indonesia's mangrove cover has decreased by 11 percent. However, a 2021 update of the National Mangrove Map (Peta Mangrove Nasional) suggests an increased area of mangrove, from 3,311 million ha (2013–18) to 3,364 million ha (2021) (KLHK 2021).

In 2019, 390 (33.8 percent) of Indonesia's coral reefs were categorized as being in physically poor condition (LIPI 2020), even though they are among the most biologically rich and diverse in the world. More than 590 species of coral have been identified in Indonesian waters. Indonesia is also home to more than 65 percent of the world's coral species (ADB 2014). In 2019, most Indonesian coral reefs were in poor or fair condition, with 33.8 percent categorized as poor and 37.4 percent as fair (LIPI 2020).

Indonesia has one of the most expansive seagrass ecosystems in the world (Green and Short 2003). Research conducted by the Indonesian Institute of Sciences (Lembaga Ilmu Pengetahuan Indonesia/LIPI) in 2017 revealed that 50 percent of the seagrass in eastern Indonesia was in moderate condition, 43 percent in fair condition, and 7 percent (in Batanta, West Papua) in poor condition (LIPI 2017). However, the government has committed to continuously expanding MPAs and ensure their effectiveness in conserving ocean ecosystems.

The Way Forward

Recommendations for a continued ocean economy:

- **Encourage and ensure meaningful participation in decision-making.** Broader political dynamics taking place in Indonesia influence decision-making around the management of marine resources and fisheries. There is a tendency to exclude the aspirations of the community from decision-making and also to limit community engagement in decision-making, as, for example, is seen in the establishment of the Omnibus Law on Job Creation.
- **Improve the collection and analysis of fisheries data to allow it to be used for effective and sustainable management, and ensure laws and policies are enforced.** Indonesia is the world's second-largest wild-capture and aquaculture producer, but the performance of the fisheries sector is lagging. This might be caused by overfishing, deficiencies in fisheries data, and the inability to manage stock sustainably.
- **Implement strategies for inclusion and gender equity to support the long-term recovery and resilience of fishing communities.** The fisheries sector, both capture fisheries and aquaculture, is dominated by small-scale fishers. It is vital that local businesses are supported so that value added is retained by small-scale fishers and local communities, and market access is improved for them (Pomeroy et al. 2020). Furthermore, the role of women in the sector is often been overlooked. Understanding local food systems and livelihood practices are ways to ensure resilience in the sector.
- **Ensure the long-term sustainability of shrimp aquaculture so that it does not compromise the health or natural functions of ocean ecosystems.** It is important for shrimp farms to be sustainable and certified in order to protect mangroves, and for the opportunity costs of mangrove conversion to be internalized in order to disincentivize deforestation.

- **Provide policies for and encourage research into the seaweed industry.** The seaweed industry could provide considerable growth and income for middle- to low-income communities due to the low capital investment requirements (Neish 2013). Policies that enable and support the processing industry can increase the value of seaweed in Indonesia and improve the overall value chain distribution.
- **Increase the protection and restoration of Indonesia's intact essential marine ecosystems, such as mangrove forests, seagrass beds, and coral reefs, given the contribution that these systems make to Indonesia's economy and the wellbeing of its people**. Significantly less than 20 percent of Indonesia's MPAs are covered with essential ecosystems such as mangrove forests, seagrass beds, and coral reefs.
- **Advance an ecosystem approach to fisheries management as the preferred option and best practice for the long-term sustainability of fisheries and ecosystem services.** Indonesia's seas are divided into fisheries management areas (Wilayah Pengelolaan Perikanan/WPP). These could adopt a spatial management approach, managing the multiple uses of an ocean landscape or seascapes, which include productive waters for fisheries and aquaculture, seabed mining, marine tourism, shipping lanes, and ports; multiple-use MPAs (including no-take reserves); and networks of MPAs that boost conservation.
- **Encourage other effective area-based conservation measures alongside government-led MPAs.** These are areas with diverse management objectives, including habitat protection, sea tenure for traditional or customary communities, fisheries, and tourism, among other goals (Estradivari et al. 2022). A network of such schemes and MPAs can strengthen ocean ecosystem conservation between regions, reduce conflicts of interest, accommodate diverse customs and local wisdom, and provide opportunities for knowledge sharing on successful MPA management in a network.

INTRODUCTION

Indonesia faces various challenges in managing its marine resources and fisheries. The findings in this section will give context and short overview of Indonesia's marine and fisheries sectors.

Indonesia is a vast archipelago consisting of 16,056 islands. It has a coastline of 108,000 kilometers (km) (Pushidrosal 2018) and is surrounded by a water area nearly four times larger than its land area. Indonesia is endowed with vast marine resources and fisheries, it compromises with a large part of the Coral Triangle, an area containing 76 percent of the world's coral species (Veron et al. 2009) and 37 percent of the world's coral reef fish species (Hoegh-Guldberg et al. 2009). With the world's second-longest coastline and vast marine waters, Indonesia has one of the most fertile fishing grounds in the world. Indonesia's mangrove forest area is the largest in the world—18 percent of the world total. It is also the world's second-largest producer of marine wild-capture fish (Tran et al. 2019) and supplies about 25 percent of global fisheries demand (BKPM 2018). Strategically located in the center of major maritime trade routes and bridging two oceans, Indonesia's seas link countries and continents. Indonesia possesses the only routes connecting various ocean basins in the tropics, and these waters also play a pivotal role in the ocean and climate system (Sprintall et al. 2014). The ocean and its marine resources are also major sources of protein, food, and livelihoods (Gibson et al. 2020).

Indonesia faces challenges in managing its marine resources and fisheries. These include overcoming conflicts between overcoming conflicts in coastal development; degradation of the ecosystem; combating illegal, unreported, and unregulated (IUU) fishing; and reducing ocean pollution. The management of marine resources and fisheries is also affected by Indonesia's complex political situation (MacAndrews 1994), as well as clashing economic and environmental interests.

Fisheries contributed 2.8 percent of Indonesia's gross domestic product (GDP) in 2020 (BPS 2021). The ocean makes a critical contribution to livelihoods, food and nutritional security, and well-being for many households in Indonesia, including disadvantaged families. With proper and sustainable management, Indonesia's fisheries could improve their economic, social, and environmental performance. Table 1.1 provides data on Indonesia, its fisheries sector, and its marine resources.

Table 1.1 | **Indonesia at a Glance, 2016–17 and 2019–20**

Item	2016–17	2019–20	Change (%)	Source
Population				
Population (millions)	261 (2017)	267 (2020)	2.3	BPS
Urban population (%)	55.2 (2017)	56.6 (2020)	2.5	BPS
GDP				
GDP (US$, trillions)	1.10 (2017)	1.12 (2019)	1.8	World Bank
GDP per capita ($)	3,837 (2017)	4,135 (2019)	7.8	BPS
Contribution to GDP (%)				
Fisheries	2.6 (2017)	2.8 (2020)	7.7	BPS
Agriculture	13.2 (2017)	13.7 (2020)	3.8	BPS
Manufacturing	20.2 (2017)	19.9 (2020)	–1.5	BPS
Services[a]	13.8 (2017)	14.5 (2020)	5.1	BPS
Fisheries Production (t, million)				
Wild-capture fisheries	6.9 (2017)	7.5 (2019)	8.7	KKP
Aquaculture	5.6 (2017)	6.4 (2019)	14.3	KKP
Seaweed	10.5 (2017)	9.9 (2019)	–5.7	KKP

Table 1.1 | **Indonesia at a Glance, 2016–17 and 2019–20 (continued)**

Item	2016–17	2019–20	Change (%)	Source
Fisheries Exports (t, millions)				
Wild capture	0.6 (2017)	0.7 (2018)	16.7	KKP
Aquaculture	1.7 (2017)	1.7 (2018)	0	KKP
Seaweed	0.2 (2017)	0.3 (2018)	50.0	KKP
Foreign Direct Investment ($, millions)[b]				
Fisheries	13.1 (2017)	5.0 (2020)	–61.8	BKPM
Food crops and plantations	339.6 (2017)	384.4 (2020)	11.65	BKPM
Domestic Direct Investment ($, millions)[c]				
Fisheries	0.18 (2017)	3.02 (2020)	94.03	BKPM
Food crops and plantations Fisheries	695 (2017)	513(2020)	–26.18	BKPM
MPAs				
Number of MPAsS	177	196	10.7	KKP
Cover (ha, millions)	20.87 (2018)	23.14 (2019)	10.9	KKP
Essential Ecosystems				
Mangroves (ha, millions)	2.90 (2017)	2.96 (2019)	2.1	KLHK
Coral reefs (ha, millions)	2.52 (2016)	2.52 (2018)	0	LIPI
Seagrass (ha, millions)	0.29 (2017)	0.29 (2018)	0	LIPI

Sources: BPS: Statistics Indonesia (Badan Pusat Statistik); KKP: Ministry of Marine Affairs and Fisheries (Kementerian Kelautan dan Perikanan); BKPM: Indonesian Investment Coordinating Board (Badan Koordinasi Penanaman Modal); KLHK: Ministry of Environment and Forestry (Kementerian Lingkungan Hidup dan Kehutanan); LIPI: Indonesian Institute of Sciences (Lembaga Ilmu Pengetahuan Indonesia).
Notes:
[a] Services: accommodation and food services; financial services and insurance; business; education; other services.
[b] Foreign direct investment for the fourth quarter of 2020.
[c] Despite the increase in 2019, the aggregate value of domestic investment in the fisheries sector is low compared with other sectors. For example, domestic investment in the food crop and plantation sector in 2019 reached Rp 43 trillion.

SITUATIONAL AND POLITICAL CONTEXT OF 2019–2022

This section provides a brief description of Indonesian politics and governance in the context of marine issues. It examines some of the broader political dynamics in Indonesia in 2019 and 2022 and delves deeper into the complex relevance of marine resource and maritime issues to Indonesia's development and global economy. It then reviews significant programs, developments, and ongoing issues.

Reelection of President Joko Widodo

In May 2021, President Joko "Jokowi" Widodo was reelected for a second five-year term. In his reelection speech in October that year, he highlighted his commitment to advancing and accelerating development, with the goal of raising Indonesia's GDP from $1 trillion to $7 trillion by 2045 (Kompas.com 2019).

In his second term, Jokowi aims to focus on Indonesia's economic growth and investment, including the marine and fisheries sector. The two main government authorities in the marine and fisheries sectors are the Coordinating Ministry of Maritime Affairs and Investment (Kementerian Koordinator Kemaritiman dan Investasi/ Kemenkomarves) and the Ministry of Marine Affairs and Fisheries (Kementerian Kelautan dan Perikanan/KPP).[1] Luhut Binsar Panjaitan headed up the Coordinating Ministry of Maritime Affairs before the addition of investments to the ministry's responsibilities, and he was asked to stay on with the expanded remit. President Jokowi expects him to remove the bottlenecks to investment and operationalize larger investment commitments (*Jakarta Post* 2019). Edhy Prabowo, a politician from the Gerindra party, was selected as KKP minister on October 23, 2019. He was a member of parliament from 2014 to 2019 and head of the House of Representatives Commission IV, which oversees agriculture, environment, land, and marine affairs. The president asked him to prioritize improving communication with fishers and strengthening and optimizing the aquaculture sector (*Tempo* 2019). Prabowo resigned in November 2020 after being named a suspect in an alleged bribery case. He was replaced by Sakti Wahyu Trenggono, a businessperson and politician from the National Mandate Party.

President Jokowi's prioritization of economic development set the tone for the direction of national development through 2024. According to Presidential Regulation (Perpres) No. 18/2020 on the National Medium-Term Development Plan, the government is to focus on seven development priorities from 2020 to 2024:

- Strengthening economic resilience for quality growth
- Reducing inequality and ensuring equity
- Improving the quality and competitiveness of Indonesia's human resources
- Enhancing the culture and character of the country
- Strengthening infrastructure to support economic development and basic needs
- Improving the environment and increasing resiliency to disasters and climate change
- Strengthening political and legal stability and security, and transforming public services

The National Medium-Term Development Plan 2020–24 was developed by the Ministry of National Development Planning (Bappenas) through consultations with national and local government officials, local and international partners, experts, and civil society.

Direction of the Marine and Fisheries Sector

Perpres No. 18/2020 on the National Medium-Term Development Plan 2020–24 includes several strategic projects related to the marine and fisheries sector:

- Development of three integrated international fishing ports and markets (North Sulawesi, North Sumatra, and Maluku) to increase the production of wild-capture fisheries to 10.1 million t by 2024 and fisheries exports to $8 billion a year
- Enhancement of 350 small-scale fisher and farming businesses to increase their annual income by 10 percent and 5 percent, respectively, and increase commodity productivity by 5 percent a year. Monthly fisher income is targeted to increase by 49 percent from Rp 3.75 million in 2020 to Rp 5.58 million in 2024
- Revitalization of prawn and milkfish (*bandeng*) ponds (on the north coast of Java, Lampung, South Sulawesi, and West Nusa Tenggara), with a target of increasing fish production by 8.5 percent to 10.32 million t a year and prawn exports by 8 percent a year

- Improvement of maritime security in the North Natuna Sea, with the objective of protecting Indonesia's sovereignty and reducing piracy, violence, and other crime at sea (including IUU fishing and transnational crimes)
- Development of 10 tourist destinations, including seven with a focus on marine tourism (Lombok—Mandalika, Labuan Bajo, Manado—Likupang, Wakatobi, Raja Ampat, Bangka Belitung, and Morotai). All seven destinations are in MPAs under the authority of the KKP or the KLHK.

During a national coordination meeting in December 2019, then-fisheries minister Prabowo highlighted five policy priorities that his office would focus on in 2020 (KKP 2018b, 2019d):

- Improving communication with fishers, simplifying the licensing process, developing fishing seaports, managing fisheries in Indonesia's exclusive economic zone and in the deep sea, and protecting and empowering fishers
- Optimizing and strengthening the aquaculture sector to create jobs and increase the supply of animal protein for human consumption
- Strengthening the marine and fisheries industries to improve investment and fishery exports
- Managing sea, coastal areas, and small islands and improving the surveillance of quarantine for marine resources and fish
- Strengthening human resources and research innovation in marine and fisheries

In addition, the KKP also set three main priorities for 2021 to 2024:

- Increasing nontax state revenue from capture fisheries to increase the welfare of fishers
- Supporting the development of the aquaculture sector to increase exports by increasing the quality of marine and fisheries research
- Developing village-based freshwater, brackish, and marine aquaculture

The National Medium-Term Development Plan set targets for the marine and fisheries sector and is expected to be executed by the implementing ministries in their annual plans. The KKP set a more ambitious economic growth target for the fisheries sector in 2020 than that set by Bappenas. Table 2.1 sets out the targets for 2020 and 2024.

Table 2.1 | **Marine and Fisheries Targets for 2020 and 2024**

	Actual 2019	Bappenas 2020 Target	KKP 2020 Target	Bappenas 2024 Target
Annual economic growth in fisheries sector (%)	5.8	6.5	7.9	7.8
Annual fish production, including wild capture and aquaculture (t, million)	13.9	15.5	15.5	20.4
Wild-capture fishery	7.5	8.0	8.0	10.1
Aquaculture, excluding seaweed	6.4	7.4	7.5	10.4
Seaweed (t, millions)	9.9	11	11	12.3
Fisheries exports ($, billions)	5.2	6.2	6.2	7.9
Annual per capita fish consumption (kg)	54	58	56	62
Marine conservation area (ha, millions)	23.1	20	20.7	26.9

Sources: PERPRES 2020; KKP 2019b, 2020e; KKP 2019g
Note: Bappenas: National Development Planning Agency (Badan Perencanaan Pembangunan Nasional); KKP: Ministry of Marine Affairs and Fisheries (Kementerian Kelautan dan Perikanan)

Implications of COVID-19 for the Marine and Fisheries Sector

On March 2020, President Jokowi announced the first COVID-19 case in Indonesia. As the pandemic spread across the country, disruption of Indonesia's food system grew. The COVID-19 crisis disrupted domestic supply chains and restricted production, while job losses jeopardized the ability of households to buy food. The pandemic also exacerbated ongoing challenges in Indonesia's supply chain, such as high logistics costs and complex supply chains (World Bank 2015).

The COVID-19 crisis hit the marine and fisheries sector hard, disrupting supply chains, reducing market access, and putting the jobs of 1.1 million fishers and others in the sector at risk (*Tempo* 2020). Demand for fishery products decreased by 50 percent in April 2020, causing vast quantities of fish products to go to waste (Mongabay 2020), as fish stocks piled up and were thrown away. Certain varieties of pond fish were harvested in large quantities but sold cheaply (McCarthy et al. 2020). As a result, logistics costs reportedly increased by 40 percent, while fish prices dropped dramatically—by 50–75 percent. Prices for small fish fell from Rp 5,000–Rp 8,000/kg to Rp 1,500–Rp 3,000/kg (McCarthy et al. 2020). Fishers' income also declined. In North Sumatra, for example, income fell from Rp 3.5 million per trip to Rp 1 million–Rp 1.5 million per trip, threatening the ability of fishers to meet their basic needs (Samudranesia 2020).

The export volume of live grouper declined during the pandemic in 2020. In the first quarter of 2020, exports reached just 295 t, significantly below the 793 t exported in 2019 (Wiradana et al. 2021). From January to February 2020, the export volume of live crabs decreased by 30.7 percent and the value by 32.3 percent (Wiradana et al. 2021).

Restrictions on transportation and the number of workers in factories reduced fish absorption capacity, causing output to fall about 10 percent in March 2020 (Mongabay 2020b). This situation is in stark contrast to conditions in 2018 to 2019, when yields were higher. Fish workers—mainly women who sell fish in the post-harvest sector and on informal stalls—faced the greatest loss of income and risk of infection (Seafoodsource 2020). The inability of small-scale fishers to access cold chain infrastructure resulted in degraded fish quality and wastage. Clusters of the coronavirus were found at ports, fish auction venues, and markets, putting fishers and workers at risk of infection and loss of income.

The welfare of Indonesia's fishers declined gradually in the first semester of 2020; in the second quarter of 2020, it decreased to less than 100 in the fishers' purchasing power (Nilai Tukar Nelayan/NTN) index (Wiradana et al. 2021), indicating that fishers and fish farmers are struggling.[2] Despite lower demand and lower prices, the households of small-scale fishers coped by continuing with their existing occupation of fishing and trading (Campbell et al. 2021). There have been no reports on any positive effects COVID-19 has had on Indonesian fishers.

Over the pandemic, fishers could not rely on savings, loans, or other forms of employment to improve their livelihoods, given that most are small-scale and informal. In Indonesia, small-scale fisheries produce more than 80 percent of the country's fish catch, thereby playing an integral part in sustaining the country's food security and employment (Ayunda et al. 2018). About 90–95 percent of Indonesian fishers use vessels that are under 10 gross tons (GT) (CEA 2018).

In view of difficulties caused by the pandemic, the government reduced the production target for inland and wild capture from 8.0 million t to 7.7 million t (Mongabay 2020a), while the KKP provided about Rp 474.9 billion in cash payments to the poor and also provided other economic aid (*Kompas* 2020a). The KKP intends to push the aquaculture sector as a COVID-19 response and to continue to restore and support the national economy.

Sustainable Development Goal Commitments on Life below Water (SDG 14) and Climate Action (SDG 13)

To conserve and sustainably use sea and marine resources (Sustainable Development Goal/ SDG 14), Indonesia is focusing on five programs (Bappenas 2019):

- Ensuring the availability of policy frameworks and related instruments for national marine spatial planning
- Actively managing 11 fisheries management areas (Wilayah Pengelolaan Perikanan/WPP) in a sustainable manner (SDG 14.2)
- Ensuring the catch of fish species is within safe biological limits (SDG 14.4)
- Increasing the number of coastal and marine conservation areas (SDG 14.5)
- Ensuring the availability of policy frameworks and instruments to support the implementation of the United Nations Convention of the Law of the Sea (SDG 14.7 c)

Progress made by Indonesia toward SDG 14:

1. **SDG 14.2:** "*By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.*"
   The government divided fisheries into 11 management areas, WPPs, and the management plan for each is regulated by Marine and Fisheries Ministerial Regulation (Permen KKP) No.18/2014. In 2019, three of 11 WPPs mapped the potential of their marine and fisheries resources for sustainable marine economic development (Bappenas 2021).
2. **SDG 14.4:** "*By 2020, effectively regulate harvesting and overfishing, illegal, unreported, and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics.*"
   To achieve the goals of SDG 14.4, every year the Indonesian government determines the value of the maximum sustainable yield and the amount, in metric tons of live-weight equivalent, of the total allowable catch. The permitted catch is 80 percent of the maximum sustainable yield (Bappenas 2021). In 2017, the maximum sustainable yield was set at 12.54 million t (Bappenas 2021).
   In 2019, according to Bappenas (2019) the proportion of every fish species caught was still in the range of 55.6 percent, meaning all were within safe biological limits. In 2020, Bappenas (2021) found that national capture fishery production had reached 7.70 million t or 71.14 percent of the total allowable catch. However, multiple studies show that 72 percent of Indonesia's fish resources are fully exploited and subjected to overfishing (Adhuri et al. 2015; BPS 2016; CEA 2018). This calls into question the claim that Indonesian fish catches are sustainable.
3. **SDG 14.5:** "*By 2020, conserve at least 10 percent of coastal and marine areas.*"
   Indonesia has made significant progress in achieving SDG 14.5. In 2020, Indonesia succeeded in increasing the area of MPAs by 24.1 million ha from the 2020 target of 23.8 million ha (Bappenas 2021). The effectiveness of MPA management is improving gradually. However, two-thirds of MPAs are still in early stages of operation, do not have adequate management, and face challenges, including inadequate financing and staffing, complex governance, and low compliance (KKP 2020g).

As a continuous effort to support the realization of SDG 14, Indonesia participated in the High-Level Panel for a Sustainable Ocean Economy, initiated in 2018. In 2020, the Indonesian president and government committed to 100 percent sustainable ocean management. Indonesia has committed to sustainably managing nearly 30 million square kilometers (km^2) of its national waters by 2025. The government underlined three priorities during the High-Level Panel:

- Continuing to support global efforts to address marine plastic debris
- Ensuring fisheries are sustainable and committing to combating IUU fishing and transnational organized crime in fisheries
- Mainstreaming discussions on the ocean into climate change negotiations

Under the 2015 Paris Climate Agreement, Indonesia committed to reducing emissions by 29 percent from the business-as-usual scenario by 2030.[3] Furthermore, Indonesia also committed to reducing its emissions by 41 percent with international assistance as its commitment to SDG 13 on climate change (Bappenas 2021).

In 2021, the government submitted an updated version of the national climate commitment to the United Nations, with the same topline emissions targets (emissions reduction by 29 percent in 2030, and 41 percent with international assistance). The government also submitted Indonesia's first long-term strategy for peaking greenhouse emissions in 2030 and reaching net-zero emissions by 2060 or sooner (WRI Indonesia 2021a).

Progress made by Indonesia in realizing SDG 13 on combating climate change:

1. **SDG 13.1:** "*Strengthening resilience and adaptive capacity from natural and climate-related disasters.*"
   Indonesia has continually tried to reduce the risks of disasters. It reduced the risk from 169.9 (high-risk) in 2015 to 143.6 in 2019, as assessed by the Indonesia Disaster Risk Index (Bappenas 2021). The government has also established a national plan for disaster management for 2020 to 2044 to provide a better reference for disaster management for all stakeholders.

   At the regional level, the government is preparing local disaster management plans. As of 2021, all 34 provinces had such plans, although some have expired and must be updated (Bappenas 2021).

2. **SDG 13.2:** *"Increasing capacity of adaptation and mitigation to the impacts of climate change."*
   Indonesia has committed to reducing greenhouse gas emissions by 29 percent below business-as-usual by 2030 and up to 41 percent with international assistance (Bappenas 2021). As of 2019, Indonesia has cut its cumulative greenhouse gas emissions by 23.46 percent from the cumulative baseline and reduced greenhouse gas emissions intensity by 20.77 percent from the baseline of 420 t CO_2e/billion rupiah (Bappenas 2021). In 2020, Bappenas studied the government's budget allocation for low-carbon development. It found that in 2017, 2018, and 2019, the budget allocation for low-carbon development activities was Rp 54.57 trillion with an 82 percent realization rate, meaning the government spent Rp 44.69 trillion (Bappenas 2021). In 2020, the funding was sharply decreased as budgets were allocated to handle the COVID-19 crisis.

3. **SDG 13.3:** *"Increasing public awareness and efforts about climate adaptation and mitigation through education institutions.*"
   To encourage environmental conservation efforts and sustainable development, the KLHK initiated a program called Adiwiyata (Green School). In 2019, the most recent year for which data is available, an additional 434 Adiwiyata schools participated in the Adiwiyata program (Bappenas 2021).

Ongoing Issues in the Maritime Sector

Recent Policies and Regulations of the Ministry of Marine Affairs and Fisheries

To support the KPP's 2020-2024 priorities, former minister Prabowo set out a plan to review 29 regulations that were believed to hamper the business sector and complicate business for entrepreneurs and fishers (*Kompas* 2019). The plan was made official with Ministerial Instruction No. 717/2019. As of December 2020, KKP has revised nine of the regulations (see Annex A).

The instruction revoked several regulations implemented by previous administrations, such as a ban on the use of *cantrang* (trawl nets or destructive seine nets), which then-minister Prabowo revoked on the grounds that their use can increase job creation and seafood production (*Kompas* 2020c). The ban by his predecessor had led to mass protests, especially among fishers from Pantura, a strong political group operating on the north coast of Java. As of June 2020, the ministry reallowed the use of trawl nets and seven other types of fishing gear, including small ring trawlers with two vessels, large ring trawlers with two vessels, *paying* (a type of seine net), bottom trawlers for shrimp, fishing rods, squid jigging (a type of equipment and technique), and mechanical *huhate* (pole and line) (*Kompas* 2020b).

Prabowo also reallowed the export of lobster larvae. Indonesia is the world's largest supplier of lobster larvae, demand for which is high (Medcom 2019). In May 2020, the KKP revoked Permen-KP No. 56/2016, which prohibited the catching of lobsters and the exporting of lobster larvae, replacing it with Permen-KP No. 12/2020 (Tirto 2020). The original regulation was intended to protect the declining wild population of lobsters (Mongabay 2020d). It was also intended to stop illegal lobster fishing. The KKP than banned the export of lobster seed through Permen-KP No. 17/2021.

The new regulation is perceived as flawed. Many of its articles support large investors and harm small-scale cultivators. For example, only a limited number of exporters are permitted to export lobster larvae, a rule that favors larger companies, and small-scale lobster larvae catchers can sell only to these exporters. For small fishers to obtain an export permit, they must register with a group of fishers at regulated catch locations only.

Prabowo also revoked the regulation allowing for the sinking of IUU ships.

The Omnibus Law and Its Implications for the Marine and Fisheries Sector

Reflecting the new emphasis on economic development in Indonesia, on October 5, 2020, the House of Representatives passed the Omnibus Law on Job Creation (UU Cipta Kerja 11/2020). This comprehensive all-in-one document amended dozens of laws affecting various sectors. It was designed to strengthen the economy by increasing competitiveness, creating jobs, and stimulating domestic and foreign investment. It also removed bureaucratic inefficiencies, excessive licensing requirements, and overlapping regulations in order to improve competitiveness (*Jakarta Post* 2020b).

Various actors opposed the Omnibus Law. Many deemed the law controversial because it includes provisions and procedures that might lead to human rights violations and environmental degradation. And it is feared that other changes may jeopardize the sustainability of the marine and fisheries sector. A report by the marine think tank Indonesia Ocean Justice Initiative (IOJI 2020) highlights several problematic features of the law:

- Article 27 section 10 now allows foreign fishing vessels to conduct activities in Indonesia's exclusive economic zone. This change would lead to the large-scale exploitation of Indonesia's fisheries resources by foreign parties.
- Article 27 section 15 removes the obligation for foreign fishing fleets to have 70 percent of their crew members be made up of Indonesian workers when operating in Indonesia. This change would allow large corporations with foreign crews financed with foreign capital to dominate Indonesia's marine resources.
- Article 18 section 22 removes the obligation to prioritize the national interest in using small islands and their surrounding waters. It allows foreign parties to invest and exploit small islands and subjects them to only administrative sanctions for the illegal use of small islands.

- Article 27 section 2 abolishes the National Committee on Fish Stock Assessment (Komisi Nasional Pengkajian Sumber Daya Ikan/Komnas Kajistan), which is responsible for measuring the utilization of fish resources to ensure they remain within sustainable limits. In September 2020, the ministry published Kepmen-KP No. 35 2020 on the extension of Komnas Kajistan.
- Article 18 section 14 gives the government the authority to issue business licenses, even where spatial and zoning plans have not yet been developed. It removes the requirement for documents to be prepared at the provincial-, regency- and city-levels for national spatial planning, as well as the requirement for a detailed zoning plan. This change could lead to ecosystem imbalance and adversely affect surrounding communities.

Many articles in the Omnibus Law weaken community engagement at the initial stage of spatial planning, at the environment impact analysis (known in Indonesia as the AMDAL), and at the granting of environmental permits.

Arrest of Edhy Prabowo: The Lobster Seeds Export Graft Case

On November 2020, the Corruption Eradication Commission named seven suspects in a bribery case related to the granting of permits for fishponds, lobster, and other aquaculture businesses, and the management of fisheries. The suspects included Edhy Prabowo, who was KKP minister at the time and was alleged to have accepted bribes for lobster larvae export permits. Following Prabowo's arrest, the export of lobster larvae was suspended. In December 2020, the president appointed Sakti Wahyu Trenggono, a former deputy defense minister, as the new KKP minister. The new minister than banned the export of lobster seed through Permen-KP No. 17/2021.

Illegal, Unreported, and Unregulated Fishing and Problems Enforcing Overlapping Jurisdictional Authority

Both national and foreign-flagged fishing vessels engage in IUU fishing activities in Indonesia, using destructive fishing methods and illegal fishing gear and failing to register or report their catch. Most IUU activity by foreign-operated vessels comes from neighboring countries and usually utilizes large vessels (over 80 GT) (USAID SEA n.d.). For national vessels, IUU activity generally concerns low compliance with the rules of fish resource management, including failure to use a vessel monitoring system (these allow regulatory organizations to track and monitor fishing vessels) or report catches in vessel logbooks (Widjaja et al. 2019). Illegal fishing alone costs Indonesia an estimated $4 billion a year (Cabral et al. 2018).

Perpres No. 115/2015 established an IUU fishing taskforce, Task Force 115. It was disbanded just four years later in December 2019. The minister revived it in May 2020, as stated in Perpres No. 165/2000. The task force is headed by the KKP minister and will include members from the KKP, the navy, the Indonesian Maritime Security Agency, the Attorney General's Office, the Ministry of Foreign Affairs, the Coordinating Ministry for Maritime Affairs and Investment, and the president's special and expert staff, as well as academics and maritime and fisheries experts. It is still unclear how day-to-day coordination will be handled, as the standard operating procedures are still being drafted. Overlapping jurisdictional authority remains an issue. For example, two organizations have the authority to act as enforcement agents for all waterbodies—the Indonesian Maritime Security Agency (Badan Keamanan Laut Republic Indonesia/BAKAMLA) under Law (UU) No. 23/2014 concerning Marine Affairs and the Indonesian Sea, and the coast guard, part of the Ministry of Transportation, under UU No. 17/2008 on Shipping. In addition, the navy, the KKP, the water police, and the Ministry of Transportation are responsible for shipping operations conducted in Indonesia's waters, under 12 laws related to enforcement.

In early 2020, reports of foreign fishing vessels entering Indonesian waters and stealing fish reappeared, and IUU fishing increased even during the COVID-19 crisis. In January 2020, Chinese vessels accompanied by their own coast guard entered Indonesia's exclusive economic zone surrounding the Natuna Islands (*Jakarta Post* 2020c). In July 2020, a high-speed chase took place in the waters northeast of the Natuna Islands, as patrol officers pursued a Vietnamese vessel suspected of illegal fishing (Mongabay 2020e).

Quota-Based Fisheries Policy

In 2021, the KKP stated that it was preparing a policy on quota-based fisheries (*kebijakan perikanan terukur*). It will come into force in 2022 and is one of several KPP initiatives to develop a "blue economy" (*Kompas* 2021a) to boost economic growth and increase Indonesia's foreign exchange earnings from the global fisheries market, which is worth $167 billion.

The government expects the implementation of quota-based fisheries to ensure the sustainability of national fishery resources and ecological and economic stability within the sector (Antara 2021b). However, this policy has raised concerns among local NGOs and activists since the objective of quota-based fisheries is focused on attracting large-scale fishing industry (vessels larger than 30 GT) and increasing large-scale foreign investment. The government will grant concessions to several large corporations to catch fish. Extraordinarily, this means that several large companies could together control 66 to 95 percent of the sector (Mongabay 2022a). The concern is that traditional and small-scale fishers may have a very small portion of the quota, therefore widening the income gap and raising the possibility of social conflict (Mongabay 2022b). Furthermore, it is also unclear if the policy can be enforced because of the difficulty of measuring catch and because Indonesia's fishing ports are not equipped with the necessary infrastructure (*Kompas* 2022a).

Protection of Small-Scale Fishers

Small-scale fishers are important to Indonesia's national economy, but they are largely invisible and are not prioritized in the national fisheries agenda. In UU No. 7/2016 on the Protection and Empowerment of Fishers, Aquaculture and Salt Farmers, small-scale fishers are defined as those who conduct fishing activities with vessels under 10 GT. However, defining small-scale fisheries only by vessel size prevents some marginalized and poor fishers from accessing government support. Indonesia's regulations are also structurally biased against small-scale fishers and fail to take into account their heterogeneous nature. The current legal definition is unable to capture the dynamics and diversity of the actors (Halim et al. 2019) and further marginalizes them. For example,

- in the case of the quota-based policy, local fishers are expected to take on jobs as crew on fishing ships, with vocational education provided by the KKP. This suggests that small-scale fishers may be subordinated—from independent actors in fisheries to ship workers. In addition, the government has not prepared a plan to organize small-scale fishers or cooperatives as a way to maximize their participation in the industry;
- conflict has occurred between those mining sand for a new port in Makassar and fishers on Kodingareng Island, Makassar, South Sulawesi, with fishers having suffered a loss of livelihood and food security. A systemic problem throughout Indonesia is the commodification of seascapes with property rights, including areas that are already managed and used by small-scale fishers.

In 2020, the fishers' purchasing power index (NTN) in most provinces was below 100, indicating that the costs of fishing exceeded revenues (Suhana 2020). It did, however, increase to 105.9 in 2021, after the government implemented a national economic recovery program to deal with the impact of the pandemic. However, the total number of fishers continued to decrease, from 2.16 million in 2010 to 1.83 million in 2019 (BPS 2020).

Safeguarding Indonesia's Migrant Crew

Several deadly assaults on Indonesian migrant fishers and crew occurred in 2020 (*Jakarta Post* 2020a), and the fisheries sector is exploiting ever cheaper labor to offset losses arising from overfishing (ILO 2013). The exploitation of Indonesian workers on foreign fishing vessels has been going on for some time and illegal fishing, the trafficking of crew, and forced labor have increased (Bisnis 2020).

Indonesia is considering banning its citizens from going abroad to work on foreign fishing vessels, following a report that the body of an Indonesia crew member, who had died on in a foreign vessel, had been dumped into the ocean (Mongabay 2020c). While a moratorium could help prevent the sending of crew through official channels, it would not prevent illegal recruitment.

Indonesia, China, Taiwan, and South Korea have not ratified International Labour Organization (ILO) Convention 188/2007 on Work in Fishing, which entered into force in 2017 (ILO 2017). The Convention is the only international protocol to guarantee certain working and living conditions for crew on fishing vessels (*Diplomat* 2020). Countries that have not signed the Convention have limited obligations in international law to ensure the protection of workers in the fishing industry (*Diplomat* 2020). Ratifying the Convention can protect workers and may boost the sector economically (ILO 2017).

In 2020, the government published Government Regulation (Peraturan Pemerintah/PP) No. 22/2022 on migrant protection in commercial ship crew and migrant fishery ship crew. The decree intends to protect Indonesian migrant workers aboard foreign fishing vessels, including distant water fishing vessels.

Marine Spatial Planning and Marine Infrastructure Investment

The use of space for aquaculture (fish, seaweed, shellfish farming) competes with other activities in MPAs, such as seabed mining, marine tourism, recreation, shipping lanes, and ports. Development of maritime infrastructure and businesses—particularly ports, mines, and reclamation projects—has caused tension in Indonesia:

- Reclamation of Benoa Bay in Bali was supported by the Coordinating Minister of Maritime Affairs, who stated, based on Perpres No. 51/2014, that an area of 700 ha could be reclaimed. However, communities in Bali have opposed the plan since its launch in 2012 and have asked the central government to cancel it.
- Reclamation of Jakarta Bay was first initiated in 1995, but it was not until 2012 that the Governor of DKI Jakarta issued Gubernatorial Regulation (Pergub) No. 121/2012 to support the formation of 17 new islands. The goal was to meet the land needs of the growing population in Jakarta and manage the city's floods. In September 2019, the then-governor of Jakarta, Anies Baswedan, revoked permits for 13 of the islands. Since its inception, the Jakarta Bay reclamation policy has raised concerns about the environment, the marginalization of coastal communities, and corruption.
- Reclamation of land for a new port in Makassar in the Sangkarrang Islands in eastern Sulawesi is a national strategic project,[4] with 1.4 ha due to be reclaimed along the city's coastline using sand dredged from the Sangkarrang Islands. However, the work has disturbed traditional fishing grounds, leading to smaller catches and loss of income. In July 2020, dredging contractors invited five fishers to the dredging site, where they gave them envelopes filled with money. One of the fishers tore up his envelope in a protest that led to criminal charges against him and three others for defacing the rupiah. They faced up to five years in prison (*Kompas* 2020d). They were detained for two weeks and were released on August 31 and September 1, 2020 (*Kompas* 2020f).

To avoid overlap and conflicts, Indonesia regulates the management of spaces through UU No. 27/2007 (updated in UU No. 1/2014). The regulation, also called RZWP3K, makes clear that each provincial government is responsible for drafting a zoning plan for its coastal areas and small islands. The plan should regulate the zoning of all marine and coastal use, including fishing zones and aquaculture, to ensure that activities in those areas are not in conflict with others. The zoning, management, and action plans will also be considered and integrated with the management of WPPs. As of June 2020, 27 provinces have implemented the RZWP3K and created coastal and small islands spatial plans; the remaining seven were expected to have plans in place by the end of the year (Antara 2020), but no further information is available.

Development of Aquaculture

The government has decided to develop and boost the aquaculture sector as one of its priority programs for the marine and fisheries sector. After Prabowo was inaugurated as KPP minister, he stated that the ministry would focus on aquaculture (KKP 2019a). The government is targeting this subsector in order to strengthen the

economy by providing employment and securing food supply. Current initiatives by the KKP's Directorate General of Aquaculture include Digifish, an incubation platform to promote digital innovation in fisheries and aquaculture development in Indonesia and promote the digital economy. The ministry has also increased the target for aquaculture insurance to cover an additional 5,000 ha of new aquaculture farms. In 2019, 20,837 ha and 15,026 people were covered by insurance (KKP 2020b).

Collection and Analysis of Fisheries Data

In 2016, the government launched an initiative for a one-data policy for the fisheries sector (KKP 2016a). The ministry set up the platform Satu Data KKP (https://satudata.kkp.go.id/) to ensure the integrity of data and information and provide a reliable data source for policymakers. The ministry aims to standardize procedures for collecting and processing data, and ensure open access to fisheries data. However, the system is not yet reliable or consistent. Through Satu Data KKP, the KKP was one of the first ministries to input data for the One Data policy.

In 2019, President Jokowi signed a regulation (Perpres No. 39/2019) on Satu Data Indonesia, an integrated data management service designed to improve internal government data and increase the government's transparency and accountability. It is expected to make various types of data, including data related to the marine and fisheries sector, easily accessible and usable by central and regional governments and the public.

Recent Political Milestones

Table 2.2 | **Political Milestones in 2019 and 2022**

Year/Month	Milestone
2019	
September	The KKP prepares for a transition of leadership from Susi Pudjiastuti, who had led the ministry since 2014.
October	Indonesia reaches its target of expanding its MPAs to 22.68 million ha.
	Edhy Prabowo selected as new KKP minister.
December	The KKP reviews 29 regulations to ease the business process for entrepreneurs and fishers. It adopts Ministerial Instruction No. 717/2019 concerning the Assessment of Marine and Fisheries Regulations.
	Chinese fishing boats and coastguard vessels operate illegally in the Natuna waters, part of Indonesia's exclusive economic zone. The Chinese insist the territory falls under the nine-dash line[a] and that their vessels , therefore, have the right to fish in the area.
2020	
January	The KKP organizes public dialogues and national consultations with stakeholders for the KKP Annual Plan.
	The government announces plans to bring more than 300,000 ha of former shrimp farming ponds back into production in order to increase seafood yields without causing the further deforestation of mangroves.
February	Revisions to various marine and fisheries regulations are sent to the House of Representatives for approval.
March	Indonesia sends 30 large fishing vessels (100 GT–class vessels) to the North Natuna Sea, guarded by Indonesia's Maritime Security Agency. The presence of these vessels is intended to underscore Indonesia's territorial sovereignty.
	The government drafts the Omnibus Law on Job Creation.
	President Joko Widodo declares COVID-19 a public health emergency on March 31. The COVID-19 crisis affects the marine and fisheries sector significantly, as fish prices fall by up to 50 percent.
April	Indonesia issues a regulation to boost state spending by Rp 405.1 trillion ($24.6 billion), and anticipates a deficit of 6 percent of GDP.
May	Task Force 155, to fight IUU fishing, is reconstituted.
	Indonesia considers a moratorium to prevent crew working abroad on foreign fisheries vessels in order to protect them from assault and human rights violations. The moratorium was not put into action.
	Funds from a Rp 1.02 trillion stimulus package are distributed to small-scale fishers and aquaculture farmers affected by the COVID-19 crisis.
June	The ban on the export of lobster larvae is revoked.
July	The KKP plans to revoke the ban on *cantrang* (trawl nets or destructive seine nets).
September	KKP publishes Kepmen-KP No. 35/2020 on the extension of Komnas Kajistan.
October	The Omnibus Law is passed.
November	Then-KKP minister Edhy Prabowo is arrested for corrupt dealings with respect to lobster larvae. (He is eventually found guilty.)
December	Sakti Wahyu Trenggono, a former deputy minister of defense, is appointed as the new KKP minister.
	At the High-Level Panel for a Sustainable Ocean Economy, Indonesia signs a commitment on sustainable ocean economy transformation and aims for sustainable management of 100 percent of ocean area within its national jurisdiction by 2025.
2021	
February	The government announces the drafting of a quota-based fisheries policy to increase investment in the fisheries sector. The policy is controversial with NGOs and small-scale fishers as it is seen as benefiting large corporations.
June	The government issues Permen-KP No. 18/2021, regulating fishing gear with the aim of achieving the sustainable management of fisheries resources.
August	The government bans exports of lobster seed in Permen-KP No. 17/2021.
October	KLHK updates the National Mangrove Map 2021.
2022	
March	The government launches Permen-KP No. 19/2022 on estimated potential of fisheries resources, total allowable fish catch, and the level of utilization of WPPs.
June	The government launches PP No. 22/2022 on the protection of migrant commercial ship crew and migrant fishery ship crew. The government regulation intends to protect Indonesian migrant workers aboard foreign fishing vessels, including distant water fishing vessels.

[a] The nine-dash line (sometimes referred to as the 10-dash line or the 11-dash line) is the maximum extent of Chinese historical claims within the South China Sea.
[b] KKP: Ministry of Marine Affairs and Fisheries (Kementerian Kelautan dan Perikanan).

TRENDS IN WILD-CAPTURE FISHERIES AND AQUACULTURE

This section dives into the fisheries sector in Indonesia, examining production and projections for wild-capture fisheries and aquaculture.

Overview of Seafood Production and Projections

Seafood Production

Indonesia is the second-largest wild-capture and aquaculture producer in the world (after China), but its importance is not reflected in the economic performance of the sector. Indonesia produces about 7 percent of global capture fisheries output (FAO 2020b). In 2019, its fishery production reached 23.9 million t, of which wild-capture fisheries accounted for 7.5 million t and aquaculture 16.3 million t (KKP 2019b). This output represented 60 percent of the target level of 38.3 million t (KKP 2019b).

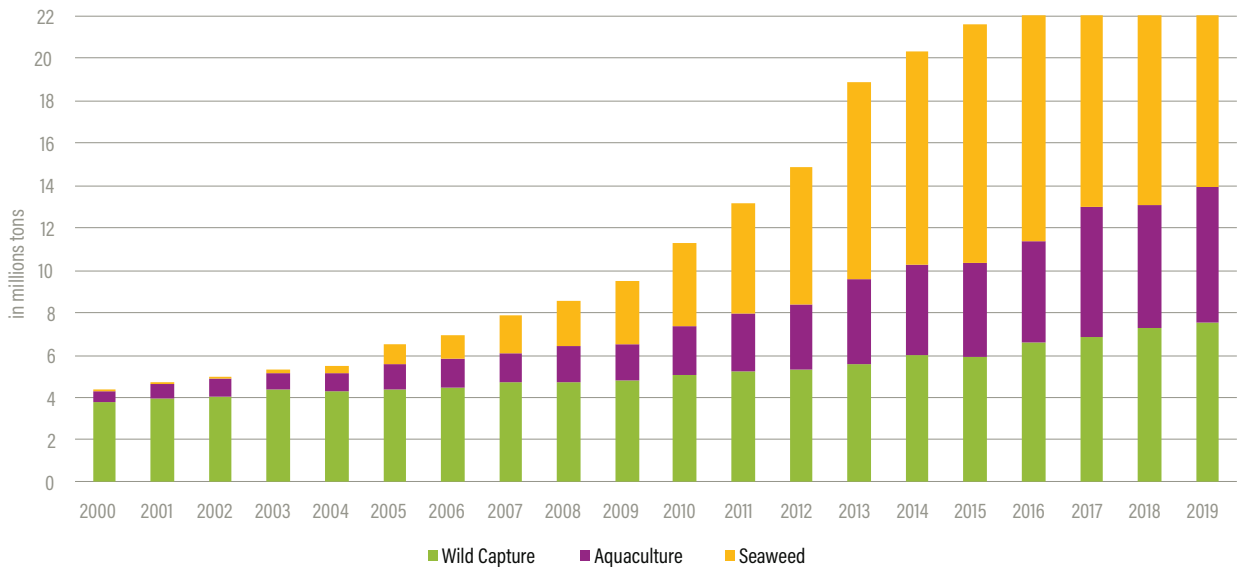
The growth of wild-capture fisheries has slowed in recent years. In contrast, aquaculture has surged, with production rising from 2.4 million t in 2010 to 6.4 million t in 2019 (Figure 3.1). Seaweed production experienced especially rapid growth, reaching 9.9 million t in 2019 (KKP 2020c). Driven by the expected continuation of seaweed sector growth, the ministry set the 2019 seafood sector production target at 39.97 million t, a 19 percent increase from the 2018 target and a 63 percent increase from the actual 2018 production of 11.3 million t (KKP 2019j).

The fisheries sector contributed more than Rp 252 trillion (about $18 million) to Indonesia's GDP in 2019 (2.7 percent). This contribution is larger than in regional peers such as China, the Philippines, Malaysia, and Thailand. However, for a variety of reasons—including depleted fish stock, pollution, data deficiencies, and lack of coordination among agencies—Indonesia's fisheries sector was unable to meet its production, export, and growth targets between 2017 and 2019 (Table 3.1).

In 2018, the value of wild-capture and aquaculture exports, including seaweed, was roughly $4.86 billion, and nontax revenue amounted to $46 million. The targets were $5 billion in export value and $41 million in nontax revenue. The inability of the KKP to meet its export targets in 2018 and 2019 reflected the declining prices of several major commodities, particularly shrimp, which accounted for the largest share of the value of exports (34 percent) (Bisnis 2019).

The growth rate of Indonesia's wild-capture fisheries production has slowed, consistent with global trends. Production from wild-capture fisheries in inland and marine waters made up 57 percent of total seafood production in Indonesia in 2019. This figure has remained stable since 2013 but is lower than it was in 2010–12, when it represented 63–68 percent of the total. Catch

Figure 3.1 | **Volume of Wild-Capture, Aquaculture, and Seaweed Production in Indonesia, 2000–19**



Source: KKP 2019h

Table 3.1 | **Target and Actual Production, Exports, and Growth in Indonesia's Fishery Sector, 2017–20**

	2017		2018		2019		2020
Item	**Target**	**Actual**	**Target**	**Actual**	**Target**	**Actual**	**Target**
Production (t, millions)	29.5	24.2	33.5	24.5	38.3	23.9	26.5
Export ($, billions)	7.6	4.5	5	4.9	9.5	4.9	6.2
Growth (%)	8.0	5.9	11	5.2	11	5.8	7.9

Sources: KKP 2017a, 2018a, 2019b, 2019c

diversity is high: As many as 90 species make up 90 percent of capture fisheries production. By volume, skipjack tuna accounts for the largest portion of wild-capture landings (Figure 3.2).

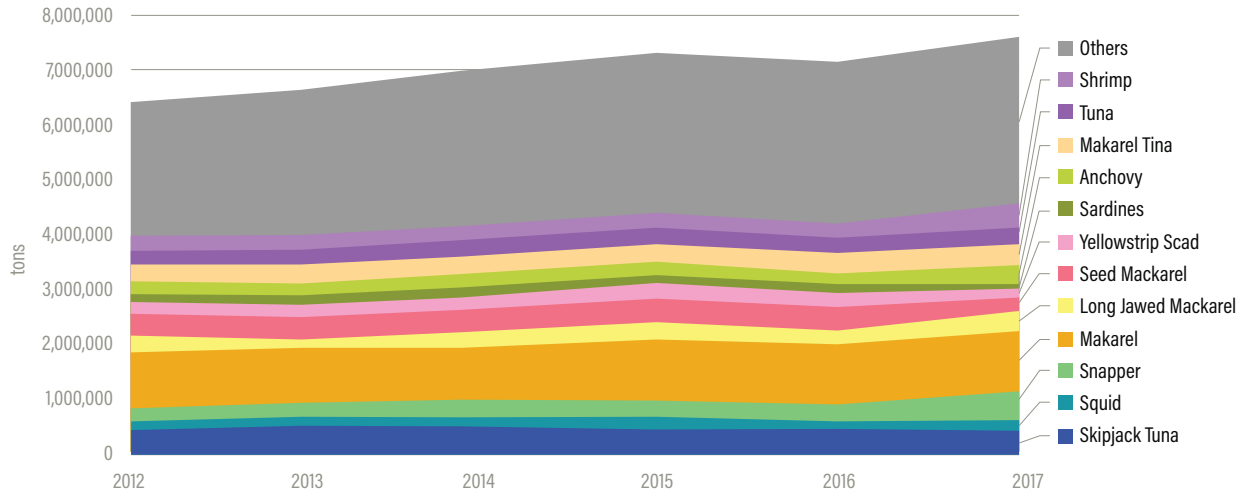
Despite its high production, Indonesia is not a large-scale exporter. Its exports of seafood are not among the world's top 10 (FAO 2018) and are lower than those of Vietnam and Thailand, which produce smaller volumes. In 2018, for example, the value of Indonesia's exports was $4.9 million (KKP 2019b), far lower than the $9 million exported by Vietnam (Seafoodsource 2019). These figures are particularly striking given that Indonesia accounts for 7 percent of global fish production and Vietnam just 3 percent (FAO 2020b).

Export revenues and product quality are low in Indonesia. Indonesia has one of the world's highest rejection rates of fishery products. Frozen prawns exported to the United States are often rejected because of contamination with gravel; bamboo (*Jakarta Post* 2016); antibiotics, such as oxytetracycline, chlortetracycline, and chloramphenicol; and viral infections (Oktaviani and Erwidodo 2005). Fish are also often contaminated due to the low level of awareness of fishers and fisheries regarding safeguarding of quality (by avoiding hazardous materials in preserving or processing fish, for example). The problem is exacerbated by the lack of government and corporate control over the use of unsafe materials for preservation and processing.

Furthermore, Indonesia's catch statistics in their current form cannot be reconciled with trade statistics. In the case of seaweed production and trade, Indonesia has production statistics for wet seaweed in tons (11.3 million t in 2018), but what is exported is in fact dry/raw *Eucheuma cottonii* seaweed carrageenan, which is of low value. Another problem in the case of snapper and grouper fishery is that the two are recorded together as "other fish" (500,384 t in 2014), so the trade of the individual species cannot be monitored.

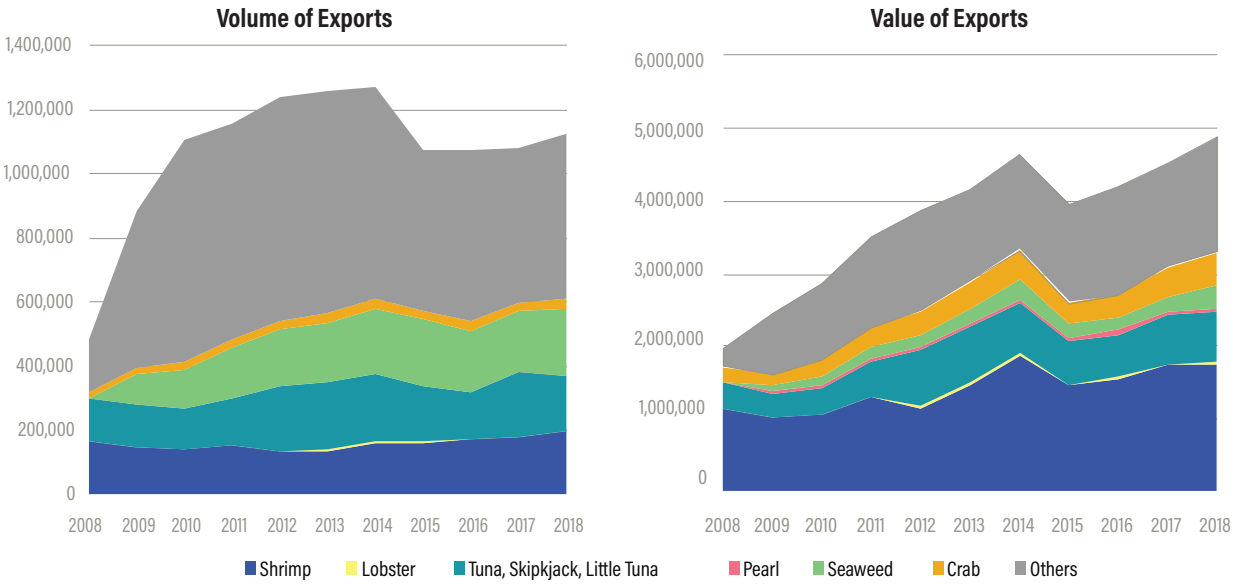
Shrimp is Indonesia's most important fisheries export commodity (Figure 3.3). Unprocessed crustaceans represented 45 percent of the total value of Indonesian fisheries exports (BKPM

Figure 3.2 | **Volume of Wild-Capture Landings in Indonesia, by Fish Type, 2012–17**



Sources: KKP 2017a, 2018a, 2019b, 2019c

Figure 3.3 | **Volume and Value of Wild-Capture Exports by Indonesia, 2008–18**



Source: KKP 2019h

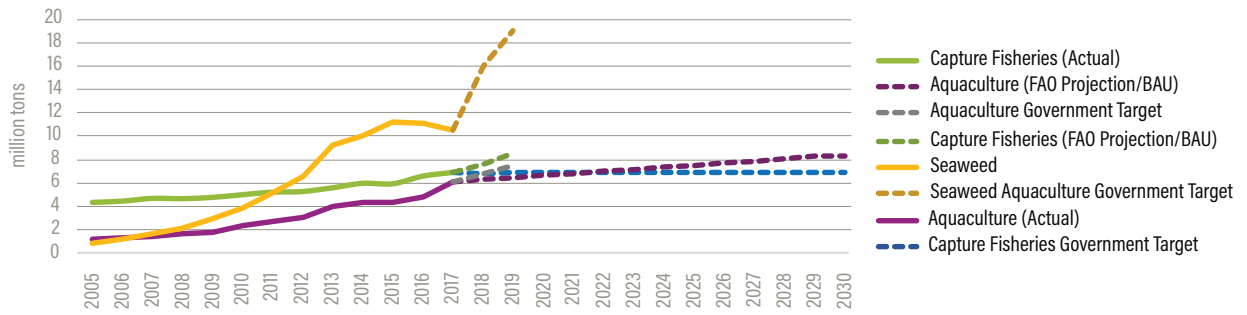
2018). Indonesia exported about 197,000 t of shrimp in 2018 (KKP 2018a). The second-most important fishery commodity is tuna, which accounts for 22 percent of the total value of fisheries exports. Indonesia produces mainly skipjack and yellowfin tuna. It exported 168,434 t in 2018 (KKP 2018a), mainly to the United Kingdom, Germany, the United States, and Japan. Crab has the highest added value of all fishery exports.

Seafood Projections

Capture fisheries are likely to be limited in their capacity to meet further growth in demand, as most are already fully exploited or overexploited (CEA 2018). In contrast, aquaculture production is projected to expand by 5.6 percent a year, overtaking capture fisheries as the principal source of seafood production in Indonesia by 2030 (Figure 3.4). According to projections by the Food and Agriculture Organization (FAO 2020b), aquaculture production will compensate for stagnant capture fisheries in meeting the demand for aquatic products. Population growth, increasing per capita incomes, and urbanization are expected to increase demand for fish globally.

In early 2020, the COVID-19 pandemic impacted fisheries and aquaculture negatively. Lockdown restrictions in some countries resulted in logistical difficulties in seafood trade, while shortages of seeds, feed, and related aquaculture items have also been reported (FAO 2020a). Declining demand and prices significantly reduced the activities of capture fishery production in many countries. The slowdown is likely to increase wild fish stocks in the short term. However, the unsold aquaculture produce will result in an increase in fish stocks in ponds, increasing the need for more feed and thus pushing costs higher, as well as risking fish infections (FAO 2020c).

Figure 3.4 | **Actual and Projected Seafood Production in Indonesia by Subsector, 2005–30**



Source : FAO 2020b; KKP 2019g

The government reduced its production target for capture fisheries for 2020 from 8.0 million t to 7.7 million t. The change reflected the decline in fish demand of up to 30–40 percent because of the pandemic and the many obstacles to production it created (Mongabay 2020a).

Assessment of WPPs

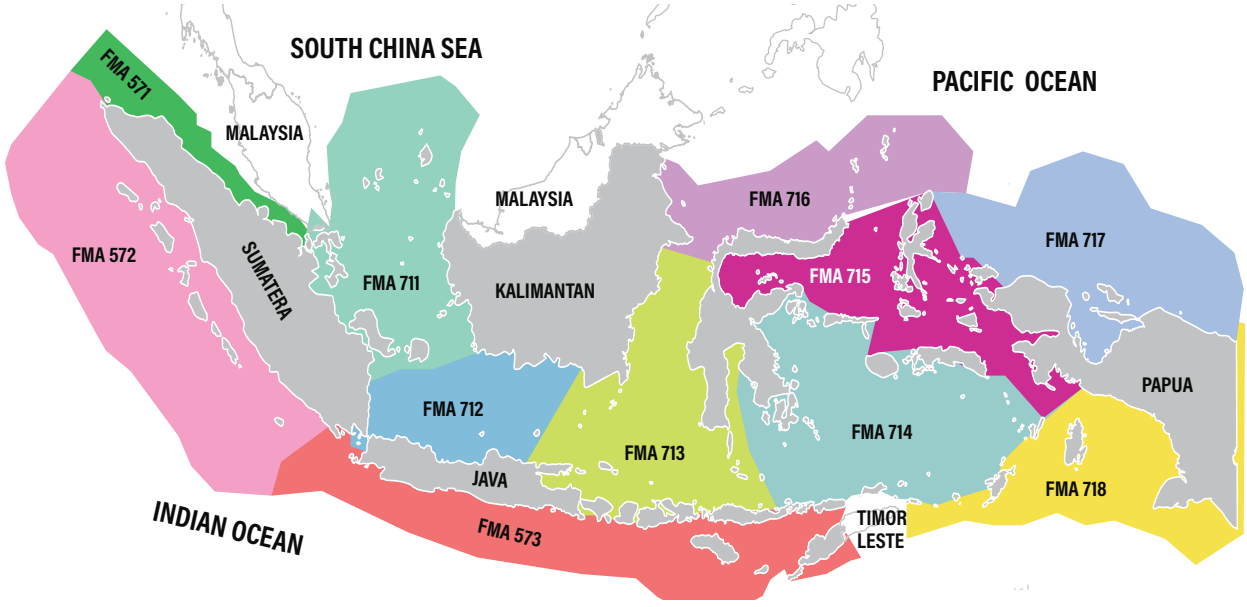
Accurate and timely data on stock status and fisheries efforts are needed to safeguard the long-term performance of the sector. The latest national stock assessment was recently released, in March 2022. Prior to that, the most recent release was in 2017. Fish stocks are recorded in Kepmen-KP No. 19/2022, which contains the new statistics and succeeds Kepmen-KP No. 50/2017. Both record the maximum number of fish that can be caught in each WPP (Figure 3.5). The National Commission on Stock Assessments (Komnas Kajiskan) is the independent body with the authority to assess stock.

In Indonesia, the collection of data on fish stocks, among others, is a challenge. Indonesia has 11 fisheries management areas, or WPPs, as set out in Permen-KP No. 18/2014. These vast fishing grounds, approximately 22.8 million ha, create challenges for data collection and monitoring. Indonesia's WPPs fall into parts of two areas designated by the FAO as major fishing areas (57—the Eastern Indian Ocean; and 71—the Western and Central Pacific Ocean). In addition, Indonesia has diverse marine ecosystems and many different species are caught. Recording species is a challenge and species identification may not always be accurate because Indonesia lacks trained personnel and the Indonesian language is used in naming species, a system that is ambiguous and not systematic (Wibisono et al. 2022).

In 2017, nearly half of Indonesia's wild fish stocks were overfished, reducing their current and future productivity (see Annex B). Most species are either fully exploited (yellow) or overexploited (red) (Table 3.2.a). Exceptions include demersal and reef fish groups in WPP 571, WPP 715, and WPP 718; crab and squid in WPP 572 and WPP 711; and small pelagic groups in WPP 712. Data for 2022 (see Table 3.2.b) still shows that the majority is fully exploited (yellow) but more are overexploited (red). Both reef fish and lobster are overfished in eight WPP in both 2022 and 2017 data. Furthermore, there are many more species that are now fully exploited compared to 2017.

Given the challenges presented by Indonesia's national stock assessment, actors in the sector have conducted their own stock assessments in specific locations and/or of specific species (boxes 3.1 and 3.2).

Figure 3.5 | **Indonesia's WPPs**



Source: Bardono 2015

Table 3.2 | **Level of Fish Stock Exploitation (Utilization Rate) in Indonesia, by WPP and Species**

a. Utilization Rate in Indonesia's WPPs and by Species, 2017

Fisheries Management Area (WPP)	Small Pelagic	Large Pelagic	Demersal Fish	Reef Fish	Penaeid Shrimp	Lobster	Crab	Blue Swimming Crab	Squid
571	0.83	0.52	0.33	0.34	1.59	1.30	1.00	0.93	0.62
572	0.50	0.95	0.57	0.33	1.53	0.93	0.18	0.49	0.39
573	1.50	1.06	0.39	1.00	1.70	0.61	0.28	0.98	1.11
711	1.41	0.93	0.61	1.53	0.53	0.54	1.09	1.18	1.84
712	0.38	0.63	0.83	1.22	1.11	1.36	0.70	0.65	2.02
713	1.23	1.13	0.96	1.27	0.52	1.40	0.83	0.73	1.19
714	0.44	0.78	0.58	0.76	0.39	1.73	1.55	0.77	1.00
715	0.88	0.97	0.22	0.34	0.78	1.32	1.19	0.98	1.86
716	0.48	0.63	0.45	1.45	0.50	0.75	0.38	0.5	1.42
717	0.70	1.00	0.39	0.91	0.46	1.04	0.87	1.21	1.09
718	0.51	0.99	0.67	1.07	0.86	0.97	0.85	0.77	1.28

Source: KEPMEN-KP 50/2017

b. Utilization Rate by WPP and Species, 2022

Fisheries Management Area (WPP)	Small Pelagic	Large Pelagic	Demersal Fish	Reef Fish	Penaeid Shrimp	Lobster	Crab	Blue Swimming Crab	Squid
571	0.3	1.4	1.2	0.4	1.6	1.4	1.5	0.8	0.7
572	0.2	1.1	0.9	1.1	1.5	1.6	0.1	1.6	0.4
573	0.6	0.9	0.2	2.5	1.2	2.0	0.7	0.6	1.1
711	0.8	0.7	0.8	0.5	0.6	1.1	1.9	1.2	0.5
712	0.4	1.3	1.1	0.8	0.8	0.5	0.9	0.7	0.9
713	1.0	0.8	0.3	1.3	0.8	1.3	0.7	1.5	1.2
714	0.7	0.7	0.7	1.1	1.0	1.7	1.4	0.6	0.5
715	0.7	0.7	0.7	1.3	0.7	1.2	0.7	0.7	0.9
716	0.7	0.5	0.4	1.6	0.5	0.9	0.8	0.5	0.9
717	0.3	0.9	0.5	1.2	0.5	0.8	0.2	1.5	0.6
718	0.51	0.99	0.67	1.07	0.86	0.97	0.85	0.77	1.28

Source: KEPMEN-KP 19/2022

Overexploited Fully exploited Moderately exploited

Note: Exploitation is recorded using an index, where 1 is fully exploited and the catch allowance/potential fish stock = 1. Overexploited: Annual fish catch exceeds estimated potential yield limit. Fully exploited: Annual fish catch is 80–100 percent of estimated potential yield limit. Moderately exploited: Annual fish catch is less than 80 percent of estimated potential yield limit. Definitions are as stated in PERMEN-KP 29/2012. See Annex B for full stock assessment

BOX 3.1 | DATA ON SNAPPER AND GROUPER STOCKS FROM THE NATURE CONSERVANCY

The Nature Conservancy (TNC) compiled data on snapper and grouper species to help the KKP establish its fishing rules for demersal fish, especially snapper and grouper. These fish face the risk of being exploited and overfished in all phases of their lives, but especially during their pelagic/juvenile stages because of the use of certain types of fishing gear. The increasing demand in some markets for plate-sized fillets, which come primarily from smaller fish, resulted in overfishing of smaller snapper and grouper, jeopardizing the health of this sector. The TNC report shows that small pelagic fish are often found in the catch of seines, reducing their ability to regenerate. Although progress has been made in providing data for stock assessment, measuring stock is still a challenge, especially given that there are 100 species of snapper and grouper, a large number of vessels, and many types of fishing equipment in use.

Source: TNC 2016

BOX 3.2 | ESTIMATING TUNA STOCKS

Tuna is not included in Indonesia's fish stock status due its migratory nature. Indonesia is a member of the Regional Fisheries Management Organization, a global organization that aims to manage tuna fisheries to ensure that stocks are maintained at or above levels that can support a maximum sustainable yield. There are five Regional Fisheries Management Organizations, multilateral organizations that aim to manage highly migratory fish stocks. For example, the Western and Central Pacific Fisheries Commission (WCPFC) seeks to address problems in the management of high-seas fisheries resulting from unregulated fishing, excessive fleet capacity, vessel reflagging to escape controls, insufficiently selective gear, and unreliable and inadequate databases for the western and central Pacific.
The WCPFC has implemented fishing quotes for big-eye tuna and limits on purse seine fishing on the high seas. Since 2012, Indonesia's long-line big-eye catch limit has been 70 percent of 8,413 t a year, and purse seine fishing on the high seas in the Western and Central Pacific area—as defined by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean—has been limited. This ensures fish harvest is sustainable. The WCPFC prohibits fishing if the total catch limit is reached. From 2020, however, there was no limit, as member states could not agree on total catch limits.

Source: WCPFC 2020

In Indonesia, fisheries management could be improved if data deficiencies and gaps were addressed. The current stock assessment system is not designed to provide production statistics for scientific stock assessment, meaning Indonesia cannot set catch levels that ensure the sustainability of stocks. Capture fisheries in Indonesia use multiple types of gear to catch multiple species. Fisheries data is of poor quality, as there are no accurate catch or effort statistics, population dynamics of target species are mostly unknown, and vessel catches are often unknown (Wibisono et al. 2022).

In 2014, the government began to promote the use of logbooks (Permen-KP No. 48/2014) and launched the e-logbook in 2017. This allows fishing vessels to report their daily records—catch, vessel, time, location—and landing declaration accurately and in real time (KKP 2019e). In 2019, the KKP set a target of 10,000 vessels using e-logbooks. As of August 2019, just 6,000 vessels were doing so (KKP 2019e). The government planned to target up to 20,000 e-logbooks by 2020 (KKP 2019e), though this target was not reached (DariLaut.id 2020). However, logbooks may be suitable for recording catch in central ports but are less suitable for fisheries that are dominated by small-scale fishers, who are usually highly dispersed and land in many locations.

Fishing Vessels

Indonesia had 768,972 fishing vessels in 2018, including 174,236 nonmotorized boats, 311,954 outboard engine boats, and 282,782 inboard motorboats (KKP 2019g) (Table 3.3).

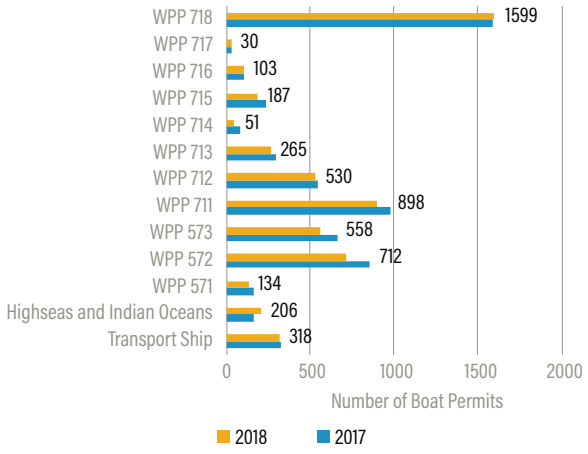
According to the KKP, 5,591 vessels larger than 30 GT were licensed in 2017 (Figure 3.5); about 5,133 (less than 0.73 percent) of them were licensed to operate across Indonesia's territories. The largest number of vessels above 30 GT operate in WPP 718 (Aru and Arafura in the Eastern Timor Sea), followed by WPP 711 (the Karimata Strait, the Natuna Islands, and the South China Sea), and WPP 572 (the Western Sumatra Sea areas and the Sunda Strait).

Table 3.3 | **Number of Fishing Vessels in Indonesia, by Vessel Type and Motor Size, 2006–18**

Year	Nonpower Boats (thousands)	Power Boats			Total (thousands)
		Outboard Motor (thousands)	Inboard Motor (thousands)	Subtotal for Motorized Vessels (thousands)	
2006	249.9	185.9	154.3	340.3	590.3
2007	241.1	185.5	162.9	348.4	590.3
2008	212.2	229.3	154.4	384.1	596.1
2009	193.7	236.6	157.2	393.8	587.6
2010	172.9	231.3	164.1	395.4	568.3
2011	170.9	225.7	185.1	410.9	581.8
2012	172.3	245.8	198.5	444.3	616.6
2013	175.5	237.6	226.5	464.1	639.7
2014	165.1	238.01	222.5	460.5	625.6
2015	143.1	246.8	178.3	425.1	568.3
2016	190.9	181.1	171.7	352.9	543.8
2017	198.3	183.6	181.2	364.8	563.2
2018	174.2	311.9	282.7	594.7	768.9
	Change (%)				
2006–16	–1.9	0.5	1.5	0.7	–0.7
2015–16	33.4	–26.6	–3.7	–17.0	–4.3
2016–18	–0.1	0.7	0.7	0.7	0.4

Source: KKP 2019g

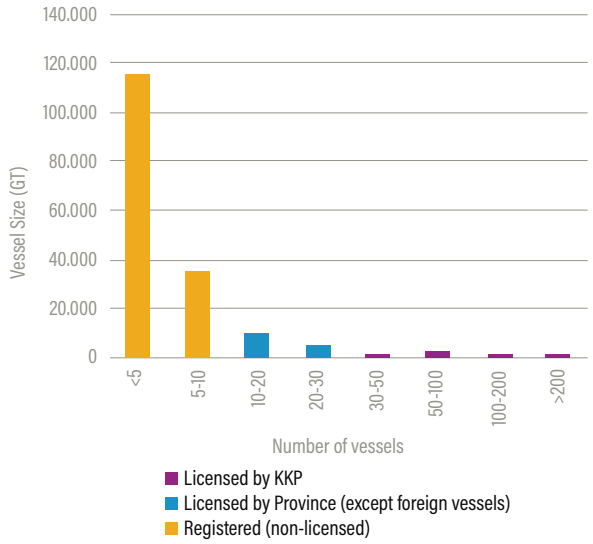
Figure 3.5 | **Number of Fishing Vessels Licensed in Indonesia by WPP, 2017 and 2018**



Source: KKP 2019h
Note: The figure shows only vessels of at least 30 GT.

However, Indonesia's fishing fleet is dominated by small-scale fisheries, with 96 percent of the fleet consisting of nonmotorized vessels, onboard engine vessels, and vessels below 10 GT (Figure 3.6). This large proportion of small-scale fishers affects fishing productivity because of the density of fishing activities in coastal areas, their limited capacity to reach more distant fishing grounds, and the many conflicts over resource use. Significant management effort is, therefore, needed.

Figure 3.6 | **Capacity of Indonesia's Fishing Fleet, 2016**



Source: KKP 2019g

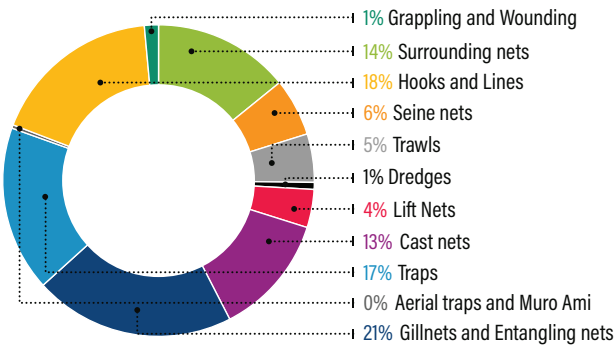
Before 2020, small-scale fishers in Indonesia were not regulated and were exempt from a requirement to notify local government regarding the type of gear they use. Now, however, Permen-KP No. 25/2020 requires small-scale fishers and all vessels below 30 GT to obtain the following documents for vessels they own: a vessel measurement document (*surat ukur*); the vessel's deeds (*gross akta*); the vessel's permit, which includes the vessel measurement document (*izin yang mencakup buku kapal perikanan*); the fishing vessel registration (*bukti pencatatan kapal perikanan*); the fishery business license (*surat izin usaha perikanan*); and the fishing license (*surat izin penangkapan ikan*).

There is a lack of comprehensive data on fishing vessels and this is likely the result of the large number of unregistered vessels. Unlicensed vessels also make it harder to combat IUU and overfishing, as without proper vessel registration and license numbers, vessel activities go unnoticed and unrecorded.

Fishing Gear Used

Indonesian fishers use a wide range of fishing gear. In 2017, gillnets and entangling nets accounted for the largest share (21 percent), followed by hooks and lines (18 percent), seine nets (6 percent), and trawl nets (5 percent) (Figure 3.7). Seine nets and trawl nets are considered destructive fishing gear.

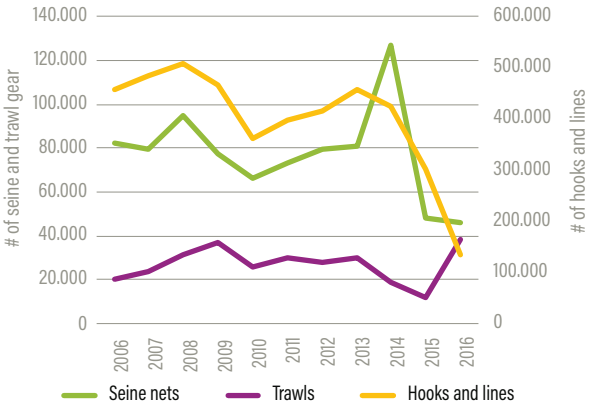
Figure 3.7 | **Fishing Gear Used in Indonesia, 2017**



Source: KKP 2019g

The use of Danish nets (a type of seine net) and bottom trawl nets for shrimp increased in 2016 (Figure 3.8). However, use of this gear may have declined after 2016 as a result of Permen-KP No. 71/2016, which prohibited the use of seine nets, trawls, and aerial traps. However, in mid-2020, purse seine nets (known locally as *pukat cincin*), one-boat seine nets *(payang)*, Danish seine nets *(cantrang)*, and nets for bottom trawling for shrimp *(pukat hela dasar udang)* were reauthorized for use (Mongabay 2020f).

Figure 3.8 | **Use of Seine Nets, Trawl Nets, and Hooks and Lines in Indonesia, 2006–16**



Source: KKP 2019h

Role of Fisheries in Food and Nutrition Security

Fish contribute to food security and nutrition by providing nutritious food and generating income (HLPE 2014). Fish provide micronutrients—amino acids; vitamins A, B12, and D; and minerals such as iron, calcium, zinc, and selenium—that are important for child development and general health (Ocean Panel 2021b).

In 2004, the government launched the *Gemar Makan Ikan* (Enjoy Eating Fish) campaign to increase awareness about the importance of fish consumption. It continues to operate (*Kontan* 2021). Fish consumption in Indonesia has increased every year since 2010 (Figure 3.9). Fish accounted for 46 percent of total animal-based food consumption (Benton and Thilsted 2014) and contributed 50 percent or more of total animal protein intake to the average Indonesian's diet (FAO 2017). The degradation of fish stocks would potentially limit the contribution of the fisheries sector to food security and protein intake in Indonesia (Bene et al. 2007).

In 2019, the national rate of stunting in children was 27.7 percent, well above the World Health Organization (WHO) standard of 20 percent. According to the World Bank, stunting can cause economic losses of 2–3 percent of Indonesia's GDP per year (Shrimpton and Rokx 2013). Stunting is high in some of Indonesia's major fish-producing provinces. For example, in 2018, East Nusa Tenggara province, a center of fish resources in Indonesia, had the highest percentage of stunted children, at 42.5 percent of those under 5 (*Pos-Kupang* 2019). Daily per capita fish consumption was about 6.7 grams in the province in 2017 (BPS NTT 2019), well below the recommended level of 80 grams. However, improving food security and nutrition in Indonesia is not only related to increasing the domestic consumption of protein (in this case fish) and the assurance of fish supply, but also requires improving physical and economic access to nutritious food, including cheap fish. Creating access to fish protein is an opportunity for Indonesia to overcome the problem of nutritional deficiency.

Employment and Labor Productivity

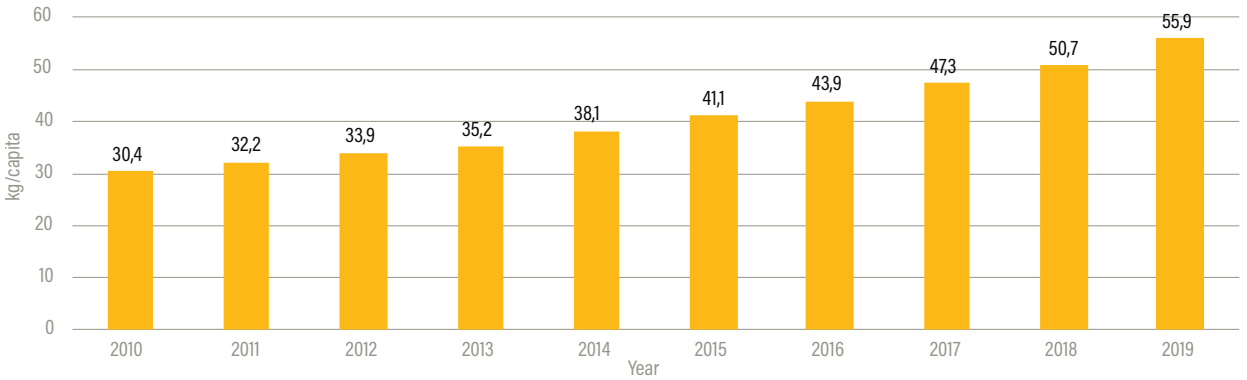
Between 2013 and 2018, the number of fishers in Indonesia fell by 0.03 percent (Table 3.4). In 2017, the numbers of fishers was 6.8 million (KKP 2019g). It decreased by 7 percent in 2018 to about 6.3 million.[5] Most fishers in Indonesia are small-scale and likely work in the informal sector, with little or no protection from market volatility or physical risk at sea.

Table 3.4 | **Number of Fishing Vessels in Indonesia, by Vessel Type and Motor Size, 2006–18**

Year	Change in Number of Fishers in Indonesia (%)
2010	2.6
2011	2.7
2012	2.7
2013	2.7
2014	2.7
2015	2.7
2016	2.6
2017	2.6
2018	–7
Percentage change 2013–18	–0.03

Source: KKP 2019g

Figure 3.9 | **Annual Fish Consumption in Indonesia, 2010–19**



Sources: KKP 2018c, 2019g

The role of women in the sector is often overlooked. Women represent 42 percent of the sector's workforce and 74 percent of the workforce in the aquaculture subsector (Table 3.5). Women work mostly in post-harvest jobs, including sales. The lack of recognition of the key role women play in the fisheries sector prevents more from participating and accessing government economic support.

More than 4 million people worked in the aquaculture sector in 2018, with the freshwater subsector accounting for 66 percent of all jobs (KKP 2019h) (Figure 3.10). The brackish water and marine aquaculture subsectors accounted for 20 percent and 14 percent of employment, respectively.

Indonesia's aquaculture labor productivity (t/person) is low. In 2016, average production was less than 1 t per fish farmer, compared with 1.4 t in Vietnam, 4 t in Asia, 10 t in China, and 165 t in Norway (FAO 2020b).

Skilled labor plays an important role in increasing productivity (Mahalik and Kim 2014). The KKP has created a series of training courses to improve farmer skills. To enhance the effectiveness of the training, it plans to increase the number of farmer groups, which will allow farmers to exchange knowledge and skills. The effectiveness and continuation of this government program must be monitored.

Table 3.5 | Indonesia's Fisheries and Aquaculture Workforce, by Sex, 2018

Job	Men		Women		Total
	Number	Percentage of Total Workforce (%)	Number	Percentage of Total Workforce (%)	
Fishers	1,395,785	96	63,371	4	1,459,156
Fish seller	9,505	35	17,427	65	26,932
Fish seller in port	95	83	20	17	115
Aquaculture farmer	441,131	26	1,256,869	74	1,698,000
Total	**1,846,516**	**58**	**1,337,687**	**42**	**3,184,203**

Source: KKP 2019g

Figure 3.10 | **Number of Freshwater, Brackish Water, and Mariculture Farmers in Indonesia, 2007–18**

Source: KKP 2019g

Trends in Aquaculture

The aquaculture sector is one of Indonesia's development priorities; the 2020–24 National Medium-Term Development Plan includes the increase of aquaculture production and revitalizing aquaculture ponds among its strategic priorities. The government through Perpres 2020 has set ambitious targets for increased aquaculture production of 10.5 percent a year to 2024 (see Table 2.1)).

Volume and Value of Production

Aquaculture production in Indonesia has grown rapidly in recent years and is projected to overtake wild-capture fisheries within the next decade. Aquaculture production increased from 2.4 million t in 2010 to 6.4 million t in 2019, with seaweed production surging from 4 million t in 2010 to 11.3 million t in 2018 (Figure 3.11).

The main species farmed in Indonesia have remained unchanged since 2003. They include shrimp, grouper, tilapia, carp, milkfish, barramundi, pangasius, catfish, gouramy, and seaweed. The first nine species account for about 90 percent of production by volume (FAO 2020b). These species are farmed mainly in freshwater, brackish water, and mariculture settings. Freshwater species—more than 70 percent of which is consumed domestically (KKP 2015)—dominate, followed by brackish water species, such as shrimp and milkfish. The contribution of mariculture remains marginal if seaweed is excluded.

Shrimp is the most important commodity in terms of value. It accounted for 6 percent of production volume in 2017 but 31 percent of production value. Seaweed is the most important commodity in terms of volume but makes only a small contribution to the value of aquaculture production.

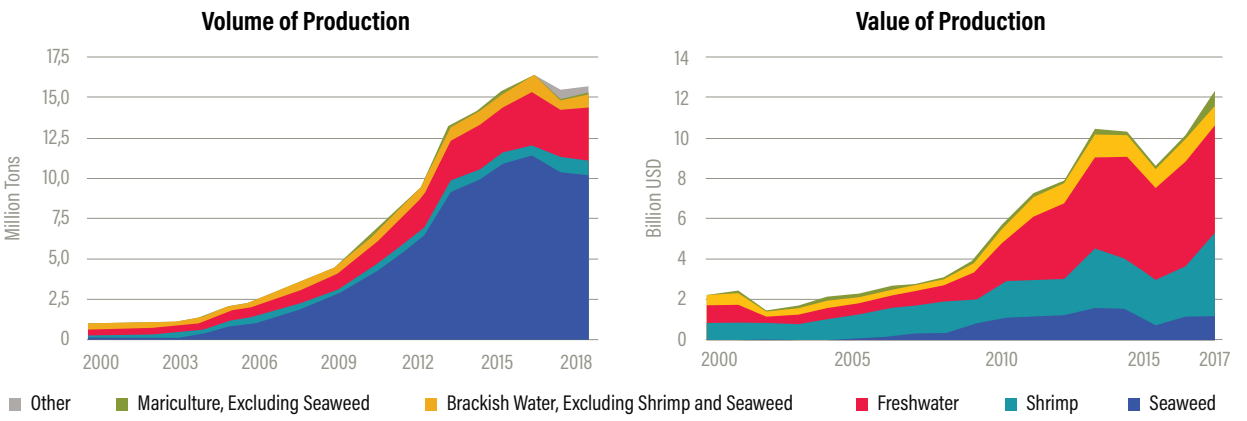
WPP Assessment for Aquaculture

This section highlights the potential and issues in aquaculture production in WPPs 714, 717, and 718.

In WPP 714, many coastal areas have been used for aquaculture crops, including seaweed and pearl oysters (KKP 2016c). This is supported by high levels of nutrients that enter the sea from the land. Mariculture and *tambak* (fishponds) have been developed in areas such as Tual, Saumlaki (in Maluku), and Konawe (in Southeast Sulawesi).

- In Tual, the mariculture cultivation area reached up to 800 ha (14 percent of total potential area) in 2014. Fish types cultivated include napoleon and *kerapu*, and, pearl oysters. Seaweed types include *Kappaphycus alvarezii* and *Gracilaria sp*. In 2014, gross production of *kerapu*, pearl oyster, and seaweed reached 1,100 t, 305 million t, and 20,800 t, respectively. Seaweed production roughly doubled between 2011 and 2014, rising from 10,2000 t to 20,8000 t (wet weight).

Figure 3.11 | **Volume and Value of Aquaculture Production in Indonesia by Type, 2000–18**



Source: Volume figures are from the KKP (2019h). Value figures are from FishStatJ (n.d.) and the FAO (2019).

- In Saumlaki, ongoing mariculture activities include lobster, pearl oysters, and seaweed. Some 8,000 workers are cultivating seaweed on 1,700 ha. Seaweed cultivation has taken place since 2007. The 2014 net production was 2,500 t, mainly *Kappaphycus alvarezii* and *Eucheuma cottonii*. An environmental carrying capacity study conducted in Saumlaki identified further potential seaweed areas of at least 1,300 ha. A related study of fish aquaculture (where *keramba* or wooden offshore platforms are used) identified approximately 1,200 ha that could be used (KKP 2016c).
- In Konawe, at least 8,700 ha is used for seaweed cultivation. However, production is limited by disease and other ecological factors (KKP 2016c). Just 11 percent of the coastal zone is suitable for shrimp farming in ponds with traditional management methods. The remaining area requires other interventions, including soil improvement and polyculture.

In WPP 717, the development of marine aquaculture is limited (KKP 2017b). Indonesia is one of the world's leading exporters of dry seaweed *(Eucheuma cottonii)*. Cultivation in WPP 717 ended in 2014, however, because of the low capacity of local communities, conflict between investors and communities, and seaweed disease (ice-ice disease). One of the focus areas for seaweed was Biak Numfor district, which cumulatively produced 40 t of seaweed between 2009 and 2013 but ended production in 2014 (KKP 2019i).

Marine aquaculture is also limited in WPP 718 (KKP 2016b). In Merauke, for instance, various logistical issues (e.g., inadequate road infrastructure and overlong transport time) limit the development of mariculture, despite the potential for shrimp and crab aquaculture in areas such as Kimaam Island. About 70 ha out of a potential 666,000 ha are devoted to inland aquaculture. In 2014, the local government began to focus on building the capacity of local communities to engage in inland aquaculture, and strengthening local supply chain capacity.

Effects on the Environment

Aquaculture could help reduce the burden on wild fish stocks to meet potential food demand. However, the growth of aquaculture raises concerns about feed, which is costly (Costello et al. 2020). About 70 percent of the total production cost of aquaculture is fish feed (*Kompas* 2020e). There are also concerns about space, water, and disease.

Coastal and marine environments have many uses, including conservation, tourism, shipping, and aquaculture, but some may conflict with others. Aquaculture ponds have been the main cause of mangrove degradation in coastal areas. Mangroves are crucial to many ecosystem services, providing nurseries for commercially important species, regulating carbon, protecting coastal areas, and contributing to community livelihoods and wellbeing.

Indonesia is in the process of developing coastal and marine spatial plans (RZWP3K) to govern the use coastal and marine areas. As of January 2021, 27 provinces have enacted coastal and small islands zoning plans (Bisnis 2021).

Aquaculture practices require adequate freshwater, but most aquaculture farmers discharge their wastewater into the same waterbody from which they obtain their freshwater. Before being discharged, wastewater from aquaculture should be treated so that it does not damage or pollute the water body. Indonesia has no clear standards for discharging aquaculture ponds wastewater. To ensure waterbodies are not polluted, authorities should assess the carrying capacity of each waterbody.

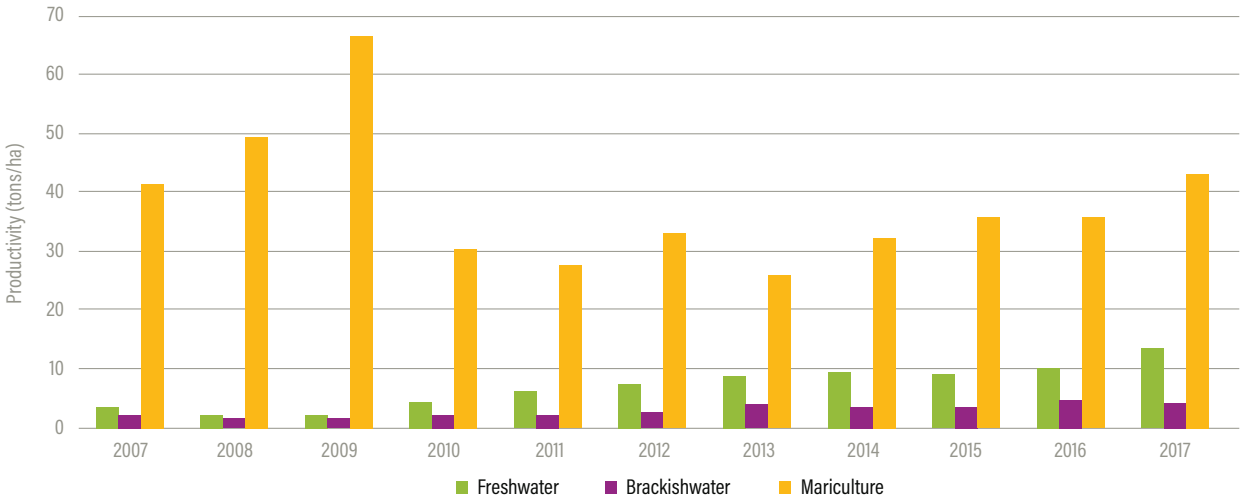
Globally, disease results in forgone annual revenues of about $6 billion in the aquaculture industry (World Bank 2014). In Indonesia, diseases include white spot syndrome virus in *Litopenaeus vannamei* (whiteleg shrimp), ice-ice disease in seaweed, and tilapia lake virus in Nile tilapia. Disease transmission is driven by the movement of live animals, the transfer of equipment from one pond to another, contact with wild hosts, and failure to provide adequate water circulation. Reducing the transmission of disease requires aquaculture farms to set and adhere to standard operating procedures, such as procedures to limit contact with wild hosts and ensure the cleaning of equipment before and after use.

Long-Term Economic Prospects for Mariculture

Mariculture is the most productive aquaculture setting in Indonesia, producing more than 40 million t per ha in 2017 (Figure 3.12). The productivity of freshwater and brackish water aquaculture, dominated by shrimp farms, increased by about 15 percent in 2017 (KKP 2019g). In contrast, the productivity of mariculture, which is dominated by seaweed production, has been declining. Seaweed is highly dependent on the weather, and expansion of cultivated area does not, therefore, necessarily increase the volume of production. Significant challenges such as disease outbreaks, epiphyte infestations, and a loss in seedling quality have led to the decrease in seaweed production (Cokrowati et al. 2019; Kambey et al. 2020). Kambey et al. (2020) suggest Indonesia lacks the legislation and policies necessary to address biosecurity-related issues to ensure the future of the seaweed industry. The biggest challenge in developing a national strategy on biosecurity is that seaweed is categorized with other fisheries and aquatic animal industries, even though outbreaks of disease and pests develop far more rapidly in seaweed than in fish and aquatic animals. This means that seaweed cultivation systems should be considered separately.

Another reason for the lack of policy attention to seaweed is its low economic value, especially compared to fish and aquatic animals such as shrimp. However, the seaweed industry can be accessed with low capital investment and can provide a livelihood for middle- to low-income communities (Neish 2013), therefore remaining an important industry for Indonesia.

Figure 3.12 | **Productivity of Freshwater, Brackish Water, and Mariculture Farmers in Indonesia, 2007–17**



Source : WRI Indonesia, based on data from KKP 2019g.

AQUACULTURE CASE STUDIES

This section reviews Indonesia's two most important aquaculture subsectors, seaweed and shrimps, which are important for different reasons. Seaweed is labor-intensive and has significant potential for job creation and livelihoods. In 2018, seaweed production was the largest fisheries commodity by tonnage, though the value was relatively low in comparison to other commodities. In contrast, shrimp has the highest export value and produces the largest export revenues, but its expansion poses a threat to mangrove ecosystems.

Seaweed

Indonesia is the world's second-largest producer of seaweed (after China). Indonesia produces *Eucheuma cottonii*, which is used to produce carrageenan, an additive used to thicken, emulsify, and preserve food and drink, and *Gracilaria sp.,* which yields agar, a product used for various food and non-food purposes. Indonesia produced 99 percent of the world's *Eucheuma cottonii* and 25 percent of its *Gracilaria sp.* in 2017 (Fisheries and Aquaculture Department n.d.). Demand for consumption- and nonconsumption-grade carrageenan has risen rapidly across developed and developing markets in recent years (FAO n.d.) for use in the pharmaceutical and agriculture industries, among others.

Indonesia enjoyed the world's fastest growth of seaweed output between 2010 and 2018, more than doubling production from 4 million t in 2010 to 11.3 million t in 2018 (Figure 4.1) (KKP 2019h). Most of the increase was in *Eucheuma cottonii*.

China purchased more than 80 percent of Indonesia's exported seaweed in 2016–18 (Trademap 2018). Most of it was exported in raw form and at a lower value than if it had been processed. The price of Indonesian seaweed has also been constrained by lower demand from China—partly as a result of its 2015–16 economic crisis, which cut the country's purchasing power (*Jakarta Post* 2015).

Production Areas

Seaweed farming is dispersed throughout Indonesia's central and eastern island groups. Before 2014, seaweed hectarage data was reported as marine aquaculture and not disaggregated as seaweed. Starting in 2014, Indonesia's Center for Data and Information (Pusat Data dan Informasi) began providing information on seaweed hectarage (KKP 2019j).

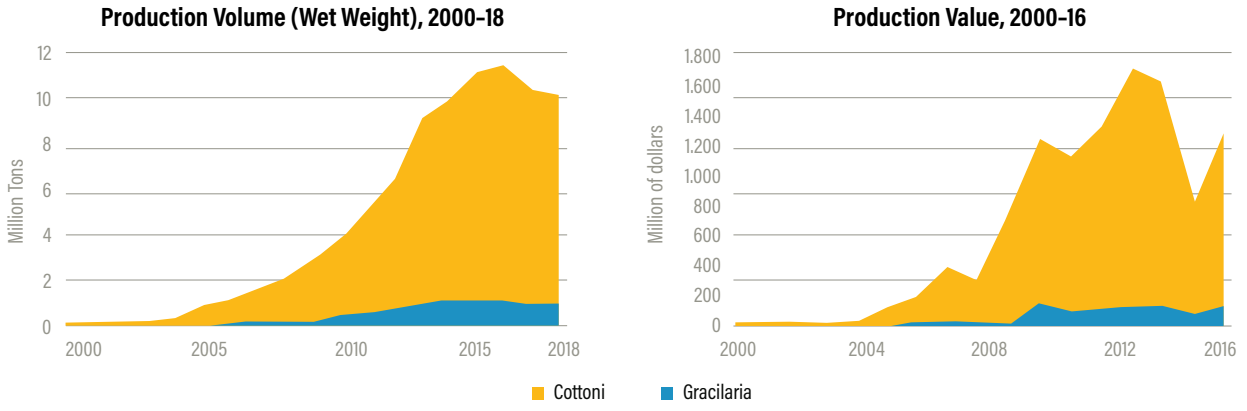
Indonesia used approximately 267,000 ha for seaweed farming in 2016 (KKP 2019j). Seaweed aquaculture farms are located primarily in South Sulawesi (35 percent of total production), East Nusa Tenggara (18 percent), Southeast Sulawesi (8 percent), and West Nusa Tenggara (8 percent) (KKP 2019j).

Seaweed farming often has to compete with other important economic activities, such as transportation and tourism. The recent regulation on zoning coastal areas and small islands (RZWP3K) is an effort to give coastal communities engaged in seaweed farming a designated space for their activities, though farmers still need to obtain a license.

Environmental and Social Considerations

Nearly all seaweed in Indonesia is produced in coastal villages by family-owned enterprises. Family members — men and women — deploy simple farming techniques using minimal capital and material inputs. In many parts of Indonesia, farmers sell their output to intermediaries (Zamroni 2018) or directly to seaweed processors.

Figure 4.1 | **Production of Seaweed in Indonesia**



Source: WRI Indonesia, based on volume data from the KKP (2019h) and value data from the FAO (2019).
Note: There is a wide gap between reported seaweed production and the sum of seaweed exports and domestic consumption, leaving more than 60 percent of reported seaweed production unidentified. This discrepancy exists even after seaweed production statistics using wet weight are converted to dry weight.

In 2017, there were about 668,000 seaweed farmers in Indonesia. Using the average price of seaweed, as provided by the Coordinating Ministry of Economic Affairs, Rp 11,600 per kg yields an average monthly income for seaweed farmers of about Rp 15 million ($1,044) in 2018—more than three times the minimum wage of Rp 4.28 million ($298) per month.

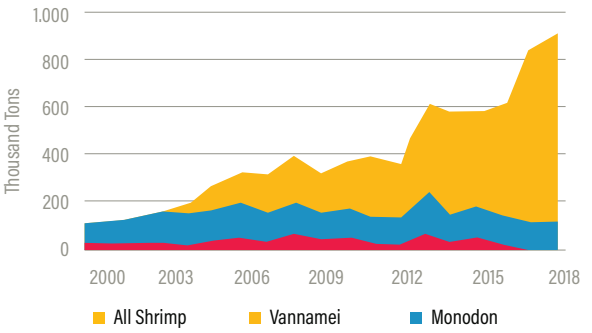
The feasibility of seaweed aquaculture depends on the environment, in particular the state of coastal waters (Nazaruddin et al. 2015). Unlike other forms of aquaculture, seaweed aquaculture does not create effluents, require feed or chemicals, spread disease, attract pests, or use wild populations for broodstock and seed. However, the exponential growth of seaweed production in the last decade is cause for assessment of its potential negative impacts, including the possible effects of widescale seaweed production on ecosystems and the potential spread of nonnative species. There are also questions about its effect on the surrounding environment, especially when natural seagrass beds or other environments are destroyed to free up space for seaweed farms. Seaweed aquaculture has been the main cause of seagrass degradation in East Nusa Tenggara, West Nusa Tenggara, and North Sulawesi (Unsworth et al. 2018).

Seaweed has also recently been used as a substitute for plastic packaging in Indonesia, the world's second-largest ocean plastic polluter. Indonesia aims to reduce 75 percent of its plastic waste in the ocean by 2025 (Presidential Regulation 83/2018). Seaweed is one promising alternative. However, the price of seaweed packaging is not yet competitive with that of plastic packaging.

Shrimp

Indonesia is the second-largest shrimp producer in the world (after China). Shrimp is the highest-value aquaculture commodity in Indonesia, earning Rp 58 trillion in 2017 (KKP 2019k). Its production volume doubled between 2005 and 2016 (Figure 4.2). Most of the growth was from the quadrupling of the production volume of *Litopenaeus vannamei*, which is preferred because it grows rapidly and at a higher density.

Figure 4.2 | **Volume of Shrimp Production in Indonesia, 2000 –18**



Source: KKP 2019k

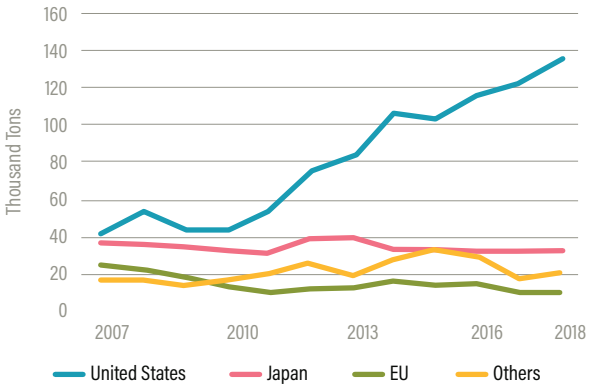
Penaeus monodon (known locally as *windu*) and *Litopenaeus vannamei* are the two main species of shrimp farmed in Indonesia. Together they account for more than 90 percent of production in terms of both volume and value. *Penaeus monodon* is native to Indonesia and has been cultivated since 1960, starting in South Sulawesi (Sianipar and Samad Genisa 1987). In the 1990s, an outbreak of a white spot syndrome virus attacked the species, resulting in a massive decrease in production across the country (Kusumastanto et al. 1998).

In the early 2000s, the Government of Indonesia enacted a decree that legalized the import of *Litopenaeus vannamei*. This gradually led to rapid growth in production of the species. Now, production of *Litopenaeus vannamei* is significantly greater than production of *Penaeus monodon*, because the former can be cultivated at very high stocking densities, resulting in higher productivity per unit area. It is also less susceptible to white spot syndrome virus and other diseases, making cultivation more predictable and productive. *Litopenaeus vannamei* is generally able to grow at least as rapidly as *Penaeus monodon*. However, there are also disadvantages to *Litopenaeus vannamei:* slow growth of the

shrimp once it has reached 20 grams, higher risk due to the high stocking density, and the fact that *Litopenaeus vannamei* is not native to Indonesia and may contaminate local shrimp stock with diseases to which they are not resistant (Funge-Smith and Briggs 2003).

Shrimp is one of Indonesia's flagship export commodities. The world's largest export market is the United States, which imports mainly *Litopenaeus vannamei* (Figure 4.3). Indonesia has been one of the main *Litopenaeus vannamei* exporters to the United States for almost a decade, second only to India in 2013–18.[7] Japan is the second-largest importer of Indonesian shrimp, mainly *Penaeus monodon*. Indonesia is the world's 10th-largest supplier of frozen shrimp to the European Union, with a 4 percent market share. Together, the United States, Japan, and the European Union make up 90 percent of Indonesia's shrimp export market.

Figure 4.3 | **Destination of Indonesian Shrimp Exports, by Volume, 2007–18**



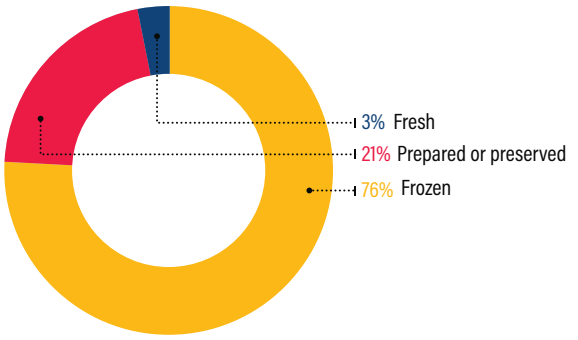
Source: Trademap 2019

Most shrimp is exported frozen (Figure 4.4). Value-added products such as ready-to-eat shrimp products increased from 3 percent of the export market in 2011 to 21 percent in 2018. Indonesia exports a smaller share of prepared shrimp products than China and Thailand, but a larger share than India and Ecuador (Trademap 2018).

Environmental and Social Considerations

Shrimp aquaculture is the main cause of mangrove degradation in Indonesia (Richards and Friess 2016). Degradation is worst along the north coast of Java, the east coast of Kalimantan, and in Southeast Sulawesi. Indonesia's ambitious goal of almost doubling shrimp aquaculture

Figure 4.4 | **Shrimp Products Exported by Indonesia, 2018**



Source: Trademap 2019

production to 1.52 million t by 2024 poses a threat to mangroves across the country. Recognizing the threat, the government enacted Coordinating Economic Ministerial Regulation (Permenko) No. 4/2017, a regulation targeting the rehabilitation of 1.8 million ha of mangroves. Achieving both the production and rehabilitation goals will require careful planning, including intensification rather than the expansion.

New landowners hold many rural shrimp ponds and have pushed out local people, including in Southeast Sulawesi and East Kalimantan. This has led to conflict between local communities and the new landowners because of different environmental views and/or future use of land (Persoon and Simarmata 2015). Many of these shrimp ponds are idle (Ilman et al. 2016) due to lack of finance, which may exacerbate the situation as locals could attempt to use the idle shrimp ponds without permission. Idle shrimp ponds can be revitalized, as targeted by current government plans.

Shrimp farming provides numerous employment opportunities for coastal communities. The subsector is dominated by traditional ponds lacking advanced technology and often using polyculture systems, with shrimp cultured in brackish water alongside other species, such as seaweed and milkfish. The number of brackish water aquaculture farmers rose from about 470,000 in 2007 to 857,000 in 2018, an increase of 82 percent (KKP 2019g). During this period, output more than tripled, indicating increased productivity.

Insurance

The KKP subsidizes insurance for aquaculture to protect farmers and improve their welfare. Eight insurance companies in Indonesia are members of an aquaculture consortium, led by PT. Asuransi Jasa Indonesia (Jasindo),[6] to coordinate prices for the government program. As the insurance program is still new, the consortium is assisted and directed by a working group consisting of the Directorate General of Aquaculture at the KKP, the Financial Services Authority (Otoritas Jasa Keuangan/OJK), the General Insurance Association of Indonesia (Asosiasi Asuransi Umum Indonesia), and each participating insurance company. The consortium offers insurance to compensate for disease and natural disasters, and compensates farmers for 50 percent of any losses.

Insurance for shrimp commodities was first introduced in 2017 to reduce the risks faced by smallholder aquaculture farmers. The claimable amount is calculated based on the capital needed to establish the facilities. Compensation ranges from Rp 1.5 to Rp 7.5 million a year. The annual insurance premium is 3 percent of the claimable amount. In 2019, smallholder aquaculture insurance was subsidized by the government, with 100 percent of the premium for smallholders paid through Indonesia's income and expenditure budget. How long the government will continue to subsidize the premium is not clear.

Table 4.1 shows claims by province. Higher claims signal a higher investment risk. In 2018, the highest claims were made in Aceh, East Java, and Lampung. The high level of claims indicates that without government subsidies, the risk of investing in shrimp farming remains too high.

Insurance at the moment is costly. For insurance programs to be successful, insurers would benefit from providing extension services—such as training in better management practices (including climate-smart and sustainable practices) and in financial literacy—and services in accessing markets (IDH 2018).

Table 4.1 | **Insurance Premiums Paid by and Claims Paid to Shrimp Aquaculture Farmers in Indonesia, by Province**

Province	Number of Aquaculture Farmers	2017		2018		Loss Ratio
		Area (ha)	Premium (Rp, million)	Area (ha)	Claims (Rp, million)	
Aceh	200	205	92	25	124	1.30
Banten	41	140	63	7	37	0.58
Gorontalo	35	96	43	1	5	0.11
West Java	129	325	146	19	96	0.65
Central Java	225	406	182	32	160	0.88
East Java	263	219	98	25	124	1.26
South Kalimantan	19	44	20	0	0	0
Lampung	90	137	61	16	80	1.30
West Nusa Tenggara	53	31	14	0	0	0
West Sulawesi	8	9	4	0	0	0
South Sulawesi	789	1,368	616	5	27	0.04
Central Sulawesi	18	40	18	0	0	0
South East Sulawesi	109	262	118	2	10	0.08
North Sumatra	25	16	7	<0	1	0.19
Total	**2,004**	**3,300**	**1,485**	**133**	**666**	

Source: OJK 2019
Note: Due to rounding, the sum of the cells in each column may not tally with the figure in the "Total" row.

STATUS OF MPAS AND ESSENTIAL ECOSYSTEMS

The management of Indonesia's fisheries economy should work in parallel with conservation efforts to safeguard MPAs and essential ecosystems. Fisheries are dependent on the regeneration of the ecosystem, and therefore, the goal is not only to maximize profit but to consider equally the conservation goals. This section, Section 5, reviews the establishment, status, and management of MPAs and the protection of essential ecosystems.

In 2019, MPAs in Indonesia expanded to over 23.14 million ha (meeting the Aichi target of 20 million ha[7]). These consists of 10 national MPAs, 156 district-based MPAs (KKPD), and 30 MPAs initiated by the KLHK. According to the KKP document MPAs Vision 2030, Indonesia is committed to achieving the national target of 32.5 million ha of MPAs (10 percent of the country's total marine area) by 2030 (KKP 2020f).

Establishment and Management of MPAs

An MPA is a coastal or marine area intended as a place of protection for important fish species and other marine biota that provide ecosystem services and have cultural and economic value. The designation as an MPA is intended to ensure the protection of the marine ecosystem. Designating coastal and marine areas with high biodiversity and healthy coral reef ecosystems, which provide a habitat for fish and shelter for reproduction, supports capture fisheries.

Habitat protection and management efforts through the establishment of MPAs are now guided by UU No. 5/1990 on the Conservation of Biological Resources and Their Ecosystems, Government Regulation No. 60/2007 on Conservation of Fish Resources, and UU No. 27/2007 on the Management of Coastal Areas and Small Islands. Since the issuance of these laws and regulations, MPAs and other protected areas have been established in almost all parts of Indonesia.

The first MPAs in Indonesia were established in the 1970s, with the creation of multiple national marine parks. As of 2020, Indonesia has established 196 MPAs, covering 23 million ha (KKP 2020a). This number exceeds the 2009 commitment to establishing 20 million ha by 2020. The government has committed to increasing the area of MPAs from 23.4 million ha in 2020 to 26.9 million ha in 2024 and 30.0 million ha in 2030 (KKP 2021b).

Two authorities manage MPAs in Indonesia: the KKP and the KLHK. As of 2019, the KKP managed 166 MPAs and the KLHK 30 (Table 5.1). The KLHK has jurisdiction over land and marine areas touching the land and is responsible for the management of protected land, as well as MPAs. The KKP manages marine national

Table 5.1 | **Description and Size of MPAs in Indonesia, 2019**

Marine Protected Area	Description	Number	Area (ha, millions)
Initiated by Ministry of Environment and Forestry		**30**	**4.63**
Marine national park (*taman nasional laut*)	Conservation area that aims to prevent the extinction or destruction of local biodiversity.	7	4.04
Marine nature tourism park (*taman wisata alam laut*)	Marine nature conservation park characterized by native ecosystems. It is managed with a zoning system.	14	0.49
Marine wildlife reserve (*suaka margasatwa laut*)	Marine reserve area that has is home to unique species of animals that require protection for their survival.	4	0.005
Marine nature reserve (*cagar alam laut*)	Nature reserve area in which unique plants, animals, and ecosystems are protected.	5	0.09
Initiated by Ministry of Marine Affairs and Fisheries		**166**	**18.51**
Marine national park (*taman nasional perairan*)	Marine conservation area that preserves the native ecosystem.	1	3.35
Marine nature reserve (*suaka alam perairan*)	Marine conservation area that aims to protect the biodiversity of fish species and their ecosystems.	3	0.045
Marine tourism park (*taman wisata perairan*)	Conservation area used for marine tourism and recreation.	6	1.54
District-based MPA (*kawasan konservasi perairan daerah*)	Marine conservation area located in regency/municipal waters, generally 0–4 nautical miles from the coast of the province.	156	13.17
Total		**196**	**23.14**

Source: KKP 2020d
Note: Due to rounding, the sum of the cells representing hectares may not tally with the "Total" figures.

parks, marine nature reserves, marine tourism parks, and district-based MPAs. The two ministries classify MPAs differently. However, all existing conservation areas are in accordance with the objectives and scope of conservation areas as defined by the International Union for Conservation of Nature (IUCN).

Most MPAs managed by the KKP are provincial MPAs (*kawasan konservasi perairan daerah*/KKPD). In 2019, there were about 156, with potential to increase. Based on Permen-KP No. 31/2020 on Conservation Area Management, provincial MPAs are managed by the provincial governor through the provincial technical offices. Ten other MPAs are directly managed by the KKP. They are national MPAs (*kawasan konservasi perairan nasional*/KKPN) located in cross-provincial areas or in national strategic areas. Permen-KP No. 17/2008 and Permen-KP No. 2/2009 regulate the management of KKPNs.

The KLHK's MPAs are managed by the Directorate General of Natural Resources and Ecosystem Conservation (Direktorat Jenderal Konservasi Sumber Daya Alam dan Ekosistem), formerly the Directorate General of Forest Protection and Nature Conservation (Direktorat Jenderal Perlindungan Hutan dan Konservasi Alam). A technical implementation unit carries out management activities in the field.

At the end of 2019, the KLHK oversaw 30 MPAs, most of them national parks (see Table 5.1). These are managed on a day-to-day basis by the Natural Resources Conservation Office (Balai Konservasi Sumber Daya Alam) or the National Park Office (Balai Taman Nasional).

Effective management improves the quality of an MPA and is more important than increasing the area and number of MPAs. The large number of low-performing MPAs, those not meeting their ecological and social goals, is probably related to inadequate management (Gill et al. 2017; Coad et al. 2019). Various elements affect the management effectiveness of MPAs, including financing, staff capacity and training, law enforcement capacity, facilities and infrastructure, governance, communication, and community relations (Leverington et al. 2010; Gill et al. 2017). However, if management is effective, the MPA is more likely to meet its ecological and social goals. A global study of more than 400 MPAs found that strong staff capacity and funding had a positive impact on the ecology of MPAs (Gill et al. 2017)

Evaluation Tools for MPAs

In Indonesia, the KLHK and KKP, the two designated management authorities, each use a different tool to monitor MPAs and evaluate the effectiveness of management. Those managed by the KLHK are assessed using the Management Effectiveness Tracking Tool (METT), the methodology used in the World Bank Score Card (World Bank 2004; KSDAE 2015). Those MPAs managed by the KKP and provincial governments are assessed using a methodology established by the KKP called Evaluating the Management Effectiveness of Aquatic, Coasts and Small Islands Conservation Areas (KKJI 2012). In 2021, the KKP introduced a revised version called EVIKA (Evaluation of Conservation Area Management Effectiveness). The Director General of Marine Spatial Management issued technical guidelines in Decree No. 28/2020. The previous tool is now considered inadequate and new upgraded tools are needed within EVIKA to assess management progress. The leading government agency managing the MPA (Satuan Unit Organisasi Pengelola/SUOP) will be assessed for inputs, processes, and outputs, while related national (ministries and institutions) or subnational government bodies will be assessed for outcomes. Through EVIKA, the government evaluates management effectiveness using adaptive and sustainable management principles. It is expected to help build conservation areas while also producing economic benefits.

The previous evaluation tool, EKKP3K, assessed the performance of MPAs using a system that was unable to provide detailed results and only showed progress had been made when 100 percent of parameters were met. It hindered the improvement of urgent issues. According to the last evaluation in 2019, out of 166 MPAs under KKP, 28 MPAs had been established (yellow rating), 24 MPAs were minimally managed (green rating), and the remaining 70 MPAs were still being initiated (red rating). About 57 percent of MPAs were at stage 1, 23 percent at stage 2, 20 percent at stage 3, and none at stages 4 or 5. All the MPAs with red ratings are KKPDs and do not yet have complete basic tools for the implementation of MPA management (e.g., zoning system, management plan, management

unit). Most MPAs in western Indonesia are still in the "initiated" stage (red rating). The 2019 evaluation classified all national MPAs as minimally managed (green rating).

To better understand the effectiveness of MPA management, in 2013 and 2017, the KKP published the management status and change in status of the 30 MPAs it managed. However, evaluation is limited because the evaluation tool, the KKP's EKKP3K, was only introduced in 2012. In addition, the guidelines for establishing and effectively managing MPAs are thorough and complex and take time to implement. However, between 2013 and 2017, all 17 MPAs with the management status of "not yet assessed" and those at stage 1 were expected to advance to stage 2 or better. Eighteen MPAs rose to "minimally managed" in 2017.

In the new EVIKA evaluation system, the effectiveness status of MPA management is grouped into three levels: bronze, with a score below 50 percent; silver, with a score from 50 percent to 85 percent; and gold, with a score above 85 percent. Bronze means the MPA is minimally managed, with the design and management of the area underway, but more effort required to meet the objectives. Silver shows that the MPA is optimally managed, with management functioning adaptively and several objectives already met. Gold shows that the conservation area is managed in a sustainable manner and provides benefits for communities within the conservation area. The assessment is conducted by filling out 42 questions against 24 indicators on the assessment sheet. By 2021, 61 MPAs have been evaluated using EVIKA. They consist of 51 provincial MPAs and 10 national MPAs.

For many of Indonesia's MPAs, the lack of ongoing funding, training, and staff capacity, and the complexity of governance are among the many difficulties faced in effectively managing MPAs (Bennett and Dearden 2014; Gill et al. 2017). In particular, steady and ongoing funding is critical for the success of an MPA (Gill et al. 2017) in order to support operational costs, including investment in human resources, and provide funds for facilities and infrastructure.

Financing MPAs

In 2017, the budget increased for some — but not all — of the marine national parks managed by the KLHK, versus 2015 (Table 5.2). For example, in Togean National Park, the budget increased significantly as a result of the proposal by the local government to establish it as Central Sulawesi's second biosphere reserve, an initiative that required the construction of tourist facilities and infrastructure and the restoration of mangrove ecosystems (Antara 2019).

Table 5.2 | **Government Budget for Indonesia's Marine National Parks, 2015 and 2017**

National Park	Size (ha, millions)	Budget ($, millions)		Change (%)
		2015	2017	
Teluk Cendrawasih	1.45	0.63	0.85	33
Thousand Islands	0.10	0.41	0.42	0
Karimun Jawa	0.11	0.93	1.22	31
Bunaken	0.09	0.77	1.46	88
Kepulauan Togean	0.36	0.33	1.34	301
Takabone Rate	0.53	0.53	0.53	0
West Bali	0.02	0.51	1.02	101
Komodo	0.12	0.47	n.a	n.a.
Ujung Kulon	0.11	0.81	1.21	48
Wakatobi	1.39	0.47	2.03	332
Total		**5.87**	**10.06**	**71**

Source: METT KSDAE 2015, 2017
Note: Due to rounding, the sum of the cells in each column may not tally with the figure in the "Total" row.

All MPAs in Indonesia are managed by the government. Their main source of management funding is, therefore, the state budget and the regional budget, but the amount allocated remains insufficient. According to the Working Group on Sustainable Financing for Indonesian Marine Protected Areas, the combined operating costs of all existing MPAs are about Rp 225 billion a year. The budget from the state budget, regional budget, and foreign NGOs covers only about a third of this amount. If periodic costs are included, such as human resources training, the budget increases to Rp 250 billion a year ($17.3 million). Therefore, activities may be limited and budget gaps may be closed by a blend of funding. The Organisation for Economic Co-operation and Development (OECD 2021) reported that Indonesia received $78 million (2017 constant prices) in overseas development aid for marine environmental protection in 2013–18, or $13 million 13 million a year.

Historically, the government has taken a top-down approach to managing the MPAs, and this may be the problem. There are ongoing efforts to support conservation with other effective area-based conservation measures in areas that are not MPAs (Estradivari et al. 2022), for example, community-managed marine areas managed by communities through their customary norms, such as *awig-awig*, *sasi*, and *area ulayat*; private sector marine areas. Area-based conservation measures are implemented in areas that may not fit within the MPA framework because conservation may not be the primary goal and, therefore, the measure has not traditionally been viewed as contributing to conservation, but have the potential to do so. These are areas with diverse management objectives, including habitat protection, sea tenure for traditional or customary communities, fisheries, and tourism, among other goals (Estradivari et al. 2022). A network of area-based conservation measures and MPAs can strengthen ocean ecosystem conservation between regions, reduce conflicts of interest, accommodate diverse customs and local wisdom, and provide opportunities for knowledge sharing on successful MPA management in a network.

Meanwhile, to support MPAs, there are possible alternative sources of funding: donor agencies; corporate social responsibility efforts, including the BUMN Partnership and Community Development Program (Program Kemitraan dan Bina Lingkungan/PKBL), which is managed by a foundation; debt-for-nature swaps; carbon markets; payment for ecosystem services; biodiversity offsets; environmental damage fines; and endowment funds. Box 5.1 describes the MPA financing strategy for Raja Ampat.

BOX 5.1 | FINANCING STRATEGY FOR THE RAJA AMPAT MPA

To ensure the sustainability of funds for the MPA in Raja Ampat, the Raja Ampat Regional Unit, a local government body, is permitted to manage ticket revenues from visitors and other revenues. It is permitted to manage these for conservation area operations without going through the regional budgeting mechanism. It can also recruit non–civil servant professional staff and adopts professional and transparent business practices to improve services to the community, rather than earn profits.
In 2007, total revenue in the Raja Ampat MPA from tourism was Rp 20.3 billion ($1.4 million). This represents 34 percent of local commercial revenue and funds from community empowerment activities. Every village carries out conservation activities and, in return, received Rp 1.5 billion ($103,702) in 2016 (Syafri 2018). Every village in the wider Raja Ampat regency benefited economically from conservation activities.

Source: Raja Ampat KKP Regional Unit (Kantor BLUD UTD KKP Raja Ampat) 2019.

MPA Staffing and Capacity

All national marine parks managed by the KLHK are understaffed (Table 5.3). In contrast, among other types of marine parks also managed by the KLHK, 17 parks are not adequately staffed. The METT evaluation results show that the number of staff members within conservation areas rose from 1.48 in 2015 to 1.60 in 2017 (Ariyanto et al. 2017). Capacity building is one of many steps that can help address deficiencies identified in an evaluation.

Table 5.3 | **Adequacy of Staffing of MPAs in Indonesia, 2017**

Size of MPAs (ha)	Minimum Number of Staff Required	National Marine Parks		Other Marine Parks	
		Number Sufficiently Staffed	Number Insufficiently Staffed	Number Sufficiently Staffed	Number Insufficiently Staffed
Less than 100,000	7	0	2	17	8
100,000–500,000	11	0	2	0	0
500,000–1,000,000	15	0	1	0	0
More than 1,000,000	21	0	2	0	0
Total		0	7	17	8

Source: METT KSDAE 2015, 2017
Note: Due to rounding, the sum of the cells in each column may not tally with the figure in the "Total" row.

WPPs were developed to ensure the sustainable management of fisheries in Indonesian waters, meaning management for capture fisheries, mariculture, and research and development in the fisheries sector. The purpose of WPPs is aligned with that of MPAs: to implement sustainable fisheries management through conservation areas. However, the percentage of MPAs contained within an WPP in average remains low, at just 3.6 percent. Table 5.4 shows the distribution of MPAs within WPPs.

In the decade to 2021, policy changes in Indonesia have created challenges in MPA management. In 2014, the Indonesian government enacted the new UU No. 23/2014 on Regional Governments, replacing the former UU No. 32/2004. The enactment of the new UU No. 23/2014 appears to be a setback for Indonesia's decentralization system, particularly in the management of coastal and marine areas. With this regulation, the territorial waters within 12 nautical miles of the coastline (including MPAs) were transferred wholly to provincial governments. Previously, responsibility was shared between the provincial and district governments. This transition creates several challenges: Human resources are insufficient and an MPA management plan may not exist at the provincial level. Limited resources may result in a lack of law enforcement by MPA management in protected areas, and activities such as illegal fishing may go unchallenged (Dirhamsyah 2016). In addition, the local context, including the rights and needs of local communities, must be considered in the sustainable management of an MPA. Poor MPA performance often stems from a lack of local community participation in design and implementation (Ferse et al. 2010; KKP 2020g).

Given these challenges, the Government of Indonesia, through the KKP, released a plan, MPA Vision 2030, to solve the problems related to sustainable management of MPAs in Indonesia. This strategy is one of seven marine management tools that aim to ensure the 20 million ha of MPAs are effectively and equitably managed, establish 32.5 million ha of MPAs by 2030 to effectively protect marine biodiversity, and manage the sustainable use of fisheries in coastal areas and small islands to improve the welfare of communities. It is an appropriate and integrated policy incorporating economic, social, and ecological considerations. MPA Vision 2030 is also aimed at ensuring more effective implementation of the Omnibus Law and addresses seven areas for action:

- Integrating planning among the national and local governments
- Increasing the capacity of human resources
- Formulating regulations and policies
- Sustainable use of marine and fisheries resources
- Sustainable financing
- Other effective area-based conservation measures
- Creating a community platform to ensure communities participate in management.

MPAs and WPPs

The distribution of MPAs within WPPs varies widely (Figure 5.1). WPPs 715 and 711 are located in the Maluku and Natuna seas and 7.7 percent and 7.2 percent respectively are categorized as MPAs. However, MPAs are located along the coast and up to about 12 nautical miles (still within the jurisdiction of the provincial government) out to sea, while WPPs also cover deep sea areas and fall under the jurisdiction of the national government. Though the area covered by MPAs is small compared to the area covered by WPPs, MPAs plays a crucial role in supporting fisheries within a WPP, as their role is to protect the spawning, nursery, or feeding grounds of target species.

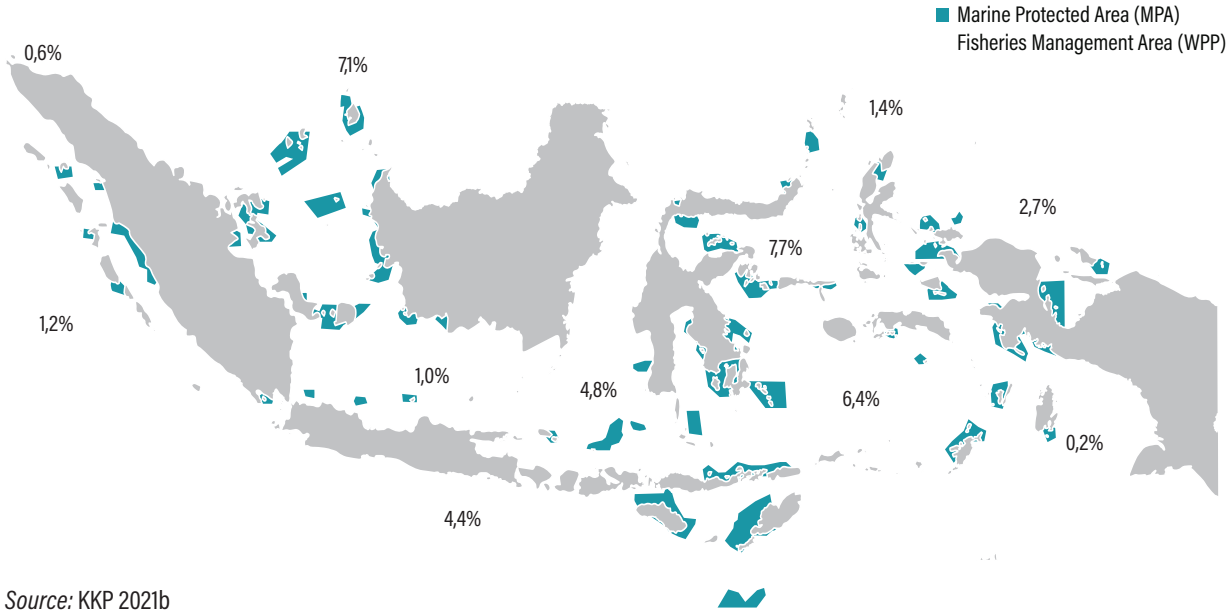
Indonesia faces several fisheries management issues. First, IUU fishing has become a significant problem within capture fisheries. In 2014–19, there were 29 instances of IUU fishing within WPP 716. Indonesia loses an estimated $4 billion a year to IUU fishing (Cabral et al 2018). To enhance the management of WPPs, it is necessary to implement conservation-based management within WPPs by integrating regulations and increasing the MPA zones within the area, and also including other effective area-based conservation measures (Estradivari et al. 2022). By promoting MPAs and other such measures, nodes of marine conservation management and conservation areas can be set up in a WPP (Estradivari et al. 2022). Currently, Indonesia is shifting the management of WPPs from an ecosystem approach to a fisheries management approach. A fisheries management approach "strives to balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic, and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries (FAO 2003). Shifting to an integrated approach would ensure long-term sustainability of fisheries and the ecosystem services they provide (Muawanah et. al. 2018).

Table 5.4 | **Indonesia's WPPs and MPAs, 2021**

WPP	Location	WPP Area (ha)	MPA Area (ha)	Percentage of the Area's MPAs Located in a WPP	Number of MPAs
D571	Malacca Strait and Andaman Sea	14,009,132	87,708	0.6	6
572	Western Indian Ocean, Sumatra, and the Sunda Strait	93,605,689	1,137,606	1.2	27
573	Southern Java Indian Ocean to south Nusa Tenggara, Sawu Sea, and West Timor Sea	94,306,541	4,106,749	4.4	23
711	Karimata Strait, Natuna Sea, and South China Sea	65,821,917	4,735,066	7.1	18
712	Java Sea	43,432,056	428,773	1.0	15
713	Makassar Strait, Bone Bay, Flores Sea, and Bali Sea	47,719,293	2,300,100	4.8	30
714	Tolo Bay and Banda Sea	65,843,418	4,178,942	6.4	22
715	Tomini Bay, Maluku Sea, Halmahera Sea, Seram Sea, and Berau Bay	47,569,557	3,673,369	7.7	22
716	Sulawesi Sea and northern Halmahera Island	52,628,860	728,999	1.4	22
717	Cendrawasih Bay and the Pacific Ocean	63,556,631	1,715,734	2.7	4
718	Aru Sea, Arafura Sea, and eastern part of Timor Sea	47,275,657	114,000	0.2	1
	Total	**635,768,751**	**23,145,681**	**3.6**	**188**

Source: KKP 2021b
Note: WPP: Fisheries Management Area (Wilayah Pengelolaan Perikanan); MPA: Marine Protected Area. Due to rounding, the sum of the cells in each column may not tally with the figure in the "Total" row.

Figure 5.1 | **Percentage of MPAs per WPP in Indonesia, 2021**



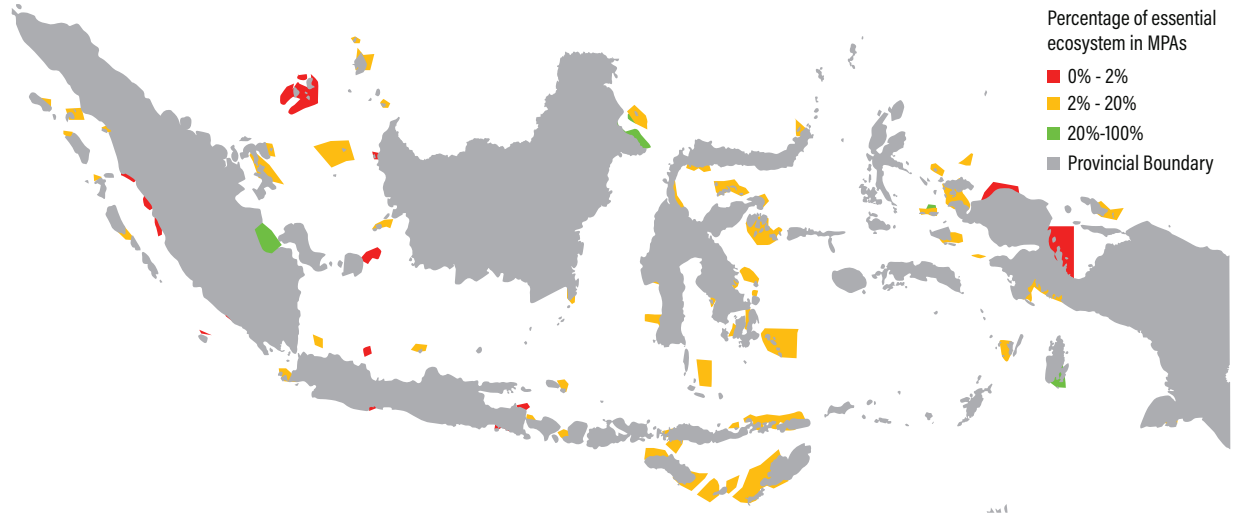
Source: KKP 2021b

Importance of MPAs in Protecting Essential Ecosystems

Indonesia's MPAs play an important role in protecting essential ecosystems. Studies suggest that 20–30 percent of every essential ecosystem should be protected in an MPA (Bohnsack et al. 2000; Airame et al. 2003; Fernandes et al. 2005; Green et al. 2007; McLeod et al. 2009). Significantly less than 20 percent of Indonesia's marine protected areas (MPAs) are covered by essential ecosystems, such as mangrove forests, seagrass beds, and coral reefs (Figure 5.2).

An analysis by the World Resources Institute Indonesia (WRI Indonesia) shows that 84 percent of mangroves, 55 percent of seagrass, and 57 percent of coral reefs in Indonesia are not inside a protected area (Table 5.5) (see Annex C for an explanation of the calculation). This finding suggests that there is significant opportunity to incorporate the conservation of essential coastal ecosystems—especially those that remain intact—in planning for MPAs or forest conservation areas (for mangroves).

Figure 5.2 | **MPAs in Indonesia Covered by Essential Ecosystems, 2019**



Source: WRI Indonesia analysis, based on geospatial analysis and data from the IUCN (2019), the KLHK (2018) and LIPI (2018b).

Table 5.5 | **Essential Ecosystem Contained within Marine Protected Areas in Indonesia, 2019**

Essential Ecosystem	Total Ecosystem Area in Indonesia (million ha)	Contained within MPA		Outside MPA
		Area (millions ha)	Percentage of Total	Percentage of Total
Mangrove[a]	2.79	0.15	15	84
Seagrass	0.29	0.13	45	55
Coral Reef	2.52	1.07	43	57

Source: Data on MPAs comes from the IUCN's World Database Protected Area (IUCN 2019). Data on terrestrial protected areas (protected forest areas and conservation forests) come from the 2018 KLHK Land Cover Map (KLHK 2018). WRI Indonesia's analysis was based on the World Geodetic System (WGS) 1984 Pseudo Mercator (EPSG: 3857). Data of seagrass and coral reef cover is from LIPI (2018b).
Note: [a] Data on mangroves are best available data.

Protection of Indonesia's Essential Ecosystems

Indonesia's coastal zones are rich in tropical coastal ecosystems, including mangroves, coral reefs, and seagrass beds, which are home to living communities of varied species (Hutomo and Moosa 2004). The coastal ecosystems also provide a wide range of services that contribute to environmental, economic, and human wellbeing.

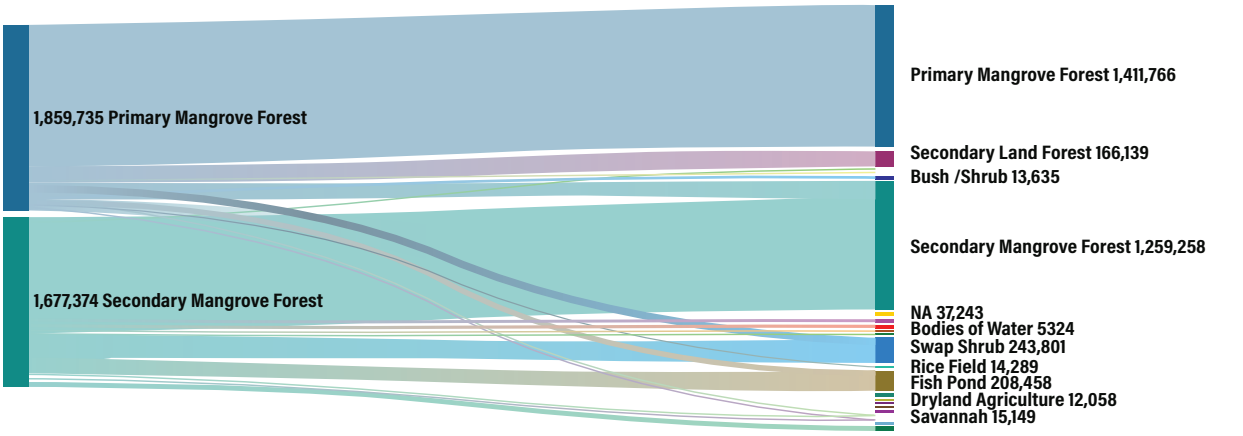
Indonesia's mangrove areas are among the largest in the world and the country holds 18 percent of global mangroves. Mangrove forests protect the coast; serve as carbon sinks; provide ideal spawning grounds for fish, shrimp, and crabs; serve as habitats for many species in marine and forest food webs; and protect both saltwater and freshwater ecosystems, among other benefits. The support they provide to fish nurseries equates to 265 kg of fish per ha per year (Jänes et al. 2020).

Indonesia's seagrass area covers more than 295,000 ha, making it the largest in Southeast Asia. These seagrass beds moderate the impact of waves and storms, reducing the vulnerability of coastal regions. Indonesia is also home to more than 65 percent of the world's coral species. Its coral area represents 18 percent of the world's coral reefs (ADB 2014).

Mangroves

Mangrove forests are one of the world's most important coastal ecosystems. They are important physically as coastal buffers, and ecologically, socially, and economically. Damage to or loss of mangroves leaves coastal areas vulnerable. In 2021, the government updated the National Mangrove Map (Peta Mangrove Nasional). This update suggests a significant 52,835 ha increase in mangrove cover to 3.364 million ha from 3.31 million ha. Total mangrove was 3.31 million ha in 2013–19, with the largest areas on the islands of Papua (1,497,724 ha), Kalimantan (735,887 ha), and Sumatra (666,439

Figure 5.3 | **Changes in Mangrove Cover in Indonesia (in Ha), 1990–2018**



Source : WRI analysis, based on KLHK 2018.
Note: Blue: Primary mangrove forest. Green: Secondary mangrove forest.

ha), according to data from a KLHK presentation in Jakarta in 2020. Efforts that the government has carried out include the establishment of the Peat and Mangrove Restoration Agency.

Before the 1960s, anthropogenic pressure on mangrove forests in Indonesia was relatively low, as these ecosystems were used only to improve local economies. In the early 1960s, pressure on mangrove forests increased dramatically as land was converted into fishponds, shrimp aquaculture, settlements, agricultural land, plantations, and industrial zones, and used for other large-scale projects.

Primary mangrove forests—wetland coastal forests, in other areas of low elevation, and in tidal, high-risk locations—have not suffered from human intervention, according to the Indonesian National Standardization Agency. It is the area covered by secondary mangrove forests in Indonesia that has been declining for decades as a result of large-scale commercial mangrove exploitation (for production of logs, charcoal, and chipboard) and conversion to rice fields, fishponds, shrimp aquaculture, dryland agriculture, settlements, agricultural land, plantations, industrial zones, and other large-scale projects (Figure 5.3). The development of brackish water shrimp also poses a significant threat to mangrove ecosystems (Ilman et al. 2016).

Spatial analysis reveals that the three largest mangrove areas—Papua–Maluku, Kalimantan, and Sumatra—experienced degradation between 2000 and 2018, driven by conversion to ponds and secondary dryland forests. Ilman et al. (2016) show that the degradation of mangrove forests in Indonesia was widespread between 1975 and 2000, when fishpond and planting activities replaced the mangrove forests. Their findings are consistent with those of Spalding et al. (1997), who identified aquaculture, especially shrimp ponds, as the main source of mangrove reduction in Indonesia. Between 1984 and 2003, the degradation of mangrove forests in Indonesia increased, partly as a result of several shrimp pond intensification programs enshrined in government regulations, which in fact resulted in extensification, such as Agriculture Ministerial Decree No. 05/1984 regarding the Shrimp Pond Intensification Program (Ilman et al. 2016).

Indonesia's mangrove forests have enormous blue carbon potential, meaning reducing global carbon emission by keeping carbon stored in protected mangrove**.** The National Strategy Target for Mangrove Management prepared by the Coordinating Ministry for Economic Affairs states that Indonesia's potential for reducing greenhouse gas emissions from mangrove conservation and restoration could reach 59 million t of carbon dioxide equivalent (CO_2e) by 2045. According to the National Medium-Term Development Plan 2020–2024, mangrove conservation could reach 50,000 ha by 2024. The government has issued a regulation on the carbon market as part of a continued effort to support Indonesia's climate commitments; this is Perpres No. 98/2021 on economic value of carbon, which can also be an instrument to incentivize the protection of mangrove from conversion that would result in emitted carbon below and above ground.

Coral Reefs

Millions of people in the world depend on coral reef ecosystems and benefit from the services they provide. It is estimated that Indonesia has approximately 75,000 km² of coral reefs—or 12–15 percent of the world's total (Lubis et al. 2016). Indonesia's coral reefs are among the most biologically rich in the world. More than 590 species of coral have been identified in Indonesian waters (Veron 1995; Veron et al. 2009). Indonesia is also home to more than 65 percent of the world's coral species (ADB 2014).

The condition of coral reefs is determined by several factors, including the proportion of the reef surface covered by hard coral or hermatypic corals, coral biodiversity, benthic structure complexity, other biota diversity, and abundance (KKP 2020g). However, the percentage of hard coral cover is commonly used alone as an indicator of reef condition because it describes the abundance of a critical ecosystem engineer. In this report, the condition of coral reefs is divided into four categories according to the definitions given by Environment and Forestry Ministerial Decree (Kepmen-LH) No. 4/2001 4/2001 (Table 5.6).

Table 5.6 | **Coral Reef Condition Based on Hard Coral Cover**

Hard coral cover	Condition
Hard coral cover ≤ 25 percent	Poor
25% < Hard coral cover ≤ 50%	Moderate
50% < Hard coral cover ≤ 75%	Good
Hard coral cover > 75%	Excellent

Source: Kepmen-LH No. 4/2001

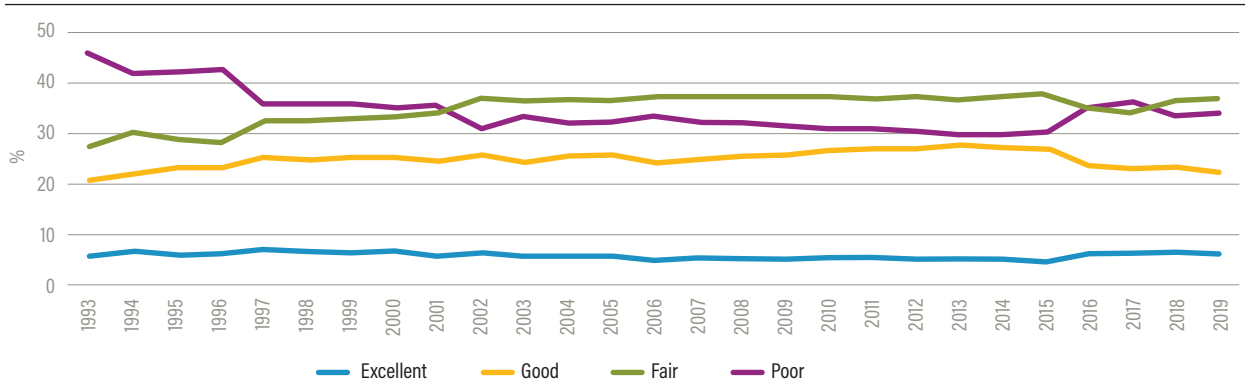
Over the period 1993–2019, Indonesia 's hard coral cover was in poor and moderate (more than 30 percent of reefs) condition (Figure 5.4). The quality of reefs with poor hard coral cover declined over the period. In the early 1990s, around 45 percent had poor hard coral cover, dropping to 35 percent in 2015. While the good and moderate hard coral reefs tend to improve over time, they slightly dropped from 2015 to 2016. Indonesia has experienced several widespread coral bleaching events in the last four decades (particularly severe in 1982, 1997, 2010, and 2016), and in some areas, this seems to have caused hard coral decline.

A report from the Indonesian Institute of Sciences (LIPI) (2020a) shows the spatial distribution of hard coral cover across Indonesia. Based on LIPI data for 2014-18, Indonesia's hard coral cover ranged from 5–77 percent per reef, with an average of 29 percent. The distribution of each hard coral condition was equally spread all around Indonesia. Average hard coral cover in the different regions of Indonesia was 23.1–74.2 percent in western Indonesia, 46.3–77.5 percent in central Indonesia, and 51.4–82.0 percent in eastern Indonesia. The poor hard coral cover in western Indonesia is in the north of Nias and Mentawai islands, while the good coral cover is mostly in Riau Islands. A study by Siringoringo et al. (2019) found that Mentawai and Padang Pariaman have less diverse corals on their west coasts. In the central part of Indonesia, the lower percentage of hard coral cover was found in Lombok (including Gili Islands), East Nusa Tenggara, and around Wakatobi and Maros waters, where the cover was 3–25 percent. The low cover in Gili Islands (Gili Trawangan, Gili Meno, Gili Air) may have been caused by tourist activity and damage during snorkeling and diving (Trisna et al. 2018). In Wakatobi, the hard coral cover ranged from 28–60 percent (Yulius et al. 2015). Lastly, in eastern Indonesia, the hard coral cover percentage of reefs in Ternate's waters ranged from 11–82 percent. According to LIPI (2017), the hard coral cover or live coral in East Nusa Tenggara is classified as moderate. In this province, the percentage of live coral is relatively equal to the percentage of dead coral. This means that the reefs still have space to grow and the condition of the reef can improve.

Most coral reefs are facing unprecedented global and local threats and are unable to provide the critical services on which so many local communities rely. Some threats are very visible and occur on the reefs. Warmer atmospheric temperatures and rising carbon dioxide levels in the ocean are primarily associated with increased ocean temperature and changing ocean chemistry, which has become the most significant global threat to coral reef ecosystems. Aside from these large-scale global hazards, coral reefs face numerous threats from local sources, most of which are related to human activity. Forest clearing, crop cultivation, intensive livestock farming, and haphazard coastal development have added sediment and nutrients to coastal waters, suffocating corals and contributing to algae overgrowth. Pollution and waste from ships and oil and gas extraction aggravate the situation. Furthermore, unsustainable fishing results in localized extinction of certain fish species, collapses and closures of fisheries, and significant ecological changes (Burke et al. 2011).

Indonesian coral reefs are also affected by inland activities. Deforestation and other land-use changes increases sediment discharge into coral

Figure 5.4 | **Condition of Coral Reefs in Indonesia, 1993–2019**



Source: LIPI 2020
Note: Hard coral cover classification: Excellent: hard coral cover ≥75%; good: 50%–75%; fair: 25%–50%; poor: ≤25%.

reefs ecosystems. Further, the El Niño–Southern Oscillation phenomena in 1997–98 triggered bleaching in Indonesia, in which the west and center-west parts of the country were the most affected (Burke et al. 2002). Disturbance to coral reefs affects not only the quality and quantity of the reefs themselves, but also reduces the abundance of marine biota. The sustainability of coral reef ecosystems can be ensured by establishing marine conservation zones to protect, preserve, and use natural resources in a sustainable way (Winanto and Suparno 2010).

Since 2020, the government has been rehabilitating coral reefs in three provinces, namely, Bali, West Papua, and East Nusa Tenggara, through the Indonesian Coral Reef Garden program. The government is ensuring that the program not only includes the rehabilitation and restoration of the reefs but that it also includes and benefits the local communities, who will manage reefs for education and ecotourism. The program is supported by the Coordinating Ministry for Maritime and Investment Affairs (Kemenkomarves) and aims to strengthen the national economy post-pandemic by boosting the marine sector. The pilot project was carried out in Bali and covers five locations: Nusa Dua, Serangan, Sanur, Pandawa Beach, and Buleleng. Thousands of structures were made and placed at the five locations, following which coral is attached. The program employs 10,171 workers in Bali, has a budget of Rp 111.23 billion and will restore up to 74.3 ha (Maritim 2021). The Coral Reef Rehabilitation and Management Program (COREMAP CTI) was implemented in East Nusa Tenggara (Mongabay 2020g).

Seagrass

Seagrass beds play an important role in the biological and physical functions of the coastal environment (Tangke 2010). Ecologically, they function as feeding, nursery, and spawning grounds for marine biota. Physically, they function as natural barriers to protect coastal areas. Indonesia has one of the largest seagrass ecosystems in the world (Green and Short 2003), and hosts 13 species of seagrass, the greatest number of all countries in the Coral Triangle (Green et al. 2007).

Indonesian seagrass often form extensive mixed or monospecific meadows. Mixed seagrass communities composed of eight or nine species are common in many coastal areas in Indonesia. They are usually found in shallow-water back-reef environments (for example, reef flats, moats) and lagoons (Seagrasswatch n.d.). The area covered by seagrass in Indonesia was 293,464 ha in 2018, according to LIPI. The number slightly increased from 2017 due to additional data from other agencies, including the Geospatial Information Agency (Badan Informasi Geospasial) and TNC (LIPI 2018a).

Most of the seagrass is in eastern Indonesia, with the majority in Maluku (192,821 ha) (Table 5.10). The distribution of seagrass is affected by the sediment substrate, light, salinity, and temperature. In eastern Indonesia, seagrass is found off small and large islands and in open regions (directly facing the vast sea). It is rarely found in gulfs, straits, or lagoons (Supriyadi et al. 2018).

Kepmen-LH No. 200/2004 categorizes seagrass meadows into three groups: fair, where vegetation cover is more than 60 percent; moderate, where vegetation cover is 30–59 percent; and poor, where vegetation cover is less than 29 percent. As of 2017, most seagrass meadows in Indonesia are classified as moderate, with vegetation coverage up to 42 percent (Figure 5.9).

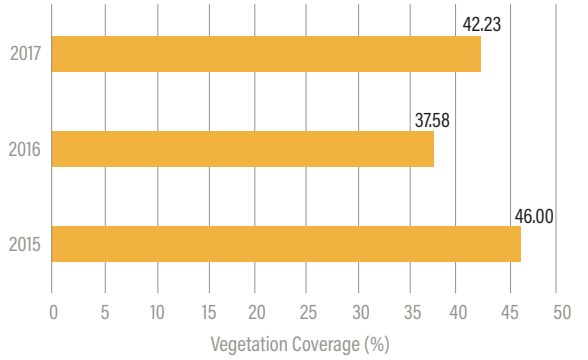
Table 5.7 | **Seagrass Area in Indonesia, 2017**

Province	Seagrass Area (ha)
Bali–Nusa Tenggara	22,356.10
Java	486.35
Kalimantan	10,083.58
Maluku	103,447.52
Papua	105,599.33
Sulawesi	45,347.11
Sumatra	3,963.92
Total	**291,283.92**

Source: WRI Indonesia analysis, based on data by LIPI (2018b).
Note: The 0.01 ha discrepancy in the total is due to rounding.

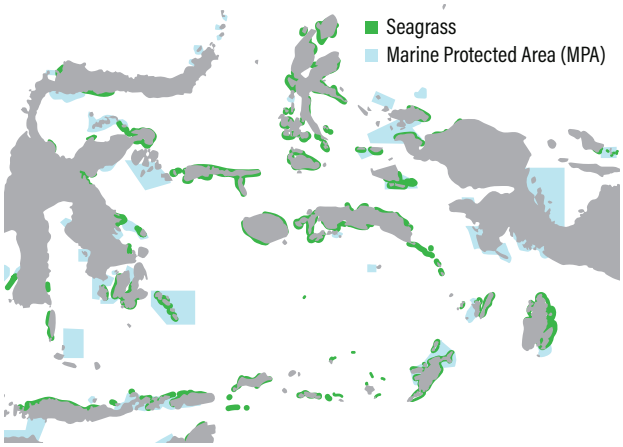
Seagrasses capture carbon dioxide through photosynthesis and incorporate it within their biomass, both above and below the seafloor (Ramesh et al. 2018). They capture carbon up to 35 times faster than tropical rainforests. Even though seagrass covers only 0.2 percent of the

Figure 5.5 | **Seagrass Cover Across Indonesia, 2015–17**



Source: LIPI 2018b

Figure 5.6 | **Seagrass in Eastern Indonesia**



Source : WRI Indonesia analysis, based on data by LIPI (2018b).

seafloor, it absorbs 10 percent of the ocean's carbon each year, making it an incredible tool in the fight against climate change. Research from LIPI shows that seagrass beds can absorb an average of 6.59 t of carbon per ha per year, equivalent to 24.1 t of carbon dioxide (LIPI 2018).

Despite its importance, seagrass has decreased in recent decades because of natural and anthropogenic activities. Natural factors include strong waves and currents, storms, earthquakes, and tsunamis. Human activities include beach reclamation, dredging and sand mining, and pollution. A study of Pari Island (in Indonesia's Thousand Islands) found seagrass cover had decreased by 25 percent from 1999 to 2004, presumably as a result of massive development on the island (Hernawan et al. 2017). The rapid loss of seagrass beds disrupts the links between seagrass beds and other habitats (Heck et al. 2008), with long-term impacts on both. There is thus an urgent need to increase the resilience of this important ecosystem to enhance it and ensure its survival, and to update the assessment of seagrass ecosystems.

According to LIPI, 32 percent (94,025 ha) of Indonesia's seagrass areas were contained within an MPA in 2017, with 33,734 ha in a KKP3K and 25,992 ha in KKPDs or provincial-based MPAs. KKP3K areas have been established to protect, conserve, and use the coastal areas and small islands and their ecosystems, including seagrass. The KKPD of Southeast Maluku and KKP3K of Raja Ampat have larger areas of seagrass (18,157 ha and 10,090 ha) than other MPAs (Figure 5.10). The KKPD of Southeast Maluku and Raja Ampat are rich in conservation value due to their location at the center of the world's marine biodiversity triangle, the Coral Triangle. The large variety of coral reefs, mangroves, and seagrass supports diverse biota. Raja Ampat was designated as an MPA because of its richness in natural resources, including mangroves, coral reefs, and seagrass. Seagrass populations are found almost everywhere in the Raja Ampat islands, with beds scattered around Waigeo, Kofiau, Batanta, Ayau, and Gam. Seagrass beds in Raja Ampat regency are generally homogeneous, associated with coral reefs and found mostly in tidal areas and shallow coral reef flats. The seagrass condition in KKP3K Raja Ampat is categorized as moderate, with a vegetation coverage of about 40–53 percent.

In eastern Indonesia, local communities and the government have tried to protect seagrass by imposing a fishing moratorium called *sasi*. Some MPAs—on Wakatobi Island and in Buton Regency, for example—have increased their seagrass cover. Currently, Indonesia has included 32 percent of its seagrass areas within the MPAs, where Papua has the largest percentage of protection, reaching 90 percent, while Sulawesi, Kalimantan, and Java have about 26 percent, 17 percent, 1 percent, respectively. The government, therefore, has an excellent opportunity to meet the national goal of establishing 32.5 million MPAs by 2030 by maximizing the protection of each coastal marine habitat and prioritizing expansion in regions with less-than-optimal protection.

THE WAY FORWARD

The health of Indonesia's ocean ecosystem and consequently its ocean economy is under threat. This report provides evidence of the important economic and social benefits provided by Indonesia's ocean activities, but also highlights the ongoing challenges in the management of marine resources and fisheries. These challenges could ultimately undermine Indonesia's ability to secure a robust sustainable ocean economy that contributes to the well-being of people globally.

As part of its post-COVID recovery, Indonesia should invest in measures that take a long-term view of marine resources and fisheries management and do not harm ecosystem health. Implementation of a sustainable ocean economy in Indonesia will add economic value to the marine sector and will contribute to longer-term ecosystem protection. The small contribution of the fisheries sector to GDP (2.8 percent in 2021) (BPS 2021) and of the maritime sector (6 percent in 2016) (Bappenas 2019b), which consists of maritime transport, industry, services, tourism, and fisheries (Bappenas 2019b), implies that there is considerable room to win sustainable economic benefits from the marine and fisheries sector. This is in line with the government's ambition to increase the combined contribution of maritime and fisheries by 12.5 percent by 2045 (Bappenas 2019b).

Furthermore, Indonesia recently stated its ambition to reach net-zero emissions by 2060, including through contributions from the marine sector. In 2020, the headline commitment of the High-Level Panel for a Sustainable Ocean Economy for transformation to a sustainable ocean economy provided a pathway for realizing multiple objectives.

Toward a sustainable ocean economy means:

- **Encouraging and ensuring meaningful participation in decision-making.** Broader political dynamics taking place in Indonesia influence decision-making related to the management of the country's marine resources and fisheries. The current trend is to limit community engagement in decision-making. For example, the Omnibus Law, designed to accelerate investment, has limited, if not weakened, government support for the environment and marginalized groups (such as coastal communities and small-scale fishers who are dependent on marine and coastal ecosystems and natural resources), as well as communities in need of protection, such as ship crew who are often victims of forced labor.
- **Improving the collection and analysis of fisheries data, which is needed for effective and sustainable management, and ensuring laws and policies are enforced.** Indonesia is the second-largest wild-capture and aquaculture producer in the world, but its fisheries sector has not fulfilled its economic potential. It contributed about $18 million to the country's GDP in 2019, and growth in wild-capture fisheries has slowed in recent years. This may be due to overfishing, deficiencies in data, and the inability to manage stock sustainably. Fisheries data is of poor quality and there are no accurate catch or effort statistics, as capture fisheries in Indonesia use multiple types of gear enabling them to catch multiple species, population dynamics of target species are mostly unknown, as are vessel catches (Wibisono et al. 2022). The current stock assessment system is not designed to provide production statistics for scientific assessment of stock. This means catch data is produced from inadequate stock data and it is unclear whether catches are sustainable.
- **Implementing inclusion and gender equity strategies to support and enable long-term recovery and resilience of fishing communities.** The fisheries sector is dominated by small-scale fishers in both capture fisheries and aquaculture, and it is, therefore, vital to support local sellers and other supply chain actors to retain the value of fisheries, and improve market access (Pomeroy et al. 2020). Understanding local food systems and livelihood practices are ways to ensure resilience. Furthermore, the role of women in the sector has often been overlooked. Women represent 42 percent of the sector's workforce and 74 percent of the workforce in the aquaculture subsector. The lack of recognition of the key role women play in the fisheries sector has prevented more women from participating and accessing economic opportunities.
- **Assessing and implementing actions to ensure the long-term sustainable performance of shrimp aquaculture so that it does not compromise the health of the ocean.** Shrimp aquaculture is one of the most significant economic growth areas in Indonesia's aquaculture sector, and shrimp dominates exports. However, brackish water shrimp aquaculture is one of the largest drivers of mangrove conversion in Indonesia. This highlights the importance of a sustainable and certified shrimp farm

model that is compatible with environmental concerns, including mangrove deforestation. It is also necessary to disincentivize mangrove conversion by internalizing the opportunity costs of mangrove carbon potential.

- **Providing policy and research support to the seaweed industry.** The seaweed industry has significant growth potential, as it can be easily accessed, requiring low levels of capital investment, and therefore can provide livelihood for middle- to low-income communities (Neish 2013). However, it also generates low economic returns, and this is why the industry has not been given enough policy attention. The productivity of seaweed has been declining, especially when compared to the productivity of brackish water shrimp aquaculture, which increased by about 15 percent in 2017 (KKP 2019g).
- **Increasing protection for Indonesia's intact essential marine ecosystems—mangrove forests, seagrass beds, and coral reefs—and restoration for those that are degraded, given the contribution they make to Indonesia's economy and the well-being of its people**. Less than 20 percent of Indonesia's MPAs are covered by essential ecosystems.
- **Advancing an ecosystem approach to fisheries management for the long-term sustainability of fisheries and ecosystem services.** Indonesia's WPPs, or fisheries management areas, are currently moving toward an integrated design—as spatial management areas that include productive waters for fisheries and aquaculture, seabed mining, marine tourism, shipping lanes, and ports,, multiple-use MPAs (including no-take reserves), and MPA networks, instead of only as wild-capture fisheries WPPs. Managed areas such as these will serve multiple objectives, both fisheries management and conservation. An ecosystem approach to fisheries management provides a holistic and integrated framework for managing resources and addresses some key elements of fisheries management missing from MPAs, such as the assignment of fishing rights and overall management of an area beyond the boundary of an MPA. As of March 2020, Indonesia has been able to secure 23.4 million ha within MPAs. MPA management is currently suboptimal and a large number of parks and protected areas are still not well managed. This is due to a lack of funding, training, and capacity of staff, and the complexity of governance and regulations. The ecosystem approach to fisheries management ensures the MPA performance is linked to the objective of a productive WPP.
- **Encouraging other effective area-based conservation measures alongside government-led MPAs.** There exist other effective area-based conservation measures that are led by the government, customary and local communities, or the private sector, with diverse management objectives, including habitat protection, traditional or customary management, fisheries, tourism, among other aims. (Estradivari et al. 2022). These include areas managed by communities through their customary norms, such as *awig-awig*, *sasi*, and *area ulayat*. Integrating MPAs with area-based conservation measures can reduce the risk of creating more "paper parks," marine parks that exist in theory but do not provide the conservation that they are supposed to. Such networks of protected areas can strengthen cooperation between regions, reduce conflicts of interest, accommodate diverse customs and local wisdom, and provide opportunities for knowledge sharing.

Annex A

Regulations Revised by the Ministry of Marine Affairs and Fisheries

Table A.1 | **Regulations Reviewed by the Ministry of Marine Affairs and Fisheries (KKP) as of December 2020**

Regulation	Issue	Revision
Government Regulation		
Regulation No. 75/1975	Types and rates of nontax state revenue charged by the KKP	None
Ministerial Regulation		
Regulation No. 2/2009	Process for determining marine conservation areas	None
Regulation No. 17/2008	Conservation areas in coastal areas and small islands	None
Regulation No. 30/2010	Management of and zoning plans for marine conservation areas	None
Regulation No. 30/2012	Wild-capture business within Indonesian waters as revised in Regulation No. 57/2014	Regulation No. 58/ PERMEN-KP/2020
Regulation No. 12/2012	Wild-capture business on the high seas	None
Regulation No. 23/2013	Registration and marking of fishing boats, as revised in Regulation No. 5/2019	Regulation No. 58/ PERMEN-KP/2020
Regulation No. 21/2014	Banning of export of seeds of *arwana* and *botia* fish, and live *botia* fish from Indonesia	Regulation No. 18/ PERMEN-KP/2020
Regulation No. 26/2014	Regulating of fish aggregating devices	None
Regulation No. 41/2014	Importing of dangerous fish to Indonesia	Regulation No. 19/ PERMEN-KP/2020
Regulation No. 56/2014	Moratorium on catching wild fish in Indonesian waters	None
Regulation No. 57/2014	Authorization of *andon*, a fishing practice carried out by fishers using fishing boats with less than 30 GT in fishing areas, according to fishing permit (*surat izin penangkapan ikan andon* [SIPI Andon])	None
Regulation No. 58/2014	Disciplining civil servants in implementing moratorium on transshipment and use of foreign captain and crews	Regulation No. 11/2020
Regulation No. 56/2016	Banning of capturing of lobster, crab, and blue swimming crab	None
Regulation No. 4/2015	Prohibition of fishing activities in breeding and spawning grounds in WPP 714	None
Regulation No. 35/2015	System for and certification of human rights in fishery sector	None
Regulation No. 36/2015	Criteria and grouping of small-, medium-, and large-scale fishers in fishery product collection	None
Regulation No. 38/2015	Procedures for collecting nontax revenue from the fishery sector	None
Regulation No. 15/2016	Boats that carry live fish, as revised in Regulation No. 32/2016, in effort to prevent and eradicate IUU fishing	No. 15/PERMEN-KP/2020
Regulation No. 71/2016	Fishing routes and placement of fishing gear in WPPs in Indonesia	Regulation No. 59/ PERMEN-KP/2020
Regulation No. 2/2017	Requirement and mechanism for certification of human rights in fishery	None
Regulation No. 8/2019	Licensing system for foreign investment and recommendation for use of islands with areas of less than 100 km^2	Regulation No. 53/ PERMEN-KP/2020
Regulation No. 24/2019	Permission process for use of coastal and small islands	Regulation No. 54/ PERMEN-KP/2020
Regulation No. 25/2019	Reclamation of coastal areas and small islands	None

Table A.1 | **Regulations Reviewed by the Ministry of Marine Affairs and Fisheries (KKP) as of December 2020 (continued)**

Regulation	Issue	Revision
Ministerial Decree of the Department of Marine Affairs and Fisheries		
Decree No. 86/2016	Productivity of fishing boats, as follow-up to evaluating utilization of fish resources in each WPP	None
Decree of the Director General of Wild-Capture Fisheries		
Decree No. 8/2019	Procedure for physically checking fishing boats and gear	None
Decree No. 51/2019	Guidelines for due diligence process for licensing fishing businesses	None
Decree No. 62/2019	Approval of boat procurement	None
Letter No. 1234/DJPT/PT.410.D4/31/12/2015	Restrictions on size of fishing boats in the *surat izin usaha perdagangan*, a license granted by the government to employers to carry out business activities, and/or *surat izin penangkapan ikan* and *surat izin kapal pengangkut ikan*, licenses every fishing vessel with an Indonesian flag must carry in order to fish in Indonesian waters	None

Annex B

Stock Status in Indonesia

Table B.1 | **Stock Status in Indonesia by WPP, 2017**

Fisheries Management Area (WPP)	Catch and Utilization Rate	Small Pelagic	Large Pelagic	Demersal Fish	Reef Fish	Penaeid Shrimp	Lobster	Crab	Blue Swimming Crab	Squid	Total
Malacca Strait and Andaman Sea (WPP 571)	Potential catch (t)	99,865	64,444	145,495	20,030	59,455	673	12,829	13,614	9,038	425,444
	Total allowable catch (t)	79,892	51,555	116,396	16,024	47,564	538	10,263	10,891	7,230	
	Utilization rate	0.83	0.52	0.33	0.34	1.59	1.30	1.00	0.93	0.62	
Indian Ocean: West of Sumatra and the Sunda Strait (WPP 572)	Potential catch (t)	527,029	276,755	362,005	40,570	8,023	1,483	9,543	989	14,579	1,240,975
	Total allowable catch (t)	421,623	221,404	289,604	32,456	6,418	1,186	7,634	791	11,663	
	Utilization rate	0.50	0.95	0.57	0.33	1.53	0.93	0.18	0.49	0.39	
Indian Ocean: South of Java (WPP 573)	Potential catch (t)	630,521	586,128	7,902	22,045	7,340	970	526	3,913	8,195	1,267,540
	Total allowable catch (t)	504,417	468,902	6,322	17,636	5,872	776	421	3,130	6,556	
	Utilization rate	1.50	1.06	0.39	1.00	1.70	0.61	0.28	0.98	1.11	
South China Sea: Karimata Strait, Natuna Sea (WPP 711)	Potential catch (t)	330,284	185,855	131,070	20,625	62,342	1,421	2,318	9,711	23,499	767,126
	Total allowable catch (t)	264,227	148,684	104,856	16,500	49,874	1,137	1,854	7,769	18,799	
	Utilization rate	1.41	0.93	0.61	1.53	0.53	0.54	1.09	1.18	1.84	
Java Sea (WPP 712)	Potential catch (t)	364,663	72,812	657,525	29,951	57,965	989	7,664	23,508	126,554	1,341,632
	Total allowable catch (t)	291,730	58,250	526,020	23,961	46,372	791	6,131	18,806	101,243	
	Utilization rate	0.38	0.63	0.83	1.22	1.11	1.36	0.7	0.65	2.02	
Makassar Strait, Bone Bay, Flores Sea, and Bali Sea (WPP 713)	Potential catch (t)	208,414	645,058	252,869	19,856	30,404	927	4,347	5,463	10,519	1,177,857
	Total allowable catch (t)	166,731	516,046	202,295	15,885	24,323	742	3,478	4,370	8,415	
	Utilization rate	1.23	1.13	0.96	1.27	0.52	1.40	0.83	0.73	1.19	

Table B.1 | **Stock Status in Indonesia by WPP, 2017 (continued)**

Fisheries Management Area (WPP)	Catch and Utilization Rate	Small Pelagic	Large Pelagic	Demersal Fish	Reef Fish	Penaeid Shrimp	Lobster	Crab	Blue Swimming Crab	Squid	Total
Banda Sea and Tolo Bay (WPP 714)	Potential catch (t)	165,944	304,293	98,010	145,530	3,180	724	1,145	1,669	68,444	788,939
	Total allowable catch (t)	132,755	243,434	78,408	116,424	2,544	579	916	1,335	54,755	
	Utilization rate	0.44	0.78	0.58	0.76	0.39	1.73	1.55	0.77	1.00	
Tomini Bay, Maluku Sea, Halmahera Sea, Seram Sea, and Berau Bay (WPP 715)	Potential catch (t)	555,982	31,659	325,080	310,866	6,436	846	891	495	10,272	1,242,526
	Total allowable catch (t)	444,786	25,327	260,064	248,693	5,149	677	713	396	8,218	
	Utilization rate	0.88	0.97	0.22	0.34	0.78	1.32	1.19	0.98	1.86	
Sulawesi Sea and North of Halmahera (WPP 716)	Potential catch (t)	332,635	181,491	36,142	34,440	7,945	894	2,196	294	1,103	597,139
	Total allowable catch (t)	266,108	145,193	28,914	27,552	6,356	715	1,757	235	882	
	Utilization rate	0.48	0.63	0.45	1.45	0.5	0.75	0.38	0.50	1.42	
Pacific Ocean, Cendrawasih Gulf (WPP 717)	Potential catch (t)	829,188	65,935	131,675	15,016	9,150	1,044	489	58	2,140	1,054,695
	Total allowable catch (t)	663,350	52,748	105,340	12,013	7,320	835	391	46	1,712	
	Utilization rate	0.7	1.00	0.39	0.91	0.46	1.04	0.87	1.21	1.09	
Arafura Sea, East Timor Sea, Aru Sea (WPP 718)	Potential catch (t)	836,973	818,870	876,722	29,485	62,842	1,187	1,498	775	9,212	2,637,565
	Total allowable catch (t)	669,578	655,096	701,378	23,588	50,274	950	1,198	620	7,370	
	Utilization rate	0.51	0.99	0.67	1.07	0.86	0.97	0.85	0.77	1.28	
Total allowable catch (t)											12,541,438

Overexploited Fully exploited Moderately exploited

Source: PERMEN-KP 2014

Table B.2 | **Stock Status in Indonesia by WPP, 2022**

Fisheries Management Area (WPP)	Catch and Utilization Rate	Small Pelagic	Large Pelagic	Demersal Fish	Reef Fish	Penaeid Shrimp	Lobster	Crab	Blue Swimming Crab	Squid	Total
Strait Malacca and Andaman Sea (WPP 571)	Potential catch t)	157,151	75,095	230,000	34,518	47,610	477	10,870	2,906	32,511	591,138
	Total allowable catch (t)	141,436	37,548	115,000	31,066	23,805	239	5,435	2,034	22,578	
	Utilization rate	0.3	1.4	1.2	0.4	1.6	1.4	1.5	0.8	0.7	
Indian Ocean: West of Sumatra and the Sunda Strait (WPP 572)	Potential catch (t)	479,503	438,877	204,500	33,429	35,560	2,722	6,787	2,533	26,039	1,194,985
	Total allowable catch (t)	431,553	219,439	143,150	16,715	17,780	1,361	6,108	1,267	23,436	
	Utilization rate	0.2	1.1	0.9	1.1	1.5	1.6	0.1	1.6	0.4	
Indian Ocean: South of Java (WPP 573)	Potential catch (t)	624,366	354,215	299,600	23,725	8,514	1,563	585	3,750	22,124	1,338,442
	Total allowable catch (t)	437,056	247,950	269,640	11,863	4,257	782	410	2,625	11,062	
	Utilization rate	0.6	0.9	0.2	2.5	1.2	2.0	0.7	0.6	1.1	
South China Sea: Karimata Strait, Natuna Sea (WPP 711)	Potential catch (t)	536,917	163,744	289,300	197,580	71,810	1,467	3,388	9,804	32,369	1,315,379
	Total allowable catch (t)	375,842	114,621	202,510	138,306	50,267	734	1,694	4,902	22,658	
	Utilization rate	0.8	0.7	0.8	0.5	0.6	1.1	1.9	1.2	0.5	
Java Sea (WPP 712)	Potential catch (t)	275,486	145,863	358,832	71,526	83,820	1,481	7,360	23,508	66,609	950,665
	Total allowable catch (t)	247,937	72,932	179,416	57,221	58,674	1,037	5,152	16,456	46,626	
	Utilization rate	0.4	1.3	1.1	0.8	0.8	0.5	0.9	0.7	0.9	
Makassar Strait, Bone Bay, Flores Sea, and Bali Sea (WPP 713)	Potential catch (t)	284,302	162,506	374,500	167,403	56,835	765	6,213	9,253	11,370	1,073,147
	Total allowable catch (t)	142,151	113,754	337,050	83,702	39,785	383	4,349	4,627	5,685	
	Utilization rate	1.0	0.8	0.3	1.3	0.8	1.3	0.7	1.5	1.2	
Banda Sea and Tolo Bay (WPP 714)	Potential catch (t)	222,881	370,653	292,000	121,326	6,472	724	1,758	4,705	13,460	1,033,979
	Total allowable catch (t)	156,017	259,457	204,400	60,663	3,236	362	879	3,294	9,422	
	Utilization rate	0.7	0.7	0.7	1.1	1.0	1.7	1.4	0.6	0.5	

Table B.2 | **Stock Status in Indonesia by WPP, 2022 (continued)**

Tomini Bay, Maluku Sea, Halmahera Sea, Seram Sea, and Berau Bay (WPP 715)	Potential catch (t)	443,944	74,908	80,226	105,336	5,295	1,217	336	157	3,874	715,293
	Total allowable catch (t)	310,761	52,436	56,158	52,668	3,707	609	235	110	2,712	
	Utilization rate	0.7	0.7	0.7	1.3	0.7	1.2	0.7	0.7	0.9	
Sulawesi Sea and North of Halmahera (WPP 716)	Potential catch (t)	197,012	176,832	215,900	24,909	6,705	1,494	1,470	265	1,908	626,495
	Total allowable catch (t)	137,908	123,468	194,310	12,455	4,694	1,046	1,029	186	1,336	
	Utilization rate	0.7	0.5	0.4	1.6	0.5	0.9	0.8	0.5	0.9	
Pacific Ocean, Cendrawasih Gulf (WPP 717)	Potential catch (t)	135,140	189,718	69,210	19,814	7,423	736	545	291	1,826	424,703
	Total allowable catch (t)	121,626	132,803	48,447	9,907	6,681	515	491	146	1,278	
	Utilization rate	0.3	0.9	0.5	1.2	0.5	0.8	0.2	1.5	0.6	
Arafura Sea, East Timor Sea, Aru Sea (WPP 718)	Potential catch (t)	836,973	818,870	876,722	29,485	62,842	1,187	1,498	775	9,212	2,637,564
	Total allowable catch (t)	669,579	655,096	701,378	23,588	50,274	950	1,198	620	7,370	
	Utilization rate	0.51	0.99	0.67	1.07	0.86	0.97	0.85	0.77	1.28	
Total allowable catch (t)											11,901,790

Overexploited Fully exploited Moderately exploited

Source: KEPMEN-KP 19 of 2022

Annex C

Essential Ecosystems and Conservation Areas

The areas of mangroves, seagrass beds, and coral reefs were calculated using the WGS Projection System 1984 Pseudo Mercator (Table C.1).[8]

Analysis overlaid data on MPAs with data on mangroves, seagrass, and coral reefs (Figure C.1).

The results show that only 0.14 million ha of mangroves, 0.13 ha of seagrass, and 1.08 million ha of coral reefs are located within an MPA. The MPA of Kramat Island, Bedil Island, and Temudong Island has the largest area of mangroves, seagrass, and coral reef relative to its size (76 percent) (Figure C.2). In contrast, just 0.1 percent of the KKPD (provincial MPA) of Sea Turtle in Pengumbahan Sukabumi consists of mangrove, seagrass, and coral reefs. Table C.2 shows the share of Indonesia's essential ecosystem that is located in MPAs.

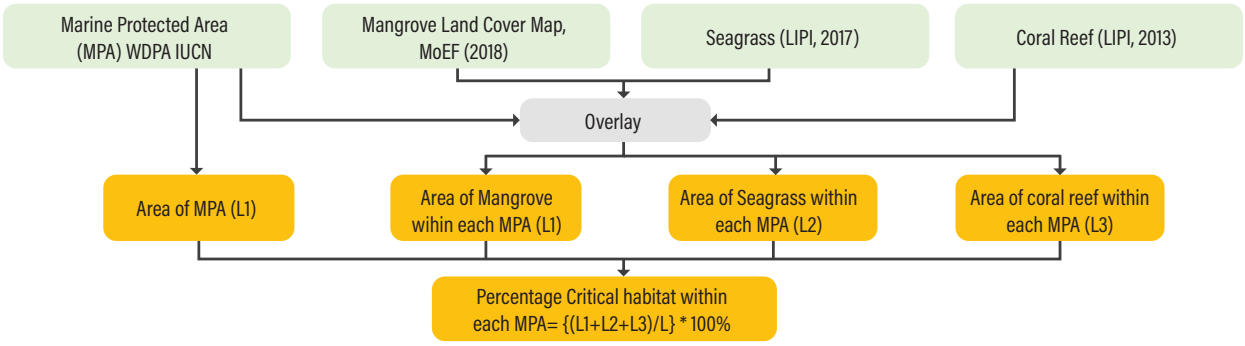
Not all MPAs were designated as such to protect mangroves, seagrass, or coral reefs. For example, Sawu in East Nusa Tenggara was designated

Table C.1 | **Size of MPAs and Essential Ecosystems in Indonesia**

Type of Area	Size (ha)	Year	Source
Marine protected area (MPA)	21.4 million	2019 (December)	World Database Protected Area, International Union for Conservation of Nature (IUCN 2019)
Mangrove forest	2.79 million	2018	KLHK 2018
Seagrass bed	290,000	2013	LIPI 2018b
Coral reef	2.52 million	2017	LIPI 2018b

Source: LIPI 2018b; KLHK 2018; IUCN 2019

Figure C.1 | **Essential Ecosystems in Indonesia's MPAs**



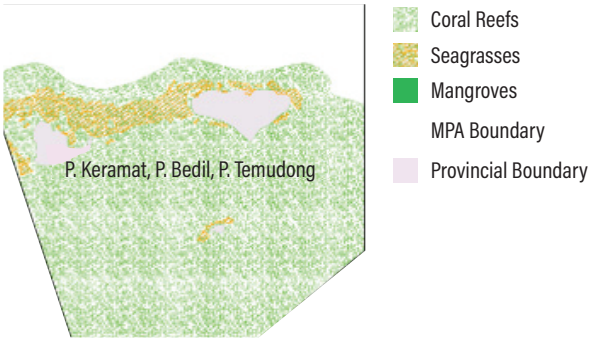
Source: LIPI 2013; LIPI 2017; KLHK 2018; IUCN 2019

Table C.2 | **Percentage of Essential Ecosystem in MPAs in Indonesia**

Percentage of Essential Ecosystem in Marine Protected Area	Number of MPAs
0–2	79
3–20	86
21–100	20

Source: LIPI 2018b; KLHK 2018; IUCN 2019

Figure C.2 | **Coral Reefs and Seagrass in Keramat, Bedil, and Temudong Islands**



Source: LIPI 2020b

an MPA to protect a whale habitat, and a large portion of the area is in deep water. Other explanations for the small share of ecosystems in MPAs include the following:

- The mangrove, seagrass, and coral reef belt is narrow compared with the MPA area. MPAs in Indonesia are very large and include the deep sea.
- Many coral reef ecosystems, especially in central and eastern Indonesia, have slopes up to 90 percent (wall). In the imagery, the types of wall coral reefs are visible only as thin lines, although they are vertically wide. The area calculated may thus be smaller than it should be.
- The spatial data on essential ecosystems produced by KLHK and LIPI may have blank spots, especially for seagrass beds. On Kei Kecil Island, for example, there is a large area of seagrass that does not appear in the LIPI database.

ACRONYMS LIST

Bappenas	Badan Perencanaan Pembangunan Nasional (National Development Planning Agency)
EKKP3K	Evaluasi Efektivitas Pengelolaan Kawasan Konservasi Perairan, Pesisir dan Pulau-pulau Kecil (Evaluating the Management Effectiveness of Aquatic, Coasts and Small Islands Conservation Areas)
FAO	Food and Agriculture Organization
GT	gross tons
ha	hectare
IUCN	International Union for Conservation of Nature
IUU	illegal, unreported, and unregulated
Kemenkomarves	Kementerian Koordinator Kemaritiman dan Investasi (Coordinating Ministry of Maritime Affairs and Investment)
KKP	Kementerian Kelautan dan Perikanan (Ministry of Marine Affairs and Fisheries)
KKPD	Kawasan Konservasi Perairan Daerah (District-Based Marine Protected Area)
KKPN	Kawasan Konservasi Perairan Nasional (National Marine Protected Area)
KLHK	Kementerian Lingkungan Hidup dan Kehutanan (Ministry of Environment and Forestry)
LIPI	Lembaga Ilmu Pengetahuan Indonesia (Indonesian Institute of Sciences)
METT	Management Effectiveness Tracking Tool
MPA	Marine Protected Area
NGO	nongovernmental organzation
NTN	Nilai Tukar Nelayan (fishers' purchasing power index)
PERPRES	Peraturan Presiden (Presidential Regulation)
WGS	World Geodetic System
WPP	Wilayah Pengelolaan Perikanan (Fisheries Management Area)
WRI	World Resources Institute

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ENDNOTES

1. Kemenkomarves was previously the Coordinating Ministry of Maritime Affairs. When the additional remit of investment was awarded, the ministry became responsible for coordinating seven implementing ministries: the Ministry of Energy and Mineral Resources (Kementerian Energi dan Sumberdaya Mineral Republik Indonesia), the Ministry of Public Works and Housing (Kementerian Pekerjaan Umum dan Perumahan Rakyat Republik Indonesia), the Ministry of Transportation (Kementerian Perhubungan), the Ministry of the Environment and Forestry (Kementerian Lingkungan Hidup dan Kehutanan [KLHK]), the Ministry of Marine Affairs and Fisheries (Kementerian Kelautan dan Perikanan [KKP]), the Ministry of Tourism and Creative Economy (Kementerian Pariwisata dan Ekonomi Kreatif [Kemenparekraf]), and the Investment Coordinating Board (Badan Koordinasi Penanaman Modal).

2. The NTN is a measure indicating the exchangeability of fish catches with goods or services required for production needs and/or household consumption.

3. Indonesia previously committed to a 26 percent reduction with no specified deadline.

4. A national strategic project is a project and/or program implemented by national government, regional government, and/or a business entity that is strategic to increasing growth and development as part of the effort to create jobs and improve the welfare of Indonesia's citizens.

5. Fishers include people who fish full-time, part-time (the majority), or seasonally.

6. The companies are PT. Asuransi Bringin Sejahtera Artamakmur, PT. Asuransi Asei Indonesia, PT. Asuransi Binagriya Upakara, PT. Asuransi Central Asia (ACA), PT. Sompo Insurance Indonesia, PT. Asuransi Jasa Tania (Jastan), and PT. Asuransi Bhakti Bhayangkara.

7. The Aichi biodiversity targets were established by the Convention on Biological Diversity in an effort to protect and conserve the biodiversity that underpins global food security, health and clean water. See CBD Secretariat (2020).

8. Using the Mollweide projection system, the IUCN (2019) estimated the area of Indonesia's MPAs at 20.1 million ha. Using the WGS projection 1948 Pseudo Mercator, WRI Indonesia estimated the area at 21.4 million ha. According to the user manual for the World Database Protected Area, IUCN version 1.5, MPA areas can be partially in coastal areas or completely in marine areas. The analysis by WRI Indonesia, therefore, used data from the World Database Protected Area in coastal and marine area. Mangrove data was obtained from the Land Cover Map of KLHK for primary and secondary mangrove forest in 2018.

ABOUT WRI

World Resources Institute Indonesia is an independent research organization that turns big ideas into action at the nexus of environment, economic opportunity, and human well-being.

Our Challenge
Natural resources are at the foundation of economic opportunity and human well-being. But today, we are depleting Earth's resources at rates that are not sustainable, endangering economies and people's lives. People depend on clean water, fertile land, healthy forests, and a stable climate. Livable cities and clean energy are essential for a sustainable planet. We must address these urgent, global challenges this decade.

Our Vision
We envision an equitable and prosperous planet driven by the wise management of natural resources. We aspire to create a world where the actions of government, business, and communities combine to eliminate poverty and sustain the natural environment for all people.

Our Approach
COUNT IT
We start with data. We conduct independent research and draw on the latest technology to develop new insights and recommendations. Our rigorous analysis identifies risks, unveils opportunities, and informs smart strategies. We focus our efforts on influential and emerging economies where the future of sustainability will be determined.

CHANGE IT
We use our research to influence government policies, business strategies, and civil society action. We test projects with communities, companies, and government agencies to build a strong evidence base. Then, we work with partners to deliver change on the ground that alleviates poverty and strengthens society. We hold ourselves accountable to ensure our outcomes will be bold and enduring.

SCALE IT
We don't think small. Once tested, we work with partners to adopt and expand our efforts regionally and globally. We engage with decision-makers to carry out our ideas and elevate our impact. We measure success through government and business actions that improve people's lives and sustain a healthy environment.

PHOTO CREDITS

Cover photo WRI Papua ; pg. 2, Rizky Januar Haryanto, pg. vi, 5, 42 Sakinah Ummu Haniy; pg. 18, 41, Gusti Ayu Ismayanti; pg. 25 Wahyuddin; Nessa Auliya, table of contents, pg. iv, 7, 8, 12, 23, 26, 39, 48, 62 Poriaman Sitanggang.

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