FEASIBILITY OF MPA 30% BY 2045 VISION

POLICY REPORT SUBMITTED TO THE MINISTRY OF MARINE AFFAIRS AND FISHERIES

By:
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Jakarta
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Foreword

By Meizani Irmadhiany

As Indonesia strives to meet its commitment to conserve 30% of its marine territory by 2045, we present this financial feasibility report, which uses a cost-benefit analysis approach to evaluate the expansion of Marine Protected Areas (MPAs) across the nation. Our efforts align with global and national priorities in safeguarding marine biodiversity, ensuring the sustainable use of marine resources, and promoting resilience to climate change. This analysis aims to provide evidence-based insights into the long-term socio-economic and environmental benefits of MPA expansion, while also addressing the financial investments and challenges involved.

This report underscores the importance of integrating ecological health with sustainable economic growth. By carefully weighing the projected costs against the potential benefits, we aim to offer a comprehensive framework to guide decision-makers, policymakers, and stakeholders in ensuring that marine conservation delivers lasting value for communities, ecosystems, and industries dependent on healthy oceans. The study area

Our work would not have been possible without the invaluable support and collaboration of several key partners. We would like to extend our deepest gratitude to **Blue Nature Alliance (BNA)** for their generous funding support, which has been instrumental in enabling this comprehensive analysis. Our heartfelt thanks also go to the Ministry of Marine Affairs and Fisheries for their collaboration and commitment to the protection of Indonesia's marine resources. Finally, we would like to acknowledge the crucial contributions of the Rekam Nusantara Foundation and IPB University, whose collaborative efforts have enriched this endeavour with a wide-ranging science-based insights.

Together, these partnerships have allowed us to advance our shared vision of preserving Indonesia's unique marine ecosystems while ensuring sustainable benefits for future generations.

Meizani Irmadhiany
Executive Chair of Konservasi Indonesia

Foreword

By Irfan Yulianto

Indonesia is home to some of the planet's most biologically diverse marine ecosystems, and marine protected areas (MPAs) are an integral part of our strategy to protect these vital ecosystems while enhancing the resilience of coastal communities. However, achieving effective MPA management requires strong policies and a clear understanding of both the costs and benefits involved. This report provides an assessment of the economic feasibility and appropriateness of the proposed design, policy, or decision of the MPA and its network to achieve the MPA 30x45 Vision.

This policy report not only highlights the tangible economic benefits of MPAs—ranging from enhanced fish stocks to tourism opportunities—but also presents an analysis of the potential costs associated with their establishment and management. The analysis demonstrates that the long-term benefits far outweigh the initial investments, making a compelling case for scaling up MPA efforts in Indonesia.

We would like to extend our deepest appreciation to everyone who has contributed to this report. The development of this report has been a truly collaborative effort, made possible by the shared dedication of the Ministry of Marine Affairs and Fisheries, Konservasi Indonesia, and IPB University with us at the Rekam Nusantara Foundation. We are deeply grateful for the partnership we have fostered, as it has enabled us to draw on diverse areas of expertise, engage in rich discussions, and produce a robust analysis that reflects multiple perspectives and insights. This collective commitment has helped shape a document that not only quantifies the economic benefits of MPAs but also addresses the long-term value of preserving marine ecosystems for future generations.

Irfan Yulianto

Chairperson of Rekam Nusantara Foundation

Foreword

By Dr. Firdaus Agung

We are honored to present this report on the Cost-Benefit Analysis (CBA) for Achieving Indonesian Marine Protected Area (MPA) Vision 30x45. This document underscores the ministry's commitment to preserving Indonesia's marine biodiversity while ensuring that the economic, social, and ecological benefits are fully realized and distributed equitably among our coastal communities.

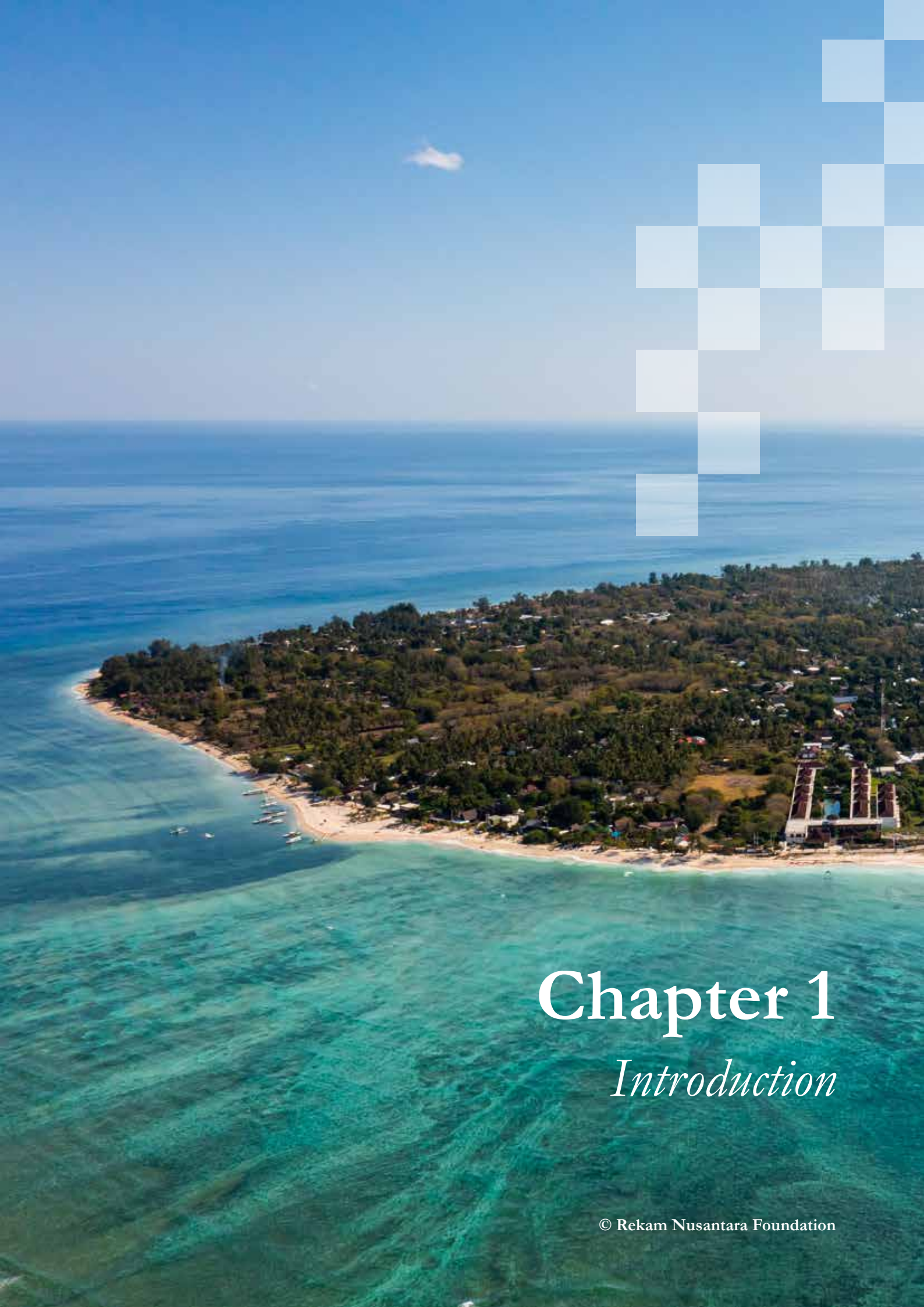
As a signatory of the UN Convention on Biological Diversity, Indonesia is committed to implementing the recommendations adopted by other member countries. In line with Target 3 of the Kunming-Montreal Global Biodiversity Framework, Indonesia has pledged to protect, conserve, and sustainably use 30% of its coastal and marine waters. The establishment and proper management of MPAs have become essential tools for preserving biodiversity, sustaining fisheries, and supporting the livelihoods of coastal communities.

This report explores the economic and ecological benefits of expanding MPA coverage network and underscores their role in achieving the MPA Vision 30x45 and the feasibility of establishing and effectively managing large-scale MPAs beyond 12 nautical miles. It highlights the economic feasibility and appropriateness of the proposed design, policy, or decision of the MPA and its network to achieve the MPA Vision 30x45, by comparing the costs and benefits associated with its development. The analysis employed a business-as-usual (BAU) scenario on a combination of the presence of a core zone (10%) and full (100%) protection levels from the MPA expansion cost perspective, and different percentage of fisheries benefits (20% and 30%) and fisheries rent capture (20% and 30%). Interestingly, the study found out that the 100% full protection scenario may not necessarily outperform MPAs with a 10% core zone as long as fisheries benefits are guaranteed.

We are deeply grateful for the invaluable collaboration between the Ministry of Marine Affairs and Fisheries, Konservasi Indonesia, Rekam Nusantara Foundation, and IPB University, that has made the development of this report possible. The collective expertise and shared commitment of our partners have enriched this analysis, and their contributions have been instrumental in ensuring that this report offers a well-rounded, impactful perspective on the future of Marine Protected Areas in Indonesia. It is our hope that this report will serve as a tool for policymakers, MPA managers, and community leaders in shaping the future of Indonesia's marine resources. We believe that with continued collaboration, we can make MPAs a cornerstone of sustainable development for generations to come.

Dr. Firdaus Agung
Director of Aquatic Biota and Ecosystem Conservation
Directorate General of Maritime and Marine Space Management
Ministry of Marine Affairs and Fisheries

Feasibility of MPA 30% by 2045 Vision



Chapter 1

Introduction

Chapter 1
Introduction

1.1. Background and Rationale

Indonesia, as a ratifying country of the United Nations Convention on Biological Diversity[1], is obliged to adopt and follow up on the recommendations of the Convention. As such, Indonesia is required to implement the Kunming-Montreal Global Biodiversity Framework, which has four goals to be achieved by 2050, and 23 targets to be achieved by 2030[2]. In the context of marine biodiversity conservation, Indonesia must follow up on Target 3 which recommends protecting 30% of the world's oceans by 2030 through a network of Marine Protected Areas (MPAs) and Other Effective Area-based Conservation Measures (OECMs), popularly known as Target 30x30[3]. To that end, Indonesia has the so-called Marine Protected Area (MPA) 30x45 Vision, whereby 30% of Indonesia's coastal and marine waters have to be protected, conserved, and sustainably utilized by 2045. The MPAs can be managed separately or through a network.

Biodiversity conservation has been recognized as an important element to support economic development. However, this recognition has yet to be fully realized. This can be seen from the fact that there is still an opinion that conservation activities, such as through the establishment and management of MPAs, are cost-centered and not benefit-generated. The costs may exceed the benefits, making it economically unfeasible.

The financial and economic viability of the MPA 30x45 Vision should be proven. The sources of potential benefits should be determined and counted. Similarly, all the costs incurred should be considered. The benefits of an MPA can be derived from fisheries, aquaculture, marine tourism, and other goods and services whose existence depends on the MPA. The costs of an MPA cover not only those of the establishment but also management. All the MPA benefits and costs are estimated in this study. An ordinary and extended cost-benefit analysis (CBA) can be used in determining the MPA 30x45 Vision.

CBA plays an important role in MPA design by providing a systematic framework for assessing the economic and ecological implications of the area establishment, management, and utilization. Studies have shown that CBA can help improve MPA management effectiveness and strengthen subsequent management strategies. In particular, CBA offers:

- **Efficient allocation of resources for MPA establishment and management.** By comparing the costs of implementing and maintaining an MPA with the benefits it generates, decision-makers can determine the optimal size, location, and management strategy for an area. This ensures that a certain amount of resources are used effectively to achieve conservation goals. Likewise, the analysis guided the resource allocation among existing and even competing activities within MPA.

[1] Through Law 5/1994 concerning Ratification of United Nations Convention of Biological Diversity.
[2] Kunming-Montreal Global Biodiversity Framework (https://www.cbd.int/gbf/).
[3] Target 3 of Kunming-Montreal Global Biodiversity Framework at https://www.cbd.int/gbf/targets/.

- **Valuation of ecosystem services.** MPA provides an array of ecosystem services such as fish stock enhancement, carbon sequestration, tourism, and shoreline protection. CBA enables decision-makers to assess the economic value of these services, both in monetary terms and in terms of improving the overall well-being of local communities. By quantifying these benefits, CBA helps justify investments in MPA and facilitates well-informed decision-making by considering the potential benefits of different management options.
- **Justification for stakeholders and policymakers.** CBA provides a transparent, evidence-based rationale for MPA establishment. By demonstrating the costs and benefits of MPA establishment, CBA helps build support and consensus among stakeholders, including policymakers, resource managers, local communities, and industry representatives. This enables a comprehensive evaluation of impacts on different sectors, such as fisheries, tourism, and energy, and ensures that the interests of multiple stakeholders are considered and balanced.
- **Long-term sustainability.** MPAs are long-term conservation measures that aim to maintain and restore the health of marine ecosystems. CBA helps assess the long-term economic viability and sustainability of MPA by considering the costs of implementation, enforcement, and monitoring, as well as the benefits gained over time. By incorporating discount rates and considering future impacts, CBA helps determine the optimal duration, adaptive management strategies, and investments needed to ensure the long-term success of MPA.
- **Prioritization and selection.** CBA makes it possible to compare and prioritize different MPA design options. This aids trade-offs between conservation objectives, economic activities, and community needs. For example, CBA can assess the costs and benefits of establishing a relatively small and highly protected MPA, compared to a large MPA with multiple uses/functions. This facilitates decision-makers to identify the most effective strategies to maximize conservation benefits and minimize economic costs and potential conflicts among different stakeholders.
- **Funding strategy.** CBA helps management authorities (governments) and stakeholders understand financing gaps as a basis for developing MPA management financing strategies. CBA is also a bridge to build understanding among policymakers on the potential socio-economic benefits of investing in MPA management.

In summary, CBA enables ecological and economic estimates of the costs and benefits of expanding MPA coverage nationwide. On the cost side, the assessment includes the costs of establishing and operating MPAs, including Large Scale Marine Protected Areas (LSMPAs), and opportunity costs of fisheries. On the benefits side, CBA assesses marine ecosystems (i.e. coral reefs, seagrass, and mangrove) and associated ecosystem services (i.e. provisioning, regulating, habitat, and cultural services). The process of CBA could inform and motivate all stakeholders involved to support the MPA 30x45 Vision.

1.2. Study Objectives

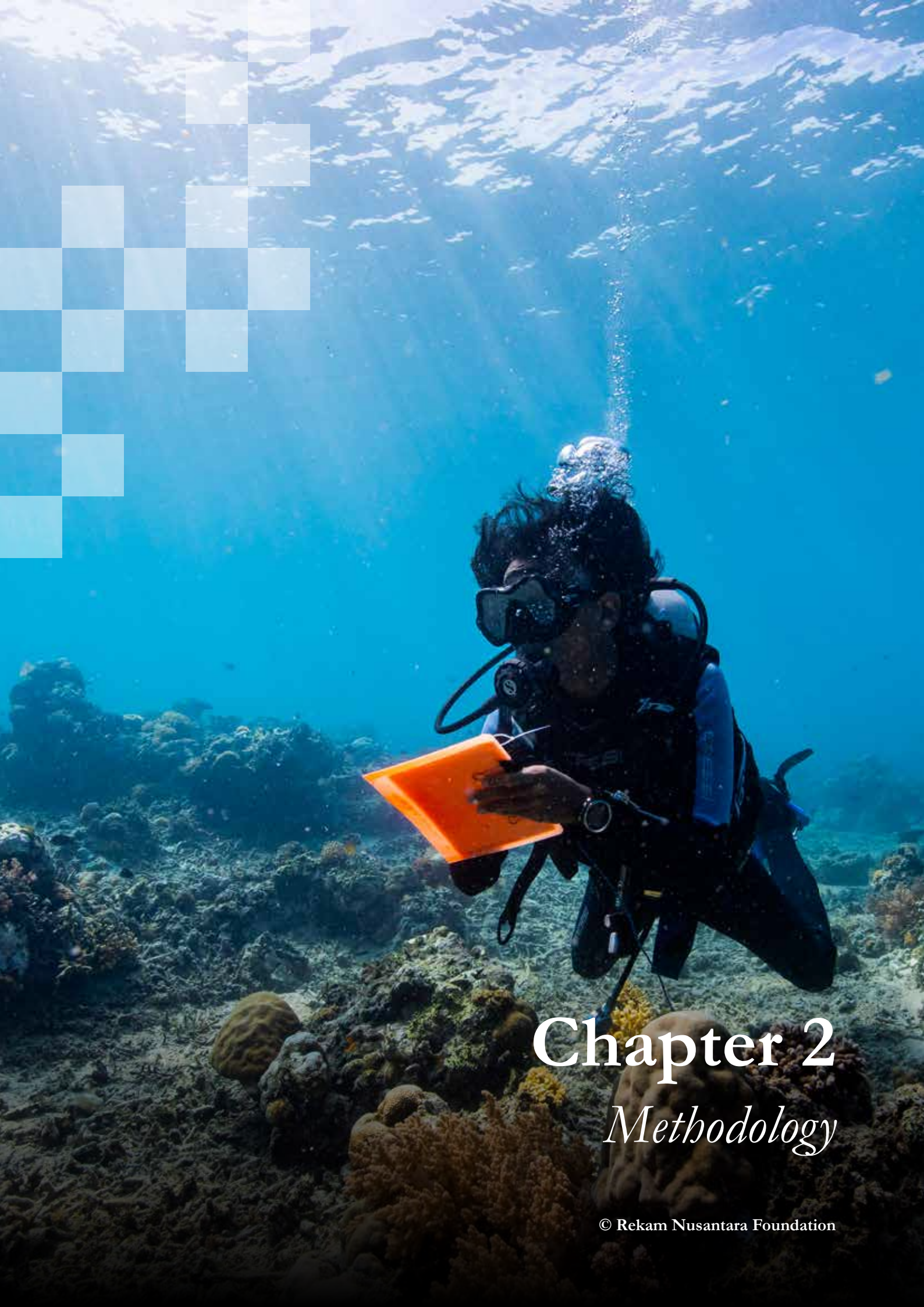
The overarching objective of this activity is to assess the economic feasibility and appropriateness of the proposed design, policy, or decision of the MPA and its network to achieve the MPA 30x45 Vision. The specific objectives are to:

(1) Identify and estimate cost and benefit components.

(2) Understand the financial feasibility of the vision at the national and sub-national (WPP) levels, and large-scale MPA (LSMPA)

(3) Provide scientific-based recommendations to the government on the MPA development pathway.

(4) To derive and propose a CBA methodology that can be adapted to study the financial and economic viability of an individual MPA.



Chapter 2

Methodology

Chapter 2
Methodology

The CBA was through the following steps: (1) determining the cost and benefit components; (2) calculating projected areas for MPA in each WPP; (3) calculating the total costs and benefits of each component, and (4) analyzing the costs and benefits for all MPAs in Indonesia. A special analysis was held for the LSMPA on the Western coast of Sumatra.

2.1. Determining Cost and Benefit Components

The cost and benefit components used in this study are shown in Figure 1. The cost components divided into the establishment and management costs are presented in Table 1.

Although having been identified, not all costs and benefits can be directly estimated because of data unavailability. Hence, economic valuation approaches are used to determine these costs and benefits.

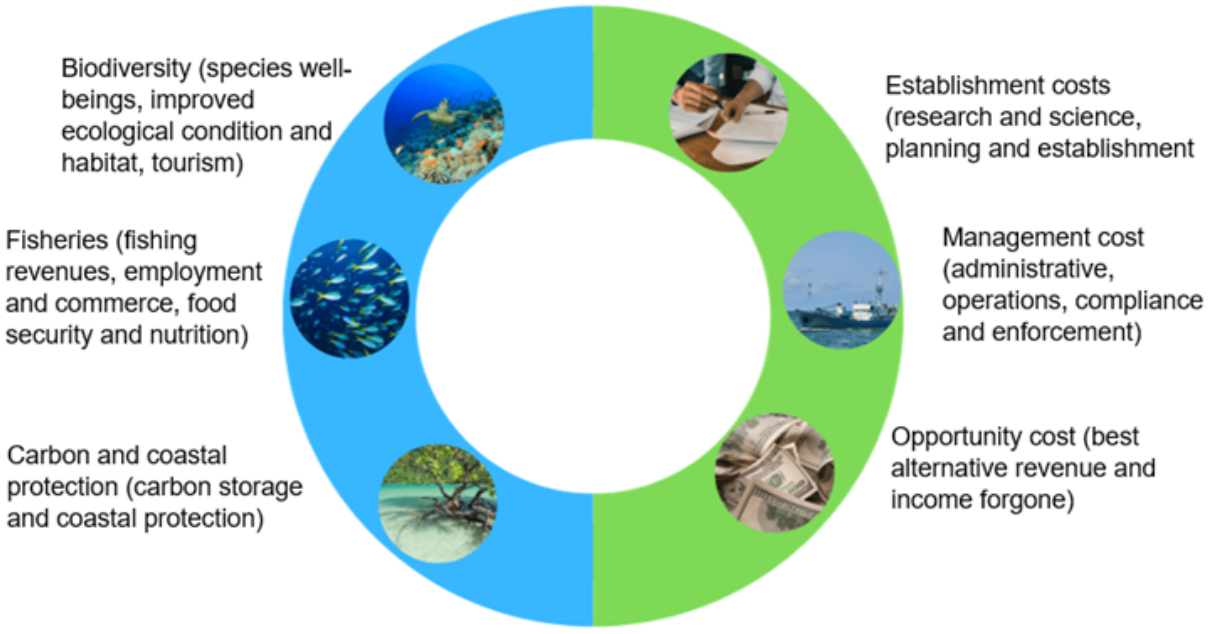


Figure 1. Cost and benefit components

2.1.1. Estimation for Cost Components

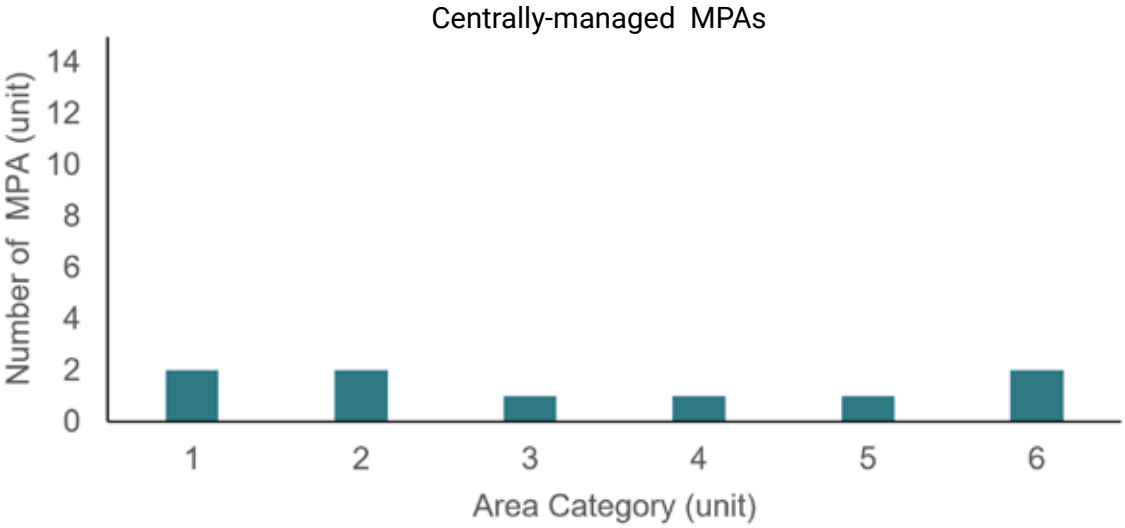
Data from nine centrally-managed MPAs and 96 provincially-managed MPAs for 2017–2023 were used to estimate MPA establishment and management costs. The data were sourced from the Ministry of Marine Affairs and Fisheries (MMAF) and the Wildlife Conservation Society (WCS) Indonesia Program. According to the Marine Affairs and Fisheries Ministerial Regulation 31/2020 on Management of Conservation Area, the establishment and management cost components are 16 and 14, respectively. The data were collated and screened through the following steps before being used in the analysis.

- Screening the data completeness of each MPA. Based on that, 45 MPA data consisting of 9 centrally-managed MPAs and 36 provincially-managed MPAs are used.
- Using the consumer price index (CPI) and social interest rate of 6.82%, all the data were adjusted to Jakarta's price and compounded to the base year of 2023.
- Categorizing 45 MPAs by size into six classes and determining the costs of each class. The six classes are (1) 0-10,000 ha, (2) >10,000 to 50,000 ha, (3) >50,000 to 150,000 ha, (4) >150,000 to 300,000 ha, (5) >300,000 to 600,000 ha, and (6) >600,000 ha. The number of MPAs by category is shown in Figure 2.

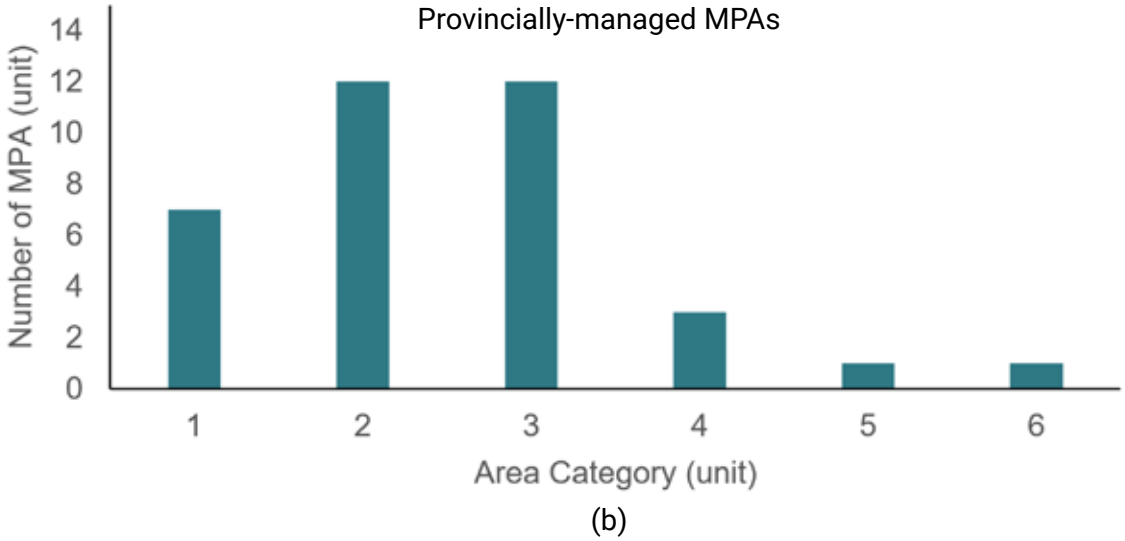
Table 1. MPA establishment and management cost components affected and unaffected by MPA size.

Establishment Costs	Management costs
Affected by MPA Size	
• Identification and inventory; • Procurement of management infrastructure; • Preparation of Management Plan (including utilization technical plans); and • Preparation of zoning plan for MPA designation	• Staff salary; • Biophysical monitoring; • Community empowerment; • MPA surveillance and security (including the use of IoT); • MPA surveillance and security jointly with local communities (POKMASWAS); and Promotion of MPA
Unaffected by MPA Size	
• MPA reservation; • MPA designation by the Minister of MAF; • Formation of MPA management unit; • Procurement of management facilities; • Preparation of Monitoring Plan: Biophysics; • Preparation of Monitoring Plan: Socio-economics; • Preparation of Outreach and Communication Plans; • Preparation of Area Surveillance and Security Plan; • Preparation of Joint Area Surveillance and Security with Local Communities Plan (Community Surveillance Groups/POKMASWAS); • Preparation of Management Costs Budget Plan; • Preparation of Office Operational Plan (staff salary); and • Preparation of office operational plan	• Management unit staff quality improvement; • Outreach & Communication (including dissemination of MPA legal status to stakeholders) • Monitoring of socio-economic aspects associated with the MPA; • Ecosystem rehabilitation; • Licensing services; • Development of cooperation programs (partnerships); • Development of MPA management network; and • MPA management performance reporting (minimum 6 specific activities: capture fisheries, responsible aquaculture, aquatic/marine nature tourism, education & research, management, surveillance).

- Using the average data of each class of MPA to proxy the costs of the unavailable data MPA. The costs of designing a socio-economic monitoring plan, preparation of MPA surveillance and security plan, and preparation of joint MPA & local communities surveillance and security plan were unavailable in all sampled MPAs. Hence, they were proxied by the lowest meeting expenses to prepare the biophysical monitoring plan. Similarly, developing the MPA management network was not available. It then was proxied by the cost of developing cooperation or partnership.
- We used Generalized Linear Modelling (GLM) by RStudio to determine the sunk cost and per-hectare cost of MPA establishment and management 2024-2045. The sunk cost is the minimum cost of establishment and management that is not influenced by the MPA size. We determined the best models for the MPA establishment and management costs based on the Akaike Information Criterion (AIC) and R-square (R2). We predicted the management costs at the national and sub-national (WPP) level for 2024-2045.



(a)



(b)

Figure 2. Number of MPAs per area category at national level (a), and provincial level (b).

2.1.2. Large-scale (Pelagic) MPA Costs

Pelagic or offshore MPA is assumed to occur in WPP 572 and 573 (Figure 3) based on Ecologically Biologically Significant Areas (EBSA) and are shaped by unique environmental and geological factors that enhance both their ecological importance and management complexities. The costs of pelagic MPA are estimated based on the MPA establishment and management costs in these MPAs. The size of the offshore MPAs is used to estimate the total cost required.

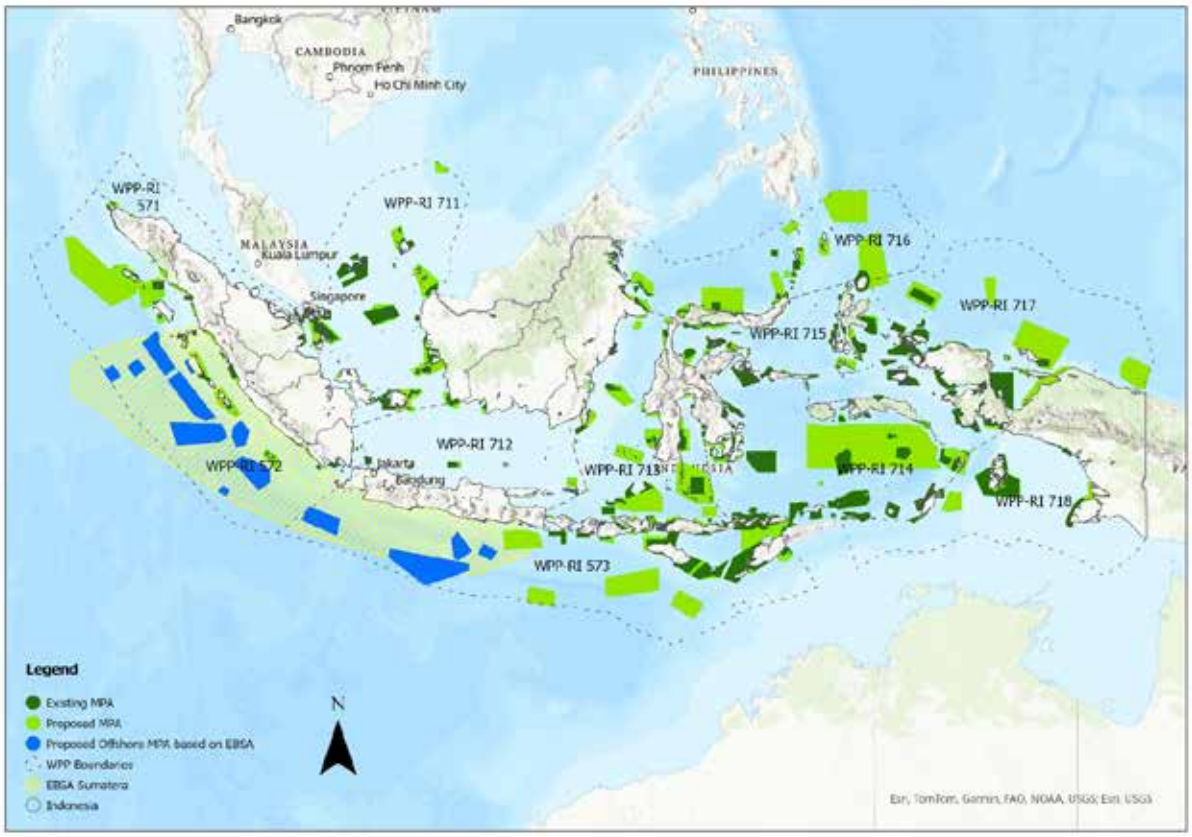


Figure 3. MPA expansion plan with EBSAs

2.1.3. Opportunity Cost

Opportunity cost is assumed to be paid to the fishers who were displaced and left the fisheries due to MPA existence. It was proxied by the No-Take Zone (NTZ) percentage of the Business As Usual (BAU) fisheries value generated from MPA. For instance, if the NTZ is 10%, the estimated opportunity cost is 10% of the fisheries value of the BAU.

2.1.4. Fisheries Benefits

The calculation of MPA benefits used a macro approach at the WPPNRI level using a fish resource accounting and bioeconomic approach. The main elements in the calculation of a physical account are based on the opening stock, changes, and closing stock. Changes

in fish stocks are assumed to be influenced by fishing activities, fish growth, reproduction, and spillover from MPA. A monetary account of the fish resources is estimated by monetizing the physical account. This is essentially a bioeconomic approach, illustrated in Figure 3.

The bioeconomic approach ended with the calculation of the resource rent which is a pure profit after taking into account total fisheries revenue and all fishing costs. The pure profit is the net benefit of the fisheries' resources resulting from fishing activities, The total resource rent from a fisheries in a particular fishing ground is the pure profits generated by all fishing activities, using all fishing gears, and computing all costs. The fisheries resource rent is the value or benefit of fisheries.

Time series data from 1990-2021 that included fish production, fish prices, fishing cost, and fishing efforts (number of fishing fleets and the total number of vessel gross tonnage) were used to estimate the fisheries resource rent. The existence of data over this 30 (thirty) year period makes it possible to identify long-term trends related to fish resources and zfishing businesses in each WPPNRI.

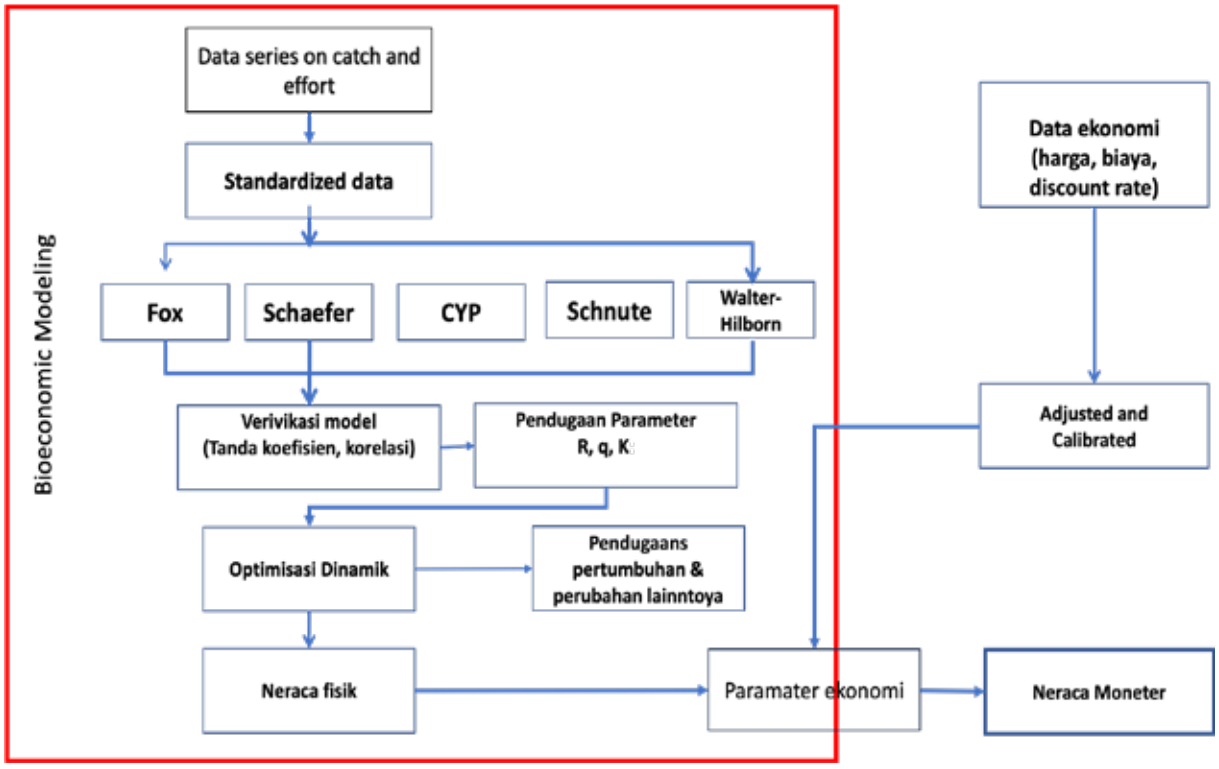


Figure 4. Process calculating MPA benefits to the fisheries sector.

2.1.5. Values of Ecosystem Services

Ecosystems that are included in this analysis are mangroves, seagrass, and coral reefs. These ecosystems provide regulating and habitat services that can be valued economically. The services are carbon sequestration (blue carbon), abrasion protection, wave attenuation, coastal protection, biodiversity, habitat, nursery ground, spawning ground, and food chain provisioning (Table 4).

Mangrove maps were obtained from the Ministry of Environment and Forestry. Seagrass bed maps were obtained from the Geospatial Information Agency, National Research and Innovation Agency (BRIN), Ministry of Fisheries and Maritime Affairs (MMAF), and through the verification process using SPOT 6/7 imagery from BRIN and MMAF. The monetary values of the services of each habitat are given in Table 3. (Fauzi et al., 2023).

Table 3. Value of environmental services of mangroves, seagrass, and coral reefs (Rp/Ha)

BENEFITS	Mangroves	Seagrasses	Coral Reefs
Regulating services			
Carbon sequestration	28.550.545	2.148.556	
Abrasion protection	49.611.157		
Wave attenuation	45.353.946		33.289.997
Coastal protection	54.887.781	51.915.776	18.406.599
Habitat Services			
Biodiversity	16.021.978	38.413.029	6.954.515
Habitat, Nursery and Spawning Ground	1.906.560	24.234.005	3.960.720
Food chain provisioning	13.499.700	13.305.174	

2.1.6. Benefits from Marine Tourism

Two benefits from tourism used in this study were income generated by the tourism business and entry fee or ticket to enter a tourist area or attraction.

The income benefits were estimated based on secondary data from tourism activities in Anambas, Karimunjawa, Gili Matra, Pieh, Bunaken, Waigeo, Raja Ampat, and Morotai. The benefits consisted of tourist spending on local transportation, costs, hotels or homestays, meals, snorkeling, scuba diving, and souvenirs. The average spending in the seven tourist destinations was used to estimate the income from tourism in all WPP.

The benefit of tourism entry fees was estimated based on ticket revenue in Gili Matra, Waigeo, Raja Ampat, Anambas, and Pieh in 2023. The Gili Matra's ticket was a proxy for the ticket revenue in WPP-713, 573, and 712, the Raja Ampat's for WPP 714, 715, 716, 717, and 718, the Anambas' for WPP 711 and 57, the Pie's for WPP 572. All the entry tickets were counted per hectare basis.

2.2. Analysis Scenarios

This analysis was conducted based on seven scenarios of MPA development and fisheries management as shown in Table 4. They are:

- Business As Usual (BAU). The BAU is the base scenario where there is no change in MPA size from the current state (8% of Indonesian waters are protected) by 2030 and 2045. The no-take zone (NTZ) of the MPAs is 10%, and fisheries resource rent is 20%.
- Scenario 1. MPAs are developed to reach 10% by 2030 and 30% by 2045. The fisheries benefits increase by 10% from 2023 to 2030, 20% from 2031 to 2041, and 30% from 2042 to 2045. The fisheries resource rent is 20% and NTZ is 10%.
- Scenario 2. MPAs are developed to reach 10% by 2030 and 30% by 2045. The fisheries benefits increase by 10% from 2023 to 2030, 20% from 2031 to 2041, and 30% from 2042 to 2045. The fisheries resource rent is 30% and NTZ is 10%.

Table 4. Scenarios of MPA Development and Management

Business As Usual (BAU): Scenario-0 MPA 8% by 2030, MPA 8% by 2045, 10% NTZ, 20% FRR		
	10% No-take Zone	**100% No-Take Zone**
20% Fisheries Resource Rent (20% FRR) across all WPPs	**SCENARIO-1** • MPA 10% by 2030 •MPA 30% by 2045 •Benefit increased by 10% from 2023 to 2030, 20% from 2031 to 2041, and 30% from 2042 to 2045.	**SCENARIO-4** • MPA 10% by 2030 •MPA 30% by 2045 •Benefit increased by 10% from 2023 to 2030, 20% from 2031 to 2041, and 30% from 2042 to 2045.
30% Fisheries Resource Rent (30% FRR) across all WPPs	**SCENARIO-2** • MPA 10% by 2030 •MPA 30% by 2045 •Benefit increased by 10% from 2023 to 2030, 20% from 2031 to 2041, and 30% from 2042 to 2045.	**SCENARIO-5** • MPA 10% by 2030 •MPA 30% by 2045 •Benefit increased by 10% from 2023 to 2030, 20% from 2031 to 2041, and 30% from 2042 to 2045.
Different Fisheries Resouce Rent (DFRR). The resource rent is 20% in WPP 571, 711, 712, and 713 and 30% in the other WPPs.	**SCENARIO-3** • MPA 10% by 2030 •MPA 30% by 2045 •Benefit increased by 10% from 2023 to 2030, 20% from 2031 to 2041, and 30% from 2042 to 2045.	**SCENARIO-6** • MPA 10% by 2030 •MPA 30% by 2045 •Benefit increased by 10% from 2023 to 2030, 20% from 2031 to 2041, and 30% from 2042 to 2045.030

- Scenario 3. MPAs are developed to reach 10% by 2030 and 30% by 2045. The fisheries benefits increase by 10% from 2023 to 2030, 20% from 2031 to 2041, and 30% from 2042 to 2045. The fisheries resource rent varies by the WPPs and NTZ is 10%. The resource rent is 20% in WPP 571, 711, 712, and 713 and equals 30% in the other WPPs.
- Scenario 4. MPAs are developed to reach 10% by 2030 and 30% by 2045. The fisheries

benefits increase by 10% from 2023 to 2030, 20% from 2031 to 2041, and 30% from 2042 to 2045. The fisheries resource rent is 20% and NTZ is 100%.

- Scenario 5. MPAs are developed to reach 10% by 2030 and 30% by 2045. The fisheries benefits increase by 10% from 2023 to 2030, 20% from 2031 to 2041, and 30% from 2042 to 2045. The fisheries resource rent is 30% and NTZ is 100%.
- Scenario 6. MPAs are developed to reach 10% by 2030 and 30% by 2045. The fisheries benefits increase by 10% from 2023 to 2030, 20% from 2031 to 2041, and 30% from 2042 to 2045. The fisheries resource rent varies by the WPPs and NTZ is 100%. The resource rent is 20% in WPP 571, 711, 712, and 713 and 30% in the other WPPs.

2.3. Assumptions.

This study was carried out by relying on the following assumptions and adjustments:

- ✓ All the prices were adjusted to Jakarta-based prices using Consumer Price Indexes (CPIs).
- ✓ The discount rate is counted based on the social interest rate of 6.00%
- ✓ The base year is 2023.
- ✓ The time frame for the analysis is 2024-2045.
- ✓ The results of the analysis are the present value of 2024.
- ✓ The cost does not include fisheries resource management costs or the costs of managing the WPPs.
- ✓ The fisheries benefits are the resource rents generated from fishing in the WPPs which is assumed to have been influenced by the MPAs.

2.4. CBA Methods and Indicators

Two financial indicators estimated in the study to provide recommendations on the feasibility of the MPA 30x45 vision at national and sub-national (WPP) levels are (Gittinger, 1972; GGGI, 2014):

1. Net Present Value (NPV) and Benefit Cost Ratio (BCR). The NPV and BCR were estimated based on the MPA direct costs and benefits. The direct costs were those of (1) establishment of new MPAs, (2) expansion of the existing MPAs, and (3) MPA implementation. The direct benefits were those of (1) fisheries within MPA and in the WPP and (2) tourism.
2. The Extended NPV (ENPV) and Extended BCR (EBCR). The ENPV and EBCR were counted by incorporating direct and indirect costs and benefits. The indirect costs were fisheries opportunity costs and the indirect benefits are the values of ecosystem services (Table 3).

Chapter 3

Result

Chapter 3
Results

3.1. Cost and Benefit Structure

The structure of costs and benefits by MPA management scenarios is shown in Table 5. Without an additional MPA or under BAU scenario-0, the direct and extended costs are Rp22.2 and 23.66 trillion respectively. Under the different MPA management scenarios, the total direct cost ranges from Rp 41.99 trillion to Rp 54.18 trillion. The extended total cost varies from Rp 23.66 trillion to Rp 55.64 trillion. The costs are the present values of 2024-2045 annual costs. A simple average can be taken to get a yearly cost. This way, the annual average cost is about Rp 1.03 trillion (BAU scenario) to Rp 2.42 trillion (Scenario-6). By composition, the largest cost is the management cost which is about 10 times that of the establishment. This implies that more efforts should be made to manage the already formed MPAs than to establish the new ones.

Table 5. Present Value (2024-2045) Cost and Benefit Components of the MPA 30x45 Vision Under Different Management Scenarios (Rp Trilyun)

	BAU (Scenario-0)	10% NTZ			100 NTZ		
		20% FRR (Scenario-1)	30% FRR (Scenario-2)	DFRR (Scenario-3)	20% FRR (Scenario-4)	30% FRR (Scenario-5)	DFRR (Scenario-6)
Costs							
Establishment cost (C1)	0	4,30	4,32	4,32	4,32	4,32	4,32
Management costs (C2)	22,2	37,70	37,67	37,67	49,86	49,86	49,86
Total Costs , TC = C1+C2	**22,2**	**42,0**	**41,99**	**41,99**	**54,18**	**54,18**	**54,18**
Opportunity costs (OC)	1,46	1,46	1,46	1,46	1,46	1,46	1,46
Total Extended Costs, TEC = (TC +OC)	**23,66**	**43,46**	**43,45**	**43,45**	**55,64**	**55,64**	**55,64**
Benefits							
Fisheries rent capture (B1)	245	370	554,21	484,76	340,33	510,50	445,32
Tourism: income (B2)	84,87	105	105,03	105,03	0	0	0
Tourism: ticket revenue (B3)	5,35	6,63	6,63	6,63	0	0	0
Total Benefits TB = (B1+B2+B3)	**335,34**	**481,13**	**665,87**	**596,42**	**340,33**	**510,50**	**445,32**
Extended Benefits							
Mangrove (EB1)	84,20	175,30	175,30	175,30	175,33	175,33	175,33
Seagrass (EB2)	179,60	341,30	341,30	341,30	341,30	341,30	341,30
Coral reef (EB3)	321,19	397,50	397,50	397,50	397,50	397,50	397,50
Total Extended Benefits, TEB = TB +EB1+EB2+EB3	**920,33**	**1.395,23**	**1.579,97**	**1.510,52**	**1.254,46**	**1.424,63**	**1.359,45**

The benefits and extended benefits structure are also presented in Table 4. By composition, fisheries, through fisheries resource rent, provide larger benefits compared with tourism. Under scenarios 4, 5, and 6, no benefits are from tourism as the MPAs are entirely closed from tourism-related activities. The extended benefits from mangrove, seagrass, and coral reef ecosystem services are considerably larger than the MPA direct benefits. This indicates that protecting or conserving marine ecosystems will generate more financial impacts if the ecosystem functions and services are also counted. The direct benefits range from Rp 340.33 trillion (scenario 4) to Rp 665,87 trillion (scenario 3). The extended benefits vary from Rp 1,254 (scenario 4) to Rp 1,579 trillion (scenario 3). All the new proposed scenarios bring higher benefits than that of the BAU. In other words, the new MPA management scenarios should be considered the breakthrough marine conservation strategies, compared to the BAU management status. As in the costs, the benefits are the present values of the steam of the advantages derived from 2024 to 2045. An average yearly benefit can be counted to unveil MPA asset values. The average benefit and extended benefits range from Rp 14,60 trillion (scenario 4) to Rp 28,95 trillion (scenario 3) and Rp 54.55 (scenario 4) to Rp 68,69 trillion (scenario 3), respectively.

3.2. National Program Feasibility

Based on the cost and benefit structures, the feasibility and viability of the MPA 30x45 vision at the national level are determined. Common indicators used to indicate feasibility and viability are the present value of the net benefit (net present value) and benefit-cost ratio. The decision on the feasibility and viability of the vision is positive and hence can be manifested if the benefits exceed costs. As previously explained in the methodology, the indicators used to determine feasibility net present value (NPV) and benefit-cost ratio (BCR). In addition, since environmental services and the opportunity cost of fisheries are also assessed technically and financially, the extended NPV and extended BCR are therefore used to ascertain the overall viability of the vision. The estimated NPV, BCR, extended NPV, and extended BCR are shown in Table 6.

Table 6. Feasibility and viability of indicators of the MPA 30x45 vision (in Rp trillion).

	BAU (Scenario-0)	10% NTZ			100 NTZ		
		20% FRR (Scenario-1)	30% FRR (Scenario-2)	DFRR (Scenario-3)	20% FRR (Scenario-4)	30% FRR (Scenario-5)	DFRR (Scenario-6)
Net Present Value (NPV)	313,14	439,13	623,88	554,43	286,15	456,32	391,14
Exteded Net Present Value (ENPV)	896,67	1.351,77	1.536,52	1.467,07	1.198,82	1.368,99	1.303,81
Cost Benefit Ratio (CBR)	15,11	11,46	15,86	14,20	6,28	9,42	8,22
Extended Benefit Cost Ratio (EBCR)	38,90	32,10	36,36	34,76	22,55	25,60	24,43

All the NPVs are positive and all the BCR values are greater than one. These denote the financial viability of the vision. In other words, the vision should be programmed and implemented from the technical and non-technical viewpoints. The BAU and six proposed scenarios are viable. Nevertheless, to gain more benefits, and to protect marine waters as an Indonesian

commitment to international communities, the proposed scenarios rather than the BAU should be taken as a priority,

By comparing the proposed scenarios, scenario 2 (10% no-take zone and 30% fisheries resource rent) generates the largest NPV, ENPV, and CBR. Although the BAU scenario gives the highest EBCR, it has the smallest ENPV. The smallest NPV is the result of scenario 4. Scenarios 2 and 3 bring on NPV and ENPV whose percentages are much higher than the BAU scenario. (Table 7). Hence, the best management scenario is scenario 2, followed by scenario 3 (10% NTZ and different fisheries resource rent).

Table 7. NPV and ENPV comparison between BAU and the other scenarios.

	BAU (Scenario-0)	20% FRR (Scenario-1)	30% FRR (Scenario-2)	DFRR (Scenario-3)	20% FRR (Scenario-4)	30% FRR (Scenario-5)	DFRR (Scenario-6)
NPV	313	439	623	554	286	456	391
ENPV	896	1.351	1.356	1.467	1.198	1.368	1.303
% of NPV Difference from the BAU	-	0,40	0,99	0,77	- 0,09	0,46	0,25
% of ENPV Difference from the BAU	-	0,51	0,51	0,64	0,34	0,53	0,45

3.3. Sub-National Program Feasibility

An attempt has been made to determine the feasibility of the MPA 30x45 vision at WPP level. Scenario 3 was used to estimate NPV and ENPV in each WPP simply because its analysis is based on the different resource use rent. The result is presented in Figure 4 which indicates:

1. MPA 30x45 vision is also feasible in each WPP based on the positive and large values of NPV and ENPV. This means that if the vision is accepted at the national level, it should be undoubtedly implemented at the WPP level.
2. The NPV ranges from Rp 7.98 trillion in WPP 717 to Rp 60.86 trillion in WPP 712. The average NPV is Rp 41.5 trillion.
3. The largest NPV and ENPV occur in the WPP 711 and 714, respectively.
4. The smallest NPV happens in WPP 717 while the smallest ENPV falls in WPP 571 and 712.
5. Overall, it is obvious that ENPV is substantially higher than NPV in all WPPS, particularly in eastern Indonesia. The ENPV is about five times the NPV in WPP 717 and six times in WPP 714. This indicates that protecting marine ecosystem brings on more positive impacts on the environment in eastern Indonesia.

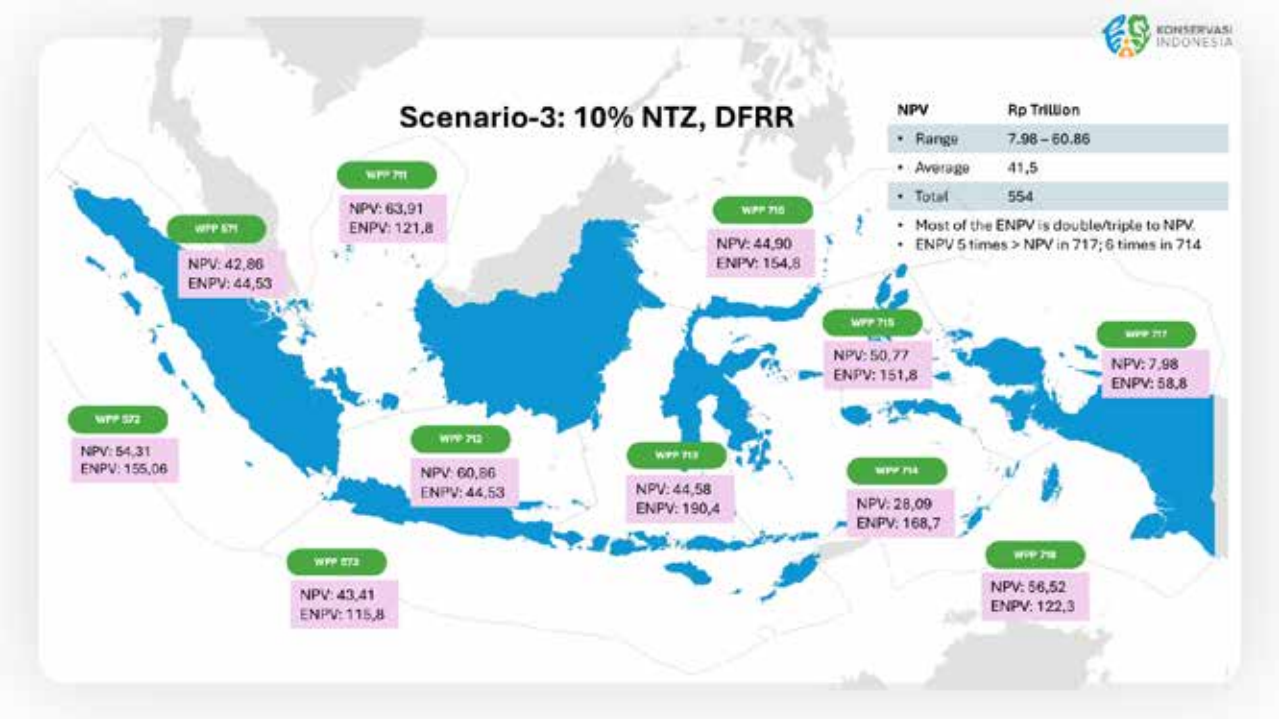


Figure 5. NPV and ENPV by WPPs

3.4. Large-scale MPA Feasibility

Another attempt was also made to find out if a large-scale MPA (LSMPA) is feasible to be developed in WPP 572 and the waters off the southern coast of Java island, a part of WPP 573. The WPPs are the Indonesian Exclusive Economic Zone (EEZ) in the Indian Ocean. The WPPs also border with the proposed EBSA south of Java island outside the Indonesian EEZ toward Cocos Island and Christmas Island at an area of latitude 12° to 17° S and longitude 107° to 117° E. The area proposed for the EBSA comprises the core spawning area for SBT and is outside the national boundaries of both Australia and Indonesia (CBD, 2013). While most of the EBSA is situated beyond the Indonesian EEZ, it may be considered as LSMPA which is beyond national jurisdiction. Nevertheless, the MPA 30x45 vision has included areas that may be considered as LSMPAs. A CBA in the WPP 572 and a part of 573 was conducted and its result is presented in Table 8.

The LSMPA is dedicated as a fisheries MPA as it is located offshore and coastal ecosystems do not occur. The benefits of the LSMPA are fisheries and tourism. The LSMPA is a proposed MPA to be established; hence, there is no existing one that needs to be expanded. Therefore, no BAU scenario exists. The analysis was based on scenario 1 (10% NTZ and 20% FRR) and scenario 3 (10% NTZ and 30% FRR).

A total of 26.26 million ha of LSMPAs or fisheries-based MPAs consisting of 13.86 million ha in WPP 572 and 12.41 million ha in WPP 573 is designed to be created. As shown in Figure 5, there are several LSMPA parcels or units. The formation of new parcels of MPA is planned to grow gradually from nothing in 2023 to 10% by 2030, reaching 20% by 2041, and finally 30% by 2045. The areas designed for LSMPAs in WPP 572 and 573 are shown in Figure 5, while the cost-benefit analysis results are in Table 8.

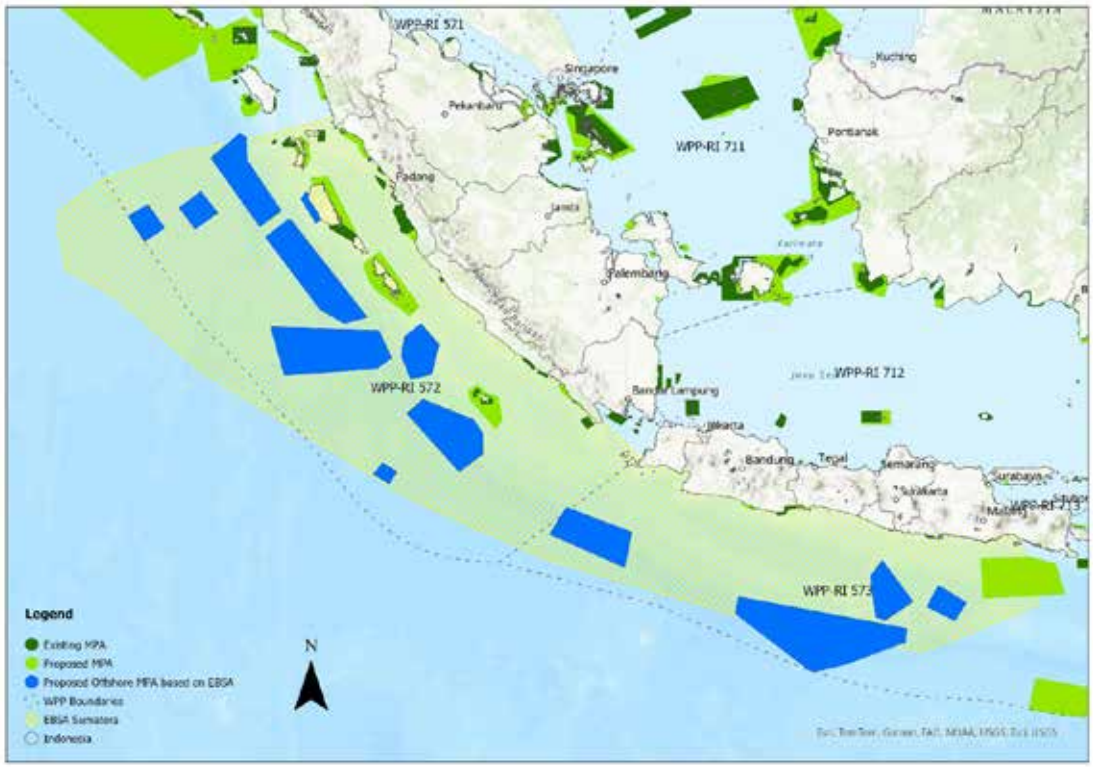
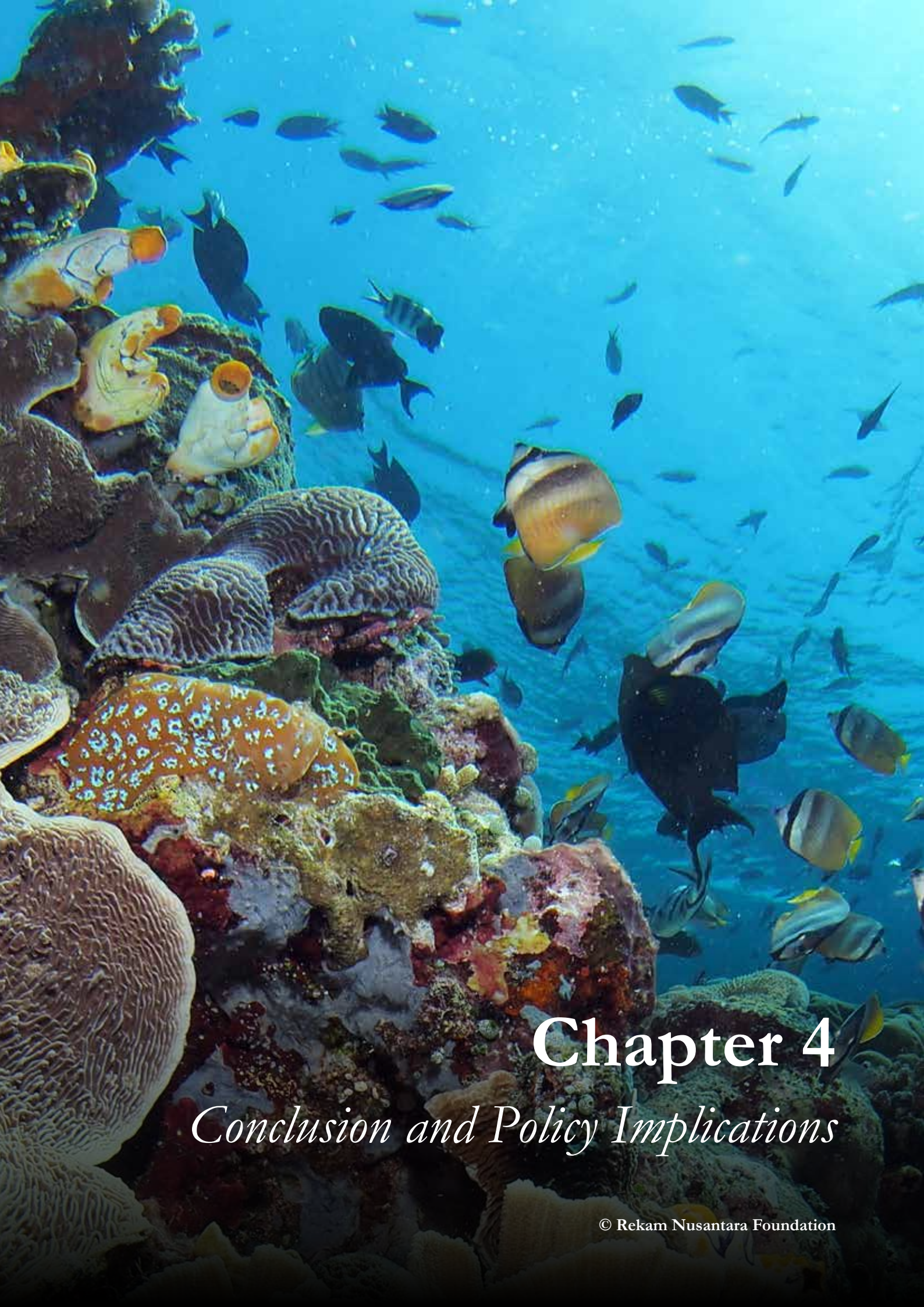


Figure 5. LSMPAs are planned to be created in WPP 572 and 573.

Table 8. Feasibility of LSMPA in WPP 572 and 573 under scenarios 1 and 2

	Scenario 1		Scenario 2	
	WPP 572	WPP 573	WPP 572	WPP 573
New Establishment (000 Ha)	13,863	12,414	13,863	12,414
Total investment (trillion IDR)	4.19	6.30	4.19	6.30
NPV (Rp Trillion)	12.82	11.14	13.78	12.27
ENPV (Trillion)	113.53	92.59	114.48	93.72
BCR (Trillion)	10.56	5.92	11.28	6.42
EBCR (Trillion)	77.38	40.14	78.03	40.61

The results indicate that NPV and BCR indicators confirm positive results that can be generated if LSMPAs are established in these WPPs. MPA management of scenario 2 is better than scenario 1, referring to all financial indicators. In other words, if fisheries-based MPA is a policy priority, an integrated protection-production approach should be addressed in such a way that 10% of the area is an NTZ, 90% of the area should be managed by following conservation management measures, and fishing efforts should be controlled at the level to attain 30% resource rent.



Chapter 4

Conclusion and Policy Implications

Chapter 4
Conclusion and Policy Implications

- The expansion of MPA as one of the five marine and fisheries development pillars, or the MPA 30% by 2045 Vision (MPA 30x45 Vision) was financially evaluated in this study. It provides information to the government, particularly the Minister of Marine Affairs and Fisheries (MMAF), Coordinating Ministry of Food (previously Coordinating Ministry of Maritime and Investment Affairs), Ministry of National Development Planning (Bappenas), and House of Representative (DPR) to make policies related to sustainable marine resource management. The implementation of the MPA 30x45 vision should be prioritized not only to fulfill the Indonesian pledge on Target 3 of the Kunming-Montreal Global Biodiversity Framework (GBF) but also as a long-term strategy to reach food self-sufficiency and sovereignty. Fish is the main protein intake for Indonesian people. Hence taking long-term and sustainable marine and fisheries resources through MPA 30x45 vision implementation will help the government achieve a continuous protein supply. This study was an effort to guide the above government agencies in making policies and decisions at the national and sub-national (WPP) levels.
- The study was a follow-up step of the previously conducted spatial analysis to geographically determine 30% of Indonesian jurisdictional waters as protected areas. That technical spatial plan needs to be supported by this macro-financial analysis so that comprehensive policies underlying MPA 30x45 vision implementation can be generated.
- Overall, it can be concluded that the MPA 30x45 vision is feasible to be programmed and implemented at the national and sub-national levels. This is based on the results of CBA analysis indicators; the NPV, BCR, ENPV, and EBCR that were estimated for 23 years, from 2024-2045. The result of the analysis implies that the MPA 30x45 vision should be comprehensively programmed in the long-term spectrum by considering all direct and indirect cost and benefit elements. The results of the analysis may be used to underscore and justify the need to implement Law No. 29/2024 on the Long-term National Development Plan (RPJP), 2025-2045 which specifically targets 30% protection of the Indonesian marine ecosystem.
- The BAU scenario (no new MPA establishment and expansion) was used as the basis management scenario. The proposed scenarios are combinations of No-take Zone (NTZ) and fisheries resource rent (FRR) percentages. They are (1) 10%NTZ, 20%FRR, (2) 10%NTZ, 30%FRR, (3) 10%NTZ, Different FRR), (4) 100%NTZ, 20%FRR, (5) 100%NTZ, 30FRR, and (6) 100NTZ, different FRR.
- The direct costs of MPA consist of those of establishment and management. The indirect cost incurred is the opportunity cost of fisheries arising from fisheries activities that should be replaced or relocated due to the presence of the MPA. The direct benefits of MPA are from fisheries and tourism. The indirect benefits are the values of ecosystem services produced by coral reefs, mangroves, and seagrasses. The direct cost ranges from Rp 22.2 trillion (BAU scenario) to Rp 54.8 trillion (scenarios 4, 5, and

6). The extended cost ranges from Rp 23.66 trillion (BAU scenario) to Rp 55.64 trillion (scenarios 4, 5, and 6). The direct benefit ranges from Rp 335.34 trillion (BAU scenario) to Rp 665.87 trillion (scenario 2). The extended benefit ranges from Rp 920 trillion (BAU scenario) to Rp 1,579.97 trillion (scenario 2).

- Of the six MPA development scenarios, based on NPV, ENPV, BCR, and ENCR indicators, it was found that scenario 2 is the best MPA development policy option. Implementing this policy option in the long-term framework of 23 years will require a present direct cost of Rp.41.99 trillion and a present extended cost of Rp 43.45 trillion. Yet, it will bring about a present direct benefit of Rp 623.88 trillion and a present extended benefit of Rp 1,536.52 trillion.
- The study also reveals positive net present values generated by MPA 30x45 vision implementation in all WPPs. The WPPs in eastern Indonesia tend to result in slightly higher net benefits than in western Indonesia. The LSMPAs in WPPs 572 and 573 also generate positive net benefits.
- The study did not include fisheries management costs in all WPPs, particularly in the non-protected waters. Ideally, this cost should be included. Consequently, it will increase costs and reduce benefits. Assuming the fisheries management costs are three or four times the direct MPA costs, the MPA 30x45 vision is still a feasible program to be prioritized.
- Policy implications that can be derived from this study are
    - Fisheries resource rent of 30% should be achieved and retained. The government should design and apply fisheries management mechanisms in a way that fishing inputs and outputs are controlled to reach the 30% resource rent.
    - Sustainable fisheries resource management and MPA implementation should be unified. A fishery without MPA or production without protection measures will eventually end up with resource degradation and over-exploitation. In contrast, an MPA without fisheries production will undeniably engender ecosystem health but socio-economically unimpactful. Integration of fisheries production and resource protection can be meaningful ecologically, biologically, and socio-economically.
    - Although the MPA 30x45 vision is financially feasible and can generate a significant amount of present value of net benefit, it requires substantial costs that may not be able to be provided only by the government agencies. Therefore, to conceive the MPA 30x45 vision, a blended financing model should be created to pay for MPA establishment and management.
    - The central government should set priorities to finance MPA through non-contemporary funding mechanisms by reforming state budget allocation and spending. More budget allocation for MPA may come from decentralized, deconcentrated, and fisheries resource revenue-sharing funds. The provincial governments should also prioritize MPA development by allocating and reallocating a sizeable amount of the provincial budget (APBD).

- Non-state budget mechanisms such as trust funds, environmental funds, blue or green bonds, conservation insurance, and even a newly introduced debt-for-nature swap, should be intensified and expanded to finance the MPA 30x45 vision.
- The government should doubtlessly offer opportunities to implement the vision to local, national, and international non-governmental organizations. National business sectors should also be invited to make their contribution. Currently, MPAs are cost-centered and under the management responsibility of the government agencies. Non-government-managed MPAs or cooperatives management (co-management) approach should be developed by involving stakeholders and local communities as the main MPA users and beneficiaries. The stakeholders, especially the local communities often considered MPA rightsholders, should be invited to develop sustainable businesses and turn MPA from cost-centered to profit-centered.
- This is a macro perspective study should be followed up with an individual MPA-based study when an MPA will be developed. The method used in this study, particularly cost and benefit variables can be used, can be used to guide identification and calculation of the individual MPA cost and benefit components. Similarly, the value of ecosystem services should be valuated by using local data and information. Finally, it should be kept in mind that although at the national and WPP levels. The MPA 30x45 vision is feasible, the different conclusion may be resulted from individual MPA-based studies. This indicates the importance of the individual MPA-based study in order to define MPA specific objectives and management strategies for each MPA.

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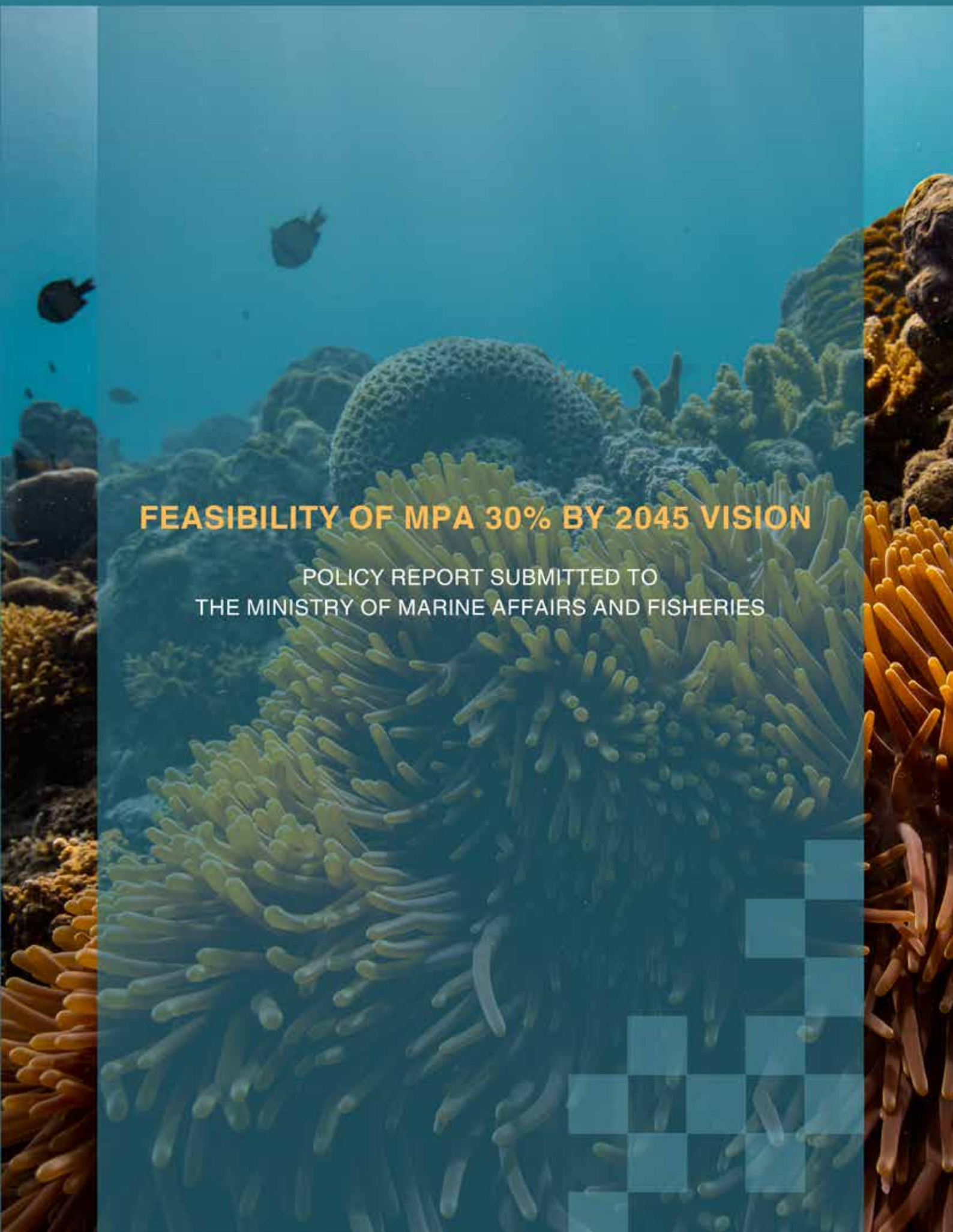

FEASIBILITY OF MPA 30% BY 2045 VISION

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