Blue Halo S – Blue Ecosystem Adaptation Mechanism (BEAM)

ANNEX 2: Feasibility Study

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Abbreviations and Acronyms

ACI	Adaptive Capacity Index
AESI	Asosiasi Energi Surya Indonesia/Indonesia Solar Energy Association
AFD	French Development Agency
AIIB	Asian Infrastructure Investment Bank
APBD	Anggaran Pendapatan dan Belanja Daerah/Regional Government Budget
APBN	Anggaran Pendapatan dan Belanja Negara/State Budget
APL	Areal Penggunaan Lain/Outside Forest Areas
ASEAN	Association of Southeast Asian Nations
Bappeda	Badan Perencanaan Pembangunan Daerah/Regional Planning Development Agency
Bappenas	Kementerian Perencanaan Pembangunan Nasional/Ministry of National Development Planning Indonesia
BIG	Geospatial Information Agency
BKPM	Badan Koordinasi Penanaman Modal/Ministry of Investment / Indonesia Investment Coordinating Board
BLUD	Badan Layanan Umum Daerah/Regional Public Service Agency
BOS	Bantuan Operasional Sekolah/School Operational Assistance
BPDLH	Environmental Fund Service Agency
BPS	Badan Pusat Statistik/Central Bureau of Statistics
BRG	Badan Restorasi Gambut/Peat Restoration Agency
BRGM	Badan Restorasi Gambut dan Mangrove/Peat and Mangrove Restoration Agency
BRIN	Badan Riset dan Inovasi Nasional/National Research and Innovation Agency
CBIB	Cara Budidaya Ikan Baik/Good Fish Farming Practices
CBOs	Community-Based Organizations
CCDP	Coastal Community Development Program
CCVA	Climate Change Vulnerability Assessment
CDD	Consecutive Dry Days
CDF	Cumulative Distribution Function
CHES	coupled human-environment system
CMFA	Coordinating Ministry for Food Affairs
COREMAP-CTI	Coral Reef Rehabilitation and Management Program - Coral Triangle Initiative
CRS	Creditor Reporting System
CSOs	Civil Society Organizations
CTF	Conservation Trust Fund
CTI	Coral Triangle Initiative
CV	Commanditaire Vennootschap (Limited Partnership in Indonesia)
CWD	Consecutive Wet Days
DAK	Dana Alokasi Khusus/Special Allocation Funds
DDI	Domestic Direct Investment
DIBI	Data and Information on Indonesian Disasters
DJF	December-January-February
DJPK	Direktorat Jenderal Perimbangan Keuangan/Directorate General of Fiscal Balance
DKI	Daerah Khusus Ibukota/Special Capital Region
DKP	Dinas Kelautan dan Perikanan/Regional Marine and Fisheries Agency
DMI	Dipole Mode Index
DPMPTSP	Dinas Penanaman Modal dan Pelayanan Terpadu Satu Pintu/Investment Board One-Stop Service
DPN	Daerah Pariwisata Nasional/National Tourism Destinations
EAA	Ecosystem-based Approach to Aquaculture
EAFM	ecosystem approach to fisheries management
EBT	Energi Baru Terbarukan/Renewable Energy
EEZ	Exclusive Economic Zone
EFT	Environmentally Friendly Technologies
EIB	European Investment Bank
ENSO	El Niño-Southern Oscillation
ESDM	Ministry of Energy and Mineral Resources
EV	Electric Vehicle
FAO	Food and Agriculture Organization
FDI	Foreign Direct Investment
FGD	Focus Group Discussion

WPP	Fisheries Management Area
FMP	Fisheries Management Plan
FP	Funding Proposal
FPIC	Free Prior Informed Consent
FS	Feasibility Study
GCF	Green Climate Fund
GCMs	Global Climate Models
GDP	Gross Domestic Product
GEF	Global Environment Facility
GESI	Gender Equality and Social Inclusion
GHG	Green House Gas
GIS	Geographic Information Systems
GIZ GmbH	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Corporation for International Cooperation GmbH)
GoI	Government of Indonesia
GRDP	Gross Regional Domestic Product
GrSI	Green Industry Standard
GT	Gross Tonnage
ha	Hectare
HCR	Harvest Control Rules
HS	Harvest Strategies
IEA	International Energy Agency
IESR	Institute for Essential Service Reform
IFAD	International Fund for Agricultural Development
IKI	International Climate Initiative
IMTA	Integrated Multi-Trophic Aquaculture
INDC	Intended Nationally Determined Contribution
IOD	Indian Ocean Dipole
IoT	Internet of Things
IPCC	Intergovernmental Panel on Climate Change (IPCC)
IPLC	Indigenous Peoples and Local Communities
IPPU	Industrial Process And Production Use
IRBI	Indonesian Disaster Risk Index
IRW	Investment Readiness Window
ITDC	Indonesia Tourism Development Corporation
IUU	Illegal, Unreported, and Unregulated
JJA	June-July-August
KBLI	Klasifikasi Baku Lapangan Usaha Indonesia/Indonesian Standard Industrial Classification
Kemenkop UKM	Kementerian Koperasi dan Usaha Kecil dan Menengah
KK	Kawasan Konservasi/Conservation Area
KKLD	Kawasan Konservasi Laut Daerah/Conservation Area in District
KKP	Kementerian Kelautan dan Perikanan/Ministry of Maritime Affairs and Fisheries
KKPD	Kawasan Konservasi Perairan Daerah/District Marine Conservation Area
KLHS	Kajian Lingkungan Hidup Strategis/Strategic Environmental Assessment
KSDAE	Directorate General of Natural Resources Conservation and Ecosystem
KSPN	Kawasan Strategis Pariwisata Nasional/National Strategic Tourism Areas
KUR	Kredit Usaha Rakyat/People's Business Credit
LCD	Low Carbon Development
LFG	Landfill Gas
LIPI	Lembaga Ilmu Pengetahuan Indonesia/The Indonesian Institute of Sciences
LPMUKP	Lembaga Pengelola Modal Usaha Kelautan dan Perikanan/Marine and Fisheries Business Capital Management Agency
M&E	Monitoring and Evaluation
M4CR	Mangrove for Coastal Resilience
MCAs	Marine Conservation Agreements
MEMR	Ministry of Energy and Mineral Resources
MLFs	Medium and Large Fisheries
MLFs	Medium and large-scale fisheries
MMAF	Ministry of Marine Affairs and Fisheries
MoA	Ministry of Agriculture

MoAASP	Ministry of Agrarian Affairs and Spatial Planning/National Land Agency
MoE	Ministry of Environment
MoHA	Ministry of Home Affairs
MoI	Ministry of Investment or Ministry of Industry (context dependent)
MoTCE	Ministry of Tourism and Creative Economy
MPA	Marine Protected Area
MPAs	Marine Protected Areas
MSFs	Micro And Small-Scale Fisheries
MSL	Mean Sea Level
MSME	Micro, Small and Medium-sized Enterprises
MSP	Marine Spatial Planning
MSW	municipal solid waste
NBCAP	National Blue Carbon Action Partnership
NCA	Nature Conservation Areas
NDC	Nationally Determined Contributions
NGO	Non-Governmental Organization
NPV	Net Present Value
NRA	Nature Reserve Areas
NSPK	Norma Standar Prosedur Kriteria/Norms, Standards, Procedures, and Criteria
Nusantara	Another name for Indonesia
OECD	Organisation for Economic Co-operation and Development
OECMs	Other Effective area-based Conservation Measures
OJK	Otoritas Jasa Keuangan/Finacial Services Authority
OLS	Ordinary Least Squares (regression analysis method)
PAD	Pendapatan Asli Daerah/Local Own-Source Revenue
PD	Perusahaan Daerah/Regional Company in Indonesia
PEN	Pemulihan Ekonomi National/National Economic Recovery
PKKPRL	Persetujuan Kesesuaian Kegiatan Pemanfaatan Ruang Laut/Marine Space Utilisation and Suitability Area
PLTSa	Pembangkit Listrik Tenaga Sampah/Waste-Based Power Plant
PMU	Project Management Unit
PNBP	Penerimaan Negara bukan Pajak/tax and non-tax state revenues
POME	Palm Oil Mill Effluent
PP	Government Regulation/Peraturan Pemerintah
PPE	Personal Protective Equipment
PPI	Fish Landing Base
PPN	Archipelagic Fishing Port (Class B)
PPP	Public-Private Partnership or Coastal Fishing Port (Class C) (context dependent)
PPS	Pelabuhan Perikanan Samudra/Ocean Fishing Harbor
PRO	Pusat Riset Oseanografi/Oceanographic Research Centre
PT	Perseroan Terbatas (Limited Liability Company in Indonesia)
PT BNI	PT Bank Negara Indonesia
PT SMI	PT Sarana Multi Infrastruktur
Qanun	Aceh's Regional Regulation
QBF	Quota-Based Fishing
QFP	Quota-Based Fisheries Policy
RAD-GRK	Rencana Aksi Daerah Penurunan Gas Rumah Kaca/Regional Action Plan for GHG emission Reduction
RAKORBANG	Rapat-Rapat Koordinasi Pembangunan/Development Coordination Meetings
RAKORTEK	Technical Coordination Meetings (Rapat-Rapat Koordinasi Teknis)
RAN-API	Rencana Aksi Nasional Adaptasi Perubahan Iklim/National Action Plan for Climate Change Adaptation
RAN-GRK	Rencana Aksi Nasional Penurunan Gas Rumah Kaca/National Action Plan for GHG emission Reduction
RAS	Recirculating Aquaculture Systems
RCO	Research Center for Oceanography
RDF	refuse-derived fuel
RE	Renewable Energy
RENSTRA	Rencana Strategis/Strategic Plan
RKP	Rencana Kerja Pemerintah/Government Work Plan
RPJMD	Rencana Pembangunan Jangka Menengah Daerah/The Regional Medium-Term Development Planning

RPJMN	Rencana Pembangunan Jangka Menengah Nasional/The National Medium-Term Development Planning
RPJPD	Rencana Pembangunan Jangka Panjang Daerah/Regional Long-Term Plan
RPJPN	Rencana Pembangunan Jangka Panjang Nasional/National Long-Term Plan
RPPLH	Rencana Perlindungan dan Pengelolaan Lingkungan Hidup/Environmental Impact Assessment Reports
RTRL	Rencana Tata Ruang Laut/Marine Spatial Plan
RTRW	Rencana Tata Ruang Wilayah/Urban Land Use Plan
RUEN	Rencana Umum Energi Nasional/National General Energy Plan
SCC	Social Cost of Carbon
SDGs	Sustainable Development Goals
SEA	Strategic Environmental Assessment
SEI	sensitivity and exposure index
SEQI	Seagrass Ecological Quality Index
SFF	Sustainable Fisheries Fund
SIDIK	Sistem Informasi Data Indeks Kerentanan/Vulnerability Index Data Information System
SLA	Sea Level Anomaly
SLL	Sustainable Linked-Loans
SNI	Standar Nasional Indonesia/Indonesia National Standard
SSP	Shared Socioeconomic Pathway
SST	Sea Surface Temperature
SUOP	Management Unit of Marine Protected Area (Unit Pengelola Kawasan Konservasi Laut)
TFCCA	Tropical Forest and Coral Reef Conservation Act
TPS3R	Tempat Pengolahan Sampah. Reduce-Reuse-Recycle/3R waste management facilities
TPST	Tempat Pengolahan Sampah Terpadu/Waste Treatment Facilities
TFCA	Tropical Forest Conservation Act
UD	Usaha Dagang (Sole Proprietorship in Indonesia)
UMi	Ultra-Micro Loans
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USD	United States Dollar
UU	Undang Undang
WASH	water, sanitation and hygiene
WPP	Wilayah Pengelolaan Perikanan/Fisheries Management Area
WPP 572	Wilayah Pengelolaan Perikanan/Fisheries Management Area 572
WPPNRI	Wilayah Pengelolaan Perikanan Negara Republik Indonesia/Fishery Management Areas of the Republic of Indonesia
WTE	Waste to Energy
ZEEI	Indonesian Exclusive Economic Zone
ZTCM	Zonal Travel Cost Method

Executive Summary

This Feasibility Study is designed to provide a comprehensive analysis supporting the Blue Halo S – Blue Ecosystem Adaptation Mechanism (BEAM) GCF Funding Proposal (FP). It presents detailed information that contributed to the development of the FP and facilitates access to the models, data, and assumptions that informed the design of the proposed Project approaches and targets.

The Feasibility Study (FS) provides analyses of the current and projected impacts of climate change on Indonesia's Wilayah Pengelolaan Perikanan[1] 572 (WPP 572) and the vulnerable populations that live in adjacent coastal areas. It also establishes the baseline context for the proposed Project activities.

The FS provides context for the Project, offers a detailed analysis of relevant market dynamics, and presents evidence demonstrating the effectiveness and responsiveness of the Project's selected approaches. These approaches are designed to address the adaptation needs of beneficiary populations, while simultaneously mitigating greenhouse gas (GHG) emissions. Ultimately, the Project aims to achieve a paradigm shift towards a protection-production model of marine management that sustainably benefits both vulnerable populations and the ecosystems on which they rely. Please refer to the table of contents above for a list of the detailed information found in each of the sections described below.

This Feasibility Study is structured into the following sections:

Section 1: Baseline Description: Country and Project Area Profile

This section provides an analytical overview of marine resource management and the blue economy context across the six Project provinces adjacent to WPP572, utilizing a structured methodological framework. Data collection involves a combination of desk reviews, Focus Group Discussions (FGDs), in-depth interviews, and direct observations, facilitated by local enumerators to ensure accuracy and appropriate context.

This methodology combines primary insights from FGDs, interviews, and site visits – capturing local perspectives, stakeholder roles, and management practices – with secondary data from regional and national databases, providing a broader context with demographic, economic, and environmental statistics for each province.

Quantitative findings from the study revealed significant targets and contributions: the Government of Indonesia's strategic plan to manage 97.5 million hectares of territorial waters by 2045 specifically aims to bolster marine biodiversity and support economic livelihoods. The economic output from marine resources in WPP572 contributes over USD 280 billion to the national economy. Approximately 130 million people, approximately 50% of Indonesia's population, depend on these resources directly or indirectly for their livelihoods.

The assessment also highlights challenges such as variability in fisheries production, data availability and quality, and limited economic information available from the informal sector. Regulatory inconsistencies were also found to impact the effectiveness of governance and policy across the studied provinces.

Challenges such as climate change, overfishing, and pollution were identified as major threats to the sustainability of protected marine areas, with potential economic losses from climate impacts on marine and coastal sectors projected to reach IDR 81.82 trillion by 2024.

The study suggests that addressing data collection and management gaps is crucial for supporting sustainable practices and effective resource governance. Moreover, enhancing community involvement

[1] Wilayah Pengelolaan Perikanan Negara Republik Indonesia, referred to as WPP in this study, are the Fishery Management Areas of the Republic of Indonesia.

and strengthening legal frameworks could help reduce economic losses from illegal fishing activities and promote sustainability in the face of climate impacts.

Section 2: Natural Capital Baseline of Project Area

This baseline assessment evaluates the status and trends of mangroves, seagrass beds, and coral reefs in WPP 572. Grounded in satellite data, field observations, and historical trends, it provides insights into the changes and challenges these critical ecosystems face.

The mangrove ecosystems in WPP 572 cover approximately 36,000 ha, representing about 1.2% of Indonesia's total mangrove coverage. Between 1996 and 2020, WPP 572 experienced a decline of around 1,900 ha, signifying a 5% reduction from its extent. This regional loss translates into blue carbon emissions, reaching up to 4.5 million tons of CO_{2e} by 2060.

WPP 572 also holds around 24,854 ha of seagrass beds, which constitutes about 4.7% of the national total. This ecosystem has experienced a considerable degradation rate, almost 3% per annum. The projected losses for seagrass beds by 2060 could result in around 7.5 million tons of CO_2 emissions, underscoring the critical need for targeted conservation efforts. Please also see Annex 22 for GHG emissions calculation linked to this analysis.

WPP 572 hosts approximately 17% of Indonesia's coral reef ecosystems, making it the third largest WPP in terms of coral reef coverage. This region encompasses over 63% of its coral reefs within the provinces of Sumatera Barat and Sumatera Utara. These coral reefs suffer from suboptimal conditions, with only 21% and 9% in good and excellent condition respectively, with the majority being in fair or poor states and threatened heavily by climate change.

The drivers of ecosystem degradation in WPP 572 are climate change and anthropogenic, with unsustainable land use changes, pollution, and destructive fishing practices exacerbating the impacts of climate change on these key ecosystems. These activities not only diminish the extent of these critical habitats but also reduce their ability to sequester carbon.

Section 3: Climate Change Profile – Risk and Vulnerability

The Climate Change Vulnerability Assessment (CCVA) for WPP 572 reveals significant ecological, social, and economic vulnerabilities to anticipated climate change impacts. This region, recognized as one of Indonesia's foremost fishing zones, faces escalating risks that could impact its marine and coastal ecosystems as well as the communities reliant upon them.

Sea level rise is projected to accelerate from 0.24 cm to 0.55 cm per year during the 2021-2040 period (SSP 2-4.5) and 0.67 cm per year between 2041 and 2060 (SSP 2-4.5), resulting in total SLR of up to 20 cm by mid-century. This rise threatens coastal infrastructure and habitats, intensifying erosion and salinity intrusion into freshwater resources. Concurrently, mean sea surface temperature (SST) anomaly is expected to rise, with an increase ranging from 0.51°C to 1.27°C by 2060 with deviation of ± 0.39 °C (SSP 2-4.5; SSP 3-7.0). Warming is likely to shift marine biodiversity and increase coral bleaching events, which are critical concerns for marine conservation, local fisheries, and eco-tourism.

Coastal communities, heavily reliant on fisheries and aquaculture, are particularly sensitive to these changes which impact their livelihoods and food security. The region could face substantial economic losses - projected to reach IDR 81.82 trillion by 2024. These losses stem from reduced productivity in marine fisheries and coastal aquaculture sectors, which are crucial to the local and national economy.

Adaptive capacity across WPP 572 shows marked variability, with Bengkulu, Aceh, and Banten provinces identified as most vulnerable to climate risks due to their relatively lower adaptive capacities and high exposure levels. Aceh and Lampung are also particularly susceptible, grappling with critical coastal ecosystem conditions and significant vulnerability to projected climate impacts. To mitigate these risks and enhance regional stability and economic resilience, it is essential to bolster infrastructure, engage communities in resilience-building efforts, utilize technology for effective adaptation, and embed climate resilience into comprehensive policy planning.

Section 4: Legal, Institutional, Political Framework and Financial and Market assessment

Indonesia's approach to Marine Protected Areas (MPAs), particularly within the WPP 572 region, represents a complex interplay of legal, institutional, and financial frameworks aimed at preserving marine biodiversity and promoting sustainable use of marine resources. Despite robust regulatory foundations and legislative measures, including MMAF Regulation No. 31/2020 and MoE Regulation No. 15/2021, actual implementation exhibits discrepancies between national mandates and local execution. This misalignment underscores a critical gap in the legal framework where the integration and coherence of marine conservation regulations with broader environmental policies remain inconsistent, leading to ineffective enforcement and operational challenges across different administrative levels.

The institutional framework for managing MPAs involves an array of stakeholders from government bodies, non-governmental organizations, and community groups. Although this diverse participation enriches the governance landscape, it also introduces complexities in role definition and coordination. Existing institutional arrangements reveal a fragmented management structure with bureaucratic overlaps and insufficient clarity on stakeholder responsibilities. This lack of streamlined coordination undermines the efficacy of conservation efforts, particularly in ecologically critical areas like WPP 572.

Financially, the MPAs suffer from underfunding, relying mainly on state budgets and occasionally supplemented by international aid or private contributions. These financing models fall short of addressing the scale and scope of required marine conservation efforts. This financial inadequacy is further exacerbated by the absence of innovative financing mechanisms tailored to the unique needs and potential of the sector.

In response to these challenges, it is necessary to support a unified legal and policy framework that integrates conservation regulations and incorporate the threats of climate change, enhancing consistency and operational efficiency across all levels of governance. Establishing formalized mechanisms for inter-agency collaboration, clearly defining roles and responsibilities, and strengthening local governance capacities are essential steps towards optimizing institutional arrangements. Financially, direct support to blue economy enterprises and implementing innovative mechanisms such as Blue Bonds, Payments for Ecosystem Services (PES), and Conservation Trust Funds (CTF) may be strategic. These initiatives aim to diversify and stabilize funding streams while directly linking financial incentives to conservation outcomes.

Section 5: Blue Economy Market Context and MPA Financing

Indonesia’s blue economy, particularly in the WPP 572 region, holds significant economic value, estimated by the World Bank at over USD 280 billion annually, driven predominantly by traditional sectors such as capture fisheries, aquaculture, and fish processing which together account for 83% of the total value addition. Alongside these established industries, emerging opportunities in shipbuilding, maritime transport, and marine manufacturing underscore the expansive potential of Indonesia’s blue economy. Recent data from Badan Koordinasi Penanaman Modal (BKPM)[2] indicates a notable increase in Domestic Direct Investment (DDI) in the fisheries sector, which doubled in 2023 to IDR 2.5 trillion (approximately USD 156 million), highlighting active economic growth. Conversely, Foreign Direct Investment (FDI) in the same sector decreased to USD 25.7 million, despite an increase in project numbers, illustrating a complex investment landscape.

On the supply side, financial contributions to Indonesia’s blue economy are diverse, involving both formal banking sectors and emerging financial technologies. Traditional banks, such as Bank Rakyat Indonesia (BRI)[3], have tailored their services to improve accessibility in remote areas, thereby supporting financial inclusivity across the archipelago. Illustrating the growing confidence in the sector, FishLog, a fisheries logistics startup, has received funding from major state-owned banks including BRI Ventures, BNI

[2] Ministry of Investment / Indonesia Investment Coordinating Board
[3] https://bri.co.id/

Ventures, and Mandiri Capital.The government's support is evident through initiatives like ultra-micro loans (UMi), which have allocated IDR 622.6 trillion (USD 38.75 billion) to micro and ultra-micro businesses, facilitating financial access. However, sector-specific interventions are limited, with Lembaga Pengelola Modal Usaha Kelautan dan Perikanan (LPMUKP), the microfinancing arm of the Ministry of Marine Affairs and Fisheries, as a notable exception, distributing IDR 328.51 billion (USD 20.5 million) specifically for marine and fisheries-related enterprises by 2023.

The blue economy market context analysis for WPP 572 reveals a dynamic interaction between robust economic activities and the evolving financial frameworks designed to support them. The region's substantial economic activities, coupled with a diverse array of financial sources, create fertile ground for further economic development and conservation efforts within the marine and fisheries sectors. However, to fully realize this potential, targeted interventions are necessary to bridge the existing gaps between demand capabilities and supply offerings to ensure a sustainable and prosperous blue economy for the region.

Section 6: **Project Design and Approach**

The BEAM initiative is strategically structured to address challenges in Indonesia's blue economy, focusing specifically on WPP 572. The project design integrates a deep understanding of environmental and economic landscapes, pinpointing essential gaps in ecosystem management, fisheries sustainability, and regulatory frameworks. This foundation informs the development of two primary project Components, each crafted to establish and leverage an environment conducive to sustainable marine and coastal management practices.

BEAM's design is rooted in an integrated approach that combines regulatory support, locally-led climate action, and investment readiness. The objective is to stimulate sustainable growth and ensure long-term viability within the blue economy. The project is devised to align with national economic and conservation goals, enhancing the regulatory and operational environment for sustainable practices.

The project's design incorporates insights gained from direct consultations with various stakeholders, including government entities, financial institutions, and community representatives. This engagement ensured the project's alignment with real-world needs and capacities, focusing on strategic areas to maximize scalability and impact.

- Component 1 focuses on creating enabling conditions through regulatory reforms, capacity building, and innovative financial mechanisms. These are essential for supporting sustainable economic activities and long-term environmental stewardship.
- Component 2 applies to the frameworks established in Component 1, focusing on actionable climate adaptation and mitigation initiatives and enhancing investment readiness among local enterprises. It comprises locally led climate action and investment readiness: two grant windows that provide direct financial support for community-led adaptation (Window 1) and ecosystem restoration and renewable energy (Window 2), and the Investment Readiness that delivers action-oriented research on blue economy market gaps and technical assistance to BLU LPMUKP to improve microcredit access for small-scale fishers and fish farmers.

The activities under each Component are directly linked to the project's strategic objectives. Component 1 includes activities aimed at improving regulatory and financial frameworks, enhancing data management, and integrating gender and social inclusion into fisheries management. These foundational efforts set the stage for sustainable development within the blue economy. Component 2 leverages this foundation to provide direct financial support through grants (Window 1 and 2) that foster ecosystem restoration, develop alternative livelihoods, and enhance the climate resilience of coastal communities, while the Investment Readiness strengthen the enabling environment for blue economy finance.

Section 7: Options Analysis

The BEAM Project seeks to address the critical funding gap in Indonesia's blue economy by deploying grants from the Green Climate Fund (GCF) for a 6-year Project in the WPP 572 region. An evaluation of various grant mechanisms identified direct grants, reimbursable grants, revolving grants, technical assistance grants, and performance-based grants, to determine the most suitable funding approach for achieving Project goals.

A comparative analysis of these mechanisms highlighted direct grants as the optimal choice for BEAM due to their simplicity, flexibility, and ability to facilitate innovation. Direct grants provide upfront funding with low administrative burdens, enabling rapid project implementation and adaptability to unforeseen challenges. They also encourage risk-taking and experimentation, which are crucial for developing sustainable blue economy solutions. While other mechanisms like reimbursable or performance-based grants offer benefits such as financial accountability or investor appeal, their complexity and restrictive conditions make them less suitable for the immediate needs of BEAM's target beneficiaries, including coastal communities and MSMEs.

The rationale for selecting direct grants is further supported by successful precedents, such as the Coral Triangle Initiative and the GEF Small Grants Programs, which have demonstrated the effectiveness of demand-led grant mechanisms in driving marine conservation and community resilience. By adopting a transparent call-for-proposals process, BEAM aims to ensure equitable access to funding while aligning with local priorities for climate adaptation and blue economic growth. To maximize impact, the project will complement direct grants with technical assistance, addressing capacity gaps and laying the groundwork for future market-based solutions. This funding model not only addresses current gaps but also paves the way for sustainable, long-term development in the region.

1 Section 1: Baseline Description: Country and Project Area Profile

1.1 Approach and Methodology

To conduct an in-depth analysis of marine resource management and the development of the blue economy in the selected six provinces, a structured and multifaceted methodological approach was adopted. This approach was designed to be informed by accurate, relevant, and current data. Various data collection techniques were integrated, including desk review, focus group discussions (FGDs), in-depth interviews, and direct observation. The study sought to understand local community issues in the blue economy sector and identify sustainable interventions, with local enumerators in each province assisting. The methodology comprised three main components: desk review, field data collection, and data management and analysis.

1.1.1 Desk Review

The desk review established the knowledge landscape and context for primary data collection by analyzing secondary data sources on the blue economy and marine resource management in the target provinces. Key elements included:

- Literature Analysis: We conducted a thorough examination of academic journals, policy documents, government reports, and previous research studies to extract pertinent information related to the blue economy sectors, environmental sustainability, socio-economic dynamics, and regional development trends.
- Data Compilation: The process involved aggregating and synthesizing data from various sources to create a baseline understanding of fisheries production, marine conservation efforts, economic indicators, and socio-cultural aspects in the study area.
- Gap Identification: By analyzing the existing literature and data, we identified knowledge gaps and areas where additional research and data collection were necessary. This step helped to direct the focus of subsequent field research activities.
- Historical Context: Reviewing the historical context and evolution of the blue economy within these regions provided insights into long-term trends, policy changes, and their impacts on local communities and ecosystems.
- Regulatory Framework Analysis: We reviewed legal and policy frameworks governing marine resource management and economic activities in the coastal regions to understand the regulatory context and identify compliance and governance challenges.

1.1.2 Data Collection in 6 Provinces

The data collection phase was meticulously structured to capture a wide range of perspectives and information across the six provinces. This phase is separated into primary and secondary data collection, each serving distinct yet complementary purposes.

Primary Data Collection through FGDs, Interviews, and Observations

Interview participants were selected based on their roles in Blue Economy sectors, including representatives from the government, private sector entities, NGOs and local communities in the WPP 572 project areas.

- Ethical protocols were strictly followed. For data protection purposes, informed consent was obtained from the participants to ensure confidentiality, voluntary participation, and the right to withdraw. Focus Group Discussions (FGDs): FGDs in each province facilitated dialogue among stakeholders, revealing shared concerns, opportunities, challenges, and insights into regional blue economy and environmental sustainability practices.
- In-Depth Interviews: Targeted interviews were conducted with key informants who possess specific knowledge or experience relevant to the blue economy sectors. These interviews provided deep insights into individual and organizational roles, experiences, perceptions, and suggestions for sustainable marine resource management.

- Observations: Field visits to coastal communities, marine conservation areas, and fishing ports were conducted to observe on-ground conditions, practices, and interactions within natural and socio-economic environments.
- Significant efforts were made to collect information from women and marginalized groups throughout data collection. Additional information on these approaches and results can be found in Annex 08 Gender Assessment and Gender Action Plan.

Secondary Data Collection

- Regional and National Databases: We accessed and analyzed data from regional and national databases to obtain statistical information on marine resources, economic activities, demographic trends, and environmental indicators specific to each province.
- Document Review: Government reports, project documents, strategic plans, and previous research studies specific to the provinces under study were reviewed to supplement the primary data with historical, policy, and programmatic insights.
- Local Enumerator Teams: Small local enumerator teams were established in each province to facilitate data collection, ensure accuracy, and bridge the research team-community relationship, enhancing the credibility and depth of field data.

1.1.3 Data Management & Analysis

The data management and analysis phase was crucial for synthesizing the collected information into actionable insights. This phase ensured the systematic organization, processing, and examination of the data obtained from both primary and secondary sources.

Data Management

- Data Organization: All collected data, including notes from FGDs, interviews, observation reports, and secondary sources, were cataloged and stored in a structured database. This organization facilitated easy access and retrieval of information for analysis. All participants were fully informed about what data was being collected, how it would be used, and how their privacy would be protected. Consent was voluntary and personally identifying information was removed from the database / data points to ensure privacy of respondents.
- Quality Control: Rigorous checks were implemented to ensure the accuracy and reliability of the data. This involved verifying enumerator data, cross-checking facts, and reconciling discrepancies between different data sources.

Data Analysis

- Quantitative Analysis: Statistical methods were applied to quantify the data and identify patterns, trends, and correlations within numerical datasets.
- Qualitative Analysis: Thematic analysis was conducted on narrative data from interviews, FGDs, and field observations. This involved coding the data into themes and sub-themes, which allowed for the extraction of key insights, opinions, and narratives related to the study objectives.
- Integration of Findings: Both quantitative and qualitative findings were integrated to provide an understanding of the study's themes. This holistic approach facilitated a nuanced analysis of the socio-economic and environmental dynamics of the blue economy in the provinces.
- Reporting: The final step involved the compilation of the analyzed data into a coherent report, highlighting key findings, insights, and recommendations. The report also included visual aids like charts, graphs, and maps to effectively communicate the research outcomes.

1.2 Research Limitations

The study encountered several limitations that are important to acknowledge to better understand the context and scope of the findings:

- Inconsistency in Data Across Provinces: Variations in data availability and quality across the six provinces, resulted in discrepancies in data collection methods, reporting standards, and updates, complicating cross-regional comparisons.

- Accessibility and Completeness of Data: In certain areas, accessing comprehensive datasets was challenging due to restrictive data-sharing policies or the absence of systematic data collection mechanisms. This limitation sometimes led to gaps in the information needed for a full understanding of the local blue economy dynamics.
- Temporal Constraints: The study was conducted within a specific timeframe, which may not have fully captured seasonal or annual variations in economic activities, resource use, and environmental conditions. These temporal constraints could affect the representation of long-term trends and patterns.
- Resource Limitations: The study's comprehensiveness may have been compromised due to resource constraints such as time, budget, and manpower, particularly in regions requiring extensive fieldwork and data validation.

1.3 Country Profile

1.3.1 General Overview of Indonesia

Indonesia is an archipelagic nation with more than 17,000 islands and the world's third-longest coastline of 81,000 km.[4] Located between Asia and Australia, this 1.9 million km^2 island nation is home to 270 million people representing over 500 ethnic groups.[5]

Indonesia is a world center of marine biodiversity encompassing over 3,000 fish and 600 coral species, critical migratory species corridors, and among the most expansive, biologically diverse mangrove and seagrass ecosystems on earth.[6] In 2020, the Government of Indonesia (GoI) set an ambitious target for protection and effective management of 32.5 million ha (10%) of its territorial waters by 2030 ("MPA Vision 2030").[7] In early 2023, this ambition was increased to protecting 30% of its waters by 2045 ("MPA Vision 30x45"), representing a total area of 97.5 million ha.[8] This Vision recognizes the role of marine and coastal ecosystems and biodiversity in supporting local livelihoods and a robust national economy, including the world's second-largest marine capture fishery,[9] and is responsible for supplying approximately 25% of the global fisheries demand.[10] Marine resources contribute over USD 280 billion in economic activities, more than a quarter of Indonesia's GDP, with fisheries and aquaculture accounting for around 3% of GDP.[11] Indonesia's biodiverse coastal ecosystems, including mangroves, coral reefs, and seagrass beds, are crucial for supporting fish habitats and supporting the economy, generating around USD 4 billion annually.

image removed

Figure 1. Indonesian Waters and MPA Vision 30 x 45.[12]

Of its over 270 million people, an estimated 50% (130 million) of Indonesians live in coastal areas and are reliant on marine and coastal resources. These coastal villages are among the poorest and most vulnerable.[13] Besides fisheries, aquaculture, and tourism that provide jobs and income, well-managed

[4] The World Factbook
[5] Lewis, M. Paul (2009), Ethnologue: Languages of the World (16th ed.), SIL International, retrieved 17 November 2009
[6] Hadi, Tri & Muhammad, Abrar & Giyanto, Giyanto & Prayudha, Bayu & Johan, Ofri & Budiyanto, Agus & Rezza, Ahmad & Alifatri, La & Sulha, Siti & Shar, Suharsono. (2020). The Status of Indonesian Coral Reefs 2019.
[7] MMAF (2020). MPA Vision 2030 and Roadmap to MPA Management: Securing 10% of marine waters in Indonesia towards biodiversity protection and sustainable use. Ministry of Marine Affairs and Fisheries, Republic of Indonesia.
[8] Basten Gokkon, "Indonesia announces plan to protect 10% of its seas by 2030, and 30% by 2045," *Mongabay*, 26 August 2022.
[9] FAO. 2022. The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation. Rome, FAO. https://doi.org/10.4060/cc0461en
[10] MOI (Ministry of Investment). 2018. Investing in Indonesia's Fisheries Sector: An Overview of Opportunities, Capabilities, and Provisions. Jakarta.
[11] Fishery and Aquaculture Country Profiles: The Republic of Indonesia (FAO, 2014). Available online: https://www.fao.org/fishery/facp/idn/en#CountrySector-Overview

[12] Ministry of Marine Affairs and Fisheries, 2024.
[13] Cahagi, D and Gurning, R. (2018). A review on Indonesian fishermen prosperity in coastal areas.

ecosystems can be a source of supply of various products, including medicinal, biochemical,[14] and other industrial products that can contribute to community incomes.[15] For the majority of Indonesia fish and seafood are not just dietary options but essential sources of protein, highlighting the significant reliance of these resources for nutritional needs.

Indonesia's aspirations for sustainable ocean development and marine conservation face growing threats from climate change. Rising atmospheric and ocean temperatures are contributing to more frequent and increasingly extreme weather events, which, together with climate-induced sea-level rise, are exacerbating coastal flooding, erosion, and other hazards. in low-elevation coastal zones.[16] Indonesia is among the most vulnerable countries to climate change due to climate-driven disasters' current and projected impacts on various dimensions of Indonesian life (geographic, social, economic, and political). Climate-driven natural disasters (e.g., floods, droughts, storm surges) and gradual changes in climatic variables (e.g., sea level rise, rainfall pattern shifts, temperature increase), coupled with Indonesia's socio-political reliance on its natural resource capital, have led to Indonesia's ranking in the top third of countries in terms of climate change impact risk (56th out of 191) in 2022.[17] Coastal communities are particularly at risk and with more than 49 million people (~18%), Indonesia has the world's fifth highest population inhabiting low-elevation coastal zones, a figure that is expected to reach 62 million people by 2030.[18] In addition, in terms of the potential economic loss in these zones, Indonesia's marine and coastal sectors will suffer the most, with up to IDR 81.82 trillion lost by 2024.[19]

Diverse vulnerability assessments are needed to develop a precise adaptation plan for regional and local landscape conditions, as increased ocean temperature and acidification levels are expected to significantly alter ocean dynamics. This has the potential to drive unprecedented rates of ecosystem and biodiversity loss. These climate changes (see Section 3 for details) have cascading effects on marine ecosystems, biodiversity, and ocean resource-dependent human communities already experiencing human pressures of overfishing (around 82% of Indonesia's fishery areas are either fully or over-exploited), rapid coastal development and marine pollution. Despite these trends, there are significant opportunities to scale proven nature-based solutions that have the potential to deliver meaningful climate mitigation and adaptation benefits alongside positive marine and coastal ecosystem, biodiversity, and sustainable development outcomes, thus building resilience for ecosystems and protecting livelihoods and coastal communities

1.3.2 General Overview of WPP 572

Indonesia uses the *Wilayah Pengelolaan Perikanan* (WPP or "Fisheries Management Area") framework to delineate and manage its diverse marine and fisheries areas. WPP are divided based on ecological characteristics, regional features, and fish resources for sustainable fisheries management. As of 2014, there are eleven WPPs, with three starting with the numbering 57.[20] The naming and numbering of WPPs are aligned with the FAO's global fisheries management area divisions, where Indonesian waters fall into areas 57 (Indian Ocean, Eastern) and 71 (Pacific, Western Central).[21] WPP 572 is situated in the westernmost part of Indonesia, located in the Indian Ocean, to the west of Sumatra and includes the Sunda Strait—connecting Sumatra with Java. This area is of strategic importance to Indonesia due to its

[14] Dev Karan, Seema Dubey, Lucia Pirisi, Alexis Nagel, Ivett Pina, Yeun-Mun Choo, and Mark T Hamann Journal of Natural Products 2020 83 (2), 286-295. DOI: 10.1021/acs.jnatprod.9b00577

[15] Valuation studies of coral/coastal ecosystems services in Indonesia include this study for Savu Sea, and this study for Natuna Sea. In Berau, WWF has an unpublished study that the proposal team had access to.

[16] The low-elevation coastal zone is defined as the land area and the total and percentage population, by country, that is located in various low elevation coastal zone bands ranging from 1m to 20m elevation above mean sea level.

[17] INFORM is a multi-stakeholder forum for developing shared, quantitative analysis relevant to humanitarian crises and disasters led by the Joint Research Center of European Commission. The INFORM Climate Change Risk Index is among the four INFORM platforms that focuses on providing quantified estimates of the impacts of climate change on the future risk of humanitarian crises and disasters.

[18] Neumann B, Vafeidis AT, Zimmermann J, Nicholls RJ. Future coastal population growth and exposure to sea-level rise and coastal flooding--a global assessment. PLoS One. 2015 Mar 11;10(3):e0118571. doi: 10.1371/journal.pone.0118571. Erratum in: PLoS One. 2015;10(6):e0131375. PMID: 25760037; PMCID: PMC4367969.

[19] BAPPENAS-OECD (2021), Blue Economy Development Framework for Indonesia's Economic Transformation

[20] Ministry of Marine Affairs and Fisheries of the Republic of Indonesia. (2014). Regulation No. 18 of 2014 on the Management of Fishery Resources in the Fisheries Management Areas of the Republic of Indonesia. Jakarta, Indonesia

[21] Food and Agriculture Organization of the United Nations. (n.d.). Fisheries and Aquaculture Department Maps. FAO. Retrieved from https://www.fao.org/fishery/docs/maps/Default.htm#CURRENT

adjacency to international waters and its composition, predominantly of deep-sea waters. WPP 572 is a crucial fisheries management area in Indonesia, involving coordinated efforts from national and subnational governments, provinces, and municipalities. The management approach is multifaceted, encompassing ecological, economic, and socio-cultural aspects to ensure sustainable utilization and conservation of marine resources.[22]

In line with Indonesia's fisheries law (Law No. 45/ 2009), all management plans within WPP areas must reflect responsible administration, clear direction, and strategy, as well as policy-making considerations for various management settings and scenarios. The holistic approach evaluates potential, conserves, controls, and monitors natural resources, updating management plans every five years. It addresses fisheries exploitation, habitat degradation, socio-economic challenges, and governance issues through collaboration with various agencies in Indonesia, including MMAF, CSOs, BAPPENAS, and UNDP. These collaborations are aimed at collecting comprehensive information and addressing identified issues under the categories of fisheries resources, socio-economy, and governance.[23]

Map image removed

Figure 2. WPP 572.[24]

WPP 572 plays a significant role by contributing 19% to the country's overall fisheries production, and a crucial role in providing essential protein, food, and livelihoods to local populations in the region.[25] WPP 572 also encompasses marine areas located beyond a 12 nautical mile distance from the coastline. The 12 nautical mile boundary is an internationally recognized limit known as the "territorial sea," marking the extent of coastal state authority. Beyond this limit but up to 200 nautical miles, these waters are considered part of the "Exclusive Economic Zone" (EEZ), where Indonesia maintains certain rights for resource management and environmental protection but does not exercise the same level of territorial control as within the 12-mile zone. WPP 572 extends from the shoreline to the limit of the EEZ. WPP 572 is home to rich marine biodiversity, including notable species of pelagic fish and extensive ecosystems of mangroves, seagrass, and coral reefs. The inclusion of extensive Marine Protected Areas within WPP 572, covering an area of 984,554 ha, plays an instrumental role in sustaining this biodiversity. Protected zones are crucial for managing marine resources and ensuring sustainable fishing practices in Indonesia, a leading global producer of marine wild-capture fish.

WPP 572, despite its considerable potential, faces significant challenges in effectively managing marine resources and fisheries. Foremost among these is the lack of accurate fisheries catch data. This data deficiency severely impedes effective fisheries management, exacerbating issues related to illegal, unreported, and unregulated (IUU) fishing, and ecosystem degradation and ocean pollution. The economic implications of IUU fishing in Indonesia's WPP 572 are profound. IUU fishing leads to revenue loss and depletion of fish stocks, impacting local communities' livelihoods and the region's economy. For instance, the economic loss suffered by Indonesia due to IUU fishing is around IDR 30 trillion per year, highlighting the magnitude of the problem.[26]

The lack of accurate fisheries catch data exacerbates the challenge of sustainable fisheries management. This deficiency hinders the ability to make informed decisions regarding quotas, conservation measures, and the overall management of marine resources. IUU fishing contributes to overfishing, which is not only an economic concern but also an environmental one, leading to ecosystem degradation and reduced biodiversity.[27] The Indonesian government has established Task Force 115 to combat IUU fishing through

[22] Ministry of Marine Affairs and Fisheries of the Republic of Indonesia. (2016). Decision No. 76/KEPMEN-KP/2016 regarding the Fisheries Management Plan for the Fisheries Management Area of the Republic of Indonesia 572. Jakarta, Indonesia
[23] Koeshendrajana, S., Rusastra, I. W., & Sukadi, M. F. (2019). Potential and Dynamics of Marine and Fisheries Resource Management in WPP 572. In Marine and Fisheries Resource Potential of WPP 572 (1st ed., pp. xi + 248). Jakarta: AMAFRAD Press

[24] Ministry of Marine Affairs and Fisheries, Conservation Areas Map
[25] Gibson, E., N. Stacey, T.C.H. Sunderland, and D.S. Adhuri. 2020. “Dietary Diversity and Fish Consumption of Mothers and Their Children in Fisher Households in Komodo District, Eastern Indonesia.” PLoS One. https://doi.org/10.1371/journal. pone.0230777
[26] Ali, M., R., & Amrullah, R. (2020). Implementation of Fisheries Resources Protection from Illegal Unreported and Unregulated Fishing Practices. 3, 389-392. https://doi.org/10.36348/SIJLCJ.2020.V03I11.009.
[27] Lestari, D., Putra, A., & Larasuci, A. (2020). The main consequences of continued illegal, unreported, and unregulated (IUU) fishing within Indonesian waters for maritime security actors and coastal communities. Research, Society and Development, 9, 24911566. https://doi.org/10.33448/rsd-v9i1.1566.

law enforcement and policy reforms. While this approach has shown positive impacts, it's important to acknowledge that its indirect economic impacts are part of a broader sustainable fisheries policy since 2014.[28]

To further address the issue of IUU fishing in the context of the Blue Economy, a multi-faceted approach is required. This approach should include strengthening the collection and analysis of fisheries data, enhancing community involvement in policymaking, and improving the legal and regulatory frameworks. Such comprehensive strategies will not only address the immediate economic losses due to IUU fishing but also ensure the long-term sustainability and resilience of marine ecosystems, which are integral to the Blue Economy.

Additionally, addressing IUU fishing in the context of the Blue Economy must consider the complexities of climate change and the intricate political landscape.[29] The competing interests of economics and the environment, further complicate resource management. A well-defined framework or taxonomy for sustainable blue investments is needed to promote ecosystem restoration, conservation, and support the fisheries sector, which is crucial for coastal communities' livelihoods. Table 1 highlights marine environments and protected areas within WPP 572, which demonstrate the potential they offer to the country's fisheries industry.

Table 1. Overview of Marine Environments and Protected Areas in WPP 572

Ecosystem	Size (ha)[30]	Notes
WPP 572	94,368,838	Contains the following provinces: Aceh, Sumatera Utara, Sumatra Barat, Bengkulu, Lampung, Banten),
WPP 572 (Conservation Areas)[31]	1,319,058	1.4% of WPP 572 is in a Conservation Area
Marine Protected Areas (MPAs)[32]	548,705	0.58% of WPP 572 are in MPAs
Mangrove	48,311	Key for fisheries industries to maintain nursery stocks, as well as for carbon sequestration and storm surge mitigation
Seagrass	125,739	Key for fisheries industries to maintain nursery stocks, and supports wider ecosystem food chain
Coral Reef	168,400	Key for fisheries industries to maintain nursery stocks, and habitat for several species

The fisheries sector is a vital economic pillar in Indonesia's development, contributing 4% to the country's Gross Domestic Product (GDP) in 2020.[33] Beyond its economic importance, the ocean's resources play a crucial role in supporting livelihoods, ensuring food security, and enhancing the well-being of many households, particularly those in disadvantaged communities.[34]

[28] Suherman, A., Santosa, M., Wijayanto, D., Sunoko, R., & Juwana, S. (2020). THE ERADICATION OF IUU FISHING IN INDONESIA FOR ECONOMIC FISHERIES. SAINTEK PERIKANAN: Indonesian Journal of Fisheries Science and Technology, 16, 154-164. https://doi.org/10.14710/IJFST.16.3.154-164.
[29] MacAndrews, C. 1994. "Politics of the Environment in Indonesia." Asian Survey 34(4): 369–80. https://doi.org/10.2307/2645144.
[30] DJPRL, 2021, https://kkp.go.id/djpt/ditpsdi/page/5049-WPP-572
[31] The designated areas serve the functions of a wildlife sanctuary and a nature preservation area.
[32] MPA, or Marine Protected Area, is a legally designated conservation area managed for the purpose of safeguarding biodiversity, habitats, ecosystems, and overall marine ecology. MPAs encompass various types of areas, such as coral reefs, coastal regions, estuaries, deep-sea environments, and coastal waters.
[33] Badan Pusat Statistik, 2021
[34] Gibson, E., N. Stacey, T.C.H. Sunderland, and D.S. Adhuri. 2020. "Dietary Diversity and Fish Consumption of Mothers and Their Children in Fisher Households in Komodo District, Eastern Indonesia." PLoS One. https://doi.org/10.1371/journal. pone.0230777

Regarding climate risk and disaster vulnerabilities in the WPP 572 area, please refer to Section 3, Climate Change Vulnerability Assessment for details. The study therein utilizes four climate variables—air temperature, sea surface temperature, rainfall, mean sea level—to determine and analyze the climate exposure across the region. Air and sea surface temperatures are pivotal in assessing exposure risks affecting socio-economic aspects of WPP 572. Temperature fluctuations can cause coral reef bleaching, fish migration, food security, income, and coastal erosion, threatening livelihoods and the sustainability of the blue economy. Climate-related disasters pose a significant risk to WPP 572, posing economic, environmental, and population implications due to the rise in extreme weather patterns.

The region's geographical location and environmental conditions make it vulnerable to natural hazards, particularly the tectonic plate boundary along Sumatra's western coast, causing powerful earthquakes. This location jeopardizes the region's economic and environmental resilience against impending calamities, heightens food scarcity concerns, and leads to economic downturns due to the destruction of farmland and coastal habitats. Sumatra's subduction zone heightens the likelihood of volcanic activity, exemplified by the 1883 Mount Krakatoa eruption. Volcanic activities can cause land shifts and tsunamis, as seen in the 2018 Krakatoa eruption, which led to a 60.5% decrease in fish production. Moreover, climate variability phenomena can induce severe dry spells, escalating the threat of extended droughts. Specifically, in WPP 572, drought risks involve endangering 48.5 million people, economic damages of IDR 142.5 trillion, and environmental degradation over 2.28 million ha.[35]

Coastal erosion, exacerbated by ocean waves and currents, threatens 529,000 individuals and causes environmental damage across 3,941 ha of coastlines in WPP 572.[36] Tropical cyclones pose significant threats in the Indian Ocean regions of Bengkulu and Lampung, with cyclones like Anggrek, Bakung, and Durga causing significant damage between 2008 and 2014. These cyclones brought severe winds (60-110 km/h) and towering waves (over 6 m), disrupting fishing activities due to the suspension of maritime operations.

1.3.3 Provinces of WPP 572

1.3.3.1 Nanggroe Aceh Darussalam (Aceh Province)

Aceh Province, with its population of 5.40 million as of 2022, exhibits a coastal demographic, where approximately 1.80 million people reside along the West Coast. The province's economy heavily relies on agriculture, forestry, and fisheries, which collectively contribute to 30.6% of its Gross Regional Domestic Product (GRDP). In 2021, the GRDP was recorded at IDR 140.9 trillion, a noticeable increase from IDR 126.8 trillion in 2018. The fisheries sector alone accounted for IDR 6.8 trillion in 2022, representing 4.83% of the GRDP. This economic growth is reflected in the per capita income, which has risen from IDR 35.1 million in 2021 to IDR 40.1 million in 2022. In terms of occupation, the province hosts 75,763 fishers and 91,993 fish farmers, highlighting the importance of coastal and marine resources in the livelihoods of its inhabitants.

map image removed

Figure 3. Aceh Province.[37]

Aceh's socio-economic status is challenging, with a 14.75% poverty rate as of 2022, despite an increase in household incomes from IDR 5.84 million in 2021 to IDR 6.68 million in 2022. On the environmental front, Aceh is prone to natural disasters. The Data and Information on Indonesian Disasters (DIBI) 2022 report indicates frequent occurrences of floods, tornadoes, and forest and land fires in the region. The province has a history of disasters, notably the devastating earthquake and tsunami on December 26, 2004, which claimed over 200,000 lives. The Indonesian Disaster Risk Index (IRBI) of 2022 places Aceh

[35] The National Disaster Management Agency (BNPB). 2023. Indonesia's Disaster Risk: Understanding Systemic Risk in Indonesia. Jakarta (ID): BNPB Disaster Data, Information and Communication Centre.
[36] ibid

[37] Allen Coral Atlas (2022); Global Mangrove Watch; Ministry of Marine Affairs and Fisheries-Conservation Areas Map; Ministry of Environment and Forestry-Land Cover Map

in a high-risk category with a score of 149.1, emphasizing the urgent need for disaster preparedness and mitigation strategies.

Table 2. Sociodemographic and Environmental Profile of Aceh

Indicator		Value	Trend
Geography and Climate	Size	56,839 km^2	N/A
	Environmental Landscape	Extensive agricultural land and coastlines	
Population	Size (Total; West Coast)	5.40 million people (2022) West Coast: 1.80 million people	↑ Increasing 1.37% (2021)
	Density	92 people/km^2 Banda Aceh municipality (regional capital) density: 4,199 people/km^2 Rural density, such as Gaoy Lues Regency: 18 people/ km^2	High degree of urbanization, different development challenges between urban and rural regions (infrastructure connectivity and economic diversification)
	Geographic Distribution	27% of the population live in one of three regions (North Aceh: 11%, Pidie: 8%, Bireuen: 8%)	
Demographics	Age	64% (15 – 59 years) 36% (<14 years, >60 years)	
	Gender (total; west coast)	2.71 million males 2.69 million females; 0.91 million males 0.88 million females	
	Household Size	4.20	
Education	School Enrolment Rate (Overall)	99.4 % (ages 7-12)	↓ Decreasing Enrolment rate declines as children get older, especially in the 19-24 age group
	Literacy Rate (Overall)	99.6% (for >15 years)	
Income and Poverty	Poverty Rate	14.7% (2022)	
	Poverty Rate Ratio: Men to Women	Data not available	
	Household income / months	IDR 6.7 million (2022)	↑ Increasing IDR 5.8 million (2021)
GRDP	Overall	IDR 140.9 trillion (2021) (Agriculture, Forestry, and Fisheries representing 30.6% of GRDP)	↑ Increasing IDR 126.8 trillion (2018) (Agriculture, Forestry, and Fisheries representing 29.7% of GRDP)
	Per Capita	IDR 40.1 million (2022)	↑ Increasing IDR 35.1 million (2021)
	Fisheries	IDR 6.8 trillion (2022) (4.83% GRDP)	↑ Increasing IDR 5.7 trillion (2018) (4.51 %l GRDP)

Indicator		Value	Trend
Traded Commodities	Import	43.0 million USD (2023)	↓ Decreasing 65.9 million USD, (2022) -34.75% YoY
	Export (Domestic Production)	536.9 million USD (2021)	↑ Increasing 317.7 million USD, (2019) 78.73% YoY
Investment Flows	Foreign (PMA)	127.6 million USD (2022)	↑ Increasing 71.2 million USD (2018)
	Domestic (PMDN)	IDR 4.4 trillion (2022)	↑ Increasing IDR 1.0 trillion (2018)
MPAs	Established	8 MPAs (151,179 ha)	
	Planned	2 MPAs (24,769 ha)	
Job Types	Formal	38.5 % (2022)	↑ Increasing 38.1 % (2020)
	Informal	61.5% (2022)	↓ Decreasing 61.9% (2020)
	Fishers	75,763 (2022)	↓ Decreasing 8.9% (2021)
	Farm Fishers	91,993 (2022)	↑ Increasing 4.8% (2021)

1.3.3.2 Sumatera Utara (North Sumatra)

North Sumatra, with its population of 14.19 million, of which 2.04 million people are on the West Coast, is a region of economic activity and diversity. The province has experienced economic growth with an increase in GRDP from IDR 533.7 trillion in 2020 to IDR 573.5 trillion in 2022. Per capita income has also shown an upward trend, rising from IDR 36.2 million in 2020 to IDR 37.9 million in 2022. Agriculture, forestry, and fishing collectively make up 23.0% of the GRDP, although the fisheries sector specifically has seen a slight decline from 2.1% of the GRDP in 2018 to 1.7% in 2022. There are 166,005 fishers and 58,752 fish farmers in North Sumatra, indicating the region's reliance on marine and aquatic resources.

North Sumatra has seen a significant reduction in poverty, with the poverty rate dropping from 8.4% in 2022 to IDR 6.3 million per month. However, the province faces challenges from natural disasters like floods, tornadoes, and landslides, which damage infrastructure. According to the DIBI 2022 report, floods, tornadoes, and landslides are common, and in October 2022, the province was struck by five earthquakes of magnitude 6.0, causing significant damage to infrastructure including homes, religious buildings, government facilities, roads, bridges, and irrigation channels. The province has a 'medium' high-risk score of 142.51, indicating a need for robust disaster risk management and resilience planning.

map image removed

Figure 4. North Sumatra Province.[38]

[38] Allen Coral Atlas (2022); Global Mangrove Watch; Ministry of Marine Affairs and Fisheries-Conservation Areas Map; Ministry of Environment and Forestry-Land Cover Map.

Table 3. Sociodemographic and Environmental Profile of North Sumatra

Indicator		Value	Trend
Geography and Climate	Size	72,981 km^2	
	Environmental Landscape	Coastal Area to Tropical Jungles	
Population	Size (Total; West Coast)	14,19 million people; 2.,04 million people	↑Increasing 1.3% annual increase (2010-2020)
	Density	205 people/ km^2 (2021)	↑Increasing 203 people/ km^2 (2020)
	Geographic Distribution	16.5% Medan, 12.5% Deli Serdang while 0.4% Pakpak Bharat	
Demographics	Age	68.15% (15-64 years) 31.85% (<14 years, >65 years)	
	Gender (total; west coast)	7.49 million males, 7.44 million females; 1.01 million males, 1.02 million females	
	Household Size	4.2	
Education	School Enrolment Rate (Overall; Male:Female)	99.5% (ages 7-12)	↓Decreasing 96.8% (ages 13-15) 78.7% (ages 16-18) 26.6% (19-24)
	Literacy Rate (Overall; Male:Female)	99.6% (2022)	
Income and Poverty	Poverty Rate	8.4% (2022)	↓ Decreasing 0.6% (2021)
	Poverty Rate Ratio: Men to Women	Data not available	
	Household income / months	IDR 6.3 million (2022)	↑ Increasing IDR 6.0 million (2021)
GRDP	Overall	IDR 573.5 trillion (2022)	↑ Increasing IDR 533.7 trillion (2020)
	Per Capita	IDR 37.9 million (2022)	↑ Increasing 36.2 million (2020)
	Sectors	Fisheries IDR 10.0 trillion (1.7 % GRDP) (2022) Manufacturing and Wholesale and Retail Trade (19.5%) (2022) Repair of Motor Vehicles and Motorcycles (19.0%) Agriculture, Forestry, and Fishing (23.0%) (2022)	↓ Decreasing Fisheries IDR 10.8 trillion (2.1% GRDP) (2018)
Traded Commodities	Import	2,781.7 million USD (2023)	↓ Decreasing 3,058.4 million USD, (2022) -9.05% YoY
	Export (Domestic Production)	11,667.7 million USD (2021)	↑ Increasing 7,376.2 million USD, (2019) 48.4% YoY

Indicator		Value	Trend
Investment Flows	Foreign (PMA)	1,316 million USD (2022)	↑ Increasing 1,227 million USD (2018)
	Domestic (PMDN)	IDR 22.7 trillion (2022)	↑ Increasing IDR 8.4 trillion (2018)
MPAs	Established	4 MPAs (162,361ha)	
	Planned	12 MPAs (136,248 ha)	
Job Types	Formal	40.9% (2022)	↑ Increasing 40.4% (2020)
	Informal	59.1% (2022)	↓ Decreasing 59.6% (2020)
	Fishers	166,005 (2022)	↑ Increasing 11.8% (2021)
	Fish Farmers	58,752 (2022)	↑ Increasing 17.6% (2021)

1.3.3.3 Sumatera Barat (West Sumatra)

West Sumatra, with a total population of 5.64 million, has a coastal population of 2.91 million. The province's GRDP has been steadily increasing, with a growth rate of 4.4% in 2022, up from 3.3% in 2021. Fisheries contribute to the province's economy, with a GRDP share of 3.7%, and the sector supported 75,867 fishers and 84,469 fish farmers in 2022.

In 2022, West Sumatra's poverty rate was 6.0%, with a slightly higher rate in rural areas. Household income increased from IDR 7.55 million to IDR 8.43 million. West Sumatra, with an IRBI score of 144.39, is susceptible to various natural disasters due to its geographical location, including earthquakes, volcanic eruptions, tsunamis, floods, and landslides.

Map image removed

Figure 5. West Sumatra Province.[39]

Table 4. Sociodemographic and Environmental Profile of West Sumatra

Indicator		Value	Trend
Geography and Climate	Size	42,119.54 km^2	
	Environmental Landscape	Coastal Area to Tropical Jungles	
Population	Size (Total West Coast)	5.64 million people 2.91 million people	
	Density	134 people/ km^2 (2022) Most Dense: Bukittinggi Municipality: 5,060 people/ km^2, Least Dense: Kepulauan Mentawai 15 people/ km^2.	
	Geographic Distribution	The population living in urban areas accounts for 36.4% (e.g., Padang, Pariaman, Bukittinggi), while 63.7% reside in rural areas (e.g., Solok, Pasaman, Agam).	
Demographics	Age	68.2% (15-64 years) 31.8% (<14 years, >65 years)	
	Gender (Total; West Coast)	2.84 million males; 2.80 million females 1.46 million males ; 1.44 million females	
	Household Size	4.20	
Education	School Enrolment Rate (Overall)	99.6% (ages 7-12)	↓ Decreasing 96.5% (ages 13-15) 83.7% (ages 16-18) 35.4% (ages 19-24)
	Literacy Rate (Overall)	99.9%	
Income and Poverty	Poverty Rate	Overall: 6.0% (2022) Urban: 4.9% (2022) Rural: 6.9% (2022)	Overall: 6.0% (2021) Urban: 4.9% (2021) ↓ Decreasing Rural: 7.2% (2021) ↑Increasing
	Poverty Rate Ratio: Men to Women	N/A	
	Household income / months	IDR 8.4 million (2022)	↑ Increasing IDR 7.5 million (2021)

[39] Allen Coral Atlas (2022); Global Mangrove Watch; Ministry of Marine Affairs and Fisheries-Conservation Areas Map; Ministry of Environment and Forestry-Land Cover Map.

Indicator		Value	Trend
GRDP	Overall	IDR 285.4 trillion Growth Rate (2022): 4.4%[40]	Growth Rate (2021: 3.3%) IDR 164.0 trillion (2018) IDR 182.6 trillion (2019)
	Per Capita	IDR 50.6 million (2022)	↑ Increasing IDR 45.3 million (2021)
	Fisheries	IDR 6.7 trillion (3.7 % GRDP)	
Traded Commodities	Import	206.4 million USD (2023)	↓ Decreasing 280.5 million USD, (2022) -26.4 % YoY
	Export (Domestic Production)	3,067 million USD (2021)	↑ Increasing 1,368.4 million USD, (2019) 87.9% YoY
Investment Flows	Foreign (PMA)	180.8 million USD (2022)	↑ Increasing 95.6 million USD (2018)
	Domestic (PMDN)	IDR 2,6 trillion (2022)	↑ Increasing IDR 2.3 trillion (2018)
MPA	Established	6 MPAs (325,975 ha)	
	Planned	1 MPA (6,528 ha)	
Job Type	Formal	34.7% (2022)	↑ Increasing 33.7% (2020)
	Informal	65.3% (2022)	↓ Decreasing 66.3% (2020)
	Fishers	75,867 (2022)	↑ Increasing 3.1% (2021)
	Fish Farmers	84,469 (2022)	↑ Increasing 0.4% (2021)

1.3.3.4 Bengkulu

Bengkulu Province, with a total population of 5.40 million in 2022 and approximately 1.49 million residing along the West Coast, has significant reliance on coastal and marine resources. GRDP reflected a total of IDR 49.9 trillion, with a growth rate of around 3.3% in 2021. Per capita income in Bengkulu has been on the rise, with a notable increase from IDR 39.15 million in 2021 to IDR 43.74 million in 2022. The fisheries sector has shown a positive trend, contributing IDR 6.8 trillion to the GRDP in 2022, which accounts for approximately 4.8% of the total GRDP. The number of fishers and fish farmers in the province totals 37,315 and 15,208 respectively in 2022, emphasizing the importance of these sectors to the local economy.

[40] The Accommodation and Food and Drink Provision Business Field demonstrated the highest growth rate of 15.80 percent from the production side, while Household Consumption Expenditure Component experienced the highest growth rate of 4.12 percent from the expenditure side

The province of Bengkulu, however, faces socio-economic challenges, with an overall poverty rate of 14.3% in 2022, slightly higher in urban areas at around 14.5% compared to rural areas at around 14.2%. Despite these figures, there has been an increase in household income, from IDR 6.52 million per month in 2021 to IDR 7.29 million in 2022. Bengkulu, a high-risk region (with a score of 155.4) in 2022, faces significant vulnerability to natural disasters like floods, landslides, and tornadoes, necessitating effective disaster risk management and mitigation strategies to safeguard its population and livelihoods.

Map image removed

Figure 6. Bengkulu Province.[41]

Table 5. Sociodemographic and Environmental Profile of Bengkulu

Indicator		Value	Trend
Geography and Climate	Size	20,130 km^2	N/A
	Environmental Landscape	Extensive agricultural land and coastlines	
Population	Size (Total)	Total: 5.40 million (2022) West Coast: 1.49 million	
	Density	134 people/ km^2 (2022) Most Dense: Bengkulu Municipality: 2,560 people/ km^2, Least Dense: Kepahiang Regency: 205 people/km^2"	
	Geographic Distribution	Nearly 70% of the population of Bengkulu lives in coastal areas. Out of the 10 regencies/municipalities in the region, only 3 regencies (Rejang Lebong, Lebong, Kepahiang) do not have a coastal area.	
Demographics	Age	69.14 % (15-64 years) 30.86 % (<14 years, >65 years)	
	Gender (total; west coast)	1.05 million males; 1.00 million females 0.76 million males; 0.73 million females	
	Household Size	4	
Education	School Enrolment Rate (Overall)	99.5% (ages 7-12)	↓ Decreasing 97.7% (ages 13-15) 79.3 % (ages 16-18) 29.4 % (ages 19-24)
	Literacy Rate (Overall)	99.5% (>15 years old)	

[41] Allen Coral Atlas (2022); Global Mangrove Watch; Ministry of Marine Affairs and Fisheries-Conservation Areas Map; Ministry of Environment and Forestry-Land Cover Map.

Indicator		Value	Trend
Income and Poverty	Poverty Rate	Overall: 14.3% (2022) Urban: 14.5% (2022) Rural: 14.2% (2022)	Overall: 0.4% (2021)
	Poverty Rate Ratio: Men to Women	*Data not available*	
	Household income / months	IDR 7.29 million (2022)	↑ Increasing IDR 6.52 million (2021)
GRDP	Overall	IDR 49.9 trillion	Growth Rate: (2021: 3.3%)
	Per Capita	IDR 43.74 million (2022)	↑ Increasing IDR 39.15 million (2021)
	Fisheries	Fisheries IDR 6.8 trillion (2022) (4.8% GRDP)	↑ Increasing IDR 5.7 trillion (2018) (4.5 %I GRDP)
Traded Commodities	Import	8.5 million USD (2023)	↓ Decreasing 24.5 million USD, (2022) -65.31% YoY
	Export (Domestic Production)	238.1 million USD (2021)	↑ Increasing 208.6 million USD, (2019) 54.9% YoY
Investment Flows	Foreign (PMA)	136.6 million USD (2022)	↓ Decreasing 52.2 million USD (2018)
	Domestic (PMDN)	IDR 6.9 trillion (2022)	↑ Increasing IDR 4.9 trillion (2018)
MPAs	Established	0 MPA (0 ha)	
	Planned	4 MPAs (85,087ha)	
Job Type	Formal	32.5 % (2022)	↑ Increasing 30.8 % (2020)
	Informal	67.5 % (2022)	↓ Decreasing 69.2 % (2020)
	Fishers	37,315 (2022)	↑ Increasing 31.2 % (2021)
	Fish Farmers	15,208 (2022)	↓ Decreasing 6.5 % (2021))

1.3.3.5 Lampung

Lampung Province, with a population of 9.2 million and 5.1 million along the West Coast, has a significant dependency on its coastal regions, with a 3.3% growth rate in 2022. The per capita income showed a positive trend, with an increase from IDR 27.2 million in 2021 to IDR 28.1 million in 2022. The fisheries sector, crucial to the province's economy, contributed IDR 13.3 trillion, accounting for 5.2% of the GRDP, albeit slightly lower than the previous year.

In terms of livelihoods, the province supported 27,544 fishers and 59,804 fish farmers in 2022. However, Lampung faces socio-economic issues, with an overall poverty rate of 14.3%, and no significant

difference between urban and rural areas. Household income in Lampung has increased from IDR 4.5 million in 2021 to IDR 4.7 million in 2022, despite facing environmental challenges like floods, tornadoes, and landslides. According to the IRBI of 2022, the province has a medium risk index of 142.6, indicating a need for strategic disaster risk management and response mechanisms.

Map image removed

Figure 7. Lampung Province.[42]

Table 6. Sociodemographic and Environmental Profile of Lampung

Indicator		Value	Trend
Geography and Climate	Size	33,575 km^2	
	Environmental Landscape	Lampung Province features diverse environmental landscapes, including lush forests, coastal areas, and a thriving agricultural sector.	
Population	Size (Total; West Coast)	9.17 million people (2022); 5.08 million people	Growth rate: 1.1 % (2020) ↑ Increasing
	Density	273 people/ km^2 (2022) Most Dense: Bandar Lampung 6,585 people/ km^2 Least Dense: Pesisir Barat Regency 55 people/ km^2	
	Geographic Distribution	Notable cities and regions in Lampung include the provincial capital, Bandar Lampung, as well as Lampung Selatan (South Lampung), Lampung Utara (North Lampung), and Way Kambas National Park, known for its rich biodiversity.	
Demographics	Age	69% (15 – 60 years) 25% (< 14 years) 5% (>60 years)	
	Gender (total; west coast)	4.69 million males; 4.47 million females 2.61 million males; 2.47 million females	Sex ratio: 104.86

[42] Allen Coral Atlas (2022); Global Mangrove Watch; Ministry of Marine Affairs and Fisheries-Conservation Areas Map; Ministry of Environment and Forestry-Land Cover Map.

Indicator		Value	Trend
	Household Size	0.18	
Education	School Enrolment Rate (Overall)	99.4 % (ages 7-12)	↓ Decreasing 98.0 % (ages 13-15) 83.1 % (ages 16-18) 31.7 % (ages 19-24)
	Literacy Rate (Overall)	99.6%	
Income and Poverty	Poverty Rate	Overall: 14.3% (2022) Urban: 14.5% (2022) Rural: 14.2% (2022)	Overall: 0.4% (2021)
	Poverty Rate Ratio: Men to Women	*Data not available*	
	Household income / months	IDR 4.67 million (2022)	↑ Increasing IDR 4.53 million (2021)
GRDP	Overall	IDR 257.5 trillion (2022)	Growth Rate: (2021: 3.3%)
	Per Capita	IDR 28.06 million (2022)	↑ Increasing IDR 27.19 million (2021)
	Fisheries	IDR 13.3 trillion (5.18 % GRDP	Growth Rate: ↓ Decreasing 5.22% (2022) ↑ Increasing 0.79% (2021) ↑ Increasing 2.00% (2020) ↑ Increasing 2.40% (2019)
Traded Commodities	Import	977.7 million USD (2023)	↓ Decreasing 1,252.0 million USD, (2022) -21.91% YoY
	Export (Domestic Production)	4,844.0 million USD (2021)	↑ Increasing 2,929.2 million USD, (2019) 54.04% YoY
Investment Flows	Foreign (PMA)	247.8 million USD (2022)	↑ Increasing 132.3 million USD (2018)
	Domestic (PMDN)	IDR 5.8 trillion (2022)	↓ Decreasing IDR 12.3 trillion (2018)
MPAs	Established	2 MPA (132,609 ha)	
	Planned	9 MPAs (121,278 ha)	
Job Type	Formal	28.49 % (2022)	↑ Increasing 27.7 % (2020)
	Informal	71.51 % (2022)	↓ Decreasing 72.3% (2020)
	Fishers	27,544 (2022)	↓ Decreasing 9.8 % (2021)
	Fish Farmers	59.804 (2022)	↑ Increasing 1.0 % (2021)

1.3.3.6 Banten

Banten Province, with a population of 12.2 million and around 2 million living on the West Coast of Java, has a diverse economy reflected in its GRDP of IDR 747.3 trillion in 2022. The GRDP growth rate showed an increase to 4.4% in 2022 from 3.3% in 2021. Per capita GRDP improved to around IDR 61 million in

2022, up from around IDR 55.2 million the previous year. Fisheries contribute to the province's economy, with a noted GRDP share of 3.7%. The fishing industry in Banten includes 54,701 fishers and 39,408 fish farmers as of 2022. The province's poverty rate stood at 6.2% in 2022, showing a decrease from 6.5% in 2021. Household income saw an increase from IDR 9.2 million per month in 2021 to IDR 10.2 million in 2022. Banten's disaster risk, as per the 2022 IRBI, is rated as medium at 133.8, indicating the potential for natural disasters such as floods, tornadoes, and landslides, which requires effective disaster risk management.

Map image removed

Figure 8. Banten Province.[43]

Table 7. Sociodemographic and Environmental Profile of Banten

Indicator		Value	Trend
Geography and Climate	Size	9,353 km^2	
	Environmental Landscape	Banten Province boasts a diverse environmental landscape, encompassing coastal areas along the Java Sea, fertile plains, and the rugged terrain of the Ujung Kulon National Park, home to endangered species like the Javan rhinoceros.	
Population	Size (Total; West Coast)	12.2 million people 1.99 million people	
	Density	1,310 people/ km^2 (2022) Most Dense: Tangerang City: 10,825 people/ km^2, Least Dense: Lebak Regency 433 people/ km^2.	
	Geographic Distribution	-	
Demographics	Age	68.1 % (15-64 years) 31.8 % (<14 years, >65 years)	
	Gender (total; west coast)	6.24 million male; 6.01 million female; 1.02 million male; 0.97 million females	
	Household Size	4.10	
Education	School Enrolment Rate (Overall)	99.3 % (ages 7-12)	↓ Decreasing 96.39 % (ages 13-15)

[43] Allen Coral Atlas (2022); Global Mangrove Watch; Ministry of Marine Affairs and Fisheries-Conservation Areas Map; Ministry of Environment and Forestry-Land Cover Map.

Indicator		Value	Trend
			79.31 % (ages 16-18) 31.72 % (ages 19-24)
	Literacy Rate (Overall)	99.6%	
Income and Poverty	Poverty Rate	Overall: 6.2% (2022) 814,020 individuals	Overall: 7.5% (2022) 4.4% (2021)
	Poverty Rate Ratio: Men to Women	*Data not available*	
	Household income / months	IDR 10.16 million (2022)	↑ Increasing IDR 9.20 million (2021)
GRDP	Overall	IDR 747.25 trillion (2022)	Growth Rate: ↑ Increasing 4.36% (2022) 3.29% (2021)
	Per Capita	IDR 60.99 million (2022)	↑ Increasing IDR 55.20 million (2021)
	Fisheries	IDR 6.6 trillion (3.7 % GRDP)	
Traded Commodities	Import	8.3 billion USD (2023)	↓ Decreasing 9.7 billion USD, (2022) -14.31% YoY
	Export (Domestic Production)	13.5 billion USD (2021)	↑ Increasing 11.0 billion USD, (2019) 26.4% YoY
Investment Flows	Foreign (PMA)	3.4 billion USD (2022)	↑ Increasing 2.8 billion USD (2018)
	Domestic (PMDN)	IDR 31.3 trillion (2022)	↑ Increasing IDR 18.6 trillion (2018)
MPAs	Established	1 MPA (99.94 ha)	
	Planned	1 MPAs (7,391.00 ha)	
Job Types	Formal	52.0 % (2022)	↑ Increasing 50.8 % (2020)
	Informal	48.0 % (2022)	↓ Decreasing 49.2% (2020)
	Fishers	54,701 (2022)	↑ Increasing 29.9 % (2021)
	Fish Farmers	39,408 (2022)	↓ Decreasing 0.6% (2021)

1.4 Blue Economy Sectors

1.4.1 Blue Economy Definition

The blue economy promotes sustainable ocean resource use for economic growth, livelihoods, and ecosystem health, balancing economic priorities with ecological and social needs.

While the concept is well known, different definitions of the blue economy exist. The European Commission define it as *"all economic activities related to oceans, seas and coasts*,"[44] similar to the ocean economy definition from the OECD, which includes *"the assets, goods and services provided by marine ecosystems."*[45] The World Bank considers it related to the *"sustainable use of ocean resources for economic growth, improved livelihoods and jobs, and ocean ecosystem and health."*[46] To emphasize the importance of environmental and social considerations, UNEP uses the term 'sustainable blue economy', defined as *"one in which the sustainable use of ocean and coastal resources generates equitably and inclusively distributed benefits for people, protects and restores healthy ocean ecosystems, builds resilience and contributes to the delivery of global ambitions for a sustainable future."*[47]

The definition of blue economy in the context of Indonesia refers to the explanation of Article 14, Paragraph 1 in the Law Number 32 Year 2014 concerning the Sea, which is: *"The blue economy is an approach to promoting sustainable marine management and the conservation of marine and coastal resources and their ecosystems to generate economic growth through community engagement, resource efficiency, minimizing waste and multiple incomes."* For this project, this definition will be used in this document to ensure alignment with the country's goals and objectives.

The definitions of ocean sustainability emphasize the need to balance economic and social development while minimizing environmental risks.

In 2021, BAPPENAS, launched the "Blue Economy Development Framework for Indonesia's Economic Transformation." The document outlines Indonesia's sustainable blue economy framework, guiding future policy planning and implementation. It highlights opportunities for marine and coastal economic activities, promotes long-term development, research, and innovative advances, and addresses implementation challenges.

Based on the above concept and scope of ocean economy, the Blue Economy Development Framework proposes the following scope for categorizing traditional, emerging, and environmental activities as described in the table below:

Table 8. Emerging and Established Sectors of the Blue Economy[48]

Established sectors	Emerging sectors
Capture fisheries and seafood processing	Marine aquaculture
Shipping and ports	Deep-water and ultra-deep-water oil and gas
Shipbuilding and repair	Offshore wind energy
Offshore oil and gas (shallow water)	Ocean renewable energy
Marine manufacturing and construction	Marine and seabed mining
Maritime and coastal tourism	Maritime safety and surveillance

[44] The European Commission. 2020. The EU Blue Economy Report 2019. https://op.europa.eu/en/publication-detail/-/publication/676bbd4a-7dd9-11e9-9f05-01aa75ed71a1/language-en/
[45] OECD. 2016. The Ocean Economy in 2030. https://dx.doi.org/10.1787/9789264251724-en
[46] The World Bank. What is the Blue Economy. 2017. Infographic. https://www.worldbank.org/en/news/infographic/2017/06/06/blueeconomy
[47] UNEP in The Commonwealth. 2023. Rapid Readiness Assessment for the Transition to a Sustainable Blue Economy.
[48] BAPPENAS-OECD (2021), Blue Economy Development Framework for Indonesia's Economic Transformation

Established sectors	Emerging sectors
Marine business services	Marine biotechnology
Marine research and development and education	High-tech marine products and services
Dredging (coastal flood defence)	

The development of some of these sectors will play a key role in maintaining and improving the state of Indonesia's ocean, which is already experiencing ocean warming, acidification, loss of oxygen, growing dead-zones, and sea level rise.[49] These trends will limit the socio-economic benefits that society derives from the ocean. Existing industries that are transitioning to more environmentally sustainable practices may also benefit from blue economy development. These sectors may receive new and innovative investment in the form of better technologies and business models to promote and restore ocean health, as well as create jobs and improve well-being of Indonesian society.

1.4.2 Blue Economy Taxonomy

A "Blue Economy Taxonomy" does not yet exist in Indonesia, but the country has a vision to develop such a framework from the already established "Green Taxonomy". The Indonesian Green Taxonomy is a classification of economic activities that support environmental protection and management efforts, as well as mitigation and adaptation to climate change. It demonstrates an aspiration to manage natural resources and environmental conditions to support a sustainable economy. The Green Taxonomy is developed by the Financial Services Authority (OJK) in collaboration with eight ministries[50] including the Ministry of Marine Affairs and Fisheries (MMAF).

The Green Taxonomy, based on *Klasifikasi Baku Lapangan Usaha Indonesia*, (KBLI) categorizes green activities across various sectors and groups, including those not yet classified as green.[51] The Green Taxonomy also creates some room for sectors/groups/ business activities that are yet to be listed in KBLI according to clarifications from the relevant ministries. There are 2,733 sectors and sub-sectors that have been studied, and 919 can be mapped to sub-sectors/groups/business activities (KBLI Level 5) and clarified on its threshold by technical ministries. Among the 919 subsectors/groups/business activities, 904 are not yet able to be directly categorized as green sector (as there are prerequisites that must be met first) while the other 15 can be included directly in a green category.

Green Taxonomy aids OJK in identifying and classifying green activities, providing guidelines for investors, governments, and bond-issuers to integrate sustainability into investment decisions. In the absence of the Blue Economy Taxonomy, in 2021, Bappenas launched the *SDGs Government Securities Framework* (the "SDGs Framework"), to organize the financing of Blue Economy activities as described above. The SDGs Framework also serves as a foundation for developing financing opportunities for the blue economy.[52]

The SDGs Framework was developed to demonstrate how the Government of Indonesia intends to issue Green and Blue Bonds and Sukuks ("Green Securities"), and Social and Sustainability Bonds and Sukuks ("SDGs Securities"), collectively referred to as "Green and SDGs Securities" to fund projects that will

[49] IPCC, 2019: Summary for Policymakers. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.).

[50] Ministry of Maritime Affairs and Fisheries, Ministry of tourism and Economy, Ministry of Transport, Ministry of Industry, Ministry of Environment and Forestry, Ministry of Energy and Mineral Resources, Ministry of Public Works and Public Housing, Ministry of Agriculture

[51] The Indonesia Financial Services Authority (OJK). (2022). Indonesia Green Taxonomy, Edisi 1.0 - 2022.

[52] Indonesia issued the Samurai Blue Bond in May 2023, with total value of JPY 20.7 billion (USD 150 million). Further analysis on the Samurai Blue Bond issuance, challenges, as well as opportunities moving forward for creation of bonds and other instrument will be explored in Report 1.1 and 1.3.

deliver environmental and social benefits that support the nation to achieve its 2030 development agenda.[53]

In the Appendix: Eligible Blue Projects, a detailed table outlines various sectors and sub-sectors eligible for blue projects as per the Government securities framework. The table categorizes sectors of the Blue Economy based on environmental and socio-economic impact, allowing stakeholders to understand potential advantages and disadvantages within the framework.

The blue economy sector is identified using the 2017-2021 Maritime GDP, comprising 12 clusters and 373 KBLI, based on its theoretical concept and definition. Then, the guide to this Maritime GDP is matched with the Provincial GDRP sectors, which includes 52 sectors with 185 products.[54] The diagram depicts established and emerging sectors from the blue economy development framework, categorized into relevant sectors for provincial government development planning.

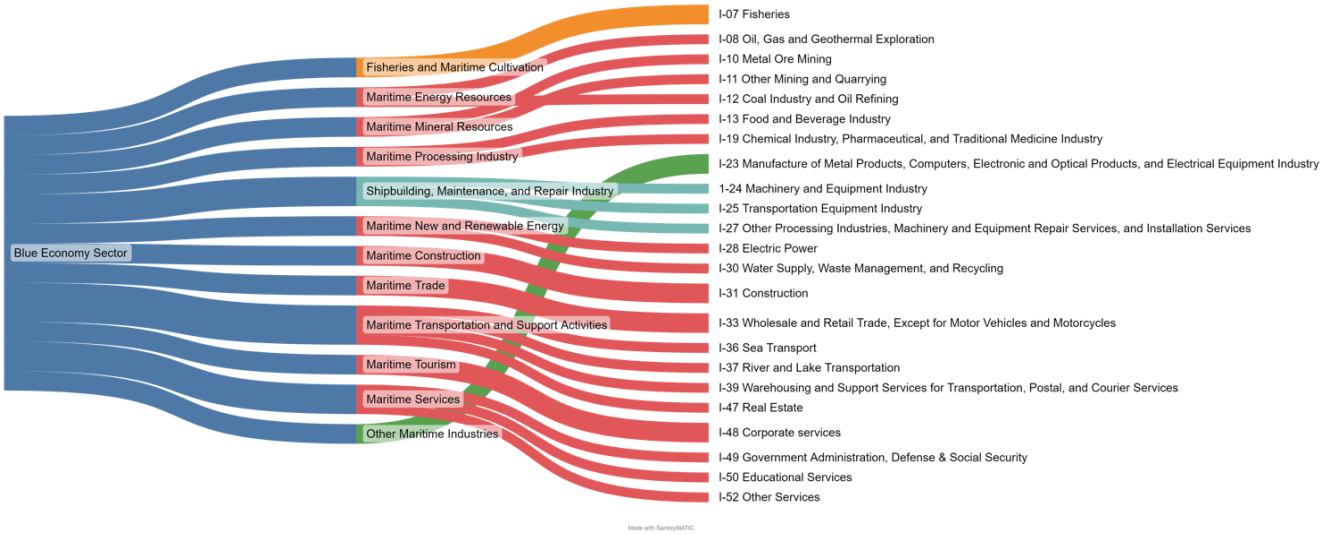


Figure 9. Twelve blue economy clusters relevant to development sectors[55]

The Blue Economy sector can use the Green Taxonomy as a reference with a more established framework in Indonesia. The following three examples of blue economy sectors that are already included in the green tagging issued by OJK are indicative of this integration:

Capture of Marine Ornamental Fish (KBLI Code: 3118): This sector—categorised under the Management of Biodiversity Natural Resources and Environment—encapsulates the essence of the blue economy. It includes activities related to the sustainable capture of marine ornamental fish. The practices within this sector demonstrate a commitment to preserving marine biodiversity while fostering economic activity. It exemplifies how traditional fishing activities can adapt to meet green criteria, focusing on ecological sustainability and responsible resource management

Capture of Non-Ornamental Marine Fish (KBLI Code: 3121): under the umbrella of Biodiversity Management, this sector reflects the broader aspects of the blue economy by encompassing activities related to the capture of non-ornamental marine fish. The blue economy emphasizes the importance of sustainable fishing practices, balancing economic gain with marine ecosystem health, and supporting local communities' livelihoods through green tagging systems.

[53] ROI SDGs Government Securities Framework
[54] Kementerian Koordinator Kemaritiman dan Investasi & Badan Pusat Statistik Indonesia. (2023). Laporan Hasil Perhitungan Produk Domestik Bruto Maritim Indonesia 2017-2021.
[55] Author's analysis based on data from 12 sector clusters in the "Report on the Calculation of Indonesia's Maritime Gross Domestic Product 2017-2021," adjusted according to the KBLI codes utilised by the BKPM (Indonesia Investment Coordinating Board)

Inter-Provincial Ferry Transport (KBLI Code: 50215): Classified under Green transport, this sector represents a critical component of the blue economy. The sector highlights the importance of sustainable maritime transport in the blue economy, demonstrating how it can become more environmentally friendly while maintaining connectivity needs.

The sectors of fishing and transport in Indonesia can align their practices with the principles of the blue economy, ensuring sustainable use of marine resources and contributing to the ecological health of marine ecosystems, thus providing a robust framework for sustainable development within the maritime sector.

1.5 WPP 572's Blue Economy Sectors

Based on the categories established in the Blue Economy Development Framework, this section identifies emerging and established sectors of the Blue Economy in WPP 572.

1.5.1 Overview of Established Sectors

1.5.1.1 Capture Fisheries

The fisheries sector in WPP 572 presents a complex scenario characterized by a diverse range of managed fish species. Small pelagic fish, large pelagic fish, demersal fish, reef fish, penaeid shrimp, lobsters, crabs, blue swimming crabs, and squid collectively contribute to the estimated potential of 12,011,122 tons within the Indonesian Exclusive Economic Zone, with WPP 572 accounting for approximately 10.24% of this total. Notably, over-exploitation is observed in large pelagic fish, reef fish, penaeid shrimp, lobsters, and blue swimming crabs, while demersal fish is fully exploited, and small pelagic fish, crabs, and squid are moderately exploited (See Appendix: Blue Economy Sectors in WPP 572).

Small pelagic fish, dominantly long-jawed mackerel (*Kembung; Rastrelliger kanagurta*), takes a prominent role in terms of production, closely followed by large pelagic fish at 256 tons (dominantly Mackerel Tuna/*Tongkol; Euthynnus affinis*). Economic analyses reveal that small pelagic fish significantly dominate the sector, contributing the highest average total value of IDR 9.2 trillion. Large pelagic fish and Aceh province emerge as noteworthy contributors, each accounting for IDR 7.08 trillion and IDR 3.2 trillion, respectively. The nuanced dynamics highlight the economic significance of the sector across regional and national contexts.

Fishing fleet data (2010 to 2021) reveals that the predominant fleets within WPP 572 consists of motorized vessels, primarily located in the provinces of Aceh and North Sumatra. In terms of trends, there was a noticeable increase in motorized vessels, particularly evident from 2017 to 2018, whereas motorized boats equipped with outboard engines and non-motorized vessels experienced a decline until the end of 2022. Comparing these trends with the overall patterns of fish catch types, there is a clear rise in the volume of small pelagic fish catches, alongside declines in other varieties such as reef fish and demersal fish. This suggests a shift towards larger fleets aimed at enhancing the production of small pelagic fish, which holds the greatest potential in WPP 572. At the Sibolga Fishing Port, there has been a three-year increase in the production of small pelagic fish, with larger vessels (exceeding 50 GT) also experiencing growth to boost small pelagic fish production (Hariarti, 2005; Hariarti & Amri, 2011). Moreover, estimations suggest a change and relocation of fishing grounds further offshore, resulting in a rise of motorized vessel fleets (Yusuf et al., 2020).

WPP 572's capture fisheries production typically exceeds 10% annually, with export volume increasing until 2020 and decreasing in 2021. Leading export commodities include tuna, TTC, squid-octopus-cuttlefish, and groupers. WPP 572 contributes 12% to the average GRDP of all provinces within its jurisdiction, with less than 2% (IDR 33.070 billion) fisheries sector contribution. Provinces like North Sumatra, Lampung, and Bengkulu have varying fisheries contributions. South Sulawesi has the highest fisheries GRDP nationally, contributing 8% to its total provincial GRDP. The data on capture fisheries production reveals a concerning trend in WPP 572. Despite an average catch production of 1.2 million tons from 2015 to 2020, the sector faces overfishing challenges, as evidenced by data from nine fish groups. Five fish groups surpass the established utilization rates: Large Pelagic Fish, Reef Fish, Penaeid Shrimp, Lobster, and Blue Swimming Crab (see **Table 11**). Notably, several provinces, including

Lampung and North Sumatra, show declines in catch production and GRDP over 2015-2020, signaling the need for attention and sustainable development in the capture fisheries sector within WPP 572.

Further analysis was conducted with the selection of priority fish species groups in WPP 572 based on an analysis recommending the following categories: large pelagic, small pelagic, demersal, and squid. The determination of priority fish species groups was carried out using a multi-criteria analysis methodology, considering production, environmental, and social factors, with specific parameters and scoring (see Table 18). The results of the analysis have identified 10 fish groups that should be prioritized, as indicated in the table below:

Table 9. Ten Priorities Fishgroup in WPP 572 Based on Multi-Criteria Analysis

Fish Group	Type of Fish Caught	Total Score
Large Pelagic	Tongkol	2.5
Small Pelagic	Teri	2.5
Demersal	Kakap merah	2.4
Demersal	Kerapu	2.3
Big Pelagic	Madidihang	2.2
Others	Cumi-cumi	2.1
Small Pelagic	Kembung	2.1
Big Pelagic	Cakalang	2.0
Big Pelagic	Tenggiri	2.0
Demersal	Manyung	2.0

The ten prioritized species align with Ministerial Decree Number 76 of 2016 regarding the Fisheries Management Plan in WPP 572, identifying 39 dominant fish species for management priority. This aligns with the government's programs, particularly those of the Ministry of Marine Affairs and Fisheries, in this regard. Continuous fish stock assessments are essential, and this represents one type of data contribution that can be made within an NGO's environmental program.

From the findings presented above, conducted through desk studies, field sampling, and FGD, it has been observed that there are gaps in fisheries data, including biodiversity, volume, and spatial distribution. A study on the deep-sea demersal fish capture in Indonesia noted that the lack of specific data per fish species and fishing effort makes stock assessment and the establishment of harvest control rules challenging.[56] Collaborative data collection methods involving fishermen in recording species and the length composition of catches have shown significant results in bridging data gaps, however, the implementation and participation of fishermen remain challenging.[57]

1.5.1.2 Shipping and Ports

WPP 572 encompasses a network of 65 cargo ports categorized by the Ministry of Transport into four hierarchical levels: Main, Collector, Regional, and Local Feeder ports. This classification reflects the ports' roles in domestic and international maritime activities, cargo and passenger handling, and inter-provincial ferry services. Each province within WPP 572 hosts at least one Main Port, contributing to the average distribution of 13 ports in Aceh, 26 in North Sumatra, 9 in West Sumatra, 3 in Bengkulu, 9 in

[56] Wibisono, E., Mous, P., Firmana, E., & Humphries, A. (2022). A crew-operated data recording system for length-based stock assessment of Indonesia's deep demersal fisheries. PLoS ONE, 17. https://doi.org/10.1371/journal.pone.0263646.
[57] *ibid*

Lampung, and 5 in Banten. Notably, Banten, as the westernmost province of Java Island, is a critical hub for crossings to Lampung and cities in Sumatra, as evidenced by its leading ship visitation figures, averaging around 18,000 units per year domestically with a Gross Tonnage (GT) of 70 million and 2,722 units internationally with a GT of 51 million.

Banten and North Sumatra are major shipping hubs, with high international visitation rates and significant domestic traffic due to Belawan Port. Banten leads in cargo handling, handling an average of 94 million tons per year domestically and 23 million tons internationally. Such figures affirm the strategic importance of Banten Province as a transport and logistics hub within the region.

The economic impact of these ports is evident in their export data, with palm oil, chemical products, and rubber being prominent commodities exported. The Belawan Port in North Sumatra exhibits the highest average export value, notably for palm oil-related products, highlighting the region's robust agricultural production. This export-oriented activity underscores the ports' significant roles in facilitating economic growth and regional development within WPP 572. The ports in Indonesia are crucial economic engines and key nodes in the maritime supply chain, as evidenced by their export figures, ship visits, and freight data. Ports are crucial for logistics and market access for products from WPP 572, including MSME and industrial businesses, ensuring their delivery to domestic and overseas markets.WPP 572's productive waters support a significant fishing industry infrastructure, with Aceh Province being the most prominent hub. The region hosts 208 ports and landing bases, with Aceh taking lead anchoring 113 fishing ports, iIt's important to recognize that the distribution of these ports extends beyond WPP 572; for example, the Ocean Fishing Port in East Sumatra is part of WPP 571, while Sibolga in WPP 572 houses the Nusantara Fishing Port. Aceh Province has the highest number of fishing ports and daily fish landing volume, primarily for local consumption. North Sumatra follows with 40.6 tons per day at Ocean Fishing Port and 87.4 tons at Fish Landing Bases. In contrast, Lampung Province has the lowest average fish landing volume at just 5.2 tons per day, indicating a more modest scale of fishery operations.

1.5.1.3 Fisheries Processing

The fisheries processing sector in WPP 572 is a significant component of Indonesia's coastal economy, characterized by a mix of traditional and advanced processing methods tailored to local and broader markets. In 2023, the Micro and Small-Scale Fisheries (MSF) segment, with at least 62,000 processing units as reported by BPS, is a cornerstone in providing food security, employment, and income, particularly in coastal communities. Employing traditional methods such as salting, sun-drying, smoking, and fermentation, these MSFs utilize natural processes, drawing on readily available resources like sunlight, salt, and smoke for preservation techniques that include dehydration, osmosis, and antimicrobial action. The industry, primarily based in Aceh and North Sumatra, is embracing advanced fermentation practices, controlled smokehouses, and technologically driven processing like freezing and canning, requiring specialized equipment and controlled environments. This integration of technology allows processors to meet diverse market demands, ranging from local consumption to international export. Within this diverse landscape, Medium and Large Fisheries (MLFs) are pivotal to Indonesia's export earnings, and in 2023, there were 1,619 MLF processing plants across the same six provinces. Freezing and canning emerged as the dominant processing methods, indicative of their crucial role in catering to both domestic and international markets. Regional disparities persist, with Bengkulu and Lampung favoring canning—a reflection of their commercial focus and capacity for value addition. Aceh, with its limited MLF activities, emphasizes fresh fish handling, suggesting a reliance on traditional fishing and a potential gap in large-scale processing infrastructure. Banten exhibits a wide range of processing techniques, such as drying and freezing, aligned with its advantageous position and easy access to important consumer markets.

The scale of these enterprises is delineated by the Regulation of the Minister of Marine Affairs and Fisheries No. 5 of 2021, the categorization of fisheries businesses as medium or large-scale is based on investment value and processing capacity. Medium-scale enterprises are defined by an investment value between IDR. 2.5 billion (approximately USD 175,000) and IDR. 10 billion (approximately USD 700,000) and a daily processing capacity of 500 kg to 5 tons of raw materials. In contrast, large-scale enterprises are characterized by an investment value exceeding IDR. 10 billion (approximately USD 700,000) and a daily processing capacity of over 5 tons. It is important to note that alternative thresholds based on specific criteria set by the Minister of Marine Affairs and Fisheries may apply to certain types of fisheries

processing businesses, as detailed in the Regulation of the Minister of Marine Affairs and Fisheries No. 10 of 2021.

The fisheries processing industry in WPP 572 is diverse, with larger enterprises focusing on frozen pelagic fish and shrimps, and smaller ones on dried or cured fish. Lampung, a prominent region, hosts established companies since the 1980s and 1990s, contributing to industry growth. Companies use wild-caught and farmed fish based on availability, seasonality, and market demand. This versatility is crucial in an industry where technological capacity, a dependable supply chain, and robust market relationships are vital for both newcomers and established firms alike.

1.5.1.4 Maritime and Coastal Tourism

The Western Sumatra Region, incorporating the provinces of Aceh, West Sumatra, North Sumatra, Bengkulu, Lampung, and Banten, is endowed with a wealth of maritime and coastal tourism attractions. With five DPN and four KSPN, along with nine National Tourism Development Areas[58], this region's allure lies in its pristine beaches, diverse marine life, and rich cultural heritage, making it a magnet for both domestic and international tourists. Out of the 329 marine tourism sites and destinations catalogued, beaches are the most prominent, especially in Aceh, which signifies the region's strong beach tourism sector. West Sumatra is distinguished by its well-established resort accommodation, and Aceh is noted for its specialty in surfing resorts and diving centers (See Figure below).

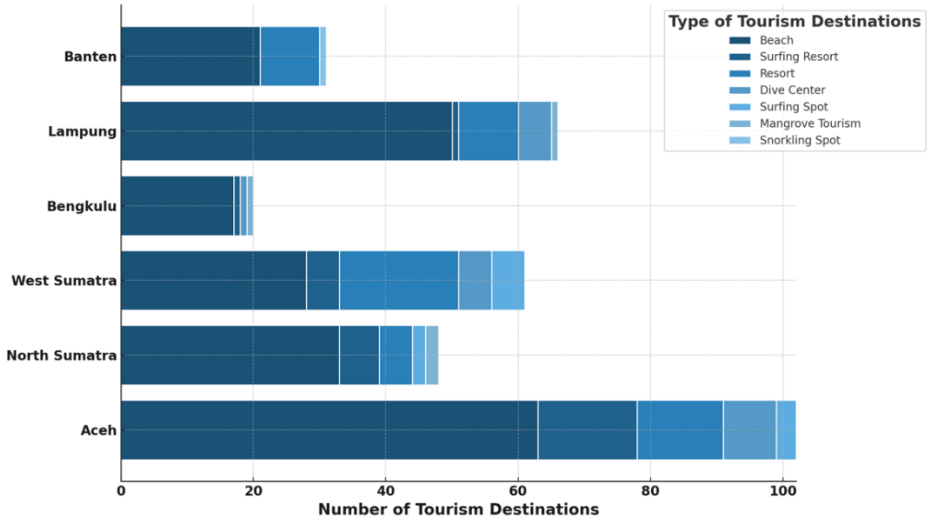


Figure 10. Distribution of Tourism Destination in WPP 572

The majority of international tourists come from Europe, Southeast Asia, and Oceania, with North Sumatra and Banten being the most visited provinces. Domestically, the maritime and coastal attractions within WPP 572 are popular. The Zonal Travel Cost Method evaluates tourism value across six provinces, revealing 82.4 billion USD annually. North Sumatra, primarily international, contributes the most, while Banten's economy is primarily sustained by domestic visitors. The disparity in economic contributions across provinces highlights the diverse economic dependency on tourism and points to potential areas for strategic growth and development (**Figure 11**).

[58] Peraturan Pemerintah (PP) Nomor 50 Tahun 2011 tentang Rencana Induk Pembangunan Kepariwisataan Nasional Tahun 2010 2025

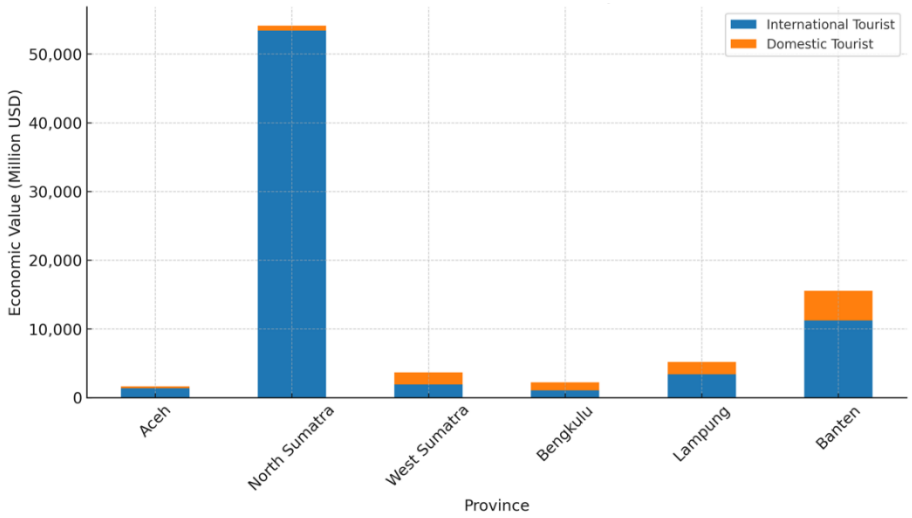


Figure 11. Economic Value of Maritime and Coastal Tourism by Province[59]

Sustainability and stakeholder collaboration are key to the region's marine tourism development, with challenges such as environmental degradation and socio-cultural disruption being areas of concern[60]. The advancement of cultural tourism has been identified as an avenue for increasing tourist retention, necessitating sensitive development strategies that acknowledge and preserve local traditions[61]. The livelihoods of local communities are intrinsically linked to the health of the marine ecosystem. Shifting from traditional fishing to marine tourism presents opportunities for economic diversification and community resilience[62]. Strategic investments and policy interventions are needed to sustain and enhance the marine tourism sector, focusing on authenticity and cultural integrity to boost local and national economies[63]. Attracting tourism investment necessitates a horizontal strategy that emphasizes resource efficiency and business support, thereby improving local economic indicators[64]. Mitigating environmental risks, such as illegal fishing and pollution, is essential to preserve the region's marine resources[65]. The creation of robust legal frameworks and active collaboration between public and private sectors can promote sustainable tourism development.

1.5.2 Overview of Emerging Sectors

1.5.2.1 Aquaculture

Aquaculture, particularly shrimp farming, has been globally scrutinized for its environmental impacts, including the destructive effects on mangrove forests.[66] Mangroves, the most carbon-rich forests in the tropics, play a crucial role in providing a range of ecosystem services and biodiversity conservation. Mangrove deforestation increases greenhouse gas emissions and impacts climate variables. WPP 572 challenges aquaculture expansion while balancing sustainability, aiming for innovative practices to maximize productivity while preserving mangroves' carbon sequestration.

[59] Author's analysis compiled from Ministry of Tourism and Creative Economy and data from the Central Statistics Agency of Indonesia.
[60] Towner, N., & Orams, M. (2016). Perceptions of surfing tourism operators regarding sustainable tourism development in the Mentawai Islands, Indonesia. Asia Pacific Journal of Tourism Research, 21, 1258 - 1273. https://doi.org/10.1080/10941665.2016.1140663.
[61] Elfriondi, Z., & Rina, N. (2021). Tradition, cultural contact and English for tourism: the case of Mentawai, Indonesia. Heliyon, 7. https://doi.org/10.1016/j.heliyon.2021.e07322.
[62] Zamzami, L., & Iwabuchi, A. (2019). From Fishing to Tourism: A New Generation of Fishermen and Marine Resource Tourism in Indonesia. Andalas International Journal of Socio-Humanities. https://doi.org/10.25077/aijosh.1.1.1-7.2019.
[63] Tarigan, M., Lubis, A., Rini, E., & Sembiring, B. (2019). Destination Brand Experience and Authenticity. Proceedings of the 2nd Economics and Business International Conference. https://doi.org/10.5220/0009328906320636.
[64] Parhimpunan, S. (2022). The Impact of Horizontal Strategy, Resource Efficiency & Business Facilitation in Tourism Foreign Direct Investment Towards Local Economic Growth in North Sumatra – Indonesia. Malaysian Journal of Business and Economics (MJBE). https://doi.org/10.51200/mjbe.vi.3858
[65] Suhaidi, Rosmalinda, Riadhi Alhayyan & Vita Cita Emia Tarigan (2022) Implementation of illegal, unreported, and unregulated fishing policies in North Sumatera Province, Cogent Social Sciences, 8:1, DOI: 10.1080/23311886.2022.2086282
[66] Ahmed, N., & Glaser, M. (2016). Coastal aquaculture, mangrove deforestation and blue carbon emissions: Is REDD+ a solution? Marine Policy, 66, 58-66. https://doi.org/10.1016/J.MARPOL.2016.01.011.

WPP 572's aquaculture sector uses traditional methods like fish grazing on plankton and seaweed, with traditional ponds dominating 69.97% utilization, but resulting in lower yields and increased disease susceptibility. Modern aquaculture utilizes technology and innovation, providing fish with factory-produced feed, vitamins, and medications, and employing IoT sensors for meticulous monitoring, leading to higher yields and accelerated growth rates. Emerging aquaculture systems are gaining ground, including:

- Recirculating Aquaculture Systems (RAS), which are closed-loop systems that reuse water and filter out waste, thereby reducing both water use and environmental impact. These systems are typified by fish tanks equipped with intensive filtration and oxygenation technologies.
- Biofloc Technology involves closed systems that capitalize on naturally occurring microorganisms in the water to provide nutrition and enhance water quality, potentially diminishing dependence on commercial feeds.
- Offshore Aquaculture, which are operations conducted in the open ocean, provide ample space for fish to grow and may mitigate disease transmission risks.
- Aquaponics is a symbiotic integration of fish farming with plant cultivation, using nutrients from fish waste to fertilize plants, thereby creating a self-sustaining ecosystem.

Support from the provincial government is essential to shifting towards intensive aquaculture systems. Supportive measures include the promotion of good aquaculture practices such as *Cara Budidaya Ikan yang Baik* (CBIB) and Indonesia Good Aquaculture Practice (Indo GAP), enabling fish farmers to achieve certification and allow premium market opportunities. They also link fish producers to funding resources like *Kredit Usaha Rakyat* (KUR) loans[67] or other platforms to encourage investment in sustainable techniques. The government's support extends to training programs and access to advanced technologies like Integrated Multi-Trophic Aquaculture (IMTA) and Recirculating Aquaculture Systems (RAS), which improve operational effectiveness and encourage ecologically friendly behaviours. Additionally, the government's role in promoting a cooperative community among researchers, industry professionals, and fish farmers is critical in transferring best practices and skills, which is a vital step towards the development of aquaculture in sustainable and diverse ways across the region.

Reflecting this sustainable development, in Aceh, traditional ponds employ a significant workforce of 57,100 fish farmers, their vital role in employment and livelihood. *Vannamei* and black tiger shrimp production thrive in these traditional brackish ponds, showcasing their historical significance. North Sumatra's aquaculture industry, dominated by 49.5% still-water ponds, is diverse, involving carp, catfish, tilapia, and milkfish, contributing significantly to production and economic value of various commodities.

West Sumatra relies heavily on still-water ponds, constituting 93.42% of the water area, with a focus on tilapia, carp, catfish, and gourami (See Appendix: Appendix: Aquaculture). Bengkulu's aquaculture landscape includes intensive ponds (52% of water area), while still-water ponds (43%), employing 11,291 people, contribute significantly to economic output and livelihoods. These ponds play a crucial role in sustaining livelihoods and supporting 71,018 individuals.

Lampung's aquaculture industry is characterized by traditional and semi-intensive ponds, accounting for 65.81% of the total water area. While *vannamei* shrimp production is prominent, still-water ponds employ most of the workforce (46.93%), indicating a labour-intensive nature. Banten stands out for its emphasis on *vannamei* shrimp in traditional ponds, comprising 81% of the area. Despite their smaller size, still-water ponds in Banten require a significant workforce of 32,879, underscoring their intensive management practices.

Seaweed contains potential compounds to be developed into high economic value products such as cosmetics and pharmacology. The potential for seaweed commodities in WPP 572 is dominated by brown seaweed (*phaeophyceae*) and red seaweed (*rhodophyceae*). BBPR2BKP has also produced several processed seaweed products from WPP 572, including tea, jelly, liquid fertilizer, and air freshener. This activity has produced new data, information and knowledge about seaweed processing products.

[67] People's Business Credit

However, its commercialization is constrained by the development on an industrial scale, lack of market analysis, and the absence of commercialization of research funding.

The aquaculture sector in WPP 572 exhibits a varied structure in terms of entity size and production capacity. Banten stands out as a focal point for aquaculture businesses, with a notable presence of medium-sized entities and one large enterprise, PT DPO Indonesia, surpassing IDR 50 billion in sales revenue. Top Indonesian entities like PT DPO Indonesia and Energi Pulau Suja compete in the seaweed, shrimp, lobster, and turtle commodities market, influenced by product diversity, technology adoption, and high demand.

Despite opportunities for growth, barriers to entry exist, encompassing challenges related to land availability, market access, and regional infrastructure discrepancies. Government regulations, exemplified by the Minister of Marine Affairs and Fisheries Regulation, play a pivotal role in shaping the competitive landscape by providing clear guidelines for aquaculture governance and environmental sustainability. The industry's growth potential is influenced by competition and regulatory frameworks, emphasizing the need for innovation and industry standard adherence.

1.6 Appendices

1.6.1 Appendix: WPP at a Glance

Table 10. WPP 572 at a Glance, 2018–19 and 2020–21

Item	2018-19	2020-21	Change (%)	Source[68]
Population				
Population	48,504,589	49,869,891	2.81%	BPS
Coastal population	14,484,327	14,942,583	3%	BPS
GDP				
GDP (USD, millions)	92,886	102,715	11%	BPS
GDP per capita (USD)	1.72	2.11	22%	BPS
Contribution to GDP (%)				
Fisheries	0.24	0.23	-7%	BPS
Agriculture	11.58	11.55	0%	BPS
Manufacturing	13.65	14.28	5%	BPS
Services[69]	9.32	9.42	1%	
Fisheries Production (tonnes)				
Capture fisheries	1,281,342	1,051,388	-17.95%	MMAF
Aquaculture	1,371,574	1,330,382	-3%	MMAF
Seaweed	62,632	37,698	-40%	MMAF
Fisheries Exports (tonnes)				
Capture fisheries & Aquaculture**	626,753	1,029,640	64%	BPS
Seaweed	975	1,173	20%	BPS
Foreign Direct Investment (USD, thousands)[70]				
Fisheries	164.1	5,287.3	3122%	MOI
Food crops and plantations	90,400.7	63,685.6	-30%	MOI
Domestic Direct Investment (USD, millions)				
Fisheries	1,364.69	5,055.74	270%	MOI
Food crops and plantations	319,313.21	260,524.36	-18%	MOI
MPAs				
Number of MPAs	35	44	26%	MMAF
Cover (ha)	N/A	548,705.48	N/A	MMAF
Essential Ecosystems				
Mangroves (ha)	N/A	48,311.14	N/A	MMAF
Coral reefs (ha)	N/A	168,399.69	N/A	MMAF
Seagrass (ha)	N/A	125,738.88	N/A	MMAF

** The data has been derived from six provinces situated within WPP 572, including Aceh, North Sumatra, West Sumatra, Bengkulu, Lampung, and Banten.*

[68] BPS: Statistics Indonesia (Badan Pusat Statistik); MMAF: Ministry of Marine Affairs and Fisheries (Kementerian Kelautan dan Perikanan); MOI: Ministry of Investment (Kementerian Investasi).
[69] Accommodation and food services; financial services and insurance; business; education; other services.
[70] Foreign direct investment for the fourth quarter of 2020

*** The exported data presented herein is sourced from BPS data on exports per province, specifically filtered using HS Export Codes. This includes HS Codes 03 (Fish and crustaceans, molluscs, and other aquatic invertebrates), 1603 (Extracts and juices of meat, fish, or crustaceans, molluscs, or other aquatic invertebrates), 1604 (Prepared or preserved fish; caviar and caviar substitutes prepared from fish eggs), 1605 (Crustaceans, molluscs, and other aquatic invertebrates, prepared or preserved) for fisheries and aquaculture products, and 1212 (Seaweeds and other algae) for seaweed.*

1.6.2 Appendix: Blue Economy Sectors in WPP 572

1.6.2.1 Appendix: Capture fisheries

WPP 572's fisheries stock assessment offers detailed insights into population sizes, distribution patterns, and sustainability of fish stocks, guiding effective management and conservation strategies for marine biodiversity. These species include small pelagic fish, large pelagic fish, demersal fish, reef fish, penaeid shrimp, lobsters, crabs, blue swimming crabs, and squid (See **Table 11**). The total estimated potential of fish species in the entire ZEEI amounts to 12,011,122 tons, with WPP 572 contributing approximately 10.24% of this total potential. Utilization levels for large pelagic fish, reef fish, penaeid shrimp, lobsters, and blue swimming crabs have been classified as *over-exploited*. In contrast, the demersal fish group is categorised as *fully exploited*, while the small pelagic fish, crabs, and squid groups are *moderately exploited*.

Table 11. Estimation of Potential, Allowable Catch, and Utilization Rate of Fishery Resources in WPP 572 According to Ministerial Decree Number 19 of 2022.

Fish Group	Estimation of Potential (tons)	Total allowable catch (tons)	Utilization Rate
Small Pelagic Fish	479,503	431,553	0.2
Large Pelagic Fish*	438,877	219,439	**1.1**
Demersal Fish	204,500	143,150	0.9
Reef Fish	33,429	16,715	**1.1**
Penaeid Shrimp	35,560	17,780	**1.5**
Lobster	2,722	1,361	**1.6**
Crabs	6,787	6,108	0.1
Blue Swimming Crabs	2,533	1,267	**1.6**
Squid	26,039	23,435	0.4
Subtotal WPP 572			**1,229,950**
Total WPP			**12,011,122**

Notes:

** : Large Pelagic Fish other than Tuna and Skipjack.*
E<0.50 : Moderate, fishing effort can be increased.
0.5<E<1 : Fully exploited, fishing effort should be maintained with strict monitoring.
E>1 : Over-exploited, fishing effort must be reduced.

The analysis of WPP 572 capture fisheries production data shows significant trends in species composition and regional contributions. Small pelagic fish species have the highest catch volume, with Aceh being the most significant contributor. North Sumatra primarily focuses on capturing small pelagic fish, averaging 121 thousand tons annually.

Based on historical data from 2018 to 2021 on fish catch volumes in the 5 provinces within WPP 572, there has been a significant decrease, especially between 2019 and 2021, after experiencing an initial increase. Even from 2020 to 2021, the decline in catch reached more than 50%. The COVID-19 pandemic has led to a decline in catch due to adverse weather conditions in Indian Ocean waters and restrictions on fish shipment activities.

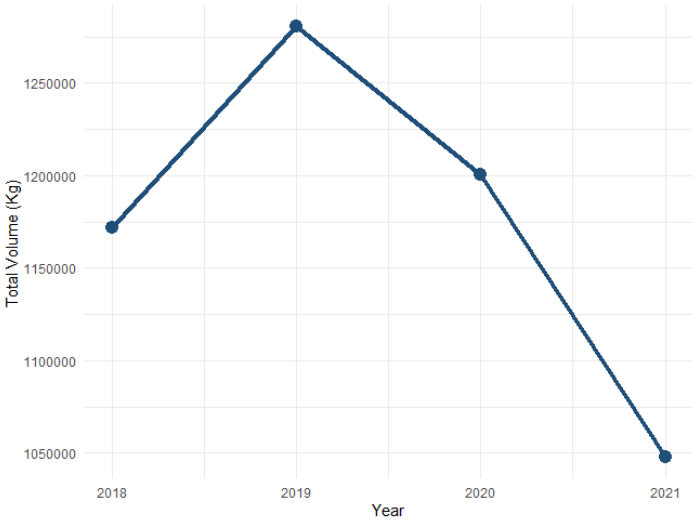


Figure 12. Total Volume of Capture Fisheries Production from 2018 to 2021

Looking at the trend of fish catch volumes based on fish groups, it is noted that the most significant decrease in catch is observed in large pelagic and demersal fish, including reef fish. Meanwhile, small pelagic fish experienced a significant increase from 2019 to 2020, followed by a slight decline in 2021.

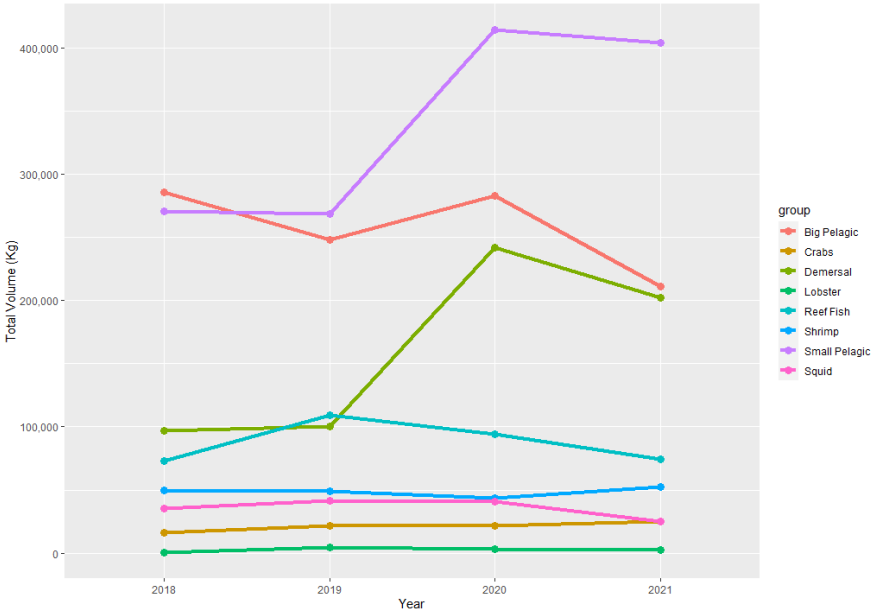


Figure 13. Total Volume of Capture Fisheries Production from 2018 to 2021 by Fish Group

Aceh province captures 115,000 tons of large pelagic fish annually, while North Sumatra province captures 121,000 tons of predominantly small pelagic fish. Small pelagic fish generate the highest average total revenue of IDR 9.2 trillion. Aceh contributes IDR 3.2 trillion from large pelagic fish, and North Sumatra generating IDR 3.1 trillion from small pelagic fish.

Table 12. Average Volume of Capture Fisheries Production (Year 2018-2021) by fish group (Unit: Tons)[71]

Fish Group	Aceh	North Sumatra	West Sumatra	Bengkulu	Lampung	Banten	Total
Large Pelagic	115,307.02	47,732.47	51,348.34	10,550.72	18,645.14	13,308.91	256,892.60
Small Pelagic	63,334.03	121,010.07	55,604.20	13,072.11	57,476.09	28,855.91	339,352.41
Demersal Fish	26,485.17	62,006.52	32,828.24	14,842.94	12,737.16	11,337.87	160,237.90
Reef Fish	18,801.87	37,351.77	11,829.51	6,204.69	5,295.27	8,305.33	87,788.44
Penaeid Shrimp	3.875.22	14,968.71	11,572.71	12,492.18	2,696.02	3,181.33	48,786.17
Lobster	176.97	89.82	954.03	1,175.52	41.08	491.44	2,928.86
Crabs	521.80	5,597.31	1,516.64	-	10,251.27	3,198.77	21,085.79
Squid	2,059.19	21,240.86	1,279.55	100.41	5,573.87	5,438.02	35,691.90

Table 13. Average Value of Capture Fisheries Production (Year 2018-2021) by fish group (Unit: IDR 1.000)[72]

Fish Group	Aceh	North Sumatra	West Sumatra	Bengkulu	Lampung	Banten	Total
Large Pelagic	3,216,892,757	1,320,474,721	1,332,321,409	321,696,560	620,331,725	276,141,348	7, 7.858,519
Small Pelagic	1,647,540,444	3,069,339,830	1,476,533,504	351,558,762	1.831.542.001	849,745,543	922,626,000
Demersal Fish	870,612,803	1,920,647,554	862,380,076	553,444,637	357,038,374	335,502,139	4,899,625,642
Reef Fish	883,358,064	2,421,634,057	603,760,962	349,712,793	275,865,646	495,060,611	5,029,392,132
Penaeid Shrimp	221,203,303	769,411,118	509,612,395	748,601,169	166,678,009	216,268,063	2,631,774,057
Lobster	31,608,692	24,838,914	62.745309	103,837,062	4,388,578	133,149,102	360,567,656
Crabs	18,061,967	253,498,988	61,222,169	-	444,069,497	203,525,499	980,378,118
Squid	79,693,123	786,057,453	55,597,428	4,115,841	171,894,103	231,997,818	1,329,355,766

[71] https://statistik.kkp.go.id/
[72] ibid

Based on the GRDP data by province, the total average GRDP of all provinces in WPP 572 is IDR 236 trillion, approximately 12% of the total GDP of Indonesia which amounts to IDR 19,588 trillion. However, the fisheries sector contributes less than 2%, amounting to IDR 33 billion to the overall GRDP in the provinces within WPP 572. The fisheries sector in North Sumatra and Lampung and Bengkulu significantly impacts provincial GDP, contributing 2% and 5%, respectively, compared to Indonesia's total GDP of less than 3% in 2022.

Table 14. The Value and Share of GRDP at Current Prices of Fisheries Sector by Province, 2021 (unit: IDR Billion)

Province	2015	2016	2017	2018	2019	2020	Average 2015-2020	Comparison to Total PDRB (%)	Increasing Average 2015- 2020	Increasing Average 2019 -2020
Aceh	669	7,235	7,908	8,578	9,272	9,526	7,198	4	23	3
North Sumatra	14,639	16,064	17,120	17,154	17,187	16,726	16,482	2	3	-3
West Sumatra	6,971	7,722	8,993	9,606	9,823	10,615	8,955	4	8	7
Bengkulu	3,795	4,095	4,413	4,793	4,909	5,446	4,575	6	7	10
Lampung	16,556	18,264	18,657	19,541	20,286	21,094	19,066	5	5	4
Banten	2,800	3,071	3,298	3,466	3,534	3,853	3,337	1	6	8
Subtotal	45,430	56,451	60,389	63,138	65,011	67,260	33,070	1	7	3

Source: Author's analysis compiled from Ministry of Marine Affairs and Fisheries statistics and data from the Central Statistics Agency of Indonesia.

Table 15. The Value of GRDP at Current Prices by Province

Province	2018	2019	2020	2021	2022	Average 2018-2022	Increasing Average 2018- 2022
Aceh	155,911	164,163	166,372	184,979	**211,750**	176,635	7
North Sumatra	741,347	799,609	811,188	859,934	**955,193**	833,454	6
West Sumatra	230,367	245,950	241,894	253,101	**285,379**	251,338	5
Bengkulu	66,403	72,098	73,305	79,603	**90,112**	76,304	7
Lampung	332,446	356,667	353,025	371,199	**414,131**	365,496	5
Banten	613,804	661,321	625,895	665,887	**747,250**	662,831	5
Subtotal	2,140,278	2,299,818	2,271,679	2,414,703	**2,703,815**	2,366,059	6

The data on capture fisheries in WPP 572 indicates that the average catch production from 2015 to 2020 reached 1.2 million tons, with a production value of IDR 34 trillion. The total production in WPP 572 contributes around 19% to the national average total fisheries production or approximately 21% to the national fisheries production value.

North Sumatra province dominates fisheries production in WPP 572, contributing significantly with an average total production of 482 thousand tons, representing approximately 39% of the total output in the region. This substantial contribution aligns with its impressive production value, totaling IDR 13 trillion.

WPP 572's fisheries data shows overfishing, with an average total catch exceeding the allowable 860 thousand tons. This trend, along with catch reductions in Lampung and North Sumatra provinces, suggests potential overexploitation and calls for improved fisheries management and conservation efforts. Table 16 presents data from the formal fisheries sector. Informal sector fishing activities are often overlooked in official figures, highlighting the need for a broader perspective to fully understand the full scope of these regions' fisheries production.

Table 16. The Volume of Capture Fisheries Production by Province, 2015 – 2020. Unit: Tons[73]

Province	2015	2016	2017	2018	2019	2020	Average	Increasing Average (%)
							2015- 2020	2015 - 2020
Aceh	173,034	189,261	236,061	288,034	265,209	304,283	242,647	10
North Sumatra	494,724	475,638	715,442	368,530	415,587	424,876	482,466	-10
West Sumatra	204,771	200,610	214,144	211,821	213,604	205,182	208,355	0
Bengkulu	62,291	62,426	65,755	67,299	70,829	68,070	66,112	2
Lampung	163,384	164,420	172,277	136,750	155,552	137,404	154,965	-4
Banten	68,006	52,445	108,703	100,487	160,562	74,726	94,155	-13
Subtotal	**1,166,210**	**1,144,000**	**1,512,382**	**1,172,921**	**1,281,343**	**1,214,541**	**1,248,700**	**-1**
National	**6,204,668**	**6,115,469**	**6,603,631**	**6,701,834**	**6,630,123**	**6,494,140**	**6,458,311**	

[73] https://statistik.kkp.go.id/

**The data in this table reflect the recorded capture fisheries production from the formal sector and do not include estimates from informal or artisanal fishing activities*

Table 17. The Value of Capture Fisheries Production by Province, 2015 – 2020 (Unit: IDR. 1,000,000)[74]

Province	2015	2016	2017	2018	2019	2020	Average	Increasing Average (%)
							2015 - 2020	2015- 2020
Aceh	4,076,787	4,551,602	7,296,406	9,621,976	7,343,863	8,247,428	6,856,344	10
North Sumatra	11,033,350	11,066,275	20,780,174	10,416,279	16,376,908	12,512,649	13,697,606	-9
West Sumatra	3,284,766	3,314,994	6,623,113	6,659,432	5,545,411	5,621,611	5,174,888	7
Bengkulu	1,344,543	1,387,463	2,145,828	2,761,936	2,626,145	2,532,356	2,133,045	10
Lampung	2,455,999	2,968,028	5,587,514	5,078,724	5,029,200	4,275,361	4,232,471	7
Banten	1,708,097	1,232,620	3,199,294	2,830,199	5,197,168	2,471,706	2,773,181	11
Subtotal	**23,903,542**	**24,520,982**	**45,632.329**	**37,368,546**	**42,118,695**	**35,661,111**	**34,867,534**	**4**
National	**110,051,683**	**111,362,581**	**184,620.258**	**204,213,404**	**180,259,441**	**171,529,685**	**160,339,509**	**6**

**The data in this table reflect the recorded capture fisheries production from the formal sector and do not include estimates from informal or artisanal fishing activities*

The selection of priority fish species groups in WPP 572 on **Capture Fisheries Chapter** is based on an analysis recommending the following categories: large pelagic, small pelagic, demersal, and squid. The determination of priority fish species groups was carried out using a multi-criteria analysis methodology. The parameters used in the analysis are as shown in the table below:

[74] https://statistik.kkp.go.id/

Table 18. Multi-criteria Analysis Parameter for Ten Priorities Fish group in WPP 572

Criteria	Scale	Weight Factor	References
Level of Exploitation	High=1 Medium=2 Low=3	5%	1. Ministerial Decree of MMAF No. 19/2022
Potential (Ton/tahun)	Low=1 Medium=2 High=3	10%	1. Ministerial Decree of MMAF No. 19/2022 2. Ministerial Decree of MMAF No. 76/2016 (RPP WPP 572)
Production Volume (Tons)	Low=1 Medium=2 High=3	15%	1. Center for Data, Statistics, and Information of the Ministry of Marine Affairs and Fisheries of the Republic of Indonesia. Average production volume across all provinces within the years 2020 - 2022
Production Value (IDR 1.000,-)	Low=1 Medium=2 High=3	15%	1. Center for Data, Statistics, and Information of the Ministry of Marine Affairs and Fisheries of the Republic of Indonesia. Average production volume across all provinces within the years 2020 - 2022
Home Range (Km)	High=1 Medium=2 Low=3	4%	1. Green, Alison & Maypa, Aileen & Almany, Glenn & Rhodes, K. & Weeks, Rebecca & Abesamis, Rene & Gleason, Mary & Mumby, Peter & White, Alan. (2014). Larval dispersal and movement patterns of coral reef fishes, and implications for marine reserve network design. Biological Reviews. 90. 10.1111/brv.12155. 2. Desk study/Web searching (Journal, Article, Report)
Population Trend	Low=1 Medium=2 High=3	3%	1. Desk study/Web searching (Journal, Article, Report)

Criteria	Scale	Weight Factor	References
Red List IUCN	Endangered, Critically Endangered =1 Near Threatened, Vulnerable =2 Not Evaluated, Data Deficient, Least Concern=3	3%	2. https://www.iucnredlist.org/
Export Market	Low=1 Medium=2 High=3	10%	1. Director General of Capture Fisheries, Statistics, Ministry of Marine Affairs and Fisheries (KKP). 2. Field Survey, 2023 3. Desk study/Web searching (Journal, Article, Report)
Local Consumption (Food Security)	Low=1 Medium=2 High=3	5%	1. Field Survey, 2023 2. Desk study/Web searching (Journal, Article, Report) 3. Expert Judgement
Local Community Impact	Low=1 Medium=2 High=3	5%	1. Field Survey, 2023 2. Desk study/Web searching (Journal, Article, Report) 3. Expert Judgement
Processing And Value Addition	Low=1 Medium=2 High=3	5%	1. Field Survey, 2023 2. Desk study/Web searching (Journal, Article, Report) 3. Expert Judgement
FGD and recommendation	Low=1 Medium=2 High=3	20%	1. Field Survey, 2023 2. Desk study/Web searching (Journal, Article, Report) 3. Expert Judgement

Based on Ministerial Decree No. 76 of 2016 regarding Fisheries Management Plan in WPP 572, there are 39 dominant fish species selected as management priorities. The selection of these priority fish species was done by identifying the catch fish species, conducting an inventory of the number of fishing vessels according to the types of fishing gear, and analyzing the composition of catch fish species according to the types of fishing gear. When comparing the data from the analysis in this study, there are several fish species that are included in the management priorities according to the Fisheries Management Plan of WPP 572. The comparison of fish species that are prioritized for management based on the Fisheries Management Plan of WPP 572 and the priority fish species from the analysis in this study is presented in the following table.

Table 19. Dominant Fish Species Based on Ministerial Decree No.76 of 2016

Types of Captured Fish	Latin Name	Contribution	Rank in Analysis
Kembung	*Rastrelliger spp.*	7.4	7
Teri	*Stolephorus spp.*	6.8	2
Selar	*Selar spp.*	6.4	20
Cakalang	*Katsuwonus pelamis*	5.5	8
Tembang	*Sardinella fimbriata*	4.3	19
Layang	*Decapterus spp.*	3.9	14
Tongkol komo	*Euthynnus affinis*	3.7	1
Tongkol krai	*Auxis tharzad*	3.6	1
Kuwe	*Caranx sexfasciatus*	3.3	18
Tongkol abu-abu	*Thunnus tonggol*	2.9	1
Tenggiri	*Scomberomorus spp.*	2.8	9
Peperek	*Leiognathus spp.*	2.2	13
Madidihang	*Thunnus albacores*	2.2	5
Layur	*Trichiurus savala*	1.9	15
Tetengkek	*Megalaspis cordyla*	1.9	
Kakap merah	*Lutjanussp.*	1.8	3
Manyung	*Netum athalassina*	1.7	10
Udang dogol	*Metapenaeus ensis*	1.6	21
Kurisi	*Nemipterus sp.*	1.5	12
Kerapu karang	*Epinephelus spp.*	1.4	16
Cumi-cumi	*Loligo spp.*	1.3	6
Udang putih	*Penaeus merguiensis*	1.3	-
Tenggiri papan	*Acanthocybium*	1.2	9
Bawal hitam	*Formio niger*	1.2	23
Kakap putih	*Lates calcarifer*	1.2	-
Beloso	*Saurida tumbil*	1.0	-

Types of Captured Fish	Latin Name	Contribution	Rank in Analysis
Tuna mata besar	*Thunnus obesus*	0.9	-
Cucut lanyam	*Carcharinus limbatus*	0.9	-
Swanggi/Matabesar	*Priachantus tayenus*	0.9	24
Ekor kuning/Pisang-pisang	*Caesio spp.*	0.9	33
Kuro/Senangin	*Eleutheronema tetradactylum*	0.9	25
Kapas-kapas	*Geres punctatus*	0.9	37
Bawal putih	*Pampus argenteus*	0.8	23
Biji nangka	*Upeneus mullocensin*	0.8	-
Japuh	*Dussumieria sp.*	0.8	-
Pari kembang/Pari macan	*Himantura undulata*	0.7	40
Lencam	*Lethrinus spp.*	0.7	28
Belanak	*Valamugil seheli*	0.7	22
Udang lainnya	-	0.7	-
Sebelah	*Psettodes erumei*	0.6	26
Daun bambu/Talang-talang	*Scomberoides sp.*	0.6	-

**The blue highlight indicates the top 10 priority fish type caught both in the analysis and recommended in the Fisheries Management Plan of WPP 572*

1.6.2.2 Appendix: Shipping and ports

In Indonesia, seaports can be categorized into two main categories namely 1) general transport seaports (human and cargo) which are managed by the Ministry of Transport, and 2) fisheries ports which are under the jurisdiction of MMAF. Both ports are crucial for the Blue Economy and Blue Halo S, serving as logistics and key components for market access, service, and goods.

Based on the hierarchy of public ports established by the Ministry of Transport, there are four categories of cargo ports in Indonesia:

- Main ports: for maritime transport, handling large volumes of cargo transfers, serving as origin and destination points for passengers and goods, and facilitating inter-provincial ferry services.
- Collector Port: The primary role of these ports is to facilitate domestic maritime transport activities, handle moderate volumes of domestic cargo transfers, and serve as points of origin and destination for passengers and/or goods. They also support inter-provincial ferry services.
- Regional ports: serve specific provinces or regions within a country, handling various goods and contributing to local and regional economic activities.
- Local feeder ports: crucial for domestic maritime transport, handling limited cargo transfers, serving as feeders for main and collector ports, and supporting ferry services within the province.

WPP 572 provinces have 65 cargo ports, with each province having a main port. Port distribution varies across categories, except Bengkulu and Banten.

Table 20. Distribution of Cargo Ports in WPP 572[75]

Port Type	Aceh	North Sumatra	West Sumatra	Bengkulu	Lampung	Banten
Main Port	1	2	1	1	1	1
Collector Port	6	8	2	0	1	1
Regional Port	3	12	3	2	4	3
Local Feeder Port	3	4	3	0	3	0
Total	13	26	9	3	9	5

The ports within WPP 572 play a strategic role as transport hubs, serving both domestic and international maritime activities. Based on data regarding the number of domestic ship visits, it is evident that the Banten Province has the highest domestic ship visitation figures among the provinces within WPP 572, averaging around 18,000 units per year with a total Gross Tonnage (GT) of 70 million. Gross Tonnage, a ship's internal volume, indicates port activity and potential revenue. Banten Province, Java Island's westernmost province, has the highest ship visitation values within WPP 572, with an average of 67 million GT annually.

map image removed

Figure 14 Distribution of Cargo Ports in WPP 572.[76]

Furthermore, when considering international ship visits, Banten Province stands out as well, with the highest international ship visitation rates averaging 2,722 units per year, amounting to an average GT value of 51 million per year, Apart from Banten, North Sumatra Province also records substantial international ship visits, reaching a total GT of 20.4 million and approximately 2,234 units per year. However, a significant portion of the international visits in Medan is centered around the Belawan Port located within WPP 571. For detailed information on Domestic and International Ship Call averages per year, please refer to Table 21.

Table 21. Domestic and International Ship Visits and Gross Tonages in WPP 572[77]

Provinces	Categorize	Domestic		International	
		Units	Total GT	Units	Total GT
Aceh	Subtotal in WPP 572	2,547	11,05,59		
	Subtotal other WPP	7,691	5,319,594	31	641,083
	Total	**10,238**	**16,414,653**	**31**	**641,083**
North Sumatra	Subtotal in WPP 572	4,908	4,833,478	3	5,538
	Subtotal other WPP	10,070	27,792,359	2,231	20,451,401

[75] Sea transport Statistic year 2020 - 2021, BPS Statistics Indonesia.
[76] Statistics Indonesia (2021)
[77] Sea transport Statistic year 2020 - 2021, BPS Statistics Indonesia.

Provinces	Categorize	Domestic		International	
		Units	Total GT	Units	Total GT
	Total	**14,978**	**32,625,837**	**2,234**	**20,456,939**
West Sumatra	**Total**	**4,792**	**7,484,997**	**411**	**6,412,861**
Bengkulu	**Total**	**1,218**	**23,229**	**275**	**807,601**
Lampung	Subtotal in WPP 572	6,696	24,907,143	637	14,868,475
	Subtotal other WPP	195	758,173	-	-
	Total	**6,891**	**25,665,316**	**637**	**14,868 475**
Banten	Subtotal in WPP 572	16,202	67,688,971	2,722	51,646,790
	Subtotal other WPP	2,407	2,408,908	-	-
	Total	**18,609**	**70,007,879**	**2,722**	**51,646,790**

In addition to examining ship visitation data at each transport port, the export potential data of ports in each province can provide insights for understanding and comparing their functions and significant roles within WPP 572. Banten Province in WPP 572 has the highest cargo loading and unloading value, handling 94 million tons for domestic activities and 23 million tons for international activities. The cargo loading and unloading ports in Banten are also located within WPP 572, making Banten Province a key hub for transport and logistics within the region. For detailed information on the Number of Domestic and International Voyage Freight (Container and Non-Container) averages per year, please refer to Table below.

Table 22. Voyage Freight Data for Cargo Handling in Provinces within WPP 572[78]

Provinces	Categorize	Domestic			International		
		Unloaded	loaded	Total	Unloaded	loaded	Total
Aceh	Subtotal in WPPNRI 572	1,124,380	790,833	1,915,213	17	8,028,804	8,028,821
	Subtotal other WPPN RI	1,612,587	1,073,352	2,685,939	219,354	367,986	587,340
	Total	**2,736,967**	**1,864,185**	**4,601,152**	**219,371**	**8,396,790**	**8,616,161**
North Sumatra	Subtotal WPPNRI 572	377,614	356,148	733,762	-	-	-
	Subtotal other WPP	6,865,705	342,095	7,207,800	2,149,699	5,677,682	7,827,381
	Total	**7,243,319**	**698,243**	**7,941,562**	**2,149,699**	**5,677,682**	**7,827,381**
West Sumatra	**Total**	**4,257,617**	**3,417,833**	**7,675,450**	**297,104**	**5,339,059**	**5,636,163**
Bengkulu	**Total**	**630459**	**30,099,892**	**30,730,351**	**5,029**	**1,355,282**	**1,360,311**
Lampung	Subtotal WPPNRI 572	13,251,937	18,915,839	32,167,776	4,350,546	14,458,382	18,808,928
	Subtotal other WPP	423,515	94,805	518,320	.	.	.
	Total	**13,675,452**	**19,010,644**	**32,686,096**	**4,350,546**	**14,458,382**	**18,808,928**
Banten	Subtotal WPPNR1 572	72,104,340	17,762,854	89,867,194	20,508,619	3,419,745	23,928,364
	Subtotal other WPP	4,255,893	.	4,255,893	.	.	.
	Total	**76,360,233**	**17,762,854**	**94,123,087**	**20,508,619**	**3,419,745**	**23,928,364**

[78] ibid

Table 23. Number of domestic and International Ship Calls by province at Commercial and Non Commercial Port, 2021[79]

Provinces	Categorize	Domestic		International	
		Units	Total GT	Units	Total GT
Aceh	Subtotal in WPP 572	2,547	11,095,059	N/A	N/A
	Subtotal other WP NRI	7,691	5,319,594	31	641,083
	Total	**10,238**	**16,414,653**	**31**	**641,083**
North Sumatra	Subtotal in WPP 572	4,908	4,833,478	3	5,538
	Subtotal other WPNRI	10,070	27,792,359	2,231	20,451,401
	Total	**14,978**	**32,625,837**	**2,234**	**20,456,939**
West Sumatra	**Total**	**4,792**	**7,484,997**	**411**	**6,412,861**
Bengkulu	**Total**	**1,218**	**2,303,229**	**275**	**807,601**
Lampung	Subtotal in WPP 572	6,696	24,907,143	637	14,868,475
	Subtotal other WPNRI	195	758,173	N/A	N/A
	Total	**6,891**	**25,665,316**	**637**	**14,868,475**
Banten	Subtotal in WPP 572	16,202	67,688,971	2,722	51,646,790
	Subtotal other WPNRI	2,407	2,408,908	N/A	N/A
	Total	**18,609**	**70,097,879**	**2,722**	**51,646,790**

[79] Sea transport Statistic year 2020 - 2021, BPS Statistics Indonesia.

Table 24. Number of domestic and International Voyage Freight (Container and Non-Container) at Commercial and Non-Commercial Port 2021 (Ton)[80]

Provinces	Categorize	Domestic		International	
		Unloaded	Loaded	Unloaded	loaded
Aceh	Subtotal in WPP 572	1,124,380	790,833	17	8,028,804
	Subtotal other WPP	1,612,587	1,073,352	219,354	367,986
	Total	**2,736,967**	**1,864,185**	**219,371**	**8,396,790**
North Sumatra	Subtotal WPP 572	377,614	356,148	-	-
	Subtotal other WPP	6,865,705	342,095	2,149,699	5,600,682
	Total	**7,243,319**	**698,243**	**2,149,699**	**5,600,682**
West Sumatra	**Total**	**4,257,617**	**3,417,833**	**297,104**	**5,339,059**
Bengkulu	Bengkulu	630,459	30,099,892	5,029	1,355,282
Lampung	Subtotal WPP 572	13,251,937	18,915,839	4,350,546	14,458,382
	Subtotal other WPP	423,515	94,805	-	-
	Total	**13,675,452**	**19,010,644**	**4,350,546**	**14,458,382**
Banten	Subtotal WPP 572	72,104,340	17,762,854	20,508,619	3,419,745
	Subtotal other WPP	4,255,893	-	-	-
	Total	**76,360,233**	**17,762,854**	**20,508,619**	**3,419,745**

[80] ibid

The Belawan Port in North Sumatra, known for its high average export value of USD 5 billion, is primarily responsible for the production of animal or vegetable fats and oils. (**Table 25**).

Table 25. Major Export Commodities from International Ports in Provinces within WPP 572[81]

Province	Port	Commodities	Volume (Kg)	Value (USD US)
Aceh	Calang	Palm oil and products	20,847,554	32,459,633
	Meulaboh	Fossil Fuel	8,747,387,333	326,457,392
West Sumatra	Teluk Bayur	Animal Or Vegetable Fats and Oils	2,015,567,675	1,543,250,920
		Rubber And Articles Thereof	132,044,905	193,981,925
		Chemical Products	69,157,437	53,537,732
Bengkulu	Pulau Baai	Coal	2,743,001	218,565,000
		Rubber And Articles Thereof,	29,354	50,185,000
		Palm Kernel She ll	56,386	5,460,000
Lampung	Panjang	Animal Or Vegetable Fats and Oils	1,651,363,379	1,399,852,365
		Coal	7,155,892,386	548,429,938
		Coffee, Tea, Mate, and Spices	268,992,609	480,527,379
Banten	Banten	Footwear	1,301,850,000	2,143,040,000
		Other articles of plastics and articles of other materials	1,155,140,000	1,141,410,000
		Iron or steel	1,321,205,000	722,650,000

In the fisheries sector, the MMAF has established a classification system for fishing ports to streamline operations and enhance the economic efficiency of the fishing industry within its territorial waters. The classification is delineated in MMAF Regulation No. 8 Year 2012 and categorized as follows:

Oceanic Fishing Port (*Pelabuhan Perikanan Samudera* - PPS): These are the largest fishing ports, capable of servicing vessels that operate not only in Indonesian territorial waters but also in ZEE and international waters. They offer substantial infrastructure, including docking facilities for ships of at least 60 GT, docks extending at least 300 meters with a minimum depth of -3 meters, and the capacity to accommodate at least 100 vessels or a total of 6,000 GT. Archipelagic Fishing Port (*Pelabuhan Perikanan Nusantara* - PPN): Medium-sized ports that service fishing vessels within Indonesian waters and the EEZ. These ports have docking facilities for vessels of at least 30 GT, dock lengths of at least 150 meters, and depths of at least -3 meters. They can accommodate at least 75 vessels or a total of 2,250 GT and manage land areas of at least 10 ha.

Coastal Fishing Port (*Pelabuhan Perikanan Pantai* - PPP): These ports cater to coastal fishing activities within Indonesian waters. They are equipped to handle smaller fishing vessels, with docking facilities for ships of at least 10 GT, dock lengths of at least 100 meters, and minimum depths of -2 meters. They can accommodate at least 30 vessels or a total of 300 GT and utilize at least 5 ha of land. Fish Landing Base (*Pangkalan Pendaratan Ikan* - PPI): Indonesia's smallest ports serve as landing bases for local fishing

[81] Sea transport Statistic year 2020 - 2021, BPS Statistics Indonesia.

vessels, accommodating vessels with docking facilities of at least 5 GT, 50 meters length, and -1-meter depth, and managing at least 1 ha of land. Aceh Province in Indonesia, with 113 fishing ports, is a significant hub for the fishing industry due to its high productivity in WPP 572 waters. Across all the provinces within WPP 572, there are a total of 208 fishing ports. The most common fishing port in this area is a fish landing base, but not all are within WPP 572, like the Ocean Fishing Port in East Sumatra and Nusantara Fishing Port in Sibolga. For more detailed information about the number of fishing ports categorized by province and port type in the year 2021, please refer to the table provided below.

Table 26. Number of Fishing Ports by Province and Port Type in WPP 572 (Year 2021)[82]

Provinces	Oceanic Fishing Port (PPS) (Class A)	Archipelagic Fishing Port (PPN) (Class B)	Coastal Fishing Port (PPP) (Class C)	Fish Landing Base (PPI)	Total
Aceh	1		1	111	**113**
North Sumatra	1	1		18	**20**
West Sumatra	1			10	**11**
Bengkulu			1	25	**26**
Lampung			3	4	**7**
Banten		1	2	28	**31**
Total	**3**	**2**	**7**	**196**	**208**

Meanwhile, the distribution of these fishing ports can be observed in the accompanying image labeled as Figure below:

map image removed

Figure 15. Distribution of Fishing Port in WPP 572.[83]

Aceh Province has the highest daily average volume of landed fish catch in WPP 572, with 513 tons per day. North Sumatra's PPS has 40.6 tons, lower than PPI's 87.4 tons and Lampung Province's 5.2 tons. Table 27 provides detailed statistics on the average volume of fish landings per day. Fish landing numbers may not accurately reflect actual production due to some vessels operating in the area being registered or originating from other locations, primarily from Java Island. Therefore, there is a possibility that these vessels land their catch in other areas other than WPP 572. To complicate more, there may be transshipment– the transfer of fish and other things from one vessel to another–occurring at sea and then landed elsewhere.

[82] Statistics of Fishing Port 2021, BPS Statistics Indonesia

[83] Statistics Indonesia (2021)

Table 27. Average Volume of Catching Fishes Landed per Day in Provinces within WPP 572 (Ton),2021[84]

Provinces	Ocean Fishing Port (PPS)	Nusantara Fishing Port (PPN)	Coastal Fishing Port (PPP)	Fish Landing Base (PPI)	Total
Aceh	3	0	4.975	513.9625	521.9375
North Sumatra	40.6	13.5	0	87.4	141.5
West Sumatra	11.95	0	0	118.175	130.125
Bengkulu	0	0	18.45	27.4575	45.9075
Lampung	0	0	2.425	2.775	5.2
Banten	0	8.65	9	92.745	110.395

1.6.2.3 Appendix: Fish Processing

Indonesia's fish processing sector varies regionally, with micro and small-scale businesses using traditional methods and local markets, while medium and large-scale industries specialize in advanced techniques.

1.6.2.3.1 The Opportunities of Fisheries Processing

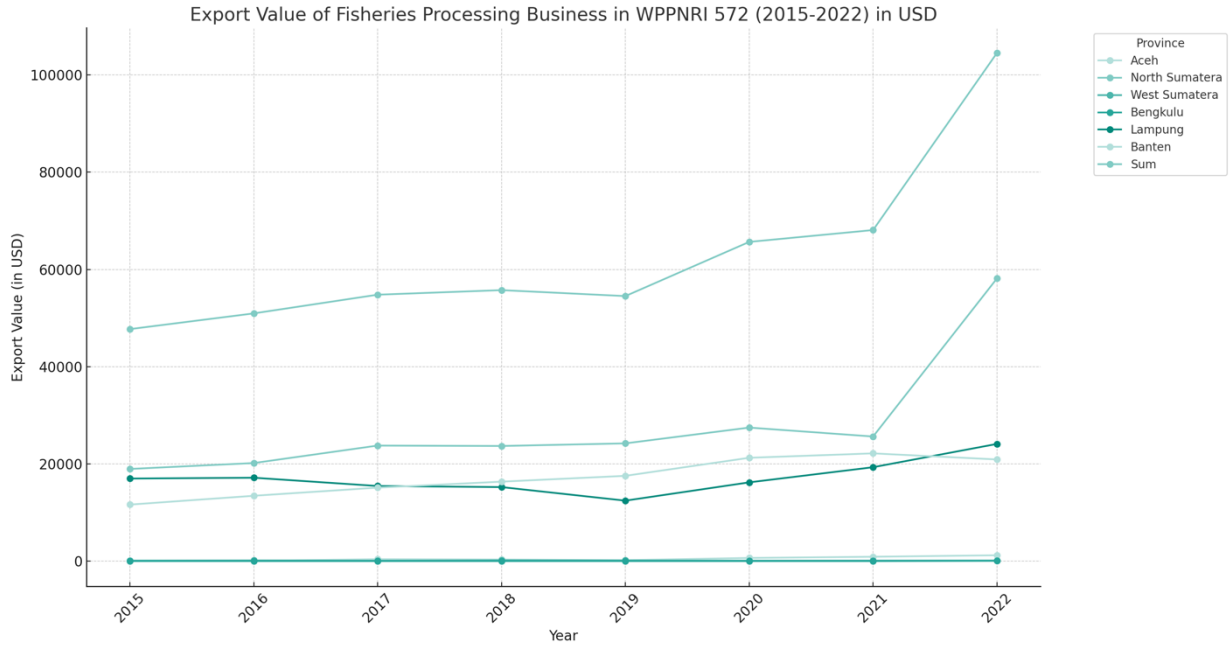


Figure 16. Export Value of Fisheries Processing Business (2015 - 2022)

The figure above shows the export value of each province in WPP 572 from 2015 to 2022, as compiled from government databases, where local sales data is difficult to obtain. In 2016-2017, there was a slight increase in sales, but in 2018-2019, fish export sales declined. However, from 2020 to 2021, export sales increased despite the pandemic situation. In 2022, exports saw a significant increase of 35% from the previous year, which was caused by the easing of pandemic restrictions and the increasing demand for seafood.

[84] Statistics of Fishing Port 2021, BPS Statistics Indonesia

Table 28. Investment in Seafood Processing in WPP 572[85]

IDR Million	2018	2019	2020	2021	2022	2023*
Investment Realization	226,758.00	193,620.33	171,415.40	124,776.00	143,226.50	243,241.90

The fisheries processing industry in WPP 572 experienced significant growth in 2018, with investment realization reaching IDR 226 billion. The industry experienced a slowdown in growth in 2019 due to decreased foreign direct investment and the COVID-19 pandemic, but showed signs of recovery in 2022 and 2023, with investment realization increasing to IDR 143 billion and IDR 243 billion respectively. This recovery suggests that the industry is resilient and has the potential to continue growing in the future.

Several factors contribute to the growth potential of the fisheries processing industry in WPP 572. These include:

- **Abundant Raw Materials:** Despite the overexploitation of some species, with proper management, WPP 572 can provide abundant fisheries resources. This abundance of raw materials provides a strong foundation for the fisheries processing industry, ensuring a steady supply of ingredients for processing and production.
- **Growing Domestic Demand:** Indonesia's population is expected to reach 293 million by 2045, boosting the domestic fish and seafood market. With rising incomes and evolving lifestyles, consumer preferences are shifting towards higher-quality seafood.
- **Rising Incomes:** Indonesia's middle class is expanding rapidly, driven by economic growth and rising disposable incomes. This growing affluence is accompanied by changing consumer habits and preferences.
- **Expanding Export Markets:** Indonesia, a significant global exporter of fish and seafood, can leverage its strategic location in Southeast Asia to access key markets like the US, Japan, China, and the EU, driving growth and expanding its global presence.

Despite its vast marine resources and strong potential for growth, Indonesia's fisheries industry in WPP 572 faces several constraints that hinder its development and limit its ability to fully realize its potential. These constraints include:

- **Lack of Infrastructure, Facilities, and Equipment:** Indonesia's underdeveloped fisheries infrastructure, particularly in Aceh, North Sumatra, West Sumatra, Bengkulu, Lampung, and Banten, hinders efficient transport, storage, spoilage, quality reduction, and the ability of fish processors to meet international standards.
- **Limited Technology for Processing:** The technology used in processing fish and seafood in Indonesia is generally low, such as freezing, canning, fermenting, smoking/grilling, and reduction/extraction. This outdated technology results in lower-quality products, reduced yields, and increased waste. The lack of access to advanced technologies such as Irradiation, High-Pressure Processing, and Enzyme Inhibition also hinders innovation and competitiveness in the sector.

Limited Access to Finance: WPP 572 highlights limited access to finance for micro and small-scale fisheries enterprises, hindering the adoption of sustainable practices and technologies due to financial institutions' perceptions of high-risk investments.

Inefficient Supply Chains: The supply chains for fish and seafood products in Indonesia are often inefficient and fragmented, leading to increased costs, reduced product quality, and lost market opportunities. This is particularly true in the regions of Aceh, North Sumatra, West Sumatra, Bengkulu,

[85] *MoI (2023)*

Lampung, and Banten, where transport infrastructure is poor and there is a lack of coordination among stakeholders

1.6.2.3.2 Fish Processing Business in Micro and Small Scale in WPP 572

MSFs play a vital role in the Indonesian economy. They contribute significantly to food security, employment, and income generation in coastal communities. In 2023, according to BPS there were at least 62.000 micro and small-scale fisheries processing plants in Indonesia.

The table displays the number of processing plants and methods in the MSF industry in six Indonesian provinces, including Aceh, Banten, Bengkulu, Lampung, West Sumatra, and North Sumatra, highlighting the region's thriving micro and small-scale fisheries sector. Processing methods vary across provinces, with fermentation being more prevalent in Aceh and North Sumatra, and mincing/surimi being more prevalent in Banten and Lampung.

Table 29. Distribution of Micro and Small Fisheries Processing Unit in WPP 572 Provinces[86]

Province	Number of Processing Unit	Fisheries Processing Methods (number of processing unit)
Aceh	1,989	Fermentation (3), Mincing/Surimi (160), Freezing (52), Panning (16), Handling of Fresh/Cold Products (112), Smoking/Grilling (163), Curing/Drying Salting (1,147), Other Processing (334), Reduction/Extraction (2)
North Sumatra	2,568	Fermentation (125), Mincing/Surimi (125), Freezing (22), Panning (137), Handling of Fresh/Cold Products (216), Canning (1), Smoking/Grilling (234), Curing/Drying Salting (1,447), Other Processing (261)
West Sumatra	1,968	Fermentation (1), Mincing/Surimi (102), Freezing (14), Handling of Fresh/Cold Products (32), Smoking/Grilling (131), Curing/Drying Salting (771), Other Processing (913), Reduction/Extraction (4)
Bengkulu	1,478	Mincing/Surimi (138), Freezing (14), Panning (1), Handling of Fresh/Cold Products (13), Smoking/Grilling (193), Curing/Drying Salting (707), Other Processing (412)
Lampung	2,122	Fermentation (28), Mincing/Surimi (784), Freezing (45), Panning (76), Handling of Fresh/Cold Products (256), Canning (4), Smoking/Grilling (75), Curing/Drying Salting (337), Other Processing (514), Reduction/Extraction (3)
Banten	1,504	Fermentation (13), Mincing/Surimi (543), Freezing (6), Panning (187), Handling of Fresh/Cold Products (45), Canning (1), Smoking/Grilling (26), Curing/Drying Salting (361), Other Processing (321), Reduction/Extraction (1)

The curing and/or drying salting fish production trend in WPP 572 provinces, particularly in Aceh, North Sumatra, and Bengkulu, is attributed to abundant raw materials and the use of small pelagic or less valuable fish like Decapterus sp and Carangidae family members, which align with local market demands and preserve cultural culinary practices. In contrast, Lampung and Banten exhibit a preference for pulverizing fish products. This inclination can be linked to the popularity of Banten and Lampung's culinary specialty, a fish cake delicacy that utilizes pulverized fish as a key ingredient. The demand for fish cake in Banten and Lampung has fueled the growth of pulverizing businesses in fisheries micro and small-scale enterprises, while West Sumatra's diverse processed fish products reflect its rich culinary traditions.

[86] *MMAF, 2022*

1.6.2.3.3 Fish Processing Business in Medium and Large Scale

Indonesia's MLFs significantly contribute to export earnings, government revenue, and fisheries sector investment. In 2023, there were 1.619 MLF processing plants in six provinces. Common methods include freezing and canning, with fermentation, smoking/grilling, and reduction/extraction also used.

There are some differences in the distribution of processing methods across provinces. For example, canning is more common in Bengkulu and Lampung, while reduction/extraction is more common in Aceh and North Sumatra.

Table 30. Distribution of Medium and Large Fisheries Processing Unit in WPP 572 Provinces[87]

Provinces	Total	Large Scale	Type of Industry (number of processing unit)	Medium Scale	Type of Industry (number of processing unit)
Aceh	13	4	Handling of Fresh/Cold Products (4)	9	Freezing (3)
					Handling of Fresh/Cold Products (6)
Banten	115	16	Freezing (4)	99	Freezing (36)
			Curing/Drying Salting (4)		Handling of Fresh/Cold Products (3)
			Other Processing (4)		Curing/Drying Salting (21)
			Reduction/Extraction (4)		Other Processing (27)
					Reduction/Extraction (12)
Bengkulu	3	N/A	N/A	3	Freezing (3)
Lampung	46	28	Freezing (28)	18	Freezing (9)
					Canning (6)
					Reduction/Extraction (3)
West Sumatra	6	N/A	N/A	6	Freezing (6)
North Sumatra	119	44	Freezing (29) Canning (12) Other Processing (4)	75	Freezing (60)
					Handling of Fresh/Cold Products (9)
					Curing/Drying Salting (3)
					Other Processing (3)

Aceh has a limited number of medium and large-scale fisheries processing industries, primarily focusing on fresh fish handling. Banten's diverse fisheries processing industries, despite its traditional fishing practices and lack of large-scale facilities, are largely due to its strategic location near major ports and consumer markets.

Banten's medium-scale fisheries processing sector, primarily focusing on frozen industries, is a key contributor to the growing demand for frozen seafood products in Bengkulu and West Sumatra. This is

[87] *MMAF, 2020*

likely due to the limited capacity of local processing facilities, leading to the transport of raw fish to nearby provinces with larger-scale industries, such as North Sumatra.

Lampung's fisheries processing industries are primarily focused on the frozen industry, primarily using crab and shrimp from abundant aquaculture sources like Vannamei and Black Tiger Shrimp. This is likely driven by the abundance of these species in Lampung's waters and the high demand for frozen crab and shrimp products in both domestic and export markets. Medium-scale fisheries processing industries in North Sumatra are dominated by frozen industries, with pelagic fishes being the main commodities. This is likely due to the abundance of pelagic fishes in the region and the growing demand for frozen pelagic fish products.

1.6.2.3.4 Fish Processing Business and Actors

The Indonesian fisheries processing sector is characterized by a diverse range of processing methods and products, reflecting the varied resource availability, market demand, and culinary traditions across the country. The government's emphasis on value-added products is fostering the advancement of innovative processing techniques and products. Concurrently, buyer preferences are influencing the production of fish products tailored to local tastes.

Among the WPP 572 provinces, Lampung thrives as one of dominant players in Indonesia fisheries processing industry. Five established fisheries companies, operating since the 1980s and 1990s, have contributed to this position.

Table 31. Prominent Fisheries Processing Entities in WPP 572[88]

No	Large Company	Main Product
1	Keong Nusantara Abadi	Frozen Escargot, Canned Escargot
2	Indokom Samudera Persada	Frozen Raw Shrimp, Frozen Boiled Shrimp
3	Phillips Seafood Indonesia	Frozen Pasteurised Seafood, Frozen Crab Meat
4	Central Pertiwi Bahari	Frozen Raw Shrimp, Frozen Boiled Shrimp
5	Anugerah Samudera Hindia	Frozen Cooked Tuna Loin, Frozen Pelagic

PT. Phillips Seafoods Indonesia is an Indonesian seafood processing company that specializes in crab meat, used in various seafood dishes. Established in 1994 by Phillips Foods Inc., the company expanded into Indonesia in the early 1990s due to the country's abundant seafood resources. It produces crab meat, frozen fish, and crab claws, selling to domestic and international customers in Indonesia, Southeast Asia, Europe, and the US.

A survey conducted among fisheries processing companies in WPP 572 revealed three distinct enterprise categories based on sales volume: small (sales below IDR 2.5 billion), medium (IDR 2.5 - 5 billion), and large (above IDR 5 billion). The processed fish product industry is dominated by larger entities, particularly in rural areas, and smaller enterprises, particularly in urban areas and near major ports, accessing larger markets and advanced processing facilities.

To enter the industry, capital, consistent raw material supply, technological capabilities, and reliable buyer relationships are crucial. However, maintaining production supply can be challenging, potentially leading to temporary cessation of operations. Larger processors can mitigate risk by diversifying their supply chain.

[88] *MoI (2023)*

Technology indeed plays a pivotal role, although not as the sole determinant of success. Consistent sourcing raw materials and maintaining robust customer relationships remain paramount.

1.6.2.3.5 Development Opportunities in Fisheries Processing

There are several opportunities to develop the Indonesian fisheries processing industry in WPP 572, including:

Promoting sustainable fishing practices: Encouraging sustainable fishing practices is vital for the long-term sustainability of the industry. The private sector can play a significant role here by investing in innovative fishing technologies and practices that reduce environmental impact and improve catch quality.

Investing in infrastructure: Investing in fisheries infrastructure, such as ports, cold storage facilities, and transport networks, particularly from private companies, can significantly enhance supply chain efficiency and reduce post-harvest losses.

Developing new products and markets: Developing new value-added fish and seafood products can help to increase domestic consumption and expand export markets.

Promoting technology adoption: Providing access to affordable and appropriate technologies, such as improved fishing gear, efficient processing equipment, quality control systems, will enhance productivity, product quality, and value addition.

Expanding access to finance: Establishing micro-lending schemes, providing loan guarantees, and financial capacity building, including promoting financial literacy will enable small-scale fisheries enterprises to invest in growth and sustainability.

Strengthening supply chain management: Improving transport infrastructure, promoting coordination among supply chain actors, and adopting digital technologies will streamline the flow of products and reduce inefficiencies.

Barrier and Risks Identification

Overfishing is the primary threat to the sustainability of the Indonesian fisheries processing industry. When fish stocks are depleted, it becomes increasingly difficult for fisheries enterprises to source raw materials, leading to higher prices and potential shortages of seafood products. This can have a domino effect on the downstream segments of the industry, including distributors, retailers, and consumers.

Illegal, Unreported, and Unregulated (IUU) fishing is a significant issue in Indonesia's fisheries industry, causing depletion of fish stocks, affecting the competitiveness of legitimate enterprises, and potentially introducing harmful practices.

Climate change is significantly affecting Indonesia's fisheries industry, affecting migration, habitat availability, and abundance, leading to increased production costs and potential seafood shortages. Indonesian fisheries processing industry faces market fluctuations due to consumer preferences, economic conditions, and geopolitical events, causing price volatility and challenging production and sales strategies.

Inconsistency of Shrimp and Tuna Quality can also be a barrier to the growth of the Indonesian fisheries processing industry. Low-quality products can damage the reputation of the industry and make it more difficult to export seafood products to high-value markets.

Incorrect mindset among fishermen can harm fishery resources, environment, and livelihoods, leading to short-term orientation, non-compliance with regulations, resistance to change, indifference to environmental conservation, and underestimation of risk management. Additionally, a mentality reliant on assistance hampers the progress of the fisheries sector and the lives of fishers.

1.6.2.4 Appendix: Maritime and Coastal Tourism

The Western Sumatra Region, including WPP 572, has significant potential in Indonesia's Blue Economy, especially in the marine and coastal tourism sector. It includes five DPN and four KSPN, nine National Tourism Development Areas, and 329 marine tourism sites and destinations, with notable differences in attractions across provinces. Beaches are the most common feature, comprising 64.4% of the total tourism

destination. Resorts follow, indicating a well-developed accommodation sector, particularly in West Sumatra. Surfing resorts, primarily in Aceh, and diving centers in Aceh and West Sumatra, showcase specialized tourism sectors with growth potential.

Sustainability and stakeholder collaboration are key to the region's marine tourism development, with challenges such as environmental degradation and socio-cultural disruption being areas of concern[89]. Cultural tourism boosts tourist retention, requiring sustainable development strategies. Shifting from traditional fishing to marine tourism offers economic diversification and community resilience.

Strategic investments and policy interventions are required to sustain and enhance the marine tourism sector. Initiatives should focus on authenticity and cultural integrity to bolster tourism's contribution to the local and national economy. Attracting tourism investment necessitates a horizontal strategy that emphasizes resource efficiency and business support, thereby improving local economic indicators.

Mitigating environmental risks, such as illegal fishing and pollution, is essential to preserve the region's marine resources. The creation of robust legal frameworks and active collaboration between public and private sectors can promote sustainable tourism development while safeguarding the ecological system. Economic Valuation of Marine and Coastal Tourism in WPP 572

The study uses ZTCM to estimate the economic value of six provinces of WPP 572 Maritime and Coastal Tourism, categorizing visitors into International and Domestic Tourists, allowing for spatial variation analysis and differentiation of economic values. The international visitor cohort was segmented into seven zones based on their geographic regions of origin: Southeast Asia, East Asia, South Asia, Oceania, Europe, America, and Africa. This segmentation facilitates the capture of the diverse value attributions placed on the area by international visitors, which may be influenced by cultural and economic disparities. Domestic visitors were categorized by zonation into four regions within Indonesia: Sumatra, Java, Lesser Sunda, and Sulawesi. This classification provides insights into the domestic valuation of the area, reflecting the economic and accessibility gradients within the country. The study used visitor data from BPS for analysis, estimating average travel costs based on transport expenses, using a conservative approach to minimize overestimating economic value. This estimation used a lower-bound cost assumption, reflecting the most economical means of transport available to visitors from their respective zones to the study area.

The ZTCM analysis proceeded as follows: (1) The number of visitors from each zone was determined based on the latest available statistics from BPS; (2) For each zone, the average travel cost was computed, incorporating the most economical transport options from the origin zone to the destination. This computation acknowledged the monetary cost of travel and incorporated a low-cost estimate to reflect a baseline economic valuation; (3) Using the calculated average travel costs and the corresponding visitor numbers, a demand function for each zone was estimated. This function represents the relationship between the cost incurred by visitors and the number of visits, facilitating the derivation of consumer surplus as a measure of economic value; (4) The consumer surplus for each zone was calculated using the demand curves. This surplus represents the excess benefit that visitors receive over the price paid for travel, thus quantifying the recreational value of WPP 572; and (5) OLS regression analysis was performed to determine the influence of travel costs and other socio-economic variables on the number of visits from each zone. The analysis considered socio-economic factors like visitor income, age, education, employment, travel frequency, and preferences, seasonal variations, tourism infrastructure, and region accessibility to understand tourism patterns within WPP 572 and provide a more accurate economic valuation.

The total economic value of tourism activities in WPP 572 is a significant USD 82.4 billion, which is deemed substantial due to its considerable proportion relative to the region's overall economic output. This valuation sees North Sumatra contributing the highest amount at USD 54.1 billion, while Bengkulu is the lowest

[89] Towner, N., & Orams, M. (2016). Perceptions of surfing tourism operators regarding sustainable tourism development in the Mentawai Islands, Indonesia. Asia Pacific Journal of Tourism Research, 21, 1258 - 1273. https://doi.org/10.1080/10941665.2016.1140663

contributor at USD 2.2 billion. North Sumatra relies significantly on international tourism, constituting 98.49% of its total economic value, equivalent to USD 53,370 million. In contrast, Banten stands out for its reliance on domestic tourism, contributing USD 4,315 million, representing 72.32% of its total economic value. This highlights the diverse economic dependence on tourism across provinces

International tourists significantly contribute to the economic value of WPP 572, accounting for 87.83% of the region's total value, with Lampung province being particularly reliant on this sector. Across the provinces, the average economic yield from international tourism is estimated at USD 12,056.13 million, juxtaposed against USD 1,437.43 million from domestic tourism. Aceh, with minimal international tourism input of USD 1,373.91 million, is a prime candidate for focused economic interventions. The role of the tourism sector as a significant employment generator in the region cannot be understated, with 3,572,402 individuals[90] being directly engaged or employed within this sector. The employment aspect of tourism in WPP 572 is crucial for understanding its socio-economic implications and developing effective development strategies.

Table 32. Economic Valuation of Maritime and Coastal Tourism in WPP 572 Presented in USD*[91]

Province	Economic Value from International Tourist	Economic Value from Domestic Tourist	Total Economic Value
Aceh	1,373,912,101	285,290,637	1,659,202,737
North Sumatra	53,370,143,757	747,050,451	54,117,194,209
West Sumatra	1,915,073,886	1,765,814,252	3,680,888,137
Bengkulu	1,039,151,393	1,187,124,988	2,226,276,381
Lampung	3,413,739,572	1,763,711,591	5,177,451,163
Banten	11,224,729,953	4,315,543,545	15,540,273,498
Total Economic Value	**72,336,750,662**	**10,064,535,464**	**82,401,286,126**

**IDR 15.664,00 per USD, currency rate of December 2023*

1.6.2.4.1 Tourist Destination and Infrastructure in WPP 572

The study identifies 329 marine tourism objects in WPP provinces, highlighting the diverse attractions and natural beauty of the area through GIS applications.(see the following link: Maritime and Coastal Tourism of WPP 572). Beach attractions constitute the most prevalent tourism objects, with 212 instances accounting for 64.4% of the total. Nanggroe Aceh Darussalam dominates beach tourism, hosting 30.7% of beach sites, offering diverse leisure activities for a wide range of visitors.

Resorts in WPP 572, primarily in Aceh and West Sumatera, are the second-most numerous tourism objects, with 28 surfing resorts and 19 dive centers demonstrating investment in tourism infrastructure to enhance visitor experience and align with international circuits, attracting niche tourism markets.[92] The Sumatran coastline, particularly WPP 572, offers significant opportunities for water sports and events due to its comparable underwater beauty and the 10 designated surfing spots.

UNESCO's initiatives in Nias Island aim to enhance sustainable and ecological travel experiences by bolstering cultural tourism in mangrove tourism sites.[93] These efforts are designed to harness Nias Island's

[90] Kementerian Pariwisata dan Ekonomi Kreatif/Badan Pariwisata dan Ekonomi Kreatif RI. (2021). Statistik tenaga kerja pariwisata dan ekonomi kreatif 2018-2021. Pusat Data dan Sistem Informasi - Kemenparekraf dan Direktorat Statistik Kependudukan dan Ketenagakerjaan - BPS. ISBN 978-623-97156-4-9.
[91] *Author's analysis*
[92] PADI. (n.d.). Dive shops in Bali. Retrieved from https://www.padi.com/dive-shops/bali/
[93] UNESCO Office in Jakarta. (2007). Cultural tourism for sustainable development in Nias Island, Indonesia. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000151792

rich cultural heritage, aligning it with contemporary travel trends that prioritize sustainability and cultural authenticity. UNESCO's eco-tourism strategy in WPP 572 promotes sustainable economic growth, cultural preservation, and diversification of tourism offerings, highlighting unique characteristics of each province.

Table 33. Distribution of Maritime and Coastal Tourism in WPP 572[94]

Province	Num of Tourism site	Type of Tourism Objects or Attractions
Aceh	102	Beach (63), Surfing Resort (15), Resort (13), Dive Center (8), Surfing Spot (3)
North Sumatra	48	Beach (33), Surfing Resort (6), Resort (5), Surfing Spot (2), Mangrove Tourism (2)
West Sumatra	61	Beach (28), Resort (18), Surfing Resort (5), Dive Centers (5), Surfing Spot (5)
Bengkulu	20	Beach (17), Dive Center (1), Surfing Resort (1), Mangrove Tourism (1)
Lampung	66	Beach (50), Resort (9), Dive Center (5), Surfing Resort (1), Mangrove Tourism (1)
Banten	32	Beach (21), Resort (9), Snorkelling Spot (1), Mongolian Culture Center (1)
Sum	329	Beach (212), Resort (54), Surfing Resort (28), Dive Center (19), Mangrove Tourism (4), Snorkelling Spot (1), Mongolan Culture Center (1)

1.6.2.4.2 Tourist Demographics/Distribution WPP 572

International visitor distribution within WPP 572 varies significantly by region. Europe represents the largest source, accounting for 43% of all visitors, followed by Southeast Asia and Oceania (13%). Conversely, South Asia (0%) and Africa (1%) contribute minimally. Table 34 details the total international visitor numbers for each region. North Sumatra attracts the highest number of visitors (47,578), exceeding the average of 12,306 visits per province. Banten receives 12,850 visitors, and Aceh 2,632. Bengkulu records the lowest number, with only 185 international visitors (**Table 34**).

Table 34. Regional Distribution of International Visitors to WPP 572 Provinces[95]

Origin of International Visitor per Region	Share Visitor per Destination Province (%)						Total Visitor per Region	(%)
	Aceh	North Sumatra	West Sumatra	Bengkulu	Lampung	Banten		
Southeast Asia	33%	8%	20%	0	13%	57%	13.812	19%
East Asia	11%	8%	20%	0	20%	0	6.375	9%
South Asia	0	0	10%	0	0	0	358	0%
Oceania	11%	17%	10%	66%	13%	14%	11.449	16%
Europe	44%	50%	30%	0	27%	29%	31.596	43%
America	0	17%	10%	33%	20%	0	9.751	13%
Africa	0	0	0	0	7%	0	491	1%
Annual Visit	**2,632**	**47,578**	**3,575**	**185**	**7,014**	**12,850**	**73,834**	**100%**

[94] *Google Maps and Survey*
[95] *Indonesia Statistics Bureau, 2022*

In 2022, WPP 572 recorded a total of 52.4 million domestic visitors. This figure represents 7.13% of Indonesia's total domestic tourism, which amounted to 734.9 million visitors. These statistics indicate a notable level of domestic interest in the region's maritime and coastal attractions. The proportion of national tourism attributed to WPP 572 suggests the region's potential for further growth and development within Indonesia's domestic tourism sector. Most of the domestic visitors in WPP 572 coastal tourism comes from Java. From all the provinces in WPP 572, the annual visit average is 8,744,366 with North Sumatra and Banten with the highest visit.

Table 35. Regional Distribution of Domestic Visitors to WPP 572 Provinces[96]

Origin of Domestic Visitor per Region	Share Visitor per Destination Province (%)						Total Visitor per Region	(%)
	Aceh	North Sumatra	West Sumatra	Bengkulu	Lampung	Banten		
Sumatra	10%	0%	10%	10%	10%	10%	2,926,619	6%
Java	60%	67%	60%	60%	60%	60%	33,103,718	63%
Lesser Sunda	10%	11%	10%	10%	10%	10%	5,478,619	10%
Sulawesi	20%	22%	20%	20%	20%	20%	10,957,239	21%
Annual Visit	**1,710,171**	**23,200,000**	**1,781,985**	**106,500**	**4,597,534**	**21,070,007**	**52,466,197**	**100%**

1.6.2.5 Appendix: Aquaculture

Aquaculture is one of the most promising industries in Indonesia, considering the vast natural resources that could support its development. The accumulated aquaculture pond areas in WPP 572 are 1,626 million sqm with a total number of laborers at 373,945 people. WPP 572's aquaculture systems are predominantly traditional and semi-intensive, primarily focusing on low-cost shrimp, seaweed, and freshwater fish production, requiring improvement in their adoption. Indonesia's aquaculture facilities are expanding due to government and private investments. Consumers are seeking affordable, high-quality fish, and Indonesia is a major supplier of shrimp and seafood to global markets, boosting aquaculture and exports.

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While the aquaculture industry in Indonesia presents numerous opportunities for growth through innovation and technology, it also faces significant challenges that must be addressed to sustain its development. Indonesia's aquaculture sector faces challenges like land availability, market access, and infrastructure deficiencies, but government regulations and technological advancements can enhance productivity and product quality, defining its current and future potential.

The following subsections will discuss the profile of the aquaculture sector in each province of WPP 572 and explore potential development opportunities for sustainable aquaculture practices.

1.6.2.5.1 Aquaculture Fisheries Economic Value in WPP 572

In the aquaculture sector of WPP 572 during the year 2022, the data reveals that Tilapia was the most produced commodity, with a production volume of 430,310 tons and a value of IDR 11,111.436 billion. Vannamei Shrimp was the second most produced, with a production of 138,189 tons valued at IDR 9,880.818 billion. Catfish, with a production of 263,192 tons, held a value of IDR 5,318.347 billion, ranking

[96] *Indonesia Statistics Bureau, 2022*

third. Carp followed closely in fourth place, with a production volume of 183,451 tons and a value of IDR 5,029.517 billion. Black Tiger Shrimp, with the lowest production volume of 27,936 tons among the top five, had a value of IDR 2,533.125 billion. This table, sourced from MMAF in 2022, provides an objective overview of the top commodities in aquaculture within WPP 572, indicating the scale of production and economic value within the sector.

Table 36. Top 5 Commodities in Aquaculture Sector in WPP 572 In 2022[97]

No	Commodities	Value (IDR. Billion)	Production (tons)
1	Tilapia	11,111,436	430,310
2	Vannamei Shrimp	9,880,818	138,189
3	Catfish	5,318,347	263,192
4	Carp	5,029,517	183,451
5	Black Tiger Shrimp	2,533,125	27,936

Table 37. Aquaculture Fisheries Export value 2018-2022 in WPP 572 based on commodities[98]

Commodities (in USD)	2018	2019	2020	2021	2022
Shrimp	418,695,675	407,350,809	503,578,881	527,020,737	452,599,690
Tilapia	48,400,710	58,704,259	71,893,712	64,751,269	78,509,446
Blue Swimming Crab	563,915	930,839	1,317,738	6,264,986	6,303,978
Ornamental Fish	1,108,547	1,588,162	1,842,941	2,055,396	3,298,444
Seaweed	3,259,474	2,257,269	2,186,734	2,801,310	3,011,008
Glass eels	1,588,318	3,449,348	2,340,574	2,140,979	2,022,321
Other Fish	770,768	181,969	180,281	1,346,663	613,637
Snails	170,322	357,744	422,286	233,319	492,777
Catfish	1,562	50,481	-	29,442	64,430
Pearl	71,618	-	-	21	20
Grouper	1,821,154	1,704,113	748,084	850,551	-
Carps	26,993	35,572	12.489	2.076	-

Indonesia's aquaculture sector's main export commodity, shrimp, reached USD 2.16 billion in 2022, with 241,200 tons exported to the US, Japan, and EU, renowned for its high economic value and popularity in the fishery sector. Indonesia is the second largest producer of tilapia in the world. In 2020, the export value of Indonesian tilapia reached USD 78.44 million (source BPS). North Sumatra contributed USD 71.89 million to the total, with tilapia primarily grown in Lake Toba, with production primarily exported to the US and Canada.

[97] *MMAF, 2022*
[98] *MMAF, 2022*

The aquaculture sector in WPP 572 offers significant investment potential, it is expected to guarantee food security for fisheries products. The direct investment realization (both local and foreign) has shown a positive trend from 2018 to 2021. In 2022, growth declined to -18% due to Russia-Ukraine conflict, resulting in increased global inflation, leading to monetary tightening, capital outflows, and currency depreciation in both developed and emerging economies.[99]

Table 38. Investment Realization in Aquaculture in WPP 572[100]

IDR Million	2018	2019	2020	2021	2022	2023*
Local & Foreign Direct Investment	9,282.54	10,190.4	55,670.8	188,179.6	153,009.6	183,770.8
Growth Rate (%)		9,8 %	445,4%	238,4%	-18,7%	20,10%

The aquaculture sector in WPP 572 is expected to grow positively due to shifting dietary preferences and limited wild fish stocks. These include:

Abundant Resources and Natural Feed: WPP 572 boasts a wealth of resources conducive to flourishing aquaculture. Ample land and freshwater allow for diverse pond construction, encompassing both freshwater and brackish water aquaculture development. Furthermore, the rich natural ecosystem provides a vibrant food source for various fish, crustaceans, and shellfish species, minimizing dependence on costly artificial feeds. This abundance of natural resources significantly reduces production costs and enhances the sustainability of aquaculture practices in the region.

Rising Demand for Sustainable Seafood: The demand for healthier food is increasing due to consumer shifts towards healthier eating habits and the depletion of wild fish stocks. This presents an opportunity for the aquaculture industry in WPP 572 to cater to this market and contribute to a healthier food system.

Competitive Advantages and Market Diversification: WPP 572 possesses several competitive advantages in the aquaculture market, including:

Readily available labour: The region provides a large and readily available workforce, ensuring adequate manpower for aquaculture operations.

Proximity to key markets: WPP 572's strategic location provides easy access to major markets, facilitating efficient product distribution and minimising transport costs. Potential for diversification: The region has the potential to diversify its export portfolio beyond traditional shrimp to encompass high-value fish species like tilapia, crab/swimming crab and grouper. This diversification can reduce market dependence and increase overall profitability.

Affordable Price: Aquaculture fish production year-round offers lower costs, consistent pricing, and quick response to demand changes, making it accessible and affordable for consumers, solidifying its market presence.

Technological Advancements and Efficiency: Advanced technologies like aquaponics, RAS, and digital monitoring can enhance aquaculture efficiency, productivity, and disease control, optimizing water usage, minimizing waste, and increasing profitability and sustainability. Despite possessing abundant resources and potential for significant growth, the development of aquaculture in WPP 572 is hampered by numerous constraints that limit its ability to fully flourish. These challenges include:

1. **Shortage of Hatcheries:**
    - Limited hatcheries availability leads to a scarcity of high-quality fish fry and fingerlings, hindering diversification of cultivated species, restricting farmers to traditional choices and limiting exploration of profitable or environmentally friendly options.

[99] United Nations. (2023). World economic situation and prospects 2023. United Nations.
[100] *MMAF, 2022*

- The absence of hatcheries hinders the development of genetically enhanced strains, limiting productivity and profitability in the sector due to disease resistance and growth rates.

2. **Insufficient Infrastructure**:
   - The absence of adequate infrastructure, such as hatcheries, processing facilities, cold storage, and transport networks, creates a significant bottleneck for the aquaculture industry. This impedes efficiency throughout the production chain, leading to increased production costs and reduced competitiveness in the market.
   - Limited access to proper facilities also hinders the adoption of advanced aquaculture practices, such as RAS and bio-floc systems, which could significantly improve resource efficiency, disease control, and overall production yields.
3. **High Feed Costs:**
   - Imported fish feed risks farmers, leading to unpredictable costs and currency exchange risks, while local producers create a monopoly-like situation, increasing production costs and reducing farmers' margins.
4. **Traditional Practices:**
   - Traditional pond-based systems cause low productivity, environmental degradation, and increased disease outbreaks. Slow adoption of modern technologies like aquaponics, RAS, and bio-floc hinders resource efficiency, disease control, and production yields.
5. **Limited Access to Finance:**
   - High capital requirements in aquaculture businesses hinder entry, particularly for individuals and small-scale farmers, limiting sector growth, entrepreneurship, and innovation.
   - Limited access to financing options hinders the ability of farmers to invest in new technologies, expand their operations, and improve their efficiency. This further restricts the growth and development of the aquaculture sector in the region.
6. **Inefficient Supply Chain:**
   - Insufficient transport leads to higher costs, longer delivery times, and product damage, limiting farmers' market reach and preventing fair prices. Limited cold chain facilities cause spoilage and quality deterioration. Fragmented and disorganized production weakens farmers' bargaining power, making them vulnerable to exploitation by middlemen and processors, reducing profitability and deterring sector development.

The upcoming subchapters will discuss the profile of aquaculture in the WPP 572 provinces.

1.6.2.5.2 Aceh Province

Table 39. Pond Area and Number of Fish Farmers in Aceh, 2022[101]

No.	Type of Fish Culture	Pond Area (m^2)	Number of Fish Farmer
1	Marine Floating Cage	43,159	574
2	Freshwater Floating Cage	63,795	232
3	Freshwater Fixed Cage	27,157	93

[101] *MMAF, 2022*

No.	Type of Fish Culture	Pond Area (m^2)	Number of Fish Farmer
4	Net Floating Cage	30,040	142
5	Jetted Pond	15,500	26
6	Still-water Pond	92,552,805	25,865
7	Other Water	2,500	20
8	Paddy Field	484,200	382
9	Intensive Pond	19,571,470	1,628
10	Traditional Pond	431,754,054	57,100
11	Semi-Intensive Pond	72,438,145	6,127
Total		**616,982,825**	**92,189**

Table 40. Top Aquaculture Commodities in Aceh, 2022[102]

No	Commodities	Value (IDR billion)	Production (tons)
1	Vannamei Shrimp	2,245,363	32,838
2	Black Tiger Shrimp	1,078,924	12,931
3	Tilapia	663,575	22,032
4	Milkfish	538,066	20,315
5	Carp	437,365	14,232

The dominant aquaculture system in Aceh is traditional ponds, which account for 69.97% of the total aquaculture area. This is followed by still-water pond culture at 15% and semi-intensive ponds at 11.74%. Traditional brackish ponds, covering nearly 70% of the water area, significantly contribute to the production of Vannamei shrimp and black tiger shrimp, yielding 32,838 tons and 12,931 tons respectively in 2022. These systems, with basic infrastructure, reflect the province's historical focus on aquaculture.

1.6.2.5.3 Traditional ponds in Aceh's aquaculture sector employ 57,100 fish farmers, while still-water ponds have 25,865 due to lower labor requirements. North Sumatra Province

Table 41. Pond Area and Number of Fish Farmers in North Sumatra in 2022[103]

No.	Type of Fish Culture	Pond Area (m^2)	Number of Fish Farmer
1	Marine Floating Cage	65,868	290
2	Freshwater Floating Cage	1,634,895	5,060
3	Freshwater Fixed Cage	8,344	41

[102] *MMAF, 2022*
[103] *MMAF, 2022*

No.	Type of Fish Culture	Pond Area (m^2)	Number of Fish Farmer
4	Net Floating Cage	106,600	324
5	Jetted Pond	233,700	372
6	Still-water Pond	109,711,849	35.284
7	Other Water	451,250	160
8	Paddy Field	69,427,825	6,945
9	Intensive Pond	7,100,000	1,668
10	Traditional Pond	33,506,170	4,276
11	Semi-Intensive Pond	8,709,650	3,782
	Total	**230,956,151**	**58,202**

Table 42. Top Aquaculture Commodities in North Sumatra, 2022[104]

No.	Commodities	Value (IDR billion)	Production (tons)
1	Tilapia	4,438,985	167,856
2	*Vannamei* Shrimp	1,942,834	24,818
3	Catfish	1,916,995	93,083
4	Carp	1,600,171	53,118
5	Black Tiger Shrimp	692,458	7,999

Still-water ponds hold the dominant position with 49.5% of the total aquaculture area utilization. This system is primarily used for cultivating various fish species, including carp, catfish, tilapia, and milkfish, reflecting the diverse demand in the province. Fish culture in paddy fields accounts for 30.1% of the total aquaculture area. This innovative system uses rice paddies for fish production, primarily tilapia, and shrimp farming, particularly Vannamei shrimps, utilizing shallow, stagnant water for 14.5% of aquaculture area.

From employment, the still-water ponds employ the largest number of fish farmers (35,824), highlighting the significant contribution of this system to job creation in the province. While the fish culture in paddy fields, employs a smaller but still significant number of fish farmers (6,945), demonstrating the growing popularity of this integrated approach.

1.6.2.5.4 West Sumatra Province

Table 43. Pond Area and Number of Fish Farmers in West Sumatra, 2022[105]

No.	Type of Fish Culture	Pond Area (m^2)	Number of Fish Farmer
1	Marine Floating Cage	19,595	380
2	Freshwater Floating Cage	603,068	1,987
3	Freshwater Fixed Cage	24,000	250
4	Net Floating Cage	35,269	556
5	Jetted Pond	965,817	7,076
6	Still-water Pond	100,085,345	71,018
7	Paddy Field	2,828,624	2,698
8	Intensive Pond	2,572,500	504
	Total	**107,134,218**	**84,469**

[104] *MMAF, 2022*
[105] *MMAF, 2022*

Table 44. Top Aquaculture Commodities in West Sumatra, 2022[106]

No.	Commodities	Value (IDR billion)	Production (tons)
1	Tilapia	3,153,786	123,407
2	Carp	1,240,850	50,412
3	Catfish	1,065,339	54,844
4	Gourami	925,044	25,589
5	Vannamei Shrimp	387,353	4,691

West Sumatra's freshwater aquaculture industry, primarily based on still-water ponds, is vital for the region's agricultural landscape, driving economic output and providing employment. With 71,018 individuals employed, it sustains livelihoods and supports the local economy by producing freshwater species like tilapia, carp, catfish, and gourami. Bengkulu Province

Table 45. Pond Area and Number of Fish Farmers in Bengkulu in 2022[107]

No.	Type of Fish Culture	Pond Area (m^2)	Number of Fish Farmer
1	Freshwater Floating Cage	238,683	240
2	Freshwater Fixed Cage	249,920	257
3	Net Floating Cage	363,782	441
4	Jetted Pond	1,008,196	898
5	Still-water Pond	75,548,636	11,291
6	Paddy Field	3,680,330	931
7	Intensive Pond	89,850,900	540
8	Traditional Pond	5,540	6
9	Semi-Intensive Pond	1,093,174	604
	Total	**172,039,161**	**15,208**

Table 46. Top Aquaculture Commodities in Bengkulu in 2022[108]

No.	Commodities	Value (IDR billion)	Production (tons)
1	Tilapia	2,073,483	88,437
2	Carp	1,284,273	49,101
3	Catfish	1,254,555	55,525
4	Vannamei Shrimp	748,426	7,791
5	Gourami	149,657	4,549

[106] *MMAF, 2022*
[107] *MMAF, 2022*
[108] *MMAF, 2022*

Bengkulu's aquaculture sector features a mix of intensive (52% of water area) and still-water (43%) ponds. While intensive ponds occupy a larger area, still-water ponds provide significantly more employment (11,291 vs. 540). Economically, freshwater species—tilapia, carp, and catfish—are dominant, each contributing over 1 billion in value. Vannamei shrimp, cultivated mainly in intensive ponds, generates 700 billion. Still-water ponds are crucial for maintaining traditional freshwater aquaculture practices in the region.

1.6.2.5.5 Lampung Province

Table 47. Pond Area and Number of Fish Farmers in Lampung, 2022[109]

No.	Type of Fish Culture	Pond Area (m^2)	Number of Fish Farmer
1	Marine Floating Cage	64,227	203
2	Freshwater Floating Cage	1,395,356	1,657
3	Net Floating Cage	125,550	763
4	Jetted Pond	42,000	90
5	Still-water Pond	97,769,051	39,644
6	Other Water	462,446	146
7	Paddy Field	3,256,400	1,301
8	Seaweed	2,670,000	472
9	Intensive Pond	21,250,773	1,665
10	Traditional Pond	135,045,000	3,977
11	Semi-Intensive Pond	109,562,200	9,886
	Total	**371,643,003**	**84,469**

Table 48. Top Aquaculture Commodities in Lampung in 2022[110]

No.	Commodities	Value (IDR billion)	Production (tons)
1	Vannamei Shrimp	3,320,180	52,853
2	Black Tiger Shrimp	736,161	6,759
3	Catfish	618,864	36,719
4	Tilapia	560,152	21,838
5	Gourami	460,696	14,829

The aquaculture industry in Lampung is predominantly composed of traditional and semi-intensive ponds, which constitute 65.8% of the total water area used for fish farming. This dominance plays a crucial role in the region's high *vannamei* shrimp production, with annual output exceeding IDR 3.3 billion. Lampung's top commodities, including black tiger shrimp, catfish, tilapia, and gourami, have production volumes below 1 billion, indicating the potential contribution of traditional shrimp ponds to the local economy.

Lampung's shrimp production is thriving, but only 16.4% of the aquaculture workforce is dedicated to shrimp production, while 46.9% are employed in still-water pond aquaculture, due to labor-intensive tasks and semi-automated systems.

[109] *MMAF, 2022*
[110] *MMAF, 2022*

1.6.2.5.6 *Banten Province*

Banten's aquaculture industry exhibits a strong emphasis on Vanname shrimp cultivation, occupying 81% of traditional pond area. This focus aligns with its designation as a key shrimp development zone and favorable environmental conditions. However, the sector extends beyond shrimp, encompassing catfish, milkfish, tilapia, and seaweed, contributing to a diverse industry.

Table 49. Pond Area and Number of Fish Farmers in Banten in 2022[111]

No.	Type of Fish Culture	Pond Area (m^2)	Number of Fish Farmer
1	Marine Floating Cage	2,100	60
2	Freshwater Floating Cage	9,750	318
3	Freshwater Fixed Cage	2,424	9
4	Net Floating Cage	1,243	70
5	Still-water Pond	11,548,892	32,879
6	Other Water	1,949,000	136
7	Paddy Field	1,033,000	2,097
8	Seaweed	600,000	150
9	Intensive Pond	1,198,098	240
10	Traditional Pond	104,167,000	2,813
11	Semi-Intensive Pond	7,836,037	636
	Total	**127,897,544**	**39,408**

Table 50. Top Aquaculture Commodities in Banten in 2022[112]

No.	Commodities	Value (IDR billion)	Production (tons)
1	Vannamei Shrimp	1,236,659	15,195
2	Catfish	292,704	15,207
3	Milkfish	245,195	11,762
4	Tilapia	221,454	6,737
5	Seaweed	182,429	51,230

While traditional ponds retain a larger footprint, still-water ponds employ a significantly higher proportion of the aquaculture workforce in Banten. With 32,879 workers compared to 2,813 in traditional ponds, despite their smaller size, still-water facilities require substantially more manpower. This is likely to reflect the more intensive management practices associated with these systems.

1.6.2.5.7 *Development Opportunities*

Indonesia's aquaculture sector offers potential for shrimp expansion through advanced production technologies, improved market access, and sustainable practices, boosting global demand for high-value commodities. WPP 572 provinces excel in freshwater fish production, promoting diversification and growth through investment, research, and sustainable practices like bio-floc technology and recirculating systems. Finally, fostering innovation through research, training, and supportive policies will further advance the aquaculture industry.

[111] *MMAF, 2022*
[112] *MMAF, 2022*

Shrimp, a high-value commodity with huge global demand, this commodity represents a lucrative opportunity for Indonesian aquaculture businesses to expand their international presence. Increased production efficiency through advanced technology and practices, improved market access via international trade shows and partnerships, and a focus on quality and sustainability through adherence to international standards and sustainable practices can enhance market value and appeal to environmentally conscious consumers.

The six provinces in WPP 572 excel in freshwater fish production, promoting diversification and development within the aquaculture sector through research, value-added products, and domestic consumption awareness campaigns.

Sustainable aquaculture practices, including bio-floc technology, recirculating systems, waste management, responsible feed and medication use, and community-based initiatives, minimize environmental impact and ensure long-term profitability.

Investing in farming hatcheries, facilities, and equipment is crucial for modernising and improving the efficiency of aquaculture operations. Modernising hatcheries ensures a reliable supply of high-quality seed stock, while upgrading infrastructure and adopting innovative technologies, such as digital platforms, can enhance data analysis, optimize resource utilization, and improve overall management.

The aquaculture industry is rapidly evolving, necessitating innovation and new technologies through research, development, farmer training, and supportive policies to ensure a thriving sector.

1.6.2.5.8 Barrier and Risks Identification

The development and sustainability of aquaculture in Indonesia face several barriers and risks. Environmental concerns include water pollution, disease outbreaks, and habitat destruction. Socio-economic challenges encompass limited access to land and water, high costs of inputs, and lack of market access and information. Climate change threatens the marine sector, requiring sustainable practices, improved infrastructure, and community engagement to mitigate risks like sea level rise, disease outbreaks, predators, and theft.

Environmental Concerns:

- **Water Pollution:** Implementing sustainable waste management practices can help mitigate the impact of intensive aquaculture on water quality. This could involve training on efficient waste management and developing community-based waste management plans to minimize pollution run-off into the sea.
- **Disease Outbreaks:** Crowded fish farms are susceptible to disease outbreaks that can rapidly spread and cause significant losses.
- **Habitat Destruction:** Development of aquaculture facilities can lead to the destruction of coastal ecosystems, including mangrove and seagrass beds, which are crucial for healthy fisheries and coastal protection.

Socio-Economic Challenges:

- **Limited Access to Land and Water:** The ecotourism development initiative could provide alternative income opportunities for coastal communities, reducing pressure on land and water resources from aquaculture and aiding in the transition to sustainable livelihood practices.
- **High Costs of Inputs:** Feed, seed, and other inputs can be expensive, making it difficult for small-scale farmers to compete with larger producers.
- **Lack of Market Access and Information:** Sustainable and diversified fishing livelihoods projects can help fishermen increase the value of their catch through improved fish preservation techniques and infrastructure, such as solar-powered cold storage rooms, which could open up new markets and reduce spoilage.

Climate Change:

- **Sea Level Rise and Changes in Water Temperature and Salinity:** Collaborative MPAs Management Support can aid in establishing and expanding protected areas, which can serve as buffers against climate impacts while conserving biodiversity.
- **Changes in Water Temperature and Salinity:** Changes in water temperature and salinity can affect the growth, reproduction, and survival of fish and shellfish.
- **Increased Frequency and Intensity of Extreme Weather Events:** Infrastructure development, such as the construction of robust cold storage facilities, can reduce the vulnerability of aquaculture operations to extreme weather events by ensuring catches are preserved despite disruptions.

Other Risks:

- **Disease outbreaks:** The aquaculture sector is vulnerable to outbreaks of diseases that can spread quickly and cause significant losses.
- **Predators:** Predators such as birds and fish can eat large quantities of farmed fish, causing significant economic losses.
- **Theft:** In some areas, theft of fish and equipment can be a major problem for aquaculture farmers.

1.6.2.5.9 Government of Indonesia Supports on the Aquaculture Sector

In 2021, MMAF has embarked on two impactful initiatives to promote sustainable aquaculture development in the country. These programs, titled Aquaculture Development for Export Enhancement Supported by Marine and Fisheries Research and Construction of Freshwater, Brackish Water and Marine Aquaculture Villages based on Local Wisdom, aim to achieve comprehensive goals:

- Increased production, productivity, and quality standards of marine and fisheries products: This objective will be achieved through targeted research and development efforts, leading to improved farming practices and enhanced product quality.
- Enhanced competitiveness and sustainability of aquaculture businesses: By fostering a collaborative environment within "Aquaculture Villages", the program seeks to facilitate knowledge sharing, resource optimization, and the development of efficient business models.
- Improved income and welfare of fish farmers: By increasing production and productivity, promoting market access, and providing financial support, the initiative aims to empower fish farmers and improve their livelihoods.
- Increased local community participation: The program actively engages local communities, leveraging their knowledge and expertise to ensure the long-term sustainability of the aquaculture villages.

The establishment of these programs is further solidified by the MMAF Regulation Number 47 of 2021 on 130 Aquaculture Villages, which provides a legal framework for their implementation. This regulation lays the foundation for establishing aquaculture villages with key characteristics:

- Focus on superior or endemic local commodities: This ensures economic viability and promotes the preservation of unique local species.
- Integration with local wisdom: The program respects and incorporates existing knowledge and practices within the community.
- Fish farming as the primary source of income: This fosters a dedicated and engaged community within the village.
- Presence of established fish farming groups: This facilitates collaboration, knowledge sharing, and collective action.

1.6.3 Appendix: Eligible Blue Projects

The table[113] evaluates eligible blue economy sectors in Indonesia based on environmental and socio-economic costs, aligning with the Green-Blue Focus of SDGs Government Securities Framework, categorizing established and emerging sectors, and highlighting sustainable development potential.

No	The Blue Economy Sectors	Environmental Cost/Benefit (*low-medium-high*)	Socio-Economic Cost/Benefit (*low-medium-high*)	Fulfilling eligible criteria of Green - Blue Focus of SDGs Government Securities Framework (*low-medium-high priority*)
Established Sectors				
1.	**Capture fisheries and seafood processing** **Sector description:** • Capture fisheries • Seafood processing	**Medium environmental cost** • The impact of over-fishing on the destruction of biodiversity of the ocean. • The economic development of the entire fish production system is heavily reliant on improving post-harvest processing and exploring sustainable fishing practices like certifications and eco-labels.	**High economic benefits:** • Marine fishing's value added is highest in lower middle-income countries, with Asia and Oceania combining having the highest employment figures in 2010.[114] • Indonesia's fish production reached 7.7 million tons in 2020, supporting national and global food providers. Around 6.2 million fishermen and farmers contributed to the industry. Asia created the most value added, accounting for 54% of worldwide value added in fish processing. Indonesia is one of the world's major players in seafood processing.	*Eligible if they implement sustainable principles in the activities of capture fisheries and seafood processing so it can be classified as "Sustainable Capture Fisheries"*
2.	**Shipping and ports**	**Low environmental cost**	**High economic benefits:**	*Eligible if they implement sustainable/green principles*

[113] Author's analysis
[114] According to OECD calculations

No	The Blue Economy Sectors	Environmental Cost/Benefit (*low-medium-high*)	Socio-Economic Cost/Benefit (*low-medium-high*)	Fulfilling eligible criteria of Green - Blue Focus of SDGs Government Securities Framework (*low-medium-high priority*)
	Sector description: • Seaports		• Asia contributed around USD 102 billion to the global economy, accounting for more than half of the global value added of port activities; • An impact survey conducted for OECD's The Competitiveness of Global Port-Cities: Synthesis Report (Merk, 2013) also indicated that around 800 jobs are directly or indirectly created from port activities at the volume of one million tons on average.	*in the projects so it can be classified as Blue Construction/Buildings*
3.	**Shipbuilding and repair** **Sector description:** The majority of it coming from container, bulker, and tanker construction	**Medium environmental cost**	**High economic benefits:** • With 47% of the market, Asia was anticipated to have the largest share. • Approximately 1.9 million people worked in shipbuilding and repair in 2010. Because the majority of shipyards are in Asian countries, the majority of jobs are in this region, particularly in China, Indonesia, Japan, and Korea	*Eligible if it will fulfil a criteria of green shipbuilding, so it can be classified as Blue Shipbuilding*
4.	**Offshore oil and gas (shallow water)** **Sector description:** • Exploration and exploitation oil and gas from offshore fields	**High environmental costs**	**High economic benefits:** • The offshore oil and natural gas industry represents the largest share of today's ocean economy and contributes to many developing economies	*Not eligible*

No	The Blue Economy Sectors	Environmental Cost/Benefit (*low-medium-high*)	Socio-Economic Cost/Benefit (*low-medium-high*)	Fulfilling eligible criteria of Green - Blue Focus of SDGs Government Securities Framework (*low-medium-high priority*)
	• Carbon emissions from oil and gas exploration			
5.	**Marine manufacturing and construction** **Sector description:** Building construction	**Medium environmental cost**	**High economic benefits:** • In 2010, marine equipment's global value added was predicted to reach USD 168 billion, with Asia accounting for over three-quarters of the market.; • According to Balance Technology Consulting (2014), maritime equipment employed 2.1 million people full-time in 2010	*Eligible if the project will fulfil a criterion of blue construction so it can be classified as Marine Blue Construction*
6.	**Maritime and coastal tourism** **Sector description:** Coastal and ocean-related tourism has many forms, including diving tourism, marine archaeology, surfing, cruises, eco-tourism and recreational fishing operations	**High environmental costs:** the development of tourism will bring about potential environmental problems, including (i) the loss of valuable habitats such as coral reefs; (ii) wetlands and mangroves used for tourism infrastructure; (iii) a large consumption of resources, including locally available food and clean water sources; and (iv) pollution caused by the discharge of untreated sewage and large amounts of solid waste.	**High economic benefits:** It has a high contribution to the economy. For example, the tourism sector in Indonesia generates the equivalent of 8.5 per cent of GDP and become a major source of income and employment (OECD, 2020b). The direct contribution to GDP was half of the number but the indirect contributions from downstream sectors are most likely higher. In 2017, it supplied 12.7 million jobs, representing 10.5 per cent of total employment.	*Eligible, Medium priority* if the coastal tourism can be managed with sustainable principles, promoting the protection and sustainable use of the marine environment and species

No	The Blue Economy Sectors	Environmental Cost/Benefit (*low-medium-high*)	Socio-Economic Cost/Benefit (*low-medium-high*)	Fulfilling eligible criteria of Green - Blue Focus of SDGs Government Securities Framework (*low-medium-high priority*)
7.	**Marine business services** **Sector description:** It includes insurance and finance, marine consultancy, renting, technical services, inspection and survey, labor supply services, and other associated activities	**Low environmental cost**	**Medium economic benefit** As a point of reference, a study from PwC in 2016 reported that maritime business services contribute £4.4 billion annually towards the UK economy and directly support the employment of 10,000-11,000 people. The report defined direct contribution as the contribution of each sector in terms of employee costs, profit (before depreciation) and tax contributions. Indirect contribution was defined to include additional demand created in the supply chain for maritime services. Induced contribution was the effect of the additional consumption of employees (directly and indirectly) employed in the sector.	*Not eligible*
8.	**Marine research and development and education** **Sectors description:** Marine research and development, alongside education, are pivotal for enhancing maritime sustainability. They bolster the blue economy by promoting literacy, skills, and innovation in marine ecosystem management, crucial for marine wildlife conservation and understanding	**Low environmental cost**	**Low economic benefit**	*Eligible, Medium priority* as supporting activities for marine infrastructure projects

No	The Blue Economy Sectors	Environmental Cost/Benefit (*low-medium-high*)	Socio-Economic Cost/Benefit (*low-medium-high*)	Fulfilling eligible criteria of Green - Blue Focus of SDGs Government Securities Framework (*low-medium-high priority*)
	the marine environment to prevent pollution effectively.			
9.	**Dredging** **Sectors description:** Coastal Flood Defense	**Low environmental cost**	**Medium economic benefits:** • According to Neumann et al. (2015), the population of deltas and flood plains, i.e. areas most vulnerable to flooding, is anticipated to grow fast - by 50% between 2000 and 2030. It is hence important to include coastal flood defense or dredging as one of the existing ocean-based sector to be dealt with in blue economy development.	*Not eligible*
Emerging Sectors				
10.	**Marine aquaculture** **Sectors description:** • At least 64.2% of aquaculture production is inland and dominated by freshwater fish such as carp species. • Aquaculture in coastal areas encompasses a diverse range of species. In brackish water ponds, shrimp are predominantly farmed due to their high economic value and suitability to the conditions.	**High environmental costs:** • Aquaculture faces challenges due to non-compliance with sustainability standards, necessitating reduction of carbon emissions and efficient practices in fishpond systems for future environmental sustainability. • The genetic quality of seaweed stock requires enhancement, as seaweed	**High economic benefits:** • Indonesian aquaculture products reach 42% of the total produced fishery products (FAO in the OECD, 2021); • In 2016, global aquaculture production, including both inland and marine production, was 110.2 million tones and was worth approximately USD 243.5 billion (FAO, 2018). At least 64.2% of aquaculture production is inland and dominated by freshwater fish such as carp species. • Aquaculture can provide an additional source of income for vulnerable coastal	*Eligible, Medium priority* with the condition of green technologies and sustainable principles • Aquaculture practices should focus on improving monitoring, control, and surveillance of mangrove and coral reefs, utilizing integrated regulations and bureaucracy to support business development and enhance maritime connectivity.

No	The Blue Economy Sectors	Environmental Cost/Benefit (*low-medium-high*)	Socio-Economic Cost/Benefit (*low-medium-high*)	Fulfilling eligible criteria of Green - Blue Focus of SDGs Government Securities Framework (*low-medium-high priority*)
	Additionally, coastal aquaculture includes the cultivation of seaweed and shellfish in cages and man-made structures situated near or along the shoreline. • With the increasing demand for fishery products and the challenges of declining capture fisheries production, aquaculture is one of the potential solutions in the development of fisheries in Indonesia.	cultivation primarily relies on cloning through cuttings. This method, necessitated by brief harvest seasons, often involves the repetitive use of parent stock, which can lead to diminished resilience and productivity. Moreover, the sector must address the impacts of climate change and prioritize environmental conservation to ensure sustainable growth. • Mangrove habitats are crucial for coastal protection, biodiversity, and carbon sequestration, but aquaculture expansion often destroys them, requiring immediate action to integrate conservation into development projects.	populations, who may otherwise rely on farming or fishing.	• More complex and still at a demonstration stage, open ocean farming projects also have potential for more sustainable fish production (OECD, 2019b).
11.	**Deep-water and ultra-deep water oil and gas** **Sectors description:** Oil and gas exploration at deep water	**High environmental cost**	**High economics benefits**	*Not eligible*
12.	**Offshore wind energy**	**High environmental benefits**	**High economics benefits**	*Eligible, High priority*

No	The Blue Economy Sectors	Environmental Cost/Benefit (*low-medium-high*)	Socio-Economic Cost/Benefit (*low-medium-high*)	Fulfilling eligible criteria of Green - Blue Focus of SDGs Government Securities Framework (*low-medium-high priority*)
	Sectors description: One of marine renewable energies			
13.	**Ocean renewable energy** **Sectors description:** One of marine renewable energies. Ocean renewable energy harnesses power from ocean sources, including wave, tidal, and thermal energies, providing a sustainable alternative to traditional fossil fuels. This sector is emerging as a key component in the transition towards a cleaner energy future, offering a consistent and renewable energy supply with minimal environmental impact during operation.	**High environmental benefits** Ocean renewable energy offers environmental benefits due to low emissions, but medium costs during manufacturing and installation can cause habitat disruption. The high benefits are seen in the long-term reduction of carbon emissions and their contribution to combating climate change.	**High economic benefits** • Ocean renewable energy offers substantial socio-economic benefits, creating new employment opportunities and contributing to local economies, especially in coastal regions, despite medium initial investment costs and potential disruptions.	*Eligible, High priority*
14.	**Marine and seabed mining** **Sectors description:** The process of retrieving mineral deposits from the deep sea	**High environmental costs:** • The scraping of the sea floor and pollution from mining processes can wipe out entire species; • Environmental impact assessments, effective regulation and mitigation strategies are needed to	**High economic benefits** • Deep sea mineral deposits are gaining interest due to depleting terrestrial metals and increasing demand for high-tech applications and green technologies like smartphones.	*Not eligible*

No	The Blue Economy Sectors	Environmental Cost/Benefit (*low-medium-high*)	Socio-Economic Cost/Benefit (*low-medium-high*)	Fulfilling eligible criteria of Green - Blue Focus of SDGs Government Securities Framework (*low-medium-high priority*)
		limit the impacts of marine mining.		
15.	**Maritime safety and surveillance** **Sectors description:** Supporting activities of maritime	**Low environmental cost**	**Medium economic benefits**	*Not eligible*
16.	**Marine biotechnology** **Sectors description:** Countries are focusing on marine biotechnology for pharmaceutical drug development, cosmetics, food production, and biofuel production. This technology has the potential to address societal challenges like sustainable food security, energy security, environmental health, human health, and industrial greening, driving the sector's growth.	**High environmental cost:** Marine biotechnology offers potential benefits but also poses environmental risks, including habitat alteration, nutrient loading, and strain on species, necessitating careful management to prevent overexploitation and ensure long-term sustainability.	**Medium economic benefits:** Marine bio-resources research is already essential in many sectors, for instance in the pharmaceutical sector for the development of new generations of antibiotics. Marine genetic resources could be at the core of new solutions to fight pandemics.	*Eligible, medium priority* • Indonesia should consider exploring and potentially engaging in a sustainable way in these activities; • Indonesia's biotechnology industry could contribute to a sustainable blue economy by developing products derived from marine and fishery raw materials.
17.	**High-tech marine products and services**	**Medium environmental costs**	**High economic benefits**	*Not eligible*

2 Section 2: Natural Capital Baseline Assessment

2.1 Introduction

For detailed information on Indonesia's profile, please refer to General Overview of Indonesia in subsection 1.3, which discusses an overview of the country, including both natural and climate profile. A climate profile of Indonesia is provided in subsection 3.1.

2.2 Baseline Natural Capital Assessment

2.2.1 Mangroves

According to the 2020 data from Global Mangrove Watch, there were approximately 36,000 ha of mangroves in WPP 572 in 2020, about 1.2% of the total mangroves in the country. This mangrove extent is the smallest of the WPPs in the country and has declined in the last two decades. Between 1996 and 2020, WPP 572 lost approximately 1,900 ha of mangroves, or about 5% of the extent of 1996, as shown in **Error! Reference source not found.**. At the national level, Indonesia lost approximately 265,000 ha of mangroves within the same period, meaning that the mangrove loss within WPP 572 accounts for less than 1% of the total loss nationwide. On average, the rate of mangrove degradation in WPP 572 was 0.2% annually between 1996 and 2020.

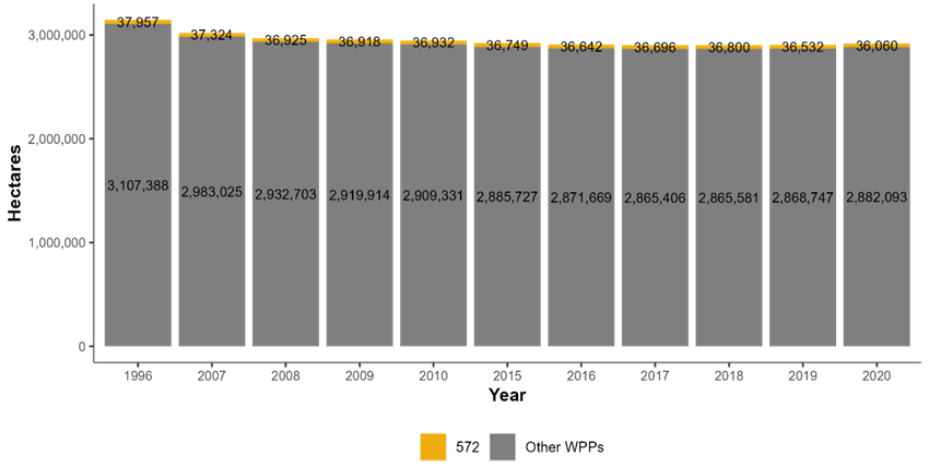


Figure 17. Mangrove Extent in Indonesia between 1996 and 2020[115]

Table 51 shows the mangrove extent at the provincial level and its change from 1996 to 2020. As provinces with the highest presence of mangroves in WPP 572, Sumatera Barat and Sumatera Utara should be given priority in intervention efforts. These two regions have the largest concentration of mangroves within WPP 572, accounting for at least 42% and 31%, respectively. However, in Sumatera Barat around 733 ha of mangroves have been lost, resulting in an annual depletion rate of approximately -0.2%. The reduction occurred mainly in Kepulauan Mentawai district, with a loss of 652 ha. Sumatera Utara has seen a net increase of 174 ha of mangroves. The increase happened in Kepulauan Nias and is concentrated in Nias Utara (northern Nias).

Aceh, Lampung, and other regions have seen a noticeable reduction in mangrove coverage between 1996 and 2020. Despite being the third largest province with mangrove extent, Aceh suffered a significant loss of mangroves of approximately -1.2% annually on average, with a total loss of 780 ha between 1996 and

[115] *Global Mangrove watch (2020)*

2020. Following Aceh, Lampung also stands out as a province experiencing a higher annual average mangrove depletion rate than the national average of -0.2%.

Table 51. Mangrove Extent in WPP 572 based on Province in 1996, 2007, 2015, 2020 (In ha)

Province	1996	2007	2015	2020
Outside of provincial boundaries	1,336.65	1,316.27	1,140.81	987.82
Aceh	3,027.36	2,944.27	2,467.80	2,241.65
Banten	2,225.35	2,226.72	2,323.42	2,262.13
Bengkulu	1,561.35	1,540.26	1,540.25	1,564.99
Lampung	1,921.13	1,597.55	1,690.44	1,678.00
Sumatera Barat	16,261.81	16,166.05	15,806.20	15,528.16
Sumatera Utara	11,623.81	11,532.93	11,780.18	11,797.69
WPP 572	**37,957.46**	**37,324.05**	**36,749.10**	**36,060.44**

Mangrove density can be used as a proxy indicator of ecosystem quality and degradation. In Indonesia, the national mapping classification for mangroves is SNI 7717 2020.[116] This standard categorizes mangrove forests into three classes: high density, with a density of >70%; medium density, with a density between 30-70%; and low density, with a density of below 30%, per ha of mangrove forest. Unfortunately, the Global Mangrove Watch data does not delineate the ecosystem quality of the mangroves. Thus, secondary data from MoE was used to complement the findings.

Table 52. Mangrove Density Distribution in WPP 572 in 2021[117]

Province	Density		
	>70%	30-70%	<30%
Aceh	86.3%	7.4%	6.2%
Sumatera Utara	73.9%	10.6%	15.4%
Sumatera Barat	77.8%	20.9%	1.2%
Bengkulu	92.9%	1.4%	5.8%
Lampung	90.1%	4.1%	5.8%
Banten	79.6%	11.3%	9.1%

As shown in Table 52, most mangroves in WPP 572 are mangroves with high density, yet the extent of low-density mangroves is still not trivial, particularly in Sumatera Utara. In Bengkulu and Lampung, more than 90% of the mangroves are highly dense despite having the least mangroves compared to other provinces within WPP 572. Around 1,400 ha and 1,500 ha of mangroves in Bengkulu and Lampung are in good condition. Conversely, Sumatera Utara has the lowest density of mangroves in WPP 572. With a share of 15.4%, 1,816 ha of mangroves in the province have low density, but this is greater than the total mangrove extent in Bengkulu and Lampung. Banten and Aceh also have low density mangroves, with 205

[116] https://pesta.bsn.go.id/produk/detail/13110-sni77172020
[117] *Ministry of Environment and Forestry, 2021*

and 138 ha, respectively. Despite having the least low-density mangroves in share (1.2%), Sumatera Barat has a relatively high extent of low-density mangrove (186 ha).

The baseline emission calculation shows that GHG emissions from mangrove loss in WPP 572 would reach 1.6, 3.9, and 4.5 million tons of CO_2 by 2030, 2050, and 2060, respectively, as shown in **Table 52**, assuming continued current loss rate.[118] Based on district-level loss rate projections, the WPP 572 mangrove area is projected to diminish subsequently by 483.96 ha in 2030, 1,142.07 ha in 2050, and 1,305.64 ha in 2060, leading to the aforementioned emission levels. In this and subsequent tables, the "outside of provincial boundaries" category describes the ecosystems that are within WPP 572 but not within provincial administrative boundaries. We include this category as it is still under the responsibility of WPP 572.

Several provinces within the WPP 572 region contribute more significantly to emissions due to the high ecosystem loss rate. Aceh is the province with the highest emission contribution due to projected high annual loss rates, ranging from 0.2% to 1.4%. The mangrove loss in Aceh will emit around 0.73, 1.94, and 2,43 million tons of CO_2 by 2030, 2050, and 2060, respectively. Despite experiencing relatively moderate loss rates, Sumatera Barat is projected to undergo substantial area loss owing to the sizable initial extent, contributing to emissions generation of 1, 2.94, and 3.89 million tons of CO_2 by 2030, 2050, and 2060, respectively, accounting for more than 50% of the total emissions in WPP 572.

Conversely, the business-as-usual trend shows that expansion happens in Kepulauan Nias, Sumatera Utara, specifically in the Nias Utara district, as the mangrove extent grows by 1.7% annually from 1996 to 2020. As a result, Sumatera Utara will create new blue carbon sinks through new mangrove forest formations if this trend continues.

Please see **Annex 22** for estimated GHG emissions calculations

[118] See GHG calculations Annex 22

2.2.2 Seagrass

According to the Allen Coral Atlas,[119] seagrass beds cover around 24,854 ha of ocean in WPP 572, approximately 4.7% of total seagrass beds in Indonesia. **Figure 18** depicts the distribution of seagrass in Indonesia based on WPP in 2020. Similar to mangroves distribution, it appears that the seagrass beds' extent in WPP 572 is relatively less significant than some WPPs as most seagrass beds in Indonesia are in the eastern part of Indonesia, such as in WPP 715 (Maluku Sea, 713 (Flores Sea), 714 (Banda Sea), and 718 (Arafura Sea). One issue with the Allen Coral Atlas is that it is based on satellite image processing on a shallow ocean identifiable by the satellite. Thus, the seagrass beds identified in this dataset are likely to be a conservative estimate as they exclude ecosystems in deeper and turbid water.

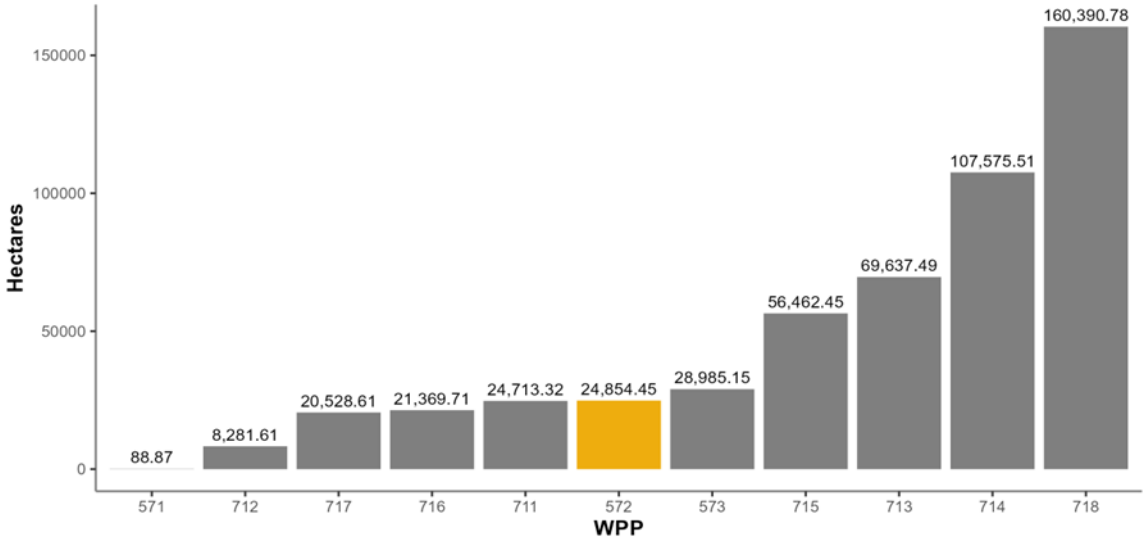


Figure 18. Seagrass distribution in Indonesia based on WPP in 2020[120]

The Allen Coral Atlas estimate differs slightly from that of Indonesia's Seagrass Data Working Group.[121] The study estimates that Indonesia's seagrass bed extent ranges from 8,385 – 18,344 km^2. Meanwhile, the Allen Coral Atlas estimate shows that Indonesia's seagrass beds are around 10,457 km^2, which is within the range of Indonesia's Seagrass Data Working Group estimate. There is little information about historical seagrass beds in Indonesia. Based on the known seagrass cover changes from available literature, the average loss of seagrass bed cover reaches 2.82% annually.[122] This rate coincides with the result from Indonesia's Seagrass Data Working Group estimate, which estimated the area loss between 2015 and 2021 at 2.8% per year. Based on this rate, seagrass bed loss in WPP 572 in the past would be approximately 700 ha annually.

[119] https://allencoralatlas.org/
[120] *Allen Coral Atlas*
[121] Rahmawati, S. E, Lisdayanti, A., Kusnadi., M. P. Rizki..., M. R. Manafi, P. Rahmadi. 2022. 'Status Ekosistem Lamun di Indonesia Tahun 2021.' Pusat Riset Oseanografi, Organisasi Riset Kebumian dan Maritim, Badan Riset dan Inovasi Nasional (BRIN). 94 hal
[122] Stankovic, Milica, Rohani Ambo-Rappe, Filipo Carly, Floredel Dangan-Galon, Miguel D. Fortes, Mohammad Shawkat Hossain, Wawan Kiswara, et al. 2021. 'Quantification of Blue Carbon in Seagrass Ecosystems of Southeast Asia and Their Potential for Climate Change Mitigation'. Science of The Total Environment 783 (August): 146858. https://doi.org/10.1016/j.scitotenv.2021.146858

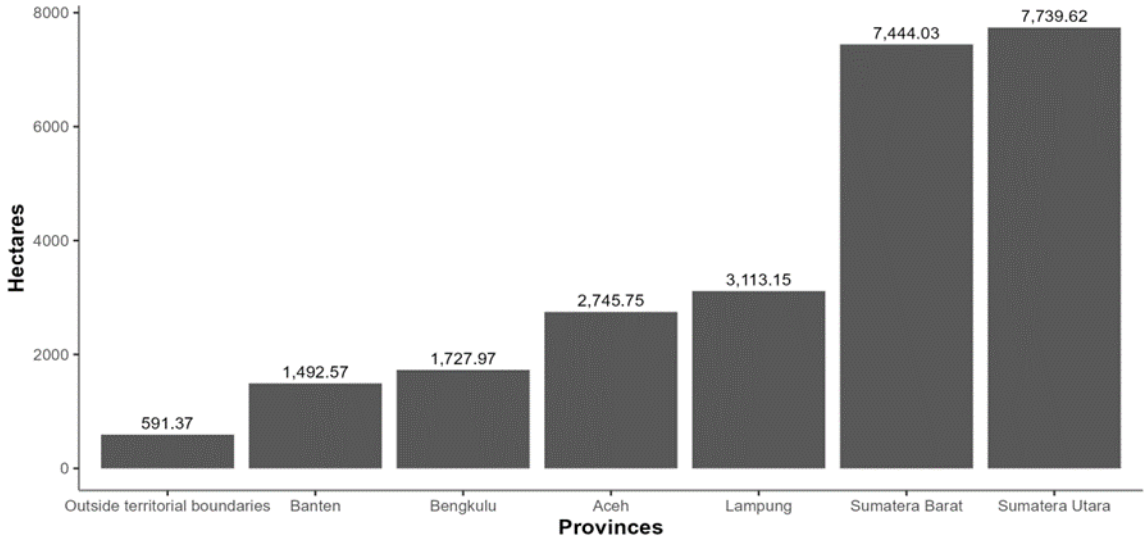


Figure 19. Seagrass Distribution in Indonesia Based on Provinces in 2020

Much like the pattern observed in mangrove distribution, Sumatera Barat and Sumatera Utara dominate seagrass distribution, collectively accounting for over 60% of the seagrass habitats within WPP 572, as shown in **Figure 19**. At the national scale, these two provinces harbor 0.25% of the country's seagrass ecosystems. Lampung also has a substantial share with 6% of the seagrass ecosystem in WPP 572. The remaining provinces within WPP 572, namely Aceh, Bengkulu, and Banten, collectively include 24% of the region's seagrass ecosystem, amounting to 0.2% of the seagrasses nationally.

Data on seagrass beds, including condition, is not yet adequately managed by the government (Hernawan, 2017). A few initiatives are evaluating the status of seagrass beds in Indonesia—among the largest ones is the COREMAP-CTI Program. Indicators to measure the status/condition of seagrass beds in Indonesia were standardized in 2017 by the Pusat Riset Oseanografi (PRO; the Oceanographic Research Centre) and Badan Riset dan Inovasi Nasional (BRIN; the National Research and Innovation Agency), with the creation of the Seagrass Ecological Quality Index (SEQI). The index comprises five indicators: 1) seagrass biodiversity, 2) seagrass cover, 3) macroalgae cover, 4) epiphyte cover, and 5) water biophysical condition. The index is then categorized into five categories: 1) very bad (0-0.36), 2) bad (0.37-0.52), 3) moderate (0.53-0.68), 4) good (0.69-0.84), and 5) very good (0.85).

With support from COREMAP-CTI, PRO evaluated the health of seagrass beds in Indonesia in 2018, 2019, and 2021 (Hernawan et al., 2021; Rahmawati, 2022). In 2018, the team monitored four sites in WPP 572: Nias Islands, Kepulauan Mentawai, Tapanuli Tengah, and Lampung, as shown in **Figure 20.** According to the figures, Nias' SEQI score is good; meanwhile, the rest of the sites are moderate.

map image removed

Figure 20. Seagrass Ecological Quality Index (Seqi) Scoring Across Indonesia in 2018.[123]

Size of the circles represent the SEQI scores. Sampling locations are: 1 = Nias, 2 = Tapanuli Tengah, 3 = Mentawai, 4 = Batam, 5 = Bintan, 6 = Lingga, 7 = Lampung, 8 = Karimunjawa, 9 = Makassar, 10 = Selayar, 11 = Kendari, 12 = Buton, 13 = Wakatobi, 14 = Sikka, 15 = Sawu, 16 = Ternate, 17 = Raja Ampat, 18 = Biak.

Unfortunately, the monitored sites differ slightly across years—specifically in WPP 572, where another monitoring was done in Tapanuli Tengah, Mentawai, and Lampung in 2021, leaving Nias with the highest

[123] Hernawan et al., 2021

SEQI score in WPP 572. The evaluation in 2021 shows an overall decline in seagrass health, as shown in **Table 53**. Kepulauan Mentawai appeared to experience the highest drop in seagrass health, slightly higher than Indonesia's average. The monitoring in 2021 also revealed that, on average, seagrass health in Indonesia is deteriorating. The result shows that the average index in 2018, 2019, and 2021 is 0.69, 0.67, and 0.66, respectively.

Table 53: Annual change rate in the SEQI score and its parameters between 2018 - 2021

Sites	SEQI	Seagrass biodiversity	Seagrass coverage (%)	Microalgae coverage (%)	Epiphyte cover (%)
Tapanuli Tengah	-0.01	0.27	0.85	1.17	7.73
Kepulauan Mentawai	-0.02	-0.46	2.33	0.24	3.16
Lampung	-0.005	0.18	-0.78	-0.84	-6.78
Indonesia	**-0.01**	**0.03**	**-0.92**	**0.32**	**5.04**

Given a higher loss rate, GHG emissions from seagrass bed loss are significantly higher than those from mangrove loss, amounting to approximately 60% more than mangrove loss. **Table 54** shows the projected loss of seagrass at the province level by 2030, which is approximately 6,183 ha, contributing roughly 2.7 million tons of CO2 emissions and a loss in sequestration potential of around 31,000 tons of CO_2. By 2050, the projected seagrass extent loss is approximately 14,318 ha, leading to about 6.27 million tons of CO_2 emissions. By 2060, the projected seagrass extent loss is estimated to be around 16,939 ha, contributing to approximately 7.42 million tons of CO2 emissions. Provinces contributing significantly to emissions from seagrass extent loss include Sumatera Barat, Sumatera Utara, and Aceh due to their large baseline areas combined with high rates of loss. Conversely, provinces like Banten and Bengkulu, with comparatively lower baseline areas, have lower seagrass loss and loss of sequestration potential.

Please see Annex 22 for estimated GHG emissions from Seagrasses

2.2.3 Coral Reef

WPP 572 is characterized by a high prevalence of coral reefs compared to other WPP areas, underscoring the need for coral reef conservation. Approximately 17% of Indonesia's coral reef ecosystem is located in WPP 572, making it the third largest WPP for coral reefs, following WPP 714 (18%) and WPP 713 (18%). WPP 715 also contains around 15% of the national coral reef coverage. The remaining 31% of the national coral reef distribution is spread across other WPPs. WPP 571 holds less than 1% of the nation’s coral reefs. The extent of coral reef cover in this study, based on the Allen Coral Atlas, includes only shallow oceans and is influenced by water turbidity during analysis. Therefore, these reef cover estimates should be considered conservative, as some coral ecosystems may not be included.

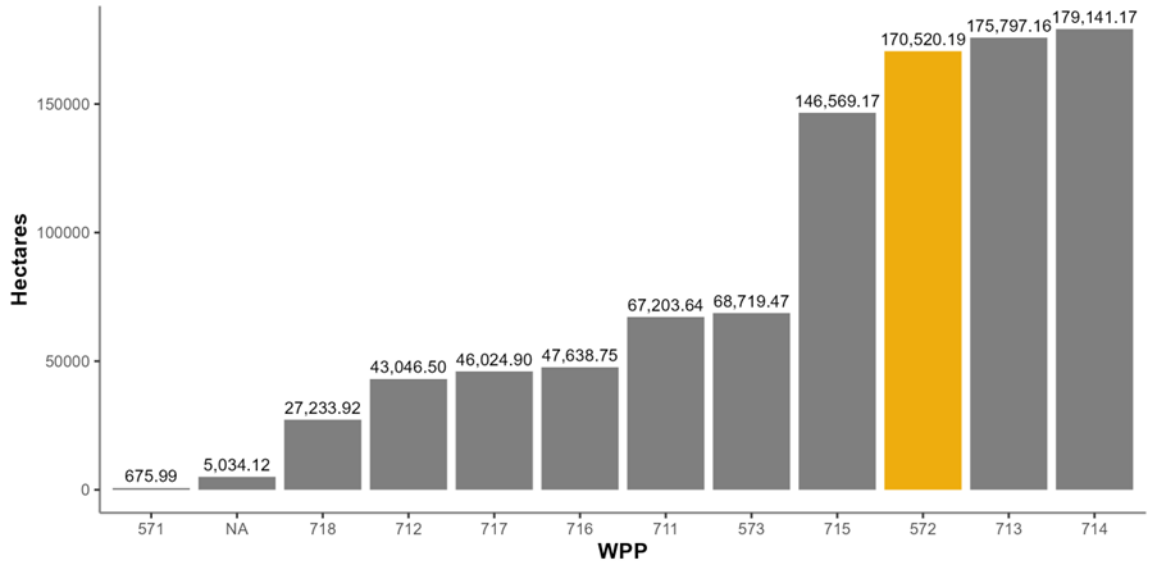


Figure 21. Coral Reef Distribution Based on WPP in 2020
Source: Allen Coral Atlas

Mirroring the distribution patterns observed in mangroves and seagrasses, Sumatera Barat and Sumatera Utara collectively account for over 63% of the coral reefs in WPP 572. Sumatera Utara has the largest area, with a coral reef area of 57,167 ha, constituting approximately 34% of the total coral reefs in WPP 572. This translates to 5.8% of total coral reefs in Indonesia. Sumatera Barat contributes 29%, Lampung accounts for 16%, and Aceh contributes 12% of the coral reefs of WPP 572. The remaining provinces, Banten and Bengkulu, and areas beyond provincial demarcations, jointly account for 9% of the coral reefs within WPP 572. On a broader scale, extending to the national level, the three most substantial coral reef provinces within WPP 572—Sumatera Barat, Sumatera Utara, and Lampung—collectively include more than 14% of the entire national coral reef expanse.

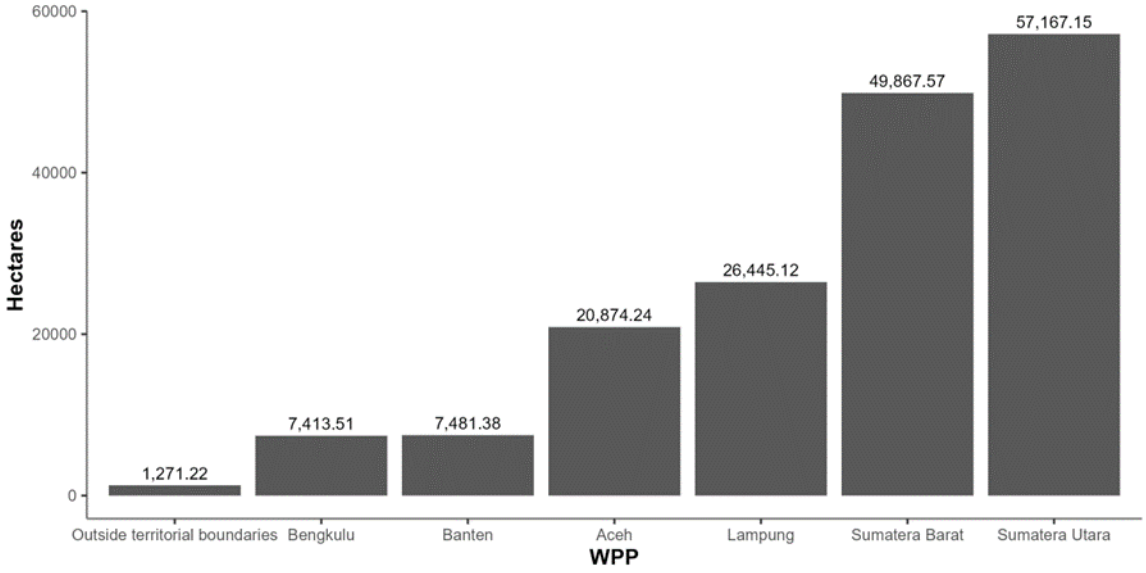


Figure 22 Coral Reef extent (hectares) per Province in WPP 572 in 2020[124]

[124] *Allen Coral Atlas*

Assessing coral cover unlike seagrass beds, is challenging due to the underwater location of coral reefs, requiring complex satellite image processing. The "Status of Indonesian Coral Reefs 2019" report by the RCO of LIPI evaluates the condition of coral reefs in Indonesia through field surveys but does not measure the extent of coral cover. Bruno and Selig (2007) found that approximately 1% of coral cover was lost annually in the Indo-Pacific Region between 1983 and 2003, increasing to around 2% between 1997 and 2003. In WPP 572, this rate equates to approximately 3,400 ha of coral cover loss. Globally, about 50% of coral reef cover was lost between 1957 and 2007 (Eddy et al. 2021). With a declining rate of up to 6.8%, Indonesia's coral reefs might lose up to 265,000 ha annually, and in WPP 572, up to 11,600 ha annually.

There are few studies that analyze the coral loss rate at a finer level. For instance, Nurdin et al (2023) found that the Spermonde Archipelago, Sulawesi, lost around 70% of live coral between 1990 and 2020. In Nusa Penida, Bali, dead corals increased from 17% in 2012 to 31% in 2016.[125,126]

In Indonesia, the criteria for coral reef degradation are regulated under the Minister of Environment and Forestry's Decree No. 4/2001, which is based on the percentage of living coral. The standard classifies the coral condition into four classes: very good, with >75% of living coral; good, with 50-75% of living coral; medium, with 25-50% of living coral; and bad, with <25% of living coral. The first two classes are further grouped as good coral conditions; meanwhile, the last two classes are grouped as poor coral conditions. The survey and monitoring of corals in shallow seas is standardized in Indonesia under the category SNI 7716:2012 [127]. The Allen Coral Atlas does not delineate the status of coral reefs. Instead, this Feasibility Study refers to LIPI (2020) to categorize coral reef quality in WPP 572.

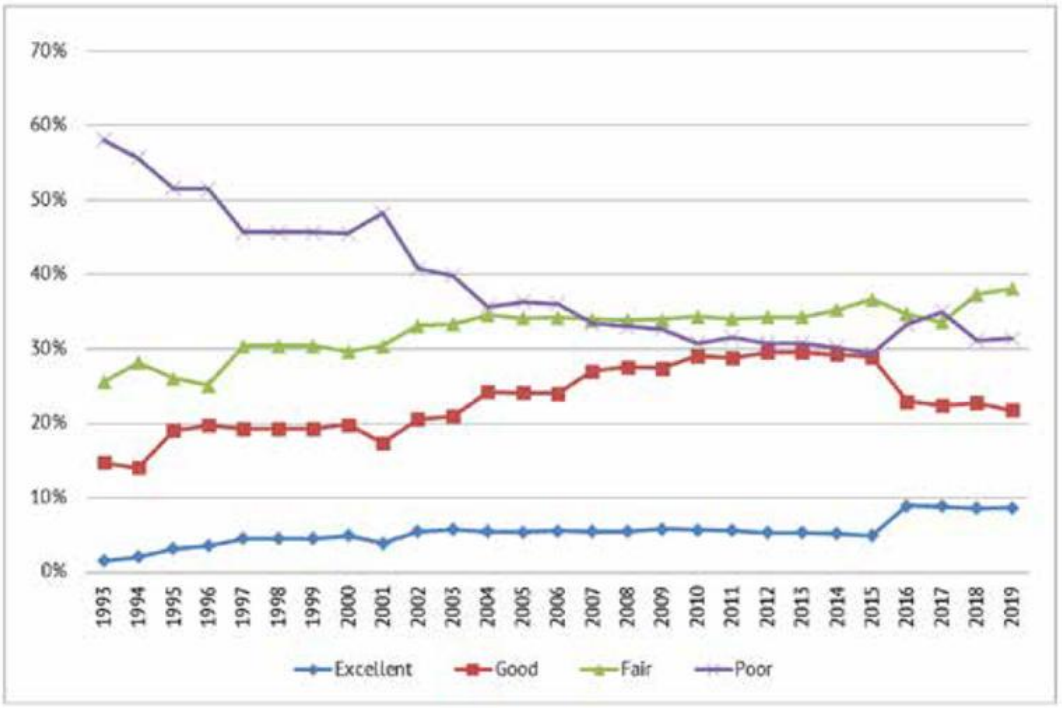


Figure 23. Trend of Coral Reef Conditions in Western Indonesia[128]

[125] D Susiloningtyas et al 2018 IOP Conf. Ser.: Earth Environ. Sci. 145 012054
[126] Nurdin, N., Prasyad, H., Rani, C., Al Azizi, S. Q., Pulubuhu, D. A., Aris, A., Aushaf, S. T., Nurdin, N., & Komatsu, T. (2023). Tracking coral loss in the Spermonde Archipelago of Indonesia: 32 years of satellite monitoring from 1990 to 2022. International Journal of Remote Sensing, 1–31. https://doi.org/10.1080/01431161.2023.2268823
[127] https://pesta.bsn.go.id/produk/detail/8757-sni77162011
[128] *LIPI, 2020*

According to LIPI (2020), most coral reefs in the western region of Indonesia, including those within WPP 572, are in suboptimal conditions that require increased intervention to safeguard these vital ecosystems. As of 2019, about 38% of the coral reefs were classified as fair conditions, closely followed by 31% in poor condition. In contrast, only 21% and 9% of coral reefs were in good and excellent condition, respectively. While the presence of coral reefs in excellent and good condition remains limited, a positive trajectory has been observed over 26 years (1993-2019), except for the good coral reefs, which experienced a decline between 2016 and 2019. In the case of poor coral reefs, the trend displayed a negative trajectory, with the proportion of reefs in poor condition declining by over 30% from 1993 to 2019. Further efforts, particularly on rehabilitation, must be made to improve and maintain the positive trajectory.

Coral reefs are at high risk due to climate change. Globally, without sufficient intervention, climatic hazards could potentially wipe out all coral reefs by the mid-to-late century (Beyer et al., 2018). Beyer et al. (2018) identified coral ecosystems more resilient to climate change by analyzing long-term coral reef conservation investments less subject to climate impacts. This analysis helps determine where to channel conservation investments for higher chances of success. The study indicates that some coral reefs in Indonesia, including those in the Sumatra region, experience relatively lower levels of climate impact. Specifically, in WPP 572, conservation investments in Sumatera Utara, Aceh, and Sumatera Barat, particularly in Kepulauan Mentawai, are expected to perform better than other reef ecosystems in the area.

2.3 Drivers of Ecosystem Degradation

At the local level, anthropocentric activities disturb the blue carbon ecosystem and coral reefs more directly than natural causes, such as natural disasters or climatic hazards, although the latter can cause more devastating impacts if they happen. The drivers of degradation and loss can broadly be categorized into two: natural and anthropogenic drivers.[129] Indonesia is considered one of the most disaster-prone countries, given its high exposure to natural and climatic hazards and high population.[130] Indonesia, particularly WPP 572, is in a zone of high tectonic and volcanic activities, which poses risks of earthquakes and tsunamis. Those disasters might disrupt coastal and ocean ecosystems, including mangroves, seagrass, and coral reefs. However, anthropocentric activities play a more significant role in disturbing ecosystem degradation. Anthropocentric pressures include unsustainable aquaculture and plantations, port, harbor, and industrial estate development and reclamation, destructive fishing activities, draining land for agriculture, and excessive resource utilization.[131,132]. As a developing country, this type of pressure will likely be intense along with the economic and population growth in the coming years.

2.3.1 Anthropogenic causes

Anthropogenic causes pose a direct, immediate risk to blue carbon ecosystems and coral reefs compared to natural causes. The destruction of the blue carbon ecosystem in the coastal and ocean areas can result from activities downstream and upstream. Our discussions with local stakeholders further emphasize the importance of including upstream economic agents as they are often not included in the blue carbon ecosystem protection discourse. The discussion also reveals that these regions face similar threats, although some issues are more pertinent in some areas. **Table** 54 **54** summarizes the threats and impacts to the ecosystem based on consultation with local stakeholders and literature review. We classified the threats into two types: the upstream, for economic actors that do not depend on marine and coastal

[129] Yando, Erik S., Taylor M. Sloey, Farid Dahdouh-Guebas, Kerrylee Rogers, Guilherme M.O. Abuchahla, Stefano Cannicci, Steven W.J. Canty, et al. 2021. 'Conceptualizing Ecosystem Degradation Using Mangrove Forests as a Model System'. Biological Conservation 263 (November): 109355. https://doi.org/10.1016/j.biocon.2021.109355

[130] Djalante, Riyanti, Matthias Garschagen, Frank Thomalla, and Rajib Shaw, eds. 2017. Disaster Risk Reduction in Indonesia: Progress, Challenges, and Issues. Disaster Risk Reduction. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-54466-3

[131] Lovelock, Catherine E, Trisha Atwood, Jeff Baldock, Carlos M Duarte, Sharyn Hickey, Paul S Lavery, Pere Masque, et al. 2017. 'Assessing the Risk of Carbon Dioxide Emissions from Blue Carbon Ecosystems'. Frontiers in Ecology and the Environment 15 (5): 257–65. https://doi.org/10.1002/fee.1491

[132] Yando, Erik S., Taylor M. Sloey, Farid Dahdouh-Guebas, Kerrylee Rogers, Guilherme M.O. Abuchahla, Stefano Cannicci, Steven W.J. Canty, et al. 2021. 'Conceptualizing Ecosystem Degradation Using Mangrove Forests as a Model System'. Biological Conservation 263 (November): 109355. https://doi.org/10.1016/j.biocon.2021.109355

ecosystems directly, and the downstream, representing economic actors that depend directly on marine and coastal ecosystems. The table below provides the upstream and downstream threats and impacts to ecosystems in WWP572.

Table 54. Threats and potential Impacts to Marine and Coastal Ecosystems

Threats to the ecosystem		Impact on the ecosystem
Upstream		
Unsustainable consumption practices	Untreated domestic (household) waste discarded into the river	Damaging blue carbon ecosystems and coral reefs
	Demand for fish species (e.g., sharks from bycatch) and size (e.g., smaller size) that are illegal to catch	Incentivizing fishers to catch illegal fish species and sizes, disturbing ecosystem balance, and potentially damaging coral reefs
Unsustainable production practices	Untreated solid waste and wastewater produced by companies upstream	Damaging blue carbon ecosystems and coral reefs due to sedimentation and spillover
	Beach sand mining and exploitation	
	Coal spillovers in rivers and ocean from coal ships	
Unsustainable tourism	There is a low demand for sustainable tourism and a high demand for cheap, less sustainable tourism.	Unsustainable tourism practices might impact the ecosystem, particularly coral reefs.
Downstream		
Illegal, unreported, and unregulated (IUU) and unsustainable fishing	Utilization of large offshore fish aggregating devices (FAD)	• Overfishing and increasing bycatch, which might disturb ecosystem balance. • Destroying the blue carbon and coral reef ecosystems
	Usage of potassium and dynamite/blast fishing	
	Utilization of illegal and unsustainable fishing tools (e.g., large-scale trawl with small mesh size)	
	Diesel spillover from fishing vessels	
Unsustainable aquaculture practices	Untreated waste from aquaculture discharges into the ocean	Damaging blue carbon ecosystems and coral reefs
	Unlicensed aquaculture establishments	Unsupervised, unsustainable practices might damage the blue carbon ecosystem.
	Converting mangroves for aquaculture	• Loss of mangroves, causing GHG emissions and loss of ecosystem services. • Seagrass and coral reefs might be destroyed due to sediment from development.
Infrastructure construction	Harbor/dock construction	• It might induce land cover change from blue carbon ecosystems and coral reefs to other uses. • Sedimentation and dredging from the development might directly affect coral reefs and seagrass.
	Seawall and breakwater construction	
	Land reclamation	
	Other public infrastructure	
Unsustainable marine &	Supporting tourism infrastructure construction (e.g., roads, tourist buildings, parks)	Might induce land cover change from blue carbon ecosystems, particularly mangrove

Threats to the ecosystem		Impact on the ecosystem
coastal-based tourism	Illegal logging construction	• Might induce land cover change to mangrove. • Seagrass and coral reefs might be destroyed due to sediment from development.
	Unsustainable tourism practices	Damaging blue carbon ecosystems and coral reefs
Unsustainable coastal household practices	Utilization of coral reefs for housing foundations in coastal and small islands	• Damaging blue carbon ecosystems and coral reefs • Inducing land cover change
	Unsustainable wood farming in mangrove	
	Untreated domestic (household) waste is discarded into the ocean.	
	Illegal reclamation to the sea for housing	

2.3.1.1 Upstream

At the upstream, untreated waste, unsustainable production practices, and high demand for unsustainable fish and tourism are stressing coastal ecosystems. Waste problems are one of the biggest challenges in the region, both waste that comes from the land and ocean waste that is washed up on the shore. This waste will potentially damage mangroves, seagrass beds, and coral reefs, especially through sedimentation, pollutants, and eutrophication that disturb the soil and hinder ecosystem growth[133]. For example, it is estimated that a staggering 200 tons of untreated waste was washed up on Labuan Beach, Banten, making the area the dirtiest beach in Indonesia. Waste problems are also troublesome in Lampung, given its geomorphology as a bay. Consultation with the local stakeholders indicates that a large portion of waste in Lampung Bay comes from ocean waste that is washed up on the beach. A study in Lampung Bay reveals that plastic waste dominates the waste piles[134]. In addition to municipal waste, solid waste, and wastewater from factories are often discarded to the river. For instance, it is found that the ocean in Muko-muko Regency is polluted by sewage discharged by nearby crude palm oil factories.

Table 55. Estimated Plastic Marine Debris to WPP 572

Province	WPP 572 Coastal population (millions)	Annual Total MSW (million kgs)	Plastic MSW (million kgs)	Mismanaged plastic MSW (million kgs)	Plastic marine debris (million kgs)
Aceh	1.37	346.21	48.75	11.97	1.46
Banten	3.38	850.72	119.78	29.41	3.58
Bengkulu	1.50	376.70	53.04	13.02	1.59
Lampung	3.85	969.77	136.54	33.52	4.08

[133] Earp, H. S., Prinz, N., Cziesielski, and Andskog, M. 'For a World Without Boundaries: Connectivity Between Marine Tropical Ecosystems in Times of Change' in YOUMARES 8 – Oceans Across Boundaries: Learning from each other, edited by Simon Jungblut, Viola Lieblich, and Maya Bode, pp 125-144. Kiel Germany: SpringerOpen, 2018. https://link.springer.com/chapter/10.1007/978-3-319-93284-2_9

[134] Kusuma, Anma Hari, Amril Ma'ruf Siregar, Helvi Yanfika, Puspita Yuliandari, Muhammad Havis, Lusmeilia Afriani, and Rudy Rudy. 2022. 'Struktur Komunitas Karang Pasca Tsunami Di Desa Kunjir, Kecamatan Rajabasa, Kabupaten Lampung Selatan, Provinsi Lampung'. Jurnal Perikanan 12 (2): 245–55. https://doi.org/10.29303/jp.v12i2.301

Province	WPP 572 Coastal population (millions)	Annual Total MSW (million kgs)	Plastic MSW (million kgs)	Mismanaged plastic MSW (million kgs)	Plastic marine debris (million kgs)
Sumatra Barat	3.01	758.14	106.75	26.21	3.19
Sumatra Utara	2.13	536.70	75.57	18.55	2.26
Total	**15.24**	**3,838.23**	**540.42**	**132.67**	**16.16**

The Ocean Account Framework suggests calculating the waste accumulated on the beach. This is estimated calculating the terrestrial waste ending up in the ocean by adopting the Jambeck et al. (2015) method.[135] In this case, the study estimates the mismanaged municipal plastic waste that is either littered or inadequately processed, generated by the population of districts adjacent to WPP 572, as a proxy to the coastal population, that ends up in the ocean. Indonesians generate approximately 0.69 kg of waste per capita, 14% of which is plastic waste.[136] Around 24.6% of waste is not appropriately treated, and of this 12% ends up in rivers and eventually the ocean.[137] Utilizing population data, the estimated waste that goes to the WPP 572 ocean is shown in **Table 55**. Indonesia's total plastic marine debris ranges from 0.48 to 1.29 million metric tons. **Thus, the coastal population in WPP 572 contributes to around 1.3 – 3.7% of Indonesia's plastic marine debris.**

Currently, the waste management system in the regions is inadequate, so households discard their waste in the river, which ends up in the sea. Consultation with the local stakeholders indicates this problem is especially apparent in rural areas, including coastal rural regions, as there are often no garbage services, such as trucks, to pick up waste from their houses. Improvements to municipal and industrial waste management, especially in the rural coastal areas, are pertinent to protect coastal ecosystems. Furthermore, climate change can exacerbate this problem as increasing wind and storm intensity can create more runoff of unmanaged solid waste to the coast and ocean.[138]

Besides waste problems, unsustainable household consumption plays a role in stressing the ecosystem. There is still a demand for illegal fish, such as shark and ray species and smaller fish. These types of fish are often a result of bycatch from trawls and fish aggregating devices, especially those with a small mesh size. However, since there is a demand for these products, including overseas markets, fishermen are incentivized to keep them instead of returning them to the sea. The team's site visit to the PPS Lampulo, Banda Aceh, revealed that fishermen still sell bycatch shark and rays in the market. This product is often sold to Medan, Sumatera Utara, and later exported overseas. Given its high price, especially (e.g. shark fin ranging from IDR700,000 to IDR1,000,000 per kg), fishermen are incentivized to sell them. These shark catches are still apparent even though the Minister of Marine Affairs & Fisheries Regulation 48/PERMEN-KP/2016 states that fishermen cannot capture some shark species.

Regarding unsustainable production practices, untreated company wastewater is discarded into the river and ends up in the ocean, damaging the ecosystem through sedimentation and wastewater. For instance, the Batang Anai River in Sumatera Barat was polluted by untreated sewage

[135] Jambeck, Jenna R., Roland Geyer, Chris Wilcox, Theodore R. Siegler, Miriam Perryman, Anthony Andrady, Ramani Narayan, and Kara Lavender Law. 2015. 'Plastic Waste Inputs from Land into the Ocean'. Science 347 (6223): 768–71. https://doi.org/10.1126/science.1260352
[136] Qonitan, Fatimah Dinan, I Wayan Koko Suryawan, and Ari Rahman. 2021. 'Overview of Municipal Solid Waste Generation and Energy Utilization Potential in Major Cities of Indonesia'. Journal of Physics: Conference Series 1858 (1): 012064. https://doi.org/10.1088/1742-6596/1858/1/012064
[137] Damanhuri, Enri, Widhi Handoko, and Tri Padmi. 2014. 'Municipal Solid Waste Management in Indonesia'. In Municipal Solid Waste Management in Asia and the Pacific Islands, edited by Agamuthu Pariatamby and Masaru Tanaka, 139–55. Environmental Science and Engineering. Singapore: Springer Singapore. https://doi.org/10.1007/978-981-4451-73-4_8
[138] Belete, D. A. 2011. "Road and urban storm water drainage network integration in Addis Ababa: Addis Ketema Sub-city." Journal of Engineering and Technology Resarch 3 (7): 217-225

that was discarded by a food and beverage manufacturer.[139] In Sepang Bay, Bengkulu, a coal-fired power plant is thought to pollute the bay, which kills turtles and other marine biota.[140] In July 2020, a coal ship was capsized, polluting the surrounding beach.[141]

Similarly, the demand for unsustainable tourism is still relatively high in Indonesia. What unsustainable tourism means here is carbon-intensive tourism and tourism that destroys or damages ecosystems such as coral reefs and seagrass beds. Recreational diving, in particular, could pose immense threats to coral reefs.[142] Sustainable tourism should be mainstreamed and not be exclusive. Nguyen (2021) estimated the price elasticity of tourism demand in Southeast Asia, including Indonesia, and found that domestic tourism demand is sensitive to price, with an elasticity of 2.45.[143] Reducing the sustainable tourism price will bring significantly more demand, yielding net economic benefits for tourism providers and reducing negative externalities.

2.3.1.2 Downstream

On the downstream side, illegal, unreported, and unregulated (IUU) fishing practices, unsustainable and illicit aquaculture, and infrastructure development pose the greatest threats to the ecosystems. IUU fishing poses significant dangers, particularly to seagrass and coral reef ecosystems. Our consultation with the local stakeholders reveals that these practices continue by local fishermen in the six provinces despite the regulations on IUU fishing, such as Law (*Undang-Undang*/UU) 45/2009 about Fisheries and programs by Directorate General of Marine and Fisheries Resources Supervision of MMAF, which include field monitoring, surveillance, and law enforcement. For instance, low-explosive coral bombing made of potassium is still exercised by fishermen in Betung Selatan Bay, Lampung. The area still has a black market for low explosives, which can only be accessed by limited people. In February 2021, seven fishermen were caught conducting fish bombing around Sipora Island, Kepulauan Mentawai.[144] As noted in the previous subchapter, Kepulauan Mentawai is a region of great importance for its blue carbon habitats.

Large trawls with small mesh, such as *pukat harimau*, which are sometimes combined with large fish aggregating devices, are also utilized by some fishermen. *Pukat harimau* is explicitly banned by Law 45/2009 as it increases by catches that might disturb ecosystem balance and may destroy coral reefs directly. However, this fishing tool is still used as it increases the catches exercised by fishermen in Sumatra Barat, Bengkulu, and Aceh.

[139] Mardiani, Dewi. 'Limbah Cair Cemari Sungai di Sumbar' Republika News 25 April 2012 https://news.republika.co.id/berita/m30fxh/limbah-cair-cemari-sungai-di-sumbar. Accessed in 26 September 2023
[140] Putri, Yolands. ' Selamatkan Laut Bengkulu dari Limbah PLTU Teluk Sepang!'. Laut sehat id 7 July 2020 https://lautsehat.id/peristiwa/lands-_/selamatkan-laut-bengkulu-dari-limbah-pltu-teluk-sepang/. Accessed in 26 September 2023
[141] Hanafiah, Junaidi. 'Tumpahan Batubara Cemari Pantai Nagan Raya, Walhi Aceh: Kerugian Lingkungan Harus Dihitung' Mongabay 25 August 2020. https://www.mongabay.co.id/2020/08/25/tumpahan-batubara-cemari-pantai-nagan-raya-walhi-aceh-kerugian-lingkungan-harus-dihitung/ Accessed in 26 September 2023
[142] Lin, B. Close encounters of the worst kind: reforms needed to curb coral reef damage by recreational divers. Coral Reefs 40, 1429–1435 (2021). https://doi.org/10.1007/s00338-021-02153-3
[143] Nguyen, Hai Quang. 2021. 'Elasticity of Tourism Demand by Income and Price: Evidence from Domestic Tourism of Countries in ASEAN'. Edited by Pier Luigi And Paula Remoaldo. Cogent Social Sciences 7 (1): 1996918. https://doi.org/10.1080/23311886.2021.1996918
[144] Sanene, Patrisius. 'Tujuh Pelaku Bom Ikan Asal Sibolga Dibekuk Polisi di Perairan Sipora' MentawaiKita 6 February 2021 https://www.mentawaikita.com/baca/5153/tujuh-pelaku-bom-ikan-asal-sibolga-dibekuk-polisi-di-perairan-sipora Accessed in 26 September 2023

Figure *24* illustrates an example of bycatch sharks sold in Lampulo Ocean Fishing Harbor, Aceh. These fishing tools, including potassium bombing, are exercised by fishermen if they are sure that there is no monitoring operation by the police department, noting that the enforcement of IUU fishing is relatively weak. Discussion during stakeholder consultations revealed that financing is the biggest problem in ocean and marine monitoring and enforcement.



Figure 24. Smoothnose Wedgefish, a critically endangered species, Lampulo Ocean Fishing Harbor, Aceh[145]

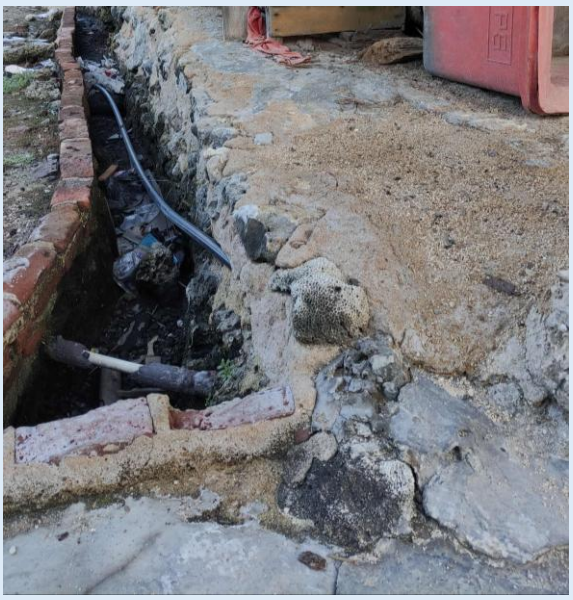
Aquaculture places stress on ecosystems, particularly mangrove ecosystems. The primary threats from coastal aquaculture are the discharge of untreated wastewater into the ocean and the conversion of mangroves to aquaculture, often illegally. Ilman et al. (2016) estimated that approximately 600,000 ha of mangroves might be converted to shrimp aquaculture between 2010 and 2030 to meet global demand, given current technology. These issues are linked to technology and financing. Many aquaculture companies do not construct adequate wastewater treatment plants due to their high cost and large space requirements. Additionally, the extensive land needed for aquaculture is due to low productivity. Improved technology is necessary to reduce the land requirements for aquaculture.

Land conversion, primarily from mangroves to other uses, is driven by infrastructure and business development. This not only leads to direct conversion but also causes sedimentation. In Pulau Baai, Bengkulu, approximately 10 ha of mangroves were converted for a coal-fired power plant.[146] Nearby, part of the ecosystem was converted for tourism infrastructure development.[147] In Pariaman, Sumatera Barat, about 1 km of mangrove forests within the protected forest was cleared for road construction.[148] This issue is mainly related to planning, necessitating careful integration of landscape and ecosystem considerations in government development planning, particularly at the local level.

[145] *Field trip in Lampulo Ocean Fishing Harbor, Aceh, on 30 May to 2 June 2023*
[146] Sipayung, Helti Marini. ' Komunitas sesalkan pembabatan mangrove di tapak PLTU oleh investor China' Antara news 28 August 2017 https://www.antaranews.com/berita/649265/komunitas-sesalkan-pembabatan-mangrove-di-tapak-pltu-oleh-investor-china. Accessed in 5 September 2023
[147] Supardi, Ahmad. 'Pengembangan Objek Wisata di Bengkulu Harus Perhatikan Aspek Ekologi' Mongabay 31 August 2020 https://www.mongabay.co.id/2020/08/31/pengembangan-objek-wisata-di-bengkulu-harus-perhatikan-aspek-ekologi/ Accessed in 26 September 2023
[148] Vinolia. 'Buka Jalan, Hutan Mangrove di Pariaman Terbabat.' Mongabay 30 December 2018 https://www.mongabay.co.id/2018/12/30/buka-jalan-hutan-mangrove-di-padang-pariaman-terbabat/ Accessed in 26 September 2023

Box 1. Coral reef mining for housing foundations





In some regions, particularly in coastal areas and small islands, coral reefs are still utilized for housing foundations. The pictures above show how coral stones are used for the foundation in the Pulau Pasaran sub-district, which is a coastal area in Lampung province. Besides in coastal areas, coral reefs are massively used as housing foundations in small islands, such as Mentawai Island, West Sumatra. Our discussions with local stakeholders indicate that this is opted for by the local communities since coral reefs are “free” since they do not need to spend money to get them. This is especially concerning in small islands where the logistics are complex and costly, making the supply of building materials limited. On the other hand, it might also be risky for investors to set up a material market in small islands since the demand is, likewise, limited, with low reservation prices. In this case, the government might consider providing subsidies for this market.

Law 27/2007 regulates coral reef management, but its article prohibiting coral reef mining might have multiple interpretations. Article 35a stated that mining coral reefs is prohibited if it causes damage to the ecosystem, however it gives the impression that mining coral reefs are allowed as long as it does not damage the overall coral reefs' ecosystem. As such, there is a need to develop stricter and clearer regulations. Local government, particularly at the district level, should consider developingrules that prohibit coral reef mining for whatever reason or scale.

Besides the abovementioned activities, coastal household practices affect the blue carbon ecosystems and coral reefs. Like the upstream household, coastal households often discard their waste directly into the ocean, mainly due to low awareness and inadequate waste facilities. Wood farming from mangroves for raw materials and fuel also harms the ecosystem, although the destruction directly related to wood farming is declining relative to mangrove conversion for aquaculture. Coral farming for housing materials is rampant, destroying the coral reefs, particularly in island areas, such as Mentawai Islands in Sumatra Barat and Nias Islands in Sumatra Utara. These coral reefs are often utilized for housing foundations, supported by a trend of housing getting closer to the coastline, making these foundations necessary. Error! Reference source not found. illustrates an example in the Pulau Pasaran sub-district in Lampung.

2.3.2 Natural Causes

Consultations with local stakeholders indicate that coastal ecosystems in WPP 572 are vulnerable to disasters such as tsunamis, earthquakes, volcanoes, and climate-related events, despite their role in mitigating the effects of these disasters. There have been instances where large disasters have damaged these ecosystems. For example, in 2004, an earthquake of 9.1–9.3 MW in the Indian Ocean caused a

tsunami that affected the western part of Sumatra Island. In Banda Aceh, the tsunami destroyed approximately 21% of the mangrove ecosystems, reducing their area from 84.32 ha to 66.24 ha (Affan et al., 2019). Additionally, the earthquake impacted the coral reef ecosystems in Weh Island, Aceh, increasing the extent of dead coral reefs.[149]

For the recent one, the tsunami happening in the Sunda Strait in 2019 also damaged the coral reef ecosystems. A study by Kusuma et al. (2022) found that the tsunami severely destroyed coral reef ecosystems in Kunjir village. This tsunami also destroyed a newly restored coral reef in Paniis Beach, Pandeglang, Banten, which a local community initiated.[150] Our discussion with local stakeholders confirms that natural events, such as abrasion, affect seagrass beds.

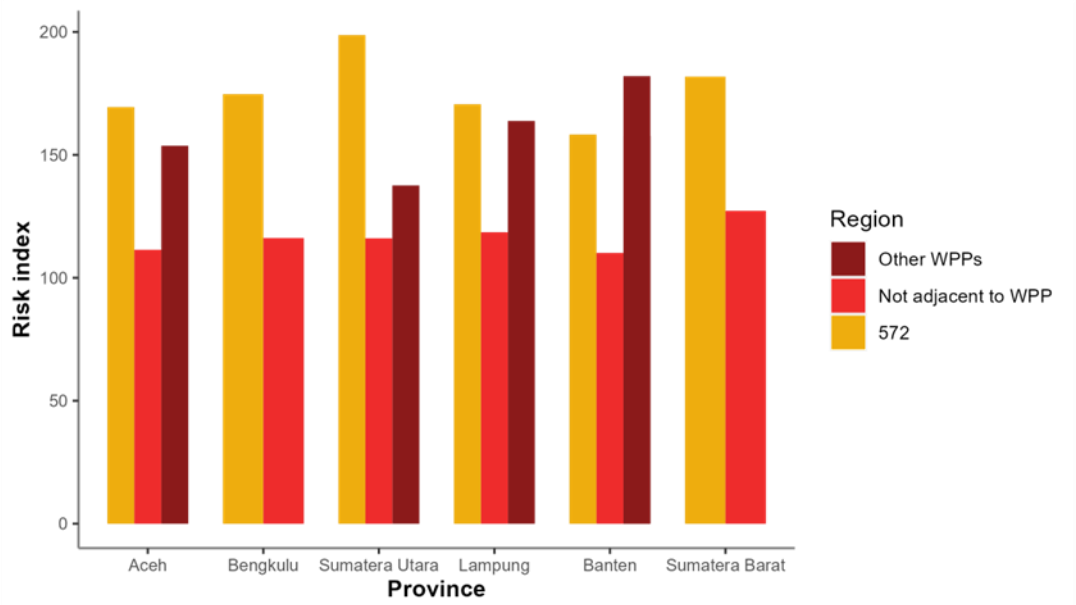


Figure 25. Disaster Risk Index in WPP 572 in 2021[151]

Climate change impacts such as storms, temperature rise, and sea level rise also damages mangroves, seagrass, and coral reefs. In 2016, the seawater temperature rise in the Indian Ocean caused coral bleaching. A study in Tapanuli Tengah, Sumatera Utara, shows that around 50% of coral cover decreased due to the event.[152] Mangroves and seagrass beds are also affected by climate change through slower plant productivity, sedimentation, salinity change, drowning, and submersion, specifically for mangroves[153] (Ward et al. 2016; Short and Neckles 1999). Some instances show that climate disasters affect restoration programs. In Pekalongan City, Jawa Tengah, a mangrove restoration program failed as the sea water constantly submerged the area (Ario, Subardjo, and Handoyo 2016).

[149] Campbell, Stuart & Pratchett, M.S. & Wahyu, Aji & Ardiwijaya, R.L. & Fadli, Nur & Herdiana, Yudi & Kartawijaya, Tasrif & Mahyiddin, D. & Mukminin, Ahmad & Pardede, Shinta & Rudi, E. & Siregar, Muhammad & Baird, Andrew. (2007). Disturbance to coral reefs in Aceh, Northern Sumatra: Impacts of the Sumatra-Andaman tsunami and pre-tsunami degradation. Atoll research bulletin. 544. 55-78

[150] Kusuma, Anma Hari, Amril Ma'ruf Siregar, Helvi Yanfika, Puspita Yuliandari, Muhammad Havis, Lusmeilia Afriani, and Rudy Rudy. 2022. 'Struktur Komunitas Karang Pasca Tsunami Di Desa Kunjir, Kecamatan Rajabasa, Kabupaten Lampung Selatan, Provinsi Lampung'. Jurnal Perikanan 12 (2): 245–55. https://doi.org/10.29303/jp.v12i2.301

[151] *Indonesia's National Board for Disaster Management*

[152] Siringoringo, R M, M Abrar, N W P Sari, R D Putra, F D Hukom, O R Sianturi, R Sutiadi, and B Arbianto. 2022. 'Coral Reefs Recovery Post Bleaching Event in Central Tapanuli, North Sumatra'. IOP Conference Series: Earth and Environmental Science 1033 (1): 012044

[153] Ward, Raymond D., Daniel A. Friess, Richard H. Day, and Richard A. Mackenzie. 2016. 'Impacts of Climate Change on Mangrove Ecosystems: A Region by Region Overview'. Ecosystem Health and Sustainability 2 (4): e01211. https://doi.org/10.1002/ehs2.1211

Coastal regions adjacent to WPP 572 are more vulnerable to disasters compared to other regions in the same provinces, posing a risk to conservation programs. **Figure 25** depicts the 2021 average disaster risk index for districts (kabupaten/kota) adjacent to WPP 572, other WPPs, or not adjacent to any ocean bodies. This index considers nine types of disasters: earthquakes, tsunamis, volcanoes, floods, landslides, extreme weather, drought, wildfire, and sea waves. The figure shows that districts adjacent to WPP 572 have a higher average disaster risk index than those in the same provinces, except for Banten. In Sumatera Utara, the average risk index in districts adjacent to WPP 572 is almost double that of districts not neighboring WPPs. Detailed, specific risks in WPP 572 are outlined in Section 3: Climate Change Profile – Risk and Vulnerability.

Estimates for GHG emissions from the blue carbon ecosystems in WPP 572 under the with and without project scenarios are provided in **Annex 22.**

3 Section 3: Climate Change Profile – Risk and Vulnerability

3.1 Indonesia's Climate Profile

Indonesia is among the most vulnerable countries to climate change, facing impacts across geographic, social, economic, and political dimensions. Climate-driven natural disasters, such as floods, droughts, and storm surges, along with gradual changes in climatic variables like sea level rise, rainfall pattern shifts, and temperature increases, contribute to this vulnerability. In 2022, according to the European Commission INFORM study, Indonesia ranked 56th out of 191 countries in terms of climate change impact risk.[154]

Indonesia's coastal communities and ecosystems are highly vulnerable to climate change. With the fifth-largest population in low-elevation coastal zones, 5.5 to 8 million Indonesians are projected to face climate threats by 2030.[155] The marine and coastal sectors, especially fisheries and aquaculture, are expected to suffer significant economic losses, with a potential revenue shortfall of IDR 81.82 trillion by 2024.[156]

Indonesia's coastal communities face significant climate threats, including ocean warming, sea-level rise, altered precipitation, acidification, and extreme weather events. Building resilience is crucial for their well-being. WPP 572, a highly productive fishing area with over 1.2 million metric tons of potential commodities, supports these communities' food security and livelihoods.[157] Despite its productivity, WPP 572's utilization rate is only 0.65, the lowest among Indonesian WPPs, indicating substantial untapped potential.[158]

This section provides a CCVA for WPP 572, detailing key climate hazards, assessing ecosystem sensitivity, and evaluating the adaptive capacity of coastal communities. The findings will inform the development of adaptation strategies and interventions to ensure a resilient and sustainable future for WPP 572's fisheries and the livelihoods dependent on them.

3.2 Objectives of the CCVA

CCVA for WPP 572 aims to provide a detailed understanding of the region's vulnerability to climate change, enabling the development of targeted interventions and policy strategies to enhance community resilience

[154] European Commission, Joint Research Centre, (2022). *INFORM Climate Change: quantifying the impacts of climate and socio-economic trends on the risk of future humanitarian crises and disasters*, Publications Office of the European Union. https://data.europa.eu/doi/10.2760/383939
[155] Neumann, B., Vafeidis, A. T., Zimmermann, J., & Nicholls, R. J. (2015). Future Coastal Population Growth and Exposure to Sea-Level Rise and Coastal Flooding - A Global Assessment. PLOS ONE, 10(3), e0118571. https://doi.org/10.1371/journal.pone.0118571
[156] Ministry of National Development Planning/Bappenas. (2021a). *Climate Resilience Development Policy 2020-20245 – Executive Summary*. https://lcdi-indonesia.id/wp-content/uploads/2021/11/ 0_Executive- Summary.pdf
[157] Based on Marine and Fishery Affairs' Ministerial Decree No. 50 Year 2017 on Estimation of Potential, Allowable Catch, and Utilisation Rate of Fish Resources in the State Fisheries Management Area of the Republic of Indonesia. https://peraturan.bpk.go.id/Details/159676/kepmen-kkp-no-50kepmen-kp2017-tahun-2017
[158] Zikra, M, Suntoyo, Lukijanto. (2015). Climate Change Impacts on Indonesian Coastal Areas. *Procedia Earth and Planetary Science*, *14*, 57-63. https://doi.org/10.1016/j.proeps.2015.07.085

and adaptive capacity. The study focuses on the experiences and livelihoods of those most affected. The key objectives can be summarized as follows:

- Assess Climate Risks: Analyze how communities in WPP 572 are exposed to climate risks, such as sea level rise, temperature changes, and extreme weather events.
- Evaluate Sensitivity: Examine the sensitivity of local communities to these climate changes and how it affects their livelihoods.
- Determine Adaptive Capacity: Assess the current capacity of communities to adapt to climate impacts and identify areas for improvement.
- Develop Tailored Interventions: Create tailored interventions and policy strategies that address specific vulnerabilities and enhance community resilience.

3.3 Climate Change Vulnerability Definition and Assessment Framework

In the latest report (Sixth Assessment Report), IPCC defines **vulnerability** as "the propensity or predisposition to which a system is sensitive or susceptible to harm and lack of capacity to cope and adapt with adverse effects of climate change." This vulnerability is determined by the profile, magnitude, and rate of climate change exposure, coupled with the sensitivity and adaptive capacity of the system within a specific area.

The report refers to climate change **exposure** as the nature and magnitude of climate hazards experienced by the system. This includes analyzing past and projected changes in temperature, precipitation, sea level, wind and waves, and extreme climate events. Climate change **sensitivity** assesses the degree to which the system is affected by these changes, considering factors such as the diversity of fish species, habitat vulnerability, and dependence on coastal resources.

Lastly, **adaptive capacity** is defined as the ability of a system to adjust to climate change to moderate potential damage, take advantage of opportunities, or cope with the consequences. This encompasses the availability and accessibility of essential infrastructure and services, financial resources, technological advancements, and community knowledge and practices.

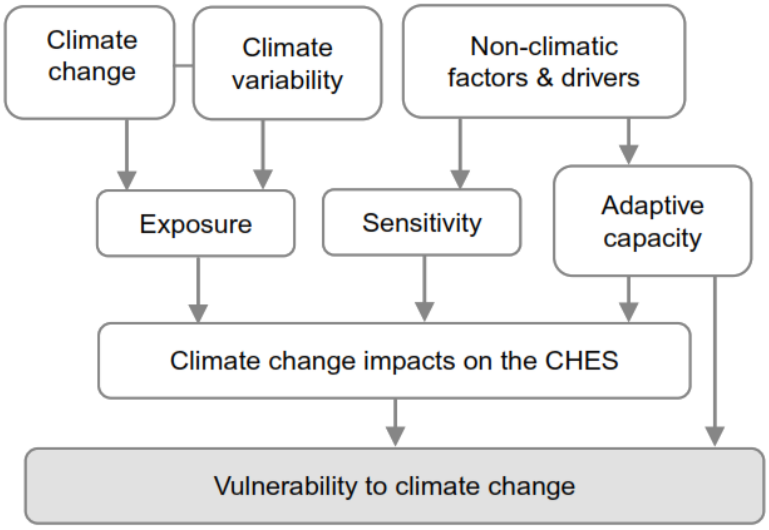


Figure 26. Climate Change Vulnerability Assessment Framework and Its Key Components[159]

[159] Soares, M. B., Gagnon, A. S., & Doherty, R. M. (2012). Conceptual elements of climate change vulnerability assessments: a review. *International Journal of Climate Change Strategies and Management, 4(1)*, 6-35. https://doi.org/10.1108/17568691211200191

The CCVA framework is commonly used to dissect a system's susceptibility to climate change. The CCVA framework assesses the above three key components: climate change exposure, sensitivity, and adaptive capacity:

- *Exposure* refers to the amount and rate of change that a species or ecosystem experiences as a result of direct (e.g., changes in temperature, precipitation) or indirect (e.g., habitat shifts caused by the changing composition of vegetation) impacts of climate change.

- *Sensitivity* refers to characteristics of a species or system that are dependent on specific environmental conditions, as well as the extent to which climate change may affect them (e.g., temperature or water supply requirements)
- Adaptive capacity is the ability of a species to adapt and persist under changing conditions through local or regional acclimation, dispersal or migration, adaptation (e.g., behavioral shifts) and/or evolution is what helps it to cope with the changes in its environment.

These components interweave to determine a system's overall vulnerability, as seen in Figure 26. High exposure, high sensitivity, and low adaptive capacity will result in worse climate change impacts on the coupled human-environment system (CHES). Meanwhile, low exposure or high adaptive capacity can mitigate the effects of sensitivity. Understanding these interconnected elements is crucial for identifying vulnerable areas and developing effective adaptation strategies and development actions.

3.4 Methodology and Assessment Components

The CCVA process involves identifying and analyzing socioeconomic, physical, and environmental factors that affect the sensitivity and/or susceptibility of the WPP 572 area to climate change and/or hazards, through the application of both qualitative and quantitative techniques. This study adheres to the international best practices methodology outlined by the IPCC AR6, combined with robust data reference, peer-reviewed academic literature, and expert interviews with local communities, organizations and private sector entities (See Annex 7, Stakeholder consultation report for more information). The following are detailed methodology and assessment components.

3.4.1 Study Scope and Problem Definition

The following Points outline the study's scope and problem framing on conducting CCVA for Indonesia's WPP 572. It includes the system definition, identification of key stressors, and evaluation of exposure, sensitivity, and adaptive capacity

- Study Area. The study system of interest is Indonesia's WPP 572, located in the Indian Ocean (western part of Sumatra Island), including the Sunda Strait. This system encompasses biophysical components (mangroves, coral reefs, seagrass, fish stocks) and socio-economic components (coastal communities' poverty, gender and inequality, fisheries, and coastal mari-, aqua-, and agri-culture).
- Key Climate Stressors and Vulnerabilities. The study prioritizes four climate-related challenges impacting the WPP 572 region: changing air and sea surface temperatures, rainfall patterns, sea level anomalies, and wind and waves. It also considers the potential interactions between these challenges. Please note that increases in wind speed and waver height were not significant and are excluded from further analysis.
- Exposure, Sensitivity, and Adaptive Capacity. The analysis assesses the exposure of WPP 572 elements to these challenges, their sensitivity (degree of impact), and the response capacity of stakeholders to manage these impacts. Based on expert and stakeholder consultations, the exposure analysis applies no specific weighting to each climate indicator, treating them as having equal impact on the coastal communities and ecosystems.

3.4.2 Data Collection and Analysis

3.4.2.1 Quantitative Data

The study utilizes historical and projected climate data (i.e., air and sea temperatures, rainfall, sea level rise, and extreme climate indices), population data (i.e., number of coastal households and members, occupations, gender demographics), natural capital data (i.e., mangrove, seagrass, and coral quality & extent, fish catch landings, fish stock), and economic data (i.e., gross regional domestic product, poverty level).

These datasets are derived from Coupled Model Intercomparison Project Phase 6 (CMIP6)[160] of the Earth System Grid Federation, BPS, MoE's SIDIK, Global Mangrove Watch, Indonesia Seagrass Data Working Group, Allen Coral Atlas, and peer-reviewed literature and references for the respective climate, socioeconomics, and natural capital data. Detailed data sources, descriptions, and their corresponding assessment are summarized in the **Error! Not a valid bookmark self-reference.** below.

Table 56. Quantitative data sources and descriptions for the study

	Personal Security/Safety	Income Security	Food Security	Social Inclusivity	Ecosystem Sustainability
Exposure	• Number of coastal populations: BPS (2020) • Demographic data (gender, age): BPS (2020) • Exposure index: SIDIK KLHK (2018)	• Number of fishers: KKP (2017-2021) • Number of marine fish cultivators: KKP (2017-2021) • Poverty level: BPS (2020) • Exposure index: SIDIK KLHK (2018)	• Aquaculture (floating nets, seagrass, ponds) productions: BPS (2013-2021) • Marine fishery production: BPS (2013-2021) • Exposure index: SIDIK KLHK (2018)	• Number of coastal households: BPS (2020) • Demographic data (gender, age): BPS (2020) • Exposure index: SIDIK KLHK (2018)	• Mangrove extent: Global Mangrove Watch (1996-2020) • Seagrass extent: Indonesia Seagrass Data Working Group (2022) • Coral extent and health: Allen Coral Atlas (2022)

[160] U.S. Department of Energy. (2023). *Earth System Grid Federation CMIP6* (Metagrid Version 1) [Data set]. https://aims2.llnl.gov/search/?project=CMIP6/

	Personal Security/Safety	Income Security	Food Security	Social Inclusivity	Ecosystem Sustainability
Sensitivity	• Occupation data: BPS (2020) • Disaster (hydrometeorology) data: BNPB (1990-2020) • Sensitivity index: SIDIK KLHK (2018)	• Occupation data: BPS (2020) • Number of fishers: KKP (2017-2021) • Number of marine fish cultivators: KKP (2017-2021) • Sensitivity index: SIDIK KLHK (2018)	• Aquaculture (floating nets, seagrass, ponds) productions: BPS (2013-2021) • Marine fishery production: BPS (2013-2021) • Sensitivity index: SIDIK KLHK (2018)	• Number of coastal households: BPS (2020) • Demographic data (gender, age): BPS (2020) • Sensitivity index: SIDIK KLHK (2018)	• Mangrove extent: Global Mangrove Watch (1996-2020) • Seagrass extent: Indonesia Seagrass Data Working Group (2022) • Coral extent and health: Allen Coral Atlas (2022) • Sensitivity index: SIDIK KLHK (2018)
Adaptive Capacity	• Number of coastal populations: BPS (2020) • Demographic data (gender, age): BPS (2020) • Disaster (hydrometeorology) data: BNPB (1990-2020) • Adaptive capacity index: SIDIK KLHK (2018)	• Occupation data: BPS (2020) • Poverty level: BPS (2020) • Gross regional domestic product data: BPS (2020) • Adaptive capacity index: SIDIK KLHK (2018)	• Aquaculture (floating nets, seagrass, ponds) productions: BPS (2013-2021) • Marine fishery production: BPS (2013-2021) • Adaptive capacity index: SIDIK KLHK (2018)	• Number of coastal households: BPS (2020) • Demographic data (gender, age): BPS (2020) • Poverty level: BPS (2020) • Adaptive capacity index: SIDIK KLHK (2018)	• Adaptive capacity index: SIDIK KLHK (2018)

3.4.2.2 Data Limitation

The climate change vulnerability assessment has several data limitations, particularly in producing analysis disaggregated beyond the provincial level, such as district level.

The decision to limit the analytical scope of climate change vulnerability assessment to the provincial level is driven by two main factors. Firstly, the decision to present analysis at province-level is made to allow the analysis covering all WPP 572 given the timeline and resource constraints.

The second limitation is that the project was conceptually designed to be a demand-led on-granting facility. Therefore, at this stage the activities at the local level at not yet defined in detail. Presenting the data at province level delivers the most value for money as it highlights priority target areas for the grants while avoiding being too restrictive for the on-granting facility to be able to disburse funds effectively.

Understandably, the province-level data and analysis provide limited granular assessment of vulnerability to climate change impacts on a local scale. Recognizing the limitations of this approach, future studies may consider incorporating district-level analyses – provided sufficient time and resources – to better inform vulnerability at a more local scale. For example, grants to be deployed based on presented project proposals should consider the local impacts of the proposed activities at the local level.

3.4.2.3 Qualitative Data

The study conducted interviews and focus groups with fishers, coastal communities, and policymakers to understand their perceptions of climate change impacts and vulnerabilities during project field visits. Targeted stakeholder consultations were conducted with fisher groups and women's organizations to ensure the integration of local knowledge and lived experiences into BEAM's design. These consultations are documented in Attachment C and D of the Stakeholder Engagement Plan (Annex 07). Organizations consulted include:

- Masyarakat dan Perikanan Indonesia (MDPI) – provided insights on sustainable fisheries and community-based management.
- KOSPIN Jasa – a cooperative supporting small-scale fisheries' access to finance.
- UD Dhea Bersaudara – a local fishers group consulted on post-harvest practices.
- UD Aris 88 – contributed perspectives on value chain improvements.
- Koperasi Putera Lautan – shared information on coastal cooperative structures.
- Koperasi ISM Karya Sinar Bahari – engaged in discussions around livelihoods and fisheries.

Key findings from these consultations include:

- Traditional fishers and women's groups contributed valuable local ecological knowledge, sharing first-hand observations of shifting fishing seasons, altered ocean currents, and declining fish stocks linked to climate change.
- Limited access to decision-making spaces where resource management and policy priorities are set, restricted availability of financial services such as credit and insurance to support livelihood diversification, and inadequate access to adaptive technologies—ranging from climate-resilient fishing gear to data and communication tools—that could strengthen resilience to environmental change.
- Women's groups highlighted their roles in post-harvest processing and market chains, and the heightened climate vulnerability of female-headed households.

These consultations ensured that BEAM's interventions are responsive to the needs of vulnerable coastal populations and promote inclusive climate resilience strategies.

3.4.2.4 Scenarios and Modelling

The study built specific WPP 572 regional climate models to project future changes in air and sea surface temperatures, rainfall, sea level, and extreme climate indices by looking at the historical changes or trends in climate variabilities. The climatic dataset uses and compiles six GCMs output of the CMIP6, with SSP 1-2.6, SSP 2-4.5 and SSP 3-7.0, as suggested by O'Neill at al. (2014).[161]

Geographically, the developed climate modelling area centers within the WPP 572 region between -11.0°S to 7.0°N and 89.0°E to 107.0°E. The model uses 30-year climate data from 1991 to 2020 to generate a historical period, while the projection period spans two periods, from 2021 to 2040 and 2041 to 2060.

These climate datasets underwent data fine-tuning for event-based and distribution-based correction, following Piani et al. (2010) suggestions and approaches to obtain more accurate results[162]. The event-based correction uses a linear regression equation between data from model output and observation data from reference data with the following equation:

$$Yobs = a + b * Xmod$$

Where a is the intercept and b is the regression slope.

The distribution-based correction is conducted to adjust the distribution of climate data from the model, which is transformed to match the observed data by using the probability density function of Gamma distribution, given by:

With a shape *parameter* k, a scale parameter θ and $\Gamma(k)$ for the Gamma function. The correction equation or transfer function (f) between model data (x) and observation data (y) is determined based on the inverse CDF value of each data so that it fulfils y = f(x).

3.5 Assessment Approach

To understand and address the impacts of climate change on various sectors within WPP 572, it was essential to adopt a well-defined assessment approach. This involved scoping the key areas of concern and framing the problem accurately to ensure a targeted and effective assessment process using the following steps:

- Sector-Specific Assessment. Evaluate the vulnerability of different sectors within WPP 572 (i.e., fisheries, aquaculture, coastal aquaculture) to climate change. This evaluation considered factors such as exposure, sensitivity, and adaptive capacity.
- Mapping and Spatial Analysis. Utilize spatial data and GIS tools to visualize the assessment results across WPP 572. This spatial analysis provided a clear picture of the areas most at risk and help in strategic planning.
- Stakeholder Engagement and Consultation. Actively involve stakeholders throughout the CCVA process to ensure data accuracy, identify local knowledge gaps, and build ownership of the assessment findings. This included field visits and stakeholder consultations in the six provinces across WPP 572 from May to June 2022, as well as ministerial discussion sessions between June and August 2023.

[161] O'Neill, B., Kriegler, E., Riahi, K., Ebi, K., Hallegatte, S., Carter, T., Mathur, R., & van Vuuren, D. (2014). A new scenario framework for climate change research: the concept of shared socioeconomic pathways. *Climatic Change 122*, 387–400. https://doi.org/10.1007/s10584-013-0905-2

[162] Piani, C., Weedon, G., Best, M., Gomes, S., Viterbo, P., Hagemann, S., & Haerter, J. (2010). Statistical bias correction of global simulated daily precipitation and temperature for the application of hydrological models. *Journal of Hydrology, 395*(3-4), 199-215. https://doi.org/10.1016/j.jhydrol.2010.10.024

3.6 WPP 572 Climate Exposures

This section addresses climatological exposure in the WPP 572 area, focusing on marine and coastal ecosystems, fishing communities, and associated infrastructure. Climatological exposure refers to the significant variations in climate that these systems and communities experience. This exposure is identified by developing historical (1991-2020) and future (2021-2060) climate models for WPP 572, and analyzing the frequency, intensity, and spatial distribution of these variations. Understanding these variations is essential for assessing the vulnerability of WPP 572 to climate change impacts (see **Figure 26**).

The Climate Change Vulnerability Assessment (CCVA) incorporates six climate variables to determine and analyze climate exposure in the WPP 572 region, following the methodologies suggested by Ellis et al. (2019) and Hewitt et al. (2016).[163] The six variables are:

- Air temperature
- Sea surface temperature
- Rainfall
- Mean sea level
- Wind speed
- Wave height

However, additional downscaled modeling for wind speed and wave height was not performed, as no notable impacts on coastal populations and ecosystems were detected. Air and sea surface temperatures are critical for assessing the risk to socio-economic activities in WPP 572. Air temperature affects the viability of coral reef diving tourism, while fluctuations in sea surface temperature can cause mass coral bleaching events and the migration of fish species, leading to income and food insecurity (see subsections **3.7** and **3.8**). Increases in mean sea level contribute to coastline erosion, which directly threatens homes and businesses along the shoreline, thus impacting the blue economy's ability to adapt to climate change.

For analyzing extreme weather events, rainfall data is examined to derive WPP 572 climatology and trends of annual maxima of 1-day, 3-day, and 5-day rainfall intensities (RX1day, RX3day, and RX5day), as well as the frequency of occurrences of consecutive dry days (CDD), consecutive wet days (CWD), and the annual count of days with rainfall ≥ 20mm (R20mm) and ≥ 50mm (R50mm).

Overall, increases in temperature, sea level, and extreme indices (except rainfall) lead to greater exposure and vulnerability for the province. Increased rainfall contributes to climate vulnerability by causing more waste runoff in coastal areas, necessitating improved waste management actions.

[163] Hewitt, J., Ellis, J., & Thrush, S. (2016). Multiple stressors, nonlinear effects and the implications of climate change impacts on marine coastal ecosystems. *Global Change Biology*, 22. https://doi.org/10.1111/gcb.13176.

Table 57. Summary of The Historical and Projected Climate Impacts

Observed (historical) Climate Trend	SST anomalies >1°C more frequent (2011-2022).	Extreme rainfall events, measured as CWD and R50mm, are high with CWD average of 58 days and R50mm of 3.2 days (1991-2020)	Sea level rise (SLR) with higher rates in the north (0.43 cm/yr) than south (0.39 cm/yr).
Impact on Ecosystems	Mass coral bleaching in Mentawai linked to SST changes & IOD events.	Erosion of coastlines, decrease water quality, changes in fish species.[164]	Mangrove productivity and health decline.[165]
Impact on Coastal Communities	Decline in fishery products by 41% (2017-2021) due to SST-induced fish migration.	Coastal flooding and reduced water quality due to waste and sedimentation	Increase coastal flooding and coastal soil salinization, harming aquaculture and agriculture.
Projected Climate Trends (2021 – 2040)	Mean SST anomaly: SSP 2-4.5: 30.37 °C SSP 3-7.0: 30.76 °C	CWD and R50mm are rising: SSP 1-2.6: CWD (56 days); R50mm (3.3 days) SSP 2-4.5: CWD (55 days); R50mm (3.2 days) SSP 3-7.0: CWD (54 days); R50mm (3.0 days)	MSL rise from 0.24 to 0.55 cm/yr. SSP 2-4.5: 0.12 m
Projected Climate Trends (2041 – 2060)	Mean SST anomaly: SSP 2-4.5: 31.07 °C SSP 3-7.0: 31.46 °C	CWD and R50mm are rising: SSP 1-2.6: CWD (56 days); R50mm (3.3 days) SSP 2-4.5: CWD (56 days); R50mm (3.2 days) SSP 3-7.0: CWD (54 days); R50mm (3.1 days)	MSL rise to 0.67 cm/yr and total increase of 20 cm. SSP 2-4.5: 0.20 m
Impact on Ecosystems	More frequent and severe IOD events leading to coral bleaching.	Increased deposition of waste (run off) in coastal areas. Increased sedimentation of coastal ecosystems	Reduce mangrove productivity and health; Increasing challenges for mangrove adaptation.
Impact on Coastal Communities	Reduce fish productivity, leading to decreased livelihoods and reduced food security.	Increased risk of coastal flooding; reduced water quality; reduced food security (due to effects of waste and sedimentation on coastal ecosystems)	Reduced fisheries productivity (livelihoods/food security); coastal infrastructure damage; increased coastal flooding; reduce agricultural productivity (salinization) leading to reduced water and food security.

[164] Piccolo, M. C. (2021). Effects of rainfall extreme events on coastal marine ecosystems. In *Precipitation* (pp. 261-285). Elsevier.
[165] Ellison, J.C. Vulnerability assessment of mangroves to climate change and sea-level rise impacts. *Wetlands Ecol Manage* **23**, 115–137 (2015). https://doi.org/10.1007/s11273-014-9397-8

3.6.1 Historical Climate Exposures

WPP 572 is primarily hot and humid, with rainfall typically occurring in low-lying areas, similar to Indonesia's climate. Across the six provinces, the observed average annual temperature spans between a minimum of 20.9°C and a maximum of 32.2°C (1991 to 2020 data). In the same period, the average monthly rainfall amounts to 228.4 mm. **Figure 27** shows the WPP 572's monthly climatology of atmospheric min-temperature, mean temperature, max-temperature, and rainfall during 1991-2020.

The wet season in WPP 572 spans from November to January, whereas the dry season begins in May and runs until September. This wet and dry season is influenced mainly by the IOD[166] and lesser exposure to ENSO. During a positive IOD event, the WPP 572 area tends to be in wetter conditions with higher rainfall.[167] Still, during the ENSO,[168] the oceanic WPP 572 area experiences a cooler sea surface temperature during La Niña.[169]

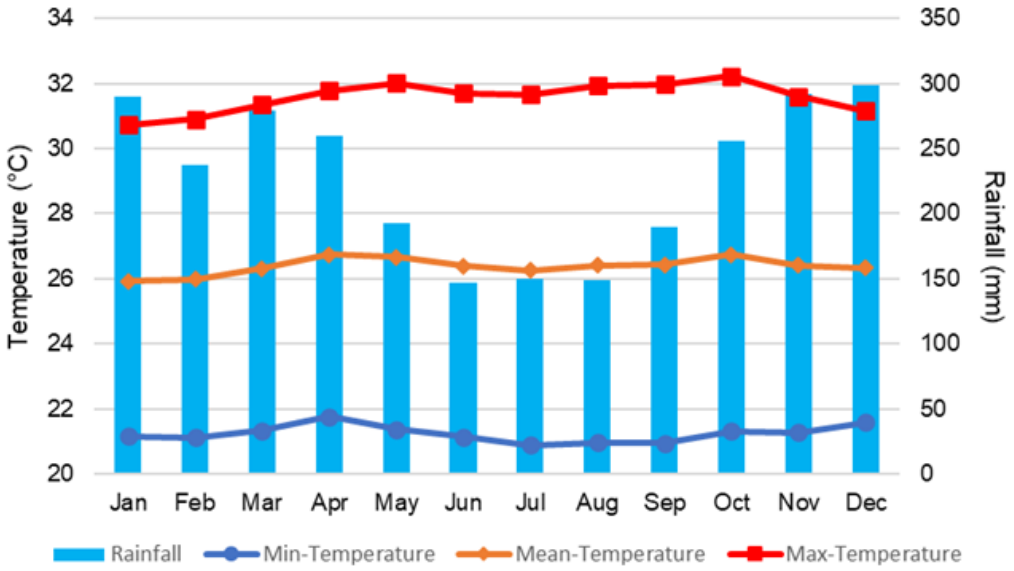


Figure 27. Monthly Climatology of Air Min-Temperature, Mean-Temperature, Max-Temperature, and Rainfall in WPP 572 between 1991-2020[170]

All historical climate variables showed worsening indices in the last three decades (1991-2020). Based on a developed historical climate model, five key highlights of climate exposures across WPP 572 are as follows:

[166] The Indian Ocean Dipole (IOD) is a climate variability that describes the difference in sea surface temperatures (SST) in the Western Indian Ocean (East coast of Africa) and the Eastern Indian Ocean (West coast of Sumatra) that affect usual climatic conditions in surrounding geographies. A positive IOD phase is characterised by cooler-than-average SST in the Eastern Indian Ocean, making the Western coast of Sumatra a wetter trend. The latest IOD updates can be followed here.

[167] Hermawan, E. (2018). Impact of teleconnection between Indian Ocean Dipole (IOD) and El Niño at normal (neutral) phase condition on the Java Monsoon rainfall variability. *Journal of Physics: Conference Series (1130)*1-9. https://doi.org/doi:10.1088/1742-6596/1130/1/012038

[168] Similar to IOD, El Niño-Southern Oscillation (ENSO) is the warming (called El Niño) and cooling (called La Niña) phases of SST in the tropical Pacific Ocean. During El Niño, the Eastern and Central parts of Indonesia experience drier conditions. In contrast, La Niña stimulates wetter conditions in this region. The latest ENSO update can be followed here.

[169] Chowdary, J. S., Gnanaseelan, C., Vaid, B. H., & Salvekar, P. S. (2006). Changing trends in the tropical Indian Ocean SST during La Niña years. *Geophysical Research Letters*, *33*(18). https://doi.org/10.1029/2006GL026707

[170] *Climateworks Centre analysis, based on the developed WPP 572 historical climate model*

- Increasing air temperature around 0.45 degrees Celsius, while the sea surface temperature anomalies can reach more than 1 degree Celsius between warmer (occurs between April-May) and cooler (occurs between September-October) periods;
- Changing rainfall level ± 20-30 mm/month;
- Rising sea levels from 0.39-0.43 cm/year;
- Having consecutive dry days (CDD) between 14-24 days, while consecutive wet days (CWD) from 44-73 days.

Compounding all climate exposure indicators and hazard levels, Banten, Aceh, and Lampung are the three provinces that have endured the worst historical climate trends**.** Between 1991 and 2020, the highest temperature increase, lowest rainfall, and extreme weather indices are happening in Banten, followed by Aceh and Lampung. Conversely, Bengkulu, West Sumatra, and North Sumatra are the least exposed provinces in the WPP 572 region in the last two decades. **Table 58** synthesizes the historical climate trends at the WPP 572 provincial level per climate variable, while the details of each exposure indicator are discussed in the following subsections.

Table 58. Historical Climate Exposure and Indices in WPP 572 Provinces between 1991-2020

Province	Climate Exposure Rank 1991 - 2020				
	Temperature	Rainfall	Sea Level	Extreme	Overall
Aceh	6	1	1	2	2
North Sumatra	4	5	2	3	3
West Sumatra	2	4	5	4	4
Bengkulu	5	3	6	6	6
Lampung	3	2	3	5	3
Banten	1	6	4	4	1

Source: Climateworks Centre analysis, based on the developed WPP 572 historical climate mode
Note: This provincial rank order represents a province that is exposed to the highest increase in temperature, sea level, and extreme indices but has the lowest rainfall. See the detailed explanation in the methodology section.

These worsening climate exposures affect marine and coastal communities and ecosystems across WPP 572 provinces. Air and sea surface temperatures and anomalies have been warming and intensifying, causing growing numbers of degraded coral health.[171] Combined increasing sea surface temperature, and sea level anomaly trends have been amplifying the number of tidal waves and abrasion events from 22 cases in 2006-2010 to 36 episodes in 2016-2020, impacting a total of 520 damaged houses in these two periods, mostly in West Sumatra, Aceh, and North Sumatra.[172]

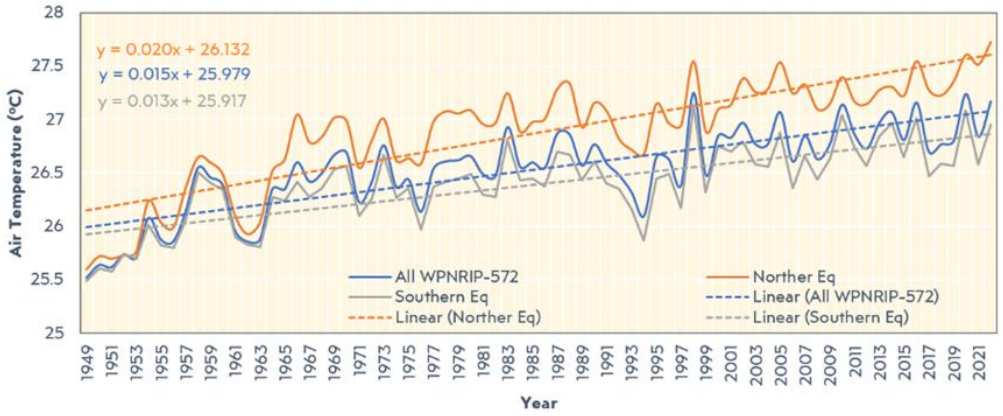
3.6.1.1 Exposure Indicator 1: Air and sea surface temperature

Based on historical climate model results, the air and sea temperature trends over the WPP 572 region have risen, mirroring the global mean temperature trends. Between 1991 and 2020, the mean air temperature in WPP 572 increased by 0.44°C, from 26.61°C in 1991 to 27.04°C in 2020. The northern part of WPP 572 (Aceh and North Sumatra) experienced a higher upward trend of 0.02°C per year compared to the southern part (West Sumatra, Bengkulu, Lampung, and Banten), which had an upward trend of

[171] Hadi, T.A., Abrar, M., Giyanto, Prayudha, B., Johan, O., Budiyanto, A., Dzumalek, A.R., Alifatri, L.O., Sulha, S. & Suharsono. (2020). The Status of Indonesian Coral Reefs 2019. Indonesian Institute of Sciences (LIPI). http://lipi. go.id/publikasi/status-of-indonesia-coral-reef/33174
[172] National Disaster Management Agency/BNPB. (2023). *Data Kejadian Bencana*. Accessed [*August 21, 2023*]. https://gis.bnpb.go.id/databencana/tabel/pencarian.php

0.013°C per year. The average trend across the entire WPP 572 region is approximately 0.015°C per year. Cooler conditions were observed during El Nino and/or positive IOD events, such as in 1994, 1997, and other El Nino years. This summary highlights the air and sea surface temperature trends and anomalies in WPP 572.

(a)



(b)

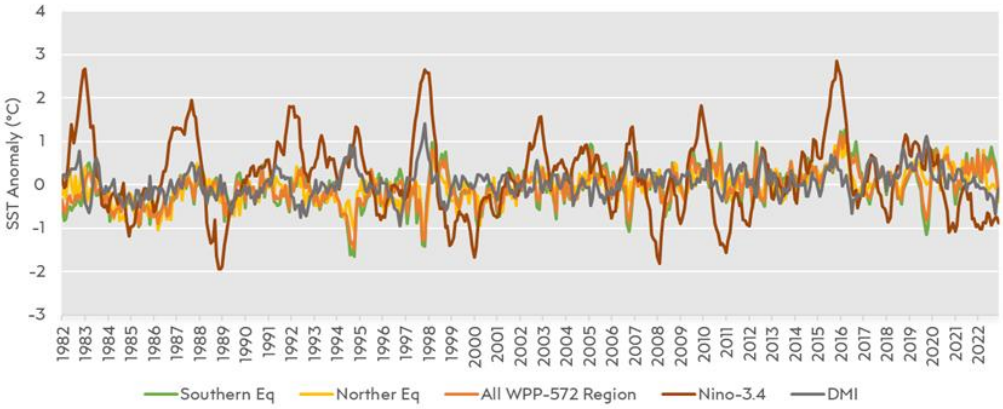


Figure 28. Air (a) and sea surface (b) temperature trends and anomaly in WPP 572[173]

The SST in the WPP 572 region typically shows higher temperatures in April and May (29.5°C) and lower temperatures in September and October (28.2°C). Generally, the cooler period for SST in this area spans from July to November, while the warmer period is from December to June. There is a noticeable monthly variation between the southern and northern parts of the region, with the northern part being warmer than the southern part by more than 1 degree in September. The increase in SST is influenced by the absorption of CO_2 by the ocean, which leads to acidification and a subsequent rise in SST.

Climate phenomena such as ENSO and the IOD also significantly impact SST variability in the region. When the DMI and Nino 3.4 indices are positive at the same time (see **Figure 28**b), the SST in the WPP 572 region can be cooler by up to 1.4°C compared to the average conditions, as observed between 1997 and 1998 during one of the strongest recorded El Niño events. This notable drop in SST was directly linked to a mass coral bleaching event off the western coast of Sumatra.[174] Additionally, the Nino-3.4 indices show a strong positive correlation with the northern part of the region rather than the southern part. The DMI also

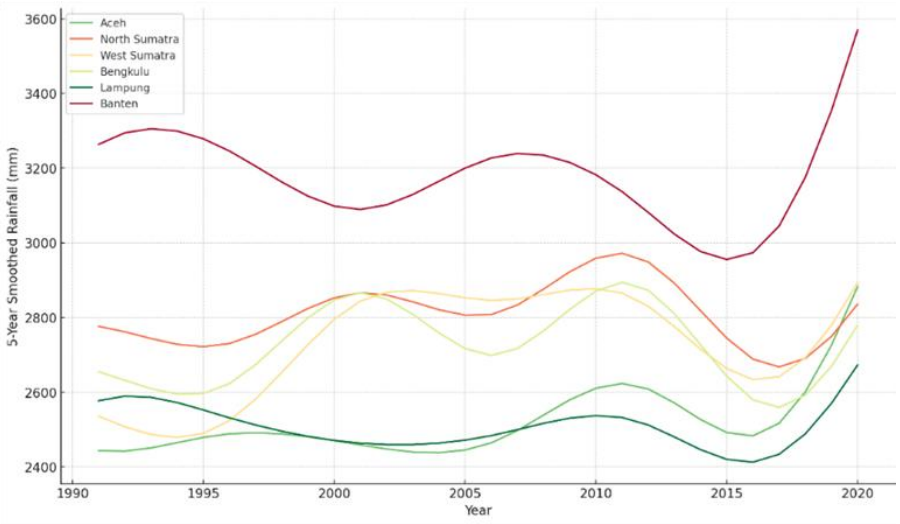
[173] *Climateworks Centre analysis, based on the developed WPP 572 historical climate model*
[174] Abram, N. J., Gagan, M. K., McCulloch, M. T., Chappell, J., & Hantoro, W. S. (2003). Coral Reef Death during the 1997 Indian Ocean Dipole Linked to Indonesian Wildfires. Science, 301(5635), 952–955. http://www.jstor.org/stable/3834840

shows a strong positive correlation with the northern part and a relatively weak correlation with the southern part of the WPP 572 region

3.6.1.2 Exposure Indicator 2: Rainfall

Rainfall is a key parameter for assessing exposure to climate risks as it contributes to the erosion of the coastal flooding and waste runoff, which further contributes to ocean pollution. The monthly rainfall pattern at WPP 572 from 1991 to 2020 shows the lowest rainfall during the dry season (May-September, 171-191 mm) and the highest during the wet season (November-January, up to 300 mm). In general, Banten was the wettest province across the WPP 572 region, where the annual average rainfall is above 3000 mm. But, Aceh and West Sumatra provinces had the highest increase in rainfall between 1991 and 2020 (see **Figure 29**a). The months with the highest rainfall occur between November and January when the rain reaches up to 300 mm. As **Figure 29**b shows, when the dry season occurs from May through October over the region in general, the northern part of the region is wetter than the southern one, and the opposite happens in the wet season. There is variation in the monthly mean precipitation between both the northern and southern parts of the region from 30 mm to 120 mm. When the dry season starts, SST decreases and starts to get warmer from December through May.

(a)



(b)

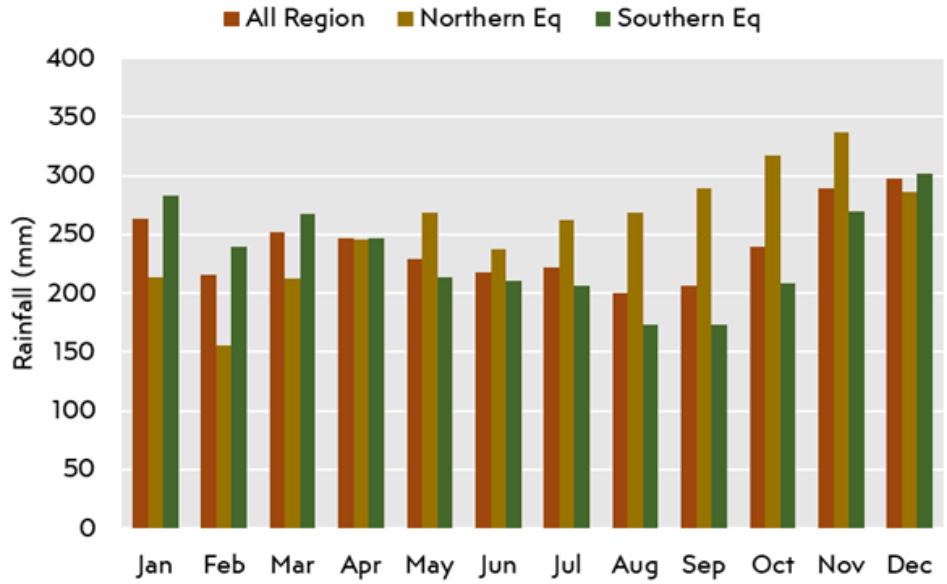


Figure 29. Five-Year Smoothed (a) Rainfall Climatology across WPP 572 Provinces and Disaggregated Monthly (b) Rainfall Climatology for the Northern and Southern Parts of WPP 572 in the 1991-2020 Period[175]

WPP 572 exhibits spatial variations in monthly rainfall across provinces from 1991 to 2020. Rainfall variability is high, with the highest amounts from November to January (250 mm to 550 mm) and the lowest from June to August (25 mm to 200 mm). Seasonal rainfall reveals an increase during the DJF rainy season (600 mm to 1300 mm) in the middle to southern part of the region. Conversely, the JJA dry season sees reduced monthly rainfall below 600 mm. **Figure 30** depicts seasonal rainfall climatology over the WPP 572 land area between 1991 and 2020.

[175] *Climateworks Centre analysis, based on the developed WPP 572 historical climate model*

map image removed

Figure 30. Seasonal Rainfall Climatology over Land Area at WPP-572 Region for 1991-2020 Periods[176]

Note: DJF (December-January-February), MAM (March-April-May), JJA (June-July-August), SON (September-October-November)

ENSO and IOD events affect rainfall patterns in WPP 572. The impact of these events varies depending on their intensity and interactions with other climate factors, including local conditions. In most parts of Sumatra, rainfall patterns are linked to the Nino-3.4 index. The strongest correlations are seen in South Sumatra, and parts of North Sumatra and Aceh provinces. According to the regression results, a one-unit change in the Nino-3.4 index typically results in a change of 20-30 mm in monthly rainfall. In some areas, such as Lampung and Banten provinces in August and September, and parts of Aceh province in February, rainfall can deviate by nearly or more than 50% from the usual monthly levels under these conditions.

Extreme climate indices related to rainfall intensity and frequency are crucial to consider. These indices help us understand the maximum rainfall intensity over specific periods. For example, the RXnday index shows the maximum rainfall intensity for a given number of days each year.

- **Figure 31** illustrates the climatology and trends of annual maximum rainfall intensities for 1-day, 3-day, and 5-day periods (RX1day, RX3day, and RX5day) across Sumatra and Banten.
- RX1day: Most areas in Sumatra and Banten experience 40-60 mm of rainfall per day, with some regions reaching 60-80 mm per day.
- RX3day: Average rainfall intensity exceeds 100 mm over 3 days in all areas. Banten, western Aceh, and parts of the west coast of North Sumatra and West Sumatra see the highest 3-day rainfall accumulations, ranging from 160-180 mm.
- RX5day: The same regions with high RX3day values also show high 5-day rainfall intensities, exceeding 200 mm over 5 days.

These indices highlight the regions with significant rainfall intensities, which is essential for understanding and managing the impacts of extreme weather events.

map images removed

Figure 31. Climatology (a-c) and trends (d-f) of extreme rainfall indices Rx1Day, Rx3Day, and Rx5Day over land area in the WPP 572 region[177]

Climate change affects the annual maxima of extreme rainfall intensities, impacting different regions in various ways.

Trends in Rainfall Indices:

- RX1day (1-day maximum rainfall): Some areas show no change or a decreasing trend, with reductions ranging from 0.2 to 1.4 mm per day each year.
- RX3day (3-day maximum rainfall): Trends show decreases of up to 2.0 mm per day each year.
- RX5day (5-day maximum rainfall): Some areas experience decreases of over 2.0 mm per day each year.

[176] *Climateworks Centre analysis, based on the developed WPP 572 historical climate model*

[177] *Climateworks Centre analysis, based on the developed WPP 572 historical climate model*

However, specific regions such as parts of Lampung, South Sumatra, Jambi, and Banten provinces exhibit increasing trends, particularly in RX3day and RX5day indices.

Frequency of Rainfall Occurrences:

- CDD: Represents the number of continuous days without rainfall. Most parts of the WPP 572 region experience CDD values between 3 to 20 days. Some southeastern areas have longer dry spells, ranging from 30 to 50 days.
- CWD: Denotes continuous days of rainfall. The eastern and central parts of WPP 572 have longer wet periods.
- R20mm and R50mm Indices: These indicate the annual count of days with rainfall exceeding 20 mm and 50 mm, respectively. The west coast of Sumatra Island records a high number of such days.

Map images removed

Figure 32 Climatology (A-D) and Trends (E-H) of Extreme Rainfall Indices CDD, CWD, and R20mm at WPP 572 Region between 1991-2020[178]

The spatial trends of projected extreme weather indices over recent decades reveal distinct patterns in the WPP 572 region. There is a noticeable decrease in the number of CDD in most parts of this region. Conversely, the number of CWD is increasing in many areas within WPP 572. Additionally, the frequency of heavy rainfall events (measured as R20mm and R50mm) is significantly rising along the western coast of Sumatra and the southwestern part of WPP 572. This increase is particularly evident in West Sumatra, with approximately 15 days of heavy rainfall per year, and Bengkulu, with around 13 days annually (see **Map images removed**

Figure *32* e-h for visual representation).

3.6.1.3 Exposure Indicator 3: Mean Sea Level (MSL)

The northern part of WPP 572 experiences a faster sea level rise (0.43 cm per year) compared to the southern regions (0.39 cm per year). Coastal areas in the provinces of Aceh, North Sumatra, Lampung, and Banten show higher rates of sea level increase. This region's annual sea level variability is heavily influenced by climate drivers, particularly on interannual timescales such as ENSO and IOD (refer to **Figure 33**).

Sea level anomalies are often below the trend line, especially during El Niño events, such as in 1994, 1997, 2002, 2004, 2006, and 2019. The most significant negative anomaly, reaching -7 cm, occurred in 1997 during strong El Niño and positive IOD events. Conversely, the highest sea level anomaly was recorded in June 2016 at 0.25 m above the average condition, with the annual mean also being high. In November 1997, the sea level dropped to about 0.19 m below the average, with the annual mean being the lowest.

Over recent decades, the monthly in the WPP 572 region has shown an average increase of 0.40 cm per year. Rapid increases in sea level can cause coastline erosion and flooding in low-lying areas, posing risks to coastal communities and agriculture.

(a)
map image removed

[178] *Climateworks Centre analysis, based on the developed WPP 572 historical climate model*

(b)

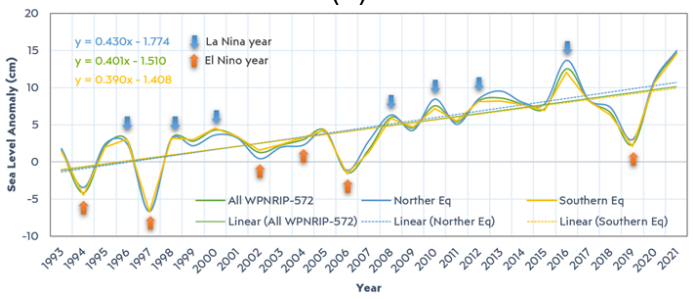


Figure 33. Annual variability (a) and trends of sea level anomalies (b) over the WPP 572 region[179]

3.6.2 Future Climate Exposures

This section discusses the projection of climate conditions at WPP 572 with three selected emission pathways. The projection of climate conditions uses the historical climatology trends and their variability (from 1991 to 2020) as the baseline for forecasting climate conditions in 2021-2040 and 2041-2060 under SSP 1-2.6, SSP 2-4.5, and SSP 3-7.0.

All future climate variables across all scenarios project worsening indices in the next two decades (2021-2040) and towards the mid-century (2041-2060). Based on a future climate model for WPP 572, five key highlights of climate variables are as follows:

- Between 2021 and 2040, the air temperature will increase between 0.51-0.54 degrees Celsius across three climate scenarios, while in the following period (2041-2060), the projected temperature will increase within a range of 0.75-1.18 degrees Celsius. The sea surface temperature is also forecasted to increase between 0.51 and 1.27 °C from 2021-2040 to 2041-2060 with a deviation ± 0.39 degrees Celcius.
- As ENSO and IOD events intensify, the amount of mean rainfall will decrease in the following decades (2021-2040) between -46.47 and -92.22 mm/month but is expected to deviate around its historical variability with slight changes between -2.05 to 1.59 mm/month between 2041 and 2060.
- A compound global warming also leads to a mean sea level rise from 0.24 to 0.55 cm/year between 2021 and 2040 and will increase to 0.67 cm/year (2041-2060) with the total increase of 20 cm by the end of 2060.
- Under the SSP 2-4.5 climate scenario, consecutive dry days (CDD) in 2021-2040 will not change much from the historical climate range (around 14-25 days) but will increase in a range of 15-33 days for the 2041-2060 period. Similar to the CDD pattern for 2021-2040, consecutive wet days (CWD) will be around the same relative to its historical climate (about 44-73 days) for both periods (2021-2040 and 2041-2060).

Generally, these projections are within a range or consistent with the national-level forecast from Bappenas by 2045 (2021a)[180] below:

- Rising sea levels from 0.8-1.2 cm/year;
- Increasing temperature between 0.45-0.75 degrees Celsius;
- Changing rainfall level ± 2.5 mm/day.

These changing climate variables will affect local communities and coastal and marine ecosystems across WPP 572 provinces with more escalating impacts. Rising sea surface temperatures will lead to

[179] *Climateworks Centre analysis, based on the developed WPP 572 historical climate model*
[180] Ministry of National Development Planning/Bappenas. (2021a). *Climate Resilience Development Policy 2020-2045 – Executive Summary*. https://lcdi-indonesia.id/wp-content/uploads/2021/11/ 0_Executive- Summary.pdf

coral bleaching cases and degrade coral health quality. The compound impact of increasing sea surface temperature and sea level rise will intensify coastal erosion, affecting its coastal communities' physical infrastructure and ecosystems' resilience. Therefore, WPP 572 coastal communities that heavily rely on marine resources may need to adapt to changing climate conditions. This adaptation might involve behavioral change approaches (e.g., education and capacity building, diversifying livelihoods, sustainable fishing practices), information and technology intervention approaches (e.g., fishing hotspots, extreme weather early warning system, new fishing techniques), and physical engineering approaches (e.g., bigger ship, breakwater, revetments, seawall, managed retreat/relocation)[181] to ensure not only the short-term adaptation but also aiming towards long-term sustainability of both coastal and marine ecosystems and population.

Referring to WPP 572 climate modelling variables, Lampung, Bengkulu, and West Sumatra are projected to be the three consecutive provinces facing the most severe future climate impacts. Over the next two decades, Lampung will experience the most significant temperature rise, lowest rainfall, and extreme weather events, followed by Bengkulu and West Sumatra. In contrast, North Sumatra, Aceh, and Banten will be the provinces least affected by climate-related issues within the WPP 572 region from 2021 to 2040. Moving on to the period between 2041 and 2060, Bengkulu will surpass Lampung as the province with the highest exposure, while West Sumatra will continue to hold the third position in terms of climate exposure within the WPP 572 region. Despite becoming the second most exposed province by the mid-century, Lampung will retain its status as the most climate-exposed province in the region throughout the entire period spanning from 2021 to 2060. For a comprehensive overview of future climate patterns and exposure at the provincial level within WPP 572, refer to **Table 59** to **Table 60.**

Table 59. Future Climate Exposures in WPP 572 Provinces Between 2021-2040[182]

Province	Climate Exposure Rank (2021 – 2040)				
	Temperature	Rainfall	Sea Level	Extreme	Overall
Aceh	5	6	3	5	5
North Sumatra	1	5	6	6	6
West Sumatra	6	3	1	4	3
Bengkulu	4	2	5	1	2
Lampung	2	1	2	2	1
Banten	3	4	4	3	4

[181] Metcalf, S., Putten, E., Frusher, S., Marshall, N., Tull, M., Caputi, N., Haward, M., Hobday, A., Holbrook, N., Jennings, S., Pecl, G., & Shaw, J. (2015). Measuring the vulnerability of marine social-ecological systems: A prerequisite for the identification of climate change adaptations. *Ecology and Society*, 20, 1-21. https://doi.org/10.5751/ES-07509-200235.

[182] *Climateworks Centre analysis, based on the developed WPP 572 future climate model*

Table 60. Future climate exposures in WPP 572 provinces between 2041-2060[183]

Province	Climate Exposure Rank (2041 – 2060)				
	Temperature	Rainfall	Sea Level	Extreme	Overall
Aceh	2	5	3	5	4
North Sumatra	1	6	6	6	6
West Sumatra	4	4	1	4	3
Bengkulu	5	1	5	1	1
Lampung	3	2	2	2	2
Banten	6	3	4	3	5

Note: This provincial rank order represents a province that is exposed and sensitive to the highest increase in temperature, sea level, and extreme indices but has the lowest rainfall

3.6.2.1 Projected exposure indicator 1: Air and sea surface temperature

From the model results, the projected mean air temperature anomaly ranges between 0.51 and 0.54°C for 2021-2040 across six provinces in WPP 572. This temperature increase in North Sumatra has a consistent projected mean-temperature increase of 0.54°C under all tested future climate scenarios. This might be due to the geographical location of North Sumatra at the equator; therefore, it has more exposure and sensitivity to climate change (see Figure 12a). In addition to North Sumatra, Lampung and Banten have a slightly higher mean-temperature increase than the other three provinces in WPP 572. On another note, Banten should also be looked at closely as the future mean-temperature anomaly in this area has the highest deviation range across three climate scenarios. However, these anomalies are still below the national average of 0.57-0.58°C across the three future climate scenarios.

Along with the global warming trend, the mean air temperature anomaly in WPP 572 for 2041-2060 ranges from 0.75 to 1.18°C. This anomaly is consistent with the national deviation between 0.86 and 1.19°C. The projected mean temperature of North Sumatra in this period has the highest increase with 1.18°C, followed by Aceh and Lampung provinces with 1.18 and 1.12°C, respectively, under the SSP 3-7.0 scenario. The lowest mean temperature warming anomaly will occur at SSP 1-2.6 scenario in Banten (at 0.75°C), Bengkulu (at 0.81°C), and West Sumatra (at 0.82°C), respectively (see Figure 34).

[183] Ibid.

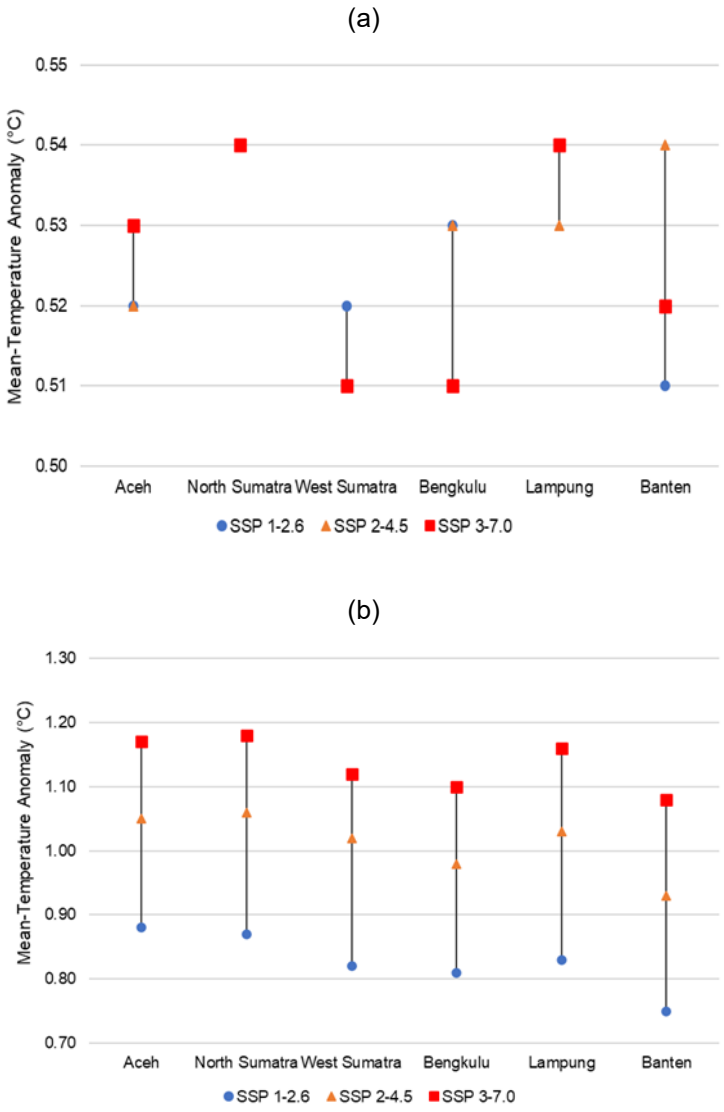


Figure 34. Projected Mean Air Temperature Anomaly for 2021-2040 (a) and 2041-2060 (b) under Three Climate Scenarios against the 1995-2020 Reference Period[184]

Similar increasing temperatures are also forecasted at WPP-572 sea surface. The associated sea surface temperature (SST) changes are from 0.51 to 1.27 ºC between 2021-2040 and 2041-2060 with a deviation ± 0.39 ºC across three socioeconomic pathways (SSPs) against the 1995-2020 reference period (see **Error! Reference source not found.**). This SST forecast is within a range with the World Bank (2023) projection for western Indonesian region.[185]

The higher and lower SST variabilities are relatively following its historical pattern, happening respectively in April-May and September-October. Further, the ENSO and IOD still significantly positive influence the SST anomaly variability, particularly to WPP-572 northern areas – meaning when the strong El Nino occur

[184] *Climateworks Centre analysis, based on the developed WPP 572 future climate model*

[185] Kaczan, D., Nurhabni, F., Cheung, W., Frölicher, T., Kuswardani, A., Lam, V., Muawanah, U., Puspasari, R., Reygondeau, G., Sumaila, U., & Teh, L. (2023). *Hot Water Rising: The Impact of Climate Change on Indonesia's Fisheries and Coastal Communities*. The World Bank, Washington, D.C.

(identified with the positive DMI), there will be a rapid drop of SST. Therefore, Aceh and North Sumatra provinces are projected to have a more SST variability relative to other WPP-572 provinces.

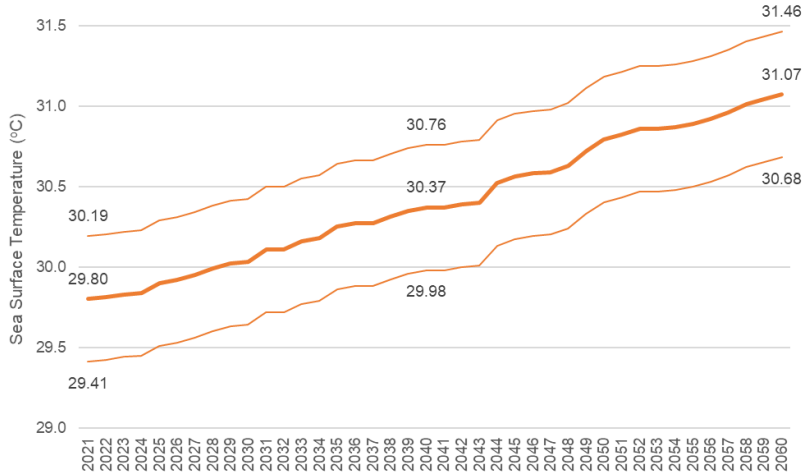


Figure 35 Projected Annual Mean Sea Surface Temperature (SST) at WPP 572 region between 2021-2060 under Three Climate Scenarios against the 1995-2020 Reference Period

A combined air and sea surface temperature increases present a detrimental combination for coastal regions, placing pressure on both the inhabitants and the ecosystems upon which they rely. Increasing wind speed due to extreme temperature differences, combined with rainfall, often leads to intensified storms and increased coastal flooding, exposing the coastal communities. For coastal ecosystems, the two major impacts of rising air temperature are ocean acidification and warmer waters that influence coral bleaching and fisheries and species displacement and redistribution.

3.6.2.2 Projected exposure indicator 2: Rainfall

The rainfall projections over the WPP-572 area show sizeable spatial variability for all future time slices, 2021-2040 (near-term) and 2041-2060 (mid-term) periods. Annual rainfall in the northern parts of the area is projected to increase up to 20% or more, while the southern parts show a reduction of up to 19% under the three reference scenarios. In addition, scenario SSP 3-7.0 for two future time slices indicates that the southern and central WPP 572 area will be dryer than the current climate (1991-2020). Figure below shows the rainfall change projection (in%) at WPP 572 between the two future periods.

map images removed

Figure 36. Rainfall Changes Projection (%) at WPP 572 Region for 2021-2040 and 2041-2060 Relative to the 1991-2020 Periods

The projected rainfall in WPP 572 is expected to decrease between 2021 and 2040, while at the national level, the future mean rainfall shows an increasing trend. Under the SSP 2-4.5 scenario, all provinces in WPP 572 will experience a decrease in the amount of average rainfall of -92.22 mm, except for North Sumatra Province, which is projected to see an increase of mean rainfall of 3.11 mm (see the middle blue straight line in **Figure 37**a). Surprisingly, the projected decreasing rainfall is slightly lower, with the mean-rainfall anomaly of -63.74 mm across six provinces under the more radiative forcing in the SSP 3-7.0 scenario, compared to the SSP 2-4.5. In terms of the most exposed provinces, Bengkulu and Lampung are the two most affected regions in this mean-rainfall anomaly. These decreasing rainfall ranges contrast with the national level projections showing an increase in rainfall between 4.41-4.89 mm across three future

climate scenarios. Decreased mean rainfall anomaly is a major challenge to coastal agricultural sustainability, which is impacted by factors like inundation, seawater intrusion, soil salinity.[186]

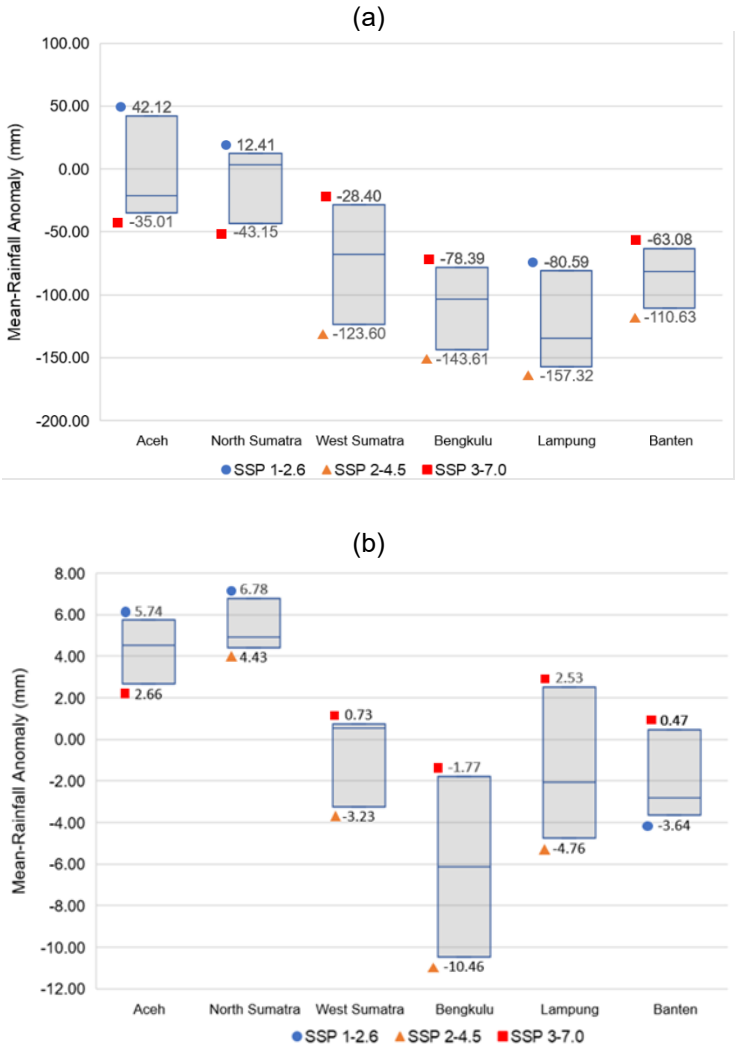


Figure 37 Projected Mean-Rainfall Anomaly for 2021-2040 (a) and 2041-2060 (b) under Three Climate Scenarios against the 1995-2020 Reference Period[187]

The decreasing trend in rainfall is consistent for the period 2041-2060 in all WPP 572 provinces, except for Aceh and North Sumatra. In these two provinces, mean monthly rainfall is projected to increase by 2.66 to 6.78 mm across all climate scenarios. Conversely, the southern parts of WPP 572 will experience a decrease in mean rainfall during the same period, with the most significant decrease occurring under the SSP 2-4.5 scenario (Please see **Figure 37**b). Bengkulu and Lampung are expected to face more severe rainfall anomalies, continuing the trend from the previous period (2021-2040).

Changes in rainfall patterns, whether increasing or decreasing, can significantly impact coastal areas. Direct effects include shifts in extreme weather events such as CWD, CDD, and the annual number of days with rainfall exceeding 20 mm (R20mm) and 50 mm (R50mm). These weather changes can lead to altered

[186] Gopalakrishnan, T., Hasan, K., Haque, A., Jayasinghe, S., & Kumar, L. (2019). Sustainability of Coastal Agriculture under Climate Change. *Sustainability*, 11, 7200. https://doi.org/10.3390/su11247200.

[187] *Climateworks Centre analysis, based on the developed WPP 572 future climate model*

water availability, resulting in either increased flooding or droughts, and can disrupt infrastructure. Coastal ecosystems, including fisheries, may also be affected due to changes in salinity levels and disruption of commercial and recreational activities.

All six model ensembles indicate an increase in the median annual number of CDD with rainfall less than 1 mm under all emissions pathways. There is, however, significant uncertainty in the 2041-2060 period, especially under the SSP 3-7.0 scenario, compared to the near-term period. Overall, CDD is projected to increase in all future time slices. As shown in **Figure 38**, the median CDD is expected to rise by seven days (47%), nine days (60%), and 12 days (80%) under SSP 1-2.6, SSP 2-4.5, and SSP 3-7.0 respectively, from the historical baseline median of 15 days.

At the provincial level, Bengkulu, Lampung, and Banten will see the highest increases in CDD compared to other WPP 572 provinces during both time periods. Bengkulu will have the most significant change in the near-term, with an increase of seven days, followed by Lampung and Banten with increases of six and five days, respectively. This pattern will continue in the 2041-2060 period, with Bengkulu, Lampung, and Banten experiencing increases of nine, eight, and seven days, respectively. North Sumatra, Aceh, and West Sumatra are projected to have the least increase in CDD in both periods.

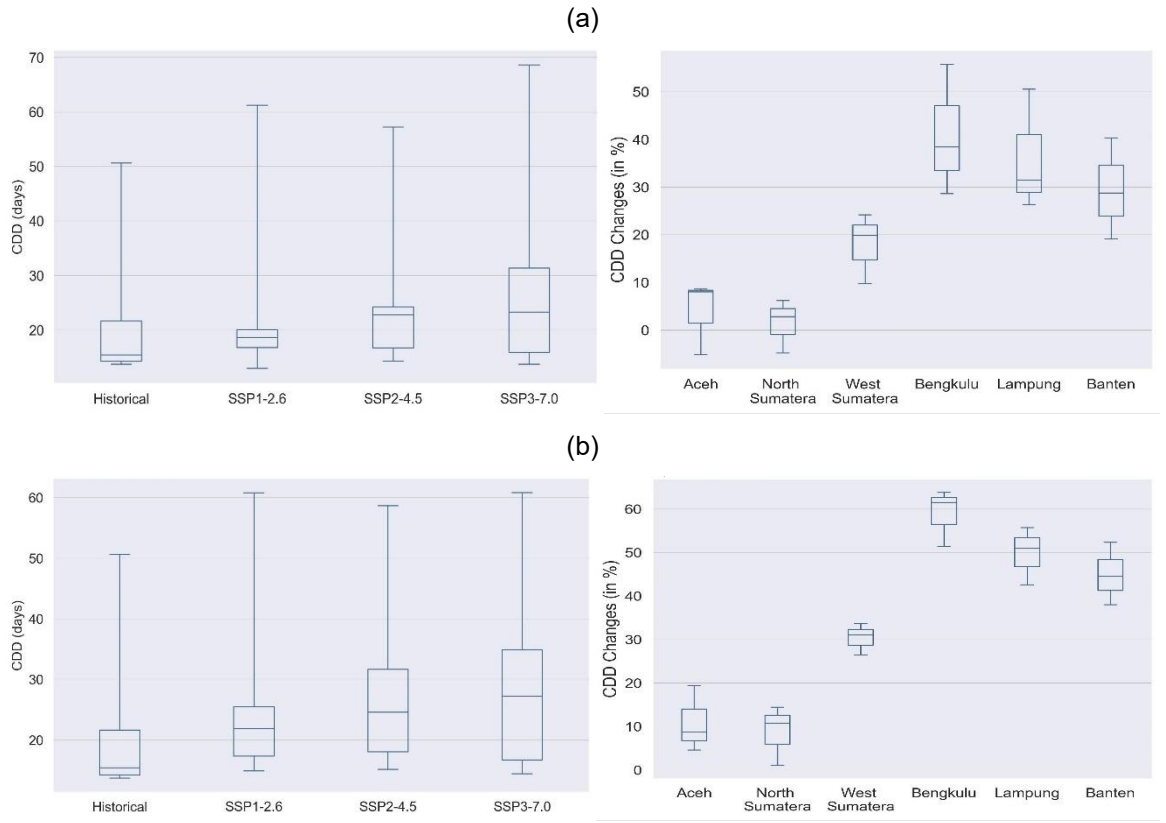


Figure 38. CDD index and changes at WPP 572 region for baseline 1995-2014, 2021-2040 (a), and 2041-2060 (b) projection periods under three SSP scenarios[188]

As for the annual number of consecutive days with rainfall amounting to more than 1 mm CWD, the model results show a decreasing trend until mid-century under all scenarios. **Figure 39** shows a slight reduction in CWD by three to five days (5% to 9%) in WPP 572 under all SSPs relative to the historical baseline

[188] *Climateworks Centre analysis, based on the developed WPP 572 future climate model*

median of 53 days between 2021-2040. From 2041 to 2060, the median CWD will decrease by four to eight days (7% to 15%) across WPP 572.

Like the most exposed CDD provinces, Bengkulu and Banten also become the most exposed to CWD with a higher decrease in wet days changes than other WPP 572 provinces in both periodical time slices and across three future climate pathways, including West Sumatra. Bengkulu will have the highest CWD decline in the near-term period, compared to the mid-term period, with a respective reduction CWD of five and four days. West Sumatra and Banten province will become the second and third CWD drops after Bengkulu in the 2021-2040 and 2041-2060 periods with up to -7 (occur in 2041-2060 period) and -5 (occur in 2021-2040 period) percentage change of CWD in respective provinces (see **Figure 39**).

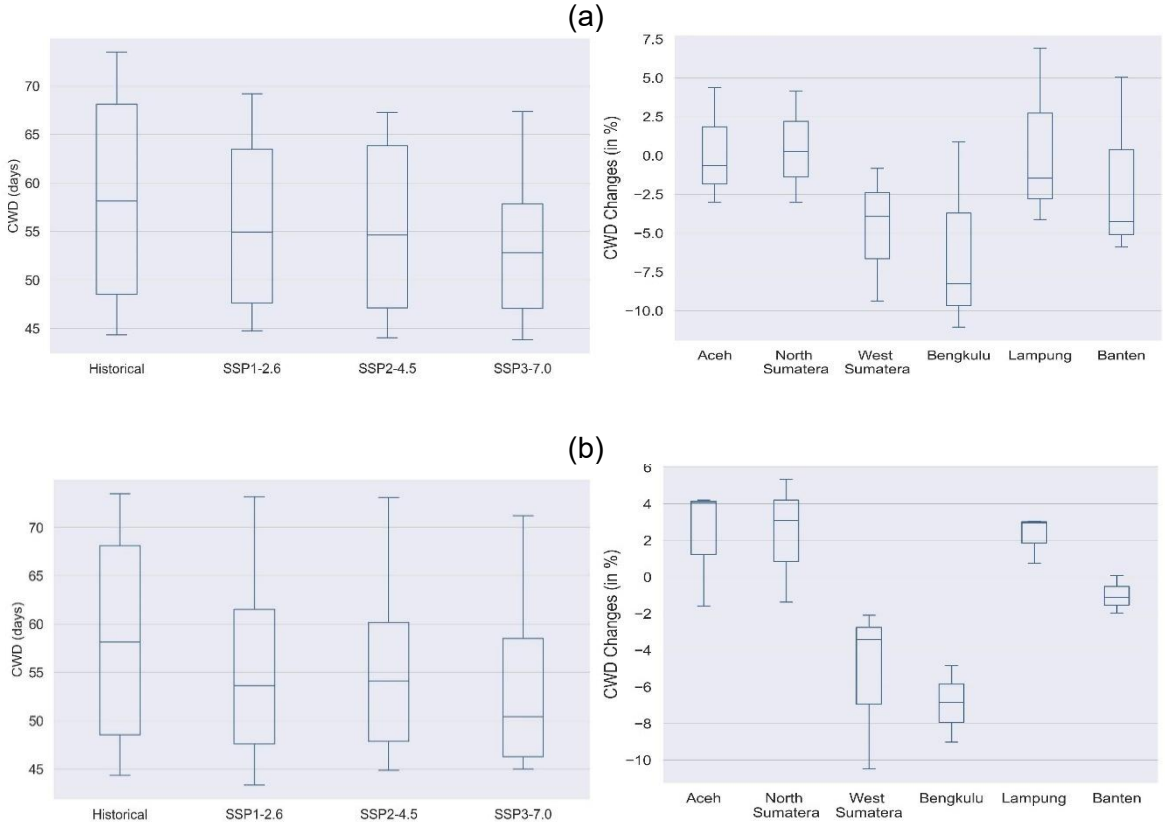


Figure 39. CWD index and changes at WPP 572 region for baseline 1995-2014, 2021-2040 (a), and 2041-2060 (b) projection periods under three SSP scenarios[189]

Despite the considerable variation of scenario uncertainty for each province, there is an increase in the median annual number of days with rainfall of more than 20 mm (R20mm) and 50 mm (R50mm) for future periods. The decreasing median of the R20mm index is found in Bengkulu by 4% to 1% for the 2021-2040 and 2041-2060 periods, respectively (see **Figure 40**). In the case of projected R20mm in Banten, it is likely consistent for all future time slices.

The increasing median of the annual number of days with rainfall of more than 50 mm is found in Aceh, North Sumatera, West Sumatera, and Lampung in the near-term projection period. The increasing median ranges from 2% to 54%. The remaining two provinces, Bengkulu and Banten, are expected to experience a slight decrease of R50mm. In the mid-century, this index will increase across all six provinces in WPP

[189] *Climateworks Centre analysis, based on the developed WPP 572 future climate model*

572 with a range from 12% up to 67%. **Figure 40** shows the R20mm and R50mm index for the two periods relative to the 1995-2014 reference period.

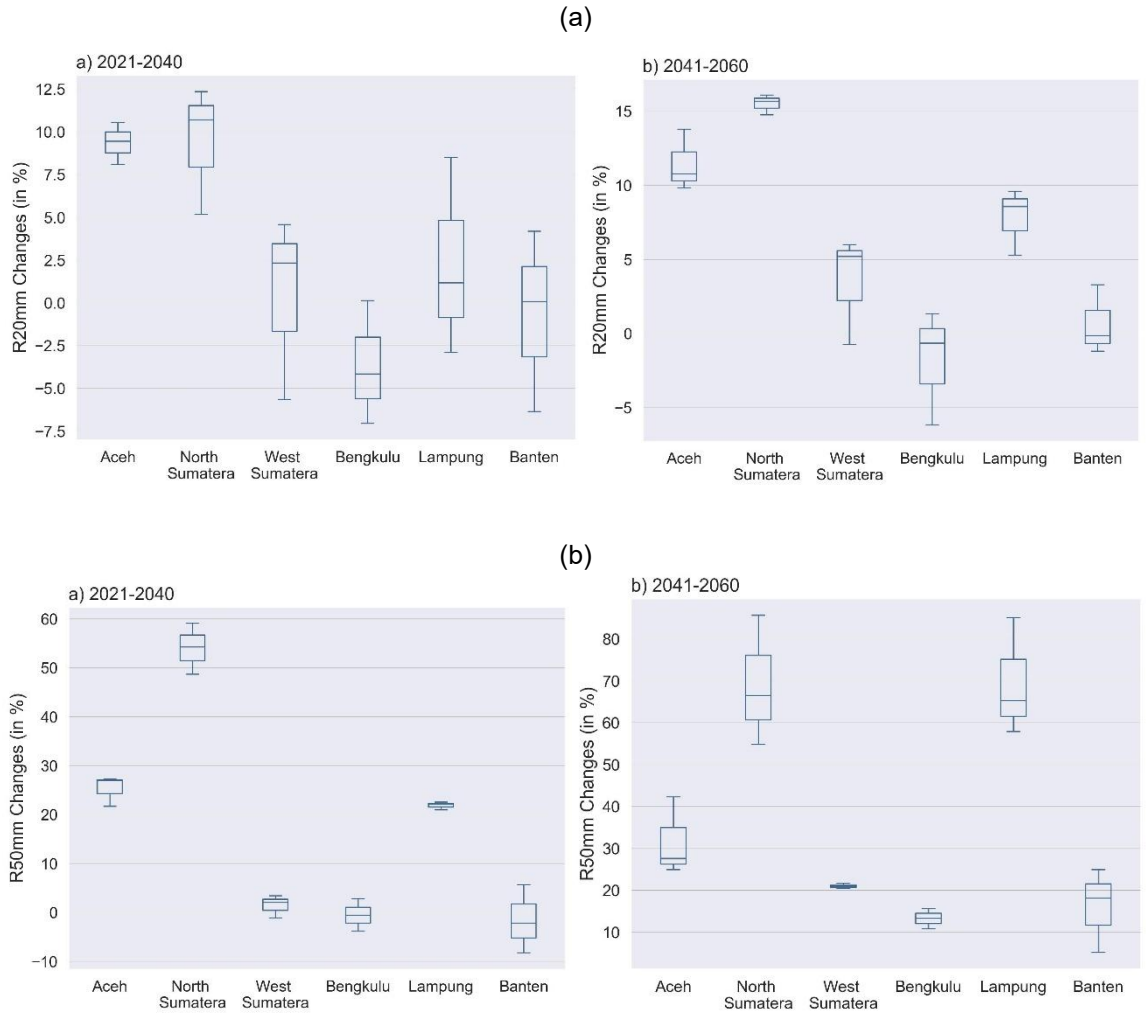


Figure 40. Projected changes of R20mm (a) and R50mm (b) index in 2021-2040 and 2041-2060 relative to 1995-2014 reference at WPP 572 provinces[190]

Referring to WPP 572 climate modelling variables, Lampung, Bengkulu, and West Sumatra are projected to be the three consecutive provinces facing the most severe future climate impacts. Over the next two decades, Lampung will experience the most significant temperature rise, lowest rainfall, and extreme weather events, followed by Bengkulu and West Sumatra. In contrast, North Sumatra, Aceh, and Banten will be the provinces least affected by climate-related issues within the WPP 572 region from 2021 to 2040. Moving on to the period between 2041 and 2060, Bengkulu will surpass Lampung as the province with the highest exposure. West Sumatra will remain in the third position regarding climate exposure within the WPP 572 region. Despite becoming the second most exposed province by the mid-century, Lampung will retain its status as the most climate-exposed province in the region throughout the entire period spanning from 2021 to 2060. For a comprehensive overview of future climate patterns and exposure at the provincial level within WPP 572, refer to **Table 58**.

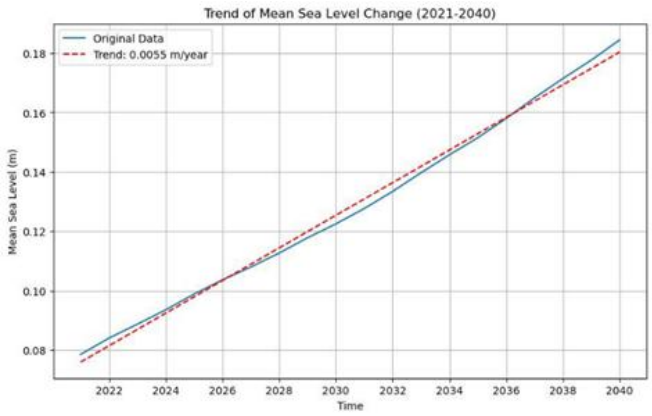
[190] *Climateworks Centre analysis, based on the developed WPP 572 future climate model*

3.6.2.3 Projected exposure indicator 3: Mean Sea Level (MSL)

The projected MSL in the WPP 572 region shows an increasing trend based on data from four different models. From 2021 to 2040, the sea level is expected to rise by 0.24 to 0.55 centimeters per year, and from 2041 to 2050, it is projected to increase by 0.67 centimeters per year. The MSL has already risen from 0.02 meters in the period from 1991-2020 to 0.12 meters from 2021-2040, and it is expected to reach 0.20 meters from 2041-2050, as illustrated in the figure below.

The rise in sea level is primarily due to thermal expansion of oceans and melting glaciers. This has significant consequences for coastal populations and ecosystems. Coastal communities may experience land inundation and displacement, increased flooding, saline intrusion, erosion, and damage to infrastructure. Coastal ecosystems are also affected by rising sea levels, leading to habitat loss, coral reef damage, and changes in coastal processes over the medium to long term.

(a)



(b)

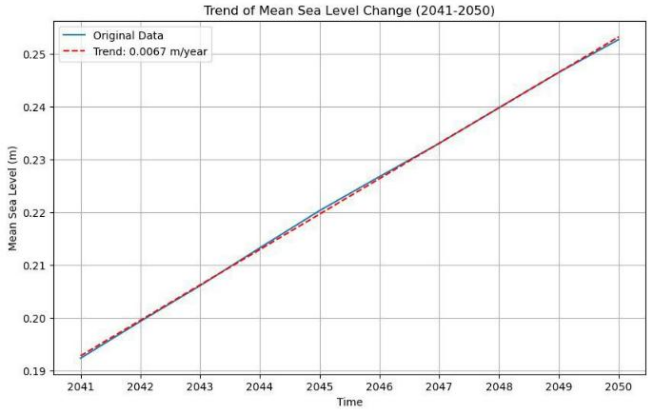


Figure 41 Mean Sea Level (in meter) for 2021-2040 (a) and 2041-2050 (b) at WPP 572 Region from CMIP6 Multi-Model Ensemble (4 Models)

3.7 WPP 572 Climate Sensitivity

This section examines the sensitivity of the WPP 572 marine and coastal ecosystems, fishing communities, and associated infrastructure to climate-related stimuli. Climate sensitivity refers to the degree to which a system can be affected by changes in climatic variables. Understanding this sensitivity is the second step for assessing the potential impacts of climate change to complement the result of climate exposures and its subsequent vulnerability (Please refer to **Figure 26**).

Sensitivity, in the context of WPP 572, encompasses the degree to which different aspects of a system are susceptible to climate change. These alterations can include changes in average temperature and precipitation patterns, increased frequency and intensity of extreme weather events, and changes in oceanographic conditions like sea level rise, ocean acidification, and salinity shifts. It is important to note that sensitivity can be positive or negative. Some regions may experience benefits from specific climate changes like extended growing seasons or shifts in fish distribution, while others face primarily negative consequences like habitat degradation and resource depletion. The following table summarizes the projected climate variabilities and their sensitivities to WPP 572's coastal ecosystems (i.e., mangroves, coral reefs, and seagrass) and population, while Figure 44 maps the impact chain analysis.

Table 61. Summary of Projected Climate Variabilities and Their Impacts on the Coastal Ecosystems and Population at WPP 572[191]

Projected Main Climate Variability	Possible Climate Hazards	Possible Impacts on the Ecosystems	Possible Socio-Economic Impacts
Mean SST anomaly: SSP 2-4.5: 31.07°C, SSP 3-7.0: 31.46°C (2041-2060)	More frequent and severe IOD events	Accelerated coral bleaching; and coral-dependent species displacement.	Reduce fish catch quantity and quality; decreased livelihoods and reduced food security.
Extreme rainfall events (2041-2060) SSP 1-2.6: CWD (56 days); R50mm (3.3 days) SSP 2-4.5: CWD (56 days); R50mm (3.2 days) SSP 3.7.0: CWD (54 days); R50mm (3.1 days)	Coastal flooding and reduced water quality due to waste and sedimentation	Increased deposition of waste (run off) in coastal areas. Increased sedimentation of coastal ecosystem	Increased risk of coastal flooding; reduced water quality; reduced food security (due to effects of waste and sedimentation on coastal ecosystems)
Mean sea level rise from 0.24 to 0.55 cm/yr (2021-2040) and to 0.67 cm/yr with the total increase of 20 cm (2041-2060)	More frequent and severe coastal flooding, leading towards intensified coastal erosion during storms and beach degradation in the mid long-term period.	Mangrove soil elevation changes, breakage & uprooting; Seagrass turbidity & sediment transport.	Increased risk of coastal flooding, beach degradation, coastal infrastructure damage; coastal aqua- and agriculture decreasing commodities due to coastline shifts. A combined impacts will lead towards potential income/ economic losses.

[191] Climateworks Centre analysis, based on the developed WPP 572 future climate model

3.7.1 Coastal Communities

Coastal communities in the WPP 572 area are more prone to climate change impacts compared to the inland Sumatra populations. In 2020, about 14 million coastal people[192] live in low-lying areas or on small islands of WPP 572 from Aceh to Banten province. As many as 450 thousand worked as fishers, marine fish cultivators, and brackish fish farmers. WPP 572 fishers were mainly concentrated in the northern region (i.e., Aceh, North Sumatra, and West Sumatra), comprising more than 250 out of 376 thousand fishers. There were 6.5 thousand marine fish cultivators mainly in North Sumatra and Banten provinces and approximately 70.2 thousand fish farmers mainly in Aceh, Lampung, and North Sumatra.

Table 62. Number of Marine Fishers and Fish Cultivators, As Well As Brackish Fish Farmers at WPP 572 in 2020[193]

Province	Number of Fishermen at Sea	Number of Marine Fish Catching Fishermen	Number of Brackish Fish Cultivators	Number of Fish Farmers
Aceh	80,689	474	39,380	120,543
North Sumatra	134,994	2,858	10,238	148,090
West Sumatra	56,505	123	488	57,116
Bengkulu	32,169	-	230	32,399
Lampung	28,540	798	15,993	45,331
Banten	43,294	2,256	3,909	49,459
WPP 572	376,191	6,509	70,238	452,938

These WPP 572 coastal communities are vulnerable to rising sea levels, threatening the coastal inundated regions and displacing people. More frequent and severe tidal floods damage crops, livestock, and infrastructure that determine the sustainability of WPP 572's coastal community livelihoods. As a result, these communities are facing an increased risk of food insecurity, poverty, and conflict. Bappenas (2019) estimated that 413,209 ha of residential areas in the coastal zone across the country could be protected through planned climate adaptation measures, such as the provision of alternative livelihoods for small fishers who cannot go to sea due to extreme weather (one of the action plans of Indonesia's National Adaptation Plan and aligned with **Activity 2.1.** of the BEAM Grant. Please refer to 0).[194] This study discusses how climate change impacts WPP 572 local communities' economy (e.g., fishers and households) and gender-related inequalities (female-headed families). This project will provide direct support to these communities by providing grants to projects that aim to diversify incomes through alternative livelihoods (**Activity 2.1**).

[192] Author's analysis, based on BPS (2020) number of household population for six provinces and 36 coastal regencies in WPP 572
[193] *Climateworks Centre analysis, based on BPS data*
[194] Ministry of National Development Planning/Bappenas. (2019). *National Adaptation Plan – Executive Summary*. https://lcdi-indonesia.id/wp-content/uploads/2020/05/Executive-Summary-NAP.pdf

3.7.2 Gender and Inequality

The age, gender, and income distribution of fishing communities influence adaptive capacity and resilience to climate change. Younger individuals might have better adaptability due to their exposure to new technologies and reliance on sustainable fishing practices, while older generations who rely on traditional fishing practices may face more significant challenges[195]. Additionally, gender roles and gender-related economic disparities can affect access to resources and adaptation options. Indeed, gender is a key factor in assessing climate sensitivity. Due to differences in gender roles, responsibilities, and access to resources, women and men are often affected differently by climate change.[196] For example, based on provincial stakeholder consultations, women are often responsible for collecting water and buying fuel, which can be more difficult in a changing climate as climate-driven natural disasters (precipitation events, flooding, droughts) can limit the availability of these commodities. The field observations also found that they need more access to assets and credit, making it harder for them to adapt to climate change. Additionally, women often need to be more represented in decision-making processes, which allow their ability and role to influence policies that affect them.

Compared to the national average (12.7%), the share of female-headed households in WPP 572 in 2020 was 15.5% (equal to 518 thousand families).[197] Aceh, West Sumatra, and North Sumatra are the three highest shares of female-led households, with 21% and 17%, respectively. This circumstance, however, also implies a more vulnerable condition as these households might find it difficult to access facilities and assistance and, therefore, need to be included in designing intervention measures.[198]

Table 63. WPP 572 Coastal Household Numbers and Gender Demographics by Province In 2020[199]

Province	Number of Coastal Households	Percentage of Gender Heads of Household	
		Male	Female
Aceh	435,071	78.7%	21.3%
North Sumatra	370,238	82.7%	17.3%
West Sumatra	695,002	82.7%	17.3%
Bengkulu	347,280	88.3%	11.7%
Lampung	813,534	88.0%	12.0%
Banten	773,196	86.7%	13.3%
WPP 572	3,434,321	84.5%	15.5%

Note: Coastal regencies in each province filter the number of provincial coastal households

[195] Badjeck, M., Allison, E., Halls, A., & Dulvy, N. (2010). Impacts of climate variability and change on fishery-based livelihoods. *Marine Policy*, 34, 375-383. https://doi.org/10.1016/J.MARPOL.2009.08.007.
[196] World Bank Group. (2016). *Gender Equality, Poverty Reduction, and Inclusive Growth*. https://documents1.worldbank.org/curated/en/820851467992505410/pdf/102114-REVISED-PUBLIC-WBG-Gender-Strategy.pdf
[197] Author's analysis, based on BPS (2020) number of poor population data for six provinces in WPP 572.
[198] World Bank Group & Asian Development Bank. (2021). Climate Risk Profile: Indonesia. WBG & ADB. https://doi. org/10.1596/36379
[199] *Climateworks Centre analysis, based on BPS data*

Incorporating women's empowerment into the adaptation intervention strategy can serve as a crucial starting point for enhancing both climate resilience and the resilience of coastal communities while also addressing the challenge of reducing poverty. Empirical data from various World Bank Group initiatives conducted in different regions demonstrate that enabling women to take on leadership roles within their communities positively impacts climate resilience; this initiative allowed for the empowerment of women-leadership to involve women decision-making processes, provide a platform for female-led innovation in the business sector and knowledge sharing, and enable female-led community resource mobilization. [200,201] This impact spans activities beyond climate adaptation, namely disaster readiness initiatives (in Bangladesh, Indonesia, and Nicaragua) and improved management of forests (in India and Nepal). This positive outcome is attributed to the inclusive approach and direct engagement with local populations.

The BEAM Grant Activity 2.1 (focused more on adaptation intervention) and Activity 2.2 (focused on the climate change mitigation) would respond to the important gender considerations cross-cutting throughout blue-economy and both climate adaptation and mitigation needs based on the gender action plan. The BEAM Grant Activity 3 will ensure that projects account for gender inequalities in the design and implementation, to ensure long-lasting change that allows women to equally benefit from diversified livelihoods, access to information and credit, among other services that will allow them to improve their adaptive capacity. A more detailed analysis on this is discussed in Annex 8. Gender Assessment Report**.**

3.7.3 Fisheries and coastal ecosystems

Climate change impacts will most likely affect WPP 572's natural resources by changing resource distribution, abundance and size. Among the main changes, shifts in SST and storm frequency will alter the freshwater flow and runoff patterns as well as inshore and offshore ecosystems (e.g., fish, coral, mangrove, seagrass) behavior and physiology that might lead to significant adverse impacts on subsistence natural resources, including local community livelihood and economics.

The fishing industry plays a pivotal role in the Indonesian economy, serving as a significant source of employment and substantially contributing to national and global food security. According to FAO (2022), by tonnage, Indonesia represented the world's second-largest capture fish producer and farming (aquaculture) producer in 2020.[202] Therefore, changes in climate variables, like La Nina year in 2016 triggered extreme weather and have caused a drop in WPP 572 marine fishery production following figure could lower the future productivity of the nation's fishery sector.

As the third largest potential contributor to Indonesia's fishery economy and marine food security, WPP 572 marine fisheries and coastal aquacultures are vulnerable to climate change. In 2022, a total of 1.2 million tons of nine fishery commodities (e.g., small and large pelagic, demersal fish, penaeid shrimp, reef fish) potential catch was identified as the nation's five-largest fishery catching area. The impacts of climate change on Indonesia's fisheries could lead to around a 13 per cent decrease in total fisheries catch potential in Indonesian waters by 2050.[203] Bappenas (2019) estimated that climate adaptation's planned scenario and effort will save at least 1,697.8 tons of national capture fisheries production in 2024.

[200] World Bank Group. (2013). Gender and climate change: three things you should know (English). *Working Paper*. WBG. http://documents.worldbank.org/curated/en/274081468183862921/Gender-and-climate-change-three-things-you-should-know

[201] Global Center on Adaptation and Climate and Development Knowledge Network. (2023). *Stories of Resilience: Lessons from Local Adaptation Practice*. GCA & CDKN. https://cdkn.org/resource/stories-resilience-lessons-local-adaptation-practice

[202] FAO. (2022). *The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation.* FAO. https:// doi.org/10.4060/cc0461en

[203] Barange, M., Bahri, T., Beveridge, M., Cochrane, K., Funge-Smith, S. & Poulain, F. (2018). Impacts of climate change on fisheries and aquaculture: Synthesis of current knowledge, adaptation and mitigation options. *FAO Technical Paper No. 627*. http://www.fao.org/3/i9705en/i9705en.pdf

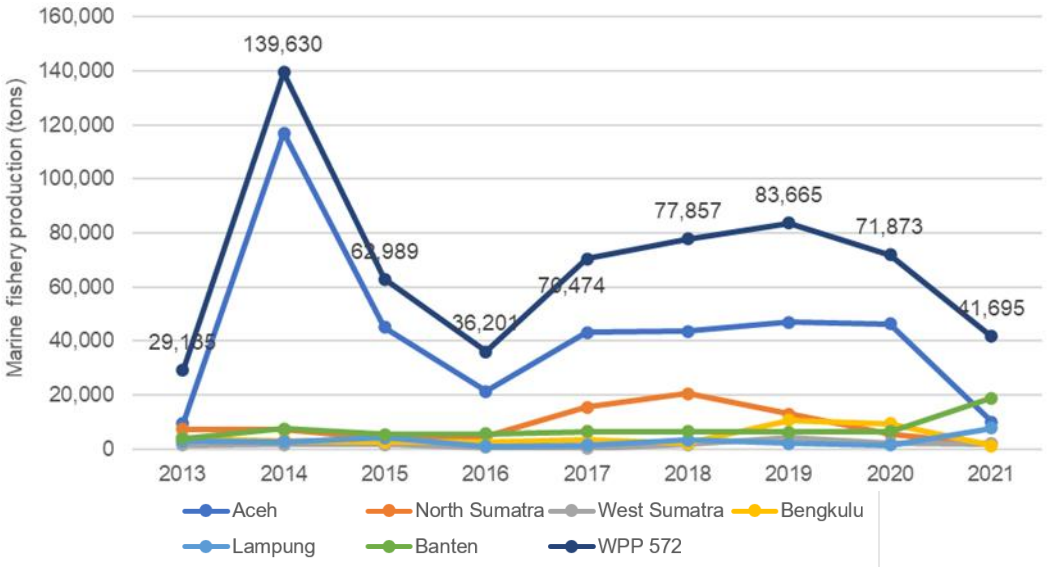


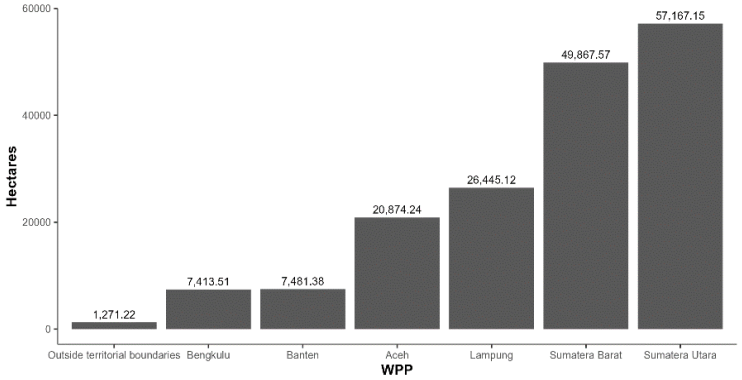
Figure 42. Historical Marine Fishery Productions in WPP 572 Area from 2013 to 2021[204]

The productivity and health of coral reef ecosystems significantly contribute to the fishery productivity within the WPP 572 zone, serving as a foundational support system. However, these critical ecosystems face substantial threats from climate change, including adverse effects on their quality and quantity, as indicated by some studies[24,15]. These effects are attributed to factors such as rising sea water temperature and changing salinity levels. The significance of this threat is amplified by the fact that WPP 572 represents Indonesia's third-largest fishery management area. Data from 2019 indicates a concerning trend: an estimated 40 out of 183 reefs, identified in figure below, within WPP 572 are projected to experience a marked decline from excellent and good conditions to fair and poor. This decline, driven by increasing water temperatures and ocean acidification, not only undermines the ecological integrity of these reefs but also diminishes the potential for alternative livelihoods for coastal communities. Specifically, it impacts on the viability of reef diving tours, which could serve as a sustainable economic alternative to traditional fishing practices.

Based on projected climate impacts on fisheries and coral reef ecosystem health, adaptation interventions in this sector should be focused in Lampung, West Sumatra, and Bengkulu. **Error! Reference source not found.**In the near- and mid-term periods, Lampung and Bengkulu would be the most climate-exposed provinces in WPP 572 (See **Table 64**). This projection will cause the relatively good and fair coral reef status in these two provinces to degrade into fair and poor status in 2050. This case might worsen in West Sumatra province with their current relatively poor coral reef status.

[204] *Climateworks Centre analysis, based on data from BPS*

(a)



(b)

map image removed

Figure 43. Coral Reefs Distribution In 2020 (A) And Their Status In 2019 (B) Across WPP 572 Area[205]
Note: Green, yellow, and red dots in Figure (b) mean reasonable, fair, and poor conditions of coral reefs

In coastal ecosystems, mangroves and seagrass beds protect the WPP 572's coastline and preserve its economy. In 2020, there were approximately 36 thousand ha of mangrove and almost 25 thousand ha of seagrass beds covering the western coast of Sumatra, concentrated primarily on North and West Sumatra.[206] These ecosystems protect coastal communities from storms, storm surges, and even tsunamis while providing a habitat for shrimp commodities.[207] At the same time, those climate-related events are also one of the main drivers of coastal ecosystem degradation, as suggested by local communities during the project consultation sessions.

Critical for both climate adaptation and mitigation objectives, degraded mangroves and seagrass areas in WPP 572 will not only jeopardize the blue carbon potential of the area but also worsen the climate impacts for coastal communities and their built environment. Ilman et al. (2016) argue that the primary driver of mangroves and seagrass loss is not the climatic drivers (e.g., rising temperatures, intensified storm surges) but mainly caused by anthropogenic (e.g., reclamation, infrastructure development, destructive fishing activities) drivers[27]. Research by McIvor et al. (2013) supports this argument by highlighting that mangroves can adjust to a slow increase in sea levels ranging from 1 to 10 mm/year.[208]

In the context of climate mitigation, Activity 2.3 (Blue Carbon Emissions) analysis finds that greenhouse gas (GHG) emissions from seagrass degradation are more extensive than from mangrove degradation. Thus, focusing more on seagrass adaptation intervention is a logical priority. A potential decline of these ecosystems due to compound effects of climate change and anthropogenic drivers would accelerate the loss of blue carbon potential, local community livelihood and their coastal landscape. Some of the identified adaptation activities in the BEAM are mangrove and seagrass restoration and conservation (Activity 2.2).

[205] Climateworks Centre analysis, based on Allen Coral Atlas[205] and Hadi et al. (2020)
[206] Based on Activity 2.2 (Natural Capital & Ecosystem Services Assessment and Mapping) analysis results
[207] Ilman, M., Dargusch, P., Dart, P., & Onrizal (2016). A historical analysis of the drivers of loss and degradation of Indonesia's mangroves. *Land Use Policy*, 54, 448-459. https://doi.org/10.1016/ j.landusepol.2016.03.010
[208] McIvor, A. L., Spencer, T., Möller, I., & Spalding, M. (2013). *The response of mangrove soil surface elevation to sea level rise*. The Nature Conservancy and Wetlands International. https://www.preventionweb. net/quick/43052

Table 64. WPP 572 Coastal Ecosystems Mapping (2020)[209]

Province	Mangrove Area (ha)	Seagrass Area (ha)	Coral Reef Area (ha)	Mangrove Rank	Seagrass Rank	Coral Rank	Overall Rank
Aceh	2,241.7	2,745.8	20,874.2	4	4	4	4
North Sumatra	11,797.7	7,739.6	57,167.2	2	1	1	1
West Sumatra	15,528.2	7,444.0	49,867.6	1	2	2	2
Bengkulu	1,565.0	1,728.0	7,413.5	6	5	6	6
Lampung	1,678.0	3,113.2	26,445.1	5	3	3	3
Banten	2,262.1	1,492.6	7,481.4	3	6	5	5
Beyond Provincial Boundaries	987.8	591.4	1,271.2				
WPP 572	**36,060.0**	**24,854.5**	**170,520.1**	**1.24%**	**4.99%**	**17.44%**	
Indonesia	**2,918,153.0**	**497,902.8**	**977,604.9**				

*Note: This table summarizes the analysis from the project **Activity 2.2** report. Mangrove, seagrass, and coral rank at WPP 572, representing the ratio between the extent of ecosystems to the nationwide area*

While North and West Sumatra hold the two most significant habitats for mangrove and seagrass, the future climate projections unfortunately nominate North and West Sumatra's habitat as the most climate-prone areas. As of 2020, North Sumatra has a combined coastal ecosystem capital of more than 76 thousand ha of mangrove, seagrass, and coral, equivalent to 33% of WPP 572 natural capital (see

[209] Climateworks Centre analysis, based on Global Mangrove Watch and Allen Coral Atlas database

Table *64*). West Sumatra had almost 23 thousand ha of combined mangrove and seagrass area with a 68 to 32% ratio for each ecosystem. If no interventions (Activity 2.2) applied, this will result in a potential ecosystem area loss up to a half from the 2020 level.[210] Prioritizing the measures for both climatic and anthropogenic degradation drivers could bring more than a quarter of socio-economic and environmental benefits for North Sumatra's marine and coastal area.

3.8 Combined Impacts of Climate Exposure and Sensitivity in WPP 572

At the national level, the government of Indonesia recognizes the impact of climate change and prioritizes the importance of climate adaptation for marine and coastal ecosystems. These impacts increase hazards in marine and coastal ecosystems, such as coastal slope decline due to floods, ecosystem damage due to ecological degradation, decreasing fishing range for small boats and marine safety endangerment due to storm surges.[211]

Among the combined impacts of climate exposure and sensitivity are:

- Extreme precipitation events: Heavy rainfall events during the wet season can trigger flash floods, landslides, and coastal erosion, impacting coastal infrastructure, disrupting fishing activities, and altering marine ecosystems. Heavy rainfall events can also exacerbate marine and coastal pollution through the flooding of waste sites that leach into the ocean. Conversely, prolonged dry periods during the dry season can lead to water shortages, the salinization of estuaries, and decreased fish productivity.
- Heatwaves: Marine heatwaves, characterized by prolonged periods of abnormally high sea surface temperatures, can stress marine life, disrupt spawning behavior, and lead to coral bleaching. These events can have significant consequences for fisheries and the livelihoods of fishing communities.
- Sea level rise: WPP 572 is vulnerable to sea level rise, threatening coastal communities, infrastructure, and ecosystems. Rising sea levels can inundate low-lying coastal areas, cause saltwater intrusion into freshwater resources, and increase coastal erosion. Rising sea levels can also limit the ability of mangroves to grow to provide their natural disaster mitigation services, as well as their ability to sequester carbon.

In WPP 572, climate change's rapid and slow onset impacts compromise the resilience of its marine and coastal communities and ecosystems. Natural disasters like floods, droughts, and storm surges can directly disrupt and damage WPP 572's communities and ecosystems. However, the gradual climatic variables, namely sea level rise, rainfall pattern shifts, and temperature increase, are typically overlooked. **Figure 44** captures the impact chain of storm events in the marine and coastal ecosystems, including its linkages towards increasing vulnerability.

The impact chain map depicts the typical potential impacts of storm events on seagrass beds, coral reefs, mangroves, and coastal communities, including how it will affect the vulnerability of other systems. For example, an intense storm surge directly impacts coral degradation and losses that indirectly increase the exposure of local coastal communities. Some coral fish are migrating or, in the worst case, disappearing, causing livelihood income loss and contributing to food insecurity. This impact chain analysis could better capture the impacts of climate change holistically and systemically and better communicate the key messages with the local actors. More importantly, this approach might avoid maladaptation risks.

[210] Using a combined annual depletion rate of mangrove and seagrass at -1.5%, based on historical trends and literature references conducted in Activity 2.2.
[211] Ministry of National Development Planning/Bappenas. (2021b). *List of Priority Locations and Climate Resilience Actions*. https://lcdi-indonesia.id/wp-content/uploads/2021/11/1_List-of-Priority-Locations- Climate-Resilience-Actions.pdf

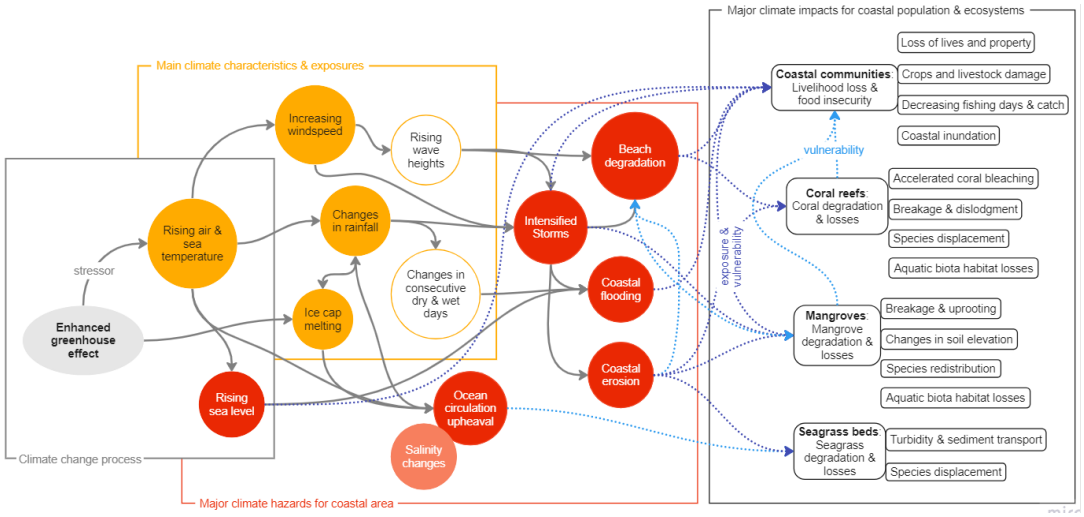


Figure 44 Impact Chain Map from Storm Events on Marine and Coastal Ecosystems that Reflects the Case of WPP 572[212,213]

This study uses SEI to quantify the combined impacts of climate exposure and sensitivity. SEI demonstrates how the system can tolerate a change or deviation from climate change, using the eight main parameters as suggested by Indonesia's MoE's.[214] poverty level, population density, topography profile, and clean water access. If the change/deviation has exceeded the tolerance limit of the system, the system becomes vulnerable because the deviation or climate change causes negative impacts.

In the SIDIK online database, we accessed exposure and sensitivity data at the village level, which consisted of eight indicators. These indicators are then weighted and normalized into SEI values, as summarized in **Table 65.** As a result, North Sumatra, Aceh, and West Sumatra are the top three consecutive provinces in WPP 572 that are most exposed and sensitive to climate change. Regionally, WPP 572 has a relatively higher sensitivity and exposure to climate change than the average nationwide level, represented by 0.608 (WPP 572) versus 0.561 (Indonesia) SEI values.

[212] *Author's analysis, adapted from Pramova et al. (2013).* Pramova, E., Chazarin,F., Locatelli, B., & Hoppe, M. (2013). *Climate change impact chains in tropical coastal areas* (Policy Brief). Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) & Center for International Forestry Research (CIFOR). https://www.cifor.org/knowledge/publication/5179/

[213] Rekacewicz, P. & Bournay, E. (2005). *Climate change: processes, characteristics and threats* (Graphic). UNEP/GRID-Arendal. https://www.grida.no/resources/6889

[214] KLHK SIDIK (2018) database: http://182.253.238.238/administrator/dashboard

Table 65. WPP 572 Climate Exposures and Sensitivity Profiles[215]

Provinces	Primary Source of Income	Topography Profile	Fuel Source	Latrine Facility	Poverty Level	Landfill/ Waste Facility	Clean Water Access	Population Density	Index (SEI)	SEI Rank
Aceh	1.00	0.40	0.50	0.40	0.85	0.60	0.47	0.60	0.64	5
North Sumatra	1.00	0.50	0.60	0.50	0.90	0.60	0.50	0.70	0.69	6
West Sumatra	0.90	0.40	0.50	0.40	0.80	0.60	0.40	0.65	0.61	4
Bengkulu	1.00	0.30	0.50	0.40	0.50	0.60	0.47	0.55	0.56	2
Lampung	1.00	0.40	0.50	0.30	0.45	0.60	0.47	0.80	0.59	3
Banten	0.90	0.40	0.50	0.40	0.25	0.60	0.40	1.00	0.55	1
WPP	**0.97**	**0.40**	**0.52**	**0.40**	**0.63**	**0.60**	**0.45**	**0.72**	**0.61**	
Indonesia	0.95	0.38	0.61	0.38	0.53	0.59	0.45	0.53	0.56	

Note: Higher value means less exposure and sensitivity to climate change, except for poverty, population density, and SEI values

[215] Climateworks Centre analysis, based on SIDIK (2018) database

3.9 WPP 572 Adaptive Capacity

This section of the CCVA focuses on adaptive capacity, which refers to the ability of individuals, communities, and systems to respond to and adjust to the impacts of climate change. This includes recovering from shocks and stresses, reorganizing systems and practices, and developing new strategies to cope with changing climate conditions.

3.9.1 Freshwater Security

Incremental alterations in hydrometeorological patterns influence agriculture and freshwater availability, as well as the escalation of sea levels and saltwater intrusion into coastal regions. Moreover, De Bettencourt et al. (2013) contend that when temperature variations are introduced alongside these shifts in rainfall, the consequences could involve the degradation of coastal land and ecosystems due to diminishing supplies and deteriorating freshwater quality.[216] In terms of public health, the combined impact of temperature fluctuations, coastal salinity, humidity, heavy rainfall, floods, and drought is likely to contribute to the emergence of health issues such as diarrhea, malaria, and other waterborne diseases like cholera and schistosomiasis.[217] At a national level, the planned efforts of climate adaptation (i.e., increase coastal infrastructure protection, improve the use of navigation technology and fishing ship size, and strengthen coastal knowledge and capacity) will protect at least 269.2 trillion m^3 of water resources and avoid a potential economic loss of IDR 7.29 trillion by 2024.

The majority area of WPP 572 is projected to have a decrease in both intensity and number of days of rainfall events. This circumstance will lead to freshwater scarcity and shifts in agricultural growing periods, impacting the local community resilience and its blue economy sectors. In addition to freshwater security and quality, saltwater intrusion becomes another issue exacerbated by rising sea levels, groundwater extraction, and land subsidence. Geographically, as shown in **Figure 36**, only the northern part of WPP 572, that is, Aceh and North Sumatra province, will have an increasing rainfall trend of up to 20% or more. In contrast, the rest of the region will experience reduced precipitation in all future climate scenarios in 2021-2040 and 2041-2060.

The BEAM Grant Activity 2.1 is designed to respond to this threat. More specifically, sub-activities in Activity 2.1, like the WASH program, will ensure that the projects account for not only addressing the coastal waste issue and management. The WASH programs play a vital role in promoting sustainable water management practices and protecting freshwater security in coastal communities. By promoting responsible water use and protecting water quality, WASH programs can contribute to the overall resilience of coastal areas facing freshwater scarcity.

3.9.2 Poverty and Food Security

The challenges of climate-related shocks and strains, which currently pose a significant barrier to reducing poverty, will exacerbate due to the impacts of climate change. Climate plays a role in most disruptive events that either maintain households in poverty or push them into it. These include natural disasters (such as tidal floods that lead to the loss of assets and disabilities), coastal agricultural setbacks, and fluctuations in food prices (caused by factors like drought or crop diseases).

A decrease in the food production system can amplify existing poverty and income challenges, resulting in higher food prices and a subsequent uptick in the poverty rate. A theoretical correlation analysis conducted by Hallegatte et al. (2016) at the national level suggests that a 50% and 100% surge in food prices could

[216] De Bettencourt, U.M., Ebinger, T.S., Fay, J.O., Ghesquiere, M., Gitay, F., Krausing, H., Kull, J., Mccall, D.W., Reid, K., Simpson, R. C. J. & Leigh, A. (2013). *Building Resilience: Integrating climate and disaster risk into development - lessons from World Bank Group experience*. World Bank Group. http://documents. worldbank.org/ curated/en/762871468148506173/Main-report

[217] Hallegatte, S., Bangalore, M., Bonzanigo, L., Fay, M., Kane, T., Narloch, U., Rozenberg, J., Treguer, D., & Vogt-Schlib, A. (2016). Shock Waves: Managing the Impacts of Climate Change on Poverty. *Climate Change and Development Series*. Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-0673-5

increase the proportion of Indonesians living in extreme poverty by more than 10% and 25%, respectively[218]. Another study by Hecht (2016) anticipates percentage gains and losses in per capita income by the province in 2050 and projects that Aceh and West Sumatra provinces might experience reductions in per capita income of -2.4 and -1.3%, respectively (see **Figure 45Error! Reference source not found.**).[219]

Around 4.7 million coastal populations are below the poverty line across the six provinces in the WPP 572 region[220] and are at stake due to the impact of future climate change. Aceh, Bengkulu, and Lampung are among the top three provinces with a share of a poor population beyond 12% of their total population in 2020. Taking into account the future climate exposures and their impacts, Lampung and Bengkulu provinces are the two most poverty-sensitive provinces due to heightened temperatures, decreased rainfall, and more frequent extreme weather events. These communities, especially poorer coastal farmers and inhabitants, often cannot afford the resources they need to adapt to climate change, such as clean water storage, irrigation infrastructure, and adaptation technologies. Additionally, these communities often cultivate land vulnerable to drought and other extreme weather events. Therefore, the Activity 2.1, Activity 2.3, and Activity 2.4 of the BEAM Grants aim to address these challenges.

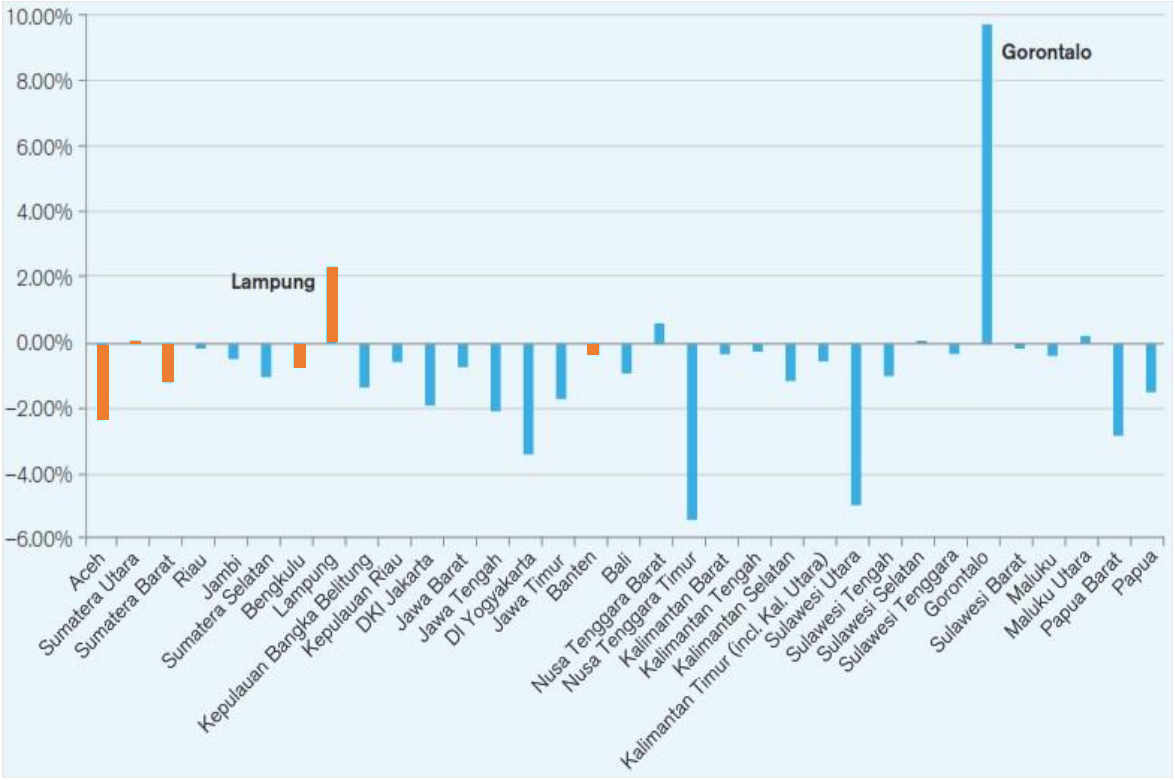


Figure 45. Percent (in 2050) Gains and Losses in Income per Capita due to Combined Climate-Health Impacts, Sea-Level Rise Issues, and Climate-Agriculture Impacts[221]

Note: The orange bars are WPP 572 provinces

[218] Ivanic, M., & Martin, W. (2014). *Short- and Long-Run Impacts of Food Price Changes on Poverty*. The World Bank Group. http://documents.worldbank.org/curated/en/106581468325435880/pdf/WPS7011.pdf

[219] Hecht, J. E. (2016). Indonesia: Costs of Climate Change 2050. *Technical Report for USAID ATLAS Project*. USAID. https://www.climatelinks.org/sites/default/files/asset/document/Indonesia%20Costs%20of% 20CC%202050%20Policy%20Brief.pdf

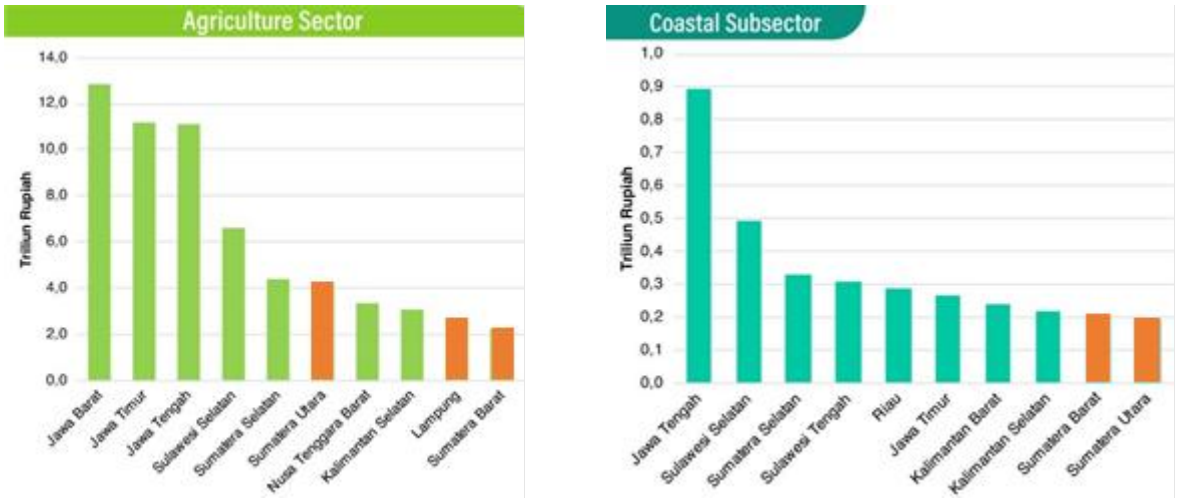
[220] Based on BPS (2020) number of poor population data for 36 regencies across six provinces in WPP 572

[221] *Hecht (2016) in the World Bank Group and Asian Development Bank (2021)*

3.9.3 Economic Resilience

The coastal economic sectors are anticipated to face enduring effects from climate-induced alterations like temperature fluctuations, changes in rainfall, ocean acidification, and rising sea levels, among other factors. This impact will manifest across various levels and commodities. Strategies for adapting to these changes and enhancing resilience should underscore the potential for interplay between fisheries and coastal agriculture and aquaculture, which can either worsen the repercussions or contribute to adaptive solutions. A study by Bappenas (2019) projects that having a bigger ship will avoid as many as 43,477 nationwide ship accidents in all categories of ships, which is vital to coastal fisheries' productivity. Economically, Bappenas (2021a) also anticipates that the marine and fishery industry could be hit hardest by climate change, facing economic losses of up to USD 5.47 billion[222] (IDR 81.82 trillion) by the end of the year (2024) under business-as-usual scenario.

As climate change is projected to exacerbate the state of WPP 572's natural resources, the economic outcomes from coastal agriculture, aquaculture, and fishery activities are also expected to worsen without appropriate adaptation measures. All provinces in the WPP 572 region, except Banten, still rely on agriculture, forestry, and fishery products (including fisheries and aquaculture) as the primary contributor (and contributed between 22-28% of the total GRDP) to their GRDP.[223] A shift in seasonal climate variability will influence the potential revenue from this sector via commodities growth processes and commodity scarcity due to a reduction in quantity. Bappenas (2021b) estimates that by the end of 2024, North and West Sumatra have a potential economic loss from agriculture, water, and coastal sectors with a combined value of up to IDR 6.72 trillion (USD 0.45 billion) and IDR 4.11 trillion (USD 0.27 billion), respectively (see Figure below).



[222] The original currency used is the Indonesian Rupiah (IDR), converted to US Dollar (USD) with a conversion rate of IDR 14,957.95 per 1 USD
[223] Based on BPS (2022) economics data for six provinces in WPP 572.

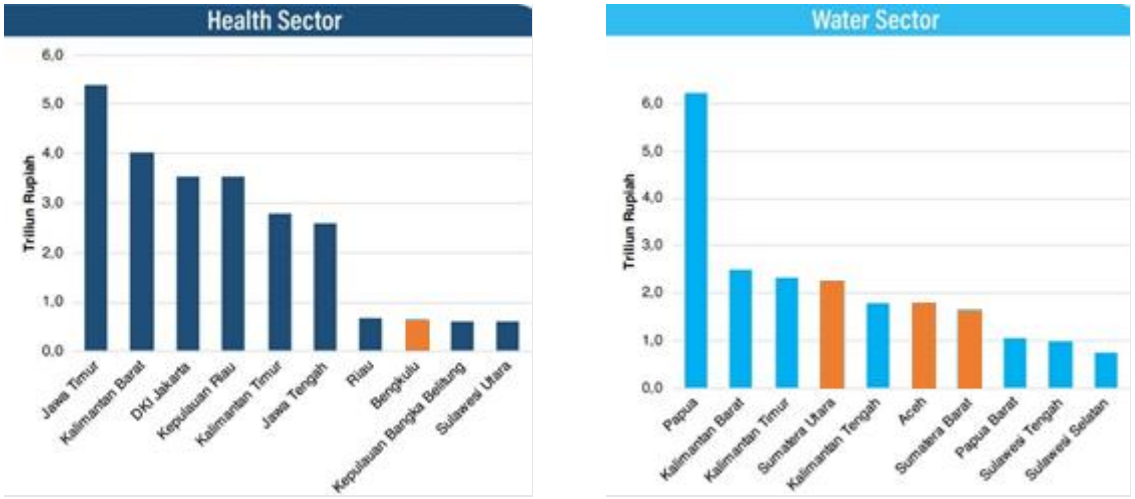


Figure 46. Top 10 Provincial Potential Economic Losses from Climate Change Impacts in Four Economic Sectors by 2024[224]

Note: The orange bars are WPP 572 provinces

More specifically, coastal agriculture economics is sensitive to climate changes, in particular, alteration of rainfall patterns, rising temperatures, and rising sea levels. A study observed rising sea levels and saltwater intrusion into coastal farmlands, reducing soil quality and crop yields. Increases in temperature and annual rainfall decrease crops' productivity as they consecutively change the evapotranspiration patterns and lifespan.

Future climate scenarios suggest adverse impacts on WPP 572 primary coastal agricultural commodities (e.g., rice, corn, cassava) production and thus impact the local economy. A study (Hecht, 2016) estimates that a degree increase in temperature would decrease rice and corn yield by -11.4 and -5.9% in 2050, respectively. Hecht (2016) also calculates the potential agricultural loss at the provincial level, projecting that Aceh, Banten, and West Sumatra are the top three with the net agricultural loss (see **Figure 47**). Taking into account the WPP 572 future climate projection results into the agricultural-dependent provinces, Bengkulu and Lampung are the two most exposed provinces.

As previously discussed, these crop failures would lead to food supply shortages and consequently cause food prices to increase. This is especially problematic for poor populations in WPP 572 coastal areas (i.e., Aceh, Bengkulu, and Lampung), who are less likely to afford higher food prices or take steps to adapt to climate change. These impacts might lead to more local farmers and communities falling into poverty. As a result, they are more vulnerable to these climate shocks and disasters.

[224] *Bappenas (2021b)*

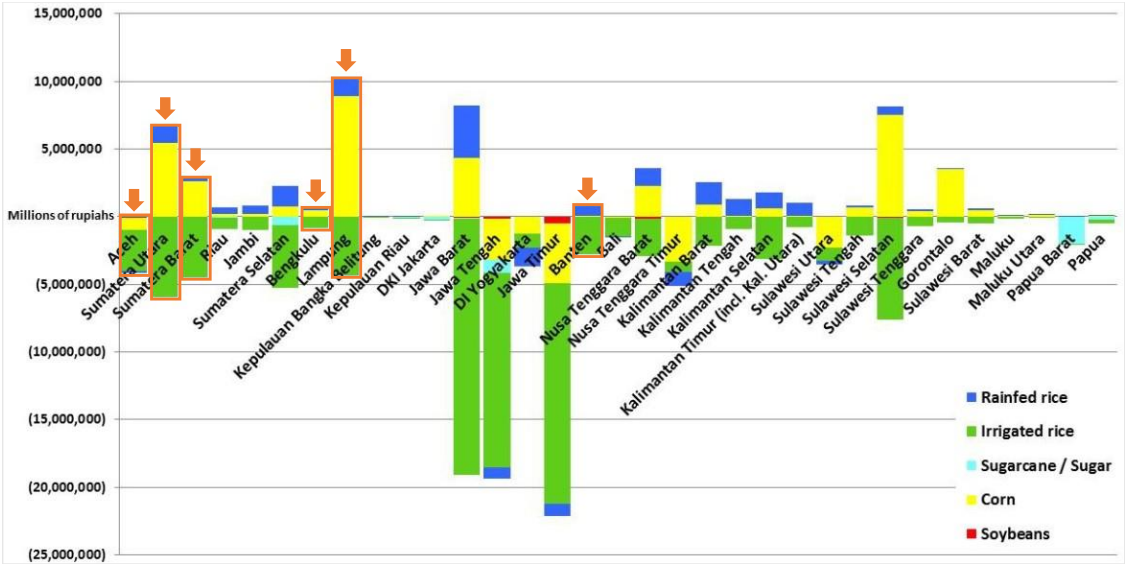


Figure 47. Projected Impact of Climate Change on the Value of Agricultural Output in 2050 (in Millions of Rupiahs)[225]

Note: The orange blocks are WPP 572 provinces

3.10 Policy Implications of Vulnerability assessment results

Based on the results of vulnerability assessments, policymakers can identify scenarios and develop a vision for the future. In order to achieve this objective, project teams should present their findings to a wide range of stakeholders. The best approach is to organize a consultative meeting where policy-makers and project team can discuss future scenarios and agree on long-term CCA objectives. Scenarios are used to develop policies in order to consider a wider range of options. Below are three broad scenarios of the future, which can assist local and national governments in planning CCA actions at the local level.

Scenario	Required response and Impact
Business as usual	**Response**: Authorities and communities do not recognize the urgent need to address current and future climate change impacts and vulnerabilities, and no action is taken **Impact:** Climate change will increasingly affect people's life, livelihoods, health and safety, development will be impeded
Resilience is built to maintain current living standards	**Response:** Authorities and project team recognize the urgent need to address current and future climate change impacts **Impact:** current living standards may maintained, but social development and economic growth would be challenged by climate change
Resilience is built that enables economic and social development.	**Response:** Authorities and project team committed to implement a wide range of low and high cost CCA measures. **Impact:** Current living standards maintained and achieving development goals

[225] *Hecht (2018)*

3.11 Summary and Conclusion

A comprehensive understanding of climate vulnerability profiles for WPP 572 marine and coastal communities and ecosystems is imperative in addressing the escalating impacts of climate change through context-appropriate and robust adaptation measures. This multidimensional analysis uses historical and future climate modelling combined with the existing assessment by MoE's SIDIK, Bappenas' RAN-API, as well as the stakeholder consultations to assess the current and future states of vulnerability within these vital ecosystems and communities, identifying key stressors and potential vulnerabilities. By establishing a robust vulnerability profile, this project can develop informed, targeted interventions to safeguard these invaluable natural systems and the livelihoods they support.

More specifically, this analysis uses the ACI and SEI from the SIDIK database to capture a more comprehensive vulnerability profile across WPP 572 provinces. ACI represents a provincial ability to avoid, anticipate, and overcome or manage impacts. At the same time, SEI demonstrates the extent to which the system can tolerate a change or deviation from climate change. In addition to the vulnerability index, this study refers to the climate resilience priority locations from Bappenas (2021b) in identifying and focusing on climate-sensitive marine and coastal area regencies across the WPP 572 region. This section discusses a combined outcome from climate exposure, sensitivity risk, and vulnerability profile in WPP 572.

Climate modelling results and analysis show that the WPP 572 provincial climate vulnerability profile will shift from its historical, putting this region at high risk of impacts under a business-as-usual scenario. As highlighted in **Table 65**, Banten, Aceh, and Lampung were the top three most prone provinces by climate change. Unlike Banten and Aceh, that will be less sensitive to the future climate in all scenarios, Lampung is projected to be the most exposed province to climate impacts by 2040. After Lampung, the worsening climate indices will happen at Bengkulu and West Sumatra, as the second and third most vulnerable provinces across WPP 572.

To complement the climate vulnerability assessment presented above, climate risk within WPP 572 can be understood as the interaction between climate hazards, exposed systems, and key vulnerabilities that affect livelihoods, food security, and water security. The principal climate hazards identified through the climate modelling analysis include marine heatwaves, rising sea surface temperatures, ocean acidification, sea-level rise, coastal flooding, shoreline erosion, changing rainfall patterns, drought conditions, storm surges, and increasingly frequent extreme weather events. These hazards affect a range of exposed systems across WPP 572, including small-scale fisheries, seaweed farming systems, coral reefs, mangrove ecosystems, low-lying coastal settlements, and Indigenous Peoples and traditional communities that depend on coastal and marine resources. The vulnerability of these systems is increased by a high dependence on fisheries and marine resources for income and food security, climate-sensitive production systems, degradation and fragmentation of coastal ecosystems, limited livelihood diversification opportunities, limited climate-resilient infrastructure, and dependence on customary resource management systems.

Climate Hazard	Exposed Systems	Key Vulnerabilities	Climate Impacts on Livelihoods	Climate Impacts on Food and Water Security
Sea Level Rise (SLR)	Coastal communities; mangroves; fisheries infrastructure; aquaculture areas; low lying coastal areas and small islands	Populations' high dependence on marine resources; poverty; limited adaptive capacity; inadequate coastal / marine resource management	Damage to coastal ecosystems and fishing / aquaculture activities; loss of tourism assets; livelihood displacement in low-lying coastal areas	Coastal flooding and saline intrusion reduce access to freshwater resources; degradation of fish breeding habitats reduces fisheries productivity and food availability
Sea Surface Temperature (SST)	Fisheries resources; aquaculture operations; coral reefs; seagrass meadows; fishing communities	High dependence on fisheries and marine natural resources; overexploited / poorly managed fish stocks; limited livelihood diversification	Fish migration to deeper waters increases fishing costs and reduces catch; declining fisheries productivity reduces household income; negative impacts on tourism linked to coral reef degradation	Reduced fish availability affects dietary protein supply; lower fisheries productivity threatens food security of coastal households dependent on fish consumption
Extreme Precipitation and Rainfall Variability	Coastal settlements; watersheds; estuaries; mangroves; seagrasses; coral reefs; fisheries; waste management systems	Inadequate waste management systems and infrastructure; ecosystem degradation; poor land-use practices;	Flooding disrupts fishing, tourism, and coastal economic activities; sedimentation damages fisheries habitats; increased recovery costs following extreme events; runoff of pollution / waste affects ecosystems and tourism potential	Flooding contaminates water resources; increased sedimentation and pollution reduce ecosystem health and fisheries productivity; creates disruptions to food supply chains and local food production

The interaction between climate hazards and these vulnerabilities generates significant impacts on livelihoods. Rising sea surface temperatures, marine heatwaves, and ocean acidification contribute to declining fisheries productivity, reduced fish catches, coral bleaching, biodiversity loss, and production losses in seaweed farming systems, resulting in reduced household income. Sea-level rise, coastal flooding, shoreline erosion, storm surges, and extreme weather events damage productive assets, disrupt livelihood activities, reduce fishing opportunities, and increase the risk of livelihood disruption for coastal communities, including Indigenous Peoples and traditional communities. These livelihood impacts also create risks to food and water security. Reduced fisheries productivity decreases the availability of fish as a key source of food and nutrition. Coral reef degradation and mangrove loss reduce ecosystem services that support fisheries and coastal livelihoods. Sea-level rise, coastal flooding, and saltwater intrusion threaten freshwater resources in low-lying coastal areas, while changing rainfall patterns and drought conditions increase the risk of water scarcity. Together, these impacts increase food and water security risks for coastal communities across WPP 572.

While Lampung, Bengkulu, and West Sumatra are forecasted to be the top three climate-prone provinces, adding the adaptation baseline, vulnerability profile, and coastal ecosystem capital would rank North and West Sumatra as the top two priority areas. North Sumatra has the highest coastal natural capital among the six provinces, representing 33% of the total WPP 572 ecosystem extent (see

Table *64*). However, at the same time, it has both exposure and sensitivity to climate change, represented by the SEI number of 0.698 and the third lowest adaptation capacity level with the ACI value of 0.500 (see two tables below). West Sumatra is considered the second priority with similar rationales to North Sumatra.

Table 66. Historical and Future Climate Composite Trends

Provinces	Historical and Future Climate Exposure Overall Rank				
	1990 – 2020	2021 – 2040	2041 – 2060	Trends	2021 – 2060
Aceh	2	5	4	↘	4
North Sumatra	4	6	6	↘	6
West Sumatra	5	3	3	→	3
Bengkulu	6	2	1	↗	2
Lampung	3	1	2	↗	1
Banten	1	4	5	↘	5

Table 67. KLHK's Adaptive Capacity and Sensitivity & Exposure Indices

Provinces	ACI Rank	SEI Rank	Overall
Aceh	1	5	5
North Sumatra	4	6	1
West Sumatra	3	4	3
Bengkulu	2	2	6
Lampung	5	3	2
Banten	6	1	4

Table 68. Bappenas' National Adaptation Plan in WPP 572 Provinces[226]

Provinces	Overall Rank
Aceh	1
North Sumatra	4
West Sumatra	6
Bengkulu	5
Lampung	3
Banten	2

Note: This provincial climate rank order represents a province that is exposed to the highest increase in temperature, sea level, and extreme indices but has the lowest rainfall. This analysis uses provincial ACI & SEI data from SIDIK (2018), where a higher ACI index means more resilience, while a higher SEI means more sensitivity and exposure to climate change. The overall rank of Bappenas is a composite rank from four sectoral hazards.

[226] *Climateworks Centre analysis, based on developed WPP 572 historical and future climate model and KLHK SIDIK data (2018) as well as Bappenas National Adaptation Plan (2019).*

The adaptative capacity in WPP 572 is slightly lower than the national average, meaning it is a moderately vulnerable region. Considering all village-level data (consisting of 15,208 villages), the average adaptive capacity index of WPP 572 provinces was at 0.515, slightly less adaptive compared to the national average at 0.530. Regarding the region's risk to climate impacts, represented by the sensitivity and exposure index, data from SIDIK also depicts slightly higher exposure (at 0.608) to climate change than the average national SEI level (at 0.561).

Aceh features as the most vulnerable province in WPP 572 by Bappenas. As shown in **Table 70**, Aceh dominates the vulnerability parameters that have a very high risk for its marine hazard (risky for fishing vessels <10 gross tonnage due to higher wave projection) with an increased risk for its coastal (having a high coastal vulnerability to climate- and extreme weather-related events) and water (having a high likely of having water scarcity) hazards. In contrast with the KLHK profiles, Banten and Lampung are the second and third most vulnerable provinces, according to Bappenas's assessment. The coastal hazard scale for both Lampung and Banten ranks as very high risk (a scale of 5), while Banten has a higher probability of having a water scarcity case (with a scale of 4) than Lampung (with a scale of 3).

Table 69. MoE's Vulnerability Profiles Across WPP 572 Provinces

Provinces	ACI	Vulnerability Rating	Flood Rating	Dryness Rating	ACI Rank	Vulnerability Rank	Flooding Rank	Dryness Rank	Overall Rank
Aceh	0.56	3.06	3.43	3.84	1	2	1	1	1
North Sumatra	0.50	2.76	2.81	3.80	4	4	4	2	3
West Sumatra	0.55	2.34	2.36	2.45	3	6	6	6	6
Bengkulu	0.55	3.00	3.30	3.00	2	3	2	4	4
Lampung	0.47	3.27	3.27	3.27	5	1	3	3	2
Banten	0.46	2.52	2.53	2.53	6	5	5	5	5
WPP 572	**0.52**	**2.83**	**2.95**	**3.15**					
Indonesia	**0.53**	**2.88**	**2.94**	**3.15**					

Table 70. Bappenas' Vulnerability Profiles Across WPP 572 Provinces

Provinces	Water Hazard Scale	Coastal Hazard Scale	Marine Hazard Scale	Agriculture Hazard Scale	Captial City Health Hazard Scale	Overall Rank
Aceh	4	4	5	3	3	1
North Sumatra	3	3	4	3	4	4
West Sumatra	2	5	2	3	5	6
Bengkulu	2	5	3	1	4	5
Lampung	3	5	3	3	2	3
Banten	4	5	3	3	1	2
WPP 572	**3**	**5**	**3**	**3**	**3**	
Indonesia	**3**	**4**	**3**	**3**	**4**	

By integrating climate projections with sensitivity, exposure, and adaptive capacity profiles, the three most vulnerable provinces within WPP 572 are identified as Aceh, Lampung, and North Sumatra. Aceh ranks as the second most climate-exposed and sensitive province (with an SEI value of 0.64) and exhibits the lowest adaptability (with an ACI value of 0.56) despite being a key contributor to marine fishery aquaculture commodities in WPP 572. Lampung is also among the top three due to its significant exposure rank from climate projections and the combined effects of the second lowest ACI (with a value of 0.47) along with the third highest SEI value (at 0.59). Lastly, North Sumatra province, with its extensive coastal ecosystems (spanning over 76.7 thousand ha), holds the highest SEI value (at 0.70) and the third lowest ACI value (at 0.50), securing its position among the top three most vulnerable provinces in WPP 572.

4 Section 4: Legal, Institutional, Political Framework, and Financial & Market Assessment

4.1 Legal Framework on Climate Action in Indonesia

4.1.1 Climate Policies and Regulation

4.1.1.1 Introduction

Indonesia's Enhanced Nationally Determined Contribution (NDC) commits to higher greenhouse gas (GHG) reduction targets of 31.89% (unconditional) and 43.2% (conditional) in 2022, compared to 29% and 41% in 2016.[227] By 2030, Indonesia aims to achieve climate resilience for its archipelago through comprehensive strategies for mitigation, adaptation, and disaster risk reduction. The country has set ambitious sustainable goals related to the production and consumption of food, water, and energy.

Aligning with these efforts, MPAs are becoming increasingly recognized as a vital ocean-based climate solution. The impacts of climate change, such as the loss of marine habitats and diminished fisheries production due to rising temperatures, heightened seawater acidity, and increasingly severe weather patterns, highlight the need for effective habitat protection and enhanced fisheries management[228].

It is necessary to examine the regulatory framework concerning climate change adaptation and mitigation within the marine sector, as well as to evaluate approaches in other sectors as part of Indonesia's NDC strategy. This assessment is essential to understand how activities across various sectors impact the marine environment, thus influencing mitigation strategies within the marine sector to achieve BEAM's investment goals.

Policy and Regulatory Framework for Climate Change

In alignment with Indonesia's NDC, a range of policies and regulations have been implemented. The framework addressing climate change includes greenhouse gas emissions reduction targets, mitigation measures aimed at curbing emissions, and adaptation strategies designed to cope with climate change-induced challenges. These climate change-related policies and regulatory frameworks can be categorized into three groups:

- Climate Change Management Policies and Regulations: These are explicitly established for climate change management and their limitations.
- Sectoral Policies and Regulations: Policies and regulations within sectors such as industrial and energy, which significantly influence the achievement of greenhouse gas emission reduction targets. This analysis will include the alignment or overlap of the national-level policy and regulatory landscape pertaining to climate change.
- Provincial Comparisons: The third section will compare national climate change policies and regulations to provincial mid-term development plans and provincial climate change policies and regulations. The goal is to evaluate both vertical and horizontal alignment within Indonesia's climate change policies and regulations.

Based on this evaluation, recommendations will be made to strengthen climate policies and regulations for the Government of Indonesia.

[227] Government of Indonesia. (2022). Enhanced Nationally Determined Contribution (NDC) Indonesia. Retrieved from https://unfccc.int/sites/default/files/NDC/202209/23.09.2022_Enhanced%20NDC%20Indonesia.pdf
[228] Konservasi Indonesia. (n.d.). Blue Halo S. Retrieved from https://www.konservasi-id.org/inisiatif-program-nasional/blue-halo-s

4.1.1.2 Laws and Regulations for Climate Change Management

Indonesia does not have a single, unified climate law on climate change. Instead, climate change management is governed by various sectoral regulations covering environmental protection, carbon pricing, and international commitments. These regulations provide legal frameworks for mitigation, adaptation, and economic mechanisms to achieve Indonesia's Nationally Determined Contribution (NDC) targets. However, challenges remain, particularly in aligning emission reduction targets with global climate goals.

The table below summarizes key regulations related to climate change in Indonesia:

Category	Regulation	Key Provisions
Environmental Protection & Management	Law No. 32/2009, as amended by Law No. 6/2023	Integrates climate considerations into planning and environmental management (KLHS, EIA).
	Government Regulation No. 46/2017, partially amended by Government Regulation No. 22/2021	Provides guidelines on environmental management, including climate-related policies.
Carbon Economic Value & Trading	Presidential Regulation No. 98/2021	Establishes carbon economic value implementation to support NDC targets.
	MoE Regulation No. 21/2022	Sets procedures for implementing carbon economic value.
	MoE Regulation No. 7/2023	Regulates carbon trading in the forestry sector.
	MoEMR Regulation No. 16/2022	Regulates carbon trading in the electric power sector.
Nationally Determined Contribution (NDC) Implementation	MoE Regulation No. 12/2024	Provides technical and institutional guidance for achieving NDC targets, covering sectoral responsibilities, funding mechanisms, and monitoring frameworks.

These regulations form the foundation of Indonesia's climate commitments, particularly in achieving its NDC target to reducing greenhouse gas emissions by 31.89% unconditionally through domestic efforts and 43.2% conditionally with international support. Mitigation efforts are primarily focused on the forestry, land, and energy sector, which together account for 97.2% of the planned reduction by 2030.

However, aligning Indonesia's emissions reduction targets with global climate goals remains a challenge. Climate action tracker estimates that to stay below 1.5°C, Indonesia emission should not exceed 948 Mt of CO_2eq by 2030, or 948 MtCO_2eq to remain under 2.0°C by 2100.[229] Similarly, Rajamani *et. al*., suggest limiting emissions no more than 92% of its emission in 2010 by 2030.[230] However, the Indonesia's current

[229] Data available at: https://climateactiontracker.org/countries/indonesia/2022-10-26/, download the scenario data and see the tab "EffortSharing."
[230] Rajamani, L., Jeffery, L., Höhne, N., Hans, F., Glass, A., Ganti, G., & Geiges, A. (2021). National 'fair shares' in reducing greenhouse gas emissions within the principled framework of international environmental law. Climate Policy, 21(8), Figure 5, p. 15.

target is 1,240 Mt of CO2eq by 2030, exceeding these recommendation by nearly 400 Mt of CO2eq, raising concern about the country's ability to meet global climate goals.

4.1.1.3 The Horizontal Alignment of Indonesia Climate Policy

Indonesia's climate mitigation strategy spans five key sectors—energy, waste, IPPU, agriculture, and Forestry and Other Land Use (FOLU)—with plans to incorporate the marine sector in its second Nationally Determined Contribution (NDC)[231]. This assessment provides a baseline for monitoring progress, supporting national planning (RPJMN), and coordinating inter-ministerial efforts.

4.1.2 Energy Sector

Mitigation efforts in the energy sector face key challenges, particularly in relation to land use and emissions trade-offs. Biofuel promotion has led to deforestation, as 1.05 million hectares of forest risk being converted to plantations for biomass cofiring.[232] This could emit 489 MtCO2eq, far exceeding the 1 MtCO2eq reduction intended. The transition to electric vehicles (EVs) has also spurred nickel mining, causing deforestation of over 5,300 hectares on Halmahera Island.[233] Indonesia's Enhanced NDC still allows coal to supply 30% of energy by 2025 and 25% by 2050, contrary to IPCC's recommendation for an 80% reduction in coal use by 2030 and full phase-out by 2040.[234] Clean coal technologies, while promoted, pose health risks, contribute to water acidification,[235] marine pollution, and coral bleaching, and remain economically uncompetitive with renewables.[236]

4.1.3 Waste and IPPU Sector

The waste sector focuses on reducing landfill dependency through landfill gas (LFG) recovery, composting, 3R (reduce, reuse, recycle), and waste-to-energy (WTE) programs. With over 7 million tons of municipal solid waste treated annually through composting and recycling, infrastructure includes thousands of waste banks and processing facilities. Upcoming WTE facilities are expected to treat 10.2 million tons of waste and avoid 6.2 million tons of CO2 emissions by 2030.[237] However, reliance on incineration (WTE and RDF) raises concerns.[238] These methods emit significantly more GHGs than coal and may divert funding from more sustainable waste reduction strategies. Emphasizing upstream waste prevention, such as reducing plastic production, offers greater long-term climate benefits.[239]

4.1.4 Forestry and Other Land Use (FOLU)

Indonesia's FOLU Net Sink 2030 targets net emissions of -140 MtCO2 by preserving and restoring 120.4 million hectares of forest.[240] Strategies include halting deforestation, restoring peatlands, conserving habitats, and managing mangrove ecosystems. MoE Regulation No. 168/2022 emphasizes the role of blue carbon ecosystems, particularly mangroves and seagrasses, which store more carbon than terrestrial

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[231] Article 7 (2) of Presidential Regulation No. 98/2021 on The Implementation Of Carbon Economic Value To Achieve Nationally Determined Contribution Targets And Control Over Greenhouse Gas Emissions In Relation To National Development
[232] https://ieefa.org/wp-content/uploads/2021/02/Indonesias-Biomass-Cofiring-Bet_February-2021.pdf
233 https://news.mongabay.com/2024/02/indonesian-nickel-project-harms-environment-and-human-rights-report-says/
[234] https://climateanalytics.org/media/report_coal_phase_out_2019.pdf
[235] https://archive.epa.gov/clearskies/web/pdf/overview.pdf
[236]https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/Coal_fired_power_stations/Final%20Report/c05
[237] Government of Indonesia. (2022). Enhanced Nationally Determined Contribution (NDC) Indonesia. Retrieved from https://unfccc.int/sites/default/files/NDC/202209/23.09.2022_Enhanced%20NDC%20Indonesia.pdf
[238] *Ibid*
[239] 1,34 gigatons CO2eq per year will be emitted until 2030 if the plastic production and use grow as currently planned globally. See: CIEL, "Plastic & Climate: The Hidden Cost of a Plastic Planet", May 2019, (https://www.ciel.org/wp-content/uploads/2019/05/Plastic-and-Climate-Executive-Summary-2019.pdf)
[240] Indonesia Enhanced Nationally Determined Contribution, p.7.

forests.[241] The BRGM aims to rehabilitate 600,000 hectares of mangroves by 2024. However, mangrove management faces legal ambiguities between national and local authorities. The second NDC is expected to clarify jurisdiction. Efforts are also being made to integrate climate adaptation into forest management, support local communities, and promote sustainable forest product use.[242]

4.1.5 Industrial Sector

Industrial policies need clearer baselines, targets, and governance mechanisms. The Green Industry Strategic Plan (2022–2024) promotes resource efficiency and emission reduction. The Green Industry Standards (GrIS) set technical and management requirements for sectors such as energy use, production, waste management, and emissions. The Forest and Plantation Industry Plan (2020–2024) aims to reduce GHG emissions through improved palm oil waste processing and greener practices in the pulp and paper industry. However, these strategies remain less ambitious than mandated by Presidential Regulation No. 98/2021 on climate mitigation.

4.1.6 Agriculture Sector

The agriculture sector has integrated low-carbon development into the 2020–2024 RPJMN, though mitigation and adaptation are not emphasized in the Ministry of Agriculture's strategic plan. The government's Just Economy agenda aims to redistribute 21.7 million hectares, including forest areas, to local communities via the Social Forestry Program. While beneficial for equity, this shift may conflict with emission goals due to weak legal understanding, poor planning, and limited local capacity.[243] Peatland regulations (e.g., MoA Regulations No. 14/2009 and No. 98/2013) aim to reduce environmental risks. However, recent legal revisions under the Job Creation Law (Perppu No. 2/2022) weaken environmental safeguards, including downgrading Environmental Impact Assessment requirements[244] and shifting criminal to administrative penalties.[245] More sustainable practices and investment in post-harvest technology are needed to align agricultural growth with climate goals.[246]

4.1.7 Marine Sector

The marine sector is planned to be included in Indonesia's second NDC, with blue carbon (e.g., seagrass and mangroves) recognized as a key mitigation component. Though the current NDC references marine ecosystems in adaptation contexts, concrete mitigation targets are still lacking. The Strategic Plan of the Ministry of Marine Affairs and Fisheries (MMAF)[247] outlined actions under the national blue economy strategy. Programs include expanding marine conservation areas from 23.4 million ha in 2020 to 26.9 million ha by 2024, and increasing the proportion of fish stocks within safe biological limits from 64% to 80%. Other efforts involve sustainable aquaculture, coastal monitoring, and marine debris cleanup. However, mitigation and adaptation indicators remain vague in current planning documents, and detailed programmatic actions are needed to meet climate targets.

[241] Indonesia Ocean Justice Initiative. Ekosistem Karbon Biru sebagai Critical Natural Capital: Penguatan Blue Carbon Ecosystem Governance di Indonesia. Jakarta: IOJI, 2023.
[242] *Ibid*
[243] Resosudarmo, I., Tacconi, L., Sloan, S., Hamdani, F., , S., Alviya, I., & Muttaqin, M. (2019). Indonesia's land reform: Implications for local livelihoods and climate change. Forest Policy and Economics. https://doi.org/10.1016/J.FORPOL.2019.04.007.
[244] Article 26 (21) of Government Regulation in Lieu of Law No. 2/2022
[245] Article 26 (21) of Government Regulation in Lieu of Law No. 2/2022
[246] Wihardja, M., Arifin, B., & Amir, M. (2023). Towards More Sustainable Agro-food Systems in Indonesia. . https://doi.org/10.35497/565196.
[247] *Ibid., p. 26.*

The marine sector remains a priority sector in the current RPJPN 2025-2045 and RPJMN 2025-2029. The policy document is is pivotal in steering Indonesia towards its long-term vision of achieving Golden Indonesia 2045.

Key Components of Marine Sustainability in RPJPN 2025–2045:

1. Blue Economy Roadmap 2045: Indonesia has introduced the National Blue Economy Roadmap 2045, serving as a strategic blueprint for sustainable ocean-based development. This roadmap outlines priorities such as sustainable fisheries, marine conservation, and the development of marine biotechnology, aligning with the broader goals of the RPJPN 2025–2045.[248]
2. Sustainable Ocean Development Policies: The RPJPN underscores the importance of maintaining ocean health and ensuring the sustainable use of marine resources. Policies are directed towards balancing economic objectives with commitments to the Sustainable Development Goals (SDGs) and net-zero emission targets, reflecting Indonesia's vital interests in sustainable ocean development.[249]
3. Coral Triangle Initiative (CTI): Indonesia actively participates in the Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF), a multilateral partnership aimed at preserving marine biodiversity. The CTI-CFF focuses on conservation efforts, sustainable fisheries management, and addressing climate change impacts within the Coral Triangle region, which is rich in marine biodiversity

Key Components of Marine Sustainability in RPJMN 2025–2029:

1. Implementation of the Blue Economy Roadmap:
   The RPJMN incorporates the Indonesia Blue Economy Roadmap 2023–2045, which consolidates policies and programs to sustainably utilize marine resources. This roadmap emphasizes sectors such as marine conservation, sustainable fisheries, tourism, renewable energy, and marine biotechnology, fostering innovation and collaboration to bolster economic growth while preserving marine health.
2. Marine Conservation and Ecosystem Management:
   A pivotal goal is to expand Marine Protected Areas (MPAs) to cover 30% of Indonesia's territorial waters, equivalent to approximately 97.5 million hectares. This expansion aims to safeguard biodiversity, enhance fish stocks, and support the livelihoods of coastal communities.
3. Integration of Ocean Accounts:
   The plan emphasizes the development of Ocean Accounts to systematically assess and monitor the value and sustainability of marine resources. This initiative supports informed decision-making and ensures that marine resources contribute effectively to national growth, health, and welfare.
4. Alignment with Sustainable Development Goals (SDGs):
   The RPJMN 2025–2029 is designed to align with the Sustainable Development Goals, particularly SDG 14: Life Below Water, which focuses on conserving and sustainably using oceans, seas, and marine resources. This alignment ensures that national development strategies contribute to global sustainability efforts.
5. Green and Blue Economy Integration:

   The plan promotes the integration of Green and Blue Economy principles, aiming to achieve low-carbon and climate-resilient development. This includes enhancing marine conservation efforts and sustainable management of ecosystem services, thereby supporting economic growth while maintaining ecological balance.

[248] "Riding the waves for a blue future in Indonesia", 24 August 2023, UN SDG, https://unsdg.un.org/latest/blog/riding-waves-blue-future-indonesia
[249] "Sustainable Ocean Development Policies in Indonesia: Paving the pathways towards a maritime destiny", Front. Mar. Sci. , 10 September 2024, https://www.frontiersin.org/journals/marine-science/articles/10.3389/fmars.2024.1401332/full

4.1.7.1 Vertical Alignment of National Climate Policy and Provincial Climate Policy

In Indonesia, through Law No. 23/2014 as amended by Law No. 1/2015 on Local Government and Law No. 32/2009 on Environmental Protection and Management, provincial-level governments are tasked with managing their local environments, including the management of greenhouse gas emissions. This responsibility involves developing and enforcing policies to mitigate climate change impacts and enhance environmental sustainability at the provincial level. Within this framework, provincial governments play a crucial role in aligning their initiatives with national climate change strategies, thereby contributing significantly to nationwide efforts to mitigate the impacts of climate change.

In this section, we aim to synthesize how provincial-level government laws and policies, particularly through their Marine Spatial Plans and Mid-Term Development Plans (given the absence of specific climate change policies at provincial level), align with national-level efforts to mitigate and adapt to climate change across the five sectors outlined in the Indonesian NDC. It was important to note that with the recently published RPJPN 2025-2045 and RPJMN 2025-2029, each province was still undergoing the development of their RPJMD by the time this proposal was submitted. Additionally, we will examine the integration of provincial-level policies with the national program in the marine sector. This analysis holds significance as the BEAM project endeavors to provide technical assistance to provincial governments in implementing the national vision and policies outlined in the RPJMN for effective implementation.

4.1.7.1.1 Aceh Province

Aceh integrates mitigation and adaptation in its Marine Spatial Plan (MSP) and RJMD, as outline in Qanun 1/2020 on the coastal zona and small islands zoning plan for Aceh until 2040. It prioritizes disaster risk reduction, ecosystem rehabilitation, and low-emission development, with a goal to cut forest and land fire emissions by 7% (42.8 million tons CO_2) supported by Fauna & Flora International and UNDP, Aceh is developing an integrated low emission development strategy across key sectors.[250]

4.1.7.1.2 North Sumatra (Sumatera Utara) Province

The alignment of the RPJMN with provincial activities in North Sumatra is detailed in Provincial Regulation No. 4 of 2019 on the Coastal Zone and Small Island Zoning Plan (2019 – 2039). It supports climate action, the RPJMN, NDC Priorities, and the Blue Economy through community engagement, ecosystem protection, sustainable fisheries, mangrove conservation, and waste management.

Additionally, Provincial Regulation No. 6 of 2021, which amends Provincial Regulation No. 5 of 2019 concerning the Regional Medium-Term Development Plan (RPJMD) for 2019-2023, emphasizes sustainable fisheries, disaster vulnerability, and alignment with SDGs 13, 14, and 15 on climate resilience, sustainable fisheries, and ecosystem conservation in West Sumatra (Sumatera Barat) Province

The West Sumatra Provincial Government has incorporated climate-related strategies in the RPJMD 2021-2026 through:

- Environmental conservation, which includes climate adaptation measures.
- Low-carbon development, covering climate budgeting, forestry, food security, waste, energy, and transportation
- Blue Carbon, recognizing GHG emissions from the marine sector for the first time.

However, despite these strategies, mission 6 under the RPJMD to improving equitable and sustainable infrastructure development does not explicitly address climate change. The closest related targets focus

[250] Pemerintah Aceh. (2020). *Strategi Pembangunan Rendah Emisi Terintegrasi Aceh* (Integrated Low Emission Development Strategy in Aceh) ILEDSA. BAPPEDA Aceh. http://182.253.224.163/assets/lampiran/Dokumen_ILEDSA.pdf

on disaster preparedness and environmental quality, but their indicators are general and do not specifically measure climate resilience.[251]

4.1.7.1.3 Bengkulu Province

The Bengkulu government, through the Regulation of Bengkulu Province No.5 of 2021 concerning the Medium-Term Regional Development Plan of Bengkulu Province for 2021-2026, has formulated strategic plans aligned with RPJMN 2020-2024. One of the key strategies focuses on achieving sustainable management of natural resources and the environment, which is closely related to climate change. This strategy supports Target 6 of the RPJMN, which aims to foster a resilient environment, enhance disaster resilience, and address climate change.

To ensure sustainable environmental practices, a strategic environmental review has been conducted, as detailed in the provincial regulation. Bengkulu province has developed five strategic missions with one focusing on the environment, specifically on realizing a sustainable environment and natural resources management for a maximally beneficial welfare.

Furthermore, the provincial regulation also explains the relationship between the province's vision and mission and the Sustainable Development Goals (TPB). Through the priority program "Wonderful Bengkulu", the province supports the development of resilient tourism, and the equitable and sustainable management of natural resources based on local excellence supporting TPB 13,14 and 15.

Regarding greenhouse gas (GHG) emissions targets, Bengkulu aims to reduce emissions in the energy sector by 20% by 2024. Additionally, within the RPJPD document, some activities support climate change mitigation and adaptation although these activities are not explicitly categorized as climate change initiatives in the document. These activities include efforts to conserve the sea and marine resources sustainably, such as managing small islands, enhancing coastal security, and conserving water areas.

4.1.7.1.4 Lampung Province

In Lampung, the priority action plan for Climate Change mitigation in 2021 covers multiple sectors, including agriculture, waste management, energy, transportation, forestry, and peatlands. This comprehensive approach is overseen by a coordination team responsible for monitoring the implementation of RAD-GRK. The Department of Environment is actively implementing adaptation and environmental management programs, with an annual budget increase from 650 million to 1.5 million. This budgetary allocation reflects the commitment to address climate change and its impacts. Furthermore, this development plan is integrated into the Lampung City Department of Environment's Strategic Plan (RESTRA DLH) for 2021-2026, aiming to initially reduce emissions by 5%, followed by a 1% reduction in subsequent years. Additionally, efforts are underway to expand open green spaces by 11.08% annually.

However, there are notable gaps in Lampung Province's approach to climate adaptation and mitigation, particularly in the marine sector. Provincial regulations such as No. 1/2018 on the Provincial Marine Spatial Plan and terrestrial spatial plan No. 1/2010 lack explicit mentions of these efforts. An analysis conducted by the fisheries department identifies climate change as a significant threat to fisheries capture, yet there is a notable absence of integration of climate adaptation and mitigation strategies into marine and fisheries planning.

Nevertheless, despite these gaps in the marine sector, Lampung's mitigation strategy aligns with Presidential Regulation No. 98 of 2021, encompassing key sectors such as agriculture, waste management, energy, transportation, forestry, and peatlands. This alignment underscores Lampung's commitment to addressing climate change across various fronts.

[251] *Ibid.*, p. V.21.

4.1.7.1.5 Banten Province

In Banten Province, the 2023-2043 spatial plan focuses on developing climate-adaptive infrastructure for drinking water and irrigation in response to climate change (adaptation). National parks and MPAs are highlighted as part of the climate mitigation efforts, along with strategies to improve air, water, sea water quality, and land cover indices. In its 2023-2026 strategic plan, there is also an emphasis on enhancing coordination for greenhouse gas emissions control to mitigate climate change impacts. One of the strategies involves establishing RPPLH and KLHS in land and marine spatial planning. Furthermore, there are programs aimed at empowering communities and providing incentives to the public. This includes initiatives for addressing environmental violation complaints, with a budget allocation of 312 million per year as part of climate mitigation strategy.

Efforts to rehabilitate mangroves outside forest areas cover approximately 2 ha with a budget of around 26 million. Additionally, mangrove planting initiatives in community forests span 326 ha, with a budget allocation of 858 million for the year 2023 (excluding state forest areas). The Head of the Coastal Community Economic Empowerment Section is responsible for coordinating the preparation of materials for climate change adaptation, disaster mitigation, and coastal environmental damage in coastal and small island areas. Unlike Lampung, where climate mitigation efforts are spread across various sectors including energy and agriculture, in other regions, such as Banten, it is primarily carried out by the Environmental and Forestry departments. Despite its relatively smaller scale, mangrove rehabilitation is at least recognized as part of the climate mitigation strategy in Banten.

4.1.7.2 Conclusion and Recommendation

The following table provides a summary of current issues and recommendations concerning climate policy and the blue economy in Indonesia. It highlights key areas where national and provincial strategies may be improved to better integrate climate change mitigation and adaptation efforts across various sectors. This analysis underscores the need for enhanced coordination and policy alignment to effectively address climate change challenges within the region.

Table 71. Conclusion and Recommendation on Legal and Institutional Framework

Conclusion	Recommendation
Indonesia's national climate policy has made significant progress in integrating the Blue Economy into its development strategy, as reflected in the RPJMN 2025-209. The inclusion of Ocean Accounts, Indonesia Blue Economy Roadmap, and the expansion of Marine Protected Areas demonstrate a stronger commitment to sustainable marine resource management.	Strengthen coordination between national and locals levels, provide capacity-building programs for regional policymakers, enabling sustainable financing mechanisms, and integrating science-based monitoring and adaptative management will help align local actions with national and global sustainability targets.
There is an urgent need to strengthen Indonesia's of GHGs emission reduction target to ensure a fair share of Indonesia contribution to the mitigation of climate change	Engage with the MoE and MMAF to better understand the potential of climate change mitigation and adaptation actions from marine sectors. This can influence the enhancement of Indonesia's climate change target.
it is important to correct the contradiction between climate change mitigation across sectors at the national level, from energy, AFOLU, and waste sectors.	Approach the coordinating ministry of maritime and investment. Both coordinating ministries should have more power to coordinate related ministries in the climate change policy at national level. Frictions between ministries should be managed by coordinating ministries, ensuring a more aligning climate change mitigation and adaptation measures across the ministries.

Conclusion	Recommendation
Not every provincial government refers to RPJMN or Perpres 98/2021 as a reference for their climate change mitigation and adaptation targets and strategies. It is positive when a Provincial Government exercises its attributive authority in addressing climate change.	However, to ensure that mitigation and adaptation efforts are at least equal to the national target, or even exceed it, it is beneficial to align with the national strategy, while allowing each province to contextualize the strategy and targets according to their specific needs

4.1.8 Development Policies, Plans and Regulations

4.1.8.1 National and Provincial Planning in Blue Economy: Regulatory Environment and Overview

Indonesia's blue economy is gaining momentum as national strategies increasingly integrate sustainability, disaster resilience, and climate change mitigation. The Indonesia Blue Economy Roadmap, developed by Bappenas, outline four key missions[252] 1) promote environmentally sustainable economic growth2) ensuring ocean health and resilience3) enhancing human well-being; and 4) fostering innovation, investment, and inclusive growth. Meanwhile, MMAF has introduced strategies[253] focusing on:

- **Expansion of Marine Protected Areas:** Expanding MPAs to cover 30% of Indonesia's waters by 2045, ensuring at least 10% are effectively managed.
- **Quota-Based Fisheries:** Implementing Government Regulation No. 11/2023 to regulate fish stock management, empower local fishers, and integrate advanced monitoring technologies.
- **Coastal, Marine, and Inland Aquaculture Development:** Scaling up production of key species like shrimp, lobsters, and seaweed while leveraging local knowledge to support sustainable practices and poverty reduction.
- **Integrated spatial planning of seascape and landscape:** Aligning marine and terrestrial spatial planning under Government Regulation No. 21/2021 and MMAF Regulation No. 28/2021 to prevent conflicts between conservation and industrial activities.
- **Marine Plastic Management:** Reducing marine plastic waste by 80% by 2045 through the National Plastic Action Partnership (NPAP) and Presidential Regulation No. 83/2018

At the subnational level, Law No 25/2005 mandates that national development Plans (RPJPN and RPJMN) guide provincial and regency-level planning. The Blue Halo S program aligns with these framework, ensuring policy coherence and budget allocation for climate resilience. Additionally, RAN-API provides a foundation for integrating climate adaptation strategies into local planning, fostering stakeholder engagement, and mobilizing funding for marine conservation initiatives.

However, challenges remain in coordinating national and regional implementation. Presidential regulation No. 35/2022 calls for better alignment between national and provincial maritime policies but is inadequate in incentive for compliance. Strengthening coordination mechanisms through revised regulation, collaborative platforms, and monitoring frameworks is essential. Bappenas and Bappeda play key roles in bridging national strategies with local execution, ensuring that MMAF's programs align with broader development goals. Moreover, enhancing regulatory clarity, stakeholder participation, and better accountability will be critical for achieving a well-integrated and sustainable blue economy.

[252] BAPPENAS, "Indonesia Blue Economy Roadmap", Jakarta: Ministry of National Development Planning/National Development Planning Agency (BAPPENAS), 2023.
[253] As introduced by Sakti Wahyu Trenggono, Minister of Marine Affairs and Fisheries in the document "Indonesia Ocean Justice Initiative. Fishermen and Ocean Justice: A Study on the Implementation of the Fishermen Empowerment Law and the Coastal Management Law in Seven Locations. Jakarta: YPL-IOJI, 2022. MMAF, 2022.

In several provinces within WPP 572, there are provinces that have integrated climate change mitigation policies, as detailed in the following table:

Table 72. Matrix of Strategic Directions for Regional Climate Change Policy

No	Province	Stated in RPJMD (Regional Medium-Term Development Plan)	Allocated in APBD (Provincial Budget)	Made priorities in RPJMD (Regional Medium-Term Development Plan)
1	Aceh	✓	✓	✓
2	North Sumatra	✓	✓	
3	West Sumatra	✓	✓	
4	Bengkulu	✓	✓	✓
5	Lampung	✓	✓	✓
6	Banten	✓	✓	

All provinces have included climate change mitigation in their RPJMD policies, reflecting strong policy commitments and allocated budgets towards these policies, underlining their financial dedication to these initiatives. However, prioritization of climate change mitigation varies among provinces. This disparity suggests that while there's universal acknowledgment of the issue, the depth of engagement and action differs across regions.

There are provincial regulations that further demonstrate the commitment of regions towards environmental preservation and sustainability. Lampung Provincial Regulation No.9/2022, Bengkulu Provincial Regulation No. 2/2022, and Banten Provincial Regulation No. 10/2012 outlined the Provincial Environmental Protection and Management Plan, also known as *Rencana Perlindungan dan Pengelolaan Lingkungan Hidup* (RPPLH). This document highlights environmental potential, current issues, and strategies for protection and management over a set period.[254]

The General Guidelines for Provincial Environmental Management (RPPLH), as delineated in Law No. 32/2009, extends its landscape-level planning to include marine and coastal ecosystems as Article 63 (1) point l mandates central government to develop policies for marine environmental protection. RPPLH also recognizes the importance of climate change indicators, such as sea-level rise, which is explicitly mentioned in Article 21 (4) as a factor to be analyzed in environmental planning. This ensures that climate mitigation strategies are integrated within the broader framework of environmental management, aligning with the Blue Halo S Project aim to safeguard marine biodiversity and ecosystems.

Integrating the RPJMD with national and provincial maritime spatial planning within their respective jurisdictions is crucial to foster development cohesion, harmony, and address cross-sectoral and regional interests in effectively utilizing and managing marine spaces[255].Government Regulation No.32/2019 provides a directive on Marine Spatial Plan, serving as a guideline for both national and sub-national Governments in formulating regulations related to Indonesian territory marine spatial plan and the marine spatial plan of coastal areas and small islands. More so, Law No. 6/2023 on Job Creation and Government Regulation No. 21/2021 on Spatial Planning require an integration between marine and terrestrial spatial planning, drawing on provisions from Government Regulation No.32/2019.[256]

[254] Regulated through Art. 9, 10, and 11 Law No.32/2009 on Environmental Protection and Management
[255] Art. 5 point c Government Regulation No.32/2019 on Marine Spatial Plan
[256] Art. 245 jo. Art. 253 Government Regulation No.21/2021 on Spatial Planning

4.1.8.2 Optimizing Sustainable Growth: Blue Economy Policy for Fisheries, Tourism, and Aquaculture

Indonesia's blue economy, particularly in the fishery and tourism sectors, presents a complex landscape, intertwined with diverse marine ecosystems, socio-economic dependencies, and evolving regulatory frameworks that collectively shape its trajectory and potential outcomes. This multifaceted interplay drives the nation's approach to marine conservation, resource management, and economic growth in the maritime sectors.

4.1.8.2.1 Sustainable Fishing Practices

Below is the list of relevant regulations on sustainable fishing practices:

- MMAF Regulation No. 31 of Year 2020 on the Management of Protected Areas
- MMAF Regulation No. 18 of Year 2021 on the Placement of Fishing Gears and Fishing Supporting Tools in the Fishery Management Area in Indonesia and the High Seas
- MMAF Regulation No. 22 of Year 2021 on the Development of Fishery Management Plan and Agency
- MMAF Regulation No. 26 of Year 2021 on the Prevention of Pollution, Prevention of Degradation, Rehabilitation, and Increase of Fishery Resources and its Environment.

By optimizing conservation area management under MMAF Regulation No.31/2020, fisheries management strategy under MMAF Regulation No. 22/2021, and creating plans to safeguard Fishery Resources from pollution and degradation under MMAF Regulation No.26/2021, a synergy between MPAs and sustainable supporting zones[257] can be achieved.

MPAs include zones with varying levels of protection and permitted activities, which are essential for marine conservation and fisheries management. No-take zones within MPAs are strictly protected areas where all extractive and potentially harmful activities, such as fishing, are prohibited. These zones serve as marine sanctuaries that allow ecosystems to recover and flourish, resulting in increased fish populations and sizes, thus providing essential nurseries for young fish and safe havens for mature breeding stock. Adjacent to no-take zones are often sustainable use zones. These are areas within MPAs where regulated activities, including certain types of fishing or tourism, are allowed under management plans designed to maintain the health of the ecosystem while providing economic opportunities for local communities. This tiered approach to conservation in MPAs ensures that while some areas are highly protected to maximize conservation and recovery efforts, others are managed to allow sustainable use, benefiting both the environment and the people who rely on these resources. The synergy between no-take and sustainable use zones can lead to a "spill-over" effect, where the abundance of marine life within protected sanctuaries extends to adjacent areas, supporting local fisheries and biodiversity. This interconnected network of zones within MPAs thus plays a crucial role in marine conservation, contributing to the sustainability of marine resources and the livelihoods of coastal communities.

Whilst MMAF Regulation No.26/2021 governs sustainable fishing practices, obligating the central and regional governments and related stakeholders to prevent degradation of fishery resources and their environment.[258] This responsibility entails implementing waste disposal rules, managing waste on small islands and neighbouring waters, monitoring potentially polluting materials, and ensuring fishing vessels adhere to regulations concerning pollution prevention, equipment use, and waste management, including

[257] As regulated in Art. 7 point q jo. Art. 14 of MMAF Regulation n No. 28/2021 on Marine Spatial Planning, introduces coastal ecosystem management zones characterized by the presence of critical ecosystems such as coral reefs, seagrass beds, mangroves, or estuaries, are identified based on their potential for sustainable development and rehabilitation. This regulation underscores the potential for community-managed areas, empowering local stakeholders to play an active role in the conservation and sustainable use of coastal ecosystems. Community management aligns with the goals of preserving biodiversity, supporting livelihoods, and enhancing ecological resilience to climate change impacts.
[258] Art. 8 (1) MMAF Regulation No.26/2021 on Prevention of Pollution, Prevention of Damage, Rehabilitation, and Enhancement of Fishery Resources and Their Environment.

educating crew members about proper waste handling.[259] To solidify this synergy and enforce adherence, it's recommended to draft a consolidated legal directive that clearly intertwines the mandates of MMAF Regulation No.31/2020 and MMAF Regulation No.26/2021. This directive should stipulate the harmonisation of conservation efforts and sustainable fishing practices, ensuring that the implementation on the ground is not fragmented. Furthermore, a mechanism for continuous monitoring, reporting, and periodic review should be established to ensure compliance and effectiveness of this integrated approach. Establishing penalties for non-compliance and incentives for best practices can further encourage stakeholders to prioritise sustainable marine practices.

MMAF Regulation No. 26/2021 is critical as it emphasizes rehabilitation, prevention, and enhancement efforts directly contributing to sustainable fisheries. This regulation is more focused on the implementation aspects related to sustainable practices, addressing specific issues such as the prevention of destructive fishing. Additionally, MMAF Regulation No. 18/2021 complements these by targeting sustainable fisheries with a particular emphasis on fishing gear, highlighting a coordinated approach to sustainability across regulations. Thus, while MMAF Regulation No. 22/2021 outlines the broader strategic framework, MMAF Regulation No. 26/2021 and MMAF Regulation No. 18/2021 provide the operational details necessary for achieving sustainable fisheries. However, the details of MMAF Regulation No. 22/2021 will be further elaborated in Section Coastal, Small Island, and Fisheries Resource Regulations.

4.1.8.2.2 Sustainable Marine Tourism

Indonesia's marine tourism sector, underscored by its pristine coastal landscapes, vibrant coral reefs, and diverse marine biodiversity contributing significantly to the nation's economy through tourism. When effectively managed, marine tourism can be a catalyst for MPA conservation, fostering sustainable practices that protect marine biodiversity while enhancing local economic opportunities. Within the context of MPA, marine tourism stands as a direct incentive for stakeholders to safeguard the marine and coastal habitats drawing tourists. However, it is crucial to recognize the dual nature of tourism: it offers opportunities but also potential damage. Non-sustainable tourism activities can damage marine ecosystems, compromising the very attractions that allure tourists. Key concerns related to tourism development include habitat alteration and pollution—manifested through sewage, waste, and chemicals—that adversely climate change impact.

Additionally, MMAF Regulation No. 93/2020 further fortifies this effort by advocating for the management of marine tourism villages. The goal of this regulation is to enhance the economic value derived from the utilization of marine and fisheries resources, as well as the environmental management and ecosystem rehabilitation.[260] In parallel, MoTCE through MoTCE Regulation No. 9/2021 underscores the importance of environmental sustainability in the realm of tourism practices. This directive not only emphasizes the protection of vulnerable ecological zones but also addresses the prudent management of visitors within natural settings.[261]

Moreover, the broader environmental challenges facing the sustainable tourism sector, the regulation's environmental sustainability criteria, presented in section D Chapter II Annex, serve as a foundational blueprint for addressing these multifaceted issues. This framework, with its divisions focusing on resource management and the management of waste and emissions, lays the groundwork for a comprehensive approach to sustainable tourism.

Conservation of natural heritage, as detailed, is not just about protecting sensitive environments; it's a critical step towards maintaining biodiversity and ensuring the long-term viability of tourist destinations. This involves managing visitor interactions within natural sites to prevent overuse, fostering respectful wildlife

[259] Art. 10 & Art. 11 MMAF Regulation No.26/2021 on Prevention of Pollution, Prevention of Damage, Rehabilitation, and Enhancement of Fishery Resources and Their Environment.
[260] Art. 2 (1) MMAF Regulation No.93/2020 on Marine Tourism Village
[261] Art. 2 (1) jo. Annex Section D of MoTCE Regulation No. 9/2021 on Guideline on Sustainable Tourism Destination.

interactions, and safeguarding the welfare of species, which collectively contribute to the preservation of ecosystems.

Resource management extends beyond mere conservation to include the efficient use of energy and water resources, underscoring the importance of sustainability in the operational aspects of tourism. By prioritizing energy conservation and sustainable water use, the tourism sector can significantly reduce its ecological footprint, contributing to the broader goals of environmental protection and climate change mitigation. The emphasis on waste and emissions management addresses the urgent need to treat wastewater, manage solid waste effectively, and reduce greenhouse gas emissions. The promotion of low-impact transportation options, along with efforts to curb light and noise pollution, highlights the comprehensive strategies required to minimize the adverse effects of tourism on the environment.

This enhanced focus on the interplay between conservation efforts and economic growth is pivotal. Sustainable tourism, as emphasized by MoTCE Regulation No. 9/2021, is not solely about mitigating environmental impacts but also about leveraging these conservation practices to enhance the economic value derived from tourism. By integrating these principles, the sector can achieve a balance where environmental stewardship and economic development are mutually reinforcing, ensuring that tourism contributes positively to both local economies and the global challenge of environmental sustainability. This holistic management approach acknowledges that waste is but one of many concerns in sustainable tourism, and that the sector itself is a significant player among various sources of environmental impact. Through this comprehensive lens, sustainable tourism can be reimagined as a catalyst for conservation and economic growth, aligning with the broader goals of environmental sustainability and resilience.

An Inquiry emerges concerning the effective alignment from these two regulatory frameworks, and how such an alignment can further the cause of environmental sustainability amidst climate mitigation endeavors. Establishing a unified national framework or oversight body is crucial to ensure consistency and synergy in applying regulations. This could involve forming a joint task force comprising MMAF, MoTCE, and relevant stakeholders to develop integrated guidelines for waste management and sustainable tourism. Strengthening public-private partnerships in these sectors will be pivotal to align all stakeholders toward achieving a sustainable environmental future.

4.1.8.2.3 Sustainable Aquaculture Practices

Introducing aquaculture practice necessitates careful management to prevent adverse effects on the marine ecosystem. Aquaculture systems can, if not judiciously chosen and managed, trigger a cascade of negative environmental repercussions, from habitat degradation to disrupting the balance of the marine ecosystem. An essential precursor to the introduction of any aquaculture activity within an MPA is a comprehensive research analysis–one that evaluates the potential biophysical, oceanographic, and socio-economic impacts. As the demand for marine products is projected to surge, the nation faces the dual challenge of meeting this demand while ensuring sustainability. Existing guidelines such as EAA present a framework, but their broad-scale adoption and implementation remain challenging. MMAF Regulation No.26/2021 governs sustainable aquaculture practices through: conducted at designated locations as per spatial planning, adhere to legally prescribed good aquaculture practices, ensure the collection and potential recycling of unused aquaculture equipment to prevent environmental pollution, and manage or treat aquaculture wastewater to meet water quality standards at the discharge location.[262] Given these regulations and guidelines, it is recommended to initiate capacity-building programs for local stakeholders to ensure a comprehensive understanding and effective implementation of the EAA. Additionally, public-private partnerships could be explored to facilitate the infrastructural needs for waste management and recycling in aquaculture. Monitoring and evaluation mechanisms should also be strengthened to assess

[262] Art 12. MMAF Regulation No.26/2021 on Prevention of Pollution, Prevention of Damage, Rehabilitation, and Enhancement of Fishery Resources and Their Environment.

compliance with MMAF Regulation No.26/2021, accompanied by incentives for those who excel in sustainable aquaculture practices.

4.1.8.2.4 Role of Blue Economy Policy in Climate Mitigation and Adaptation

Blue Economy policy aims to use ocean resources sustainably for economic growth, job creation, and improving livelihoods while protecting ocean health.[263] Despite the Indonesian government's commitment to adopting these principles in policies like the Indonesian Maritime Policy 2021-2025, there's a noticeable gap between policy implementation and practical programs addressing climate change mitigation and adaptation.

The critical analysis of Indonesia's maritime policy reveals a discernible gap in its approach to addressing greenhouse gas emissions within the maritime sector, particularly in the context of the nation's Blue Economy plan. This plan, while forward-thinking in its pursuit of sustainable practices, such as fishing, appears to lack a comprehensive consideration of the greenhouse gas emissions resulting from these very activities. The current state of policy development necessitates not only the establishment of robust, quantifiable, and specific targets for the reduction of greenhouse gas emissions but also demands an expanded scope that includes an assessment of the emissions engendered by sustainable maritime activities. Indonesia's maritime policy needs to integrate a dual-focused strategy that encompasses both the reduction of existing greenhouse gas emissions and the proactive assessment of emissions stemming from sustainable practices within the Blue Economy framework. The integration of these two aspects would enable a more comprehensive understanding of the maritime sector's overall environmental impact.

On the other hand, the question of whether MPAs are integrated into Indonesia's climate strategy is vital, especially in light of conflicts with national projects like seaport developments, notably in Linau, Bengkulu. While MPAs are designed to protect marine ecosystems, they are often overshadowed by large-scale development projects, such as the coal transport seaport in Linau. This juxtaposition raises concerns about the potential subordination of MPA plans to national development strategies. Development projects, especially those involving fossil fuels like coal, are likely to increase emissions, contrary to the environmental conservation goals of MPAs. Therefore, it is crucial to consider the environmental trade-offs of such development projects. Integrating MPAs effectively into national climate strategies might require a re-evaluation of development priorities to ensure that environmental protection and sustainable development go hand in hand. To achieve this, a cross-sectoral coordination between MMAF, MOE, and Ministry of Planning as a strategic conduit for optimizing climate action in the maritime sector and sustainable development is key.

In doing so, Indonesia's policy must prioritize transparency, measurability, verifiability, and specificity in its target-setting process. Such an approach would not only enhance the effectiveness and trackability of policy implementation but also provide a clearer direction and benchmarks for progress. This necessitates the development of a detailed roadmap that outlines the steps towards achieving these targets, thereby offering a tangible framework for evaluating the nation's contribution to global climate mitigation efforts.

Lastly, such strategies must ensure that they are inclusive and participatory, involving stakeholders from various sectors–government, industry, civil society, and local and indigenous communities – in decision-making processes to enhance the legitimacy, effectiveness, and sustainability of implemented programs and policies. Thus, fortifying the foundation upon which the nation can build a robust, sustainable blue economy that substantially contributes to the global climate mitigation and adaptation agenda.

[263] https://ijgd.unram.ac.id/index.php/ijgd/article/download/27/14/410

4.1.8.2.5 Conclusion and Recommendation

The table below delineates specific conclusions drawn from the analysis and proposes targeted recommendations for integrating and improving policies and practices within the national framework to ensure the sustainable development of Indonesia's maritime sectors.

Table 73. Conclusion and Recommendation on Policies, Plans, and Regulations on Blue Economy

Conclusion	Recommendation
Indonesia's blue economy is shaped by intricate interactions of marine ecosystems, socio-economic drivers, and evolving regulations.	Intensify efforts to harmonize national and regional plans by 2024, considering revisions in the regulation for improved compliance.
The 5 (five) strategies put forth by MMAF have not yet been formally adopted into legally binding regulations.	Integrate MMAF's strategies into Indonesia's Medium-Term and Long-Term National Development Plans. This will provide a strong legal foundation for the blue economy and sustainable marine environment in Indonesia.
Indonesia already has a commitment to environmental stewardship, disaster resilience, and tackling climate change challenges in its long-term and mid-term national plans.	Promoting derivative regulations is pivotal in ensuring the robust implementation of both the RPJPN and RPJMN, which already serve as foundational frameworks for advancing the blue economy initiative.
The potential harmonisation between MMAF Regulation No.31/2020 and MMAF Regulation No.26/2021 can lead to an essential synergy that maximises the benefits of Marine Protected Areas (MPAs) and sustainable supporting zones.	A unified legal guideline should be developed, merging the aims of both regulations. This should include clear rules for conservation and fishing, a system for regular checks on compliance, and consequences for rule-breakers. Incentives for good practices can also motivate stakeholders to maintain sustainable marine activities.
MMAF and MoTCE have established regulations emphasising the protection of ecological zones and responsible tourism management, yet the challenge remains in harmonising these directives to enhance environmental sustainability.	A unified oversight body should be formed, possibly through a task force involving the MMAF and MoTCE, to create cohesive guidelines on waste management and sustainable tourism. Strengthening partnerships between public and private sectors is also crucial for a united approach towards environmental goals.
The analysis of Indonesia's maritime policy underscores a critical gap in addressing greenhouse gas emissions, particularly under its Blue Economy plan. This gap is further complicated by the conflict between Marine Protected Areas (MPAs) and large-scale development projects, like seaport developments, which may undermine environmental protection efforts and increase emissions.	Harmonise the objectives of MPAs with national development projects to ensure environmental conservation is not compromised in favor of development, especially in projects that increase greenhouse gas emissions.

4.1.9 Coastal, Small Island, and Fisheries Resource Regulations

4.1.9.1 Introduction

The Basic Agrarian Law (BAL) No. 5/1960, representing Article 33 paragraph (3) of Indonesia's constitution, is the foundation for governing land, water, and natural resources. It grants government authority, derived from the people, to manage these resources for the public benefit. This control involves not only regulation

but also policy-making, management, and oversight. BAL's scope covers three main areas: the objective of control (land, water, resources), the legal relationship between involved parties, and the legal aspects related to resource management.

Despite the interconnectedness of land (spatial) and water resources, Indonesia's marine areas and fisheries are governed by separate laws. Marine management is divided into distinct regulatory regimes: marine law (covering spatial planning, ecosystem management, and resource direction), fisheries law (overseeing terrestrial and marine fisheries resources, and small-scale fisheries regulatory framework governed by Law No. 7 of 2016. This section will explore on how these diverse regulatory frameworks interact with each other, presenting opportunities and challenges for improving fisheries and marine area management. This Section emphasizes further the intertwine between marine spatial and fisheries governance which the spirit stemmed from BAL.

4.1.9.2 Current Regulatory Frameworks Supporting Coastal and Small Island and Fisheries Management Plans in Indonesia, Particularly in WPP 572

4.1.9.2.1 MSP and WPP Intersection

The intersection of MPA, WPP, and MSP is crucial for ocean conservation and resource management. These tools each play a role in sustainably managing marine environments. However, there's a gap in the regulatory framework that separates marine area management and fishery management. This leads to a lack of integrated implementation of area-based fishery management.

Table 74. Legal Basis and Implementation in Maritime Zones

Tools	Legal Basis	*De Jure* and *De Facto* 0-12 miles	*De Jure* 12-200 miles
MSP	Law 32/2014 and Law 6/2023 jo Law 1 2014 jo Law 27/2007[264]	Provincial Government, MMAH and MOHA regulated through PP 21/2021	National government regulated through PP 32/2019
WPP	Law 6/2023 jo Law 29/2045	National government through Fisheries Management Body (LPP) regulated through MMAF Reg. 22/2021	
MPA	Law 5/1990, Law 1/2014, Law 31/2004	Provincial Government, MMAF and MoE	MMAF

The regulatory framework of marine area management following Job Creation Law mandates the integration of the MSP, including MPA[265] into the National Spatial Plan as outlined in the amendment of Art. 42 of Law No. 32/2014 concerning Marine Affairs. Art. 42 forms the basis for the authority in MMAF Regulation No. 28 of 2021 to create a marine spatial plan comprising utilization areas, conservation areas, strategic national areas, and sea lanes. This provision requires that the Marine Spatial Area framework, as outlined in RZWP3K, be integrated with the National Spatial Plan during its review process.[266]

On the other hand, FMP following the Job Creation Law has yet to integrate its provisions with marine spatial planning. Government Regulation No. 27/2021, in conjunction with MMAF Regulation No. 22/2021, is formulated based on the status of fisheries, encompassing four aspects:[267] fishery resources; the

[264] And their derivative regulations
[265] Art 16 (2) Law No. 32/2014 amended by Job Creation Act
[266] Art 43 (6) Law No. 32/2014 amended by Job Creation Act
[267] Art. 4 MMAF Regulation No. 22/2021

environmental context of these resources; socio-economic aspects of fisheries; and fisheries governance. Despite these comprehensive categories, the regulation falls short in harmonizing fishery management with spatial marine planning, thereby perpetuating the disjointed approach between the two regulatory spheres.

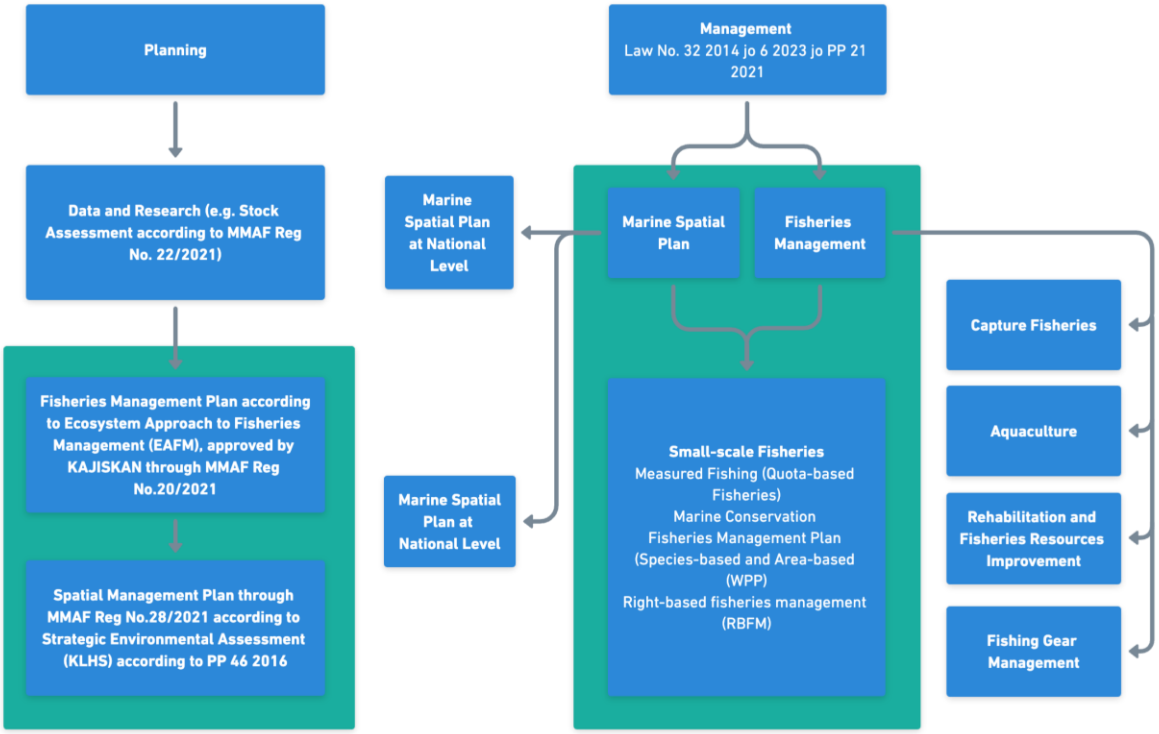


Figure 48. Marine Area and Fisheries Management Scheme
Note: Every process is subject to supervision, law enforcement and evaluation according to each regulation

4.1.9.2.2 The intersection between MPA, WPP, MSP, Right Based Fisheries Management and Small-scale Fisheries Protection

Figure 48 presents marine management comprising two integral components: marine spatial management and fisheries management, both requiring stringent environmental protection measures. In fisheries management, EAFM ensures considerations for fisheries resource stock, ecological health, socio-economic impacts along the supply chain, and inclusive fisheries governance, incorporating rights-based models as mandated by MMAF regulation No. 8 2018. Concurrently, marine spatial plans ideally integrate KLHS to dictate spatial allocations for fisheries, aquaculture, marine conservation, and rights-based or customary community marine areas. This balancing act between production and environmental protection aligns with sustainable development principles, including initiatives like the Blue Halo S core project, if SEA is employed as the basis of MSP development with the right substances and procedures.

The synergy between fisheries management and marine spatial planning is pivotal. These strategies rely on data-driven approaches and environmental protection through EAFM and SEA tools. EAFM ensures that fisheries management considers stock sustainability, ecosystem health, socio-economic impacts, and inclusive governance involving stakeholders. This information feeds into marine spatial planning, shaping the allocation of marine areas for different purposes, effectively integrating ecosystem considerations and stakeholder involvement in the planning process, thereby achieving a unified and sustainable resource management approach.

However, within the realm of fisheries management, distinct legal regulations govern specific facets. These encompass quota-based fisheries under MMAF regulation No. 28 2023, fisheries management planning regulated by MMAF regulation No. 22 2021, rights-based management under MMAF Regulation No. 8 2018, small-scale fisheries protection outlined in Law no. 7 2016, Marine Conservation mandated by MMAF

regulation No. 31 2020, fishing gear regulations stipulated in MMAF No. 18 2021, fisheries aquaculture governed by government regulation No. 28 2017, and fisheries rehabilitation and resource enhancement as per MMAF regulation No. 26 2021. These current legal frameworks cover comprehensive regulation and sustainable management across various facets of the fisheries industry, yet they are not yet connected to a single fisheries policy.

4.1.9.2.3 Gaps between Fisheries Management Realm and MPA

There are often no clear rules or designs for fishing areas within Marine Protected Areas that focus on sustainable fishing. Elements such as Harvest Strategies (HS) or Harvest Control Rules (HCR) are typically absent. Additionally, fisheries data may be inadequate, and stock assessments, Ecosystem Approach to Fisheries Management (EAFM) assessments, and planning are not standard components of MPA design or establishment. Consequently, the existing fishery zones within MPAs are not optimally managed, and essential fishery management aspects like restricted gear usage and fishing quotas are often missing.

These challenges arise from the lack of guidelines for effectively designing and managing intersectionality between marine area and fisheries management. Additionally, the significance of this aspect in the existing 'building blocks' for MPA establishment is not adequately acknowledged (refer to section AoW 1 on integrated planning). Notably, such guidelines may differ for national MPAs (KKPN) compared to regional MPAs (KKPD). Flexibility at the regional level would be crucial to adapt fishery regulations based on local conditions and cultures. Furthermore, these guidelines should clarify opportunities for fishery certification programs like Fair Trade initiatives and Fishery Improvement Projects (FIPs), which may lead to Marine Stewardship Council (MSC) certification. Lastly, MPA budgets and human resource considerations often fail to allocate resources for fishery-specific management within the MPA.

The absence of a cohesive regulatory approach creates potential for conflicting policies and undermines the effectiveness of marine conservation efforts. For instance, the delineation of areas for conservation or strategic national interests in the Marine Spatial Area framework might not align with the sustainability goals of fishery management, leading to overfishing or habitat destruction in zones not adequately protected by MPA or WPP regulations. In addition to that, the conservation goal itself is for spawning grounds, which are essential to be integrated with the fishery management plan to ensure the sustainable reproduction of fish populations and the long-term viability of marine ecosystems. This integration is crucial for balancing the needs of fisheries with the protection of marine life, ensuring that fishing practices do not undermine the areas where fish naturally reproduce and replenish their numbers.

4.1.9.2.4 Quota-Based Fisheries Policy and Fisheries Aquaculture

MMAF Regulation No. 28 2023 outlines a comprehensive Quota-Based Fisheries Policy (QFP) governing fishing quotas within Quota-Based Fishing Zones. These zones delineate specific areas for industrial, local fisherman, and non-commercial activity quotas based on distance from the coastline: industrial quotas allocated in the 12-200 nautical mile range, local fisherman quotas within 0-12 nautical miles, and non-commercial activity quotas applicable to both 0-12 and 12-200 nautical miles. The distribution of these quotas hinges on proportional representation of fish species or resource groups. Factors such as the number of fishers, fishing vessels, equipment, production data, and Fishing Log Book records inform the allocation process. It's essential to note that WPP 572, encompassing zone 04, allows operation with both domestic and foreign investments alongside WPP 573.

However, challenges arise due to insufficient fisheries data, particularly the absence of identification for all fishers, particularly traditional ones at landing sites. The lack of accurate data poses obstacles in determining allocations, especially for small fishers, requiring involvement from both the MMAF and Regional Government. To establish a measurable fisheries system, there's a necessity for an integrated landing system and adequate infrastructure to ensure catches are landed at designated fishing ports within each zone.

Supervision utilizing advanced technology is vital to monitor fish movements, preventing transshipment outside designated ports, which would compromise accurate quota calculations. The system relies on self-

assessment reports through an application based on individual logbooks, although concerns linger regarding the clarity of Fishing Quota certificates as legally binding instruments that ensure rights and obligations are upheld as per Ministerial Regulation stipulations. While industrial quotas are reserved for a maximum of two years after SIUP issuance, the regulation allows for non-tax state revenue allocation to support fisheries resource revitalization, aligning with programs like Blue Halo S. Local and small fishers require quota certificates issued by the Governor, posing potential challenges due to the lack of licensing documents and limitations in landing catches at designated ports, often due to fuel or weather constraints.

Moreover, tourism-related quotas necessitate a clear scheme of authority delegation to tourism agencies or stakeholders managing specific areas. The quota transfer system stipulated may give rise to new businesses in the fisheries sector but raises concerns about certain parties losing quotas, particularly affecting small fishers. Additionally, limited fishing areas are mandated to preserve fisheries stocks but necessitate a better connection between RPP 572 and planning for such areas in zone 4.

Meanwhile, Government Regulation No. 20 of 2017 in Indonesia manages fisheries and aquaculture, focusing on water use and land development for fish farming. It ensures adequate water quantity and quality for fish cultivation. The regulation covers planning, sea use, development, and protection measures. It requires long-term plans for water and land use in fish farming, spanning 20 years. Specific land requirements and aquaculture production to meet local, national, or export needs are emphasised. Additionally, it stresses the protection of fish-related germplasm, outlining actions like determining protection status, limited species breeding, restocking, conservation area creation, and specifying storage locations.

4.1.9.3 Conclusion and Recommendation

The following table details specific conclusions and actionable recommendations to optimize these strategies across various dimensions of marine management.

Table 75. Conclusion and Recommendation on Coastal, Small Island, and Fisheries Resource Regulations

Conclusion	Recommendation
The integration of robust environmental protection measures like SEA and EAFM, data-driven approaches, and a cohesive regulatory framework within marine spatial management and fisheries management fosters a unified and sustainable resource management approach, aligning ecosystem considerations, stakeholder involvement, and legal frameworks to ensure comprehensive regulation and sustainable management of marine resources.	Integrated Planning and Decision-Making: Develop a collaborative approach where stakeholders from both Directory General of Fisheries Capture and Directory General of Marine Spatial Management engage in joint planning and decision-making processes using SEA and EAFM as basis. This involves sharing data, coordinating efforts, and aligning objectives to ensure coherence in resource allocation and management.
Quota based fisheries policy has supervisory challenges as monitoring transshipment activities in the open sea poses significant challenges due to the lack of direct oversight or monitoring mechanisms. The reporting system depends on companies self-reporting their transshipment activities, potentially leading to inaccuracies or incomplete information.	Utilize Advanced Technology: Implement satellite tracking or vessel monitoring systems (VMS) to track vessel movements and transshipment activities in real-time, allowing for better oversight even in open sea conditions Require Independent Verification: Implement mandatory independent verification or third-party audits of transshipment activities to ensure accuracy and transparency in reporting. Enhance Regulatory Oversight: Strengthen regulatory oversight and enforcement mechanisms to conduct random inspections or audits to verify reported transshipment activities including Bakamla

Conclusion	Recommendation
Insufficient Data and Identification: Lack of comprehensive data on fishers, especially traditional ones at landing sites, hampers accurate quota determinations. Challenges in Tourism Quotas: Lack of a clear authority delegation scheme for tourism-related quotas may complicate reporting and utilization in designated areas. Potential Impact on Small Fishers: The quota transfer system might lead to certain parties, particularly small fishers, losing quotas and facing adverse effects.	Addressing the need for better infrastructure, improved data collection, and clarification of legal instruments can resolve various issues hindering effective quota implementation. Investments in landing site infrastructure, enhanced data collection methodologies, clear legal guidelines for quota certificates, and improved protective measures within the quota transfer system can collectively address these challenges. Enforcing Act No. 7/2016 to better protect small scale fishers' rights from the inequality happening due to the implementation of quota-based fisheries policy
Aquaculture management, the 5-years development plan, fisheries management plan, and marine spatial management plan are interlinked strategies for managing aquatic resources. The marine spatial management plan organizes activities in marine areas to avoid conflicts and optimize resource use.	However, gaps can emerge due to differing objectives and limited coordination among these plans. To bridge these gaps, fostering collaboration among stakeholders and integrating these plans is crucial. Aligning goals, sharing data, and coordinating efforts can improve overall management effectiveness. Incorporating sustainable practices within these plans promotes the responsible use of aquatic resources and ensures a balanced approach to economic and environmental goals.
Lack of standardized guidelines and integration strategies for effective fisheries management within Marine Protected Areas (MPAs), leading to suboptimal fishery zone management and absence of critical fishery aspects in MPA establishment.	Develop standardized, flexible guidelines encompassing Harvest Strategies, Control Rules, comprehensive fisheries data, and certifications within MPAs, allocating adequate resources to integrate fisheries management effectively and harmonise conservation goals with sustainable fishing practices.

4.1.10 Sustainable Financing Scheme and Regulations

4.1.10.1 Introduction

The development of a taxonomy encompassing criteria and categories for green, blue, and sustainable activities aims to serve as a comprehensive reference, enhancing market knowledge regarding sustainable financial instruments and activities. Parallel to this, the financial services sector is progressively highlighting its crucial role in championing sustainable development goals, addressing climate change challenges, and endorsing innovative sustainable finance mechanisms. Notably, the promotion of carbon markets within stock exchanges is being looked upon as a promising alternative source of funds. It is imperative to recognize the need for coordinated efforts and collaboration among various stakeholders, including private and government entities, to ensure the effective realization of sustainable finance goals. This initiative is also in line with the Indonesian government's regulation in introducing Public and Private Partnership (KPBU) on proportional risk allocation, which is regulated under Presidential Regulation (Perpres) No. 38 year 2015. This Section will focus on facilitating and regulating the financial framework to effectively support blue economy projects that emphasize the sustainable utilization of marine and fisheries resources. Additionally, it will address the establishment and utilization of overspecialized financial mechanisms designed to fund and promote projects aimed at environmental protection within coastal and marine ecosystems.

4.1.10.2 Regulatory Environment

Article 48 of Law No. 32/2014, as amended in the Job Creation Omnibus Law No. 6/2023, regulates that there are incentives for parties that utilize marine resources, accordance with spatial plans and/or zonation plans. Thus, the alignment of marine resource utilization with spatial plans thus becomes a prerequisite to

access these incentive schemes, whether fiscal or non-fiscal. The incentive scheme for marine resource utilization[268] is intended as a regulatory instrument to ensure that marine spatial utilization adheres to the provisions and guidelines set out in the national strategic plan. The provision of incentives in efforts that align with spatial planning is further regulated in Government Regulation No. 21/2021 on Spatial Planning, a derivative regulation to the Job Creation Omnibus Law. The awarding of incentives is extended to parties utilizing space to "address territorial implications in control or intended zones or to address policy implications or the national strategic plan." [269] This incentive scheme resonates with Indonesia's National Long-Term Development Plan (RPJPN) 2025-2045 and Medium-Term Development Plan (RPJMN) 2025-2029, underscoring the country's aspiration to become a sovereign, advanced archipelagic nation through sustainable development and effective marine management.

The incentives that can be provided comprise both fiscal and non-fiscal incentives.[270] Fiscal incentives are granted in the form of tax relief, retribution, tax savings and discount and/or non-tax state revenues. Non-fiscal incentives, on the other hand, may include compensation, subsidies, rewards, space rentals, equity participation, facilitation of Spatial Utilisation Activity Agreement approval (PKKPRL), infrastructure and facility provision, honour, and/or publicity or promotion.[271] In the context of the blue economy, this incentive scheme aligns with the spatial planning incentive regulation and is detailed further in the MMAF Regulation No. 28/2021. Incentives can be granted based on the following criteria:[272]

a. Spatial utilization activities that sustainably protect coastal resources and small islands, along with their ecological systems.
b. Contributions that have positive impacts and benefits towards the advancement of small fishers, aquaculturists, salt farmers, and the community.
c. Spatial utilization activities that preserve the environment and align with designated purposes.
d. Predominant use of local resources, partnerships with Micro, Small, and Medium Enterprises (SMEs), or cooperatives.
e. Industrial activities employing domestically produced capital goods, machinery, or equipment that boost the gross domestic product; and/or
f. Contributions to public services.

The specific criteria listed in MMAF Regulation No. 28/2021 are pivotal in ensuring that marine and coastal resources are protected. This regulatory framework that potentially involves experts for its assessment process, acknowledges the sustainable utilization of marine spatial by various stakeholders as a necessary mechanism in preventing marine ecosystem and coastal resources degradation. However, this regulation has not yet provided a comprehensive scheme regarding incentives, especially when compared to what is regulated in Government Regulation No. 21/2021. Given these shortcomings, there is a pressing need to bridge these gaps and lay the groundwork for a blue economy sustainable financing scheme.

4.1.10.3 Harmonized Stakeholder Efforts on Blue Financing Scheme

The blue economy development is a significant highlight in the RPJMN 2020-2024, aligning with four agendas that encompass economic resilience and environmental improvement. Recognizing its importance, RPJPN 2025-2045 and RPJMN 2025-2029 utilize the Blue Economy Roadmap as a primary guide for their formulation. Art. 263 (3) of Law No. 23/2014 outlines the provision for synchronizing and harmonizing national and regional development plans. This underlines the necessity of collaboration among diverse stakeholders, including governmental bodies, to ensure that these plans are effectively implemented.

[268] Art. 173 of the MMAF Regulation No. 28/2021 on Marine Spatial Arrangement
[269] Art. 164 Government Regulation No. 21/2021 on Spatial Planning
[270] Art. 65 (2) of Government Regulation No. 21/2021 on Spatial Planning
[271] Art. 166 (1) & 167 Government Regulation No. 21/2021 on Spatial Planning
[272] Art. 173 (2) of MMAF Regulation No. 28/2021 on Marine Spatial Arrangement

This collective effort is aimed at optimizing the roles and responsibilities related to the financing of blue economy initiatives. Funding for blue economy initiatives should align with spatial planning, as detailed in Government Regulation No. 21/2021, Article 164. MMAF regulations No. 31/2020 and No. 28/2021 specify two eligible areas for these incentives: Marine Protected Areas and the Approval of Marine Space Utilization and Suitability Area.

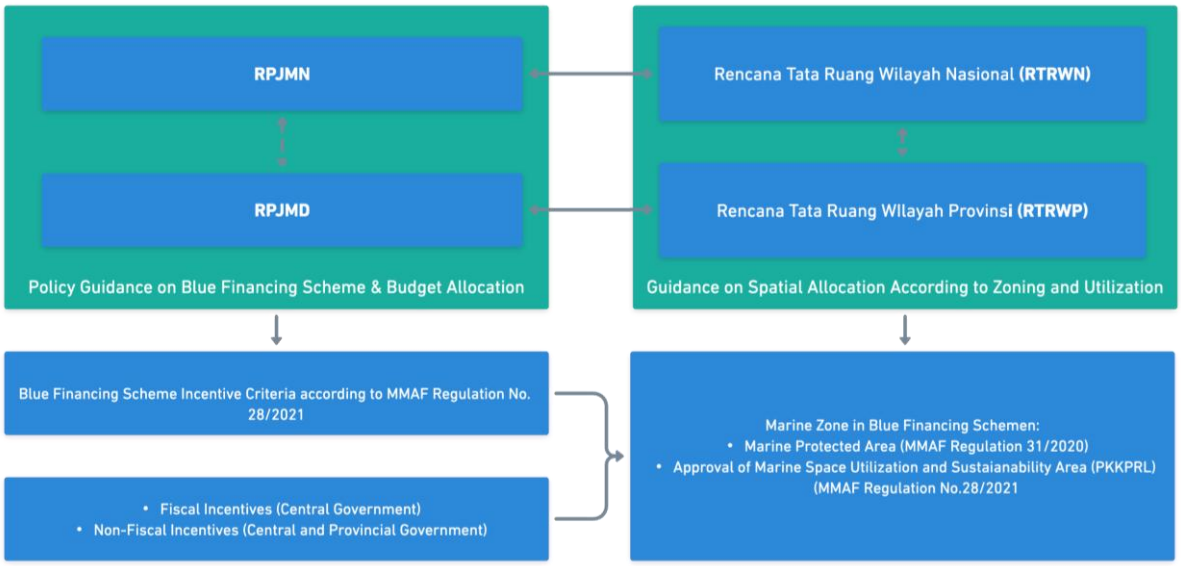


Figure 49. Blue Financing Scheme Legal Framework

4.1.10.3.1 Funding and Incentives in MPA

Funding for MPA management can come from the National State Budget (APBN), Regional State Budget (APBD), CSR and other sources funding such as angel investor, crowdfunding, innovative financing as specified in relevant laws and regulations.[273] Using funds from both national and regional government budgets, along with other sources, reflects collaboration across various levels of governance and potentially involves private entities. This holistic financial framework underscores that the sustainable management of MPAs is a shared responsibility, highlighting the importance of collective contributions and cooperation among diverse stakeholders.

Moreover, there is a non-tax revenue scheme that can potentially fund the MPA which is the administrative fine as regulated in Article 123 of MMAF Regulation No. 39/2021 pertaining to actions damaging marine areas, which include: unauthorized use of coastal and small island resources by foreign investment (point b); violation of provisions and/or permits related to the use of conservation areas (point l); and unauthorized use or violation of rules for protected and CITES-listed fish species (point ff).

While the regulation has the potential to create an enabling condition to support the blue financing scheme, there remains a notable gap in the regulation regarding the clarity and assignment of responsibilities for providing incentives. For example, it is unclear whether the BPDLH government's environmental funding, MMAF, or another financial institution is responsible for these incentives. The roles and coordination among stakeholders are not well-defined, underscoring the need for clarity and enhancement in this domain.

[273] Art. 47 of MMAF Regulation No. 31/2020 on Conservation Area

4.1.10.3.2 Funding and Incentives in Approval of PKKPRL Area

One of the potential funding sources for the PKKPRL Area is facilitated through a non-tax revenue scheme.[274] In Art. 107 of the MMAF Regulation No. 39/2021, it is regulated that the non-tax revenue scheme in the PKKPRL Area pertains to three activities: utilization of space for permanent activities at sea; utilization of undersea cable; and utilization of space for underwater pipelines. However, in the MMAF's non-tax revenue scheme for PKKPRL, there aren't clear guidelines on how funds from the PKKPRL Area holder are allocated for coastal adaptation and conservation activities. Additionally, such a revenue stream is not as lucrative, compared to those in landscape.

The apparent gap in the non-tax revenue scheme might be addressed by the incentive model highlighted in MMAF Regulation No. 28/2021. Under Article 174 of this regulation, using their delegated authority, the Minister and/or Governor could provide incentives to entities with the Approval of Marine Space Utilisation and Suitability Area. These incentives, dispensed in a non-fiscal manner, encompass support for local communities and small-scale fishers, provisioning essential infrastructure and facilities aligned with governmental aid initiatives, acknowledgment through awards for notable achievements or contributions, and publicizing efforts to augment visibility and recognition of ongoing activities. The incentive provided can be in the form of agreement facilities, tools and equipment provision given to the local communities that utilizing marine space. However, incentives under the MMAF Regulation seem significantly limited in scope and conditions, especially when compared to the incentives associated with environmental programs aligned with zoning in Government Regulation No. 21/2022. The disparity underscores the importance of critically assessing prospective derivative rules or amendments to establish a new revenue stream that can be used for marine conservation and ecosystem restoration.

4.1.10.3.3 Other Potential Incentives and Funding Opportunities

The following list provides potential incentives and funding opportunities that can also be considered to enhance and support sustainable fisheries management and marine conservation efforts. This analysis explores various regulatory frameworks and integrates them with innovative financial models to optimize resource allocation and support the sustainable utilization of marine ecosystems.

Quota-Based Fisheries as a Non-Tax Revenue

The concept of Quota-Based Fisheries as regulated in Art. 13 of Government Regulation No. 11/2023 on Quota-Based Fisheries, introduces a non-tax state revenue framework for the utilization of fish-catch quotas designated for the industry, Local Fishers, and activities with non-commercial intentions. Notably, an exception is made for small-scale fishermen. However, as of the present moment, the execution of this scheme remains under-defined, with no further guidance provided in subsequent regulations. Nevertheless, integrating this quota-based fisheries non-tax revenue scheme with other non-tax revenue structures outlined in MMAF Regulation No. 39/2021 can pave the way for an integrative funding model, aptly termed the blue financing scheme. Such integration would harmonize various revenue streams under a unified framework, thereby optimizing resource allocation, reducing bureaucratic overlaps, and enhancing the sustainable and economically viable utilization of marine resources. Blue Economy and Climate Change Mitigation

Presidential Regulation No. 98/2021 emerges as a directive concerning the economic valuation of carbon, with a distinct emphasis on the green sector. However, even as it introduces the blue carbon or marine sector in addressing climate change, it has not formally recognized the ocean sector to contribute to NDC as it did with energy, waste, industry, agriculture, and forestry sectors.[275] This positioning highlights a clear

[274] A regulated in MMAF Regulation No. 39/2021 on Requirements and Procedures for Imposing Tariffs on Non-Tax State Revenues Applicable to the Ministry of Maritime Affairs and Fisheries Outside the Utilisation of Fisheries Natural Resources
[275] See Article 8 Presidential Regulation No. 98/2021 and its framework on blue economy sectors.

discrepancy in the comprehensive integration of the blue economy framework, largely due to its lower prioritization.

Gaps in regulations on the technical aspects of blue carbon's economic valuation, can be solved through extensive engagements with a diverse array of stakeholders, encompassing donors, philanthropists, investors, and the broader private sector to build pathway and push for the development of blue taxonomy. This alignment and synergy between varied sectors could be the cornerstone for establishing a resilient and sustainable blue economy framework.

4.1.10.4 Conclusion and Recommendation

The following table outlines specific areas requiring attention and proposes targeted recommendations to enhance the effectiveness of funding mechanisms and regulatory compliance within the blue economy.

Table 76. Conclusion and Recommendation on Sustainable Financing Scheme and Regulations on Blue Economy Programmes/Activities Funding

Conclusion	Recommendation
The blue economy's funding and incentives align with spatial planning incentive regulation but require better clarity in their derivative regulations.	Establish detailed guidelines and clarity on incentive distribution mechanisms and their coordination among the BPLHD, MMAF, and other stakeholders.
Non-tax revenue schemes, including the Quota-Based Fisheries regulation, present promising funding avenues for marine conservation, but their specific applications and detailed implementation need clarity for a comprehensive blue financing approach.	Integrated Blue Economy Scheme regulation to provide clear guidelines on the allocation of funds from non-tax revenue schemes for marine conservation and ensure the harmonization of various revenue streams.
Current systems lack a comprehensive blue taxonomy framework integrated with financial and business sectors.	Create a blue taxonomy scheme, drawing insights from the green taxonomy. Foster collaboration between environmental and economic stakeholders to ensure sustainability.

4.2 Institutional Framework on Blue Carbon in Indonesia

4.2.1 Indonesian Mangrove Management

4.2.1.1 Introduction

Mangroves serve as a vital link between marine and terrestrial ecosystems, playing a crucial role in coastal protection, carbon sequestration, and biodiversity conservation. In Indonesia, the world's largest archipelagic country, mangroves are not only environmental treasures but also socio-economic cornerstones for many communities. However, the governance of these critical habitats is entangled in a web of institutional and regulatory complexities. This paper delves into the multifaceted framework governing mangrove conservation and restoration in Indonesia, where overlapping mandates and diverse interests create a labyrinthine challenge. Through an examination of the territorial divisions, land tenure arrangements, and administrative jurisdictions, we unveil the intricacies of the current system. Furthermore, we explore the establishment of the Peat and Mangrove Restoration Agency (BRGM) as a pivotal turning point in streamlining efforts and fostering cohesion among stakeholders, as well as the MPA manager’s role in mangrove governance.

4.2.1.2 Mangrove Governance Framework

The mangrove institutional and regulatory framework in Indonesia is fragmented, as multiple institutions having overlapping mandates and different interests in mangrove areas. This complexity often leads to confusion and hinder the pace of restoration and conservation efforts. This situation is shaped by the interplay between land tenure arrangements and use systems. In general, mangroves in Indonesia are divided into two main areas according to territorial mandates: (1) Inside forest areas, administered by MoE, and (2) APL which are linked to MoAASP and MMAF. At the subnational levels, each of the ministries is associated with the sectoral services of the provincial and district governments. MoAASP and local governments are particularly empowered to administer APL lands through RTRW. Furthermore, RTRL, serves as an indispensable instrument that specifies the allocation and governance of marine zones. It is instrumental in guaranteeing the sustainable exploitation of marine resources, thereby augmenting RTRW through the holistic incorporation of coastal and marine spatial management.

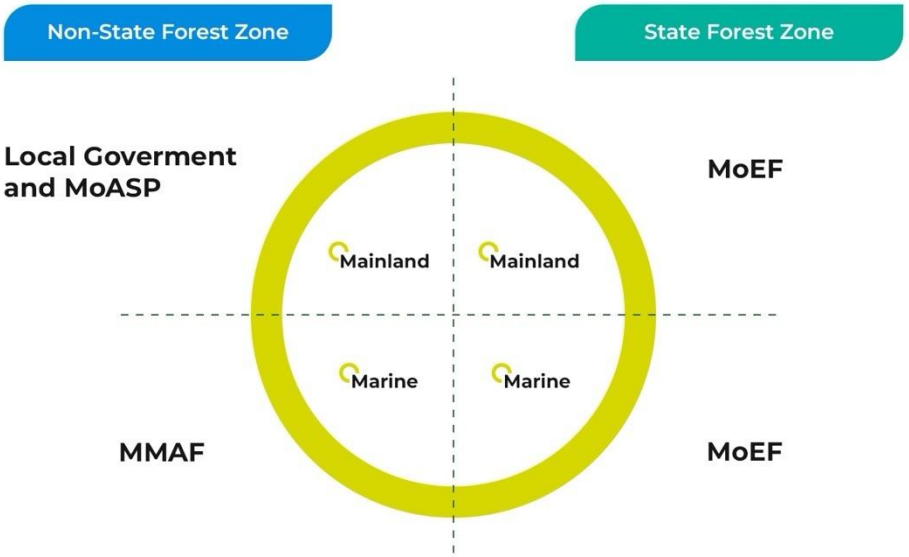


Figure 50. Distribution of mandates and jurisdiction prior to PRMA establishment (pre-2021)[276]

In early 2021, institutional arrangements for mangroves became increasingly complex with the establishment of the BRGM, with the intention of accelerating effort and coordination between stakeholders. BRGM is a coordinating body for national government agencies involved in the restoration of peatlands and mangroves. Its primary mandate is to accelerate the rehabilitation of mangroves in nine provinces, with a target area of 600,000 ha by 2024, as stated in the 2020-2024 RPJMN. However, the size of the BRGM working areas is considered very challenging to achieving the goals—not only for the targeted restoration but also monitoring effort is even more challenging.

Regarding regulatory frameworks, the responsibilities and activities of various government bodies are dictated by sectoral laws that lack harmonization. Frequently, these mandates intersect, leading to jurisdictional overlaps (refer to Table 61). Additionally, disparities in authority across different levels have impeded cohesive coordination for integrated management strategies.[277] Over recent decades, in the absence of harmonized intersectoral regulations, disparate bureaucracies have independently pursued their respective policy objectives. For instance, while local authorities may propose the expansion of

[276] Mursyid, H., Daulay, M. H., Pratama, A. A., Novita, N., Malik, A., Maryudi, A., & Laraswati, D. (2021). Governance issues related to the management and conservation of mangrove ecosystems to support climate change mitigation actions in Indonesia. Forest Policy and Economics, 133(102622). https://doi.org/10.1016/j.forpol.2021.102622

[277] Di Gregorio, M., Fatorelli, L., Paavola, J., Locatelli, B., Pramova, E., Nurrochmat, D.R.,May, P.H., Brockhaus, M., Sari, I.M., Kusumadewi, S.D., 2019. Multi-level governance and power in climate change policy networks. Glob. Environ. Chang. 54, 64–77. https://doi.org/10.1016/j.gloenvcha.2018.10.003.

aquaculture ponds through mangrove clearance, MMAF is charged with the preservation of these mangroves for conservation.

Despite the establishment of BRGM and its ambitious objectives, significant challenges remain, particularly in clarifying roles and achieving specified restoration and rehabilitation targets. This evolving situation provides local governments with an increased opportunity to lead rehabilitation efforts. By adopting effective methodologies, these localized programs can produce significant results that contribute to BRGM's broader goals. Additionally, the inclusion of stakeholders in peat and mangrove programs has expanded to involve BRGM, extending participation beyond MoE to include MMAF and Bappenas. Each entity contributes unique perspectives to rehabilitation efforts: MoE emphasizes environmental conservation and ecosystem restoration; MMAF focuses on balancing conservation with sustainable use of marine resources; and Bappenas integrates these environmental objectives into the wider national development agenda.

Table 77. Mangrove Governing Institutions and Mandates[278]

Institution	Mandates	Legal basis
MoE	Protect and manage mangroves in state forest zones	• **Law No. 5/1990 on conservation of biological natural resources and their ecosystems.** • **Law No. 41/1999 on forestry.** • **Law No. 32/2009 on environmental protection and management.**
MMAF	Manage mangroves in coastal and small island areas	• **Law No. 27/2007 on the management of coastal areas and small island.**
MoAASP	Enforce tenure rights and conduct spatial planning in nonstate forest zones	• **Law No. 5/1990 on conservation of biological natural resources and their ecosystems.** • **Law No. 26/2007 on spatial planning, as amended by the Government Regulation in Lieu of Law No.2/2022 on Job Creation**
Bappenas	Prepare the national strategy for mangrove ecosystem management	• **Decree of the National Development Planning Agency No. 89/2020 on Strategic Coordination Team for Wetland Management for Achieving Sustainable Development Goals and Low Carbon Development**
BRGM	Coordinate stakeholders at varying levels associated with the implementation of mangrove restoration	• **Presidential Regulation No. 120/2020 on Peat and Mangrove Restoration Agency**
Subnational Governments (typically provincial level government)	**Manage mangroves at the site level**	• **Law No. 23/2014 on Local Government as amended and partially revoked by Government Regulation in Lieu of Law No. 2/2022 on Job Creation**

In a bid to address the persistent problem of high mangrove deforestation rates, the Coordinating Ministry for Economic Affairs in Indonesia enacted Regulation No. 4/2017 on National Mangrove Ecosystem Management Policy, Strategy, Program, and Performance Indicators. This policy set a target to rehabilitate 3.49 million ha of mangrove habitats by 2045. Under this regulation, specific responsibilities were allocated

[278] Ibid.

to MoE, MMAF, and MoAASP. Each ministry was charged with developing guidelines to categorize mangrove ecosystems into either conservation or cultivation zones. These guidelines were to be established as NSPK (Norma Standar Prosedur Kriteria/Norms, Standards, Procedures, and Criteria), aimed at streamlining conservation practices. The jurisdictional analysis for each institution revealed distinct roles: MoE was tasked with overseeing conservation zones within forest areas, MMAF was responsible for managing conservation zones in marine and coastal areas, and MoAASP handled cultivation zones, particularly in areas designated for agricultural development. However, this categorization presented several gaps and challenges. The overlapping jurisdictions and lack of clear demarcation between conservation and cultivation zones led to conflicts in policy implementation and management practices.

Moreover, the ministerial shifts, as outlined in Presidential Regulation No. 73/2012 on National Strategy for Mangrove Ecosystem Management, made the existing framework ineffective.

This regulation had previously established a coherent approach towards mangrove management across various ministries. However, with the reorganization of ministerial responsibilities, the MoE and MMAF were re-aligned under the Coordinating Ministry for Maritime Affairs and Investment. This shift, away from their previous coordination by the Ministry for Economic Affairs, created a disconnect in the unified management of mangrove ecosystems. The reassignment necessitated a re-evaluation of the guidelines and strategies for mangrove management, highlighting the need for a more integrated and cohesive approach that aligns with the changed institutional landscape.

This realignment necessitated further regulatory updates. In 2020, the Indonesian government undertook a significant reform in mangrove ecosystem governance. President Joko Widodo rescinded Presidential Regulation No. 73/2012 on the National Strategy for Mangrove Ecosystem Management and introduced Presidential Regulation No. 82/2020 concerning The Committee for The Handling of Corona Virus Disease 2019 (COVID-19) And The Restoration Of The National Economy. This regulation was later revised by Presidential Regulation 108/2020 and ultimately superseded by Presidential Regulation 48/2023, terminating the COVID-19 pandemic handling. This series of regulatory changes, principally aimed at bureaucratic streamlining, led to the dissolution of the National Coordinating Team for Mangrove Ecosystem Management.

In response, Bappenas established a new Strategic Coordination Team for Wetland Management through Ministerial Decree No. 89/2020. This team was tasked with integrating mangrove management within the broader framework of the SDGs and Indonesia's Low Carbon Development Initiative. Notably, this alignment underscores the critical role of mangroves in contributing to the Indonesia NDC targets, highlighting their significance in both ecological preservation and climate change mitigation. The decree, with a tenure of 10 years, marks a pivotal step towards enhancing the protection of Indonesia's mangrove ecosystems, thus reinforcing the country’s commitment to sustainable development and low carbon growth strategies.

4.2.2 Marine Protected Areas Governance

4.2.2.1 Introduction

The governance jurisdiction of Indonesia's MPAs falls under the purview of the Ministry of Maritime Affairs and Fisheries and the Ministry of Environment and Forestry, encompassing Indonesian marine territory, predominantly within coastal areas. Through decentralization, provincial governments are empowered to designate MPAs, while the devolution scheme, anchored by Village Law No. 6/2014 and Article 18B of the Indonesian Constitution and its derivative acts, offers opportunities for village governments and communities to establish conservation programs.

As one of environmental management strategies mandated in Law No32/2009 on Environmental Protection and Management lieu of the law of Republic of Indonesia No 2 of 2022, Indonesia has several MPAs designated as marine national parks and established under Law No 5/1990 and other MPAs governed under marine affairs regulatory framework. Although it has never been explicitly regulated in Indonesia, Indonesian regulatory framework under forestry and marine jurisdiction provide opportunity to enable OECMs as illustrated in illustration I. The marine national parks are governed by MoE; the others by MMAF.

Under article 78A Government Regulation in Lieu of Law No 2/2022 as decreed in Law No.6/2023 on Determination of Government Regulation in Lieu of Law Number 2 of 2022 concerning Job Creation into Law, authority for the parks established under Law No 5/1990 is no longer mandated to be transferred to MMAF, but it belongs to the Central Government. President Jokowi has so far overruled this, leaving MoE in charge. However, Presidential Regulation No. 56/2019 on National Action Plan for Integrated Management of National Parks and National Water Conservation Areas is aimed at harmonising conservation targets of the two authorities with other relevant institutions, including targets on community empowerment, effectiveness of MPA management, and natural preservation to support national development.

4.2.2.2 Conservation through MPAs

The following analysis outlines the governance and jurisdictional frameworks that shape MPAs under MoE and MMAF. It provides a comparative insight into the regulatory mechanisms and conservation models mandated by respective governmental regulations.

a. MPAs under MoE Jurisdiction

Based on Government Regulation No. 28 of 2011 on Management of Nature Reserve Areas and Nature Conservation Areas as amended by Government Regulation No 108 of 2015, conservation efforts divided into two categories namely Nature Reserve Areas (NRA) and Nature Conservation Areas (NCA). NRA consisted of *Cagar Alam* and *Suaka Margasatwa* (Nature Reserve and Wildlife Sanctuary) while NCA includes *Taman Nasional* and *Taman Wisata Alam* (National Park and Nature Tourism Park). NRA and NCA management are a systematic effort carried out to manage areas through planning, protection, preservation, utilization, supervision, and control. The difference between two conservation models is the NRA aims to preserve either terrestrial or marine ecosystem while the NCA functions to conserve both. In WPP 572, there are Kepulauan Banyak, Pulau Weh Nature Tourism Park located in Aceh Province and Ujung Kulon National Park located in Banten Province.

b. MPAs under MMAF/Marine Affairs Department Jurisdiction

MMAF Regulation No. 31/2020 on Marine Conservation has rendered several prior regulations obsolete, including Ministerial MMAF Regulation No. 17/2008 on Conservation Areas in Coastal Areas and Small Islands, MMAF Regulation No. 2/2009 on Procedures for Determining Aquatic Conservation, MMAF Regulation No. 30/2010 on Management and Zoning Plans for Marine Protected Areas, and Ministerial Regulation of Marine and Fisheries No 47/2016 concerning the utilization of Marine Protected Areas as Partially Revoked by MMAF Regulation No 31/2020. Essentially, this ministerial regulation integrates the conservation area model in accordance with the Coastal and Small Island Management and the Fisheries Law, as laid out in Government Regulation No. 60/2007 on the Conservation of Fish Resources. The conservation areas are categorised into three distinct types: parks, reserves, and maritime conservation areas. A detailed breakdown of conservation areas in WPP 572 is provided in the table below:

Table 78. Conservation areas in WPP 572

	Park (*Taman*)	Marine Sanctuary (Suaka)	Maritime Conservation
Categorisation	**Coastal Park, Small Island Park, Aquatic National Park, Aquatic Tourism Park**	**Coastal sanctuaries, small island sanctuaries, aquatic sanctuaries, and fisheries sanctuaries**	**Indigenous/customary protection areas maritime; Maritime cultural protection area**
WPP 572[279] - Aceh Province	**Pulau Pieh Aquatic National Park, KKD Sawo Lahewa, Selatan,**	**KK Pulau Weh Aceh, KK Aceh Besar, KK Pisisi Aceh, KK Aceh Barat Daya, KK Aceh Selatan**	**-**
WPP 572 – North Sumatra Province	**KKD Tapanuli Tengah, KKD Pulau-Pulau Batu Nias**	**-**	**-**
WPP 572 – West Sumatra Province	**KK Aceh Jaya, KK Aceh Tamiang, Kawasan KK Selat Bunga Laut, KK Pesisir Selatan, KK Kota Padang, KK Kota Pariaman, KKBatang Gasan Padang Pariaman, KK Pasaman Barat, KK Agam**	**-**	**-**

Moreover, this section is an endeavor to analyse the primary legal references of marine conservation management regulated through MMAF KP 30/2021 jo Ministerial Regulation KP 21/2015, employing a pros and cons analysis table that can be strengthened through Blue S Program as mentioned in Table below:

Pros	Cons
• **Consolidating various MPA models, whether they are spatial, habitat-based, or species-focused.** • **Establishing a more transparent accountability framework in the marine spatial plan, where the allocation of conservation reserve areas must be legalised within two years, subject to gubernatorial approval. Once legalised, MPA managers (SUOP) should formulate a conservation plan within six months.** • **Clearly defining utilization rules within MPAs for activities such as tourism, fisheries, energy production, transport, and more.**	• Recognising the potential for conflicts with local communities due to the lack of requirements for Free Prior Informed Consent (FPIC) and community co-management, as exemplified by the Bengkulu Conservation area situated in Merpas Village. • Not mandating fish stock assessments and carrying capacity evaluations as a basis for sustainable utilisation areas. • Lacking a requirement for alternative livelihood assessments and plans as part of a proactive strategy to prevent violations.

[279] Kawasan Konservasi Ditetapkan 2022 (pub).pdf (kkp.go.id)

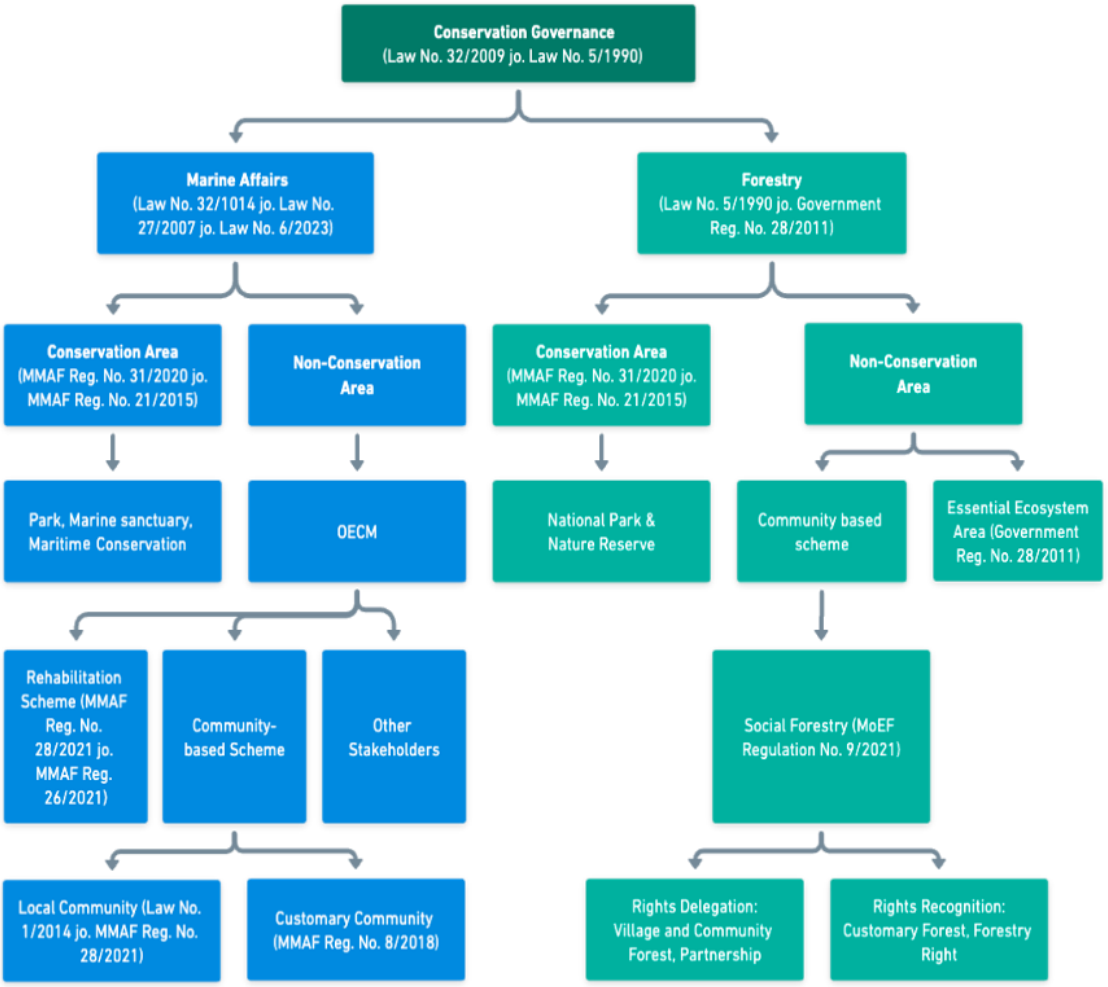


Figure 51. Indonesian Conservation Scheme

4.2.2.3 Conservation through Other effective area-based conservation measures

OECMs serve diverse purposes, ranging from areas dedicated to biodiversity conservation and enhancing ecosystem services, such as locally managed or indigenous areas, privately managed protected areas, concessions, and MCAs.[280] To those with different primary objectives but still contribute to conservation, like areas managed for cultural or non-conservation reasons. Regardless of their primary goals, all OECMs must adhere to specific criteria: they must have well-defined boundaries delineating on the map,[281] effective governance and management, a positive impact on local biodiversity, and be established for the long term. OECMs also offer opportunities to engage various groups and partners in global conservation initiatives.

This section highlights various regulations falling under the jurisdiction of MMAF and MoE in Indonesia, which enable the management of natural resources outside of formal conservation areas while aligning with the criteria outlined in CBD guidelines[282] for OECMs. Many of these enabling regulations establish the necessary legal framework for defining governing bodies and delineating specific areas, both crucial

[280] YKAN. (2012). Marine Conservation Agreements - Providing Social, Cultural and Economic Benefits to Local Communities. Retrieved from https://www.ykan.or.id/content/dam/tnc/nature/en/documents/ykan/fact-sheet/iop/english/MCA-2012.pdf
[281] FAO & SCBD. (2023). Report of the Sustainable Ocean Initiative Capacity-Building Workshop for the Wider Caribbean and Central America on Other Effective Area-Based Conservation Measures in the Marine Fishery Sector. FAO; SCBD. ISBN 978-92-5-138215-8. Retrieved from https://www.fao.org/3/cc8058en/cc8058en.pdf
[282] https://www.iucn.org/sites/default/files/content/documents/2020/9.pwp_oecm_cbd_decision_iucn_guidelines_oecm_methodology.pdf

aspects of OECMs. However, some regulations do not explicitly state that management should yield a positive effect on biodiversity or specify the required timeframe, be it short or long term. The classification of enabling regulations contributing to OECM development in Indonesia is detailed below:

Table 79. The classification of enabling regulations contributing to OECM development in Indonesia

Regulations	Scheme	Governing body	Area/zoning/clear boundaries legality	Positive effect on biodiversity	Long term
MMAF Reg. 26/2021	Rehabilitation	Private/local community	Ecosystem management zone	yes	No, at least 2 years
MMAF Reg. 28/2021	PKKPRL[283]	Private/local community	Utilisation area	Not clear	Not clear
MMAF Reg. 8/2018	Customary Rights	Customary community	Adat zone	Not clear	No time limit
Law 6 2014 jo 1/2014	Village Authority	Village government	Utilisation area	Not clear	No time limit
KSDAE Reg. P.1/2021	Essential Ecosystem Area	Government/ Private/IPLC	Outside conservation and forestry area	yes	No time limit
PP 23/2021	Social Forestry	Village government /community	Social forestry area/PIAPS	Not clear	30 years
Qanun 1 2020	Aceh Customary Rights	Panglima Laot	Traditional zone	Not clear	No time limit

[283] Spatial Utilisation Activity Agreement Approval

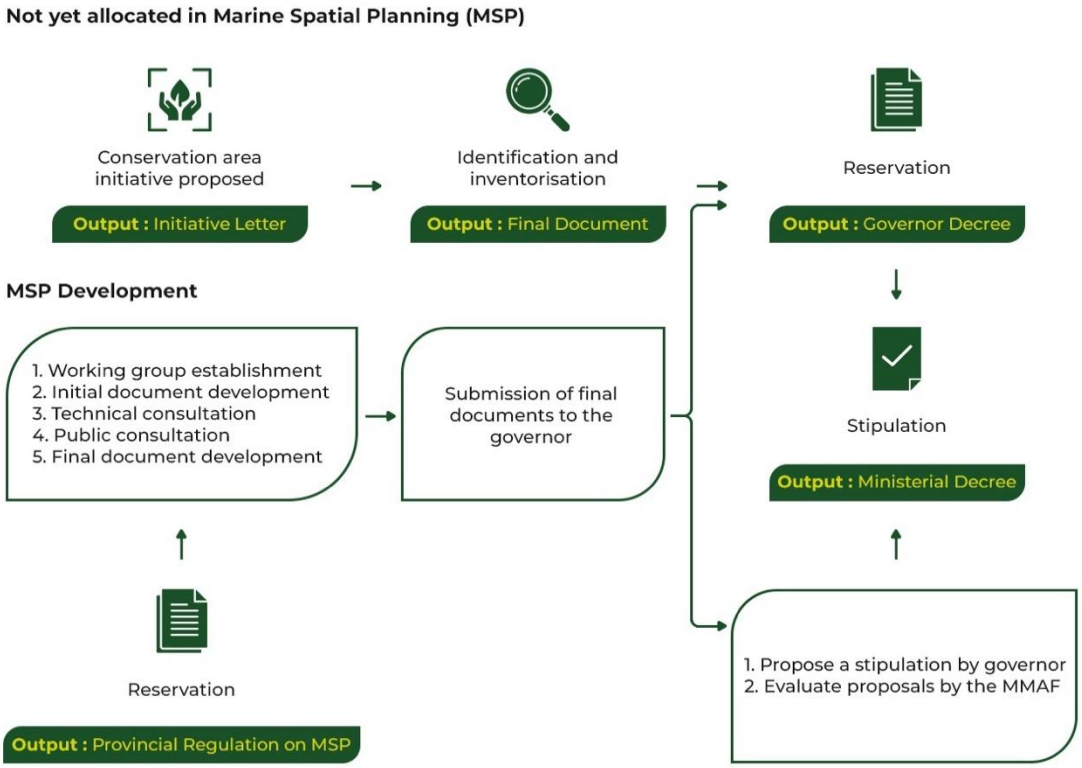


Figure 52. MPA establishment process

4.2.3 Institutional Arrangement of MPA in WPP 572

4.2.3.1 Introduction

The aquatic territories of Indonesia are segmented into various national fishery management areas by the MMAF. This division is predicated on the unique habitat characteristics and biodiversity specific to each region[284]. Established under the MMAF Regulation No. 18 of 2014, these areas, known as WPP, encompass inland waters, territorial seas, contiguous zones, and ZEEI. Notably, WPP 572 includes the waters of the Indian Ocean west of Sumatra and the Sunda Strait

4.2.3.2 Institutional arrangement in WPP 572

Various stakeholders, such as national and provincial government bodies, legislative bodies, non-ministerial institutions, village-level governments, and NGOs, play crucial roles in conservation efforts. In the following table, a detailed breakdown of the roles of these different institutions is provided:

[284] Rosalina, Y., Kartawinata, K., Nisyawati, Nurdin, E., & Supriatna, J. (2013). Kandungan karbon di hutan rawagambut kawasan konservasi PT National Sago Prima, Kepulauan Meranti, Riau. Buletin Kebun Raya, 16(2), 115-130

Table 80. Breakdown of the Roles of These Different Institutions

Institution/ Stakeholders	Legal Basis	Relevance to marine conservation	Analysis
Ministry of Maritime Affairs and Fisheries (MMAF)	MMAF Regulations No. 31 2020 and No. 48/2020	Norm, Standard, Procedure, and Criteria development on marine conservation and OECMs	The Directorate General of Marine Spatial Management is the main stakeholder responsible for governing marine conservation. The Directorate of Conservation plays a central role in developing marine conservation and Other Effective Area-Based Conservation Measures (OECMs), while the Directorate of Coastal and Small Island Utilisation and the Directorate of Fisheries Resources serve as supporting systems for fisheries management within MPAs.
The Ministry of Environment and Forestry (MoE) –and Ecosystem Conservation	MoE Regulation No. 15/2021	Manage and control forestry resources, including mangroves, as well as oversee certain marine parks and national parks that include marine areas.	The Directorate General of Nature Resources is the primary stakeholder responsible for conservation governance, encompassing protected areas within conservation zones and those outside, such as essential ecosystem areas. In contrast, the Directorate of Forestry and Partnership is tasked with legalising social forestry applications, aligning them with OECM criteria. Meanwhile, the Directorate of Fostering Essential Ecosystem Management conducts inventories of biodiversity value outside conservation and forestry areas.
Ministry of Home Affairs	MOHA Regulations No. 137/2022 and No. 67/2020	Coordinate national and regional policies and programs, including marine spatial planning	MOHA has an essential role to review alignment between Provincial Mid-Term Development plan with Provincial MSP as targeted in its 5 years strategic plan coordinated by
Ministry of villages disadvantaged regions and transmigration and Village Government	Government Regulation No. 60/2014 and Ministry of Village Regulation No. 21/2020	Norm, Standard, Procedure, and criteria development for Village Level marine protection program relevant to SDG's	The SDGs Ministry Regulation gives high importance to aligning Village Development Planning with the attainment of Village Sustainable Development Goals (SDGs), particularly focusing on marine conservation. This regulation encourages Village Governments to design development plans that enhance the marine environment and enable coastal communities to actively participate in sustainable coastal and ocean management.
National Development Planning Agency (BAPPENAS)	BAPPENAS Regulation No. 3/2022	Develop and establish national development planning, including coordinating sectoral and regional development planning as well as institutional control for international projects.	The Directorate of Maritime Affairs and Fisheries, along with the environment, coordinates policies and initiatives related to marine and fisheries development, conservation, and ecosystem management.

Institution/ Stakeholders	Legal Basis	Relevance to marine conservation	Analysis
Legislative body at national and provincial level	Law No. 17/2014	Legislate conservation-related regulatory frameworks and approve budget allocations proposed by the executive body	The legislative body holds a significant role in legislating and implementing a check and balance scheme related to the implementation of conservation plans at different levels.
National Research and Innovation Agency (BRIN)	Presidential Regulation No. 34/2022	plays a crucial role in coral reef management in Indonesia and serves as the scientific authority for biodiversity management	BRIN conducts natural science research related to coral reef ecosystems and health status, with the need for more socio-economic research in conservation.
Maritime Affairs and Fisheries Department	Law 23/2014, Government Regulation No. 18/2016 MMAF Regulation 26/2016 and 31/2020	Implementation of reserve preparation, document issuance, management preparation, synchronization of conservation plans into RZWP3K	Departments have the authority to establish service branches that manage autonomous government affairs at the provincial level. These branches may cover multiple districts or cities and include Technical Implementation Units (UPTDs) responsible for technical and operational support to provincial Department of Marine Affairs and Fisheries (DKP) sectors or agencies.
Panglima Laot	Law No. 11/ 2006, Qanun No. 9/2008 and No. 1/2020	Manage 0-4 mils marine area sustainably	The traditional body responsible for overseeing marine areas is Panglima Laot, operating within the authority, duties, and functions defined in the Qanun governing it. The Panglima Laot management area is an integral component of Aceh's WP3K and is integrated into the spatial allocation plan.
Regional Public Service Agency *(Badan Layanan Umum Daerah - BLUD)*	Article 346 Law No. 23/2014, MOHA Regulation No. 79/2018 MOHA No. 79/2018, Financial Regulation No.. 180 2016	BLU is a government agency established to deliver services to the community by providing goods and services without a primary focus on profit, while conducting its activities based on principles of efficiency and productivity	Budget Management Units (BLUD) are authorised to receive funds beyond the state budget for conservation purposes. Furthermore, according to MMAF Regulation No. 31/2020, MPA Managers or SUOPs can undergo transformation into BLUs.
Coastal Communities	Article 60 (2) Law No. 1/2014 MMAF 15/2021, MoE Regulation 44/2017,	the community is given the obligation to, among other things: implement the Coastal Area and Small Island Management program agreed at the village level	A robust legal framework empowers communities to sustainably manage their coastal resources and actively participate in MPA management through partnership schemes.
NGOs	MMAF Regulation 21/2015, MoE Regulation 44/2017, MMAF Regulation 31/2020	Initiate new conservation area and initiate partnership within MPA area to strengthen effectiveness of MPA management	NGOs can strengthen existing protected areas governed by both the MoE and MMAF. They can also assist in the legalisation of protected area reservations and collaborate with coastal communities and MPA managers in co-management efforts.

4.2.3.3 Aligning the National MPA Plan with Local Government RPJMD and RZWP3K

In general, provinces in WPP 572 allocate less than 1% of their total budget to marine and fisheries programs. Only Aceh and West Sumatra allocate more than 1%, while West Papua goes above and beyond, allocating over 8%. Bengkulu and Banten, with small MPA areas (below 100 ha), allocate limited budgets, which works well for managing small MPAs. Banten effectively manages small MPAs with minimal funding, achieving a high Evika score (above 50%) for optimal management.[285] On the other hand, Aceh, West Sumatra, and North Sumatra have large MPA areas but allocate relatively small budgets, resulting in minimal management scores. Lampung, with a small MPA area and limited funding, also faces challenges in managing its MPAs effectively, as reflected in its minimal management score (45%).

MPA designations should also be reviewed in light of the national Marine Spatial Area Plan outlined in Government Regulation No. 32/2019, potentially conflicting with the MPA 30x45 plan. However, Government Regulation No. 32/2019 designates conservation areas across various provinces within WPP 572. Nevertheless, there is a lack of alignment with MMAF Regulation No. 31/2020, which mandates that provincial and national governments must formalize conservation reservations within two years of the regulation's issuance. As of the 2019-2023 period, only the Simeleu Conservation Area in Aceh Province has been officially legalized, as detailed in the table below:

Table 81. Overview of Conservation Allocation by Province and Status

Conservation allocation in PP No. 32/2019	Province	Status	Allocation at Provincial Level MSP (RZWP3)
Regional Marine Protected Area (KKLD) Daerah Kawasan Bina Bahari, KKLD Kabupaten Aceh Jaya	Aceh	-	Allocated
KKLD Perairan Pulau Pinang (Simeneleu), Pulau Siumat, and Simanaha (Pisisi)	Aceh	Legalised through MMAF Decree No. 78/2020	Allocated
KK Pulau Mala dan Pulau Pini, KKLD Tapanuli Tengah, KKLD Nias Selatan	North Sumatra	-	Allocated
Regional Marine Conservation Area (KKPD) Payau Jorong Maligi, Pulau Penyu Area, Coral reefs conservation and marine tourism area Pulau Ujung, Pulau Tangah, and Pulau Angso, Kawasan KKPD Kabupaten Agam, Konservasi Suaka Sanctuary Conservation Alama Batang Gasan	West Sumatra	-	Allocated
KKLD Linau, Merpas, dan Sekunyi, Marine Conservation Area (KKP) in Enggano District, KKLD Mukomuko Regency	Bengkulu	-	Allocated
Coastal Park Ngambur and Pulau Betua Park in Pesisir Barat Regency	Lampung	-	Allocated as conservation reservation area as emphasised in Lampung Governor Regulation No. 20/2019

[285] https://sidakokkhl.kkp.go.id/sidako/evika-detail/215

4.2.4 Conclusion and Recommendation

The following table provides a detailed overview of conclusions and corresponding recommendations to address key challenges and opportunities in marine conservation management within WPP 572 and beyond. Each conclusion is paired with strategic recommendations aimed at enhancing the effectiveness, accountability, and sustainability of marine protection and conservation efforts.

Table 82. Conclusion and Recommendation on the Institutional Framework in Blue Economy Sector

Conclusion	Recommendation
The Marine protection agenda for Blue Halo S implementation in WPP 572 will be under the jurisdiction of MMAF, Provincial Government, MoE	To ensure the protection plan in WPP 572 provides the expected outcome, it is recommended to engage stakeholders intensively and ensure the plan is well-planned, implemented, evaluated, and adapted.
Balancing the unification of diverse MPA models, clear legal accountability, and utilization rules with challenges like limited community involvement, missing fish stock assessments, absence of alternative livelihood plans, and a prolonged integration period in Marine Spatial Planning (MSP)	Enhancing community engagement management as part of imperative procedure in MPA development, implementing fish stock assessments and carrying capacity evaluations, incorporating alternative livelihood assessments into violation pre-emptive strategies, and streamlining the integration process for new conservation areas in Marine Spatial Planning (MSP).
To apply OECM, Indonesia has several enabling policies both from forestry and marine based regulatory frameworks.	Develop a clear legal basis for OECM e.g., through Conservation Act Revision and integrate OECMs as part of conservation strategy in the national development plan
Stakeholders at various levels are crucial for conservation governance	Maximise each stakeholder's authority to better implement conservation plan at different level
Transforming MPA manager to be a BLU is great opportunity to have a sustainable financial scheme within MPA management	Identify existing MPA that can be transformed to be a BLU and integrate BLU transformation in MoE and MMAF strategic plan
An ambitious plan and strict regulations set at the national level are not effectively implemented at the local level through the Mid-term development plan and the implementation of marine conservation.	MOHA should establish disincentives for provinces that do not align their development plans with the national strategy. Additionally, as outlined in MMAF Regulation 31/2020, the national government should take proactive steps to legalise local conservation areas to support the effective implementation of the 30% marine conservation target. Inspectorate general of MMAF has key role to evaluate achievement of MMAF including its marine conservation target.

4.3 MPA Financing Schemes

4.3.1 Challenges in the Current MPA financing

MPA financing in Indonesia is reliant on the state budget. MPAs that are part of the national government authority will get the financing from the state budget directly (APBN). Meanwhile, MPAs under the subnational government authority will rely on subnational government funding APBD)—which may include fiscal transfer from the national government to regional government, but not especially earmarked for MPA financing. On average, the state budget could only finance four of the existing MPA management of 12

million ha.[286] With Indonesia's 30x45 ambition of establishing and maintaining 97.5 million ha of MPAs and according to the Strategic Plan (Renstra) of MMAF, the target for 2020 is to increase from 23.40 million ha to 26.90 million ha by 2024,[287] the country is embracing a high financial barrier to fulfil the ambition as the current budget allocated is still far from the optimal budget required to fund the MPAs and to ensure the sustainability, including the improvement of management and utilization of marine conservation areas. On average, the cost of establishing and maintaining an MPA costs can vary widely based on the specifics of the location and scope of the project between. It could range between USD 500 to over USD 1 million per square kilometer a year.[288] GoI needs significant assistance for this financing needs since even the current budget could not cover a smaller number of MPAs. Innovative financing schemes to cover the running costs of MPA management and establishment are needed. The financing gaps contribute to the lack of adequate MPA management resulting in underperformance of MPAs – putting species and ecosystems at risk. In addition, development of high-quality and competitive human resources for marine and fisheries resource supervision is needed to successfully manage the MPA. In aggregate, the estimated financing gap for Indonesia's marine conservation stands at approximately USD 1.23 trillion. This estimation is derived from the disparity between the current supply of blue finance, encompassing both public and private sources as per our tracking. From the demand perspective, it is projected that a sum in the vicinity of USD 1.64 trillion was requisite for financing marine conservation initiatives in Indonesia during the period spanning 2018 to 2022.[289]

According to a global survey[290] of 433 MPAs, 65% lack adequate funding and staffing capacity that are preventing large expansion of protected oceans from achieving their conservation goals. The survey also points out that fish population in marine protected areas with adequate personnel and budget grew almost three times more than those with inadequate resources. Lack of funding also affects staff capacity that are needed in various activities essential for conservation, such as monitoring, enforcement, administration, community engagement and sustainable tourism activities. The government's ambitious targets for expanding MPA areas should be in line with the provision of adequate human resources to fill the gaps and effectively manage the MPA areas. The success of conservation area management is measured by the competency of personnel in implementing management and zoning plans so that the set management objectives can be achieved. This section presents several traditional and emerging financing schemes for MPAs. Some of these schemes are already running in Indonesia—albeit at very limited sites, mostly with tourism potential.

4.3.2 Traditional MPA Financing

4.3.2.1 Government Support

The Government of Indonesia enacted the MPA management areas through the MMAF's regulation No. 31/2020 where in article 47 state that, the funding for the management of conservation areas comes from state budget (APBN) regional state budget (APBD) and other legitimate sources in accordance with statutory regulations. . The state budget is approved annually after the Executive body (the President and Min of Finance) holds a discussion with the Legislative body (Parliament) who will then issue a Law as a legal basis for the state budget. The line ministries—such as MMAF—formulates its budget based on the national priorities set by the President. MoF also pooling several funding sources for the state budget including Non-Tax State Revenue (PNBP). With such pooling, currently it is not possible that tax and non-tax revenues collected from a certain sector be earmarked and allocated to that particular sector. In other

[286] Working Group on Sustainable Financing of MMAF, 2011
[287] Strategic Plan Ministry of Marine Affairs and Fisheries 2020-2024, p 5.
[288] Mcgowan, Jennifer & Gammage, S & Escovar-Fadul, Ximena & Weis, S & Hansen, A & Arlington, Garvey. (2022). Sea Change: Costs and Benefits of Marine Protected Areas. 10.13140/RG.2.2.36044.69761.
[289] Wanta, D., Khomsiyah, K., & Gunawan, J. (2023). Blue Finance: Is this supporting SDG 14 Financing Gap. International Journal of Social and Management Studies (IJOSMAS), 4(1). https://www.ijosmas.org/index.php/ijosmas/article/download/286/219/721
[290] Gill, D., Mascia, M., Ahmadia, G. et al. Capacity shortfalls hinder the performance of marine protected areas globally. Nature 543, 665–669 (2017). https://doi.org/10.1038/nature21708

words, it is not yet possible to earmark tax or non-tax revenues from the Blue Economy to be channeled into MPA conservation.

In Indonesia, specific costs of establishment and managing an MPA can vary widely. According to a study conducted by Konservasi Indonesia and Rekam Nusantara Foundation[291] the cost of establishment and managing MPAs in Indonesia, ranges between USD 1.9 to USD 3.8 per ha per year. It means, when Indonesia reaches its 97.5 million ha goal (30% of Indonesia marine territorial waters) by 2045, GoI need between USD 5.5 – 7.1 billion by 2045 to establish and to maintain the MPAs. The current average state budget for marine conservation is USD 10 million per year (MMAF total budget for marine conservation 2022-24 is IDR 634.9 billion or approx. USD 39 million).[292] The huge gaps in financing show that government financing alone could never cover the cost of establishing and maintaining MPAs.

4.3.2.2 Donor Support

While the exact figures for Indonesia alone are not readily available, the broader context of philanthropy in marine conservation shows significant contributions. Globally, philanthropic funding for marine conservation was about USD 1.2 billion in 2020. But at Our Ocean Conference in 2024, 469 new commitments worth USD 11.3 billion pledged to help protect the ocean.[293]

According to OECD,[294] Indonesia received USD 78 million (2017 constant prices) in ODA (Official Development Assistance)[295] targeting marine environmental protection in 2013-18, or USD 13 million a year. This represents 4.4% of Indonesia's ocean ODA. ODA for ocean conservation fluctuates considerably in Indonesia and comprises a small part (0.5%) of total ODA to the country. In addition, exploring opportunities with other development projects such as USAID, the World Bank, etc. in conservation areas could support the sustainability of MPA management areas, however, the Project approach is to identify financial mechanisms to ensure the sustainability of MPA management from non-tax revenue, fishers, and government sources to reduce the need for multilateral or bilateral support. GCF funds are crucial for supporting marine conservation in WPP 772 by addressing the challenges of climate change and supporting the leverage of private sector investment, as well as promoting equity by assisting nations affected by climate impacts

4.3.2.3 Self-Financing through Public Service Agency

In this model, the MPA management body establishes a public service agency (BLUD) and becomes the business arm of the MPA. BLUD can then seek income-generating activities such as establishing entry fees to the area as well as applying *payment for ecosystem service* such as taking in retribution for fishers or businesses benefitting (in)directly from an MPA. BLUD also has specific characteristics where they can generate income from the state budget, philanthropy, donors, etc. Thus, capacity development for BLUD personnel is required in business models, proposal development, etc., to enable them to access funding from multiple sources. The existing of BLUD is crucial as they have responsible for overseeing and enforcing regulations within conservation area zones including raising public awareness about conservation, promoting sustainable tourism activities, and enhancing the economic benefits generated through conservation efforts for local communities. One of the most successful story in MPA self-financing comes from the BLUD Raja Ampat MPA—also the only MPA in the country under the "Gold" category for MPA management based on the assessment findings done by the MMAF together with regional government. Other MPAs in the archipelago look up to Raja Ampat and try to follow its path. However,

[291] MMAF, Konservasi Indonesia, Rekam Nusantara Foundation (2024) Cost-Benefit Analysis for Achieving Indonesian Marine Protected Areas Vision 30x45. *in press*
[292] MMAF Strategic Planning 2020-2024 taken from the Permen KP No. 17/2020
[293] https://news.mongabay.com/2024/04/annual-ocean-conference-raises-11-3b-in-pledges-for-marine-conservation/
[294] Sustainable Ocean Economy Country Diagnostics of Indonesia, OECD 2021
[295] Official development assistance (ODA) is defined as government aid that promotes and specifically targets the economic development and welfare of developing countries. The DAC adopted ODA as the "gold standard" of foreign aid in 1969 and it remains the main source of financing for development aid. ODA data is collected, verified and made publicly available by the OECD.

other MPAs may not have that equal advantage to Raja Ampat such as pristine coral reefs and other ecosystems, ease of access, as well as the strong support from the civil society, indigenous community, and the government.

Raja Ampat is cashing in on its beautiful natural resources and named as one of the top diving spots in the world.[296] It has around 112 liveaboard vessels operating throughout the year and a variety of lodgings—from homestay to luxury resorts.[297] Raja Ampat lives off mainly from its entry fees of IDR 1 million (approx. USD 60) for foreign visitors and half of the rates for domestic visitors. The fees allow unlimited entry to the area for 12 months.[298] The collected entry fees are then used to mainly for monitoring the MPAs and supporting the local community living in the areas. With improper management, BLUD Raja Ampat is considered to have misused the funds. According to data, the Corruption Eradication Commission (KPK) has detected indications of leakage in the public service sector, which have led to a decrease in regional original income (PAD) in Raja Ampat Regency amounting to IDR 5.12 billion over a period of four months in 2024. This can serve as a lesson for BLUDs in WPP 572 areas to ensure proper management for a sustainable financing approach.

This model is ideal to ensure an MPA's financing however it also poses several challenges: 1) lack of capacity in setting up and running a BLUD, 2) not all MPAs have or know their economic potentials, 3) the revenues generated may not be enough to cover MPA management costs. The first challenge could be addressed by providing technical assistance to the MPA management unit on how to run a business. Meanwhile, assessments and feasibility studies can help MPAs to understand their economic potentials or business models. Lastly, MPA management unit may need to find alternative financing to the businesses that they run.

4.3.3 Emerging MPA Financing Schemes

4.3.3.1 Conservation Trust Fund (CTF)

CTF is defined as private, legally independent grant-making institutions that provide sustainable financing for biodiversity conservation and often finance part of the long-term management costs of a country's protected area system.[299] It is a financing mechanism where it pools in money from philanthropy, private sector, and government to fund conservation and biodiversity works by giving grants to NGOs, community-based organisations, and government agencies. There are around 100 CTFs across 60 countries with a combined assets of USD 1.1 billion.[300]The Ministry of Development Plan (Bappenas) has established the Climate Trust Fund with the mission under Working Group (Pokja) III, focusing on coastal and marine ecosystem management. They will implement several programs, including Support for the Integration of Blue Carbon Ecosystems in Indonesia's Biodiversity and Climate Policies. They managed IDR 12 billion from the State Budget (APBN) and IDR 14.4 billion from Foreign Grants, bringing the total funds managed in 2023 fiscal year to IDR 26.4 billion.[301]

The Blue Abadi Fund is an example of CTF set up to support conservation works in the Bird's Head Seascape of Papua. The fund is dedicated to empowering local communities and agencies to sustainably

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[296] Papilaya, R., Boli, P., & Nikijuluw, V. (2019). Carrying Capacity of Diving Tourism in Dampier Strait Marine Conservation Area – District of Raja Ampat. IOP Conference Series: Earth and Environmental Science, 246. https://doi.org/10.1088/1755-1315/246/1/012060.
[297] Parinusa, S., Ashar, K., & Kaluge, D. (2019). Analisis Determinan Lama Tinggal Wisatawan Homestay Studi Kasus Kabupaten Raja Ampat Provinsi Papua Barat. Jurnal Pariwisata Pesona. https://doi.org/10.26905/JPP.V4I1.2471.
[298] Kaber, Y., Yulianda, F., Bengen, D., Dahuri, R., & Souhoka, J. (2023). The Strategy for the Effectiveness of Diving Ecotourism Management in the Conservation Area of the Dampier Strait Waters, Raja Ampat. *Asian Journal of Advanced Research and Reports*. https://doi.org/10.9734/ajarr/2023/v17i4478.
[299] Bladon, Annabelle & Mohammed, Essam & Milner-Gulland, Eleanor. (2014). A Review of Conservation Trust Funds for Sustainable Marine Resources Management: Conditions for Success.
[300] Bonham, C.A. & Steininger, M.K. & McGreevey, Michael & Stone, C. & Wright, Timothy & Cano, C.. (2014). Conservation Trust Funds, Protected Area Management Effectiveness, and Conservation Outcomes: Lessons from the Global Conservation Fund. PARKS. 20. 89-100. 10.2305/IUCN.CH.2014.PARKS-20-2.CB.en.
301 Quarterly Report (Q2(2023, Ministry of Development Planning (Bappenas) ICCTF, p. 52 retrived from: ICCTF-Q2-2023.pdf

manage their marine resources. Set up by CI, TNC, WWF and with the support of several philanthropy, government, and the private sector, it has disbursed funds since 2016. Total disbursed fund so far is 30 – 50 number of grantees including to the Raja Ampat MPA management unit and Fak Fak MPA management unit.302 To sustain its operation, the Fund envisions a minimum of USD 30 million in the endowment fund.
Debt-for-Nature Swap

Debt for nature swaps are agreements to reduce developing country's debt stock or service in exchange for a commitment to protect nature. In simple terms, instead of paying off the debt to the lender, the debtor uses the money for conservation works in its country. Such an agreement occurred between the US Government (USG) and GoI under the Tropical Forest Conservation Action (TFCA) is a debt-for-nature swap scheme aimed at preserving forest areas tropics in Sumatra where the deforestation rate is very high. in 2009 with TFCA Sumatra to protect endangered species such as Sumatran tiger, elephant, rhino, and orangutan. Furthermore, in 2011, TFCA Kalimantan was launched to target the rich biodiversity of Kalimantan and protecting it from threats such as illegal logging and unsustainable land use.

In 2019, the act was re-authorised and expanded to include coral reefs, becoming the TFCA. This expansion aimed to provide greater protection for both tropical forests and coral reef ecosystems, recognizing the critical role these environments play in biodiversity conservation and climate change mitigation. The updated legislation continues to support the conservation efforts through debt swaps, enabling countries to invest in local conservation projects rather than repaying their debts to the U.S. (Senator Coons).

After some delays, US reignited negotiation with GoI in mid-2023 and signed another package of swap specifically for coral reefs conservation.[303] This amount could potentially be allocated at MPA sites.

4.3.3.2 Payment for Ecosystem Services

PES is a financial mechanism that compensates landowners or resource managers for managing their land in ways that provide ecological services. In Indonesia, PES has been implemented to support various conservation and sustainable development initiatives with primarily means to achieve positive biodiversity, ecosystem and social outcomes Ecosystem services are usually grouped into four main categories (UNDP, 2020):

- Provisioning services (the products obtained from ecosystems such as food and fresh water);
- Regulating services (the benefits obtained from the regulation of ecosystem processes such as air quality and pollination);
- Cultural services (the non-material benefits that people obtain such as spiritual enrichment, recreation and aesthetic experiences) that directly affect people; and
- The supporting services are needed to maintain the other services (such as photosynthesis and nutrient recycling).

One notable example of PES in marine protected areas in Indonesia is the Misool Eco Resort and Marine Conservation Area in Raja Ampat, West Papua. The Misool Eco Resort operates a private marine reserve within the Raja Ampat archipelago. The reserve spans over 1,220 km^2 and is leased from local communities. In return, Misool Eco Resort provides financial compensation and support for sustainable livelihood projects to the local communities. This compensation includes employment opportunities at the resort, funding for local schools, and support for alternative livelihoods like sustainable fishing practices and eco-tourism. Misool Eco Resort pays local communities for the right to manage the marine area and ensure its protection. The resort also engages in active conservation efforts such as reef restoration, patrolling against illegal fishing, and conducting marine biodiversity research. This PES scheme has

[302] Conservation International. (2019). Blue Abadi Fund: Year 2 Annual Report covering the period of October 2018 – September 2019. United States Agency for International Development. Project # AID-497-G-17-0001.
[303] https://www.kkp.go.id/publikasi/foto-kegiatan-detail/7pw.html

resulted in significant conservation outcomes, including a 250% increase in fish biomass and a noticeable recovery of coral reef health.304 The involvement of local communities in conservation efforts has fostered a sense of stewardship and provided economic benefits through sustainable tourism.

Benefits:

- Provides economic incentives for conservation.
- Enhances the sustainability of natural resource management.
- Helps to mitigate climate change through carbon sequestration.

Challenges:

- Requires clear land tenure and property rights.
- Needs consistent and reliable funding sources.
- Effective monitoring and enforcement mechanisms are essential.

4.3.3.3 Mitigation Measures

4.3.3.3.1 Biodiversity Offset

Biodiversity offset refers to conservation actions intended to compensate for the loss of biodiversity due to development projects, ensuring no net loss or a net gain of biodiversity. In marine environments, this can include measures like restoring coral reefs, protecting marine habitats, or establishing MPAs to offset the impacts of activities such as coastal development, mining, and fishing. Biodiversity offsets can be used to balance development with conservation, ensuring that economic growth does not come at the expense of critical ecosystems and species.

Among a few examples of biodiversity offset programs in Indonesia is COREMAP at various locations across Indonesia, including Raja Ampat and Wakatobi. It aims to protect and rehabilitate coral reefs that have been degraded due to various human activities. This program includes community-based management, restoration of damaged reefs, and the establishment of MPAs. Activities involve transplanting corals, enforcing fishing regulations, and educating local communities about sustainable practices. The program also supports alternative livelihoods to reduce pressure on reef ecosystems. COREMAP has contributed to the restoration of coral reefs and improved biodiversity in targeted areas. The establishment of MPAs has helped protect marine habitats and increased fish populations.[305]

Benefits:

- Helps achieve no net loss or net gain in biodiversity.
- Balances development needs with conservation goals.
- Engages stakeholders in sustainable development practices.

Challenges:

- Requires rigorous monitoring and verification.
- Needs clear regulatory frameworks and enforcement.
- Effective implementation depends on stakeholder collaboration and adequate funding.

[304] Brown, C., Parker, B., Ahmadia, G., Ardiwijaya, R., , P., & Game, E. (2017). The cost of enforcing a marine protected area to achieve ecological targets for the recovery of fish biomass. *bioRxiv*. https://doi.org/10.1101/216598.
[305] Erdmann, M. V., & Caldwell, R. L. (2004). "COREMAP: Coral Reef Rehabilitation and Management Program." *Marine Pollution Bulletin*, 49(5-6), 279-282.

4.3.3.3.2 Biodiversity Credit

Biodiversity credits are tradable units representing the conservation of biodiversity. These credits are generated by projects that preserve or restore natural habitats and ecosystems, and they can be bought and sold to offset biodiversity impacts elsewhere. Biodiversity credits incentivise the protection and enhancement of ecosystems by providing a financial mechanism to support conservation efforts. This economic instrument allows private companies to finance several activities, such as marine conservation and restoration, that lead to positive biodiversity gains

As a showcase of biodiversity credit in Indonesia is the *Coral Triangle Initiative* in the *Coral Triangle region*.[306] It is a multilateral partnership aiming to safeguard the marine and coastal resources of the Coral Triangle, which includes Indonesia. The initiative supports various conservation projects to protect coral reefs, fisheries, and marine biodiversity. Through its conservation projects, CTI generates biodiversity credits by implementing sustainable fishing practices, restoring damaged coral reefs, and protecting critical marine habitats. These credits can be traded to support further conservation efforts. CTI has led to significant improvements in marine conservation, including enhanced protection for coral reefs and better management of marine resources, benefiting both biodiversity and local communities.[307]

Benefits:

- Provides financial incentives for marine conservation.
- Supports the sustainable management of marine resources.
- Encourages private sector involvement in biodiversity protection.

Challenges:

- Requires effective monitoring and verification systems.
- Needs a clear regulatory framework to facilitate trading.
- Dependence on stakeholder collaboration and adequate funding.

4.3.3.4 Collaborative Management Partnerships (Public-Private Partnerships)

In Indonesia, Public-Private Partnerships (PPP)/ KPBU are regulated under Presidential Regulation (Perpres) No. 38/2015, which aims to secure sufficient funding in a sustainable manner for infrastructure delivery by mobilizing private funds. Collaborative management occurs when a non-profit organization or a private-sector entity partners with a state wildlife authority, and the authority either outsources aspects of management or specific conservation activities (e.g. ecological monitoring, education, community engagement, ecosystem restoration) to the partner organization or enters into an agreement with the private partner that covers the full spectrum of management. This is increasingly taking the form of a PPP.

There are four main types of partnerships emerging (Baghaia, M., et al., 2018):

Delegated management. A non-profit shares governance responsibility with the state and is delegated full management authority, generally a joint entity and special purpose vehicle (e.g., foundation, non-profit company) is created in the host country, and management is ‘delegated’ to that entity, and the private sector partner represents the majority. An example would be the Misool Marine Reserve in Raja Ampat where Misool Eco Resort (a privately-owned eco-resort established in 2005) has taken the responsibility for funding and managing the 300,000 ha of MPA in partnership with the local communities.

[306] The Coral Triangle is a marine region that spans those parts of Indonesia, Malaysia, Papua New Guinea, the Philippines, the Solomon Islands and Timor-Leste with at least 500 species of reef-building corals. The Coral Triangle encompasses portions of 2 biogeographic regions: the Indonesian-Philippines Region, and the Far Southwestern Pacific Region. Further info https://wwf.panda.org/discover/knowledge_hub/where_we_work/coraltriangle/coraltrianglefacts/
[307] Coral Triangle Initiative. "About CTI-CFF." [CTI-CFF](https://www.coraltriangleinitiative.org)

Integrated co-management. A non-profit shares governance responsibility with the state, but unlike delegated management above, this structure is characterized by an equal power sharing arrangement, rather than being led by the private sector partner. The management of 1.39 million ha Wakatobi National Park involves a partnership between the Indonesian government, local communities, and the private sector—particularly the Wakatobi Dive Resort. The Wakatobi Dive Resort collaborates with the park authorities and local communities to implement sustainable tourism practices and marine conservation initiatives. The resort funds and operates a reef monitoring program, supports enforcement of no-take zones, and engages in community education and alternative livelihood programs.

Bilateral co-management. A non-profit shares governance and management responsibility with the state, and generally a separate structure is not created. The management of Komodo National Park involves a bilateral co-management approach between the Indonesian government and private sector entities, particularly the Komodo Island Resort. The Komodo Island Resort, along with other tourism operators, collaborates with park authorities to implement conservation strategies and promote sustainable tourism.

Financial and technical support. A non-profit assists the state with aspects of management without formal decision-making authority, this is the traditional method of working with protected area authorities and may not even be classified as a co-management model, such as the funding and technical support provided by Konservasi Indonesia to several MPAs in Indonesia such as Raja Ampat MPA.

4.3.3.5 Result-based financing mechanisms

Result-based financing (RBF) mechanisms are financial approaches where payments are made only after predefined results or outcomes are achieved. In ocean conservation, RBF schemes aim to incentivize and reward specific conservation achievements, such as improved marine biodiversity, better fishery management, or habitat restoration.

The Blue Abadi Fund uses RBF as one of the fund disbursement mechanisms. Funds are disbursed to local partners based on their performance in achieving conservation targets, such as the establishment and management of MPAs, restoration of coral reefs, and sustainable fisheries management.[308] A similar example is SFF which disburses payments made to fishery management organizations based on their success in implementing sustainable fishing practices, reducing bycatch, and enhancing marine habitats. The fund emphasizes measurable improvements in fish populations and ecosystem health.[309]

Benefits:

- Aligns financial incentives with conservation outcomes.
- Encourages accountability and transparency in conservation projects.
- Provides sustainable funding for long-term conservation efforts.

Challenges:

- Requires robust monitoring and verification systems to measure outcomes.
- Needs clear and achievable conservation targets.
- Dependence on reliable funding sources and stakeholder cooperation.

[308] Conservation financing for conservation programs with Indigenous Peoples and Local Communities , Final Report and Synthesis November 2020, obtained from https://www.nature.org/content/dam/tnc/nature/en/documents/EA_IPLC_Full_Report_2020.pdf
[309] Rare. "Sustainable Fisheries Solutions and Retrieval Support." [Rare](https://rare.org/program/fish-forever/)

4.3.3.6 Green and Blue Bonds

A green or blue bond is a debt instrument issued by governments, development banks or others to raise capital from investors to finance projects with positive environmental, economic and climate benefits (World Bank, 2018).

Green bonds are specifically earmarked to raise money for climate and environmental projects. These projects typically include renewable energy, energy efficiency, clean transportation, sustainable water management, and green buildings. The issuance of green bonds aims to support sustainable development by providing investors with the opportunity to finance projects that contribute to environmental conservation and climate resilience. However, green bonds have not yet been used to fund conservation at scale. In 2017 it was estimated that only 2% of bond proceeds went to land conservation and 4% to biodiversity conservation (CBD, 2017).

In 2018 GoI launched its first green bond in the form of Islamic bond (sukuk) raising USD 1.25 billion. It was followed by PT SMI, a state-owned infrastructure financing company with its green bond in 2018, raising IDR 500 billion (approximately USD 35 million). The issuance was part of SMI's commitment to support sustainable infrastructure development in Indonesia. A year later, in 2019, PT BNI issued its first green bond, raising IDR 3 trillion (approximately USD 213 million). This green bond was aimed at financing environmentally sustainable projects and supporting Indonesia's transition to a low-carbon economy.

Blue bonds are a type of sustainability bond issued to finance projects that support marine and ocean-based economies, environmental protection, and sustainable development of marine resources. These bonds are part of the broader green finance spectrum and are designed to raise capital specifically for initiatives aimed at improving ocean health, supporting sustainable fisheries, protecting marine ecosystems, and promoting blue economic growth. The total estimated amount of active blue bonds globally is around USD5 billion (World Bank, 2018).

Indonesia launched its inaugural Blue Bonds in the form of Samurai bonds[310]. A Samurai bond is a yen-denominated bond issued in Tokyo by a non-Japanese company and is subject to Japanese regulations which implemented in Indonesia. in May 2023 raising JPY 104.8 billion (approx. USD 665 million).[311] Following its success, a year later GoI launched the second Samurai Bond doubling the issuance to JPY 200 billion (approx. USD 1.27 billion). In 2018, the Republic of Seychelles issued the world's first sovereign blue bond, raising USD 15 million assisting 86 million ha of MPA.[312]

[310] Samurai bonds are yen-denominated bonds issued in Japan by non-Japanese entities. These bonds enable issuers to access Japanese capital markets and tap into the pool of Japanese investors.
[311] https://www.djppr.kemenkeu.go.id/en/indonesiasuccessfullyissuesjpy104.8billionsamuraibondandinauguralbluebonds
[312] https://www.worldbank.org/en/news/press-release/2018/10/29/seychelles-launches-worlds-first-sovereign-blue-bond

5 Section 5: Blue Economy Market Context and MPA Financing

5.1 Blue Economy Market Context Analysis

This section gives an overview of the market context for the blue economy financing in Indonesia from both the supply and demand side – at country level and specifically in WPP 572 provinces. Besides discussing various actors on each side, this chapter also offers a critical analysis of market gaps and opportunities of intervention.

5.1.1 Demand-Side Context

Estimating the precise size of Indonesia's blue economy financing demand can be challenging due to the complexity and diversity of the sectors involved, as well as the dynamic nature of economic and environmental factors. It is projected that a sum in the vicinity of USD 1.64 trillion was requisite for financing the blue economy initiatives in Indonesia during the period spanning 2018 to 2022.[313] To give a different perspective, the World Bank estimated Indonesia's ocean economy to be worth more than USD 280 billion per year, with marine building and manufacturing as the two major sectors.[314] However Indonesia's ocean economy is still dominated by conventional sectors with 83% of total value add coming from capture fisheries, aquaculture, and fish processing.[315]

Based on BKPM data DDI in the fisheries sector doubled in 2023 (IDR 2.5 trillion or approx. USD 156 million) from 2022 (IDR 1.2 trillion or approx. USD 75 million). Meanwhile FDI in the fisheries sector shrunk from USD 31.6 million to USD 25.7 million. Fisheries sector receives minimal FDI, at 0.05% of the total FDI in 2023. It fairs slightly better in DDI where it stood at the second place to last with 0.37% investment. MMAF forecasted marine and fisheries sector to grow by 8% or IDR 12 trillion (approx. USD 748 million) in 2024.[316]

Lab 45[317] estimated required investment is summarized in the table below.

Table 83. National Strategic Blue Economy Projects and Investment Size[318]

Category and (sub)sector	Investment Size (IDR 000 billion)	Investment Size (USD billion)
Marine Living Resources	**5.09**	**0.32**
• Sustainable Small-scale fisheries • Integrated Marine and Fisheries Centres • Deep Sea Farming • Pharmaceutical product development from marine resources • Seaweed development as bioenergy/biofuel, industry, and nature conservation		
Marine Non-Living Resources	**2,141.81**	**133**
• Solar energy • Tidal wave energy		
Non-Extractive use of Marine Ecosystems	**202.8**	**12.5**

[313] Wanta, D., Khomsiyah, K., & Gunawan, J. (2023). Blue Finance: Is this supporting SDG 14 Financing Gap. International Journal of Social and Management Studies (IJOSMAS), 4(1). https://www.ijosmas.org/index.php/ijosmas/article/download/286/219/721
[314] World Bank (2019), Indonesia Economic Quarterly: Oceans of Opportunity, https://openknowledge.worldbank.org/handle/10986/31993.
[315] Bappenas (2023), Indonesia Blue Economy Roadmap
[316] https://www.kompas.id/baca/english/2024/02/05/en-indonesia-tawarkan-investasi-kelautan-dan-perikanan
[317] Lab 45 (2023), Proyek Strategis Ekonomi Biru Menuju Negara Maju 2045
[318] *Lab 45*

Category and (sub)sector	Investment Size (IDR 000 billion)	Investment Size (USD billion)
• Ecotourism and priority destinations development • Area-based and type-based coastal ecotourism development • Integrated coastal ecotourism development		
Sustainable Marine Trade and Commerce	**689.5**	**42.8**
• Industrial zones and international hubs and ports for transhipment development • Green shipping • Tourism ports to access the "10 new Balis" • Shipbuilding industry development		
Marine Conservation	**606.9**	**37.6**
• Macroalgae research and innovation • Coastal line recovery • Outer islands information systems • Ecosystem rehabilitation in outer islands • Coastal areas rehabilitation • Blue carbon ecosystem services in climate mitigation		
Emerging sectors	**1.4**	**0.08**
• Sea salt production • Planning scenario for sea salt and seaweed industries		
Total Investment	**3,647.4**	**226**

From the Lab 45 investment table above, investments in solar energy at sea – ideal for climate mitigation – could be challenging for WPP 572 because of its direct exposure to the high seas with harsh conditions and the region is prone to natural disasters such as earthquakes and tsunamis. Meanwhile, tidal wave energy technology is yet to be economically viable. Other potential categories and subsectors for investment in WPP 572 are fisheries, aquaculture, ecotourism, and green shipping. It is needed to overcome the geographical challenges through design and implementation strategy to attract investment to the area.

Based on BKPM data on investment in the first quarter of 2024, Sumatra Island ranks second after Java for raising investment totaling IDR 73,7 trillion (approx. USD 4.6 billion)—of which USD 1.6 billion is FDI.[319] There is a 22.1% increase of overall investment (with 15.5% FDI increase) from the same period in 2023. Historically, the total investment in Java outweighs the total combined investment outside of the Island.

map image removed

Figure 53. Total Foreign Direct Invest (FDI) and Domestic Direct Investment (DDI) in Indonesian areas and their ranking at the first quarter of 2024[320]

Provincial fiscal capacity on Sumatra varies from middle to very low. Provincial fiscal capacity data reflects the provincial income received minus allocated budget, expenditures, and other provincial outgoing expenses. This ratio could be used in government policy and budgeting prioritization, funds allocation, as well as assessing the capacity to access third party financing.

[319] BKPM 2024 1st Quarter Investment Realisation Report https://www.bkpm.go.id/id/info/siaran-pers/investasi-luar-jawa-kembali-unggul-bahlil-ungkap-ekosistem-investasi-berkualitas-terus-terbentuk

[320] *BKPM*

Table 84. Fiscal Capacity Ratio in Sumatra Provinces

No.	Provinces in Sumatra	Fiscal Capacity Ratio	Fiscal Capacity Category
In WPP 572			
1	Aceh	1.04	Very low
2	North Sumatra	2.24	Middle
3	West Sumatra	1.46	Low
4	Bengkulu	1.17	Very low
5	Lampung	1.73	Low

Banten as the only province in WPP 572 that is located in Java Island that has a fiscal capacity ratio of 2.934 and fall under the category of “very high”.

The demand for blue economy financing at the national, provincial, and at the WPP 572 level comes from a range of entities with different needs. The following table provides an analysis of a range demand-side actors, their financings needs and their typical sources of financing.

Table 85. An Analysis of A Range Demand-Side Actors, Their Financings Needs and Their Typical Sources of Financing

No.	Actor	Financing Needs	Typical Source of Financing
1.	Fishers/farmers groups or cooperatives A larger, coordinated group of smaller or individual fishers or farmers. However, despite heavy promotion, the establishment of cooperative model and its success is relatively rare in the fisheries sector. Fisher/farmers groups are formed organically or inorganically and sometimes are established to access grant or subsidy.	The demand to establish a cooperative typically to reduce the risk and cost of investment. Thus, mobilized funds to a cooperative is preferred by investors or government programs rather than individual or business.	A functioning cooperative normally fund its members operation from membership and other dues. Some cooperatives are open to external investment or look for investment from larger financial institutions such as banks or rural banks (Bank Perkreditan Rakyat, BPRs). Cooperatives or groups can also get access to finance from special government programs or from other investors (typically off-takers) that require such an establishment. For example, BLU LPMUKP (KKP’s microcredit arm)) and shrimp off-takers prefer to give loans to groups or cooperatives.
2.	Micro, Small and Medium Enterprises (MSMEs) including one-person business (a fisher, a farmer, a tour guide), or Bumdes (village-owned enterprise) running a fish processing or ecotourism.	Investment in Capex and Opex (from as small as buying a traditional fishing boat or fuel to fish processing machine in a medium industry). According to Coordinating Min of Economic Affairs regulation for	A fisher, farmer, a home industry, or a small travel agency may opt for a microcredit provided by loan sharks, non-bank institutions (e.g. fin-tech), banks, BPR (microcredit banks), co-ops, or BLU LPMUKP In some cases, off-takers (e.g. fish aggregators or processing company may provide financing for small-scale fishers or farmers).

No.	Actor	Financing Needs	Typical Source of Financing
		microcredit[321], the following schemes are available: • Super micro: up to IDR 10 Million • Micro: IDR 10 – 100 Million • Small: IDR 100 – 500 Million	
3.	Start-ups (including tech-startups) such as Aruna, FishLog – mostly all concentrated in Java Island with limited or no presence in Sumatra	Early-stage to high-growth equity and debt capital	Angel investors, Venture Capital (VC), Banks
4.	Large enterprises (state-owned or private). An example would be a marine transport provider, large tuna processing companies, or seaweed processing plant.	Investment in Capex and Opex typically larger than MSME microcredit maximum limit of IDR 500 M (see No.2)	Banks, VCs, PEs, public sector
5.	Subnational government (SNG)	Investment in mostly public infrastructure and facilities. Loans are used to fund budget deficit. An example will be the provision of inter-island public transport	• Sub-national revenues (tax, retribution, etc) • Loan from Banks (typically provincial bank) • Loan from central government • Loan from other provinces • Non-banking institutions • Local government bonds • Public private partnership
6.	Central government	Investment in mostly public infrastructure and facilities. Loans are to fund budget deficit. An example will be fishing ports, integrated marine and fisheries centers, energy generators.	• State revenues • Domestic loans • Foreign loans (Development Financial Institutions e.g. World Bank) • Sovereign bonds

According to MMAF's data, there is an increasing trend of the overall number of fishers in WPP 572. In WPP 572, the trend is increasing except for Aceh and Lampung which see fishers decline of 9% and 10% respectively. This defies the trend of shrinking fishers' number due to generational loss of interest in the sector.[322] The blue economy has significant reliance on fishers and thus their numbers matter. An increasing trend in WPP 572 also indicates larger market potential for financing.

[321] Permenkeu No. 1/2022 and No. 1/2023

[322] Manggopa, N., Andaki, J. A., Rarung, L. K., Suhaeni, S., & Rantung, S. V. (2022). Persepsi anak nelayan terhadap usaha nelayan tradisional di Desa Bolangitang Kecamatan Bolangitang Barat Kabupaten Bolaang Mongondow Utara. Akulturasi: Jurnal Ilmiah Agrobisnis Perikanan, 10(1), 185–193. https://ejournal.unsrat.ac.id/v3/index. php/akulturasi/article/download/39981/35930/86134

Table 86. Number of Fishers in WPP 572 in 2021 And 2022[323]

Province	No. of fishers		Change
	2021	2022	
Aceh	83,173	75,763	-9%
North Sumatra	148,442	166,005	12%
West Sumatra	73,546	75,867	3%
Bengkulu	28,431	37,315	31%
Lampung	30,545	27,544	-10%
Banten	42,103	54,701	30%
Total WPP 572	**406,240**	**437,195**	**8%**

The quota-based fisheries (PIT) policy is pushing for fishers to incorporate themselves and form cooperatives or private limited companies so they could improve their access to the fishing zones. The industrial fishing zones (in which WPP 572 belongs to) require that 12 miles from the shores are reserved for corporations with the license to a fishing quota. With the vast area of management, it is likely that the license holder will also work with or sub-license to other (smaller) corporations such as fishers' cooperatives or private limited. The number of cooperatives in the marine and fisheries sector (aquaculture, fish processing, marine tourism, etc.) in WPP 572 accounts for around 80% of cooperatives in Sumatra Island and are contributing to 23% of the total national cooperatives in the sector (see Table 5).

Table 87. Number of Fishers and Fisheries Cooperatives in WPP 572[324]

No	Province	Number of fishers co-op (1) (includes fishers' coop)	Number of Fisheries co-op (2) (includes micro-enterprises such as processors)	(1)+(2)
1	Aceh	74	91	165
2	North Sumatra	117	36	153
3	West Sumatra	19	11	30
4	Bengkulu	40	11	51
5	Lampung	11	10	21
6	Banten	52	9	61
Total WPP 572		**313**	**168**	**481**
Total Indonesia		**1,505**	**620**	**2,125**

[323] *MMAF*

[324] *MMAF, 2023*

Based on *Ministry of Cooperatives and SME's* (MCSME) **data, MSMEs in Indonesia contribute to 99.99% of the total business in the country**. Based on Government Regulation No. 7/2021, businesses are categorized based on the size of their capital and revenue. MSME contributes 60.5% of GDP and are responsible for the 99.9% of the jobs created. Models from developed countries, for example, Germany – Europe's largest economy – shows that enabling MSMEs could create a significant impact for the community and the economy.[325]

Table 88. The Number of Businesses in Indonesia Based on Their Size

Enterprise	Capital (IDR billion)	Revenue (IDR billion	Total number	Percentage
Large	Above 10	Above 50	5,550	0.01%
Medium	5 – 10	15 - 50	44,728	0.06%
Small	1 – 5	2 – 15	193,959	0.3%
Micro	Max 1	Max 2	63,960,000	99.62%

Source: MCSME

Latest available MCSME data shows that there has been a decline in entrepreneurship in most WPP 572 provinces – presumably during the period of COVID-19 recovery. Since the growth of MSMEs is closely linked to entrepreneurship, the Ministry uses this indicator to measure the growth and distribution of MSME. Within WPP 572 provinces – except North Sumatra – there has been a decline in entrepreneurship. Figure 2 illustrates this trend.

Map image removed

Figure 54. Entrepreneurship Growth Indicator in 2021. Green Signifies Growth and Red Decline[326]

However, the national average entrepreneurship ratio in 2021 is 2.89% and most WPP 572 provinces stood above the national standard. The entrepreneurship ratio shows the number of entrepreneurs against the total population in that area. Of all the six provinces within the WPP 572 area, Lampung and Banten are below the national average. Bengkulu has the highest ratio, followed by Aceh, West Sumatra, and North Sumatra. In 2023, the national entrepreneurship ratio is raised to 3.47% and GoI expects the number reaches 12% by 2045.[327]

Map image removed

Figure 55. The National Entrepreneurship Ratio in 2021[328]

Based on MMAF 2023 data, 70% of businesses in WPP 572 fall under the microenterprise category.

[325] The German Mittelstand as a model for success, Federal Ministry for Economic Affairs and Climate Action, 2019

[326] *MCSME*

[327] https://www.kompas.id/baca/ekonomi/2023/11/20/wapres-amin-peningkatan-rasio-kewirausahaan-jadi-penanda-transformasi-ekonomi

[328] *MCSME*

Table 89. Number of Enterprises in Capture Fisheries, Aquaculture, Fish Processing, and Tourism Sectors[329]

Enterprise category	Aceh	Banten	Bengkulu	Lampung	West Sumatra	North Sumatra	Total
Large	260	763	48	8	334	1,114	**2,527**
Medium	97	303	25	1	80	1,016	**1,522**
Small	515	1,352	106	13	984	2,436	**5,406**
Micro	2,913	7,989	1,366	41	5,412	5,372	**23,093**
Grand Total	**3,785**	**10,407**	**1,545**	**63**	**6,810**	**9,938**	**32,548**

Many MSMEs are not yet bankable or "non-bankable", data from the Indonesian Ministry of Finance in April 2021 indicated that approximately 132 million people are currently non-bankable and do not have access to credit or financing. More than 90% of MSMEs have no access to credit largely due to the lack of transparent financial management and capability.[330] Of the 46% women-owned MSMEs, an estimated 40% perceived bank credit procedures as too complicated.[331,332]

The lack of business registration or incorporation creates a barrier to accessing finance. MSMEs in Indonesia can run their business without establishing a legal entity. By April 2023, only 5.8% (3.7 million out of 64.2 million) of MSMEs in Indonesia register their businesses.[333] That translates to 7,975 licenses issued daily – far from the 100,000 daily target set by President Jokowi in July 2022. The lack of legal entity prevents MSMEs from getting financing from formal financial providers. It also prevents them from getting other business certifications such as Halal certification. The costs and the procedures to register and maintain a legal entity are the biggest hurdles – especially for MSMEs – to legalize their business.

To simplify and encourage business registration, Government of Indonesia has set up an *Online Single Submission*. Furthermore, since 2021, government allows *sole proprietorship (one-person enterprise)*[334] which simplifies business registration for many MSMEs including the removal of a notary deed requirement – one of the biggest costs – for the registration. However, sole proprietors still need to submit monthly financial report online, which is still a barrier for businesses.

Marine and fisheries sector is regarded as high risk, and this is one of the primary factors contributing to the limited investor appetite in the market. The main contributor to this risk level is the lack of reliable investment data and information on the sector to allow the investors to make sound investment and business decisions.[335] For a small number of projects that do generate positive financial return, they have a high risk and low return profile due to the relatively unpredictable conditions in WPP 572. Furthermore, often the high risk is not accompanied by enabling regulatory environment. To attract

[329] *MMAF*
[330] PwC. (2019). Indonesia's FinTech Lending: Driving Growth Through Financial Inclusion. Retrieved from: https://www.pwc.com /id/en/FinTech/PwC_FinTechLendingThoughtLeadership_ExecutiveSummary.pdf
[331] IFC 2016. Women-owned SMEs in Indonesia: A Golden Opportunity for Local Financial Institutions. Retrieved from: https://www.ifc.org/wps/wcm/connect/260f2097-e440-4599-91ec-e42d45cf3913/SME+Indonesia+Final_Eng.pdf?MOD=AJPERES&CVID=lj8qhPY
332Oxford Business Group. (2019). How is Indonesia Expanding Banking Penetration?. Retrieved from: https://oxfordbusinessgroup.com/overview/solid-foundations-authorities-are-working-expand-banking-penetration-and-attract-foreign-entities
[333] https://www.kompas.id/baca/ekonomi/2023/04/11/pemerintah-target-10-juta-umkm-punya-nib
[334] Government Regulation No. 8 Year 2021 https://jdih.setkab.go.id/PUUdoc/176383/PP_Nomor_8_Tahun_2021.pdf
[335] (Fritsch, D. 2020. Investors and the blue economy). https://www.thecirculateinitiative.org/projects/investors-and-the-blue-economy

large-scale investments, it is critical to find ways to de-risk the enabling environment associated with ocean-based sustainable development projects and activities.[336]

5.1.2 Supply-side context

Financial intermediaries in the blue economy of Indonesia vary from informal loan sharks that cater to the fishers and micro-enterprises through short-term debt, to banks, venture capital funds and fintechs that cater to the various segments of the MSMEs through debt and equity products. Complimenting these financial intermediaries, there are several federal and state-run programs that supplement the markets through subsidized micro loan products for the high risk profile enterprise segments, including BLU LPMUKP. This section provides a brief overview of the relevant stakeholders for the blue economy and analyses the market gaps and opportunities for the Blue Halo program to intervene.

5.1.2.1 Loan sharks

Loan sharks – individuals providing micro-loans at an extremely high interest rates, generally operating outside the law – are the most common source of financing at the last mile. They provide capital and operational loans for fishing gears, boats, fuel, or feed but with high interest rates as high as 40% per month.[337] Despite the hefty costs, loan sharks are still the go-to place for small-scale fishers and farmers because loan sharks do not ask for collaterals and serve customers without difficult paperwork to fill in or long waiting time. Most fishers or farmers develop personal relationship with loan sharks since loan sharks will be the first to help them when there is a family emergency or needs. In addition to professional loan sharks, fish aggregators often act as loan sharks to fishers or farmers.

Collaterals are typically the biggest barrier for coastal communities to access financing.[338] Fishers and farmers in the coastal communities typically do not have the land certificates or vehicles (two of the most common physical collaterals in Indonesia). Some financial institutions accept their motor engines (but not the boat) as collaterals.

The exorbitant interest rates often trapping borrowers in cycles of debt, continuously borrowing to repay existing loans. Loan sharks also target vulnerable individuals, including those with poor credit or financial difficulties, exacerbating their financial problems. And loan sharks could operate outside of regulatory oversight – thus avoiding licensing requirements or customer protection – thus engaging in deceptive and extortionary practices with hidden fees or unclear terms.[339]

Despite various campaigns and programs to reduce or avoid dependency on loan sharks, people still go to them for the above-mentioned reasons: timely availability, no collateral, no hassle. Loan sharks who also function as aggregators also give access to market and act as the off-takers – although some require exclusivity in supply.

5.1.2.2 Banks

Banks – as formal financial institution – could lend to the blue economy sectors, however high risk perception and lack of collaterals limits their exposure to this segment. GoI launched microfinancing program (called Kredit Usaha Rakyat KUR) in November 2007 to help productive businesses that are *feasible* but not yet *bankable*.[340] Since 2015, the government also provides interest subsidy to the banks to

[336] Sumaila, U.R., Walsh, M., Hoareau, K. et al. Financing a sustainable ocean economy. Nat Commun 12, 3259 (2021) https://www.nature.com/articles/s41467-021-23168-y

[337] https://www.antaranews.com/berita/3559029/perjuangan-sri-wahyuni-mitra-holding-ultra-mikro-dalam-sediakan-akses-keuangan-formal-di-kampung-nelayan

[338] Nadjib, Mochammad, et al., Credit Model for Fishermen: Construction on the Nature of Business and Economic Culture, Jurnal Ekonomi dan Pembangunan Vol. 31 No. 2, 2023

[339] https://www.theguardian.com/money/2021/jun/29/loan-sharks-using-sophisticated-technology-to-target-borrowers

[340] https://kur.ekon.go.id/maksud-dan-tujuan

lower the microfinance interest rates for MSMEs.[341] However, statistics show that KUR absorption in the marine and fisheries sector is very low.[342] Despite the Ministry of Finance stating that KUR does not require collaterals, the distributing banks still expect it as a requirement for lending.[343] Therefore, the agriculture sector has far bigger KUR share than fisheries since farmers typically own a land certificate that is used as collateral. In the marine and fisheries sector, KUR tends to go to the aquaculture subsector such as shrimp farm – which is regarded as relatively lower risk compared to the capture fisheries.[344]

Beyond micro-credit segment, immature pipeline of SMEs in the blue economy (mainly fisheries) was highlighted as one of the major concerns by the banking sector. Primary interviews with the Indonesian banks revealed that high liquidity exists in the banking sector, and therefore adding additional liquidity to the (sustainability) financing sector will not solve the blue economy financing woes. Demand-supply side mismatch – as SMEs requiring early-stage high risk and patient capital versus collateralized debt products available in the traditional banking sector – requires innovative approaches to address the market constraints. While on the demand-side, investment readiness is one of the leading challenges to access finance; on the supply-side, limited understanding of the blue-economy segments beyond fisheries is an important barrier to the growth of blue-economy.[345]

Few banks such as Bank Rakyat Indonesia (BRI) have been more actively disbursing microcredits in the fisheries sector; a couple of banks have launched their venture debt arms to leverage the opportunities in the startup sector. BRI is known to be the bank of MSME and has vast access to remote areas with its network of BRI agents (persons or shops with payment terminal that help perform financial transactions on behalf of the bank). Banks have also set up venture capital arms to support tech startups such as BRI with its *BRI Ventures,* BNI with *BNI Ventures*, and Bank Mandiri with *Mandiri Capital*. FishLog – a fisheries start up in fish logistics – is the first start-up in Indonesia receiving capital from three state-owned bank: BRI Ventures, BNI Ventures, and Mandiri Capital.[346]

5.1.2.3 Bank Perekonomian Rakyat (BPRs i.e., rural banks)

BPR is a specialized bank in Indonesia with limited activities as compared to the conventional bank – they are not allowed to perform payment transactions like giro, ATM, foreign exchange, or insurance.[347] BPRs are allowed to collect savings from customers, give out loans, and perform limited investments. BPR typically has a closer reach to the community since they are set up with deep rural networks—and sometimes in areas where there is no conventional bank presence. Their credit facility has a (much) lower limit than a conventional bank with OJK limiting a credit to an individual cannot exceed 20% of a BPR's capital or 30% if credit to a group of debtors.

BPRs are sometimes preferred by debtors for their less stringent criteria than a conventional bank.[348] In return, BPR typically has higher interest rates for loans, but they also offer higher interest rates in savings. BPR Sharia (BPRS) applies Islamic principles. As per OJK data, [349] in February 2024, there are 1,567 BPR and BPRS in Indonesia with total assets worth IDR 217 trillion (USD 13.5 billion). More than half of them have capital more than IDR 50 billion. There are 191 BPRs in WPP 572 provinces.

[341] Minister of Finance Regulation No. 146/PMK.05/2015
[342] https://kur.ekon.go.id/realisasi_kur/2020/1
[343] https://finansial.bisnis.com/read/20240122/90/1734249/round-up-kur-sampai-rp100-juta-tidak-perlu-jaminan-himbara-dan-bpd-disanksi
[344] https://infopublik.id/kategori/nasional-ekonomi-bisnis/533172/index.html
[345] Primary Interviews, Blue Financing Facility
[346] https://fishlog.co.id/blog/fishlog-successfully-closes-pre-series-a-extension-round-as-it-unlocks-global-growth-and-sustainability-for-indonesian-fisheries
[347] https://ojk.go.id/id/kanal/perbankan/Pages/Bank-Perkreditan-Rakyat.aspx
[348] https://bprkbs.co.id/keuntungan-mengajukan-pinjaman-modal-ke-bank-perkreditan-rakyat/
[349] https://ibpr-s.ojk.go.id/InformasiUmum

Table 90. BPR(S) distribution in WPP 572 provinces

Province	No. of BPR(S)
Aceh	14
North Sumatra	3
West Sumatra	81
Bengkulu	8
Lampung	34
Banten	61
Total	**191**

BPR's presence in rural areas, where no conventional bank can be found, is ideal for coastal community areas, especially those in remote areas. BPRs are also willing to visit their coastal clients rather than asking them to come to the office. In an interview with one CCDP from IFAD, one of the program's successes in disbursing loan is to have BPR staff to go to the market very early in the morning when fishers come back at dawn and sell their catch in the market. The cash typically disappear quickly at the hands of fishers with their consumptive lifestyle and often spent right away at the port for alcohol or gambling.[350] Thus, pick up debt collection method at the earliest opportunity is key. Meanwhile, conventional banks operate at business hours and expect fishers to go to the branch and pay their debts.

BPRs could be one of the partners for the Blue Economy financing program if several operational challenges are addressed. BPRs' non-performing loan (NPL) in September 2023 reached 10.05% while conventional banks stayed at 2-3% (OJK defines safe zone at 5%).[351] They have limited human capital, and their Standard Operating Procedure needs to be on par with conventional banks. With the size of its investment, it is understandable if they could not match bigger banks services, including digital services that is becoming a norm these days. Essentially, BPRs need to improve themselves and innovate to stay competitive in the market. They need to use their advantage of having a closer presence to their markets.

5.1.2.4 Venture Capital Firms

Indonesia boasts a diverse set of international and local venture capital (VC) funds deploying capital in the market. These funds have played a critical role in enabling the Indonesian startup economy by providing access to risk capital for high growth enterprises. From OJK's recently released road map for venture funds (2024-2028)[352] in January 2024, increasing the availability of venture capital to fuel the growth of entrepreneurship is one of the key priorities for the Indonesian government. Local VC funds and funds with Indonesia as their primary mandate mostly focus on early-stage deals – creating a pipeline of investible enterprises and sustainable businesses in the country. There is also a growth in new climate funds – highlighting the increase in awareness of sustainability themes in Indonesia.[353] Both leading banks and many VCs are exploring venture debt instruments that provide financing without diluting the founders' ownership, making it attractive for SMEs needing working capital or expansion funds. The technology funding crunch in the country has further fueled the growth of this growing segment.

[350] Anis Kumalasari, Niken Eriana Azzahra Fauzi, & Fayza Jasmine Oktsferly. (2023). Nelayan dan Perilaku Konsumtif (Studi Etnografi pada Masyarakat Kecamatan Muncar Banyuwangi). Harmoni: Jurnal Ilmu Komunikasi Dan Sosial, 1(2), 76–90. https://doi.org/10.59581/harmoni-widyakarya.v1i2.428
[351] https://finansial.bisnis.com/read/20231207/90/1721742/kredit-macet-di-bpr-melonjak-ini-alasannya
[352] OJK (2024), Roadmap for the Development and Strengthening of Venture Capital Firms 2024-2028
[353] Indonesia Venture Capital Report, BAIN, 2023

Several local and regional VC funds have invested in blue economy startups, though most of the local activities have been sector agnostic. Local funds such East Ventures Capital, Patamar Capital, BNI Ventures, BRI Ventures and others have invested in a range of early-stage blue economy enterprises. However, these investments have been sector agnostic and are driven by the market opportunity. Except for Blue Finance Accelerator – a join initiative by UNDP and ADB – there have not been any other blue economy focused interventions in the startup ecosystem of Indonesia. Despite this, Indonesia boasts several blue economy startups. Several regional VC funds, with a few climate focused funds, are active in the Indonesia market. Circulate Capital, a global circular economy investment firm that is focused on reducing ocean plastics investing in circular economy enterprises have made three investments in the country.

VC funds identified lack of concrete data and availability of concessional capital to enable climate/ blue economy focused thematic funds as some of the critical market gaps. In primary interviews, with the sector agnostic and thematic funds, investors highlighted that each fund has its own niche in terms of the enterprise stage, ticket size, return expectations and the sub-segments targeted. Availability of concession capital is required to enable a new untested thematic area for the funds to support the cost of acceleration programs, investment readiness, market building, impact measurement, and reporting. Unlike the availability of capital and guarantee mechanisms from the Indonesian government, multilateral agencies, and development finance institutions for the traditional banking sector, there is a dearth of blue sector-aligned capital and blending mechanisms for venture capital funds. [354]

5.1.2.5 Fin-techs

As non-bank financial institution, financial technology (fin-techs) start-ups play an important role in financing especially MSME in Indonesia. According to OJK, as per January 2024[355] there are 101 licensed peer-to-peer lending fin-techs in Indonesia, including seven *sharia* ones. The total disbursed lending is IDR 22,303.76 billion (USD 1.38 billion) with almost 80% (IDR 17,386 billion) allocated on Java Island. The six WPP 572 provinces account for IDR 406 billion with Banten, which is located on Java, takes up 85% of it (IDR 346 billion). An example of fin-techs role in fisheries sector include aquaculture financing available in *Kabayan* which connect farmers with licensed fintechs to help them pay for the feed only after their harvest. Another example is *Amartha* which is focusing on financing women entrepreneurs.

Indonesia has recently seen the collapse of major lenders namely *Investree, TaniFund*, and *iGrow* –the last two focused on supporting agriculture, aquaculture, and fisheries. Before the pandemic hit, *Growpal* – a fintech focusing on financing aquaculture – also closed its business. However, according to OJK data in January 2024, 90-day non-performing loan (NPL) of fin-tech's is at 2.95% while 90-day success rate is at 97% – highlighting the overall resilience of this segment.

Though transaction costs and loan interest rates of fin-techs are high, the government of Indonesia is consistently intervening the market to bring down the rates.[356] Fin-techs have been charging a daily flat rate of 0.4% (or 146% annually). Only on 1 January 2024 the Government of Indonesia lowered the daily rate to 0.3% with the intent to further lower the rates to 0.2% in 2025 and 0.1% in 2026.[357] However, the interest rates are still relatively high if compared to unsecured loans from banks that are currently ranging between 25-30% per annum. Since COVID-19, Fin-tech applies or gives options to lenders to cover their investment with insurance. In theory, that risk sharing with lenders should lower the risk and thus the borrowing costs for debtors. Lower interest rates will increase access to finance in the market.

[354] Primary Interviews
[355] P2P Lending Statistics January 2024 https://ojk.go.id/id/kanal/iknb/data-dan-statistik/fintech/Pages/Statistik-P2P-Lending-Periode-Januari-2024.aspx
[356] Niko, Ibrahim. (2012)> The Model of Crowdfunding to Support Small and Micro Businesses in Indonesia Through a Web-based Platform. Retrieved from: https://www.sciencedirect.com/science/article/pii/S221256711200353X
[357] Surat Edaran OJK (SEOJK) Nomor 19/SEOJK.05/2023 tentang Penyelenggaraan Layanan Pendanaan Berbasis Teknologi Informasi

5.1.2.6 Marine and Fisheries Business Capital Management Agency (LPMUKP)

LPMUKP is the microfinancing arm of MMAF. In its debut year, 2017, LPMUKP managed to distribute IDR 11.13 billion (USD 700,000) and by 2023 it allocated IDR 328.51 billion (USD 20.5 million)—their highest allocation thus far.[358] Currently LPMUKP offers direct rolling funding with 3% flat annual interest rates to MSMEs or microfinance institutions, banks, and non-bank institutions with 1.5% provision and admin fees. If the financing goes through an intermediary, then the interest rate to the debtor is capped at 7% annually.[359]

The program's objective is to help the non-bankable with relatively more lenient requirements than a formal bank, and let debtors graduate within two years and develop the credit history to be able to access financial products from the formal banking institutions. Collaterals are not necessary, but the business needs to be at least already a year in operation and fulfill the sustainability and other criteria. LPMUKP also offers credit for the ultra-micro enterprises (up to IDR 10 million) without collaterals or business history.

LPMUKP has limited operations and resources, with one extension officer or analyst being responsible for several regencies – inhibiting their client acquisition and fund distribution process. The availability of extension workers is critical to: 1) scouting potential clients, 2) promoting LPMUKP service, 3) assisting potential clients with formal requirements. In fact, one of the biggest barriers to potential clients are filling up the form and preparing the required documents. While some areas in WPP 572 have already benefited from their service and Blue Halo S could provide the market linkages to further expand their operations.[360] Promotion of BLU LPMUKP's services to potential clients is therefore an existing, standing function of the institution's extension network, delivered through community-level socialization activities, an accompanied-lending model in which borrowers receive ongoing mentoring alongside financing, and partnerships with local microfinance institutions (LKM) and rural banks (BPR) that extend outreach into communities BLU LPMUKP's own staff cannot reach. The constraint in WPP 572 is therefore the capacity of this existing function – limited by the extension officer shortage described above – rather than the absence of a promotional function itself.

5.1.2.7 LPDB-KUMKM

This microfinance institution is similar to BLU LPMUKP and it disburses the revolving funds targeted at cooperatives which are categorized as BLU. LPBD is under the MCSME and to date has disbursed IDR 16.6 trillion (USD 1 billion) to 3,301 businesses (or partners).[361] The institution offers two types of financing: 1) business financing to cooperatives in the productive/real economy sectors, and 2) channeling loans to saving-and-loan cooperatives to strengthen their capacity. Effective interest rates are at maximum 9% per annum with working capital tenure at 5 years or 10 years in case of investment. A Sharia option is also available and typically at profit sharing 30:70 from gross revenue for business financing or 40:60 for investment financing.

Besides focusing on cooperatives, another notable difference between LPDB and LPMUKP is that LPDB partners with several credit guarantee institutions at the national and subnational levels (Jamkrida). Potential clients without collaterals could ask for credit guarantee from such institutions to obtain the guarantee certificate.

5.1.2.8 Credit Guarantee Institutions

Credit guarantee institutions are crucial especially for MSMEs facing the issues of having no collateral in their effort to accessing finance. In December 2023, OJK lists 22 credit guarantee firms in Indonesia with

[358] https://blulpmukp.id/kabar-kita/catat-penyaluran-dana-tertinggi-lpmukp-dorong-pertumbuhan-ekonomi-kelautan-dan-perikanan/
[359] https://blulpmukp.id/tarif-layanan/
[360] https://blulpmukp.id/kabar-kita/nelayan-nias-sukses-kembangkan-usaha-berkat-dukungan-modal-lpmukp/
[361] https://www.lpdb.go.id on 7 May 2024 at14:00 UTC

20 conventional and 2 full-fledged sharia—7 of the 20 conventional ones have Sharia units. The 20 conventional guarantee firms consist of 1 state-owned enterprise (Jamkrindo), 18 provincial government enterprises (Jamkridas), and 1 private firm (Sinarmas). In WPP 572, only West Sumatra and Banten have a Jamkrida. The slow growth of establishment of province-owned credit guarantee firms is attributed to bureaucracy where the provincial government must obtain approval from the provincial parliament.[362] OJK defines the minimum capital to establish a guarantee firm at IDR 25 billion (USD 1.55 million).

KUR disbursement at the provincial level is managed by provincial banks—which act as credit guarantor. Other than that, debtors could access credit guarantee facility from one of the firms available in their area. Jamkrindo has branches in all of Indonesia's 34 provinces.

5.1.2.9 Development Finance Institutions and Aid Agencies

Development finance institutions including multilateral institutions such as the World Bank or Asian Development Bank as well as bilateral ones like JICA, AFD, or KfW contribute to the blue economy financing market by providing sovereign loans, grants, and credit guarantee schemes. AFD and JICA for example, are working with the Indonesian government to revitalize several fishing ports in WPP 572. The World Bank with its Ocean for Prosperity program that started in 2023 has similar programs with the Blue Halo S but in the eastern part of Indonesia. The Indonesian government funds their budget deficit through foreign loans and investment from such institutions. Furthermore, there are also institutions that invest directly in businesses such as International Finance Corporation (part of the World Bank Group) or Proparco (French investment arm). The Norwegian government studied the possibility of Norwegian firms to invest and play a role in green shipping in Indonesia.[363]

5.1.2.10 Other Relevant Initiatives

5.1.2.10.1 Ultra-Micro Loans (UMi)

Government of Indonesia is also promoting the growth of *Ultra-Micro* businesses by issuing ultra-micro credits of up to IDR 10 million (USD 625). This type of lending has even lower requirements i.e., no collateral nor minimum business establishment.[364] Three state-owned financial institutions (BRI, Permodalan Nasional Madani, and Pegadaian) form a holding *UMi* to serve ultra-micro businesses. By the first quarter of 2024, their total disbursed loans to micro and ultra-micro businesses amount to IDR 622.6 trillion (approx. USD 38.75 B). That counts to 47.6% of total BRI's financing of 36.8 million clients. UMi also targets 12 million business owners currently accessing informal financing (including from loan sharks) and 18 million non-bankables.[365]

5.1.2.10.2 Warehouse receipts (Sistem Resi Gudang – SRG)

SRG was introduced in 1997 in Indonesia but has not taken off.[366] The scheme allows businesses to store their goods at designated warehouses and obtain a receipt. The receipts can be used as collateral to obtain loans or also work as financial instruments to be traded. This system has another advantage that it allows producers to keep their products when the market price drops. There are 18 commodities currently allowed in this scheme including fish and seaweed. Finance Minister Regulation No 178/PMMK.05/2021 introduced several changes including extending access to users (not limited only to farmers/fishers), interest rates adjustment, upstream-downstream financing, and so on. The main barrier to this program is the awareness and understanding of the systems from the users and local government officials – whereas local financial

[362] https://www.niras.com/projects/indonesia-green-shipping-market-study/

[363] https://www.niras.com/projects/indonesian-green-shipping-market-study/
[364] https://djpb.kemenkeu.go.id/kanwil/sulteng/id/data-publikasi/berita-terbaru/2831-umi-sebagai-salah-satu-sumber-pembiayaan-bagi-pengusaha-ultra-mikro.html#
[365] https://keuangan.kontan.co.id/news/bri-ingin-layani-12-juta-pelaku-usaha-mikro-yang-mengakses-rentenir
[366] https://ekon.go.id/publikasi/detail/2366/pemerintah-gali-penyebab-terhambatnya-sistem-resi-gudang

institutions have somewhat better understanding.[367] In 2021, warehouse receipts issued totaled at IDR 515.77 billion (USD 32.1 million) while receipts financing amount to IDR 355.3 billion (USD 22.1 million).[368] By May 2023, KKP revealed that there are 44 warehouse receipts issued for fish and seaweed with a total volume of 1,007,7 tons valued at IDR 44.28 billion (USD 2.75 million) and receipt financing at IDR 27.1 billion (USD 1.69 million).[369]

5.1.2.10.3 The Indonesia Environment Fund (BPDLH)

Launched in October 2019, BPDLH is a public service agency under the Ministry of Finance with mandates in raising, channeling, and distributing environmental and climate funds into different instruments and sectors. They raise funds from the state budget and grants and typically act as fund managers. Beneficiaries of BPDLH could be an individual, a government institution at (sub)national level, civil society organizations, the private sector, academia, or community groups.

5.2 Market Gaps and Opportunities

This section discusses the market gaps and intervention opportunities to enable the investment readiness of blue economy in WPP 572.**Technical Assistance for MSMEs**: Most enterprises in WPP 572's blue economy are micro and small. They need help with business planning, development, financial planning, accessing government schemes, and improving governance to access commercial finance. Partnerships with business incubators or resurrecting Blue Economy start-us competition such as Seafood Innovation Project (a startup accelerator for marine and fisheries)[370] can catalyze new enterprises. Networking platforms like DigiFish can facilitate peer-to-peer learning.

- **Market Access**: WPP 572 has few ports and is isolated from major markets. Connecting MSMEs to larger enterprises or off-takers is crucial. Policy advocacy for infrastructure improvements like roads, internet access, and ports is key for long-term growth.
- **Finance Access**: Financial intermediaries cite a lack of investment-ready deals and high-risk perception in WPP 572. MSMEs and cooperatives lack collateral and capacity for loan applications. Innovative financing mechanisms, simplified loan processes, and incentivizing fintechs can help.
- **Marine Entrepreneurship Innovation**: The blue economy in WPP 572 includes fishers, processors, brokers, and tourism. Start-ups focus on digital marketplaces and aquaculture automation. Innovations in marine biotechnology, maritime decarbonization, green shipbuilding, and commodity diversification are needed.
- **Sector Capacity and Knowledge**: There's a gap in research and evidence on blue economy actors and opportunities in WPP 572. Better understanding of risks, opportunities, and past performance can help develop products and services. Financial intermediaries need to understand blue financing, and enterprises need knowledge of sustainable practices.
- **Policy Advocacy**: WPP 572 lacks infrastructure and is seen as high-risk. Enabling policies and regulations can create a conducive environment for growth. Industry stakeholders should collaborate to advocate for policy reform at national and subnational levels.

[367] https://fiskal.kemenkeu.go.id/kajian/2023/08/11/2455-kajian-efektivitas-skema-subsidi-resi-gudang-ssrg-terhadap-produksi-dan-kesejahteraan-petani-padi-dan-kopi
[368] https://www.kompas.id/baca/ekonomi/2023/08/06/meski-jadi-angin-segar-sistem-resi-gudang-dinilai-belum-optimal
[369] https://www.antaranews.com/berita/3583536/kkp-sistem-resi-gudang-bantu-optimalkan-harga-komoditas-perikanan
[370] https://www.secondmuse.com/sip-announces-innovators/

5.3 Appendices

5.3.1 Appendix: Financial and Market Assessment

5.3.1.1 Financial Overview and Budget Analysis

5.3.1.1.1 Overview

In aggregate, the estimated financing gap for Indonesia's blue economy stands at approximately USD 1.23 trillion. According to a tracking database,[371] private sector contributions to the blue economy totaled USD 604.23 million, and public sector contributions amounted to USD 1,091.46 million, recorded over 5 years between 2018 to 2022, respectively. This comparison reveals a significant discrepancy, indicating that the involvement of the private sector in financing the blue economy is considerably lower than that of the public sector. This disparity suggests a potential underutilization of private sector resources and investment opportunities within the blue economy. It also highlights the need for more effective mechanisms to encourage private investment, possibly through incentives or risk-sharing arrangements. The optimal advancement of the blue economy in Indonesia necessitates an investment of USD 1.64 trillion. Yet, the fiscal capacity of the central government is capable of meeting only approximately 20-25% of this requirement, equating to around USD 320 billion to USD 400 billion (BAPPENAS, 2023). This shortfall signifies a considerable financing gap of about 75-80% to achieve the targeted blue economy contribution of 12.5% to GDP by 2045. Furthermore, Indonesia faces numerous other developmental priorities, such as poverty alleviation and infrastructure development, which also demand substantial funding. Hence, the pursuit of the blue economy in Indonesia is fraught with significant challenges and obstacles, particularly given the persistent budget deficits over the last five years and the current limitations in fund availability.

5.3.1.1.2 Sub-national Budget Trends

5.3.1.1.2.1 Aceh Province (Nanggroe Aceh Darussalam)

Aceh Province's fiscal capacity has declined over the past five years, from IDR 9.57 trillion in 2019 to IDR 3.8 trillion in 2022. The fiscal capacity ratio to total income also dropped from 0.61% in 2019 to 0.28% in 2022, averaging 0.49% annually. Pandemic-related national budget policies focused on social protection, healthcare, and economic recovery, limiting fiscal flexibility for Aceh. Despite these challenges, Aceh's

[371] The data used are combination from various sources: past studies (such as CPI's Climate Finance Landscape), summary of banks and non-banks sustainability reports, donor agencies reports, and MDBs reports.

fiscal capacity remains relatively robust due to special autonomy funds aimed at improving health, education, and infrastructure, though their use is largely pre-determined.

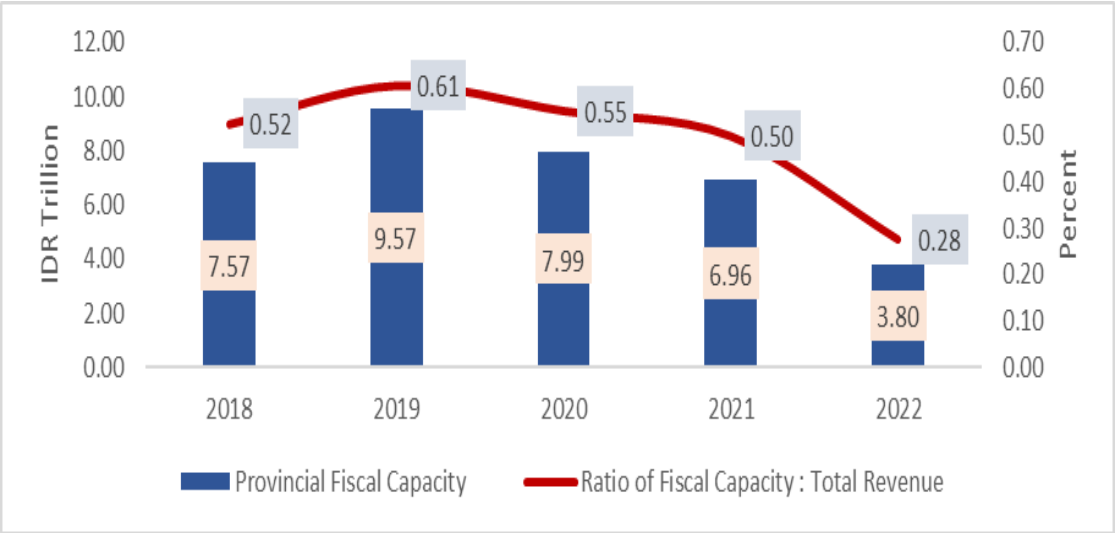


Figure 56. Aceh Province Fiscal Capacity Trends 2018-2022

Aceh Province's fiscal capacity has declined in recent years, with total income dropping from IDR 14.43 trillion in 2018 to IDR 13.7 trillion in 2022, mainly due to reduced government transfers. High dependency on these transfers means most income is pre-allocated, while routine spending and transfers to districts have increased, straining fiscal capacity. This decline hampers efforts to finance the blue economy sector, which received an average of IDR 219.93 billion (1.92% of total expenditures) from 2019 to 2022, compared to Papua's 8.03%. Effective fiscal reform is needed to improve spending quality and budget efficiency, particularly in routine expenditures and transfer funds, or to reallocate spending towards the blue economy sector of North Sumatra Province (Sumatera Utara)

North Sumatra Province's fiscal capacity has steadily increased over the past five years, rising from IDR 3.60 trillion in 2018 to IDR 4.38 trillion in 2022. This growth, despite a decline in total income, is due to reduced routine and specific expenditures and increased Local Own-Source Revenue (PAD). These factors show North Sumatra is enhancing its fiscal autonomy and strategically reallocating budget allocations to expand fiscal space.

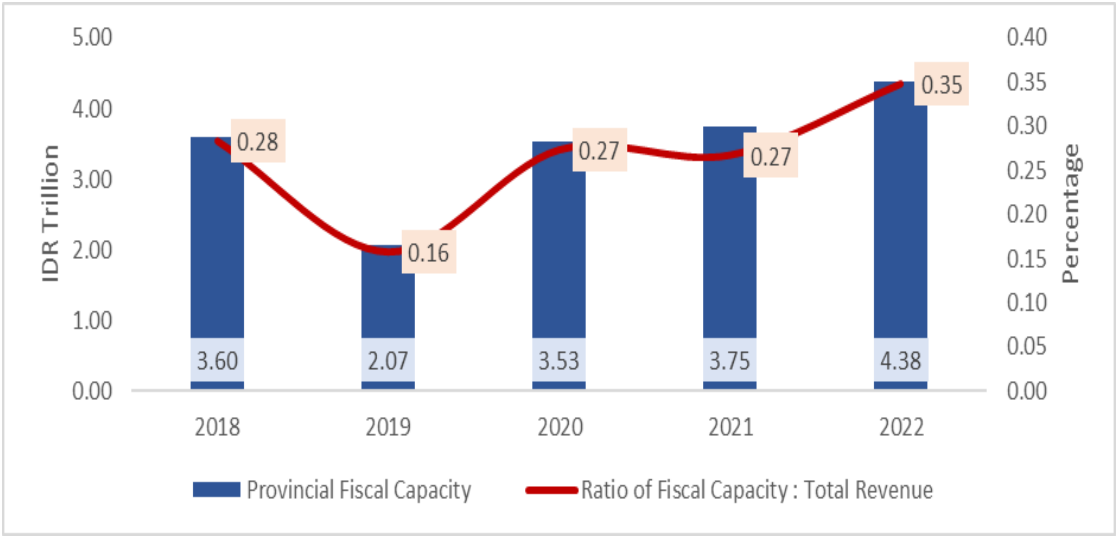


Figure 57. North Sumatra Province Fiscal Capacity Trends 2018-2020

North Sumatra Province's fiscal indicators, including fiscal capacity and structural levels, have shown steady progress. This improvement allows for strategic budget reallocation towards the blue economy,

aiming to maximize maritime potential and achieve goals like poverty alleviation, unemployment reduction, and coastal community welfare. Despite significant maritime potential and a 158.6 thousand ha Marine Protected Area, only IDR 56.89 billion (0.5% of total expenditure) was allocated annually to marine and fisheries programs from 2019 to 2022.West Sumatra Province (Sumatera Barat)

West Sumatra Province's fiscal capacity has increased from IDR 1.30 trillion in 2018 to IDR 1.74 trillion in 2022, with a modest 0.07% rise in the ratio to total income. Despite this positive trend, the figures remain modest. Significant policy changes are needed to manage fiscal conditions more flexibly, as most income is pre-allocated, limiting the ability to reallocate funds for blue economy development. West Sumatra Province faces challenges in reallocating budgetary resources for sectors like the blue economy. However, its budget allocation for marine and fisheries, averaging 1.33% of total spending (around IDR 67.06 billion), is relatively larger compared to other WPP 572 provinces. This is notable given the province's smaller total income.

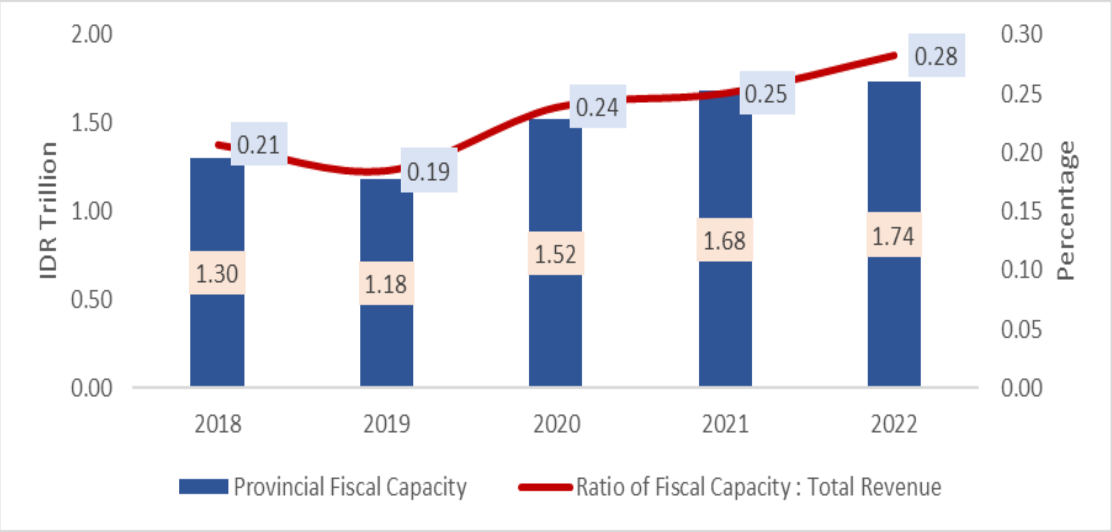


Figure 58. West Sumatra Province Fiscal Capacity Trends 2018-2022

5.3.1.1.2.2 Bengkulu Province

Over the past five fiscal years from 2018 to 2022, Bengkulu Province has exhibited a consistently decreasing trend in fiscal capacity, declining from IDR 2.14 trillion in 2018 to IDR 0.63 trillion in 2021. Correspondingly, the ratio of the province's fiscal capacity to annual revenue has also shown a steady decline, from 0.75 in 2018 to 0.21 in 2022, mirroring the downward trajectory of fiscal capacity. The data indicates a shrinking fiscal space for non-routine expenditures and transfers while the province has progressively increased its routine spending and transfers. This trend suggests that, barring strong incentives and commitment, the province is unlikely to finance blue economy-related expenditures unless there is a strategic reallocation from existing routine expenditures and transfers.

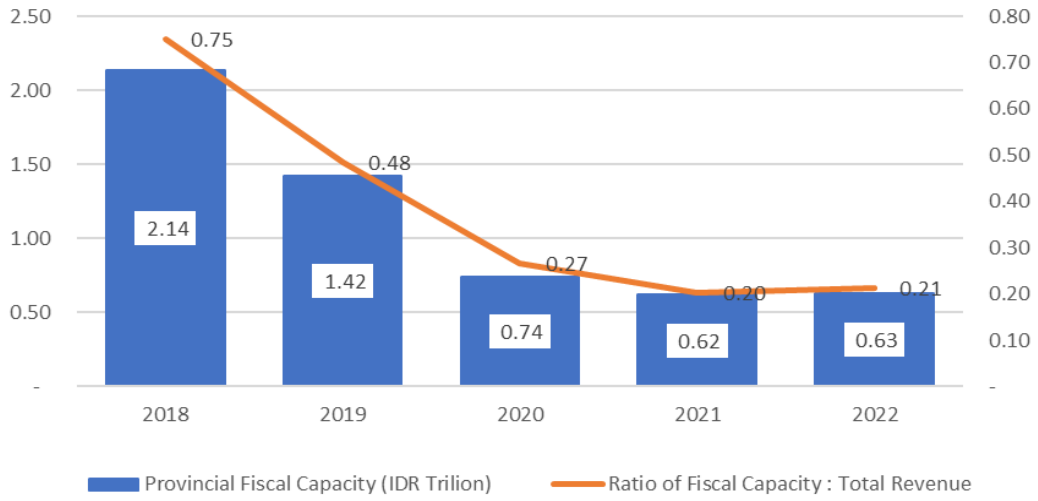


Figure 59. Fiscal capacity analysis of Bengkulu Province

5.3.1.1.2.3 Lampung Province

Lampung Province's fiscal capacity has declined annually over the past five years, dropping to IDR 1.02 trillion in 2021 but slightly improving to IDR 1.73 trillion in 2022. This decline is mainly due to increased Non-Physical Special Allocation Funds for school operational assistance (BOS) supporting the 12-year compulsory education program. The fiscal capacity ratio has also reached its lowest level in the last two years. Lampung Province faces challenges in financing the blue economy due to declining fiscal capacity over the past two years, not yet recovering to pre-COVID-19 levels. The province's heavy reliance on fiscal balance transfers complicates these efforts. Overcoming these challenges requires a concerted effort and commitment from both the central government and Lampung Province to reallocate and refocus financial resources towards blue economy development.

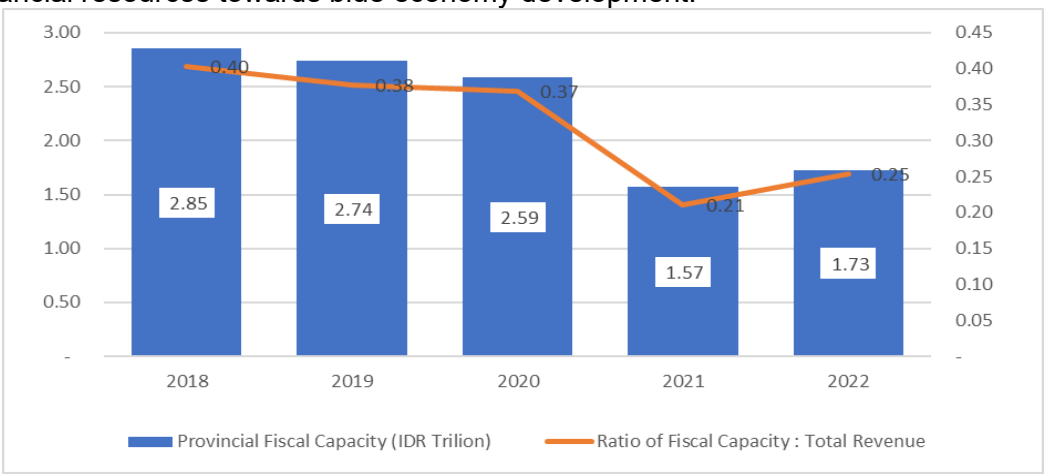


Figure 60. Fiscal capacity analysis of Lampung Province

5.3.1.1.2.4 Banten Province

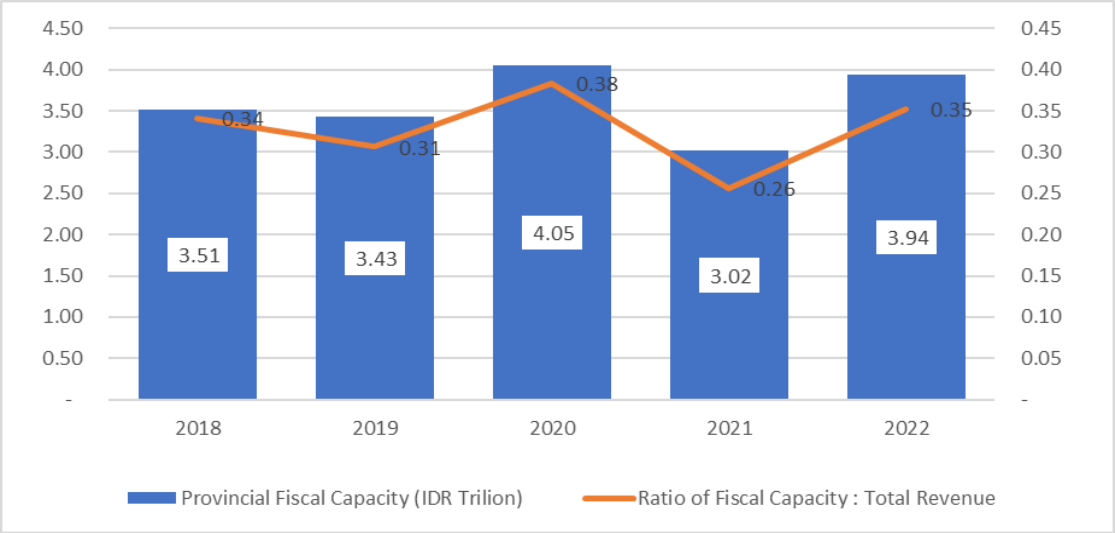


Figure 61. Fiscal capacity analysis of Banten Province

Banten Province's fiscal capacity has shown significant fluctuation over the past five years. It decreased from IDR 4.05 trillion in 2021 to IDR 3.02 trillion, then recovered to IDR 3.94 trillion in 2022. The fluctuating fiscal capacity ratio to annual revenue indicates instability in available funds. This suggests Banten's current fiscal capacity may not be sufficient to fund blue economy initiatives without alternative financing or budget adjustments. Increased routine expenditures and transfers have constrained fiscal space expansion

5.3.1.2 Intersectoral Linkage, Using Fisheries as the Primary Sector in WPP 572 Provinces

Input-Output (I/O) analysis identifies impactful sectors by examining transactions between industries, helping prioritize investment. Applied to the blue economy in WPP 572, covering fisheries, marine tourism, aquaculture, coastal construction, marine biotechnology, ocean energy, and seaborne trade, the analysis highlights sector interconnectedness. Investment strategies promoting multi-sectoral growth can drive regional economic benefits like job creation and enhanced development.

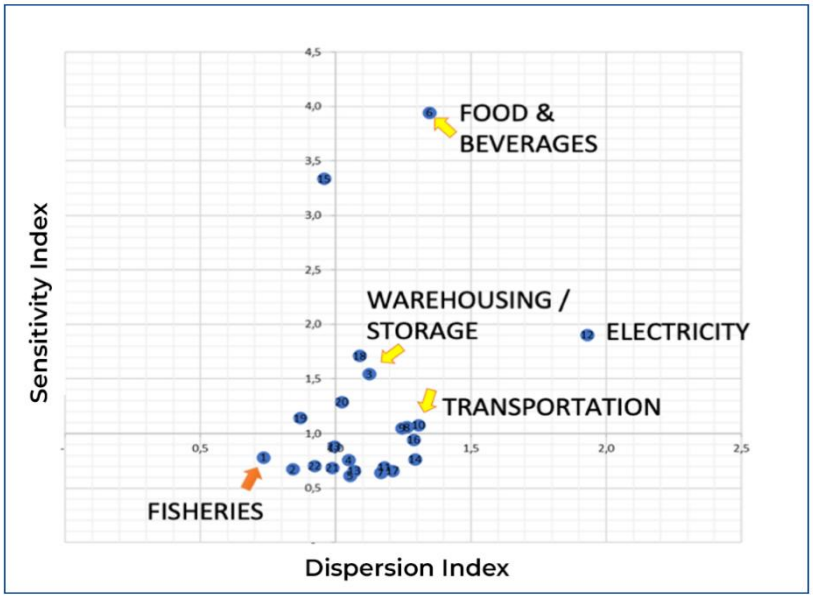


Figure 62. Sectoral Impact on Economic Growth I/O Analysis

Figure 62 shows that the fisheries sector in WPP 572 provinces has limited economic impact and can't meet end-user demands alone. A broader approach, including processing, food industries, tourism, and transport, is recommended.

Key findings from provincial-level I/O analysis (Figure 63):

- **Forward Linkage**: Aceh has the highest forward linkage (1.29), indicating significant influence on other sectors.
- **Backward Linkage**: Aceh also has the highest backward linkage (1.37), showing strong dependence on inputs from other sectors.
- **Dispersion Index**: Banten has the lowest dispersion index (0.71), meaning indirect effects are concentrated in certain sectors.
- **Sensitivity Index**: Banten's fisheries sector is least sensitive to changes in other sectors, with a sensitivity index of 0.64.
- **Output Multiplier**: Aceh has the highest output multiplier (1.37), suggesting substantial overall economic impact from increased fisheries sector output.

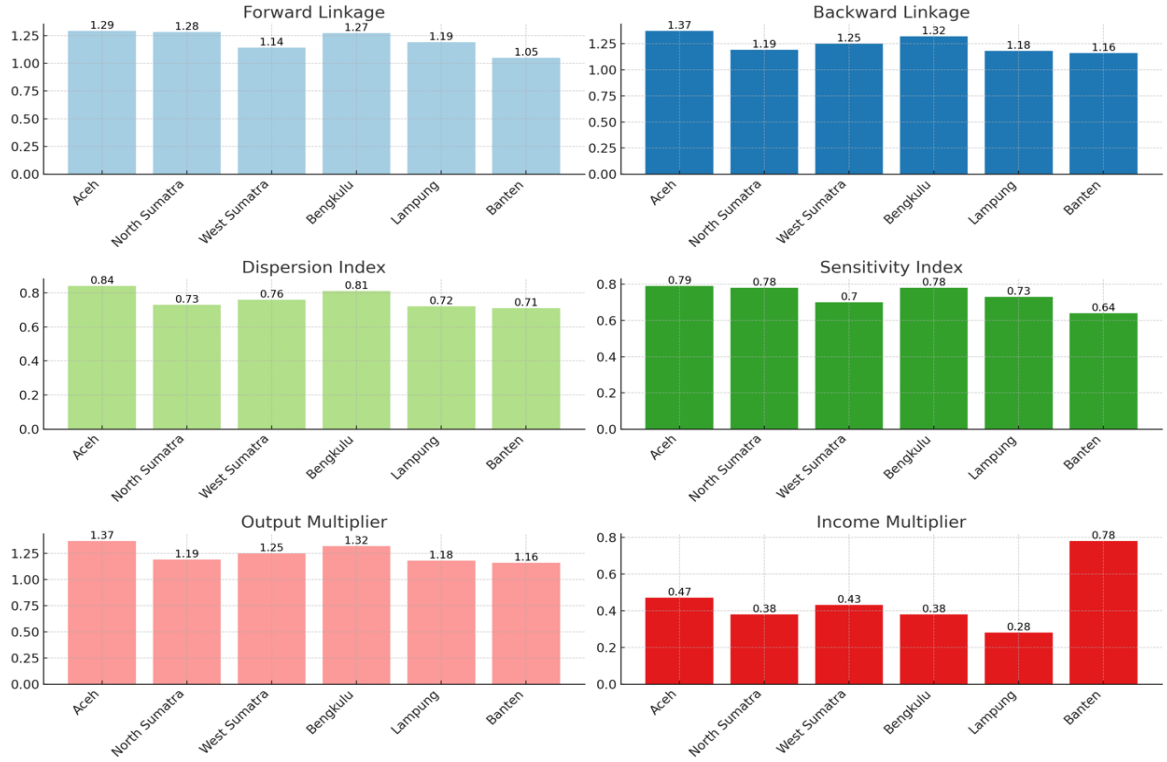


Figure 63. Analysis of Input/Output (I/O) with the Fisheries Sector as primary sector

5.3.1.3 Provincial Strategies for Optimising Investments

Building upon the findings of the I/O analysis presented in Figure 63, the summary of provincial strategies based on the input-output analysis results is as follows:

Aceh:

- **Investment**: Enhance fisheries productivity and develop related sectors through infrastructure, technology, training, and market development.
- **Inter-sectoral Development**: Foster cross-sector collaborations and adopt an ecosystem approach to balance objectives.
- **Small-scale Fisheries:** Improve income generation with access to finance and value addition activities.

North Sumatra:

- **Investment:** Invest in technology and equipment to boost productivity and enhance downstream sectors.
- **Inter-sectoral Development:** Strengthen partnerships with transport, processing, and retail sectors.
- **Small-scale Fisheries:** Improve market access, promote fair trade, and enhance working conditions.

West Sumatra:

- **Investment**: Strengthen connections with other sectors through infrastructure and quality enhancement.
- **Inter-sectoral Development**: Encourage collaborations to boost economic performance.
- **Small-scale Fisheries**: Expand income-generating capacity and employment opportunities.

Bengkulu:

- **Investment**: Modernize fisheries and enhance connected sectors.
- **Inter-sectoral Development**: Strengthen sector collaborations for sustainable growth.
- **Small-scale Fisheries**: Improve incomes through skill development and access to finance.

Lampung:

- **Investment**: Strengthen connections with other sectors via infrastructure, technology, and market expansion.
- **Inter-sectoral Development**: Encourage partnerships with related sectors.
- **Small-scale Fisheries**: Enhance income opportunities and implement social protection programs.

Banten:

- **Investment**: Enhance sectors using fisheries outputs and improve the value chain.
- **Inter-sectoral Development**: Strengthen connections with downstream sectors for balanced development.
- **Small-scale Fisheries**: Focus on income generation through productivity, value addition, and market access.

5.3.1.4 Provincial Strategies for Optimising Outputs While Maintaining Sustainable Stock Level

Enhancing fisheries productivity while preserving marine ecosystems requires sustainable practices, innovative technologies, and comprehensive management strategies. Cooperation among local communities, government, and the private sector is essential for long-term viability.

- **Aceh**: Adopt eco-friendly fishing practices, invest in sustainable aquaculture, implement stricter quotas, and restore mangroves and coral reefs. Provide capacity-building for local fishermen.
- **North Sumatra**: Implement stock assessments, closed seasons, and community-based management. Promote traceability systems and invest in sustainable aquaculture. Raise public awareness on sustainable seafood.
- **West Sumatra**: Improve management through Marine Protected Areas (MPAs), explore alternative livelihoods like eco-tourism, and strengthen regulations on illegal fishing.
- **Bengkulu**: Develop co-management practices with local communities, promote sustainable aquaculture, and invest in research for resilient fish species.
- **Lampung**: Optimize resource use with improved stock assessments, promote responsible fishing, and rehabilitate overfished areas. Invest in hatchery and breeding programs.
- **Banten**: Develop a sustainable, market-driven fisheries sector with certification schemes, improve the supply chain, and focus on innovative aquaculture. Strengthen community engagement in fisheries management.

5.3.2 Appendix: Lessons Learned Summary from Selected Projects

In the context of the Blue Halo S Program, the table provides an analysis of various projects, important for understanding the landscape in which the program operates. It categorizes these projects by program type, involved institutions, current status, funding amount, specific activities, and lessons learned. The table also identifies potential areas for synergy and collaboration with the Blue Halo S Program. This information is crucial for assessing how different sectors and organizations are contributing to sustainability goals and identifying opportunities for innovative approaches and strategic partnerships. By detailing the practices and strategies employed in these projects, the table offers insights that are valuable for future initiatives, particularly in areas where collaboration with the Blue Halo S Program is feasible.

Table 91. Lessons Learned from Past and Ongoing Projects

Program	Institution	Status And Amount The Project	Project Activities and lesson learn	Potential Colaboration	
				Type of Ecosystem Intervention	Relevance with Blue Halo S[372]
Private Sector Investment					
Sustainable Fisheries	Aruna	Ongoing - Series A round USD 65 mio	Aruna acts as a one-stop-shop and aggregator for fisheries, shortening the supply chain from fishermen to the global market. Key to Aruna's success was their ability to leverage local strengths and build robust networks. They understood the importance of local resources, the needs of the Indonesian market, and the value of partnerships,	-	

[372] The yellow color in the "Relevance with Blue Halo S" column signifies medium relevance, while green denotes high relevance. This categorization considers the alignment of the program with Blue Halo S's goals and objectives, the relevance of ecosystem interventions, and aspects related to climate change.

Program	Institution	Status And Amount The Project	Project Activities and lesson learn	Potential Colaboration	
				Type of Ecosystem Intervention	Relevance with Blue Halo S[372]
			ranging from local fisher to global investors.		
Waste Management	Waste4Change	Ongoing - Series A round USD 5 mio	Waste4Change's journey is a testament to the transformative power of technology in environmental sustainability. Their goal to significantly increase waste processing capacity, while collaborating with various sectors, highlights the crucial role of comprehensive strategies in tackling environmental challenges. Waste4Change's story underscores the need for digital integration and large-scale operations to create impactful solutions in waste management.	-	
Renewable Energy	Xurya	Ongoing - Series A round USD 33 mio	Xurya's story in the renewable energy sector illustrates the significant impact of strategic funding and partnerships in scaling clean energy solutions. This journey highlights the value of innovative business models that enable companies to adopt solar energy without initial investments, demonstrating a successful approach to promoting environmental	-	

Program	Institution	Status And Amount The Project	Project Activities and lesson learn	Potential Colaboration	
				Type of Ecosystem Intervention	Relevance with Blue Halo S[372]
			sustainability in the business sector.		
Sustainable Tourism	Indonesia Tourism Development Corporation (ITDC)	Past - USD 248.4 mio	ITDC's development of The Mandalika as a Special Economic Zone showcases the effective use of strategic funding for regional development. This project underlines the importance of leveraging government support and state capital (AIIB) to boost tourism infrastructure, demonstrating how targeted investment can catalyze significant economic and tourism growth in a region. ITDC's approach highlights the transformative potential of combining vision, substantial investment, and infrastructural development to elevate a destination's global tourism appeal.	-	
Development Partner					
Reduce, Reuse, Recycle to Protect the Marine Environment and Coral Reefs (3IDRroMar)	GiZ GmbH	Ongoing - N/A	The 3IDRroMar project, an ASEAN-German initiative, focuses on reducing land-based waste and marine litter. It incorporates strategic waste management and pilot projects in regions like the Mekong Delta. The project underscores the importance of collaborative approaches	Coral Reefs	

Program	Institution	Status And Amount The Project	Project Activities and lesson learn	Potential Colaboration	
				Type of Ecosystem Intervention	Relevance with Blue Halo S[372]
			in environmental conservation, demonstrating how regional cooperation and integrated strategies are crucial in addressing ecological challenges, especially in marine and coastal areas. This approach highlights the value of combining diverse expertise for effective environmental management.		
Eco Fishing Port	Agence Francaise de Développement	Preparation - EUR 98,7 mio	The AFD Eco Fishing Ports project in Indonesia, funded by 98.7 million euros, aims to upgrade four major fishing ports, enhancing their efficiency and sustainability. This project underscores the importance of sustainable development in the fisheries sector, balancing economic growth with environmental conservation. Key activities include improving port functions, implementing sustainability practices, and strengthening institutional capacities.	-	
International Climate Initiative IKI (2020-2023)	EIB Group – IKI Fund	Ongoing - EUR 20 mio	The International Climate Initiative (IKI) emphasizes global collaboration in addressing climate change and biodiversity	-	

Program	Institution	Status And Amount The Project	Project Activities and lesson learn	Potential Colaboration	
				Type of Ecosystem Intervention	Relevance with Blue Halo S[372]
			conservation. It supports projects that implement the Paris Agreement's goals and adapt to climate impacts. Key lessons include the significance of international partnerships in environmental efforts and the importance of aligning local projects with global environmental objectives. The initiative showcases the effectiveness of diverse, localized approaches in global climate action.		
COREMAP – CTI	GEF, World Bank, ADB	Past - N/A	The COREMAP-CTI project focuses on coral reef conservation in Indonesia. Its activities include addressing destructive fishing practices, pollution, and the impacts of climate change on coral ecosystems. A key lesson from COREMAP-CTI is the importance of long-term, comprehensive approaches to marine conservation. The project demonstrates how integrating community welfare and environmental sustainability can effectively manage and preserve marine resources. This approach highlights the need for	Coral Reefs, Mangrove, Seagrass	

Program	Institution	Status And Amount The Project	Project Activities and lesson learn	Potential Colaboration	
				Type of Ecosystem Intervention	Relevance with Blue Halo S[372]
			collaboration among government entities, international organizations, and local communities in environmental initiatives.		
Ocean for Prosperity Program (LAUTRA) (2023-2027)	World Bank	Ongoing -USD 210 mio	LAUTRA focuses on improving marine resource management and coastal community livelihoods. Key lessons include the importance of sustainable marine resource utilization and the integration of community welfare in environmental projects. The project highlights the significance of government involvement in environmental sustainability and the positive impact of such initiatives on local economies.	Coral Reefs, Seagrass, Mangrove	
Mangrove for Coastal Resilience (M4CR) 2020-2024	World Bank	Ongoing - USD 410 mio	M4CR focuses on enhancing mangrove management and supporting the livelihoods of local communities in Indonesia. Key activities include policy and institutional reforms for effective mangrove management, alongside large-scale rehabilitation of degraded mangrove areas. Lessons from the project highlight the critical role of	Mangrove	

Program	Institution	Status And Amount The Project	Project Activities and lesson learn	Potential Colaboration	
				Type of Ecosystem Intervention	Relevance with Blue Halo S[372]
			mangroves in coastal protection and the importance of integrating local community needs with environmental conservation efforts.		
National Blue Carbon Action Partnership (NBCAP)	World Economic Forum	Preparation - N/A	NBCAP a collaborative initiative between Indonesia's Ministry of Maritime Affairs and Investment and the World Economic Forum, focuses on the crucial task of restoring and preserving Indonesia's rich blue carbon ecosystems. This partnership is centered around ecosystem restoration, particularly of mangroves, and seagrasses. NBCAP aims to integrate these efforts into broader climate change mitigation strategies, emphasizing policy development, community engagement, and sustainable livelihoods	Mangrove, Seagrass	
Government Project					
KALAJU (Kampung Nelayan Maju)	Ministry of Marine Affairs and Fisheries	Ongoing - N/A	The "Kampung Nelayan Maju" (Kalaju) program focuses on transforming Indonesian fisher's settlements into advanced, clean, and comfortable living spaces. Activities include	-	

Program	Institution	Status And Amount The Project	Project Activities and lesson learn	Potential Colaboration	
				Type of Ecosystem Intervention	Relevance with Blue Halo S[372]
			integrating these settlements with economic centers like fishing ports and tourism areas, enhancing the quality and productivity of fishermen's lives. Key learnings include the importance of holistic community development in coastal areas and the challenges in balancing immediate economic benefits with long-term sustainability		
Dewi Bahari (Desa Wisata Bahari)	Ministry of Marine Affairs and Fisheries	Ongoing - N/A	The "Dewi Bahari" program aims to develop coastal villages into sustainable maritime tourism destinations. It focuses on enhancing tourism infrastructure, environmental conservation, and community engagement. Key aspects include empowering locals with tourism-related skills, promoting cultural preservation, and ecosystem health.	-	

5.3.3 Appendix: Blue Economy Market Overview and Funding Opportunities

5.3.3.1 Established Sector in Blue Economy: Market Overview

The blue economy market in Indonesia is thoroughly covered in sections 1.4, 1.5 and 5.1. Please refer to these chapters for a comprehensive understanding of the blue economy market.[373]

5.3.3.2 Emerging Sector in Blue Economy: Market Overview

In the emerging sector of WPP 572, aquaculture stands as a cornerstone of Indonesia's blue economy, marked by its extensive use of natural resources. This sector sprawls over 1,626 million square meters of pond areas and employs a vast workforce of 373,945 individuals,[374] highlighting its significant role in regional employment and economic activity. Predominantly focusing on traditional and semi-intensive systems for commodities like shrimp, seaweed, and freshwater fish, the sector is gradually shifting towards more intensive systems. This transition promises greater control over water quality and enhanced productivity, aligning with the region's commitment to sustainable practices.

Shrimp constitutes the primary export commodity within Indonesia's aquaculture sector. Data from the Ministry of Marine Affairs and Fisheries indicate that in 2022, Indonesia exported approximately 241,200 tons of shrimp, amounting to a value of USD 2.16 billion. The principal markets for these exports are the United States, Japan, and the European Union. Shrimp's relatively high economic value cements its status as a sought-after fishery export commodity.

Consistent growth in investment trends in WPP 572's aquaculture sector has been observed. The sector leverages WPP 572's rich natural resources that could reduce production costs. WPP 572 has strategic advantages such as readily available labor and proximity to key markets, positions the region's aquaculture industry for significant future growth. Advanced technologies like aquaponics and recirculating aquaculture systems could be adopted to enhance the sector's efficiency, productivity, and sustainability.

Regarding renewable energy, based on data from the Ministry of Energy and Mineral Resources (MEMR), the utilization of national renewable energy in 2022 only reached 12.3% of the target of 23% by 2025. According to the National General Energy Plan (RUEN), it is necessary to have 45.2 GW of electricity sourced from renewable energy by the year 2025. However, renewable energy development needs to be faster, with a growth rate of around 400-500 MW per year over the past five years. This growth is also far from the government’s target of increasing renewable energy by 2-3 GW per year in the last five years. Norwegian companies shown interest in West Sumatra's renewable energy potential, especially in the Mentawai Islands. These companies are exploring diverse renewable energy sources, including geothermal, micro-hydropower plants, solar cells, and ocean wave energy.[375] The Mentawai Islands, being a tourism region, necessitate a reliable electricity supply achievable through renewable energy management, catering to the immediate energy needs and aligning with broader environmental conservation and sustainable tourism objectives.

Norwegian companies in West Sumatra's renewable energy potential, especially in the Mentawai Islands. These companies are exploring diverse renewable energy sources, including geothermal, micro-hydropower plants, solar cells, and ocean wave energy.[376] The Mentawai Islands, being a tourism region, necessitate a reliable electricity supply achievable through renewable energy management, catering to the

[373] ibid
[374] Ministry of Marine Affairs and Fisheries Republic of Indonesia. (2023). Retrieved from https://statistik.kkp.go.id/
[375] Elfisha, M., & Ruhman, F. (2023, February 24). W Sumatra invites investment in renewable energy from Norway. ANTARA News. Retrieved from https://en.antaranews.com/news/273798/w-sumatra-invites-investment-in-renewable-energy-from-norway

immediate energy needs and aligning with broader environmental conservation and sustainable tourism objectives.

The sector's potential is underscored by substantial investments, such as the planned 200 MW wind power plant in Banten, a collaboration between PT PLN and AFD.[377] This project, aimed at reducing greenhouse gas emissions by 540 thousand tons of CO2 annually, highlights both the profitability and environmental benefits of renewable energy initiatives. It represents a significant step towards a sustainable energy future, demonstrating the viability and attractiveness of renewable energy investments in Indonesia. The increasing demand for renewable energy in Indonesia,[378] spurred by environmental concerns and economic incentives, opens vast opportunities for development, especially in regions like WPP 572. The availability of natural resources, combined with government support and international collaboration, positions WPP 572 as a promising area for renewable energy development. The focus on various renewable energy sources not only diversifies the energy mix but also enhances energy security and contributes to the region's sustainable development goals.

5.3.3.3 Funding Opportunities and barriers

5.3.3.3.1 Opportunities

1. Surge in Foreign Direct Investment (FDI): FDI in WPP 572 increased from USD 13.58 billion in 2018 to USD 47.7 billion in 2023, indicating international confidence in Indonesia's Blue Economy. This boosts the local economy, creates jobs, and introduces new technologies, focusing on sustainable aquaculture, conservation, and reducing marine pollution.

2. Growth in Domestic Direct Investment (DDI): DDI reached USD 6.95 billion in 2019, reflecting local confidence in the Blue Economy. This supports targeted investments, aligns with national policies, and promotes sustainable practices.

3. Sector-Specific Investment Focus: Investments are directed towards waste management, marine fisheries, aquaculture, and marine plastics. This strategic focus drives economic growth and environmental sustainability.

4. Climate Mitigation and Adaptation Initiatives: Investments address environmental challenges while promoting economic growth, protecting marine biodiversity, and safeguarding coastal areas. This aligns with global climate commitments and fosters innovation.

5. Equity as a Preferred Financing Instrument: Over USD 80 billion in equity investments indicate high investor confidence. Equity investments bring capital, expertise, and strategic guidance, promoting diversification and innovation.

6. Potential for Philanthropic Contributions: Philanthropic funds, though currently minor, have significant growth potential. They can pilot innovative projects, support research, and attract additional funding, fostering sustainable marine practices and community welfare.

5.3.3.3.2 Barriers

Decline in Banking Sector Contributions and Lack of Investment Diversification:

The reduction in funding from the banking sector to Indonesia's Blue Economy, particularly in WPP 572, has posed a significant barrier, exacerbated by the COVID-19 pandemic. Funding dropped from USD 155.19 million in 2018 to USD 25.14 million in 2019, with further declines post-2020. This reduction is partly

[377] Karyza, D. (2022, March 17). France to help PLN develop big 200MW wind farm. The Jakarta Post. Retrieved from https://www.thejakartapost.com/business/2022/03/17/france-to-help-pln-develop-big-200mw-wind-farm.html
[378] Parajuli, Bishal & Seck, Gondia & Casals, Xavier & Guadarrama, Carlos. (2023). IRENA Socio-economic analysis of the energy transition - Indonesia. 10.13140/RG.2.2.32047.00163.

due to the economic uncertainties triggered by the pandemic, leading banks to adopt a cautious approach and scale back investments in perceived riskier sectors.[379]

The impact of this funding decline is felt across various sub-sectors. Water and wastewater management received the majority of remaining funds (94.15% or USD 170.12 million), while sectors like agriculture, forestry, land-use, and natural resource management received only 3.84% (USD 6.93 million). This imbalance leaves sectors critical for climate mitigation and adaptation vulnerable without adequate financial backing[380]. The Blue Economy requires diverse and resilient funding streams, including private, public, and philanthropic sources, to enhance its resilience to external shocks and support sustainable initiatives. The underfunding of marine conservation is particularly concerning. Adequate funding is essential for the long-term sustainability of marine ecosystems. Similarly, coastal development projects, which can enhance tourism opportunities and resilience against climate change impacts, are missed opportunities without proper investment.

Dominance of Loans Over Grants: The prevalence of loans over grants in Indonesia's Blue Economy, especially in WPP 572, poses challenges due to repayment burdens. Grants are essential for innovative projects but are scarce, limiting progress in sustainability. Addressing this requires greater awareness, policy interventions, and public-private collaboration to increase grant availability.

Pandemic Impact on Investor Confidence: COVID-19 significantly affected investor confidence, particularly in the banking sector, delaying projects and highlighting vulnerabilities in the Blue Economy. Rebuilding confidence requires showcasing resilience, successful case studies, and supportive government policies.

Neglect of Crucial Sectors: Minimal financial support for marine conservation, sustainable fisheries, and coastal waste management hinders sustainable development. Adequate investment in these areas is crucial for environmental and economic benefits. An integrated investment approach is needed to support long-term sustainability and growth.

Addressing these barriers requires diversified funding, balanced investment, increased grants, restored investor confidence, and integrated financial support for crucial sectors. This market analysis should explore why businesses struggle to access capital and expand sustainable models, forming the rationale for grant interventions.

5.3.3.3.3 Recommendations

Drawing from the analysis of recent trends in FDI, DDI, sector-specific focus, and other financial aspects within Indonesia's Blue Economy, particularly in WPP 572, we can derive a set of key recommendations. These recommendations aim to enhance the Blue Halo S Program's effectiveness, addressing unique challenges and leveraging opportunities presented by these financial trends:

- **Leverage FDI**: Use increased FDI to implement sustainable fishing practices and marine conservation technologies, such as eco-friendly aquaculture systems and advanced resource management tools.
- **Enhance DDI**: Support local fisheries management and community-led aquaculture projects to distribute economic benefits evenly within Indonesia.
- **Target Specific Sectors**: Focus investments on waste management, sustainable fisheries, and marine plastics to address environmental challenges.
- **Integrate Climate Initiatives**: Align investments with climate mitigation and adaptation projects, such as resilient coastal infrastructure and mangrove restoration.
- **Encourage Equity Investments**: Promote equity investments in sustainable technologies and practices within the marine sector.

[379] Modeong, D., Wati, R., Ante, J., & Tadung, E. (2023). The effect of market risk on returns: Case of banking in Indonesia. The Contrarian: Finance, Accounting, and Business Research. https://doi.org/10.58784/cfabr.3
[380] Hong, H., Karolyi, G., & Scheinkman, J. (2020). Climate Finance. The Review of Financial Studies. https://doi.org/10.1093/rfs/hhz146.

- **Expand Philanthropic Contributions**: Use philanthropic funds for ecological balance and community welfare projects, like protecting endangered species and promoting sustainable fisheries.
- **Catalyze Partnerships**: Foster partnerships between commercial investors and philanthropic foundations to support high-impact, sustainable projects and diversify funding sources.

6 Section 6: Project Design

6.1 Strategic Foundations for the Blue Halo S – BEAM Project

The GoI recognizes the need for a paradigm shift towards sustainable coastal protection, fisheries, and marine biodiversity management to enhance climate adaptation, mitigation, and the blue economy. The national Blue Economy Development Framework aims to harmonize economic growth with ecological stewardship, supporting Indonesia's vision of a sovereign, advanced, and sustainable archipelago by 2045.

BEAM is a key mechanism of the larger **Blue Halo S Initiative** which seeks to scale the protection production model of conservation and economic growth across Indonesia and beyond. Blue Halo S currently has a pilot project in Nias, North Sumatra which is undertaking ecosystem restoration, MPA management, and reforms to the fisheries sector to increase sustainability and improve outcomes for fishers. Blue Halo S also has an ongoing project funded by OceanX, Blue Nature Alliance, Becht Family Foundation, Global Fund for Coral Reefs, Dalio Philanthropies, and Philanthropy Asia Alliance to collect primary data and help inform MPA policy, design, and preliminary fishery stock assessments in WPP 572.

To inform the project design, extensive information gathering occurred between May and October 2023, focusing on existing and potential blue economy projects in Indonesia, particularly within WPP 572. Consultations with financial sector stakeholders identified significant barriers to investment, including: the lack of blue investment guidelines and frameworks, and insufficient financial incentives and risk assessment methodologies tailored to blue finance. Stakeholders, including venture capital firms, impact investors, philanthropic investors, banks, corporate entities, and fintech lenders, emphasized the importance of supporting early-stage investments and scaling projects aligned with blue economy principles. They noted the need for better marine governance and investment readiness support for MSMEs and regional operators. The stakeholder consultation revealed a demand for government support through funding guarantees, tax incentives, and a digital platform to connect potential investors with opportunities. The need for robust partnerships and tailored financial instruments was also highlighted. The necessity of developing an investment deck that complies with financial industry standards was also highlighted to facilitate collaboration with financial institutions.

Drawing on these insights, BEAM aims to establish enabling conditions for blue economy practices, including regulation, financing and capacity, to support climate mitigation, adaptation, enhance ocean ecosystems resilience, ensuring long-term ecological and economic benefits.

6.2 Strategic Framework for Advancing the Blue Economy in Indonesia

By focusing on creating an enabling environment for investments, establishing a comprehensive grant facility, and enhancing data collection and management, BEAM aims to promote sustainable development and climate resilience in WPP 572. This section outlines the strategic approaches and specific actions BEAM will implement, ensuring the long-term sustainability and prosperity of Indonesia's marine and coastal resources.

6.2.1 Enabling Blue Economy Investments through Integrated Models

WPP 572, spans 943,690 km² across six provinces: Aceh, North Sumatra, West Sumatra, Bengkulu, Lampung, and Banten. This primary fishing zone, contributing approximately 19% of Indonesia's fisheries production, faces climate change threats, leading to the degradation of mangrove, seagrass, and coral reef ecosystems.

BEAM proposes an integrated 'Protection and Production' (PnP) model, designed by Conservation International (CI) and Konservasi Indonesia (KI). This model seeks to balance marine protection with sustainable production, focusing on securing finance for marine biodiversity protection through private sector investments and blended climate finance mechanisms. Tested successfully in the Bird's Head Seascape, BEAM represents the scaling of this model to WPP 572. Success under BEAM will require improved capacity and enabled unconventional financing approaches in the blue economy sectors.

The feasibility study (especially Section 1.5.1) identified that a lack of comprehensive data severely hinders effective fisheries management in WPP 572. Challenges include inconsistent data collection protocols across agencies and organizations, data gaps resulting from irregular monitoring and incomplete reporting, making it difficult to aggregate and analyse data effectively. Local community engagement and data sharing also face obstacles due to varying levels of literacy, capacity, and interest, particularly in Sumatera. The PnP model represents a novel approach for WPP 572, necessitating a targeted strategy for disseminating these concepts to relevant audiences. To address these challenges and the need to disseminate the PnP model, BEAM will establish a knowledge and learning hub in one of the six provinces in WPP 572. This hub will serve as a central point for managing data and best practices in Indonesia. It will provide up-to-date data on biodiversity, fisheries, and conservation models, essential for informed decision-making by scientists, policymakers, and local communities. The hub will foster collaboration by facilitating data sharing, best practice exchange, and capacity building among stakeholders, including government agencies, NGOs, and local communities. Additionally, it will support ongoing data collection and analysis, allowing local governments to respond effectively to environmental changes and threats, thereby enhancing the resilience of marine ecosystems and fisheries.

6.2.2 BEAM Grant Facility

Stakeholder consultations and the Project's feasibility analysis identified several barriers to a climate-resilient blue economy in WPP 572. These include a lack of investment-ready projects, high risk perceptions among financial institutions, limited technical capacity for ecosystem restoration and sustainable livelihoods, and fragmented regulatory frameworks. These highlight the need to support profitable climate adaptation activities such as mangrove restoration and coral reef protection, and investments in data collection and management to diversify livelihoods and strengthen community resilience. Expanding MPAs and recognizing OECMs are also necessary. While financial liquidity is high in Indonesia, capital is not flowing to the blue economy because bankable projects are scarce and perceived risks remain elevated. Addressing these challenges requires a combination of grant-based support for community-led adaptation and mitigation, targeted technical assistance to make enterprises investment-ready, and policy engagement to improve the enabling environment.

The BEAM Grant Facility is designed to overcome these barriers by deploying GCF grant resources through three complementary windows. The Grant Facility operates as an on-granting financial mechanism designed to fund marine ecosystem restoration, fisheries management, alternative livelihood support, and coastal waste management for climate mitigation and adaptation. The Grant Facility is managed by Konservasi Indonesia (KI) as the Executing Entity, with technical support from technical partners. For Windows 1 and 2, the Grant Facility issues cash sub-grants to civil society organizations, community groups, cooperatives, and other eligible entities. For Investment Readiness, the Facility provides technical assistance and services procured directly by KI to strengthen institutional capacity and address critical knowledge gaps that currently deter private investment in the region.
The Facility consists of three investment windows:

1) Window 1 (Adaptation): Supports community-led adaptation interventions in four thematic areas: ecotourism development, collaborative MPA management, sustainable and diversified fishing livelihoods, and sustainable waste management. Grants are offered through open, competitive calls for proposals. Technical assistance is provided to grantees throughout the project cycle by a dedicated Technical Partner (Penabulu).
2) Window 2 (Mitigation): Supports restoration of mangroves and seagrass, and deployment of small-scale renewable energy technologies. As with Window 1, grants are issued through open,

competitive calls for proposals. The window is expected to deliver significant GHG emission reductions while improving livelihoods and ecosystem resilience.

3) Investment Readiness: Provides technical assistance through two complementary interventions: (i) development of action-oriented research papers on blue economy market gaps and investment opportunities, and (ii) technical assistance to BLU LPMUKP, the government's microcredit provider for the marine and fisheries sector, to strengthen its operational capacity, thereby expanding affordable credit access to small-scale fishers and fish farmers. Unlike Windows 1 and 2, the Investment Readiness does not issue cash sub-grants to enterprises, instead, KI procures specialized service providers and consultants to deliver technical assistance, develop research papers, and provide capacity building.

A key design feature of the Grant Facility is its ability to support continuous learning and adaptive management. Past efforts to sustain community-level climate action have often faltered due to limited follow-up and weak institutional linkages. For Windows 1 and 2, the Grant Facility issues cash grants (medium up to USD 400,000; small up to USD 40,000) through open calls for proposals, with eligibility criteria and procedures detailed in Annex 26 and Annex 27. Technical assistance is provided to grantees through a dedicated Technical Partner (Penabulu).

6.2.3 Enhancing Data Collection for Marine Ecosystem Protection and Sustainable Fisheries Management

Effective marine ecosystem protection and sustainable fisheries management in WPP 572 are currently hindered by inadequate, outdated, and fragmented data on fish stocks, habitat conditions, and socio-economic drivers. Stakeholder consultations identified that existing data collection protocols are costly, rely on limited enumerator capacity, and are not systematically integrated into management decisions. Without accurate, timely, and accessible data, fisheries harvest strategies cannot be reliably set, MPA effectiveness cannot be properly evaluated, and the protection-production (PnP) model cannot function as intended. Strong data collection and management are essential for effective fisheries management and for coastal and marine protection, ensuring biodiversity and climate-resilient ecosystems, as well as providing sustainable marine resources for communities and commercial enterprises. BEAM will provide targeted grant-based technical assistance (TA) geared towards improving data collection practices within the region, to contribute to monitoring and use data for local decision-making.

6.3 BEAM's Theory of Change

BEAM's transformative approach is based on the premise that structured and targeted support in regulatory, policy, and market frameworks for innovative blue protection and production will create an enabling environment conducive to developing climate finance solutions to existing barriers. Its Theory of Change is presented below.

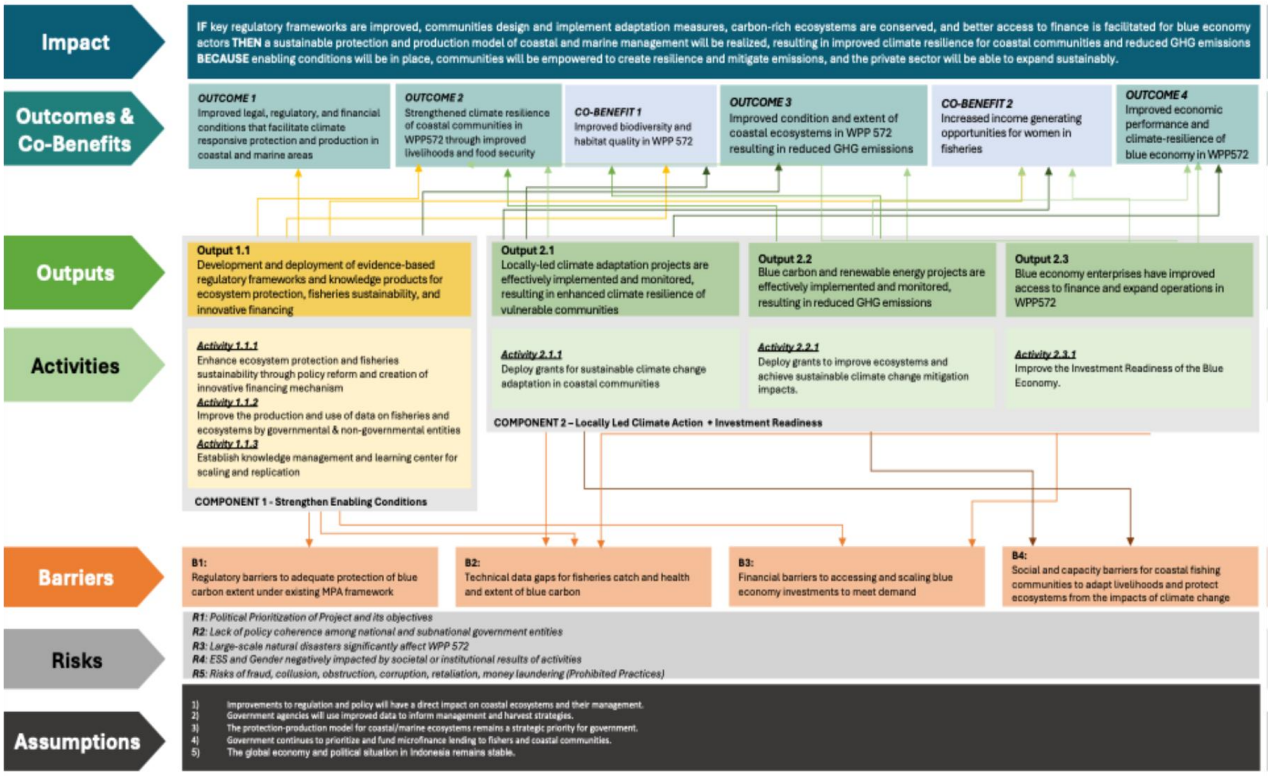


Figure 64. Diagram Showing the BEAM Theory of Change

The theory of change follows this logic:

IF key regulatory frameworks are improved, communities design and implement adaptation measures, carbon-rich ecosystems are conserved, and better access to finance is facilitated for blue economy actors **THEN** a sustainable protection and production model of coastal and marine management will be realized, resulting in improved climate resilience for coastal communities and reduced GHG emissions **BECAUSE** enabling conditions will be in place, communities will be empowered to create resilience and mitigate emissions, and the private sector will be able to expand sustainably.

Following this theory of change, BEAM's design is structured around two interrelated strategies, hereafter referred to as ‘components’:

Component 1: Strengthen enabling conditions

Component 2: Locally Led Climate Action + Investment Readiness

The combination of the enabling environment support of Component 1 and the grant windows under Component 2 (see below) aims to deliver well-prepared investments and sustainable solutions in the blue economy that will have a far-reaching impact. By addressing barriers within the enabling environment, supporting pilot investment readiness, focusing on climate change adaptation financing to enhance community resilience, and aligning with activities to unlock innovative blue finance instruments in the future, BEAM aims to contribute significantly to achieving the following key desired outcomes in WPP 572 (as shown in the theory of change):

- Outcome 1: Improved legal, regulatory, and financial conditions that facilitate climate responsive protection and production in coastal & marine areas.
- Outcome 2: Strengthened climate resilience of coastal communities in WPP572 through improved livelihoods and food security.

- Outcome 3: Improved condition and extent of coastal ecosystems in WPP572 resulting in reduced GHG emissions.
- Outcome 4: Improved economic performance and climate resilience of blue economy in WPP572.

Component 1 and Component 2 are closely linked, designed to interact and support each other, creating synergies across grant cycles. Component 1 establishes the enabling conditions for the protection and production concept, focusing on the blue economy, climate mitigation, and adaptation. Meanwhile, Component 2 serves as the practical application, testing and validating the effectiveness of these enabling conditions through tangible examples and the generation of lessons learned. The success of each component is interdependent with the goal of demonstrating a model that can be scaled nationally and implemented in other WPPs and marine conservation areas.

Furthermore, BEAM will actively contribute to the achievement of the following two co-benefits, which will be actively tracked during implementation (as shown in the above theory of change):

- Co-benefit 1: Improved biodiversity and habitat quality in WPP 572.
- Co-benefit 2: Increased income generating opportunities for women in fisheries.

This integrated strategy will ensure that the project not only addresses its primary outcomes but also enhances broader environmental and social benefits within the targeted region.

6.4 BEAM Components and Activities

6.4.0 Component 1: Strengthen Enabling Conditions

6.4.0.1 Overview

Component 1 aims to create enabling conditions and innovative financing for long-term ecosystem protection and sustainable fisheries management improvement through regulatory, data-oriented, and capacity building efforts to national and sub-national governments. Addressing the country's regulatory barriers and data gaps in coastal and marine ecosystems and fisheries is essential.

The goal of this component is to create an enabling environment for scaling investment in integrated protection and production models. This involves the promotion of innovative financial instruments to achieve national development goals, address climate-induced impacts on the blue economy, and advance climate adaptation and mitigation efforts. This will be achieved by:

1. Providing adequate resources and capacity building to government entities to support the alignment of national and subnational development plans with spatial planning, targeting specific policies to develop blue financing guidance at central and provincial levels as depicted below.

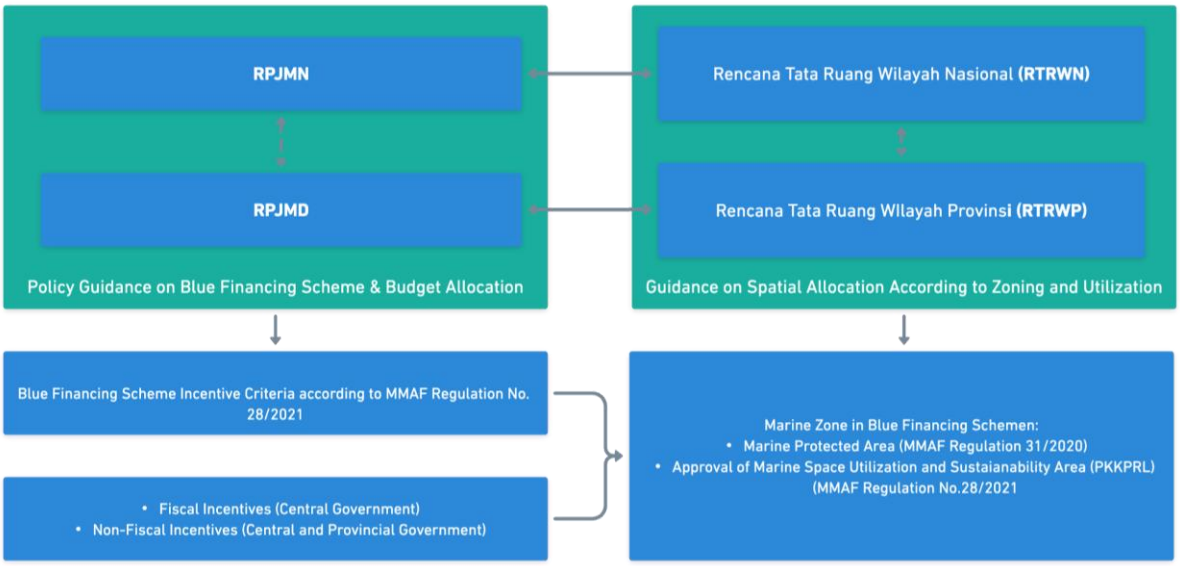


Figure 65. National and Subnational Development Plans and Spatial Plan

2. The overarching need to manage the process of data collection in the fisheries sector to enable appropriate quota setting and other regulatory tools for sustainable fisheries management is critical for climate-sensitive budgeting and planning for the blue economy sector. Equally important is developing comprehensive frameworks for gender equality and social inclusion (GESI), through targeted surveys that in the fisheries sector that more accurately reflect climate impacts, and adaptation needs of women and other socially vulnerable groups playing active, often undervalued, roles in fisheries.
3. Improving understanding of climate impacts on the fisheries sector. For example, Presidential Regulation No. 98/2021 focuses on the economic valuation of carbon, emphasizing the green sector while recognizing the blue carbon sector as secondary. This conflicts with the integration of the blue economy framework under the Environmental Fund Service Agency (BPDLH), which manages the broad spectrum of forestry and marine sectors, including carbon trading. Yet, the MMAF has not issued regulations to harmonize blue economy financing with BPDLH strategies. Given BPDLH's jurisdiction over marine and fisheries funds and the complexity of blue carbon valuation, additional policy guidance is needed.
4. Strengthening data relating to blue carbon resources. Given the prevailing gaps in regulations that detail the technical aspects of blue carbon's economic valuation, there exists a pressing need for the intervention of the MMAF on collection and management of blue carbon data. This can be achieved by collaboration of extensive engagements with a diverse array of stakeholders, encompassing donors, philanthropists, investors, and the broader private sector with the active participation of government to develop a blue economy taxonomy and supporting regulations.
5. Promoting best practices for strengthening mitigation efforts, including ecosystem restoration and protection. Funding for MPA management that addresses mitigation, restoration and protection of biodiverse carbon resources can come from the state budget, regional budget, or other legal sources as specified in relevant laws and regulations.[381] This provision is aligned with the forthcoming Presidential Regulations on Blended Finance for Fisheries and Marine Ecosystems which seek to institute governance structures for a blended financing mechanism that strengthen the blue economy

[381] Art. 47 of MMAF Regulation No. 31/2020 on Conservation Area

agenda, with a particular focus on sustainable fisheries and the management of marine protected areas.

These activities collectively aim to address regulatory, technical, and financial barriers that currently impede the transition to a sustainable blue economy, which will lay the foundation for subsequent grant-based support under Component 2.

The following paragraphs summarize the main activities envisaged under Component 1.

National Coordination and Engagement with Related Ministries: Component 1 of BEAM will engage key ministries (MMAF, CMFA, and Bappenas). Collaboration with MMAF and BAPPENAS will aim to align Indonesia's Marine Policy with national strategic plans, thereby enhancing climate change mitigation and adaptation efforts in the marine sector. The partnership with MoE, alongside MMAF, will focus on identifying and implementing potential climate change mitigation and adaptation strategies within the marine sector.

Additionally, BEAM will engage with the Coordinating Ministry for Food Affairs (CMFA) to address overlapping and sometimes conflicting climate change mitigation efforts across various national government sectors, including energy, agriculture, forestry, and waste management. This ministry will play a central role in managing the coordination of relevant ministries involved in national-level climate change policy. Efforts will concentrate on improving the capacity of these coordinating ministries to manage inter-sectoral conflicts, ensuring a more integrated and cohesive approach to climate change mitigation and adaptation measures. This strategy aims to align policies and enhance the effectiveness of climate change actions at the national level.

Aligning National and Sub-National roles and financing responsibilities: Building on the foundational work with ministries, Component 1 will tackle the current misalignment in the roles and financing responsibilities of national and sub-national related to the protection of MPAs and Other Effective Area-Based Conservation Measures (OECMs). Currently, the central government oversees marine and fisheries regulations, while sub-national governments manage social and economic activities. Yet, following the Omnibus Law on Job Creation, local governments can no longer pursue loan schemes due to the removal of Article 300 from Law No. 23/2014 on Regional Government. This change prevents the provincial government from accessing environmental loans like sustainable linked loans (SLL). In this context, it is crucial to regulate the Revenue Sharing Scheme, like the Reforestation Funding scheme, ensuring various parties can engage in coastal adaptation efforts. The absence of sustainable revenue sources, coupled with limited budgets and capacity, presents long-term financing challenges for both levels of government in the restoration and conservation of vital ecosystems while addressing this financing gap. Component 1 will seek to tackle this issue.

Improving marine ecosystems and fisheries data collection and management: The lack of comprehensive data on marine ecosystems and fisheries is a significant barrier to effective MPA and fisheries management. Component 1 (Activity 1.1.2) of BEAM will address this by improving data collection processes through collaboration with partners (e.g., NGOs/CSOs, local universities). This collaborative effort aims at enhancing scientific accuracy of both onshore and offshore fisheries data and improving overall management practices. A key element of this component includes establishing an appropriate database management system to account for the broader impacts of climate change.

Additionally, Component 1 will conduct standardized GESI surveys. These surveys are expected to reflect the roles of women and other vulnerable groups, informing better planning and management. The findings will guide the adoption of climate-resilient and sustainable practices, shaping regional and local policies around data collection and fisheries practices.

Community involvement, particularly in fishing communities, will be integral to these efforts. The expected outcome is improved data availability for setting sustainable fisheries quotas and supporting an ecosystem-based approach that aligns with the objectives of the blue economy.

Planning for finance barrier - Strengthening integrated blue protection-production planning: Component 1 will strengthen coastal and marine management planning and protection, at the provincial and local government levels. Specifically, the project will provide comprehensive support to fisheries data centers and government entities (also involving non-governmental fisheries data centers and marine policy expertise) to strengthen data production, updating, consolidation, and the effective utilization of data on fisheries and relevant coastal and marine ecosystems.

Through the implementation of the Component 1, the BEAM Project will support the development, improvement, or enactment of eleven (11) regulatory frameworks and policy documents at both national and sub-national levels. These policy outputs are designed to address specific regulatory gaps, strengthen institutional capacity, and create the enabling conditions necessary for effective ecosystem protection, sustainable fisheries management, and innovative blue financing as follows:

a. Provincial SOP/Guideline on Blue Economy Development, Sustainable Fisheries, and Marine Conservation (2 policies at each North Sumatra and West Sumatra Provinces). This provincial-level Standard Operating Procedure (SOP) or guideline will provide a comprehensive framework for the implementation of blue economy principles in North Sumatra and West Sumatra Provinces. It will translate national policies and strategies into actionable, context-specific guidance for provincial and district government agencies, covering key areas including sustainable fisheries management, marine ecosystem protection, ecotourism development, and community engagement. The guideline will establish clear procedures, roles and responsibilities, and performance indicators to ensure effective coordination across government entities and stakeholders in advancing their blue economy transition.

b. National-Level Policy Recommendation for Public-Private Partnership (PPP) Mechanism in MPA Management (1 policy). This policy recommendation will provide the basis for establishing a comprehensive PPP framework for MPA management in Indonesia, led by the Ministry of Marine Affairs and Fisheries (MMAF) and implemented through provincial Marine and Fisheries Agencies (DKPs). The recommendation will address key regulatory barriers to private sector investment in MPA management, including unclear legal and institutional frameworks, limited incentive structures, and the absence of standardized PPP guidelines for conservation areas. The policy will outline mechanisms for inclusive investment, sustainable access to marine resources, and improved infrastructure for fisheries and tourism, while ensuring that local communities benefit from private sector engagement. This policy output is expected to catalyze private capital into blue economy businesses, benefiting communities adjacent to MPAs and indirectly enhancing food security and diversified livelihoods across Indonesia's coastal villages.

c. MPA Establishment and Management Policy Documents (6 policies; 2 at each targeted 3 new MPAs). The BEAM Project will support the establishment, expansion, and improved management of Marine Protected Areas in WPP 572. At the national level, a ministerial decree will formally designate a new Large-Scale MPA, contributing significantly to Indonesia's MPA Vision 30x45 target of conserving 30% of its territorial waters by 2045. At the provincial level, two gubernatorial decrees will expand the provincial MPAs in North Sumatra and West Sumatra Provinces. Complementing these designation documents, MPA zoning plans will be developed for both National MPA (LSMPA) and the 2 provincial MPAs, in alignment with MMAF Regulation No. 31/2020.

d. Harvest Strategy for Pelagic Fisheries in WPP 572 (1 policy). This technical document will establish a science-based Harvest Strategy for pelagic fisheries in WPP 572, including a Harvest Control Rule (HCR) that defines management actions in response to the status of fish stocks. The Harvest Strategy will support the implementation of Indonesia's quota-based fisheries policy, ensuring that fishing levels are sustainable and consistent with ecosystem health and climate resilience objectives. The document will be developed through technical consultations involving fisheries scientists, government agencies (particularly MMAF), and stakeholders, and will be integrated into the broader Fisheries Management Plan (*Rencana Pengelolaan Perikanan* - RPP) for WPP 572. The Harvest Strategy will address the specific vulnerabilities of pelagic species to climate change and incorporate adaptive management mechanisms.

e. Sustainable Blue Financing Mechanism (1 policy). This policy will provide a framework for establishing and operationalizing sustainable blue financing mechanisms for MPAs and coastal management, with a particular focus on the development of Regional Public Service Agency (*Badan Layanan Umum Daerah* - BLUD) status for MPA management units. The policy will cover legal and regulatory requirements, institutional arrangements, revenue generation models (e.g., entrance fees, tourism levies, ecosystem service payments), financial management procedures, and reporting requirements. By enabling MPAs to retain and reinvest revenue generated from services, the BLUD mechanism will create a self-sustaining financing model that reduces long-term reliance on government budget allocations and external donor support.

6.4.0.2 Activity 1.1.1. Enhance ecosystem protection and fisheries sustainability through policy reform and creation of innovative financing mechanisms

The assessment on national and provincial climate policy in Indonesia reveals the fragmented nature of climate-related regulations across sectors (Please refer to Section 4). Law no. 25/2004 mandates that the RPJPN and RPJMN provide guidelines that must be adopted by each province and regency/city through RPJPD and RPJMD. Activity 1.1.1 facilitates the integration of climate change considerations into regional strategic plans (Renstra) and development plans (RKP) by involving key stakeholders to foster collaborative responses to climate change in marine and coastal areas. This activity also involves identifying key regional stakeholders and budgetary priorities to support partnership-building and explore potential funding opportunities for the Blue Halo S initiative.

By 2023, MPAs within PP 572 exceeded 1.3 million ha. The goal is to expand MPA coverage within WPP 572 to 3 million ha by 2030, contributing to the national targets of 32.5 million ha by 2030 and 97.5 million ha by 2045. To date, GoI has secured only 14% of the USD 700 billion required for establishing and managing MPAs nationwide. Activity 1.1.1 addresses this gap by developing innovative financing mechanisms, including development of Public-Private Partnership (PPP) frameworks for MPAs and the establishment of Regional Public Service Agencies (BLUD – *Badan Layanan Umum Daerah*) that can retain and reinvest revenues from tourism fees and other resources.

The project will enhance surveillance practices for local government agencies and local community surveillance groups (POKMASWAS - *Kelompok Masyarakat Pengawas*) in MPAs. With improved capacity, surveillance, and funding, it is expected that violations or non-compliance with MPA regulations will be better addressed and able to be prosecuted. In principle, MPA Management Units supported by the Project will enforce MPA regulations, but depending on the severity of non-compliance or violation and the area radius (under 12 nautical miles falls under the provincial government's authority), either the local government (i.e., the MPA management unit and the local fishery office) or the national government (i.e, Ministry of Marine Affairs and Fisheries and the law enforcement agencies) will impose penalties.

To ensure inclusion of participation, Activity 1.1.1 will not only engage a GEDSI consultant and develop inclusive communication materials but will also employ participatory tools tailored to ensure meaningful participation of vulnerable groups. These will include focus group discussions and gender-sensitive facilitation approaches. The project will work closely with local leaders, community-based organizations, and existing women's networks to ensure meaningful consultation and representation in the policy integration, MPA designation, and fisheries management plan reinforcement processes.

Activity 1.1.1 targets technical staff from the MMAF, CMFA, and other relevant government and technical consultants, and consists of four sub-activities.

Sub-Activity 1.1.1.1 Provide technical assistance to provincial governments for effective implementation of national vision and policies

This sub-activity aims to assist national and sub-national government entities to overcome key barriers in marine and coastal ecosystem management, fisheries, and blue economy development. These barriers often stem from the challenges faced by local governments in translating national vision and policies into local action level, including those policies and regulations that increase land degradation and water / waste runoff into critical ecosystems. Local governments often hesitate to allocate budgetary resources to marine conservation and fisheries management initiatives aligned with the national vision because they lack clarity on the targets their districts, regions, or provinces need to achieve, and the potential benefits of attaining these targets. Consequently, this sub-activity responds to an urgent need within local government institutions.

Importantly, these interventions are designed with replication in mind. Because they follow nationally recognized policy formats (e.g., MMAF regulations), other provinces can adopt and adapt these instruments with minor adjustments according to local contexts. This not only enhances the scalability of the intervention but also ensures alignment with Indonesia's broader marine and climate policy framework, thereby extending the project's impact well beyond the initial target areas.

This sub-activity will focus (but not be limited) on two key provinces within WPP 572: North Sumatra and West Sumatra. These provinces are prioritized due to their significant biodiversity and their role as oceanic carbon sinks. In North Sumatra, KI is leveraging established site offices and existing relationships to enhance the effectiveness of the project's implementation. KI will collaborate with key government stakeholders in these two provinces, including the Regional Planning Development Agency (Bappeda), the Regional Marine and Fisheries Agency (DKP), and the Investment Board One-Stop Service (DPMPTSP), along with the national government stakeholders (i.e. the Coordinating Ministry for Food Affairs, MMAF, Bappenas, and the Ministry of Home Affairs). KI, with the support of consultants, will conduct consultative and capacity building workshops, as well as providing technical assistance to government staff undertaking policy analysis to harmonize the national vision and national policies within the Mid-Term National Development Plan (RPJMN) 2025-2029 related to marine conservation, fisheries management, and the blue economy sector.

Implementation Phase for Sub-activity 1.1.1.1

The following outlines the primary focus for each year:

Year 1 – Initiation and Kick-off Phase.

The first year will initiate critical steps to support the integration of regional and national development plans focusing on the Blue Economy, Fisheries, and Marine Protected Areas (MPAs). The key activities are:

Consultant Mobilization: Hiring and deployment of consultants in the targeted provinces (North Sumatra and West Sumatra) by the first quarter to begin formulating policy recommendations.

Kick-off Meeting: A kick-off meeting with local and national governments will be held to align expectations, introduce the consultant teams, and confirm work plans for both provinces.

Policy Development: By year-end, consultants will produce draft policy recommendations for each province in North Sumatra and West Sumatra.

Meetings and Workshops: An initial kick-off workshop and a training workshop on BlueEconomy, Fisheries, and Marine Conservation will be conducted, each accommodating 50-60 participants. Additionally, a technical meeting per province will discuss policy recommendations at the provincial level, each accommodating 30 participants.

Year 2 – Policy Formulation and Consultation Phase.

This year focuses on advancing the development and consultation of policy recommendations:

Policy Development Continuation: Consultants will continue to develop policy recommendations for each province in North Sumatra and West Sumatra.

Consultative Meetings: *A* technical meeting per province will be held in each province to discuss and refine the policy recommendations, with technical meetings accommodating 30 participants.

Year 3 – SOP/Guidelines Development Phase.

The third year extends the focus to implementing policies and enhancing capacity for sustainable marine conservation practices:

Standard Operating Procedures/Guidelines Development: Depending on provincial needs, SOPs or Guidelines related to Blue Economy, Sustainable Fisheries, and Marine Conservation will be drafted.

Consultative and Technical Meetings: Continuation of technical meetings as in Year 2, with additional meetings to discuss the newly developed SOPs/Guidelines, each accommodating 50 participants.

Year 4 – SOP Finalization Phase.

Activities from Year 3 will continue, focusing on finalizing the policy recommendations and SOPs/Guidelines:

Final Policy Recommendations and SOP/Guidelines: Finalization of all policy documents and guidelines based on ongoing feedback and provincial needs.

Consultative and Technical Meetings: Continued series of technical and public consultation meetings to finalize and refine policies and guidelines, with the same participant accommodation as in previous years.

Year 5 – Finalization and Implementation Phase.

The final year will emphasize the implementation and monitoring of developed policies and SOPs/Guidelines.

Implementation of SOP/Guidelines: Final SOPs/Guidelines will be enacted by the head of relevant agencies.

Ongoing Support and Monitoring: Ensuring the effective adoption and application of policies and practices across the provinces.

Meetings and Workshops: Continued engagement through technical and public consultation meetings to support and refine the implementation process, accommodating the same number of participants as in previous years.

Deliverables for Sub-activity 1.1.1.1

- Technical meetings, trainings, and consultation workshops on Blue Economy, Fisheries, and Marine Conservation are conducted with key government stakeholders at national and provincial levels in North Sumatra and West Sumatra.
- Policy recommendations for provincial government regulatory frameworks and policies produced for the provinces of North Sumatra and West Sumatra.
- Provincial level SOP/guidelines on Blue Economy, Sustainable Fisheries, and Marine Conservation are developed at North Sumatra and West Sumatra Provinces.

Sub-activity 1.1.1.2. Support the development, gazettement, and management of new and existing MPAs and Other Effective Area-based Conservation Measures (OECMs)

This sub-activity aims to support national and sub-national entities to expand MPAs within WPP 572 and to achieve legal recognition of OECMs, contributing to the GoI MPA 30x45 commitment (to conserve 30% of territorial waters by 2045). This sub-activity will also support improvement the effectiveness of the management of existing MPAs in North Sumatra and West Sumatra provinces. This sub-activity will prioritize assistance in the development of one new national MPA and the development of new and/or expansion of two existing provincial MPAs within North Sumatra and West Sumatra provinces. Specifically, KI, with support of consultants, will conduct consultative and capacity building workshops and provide technical assistance to the key government stakeholders at national and provincial levels (i.e. MMAF and

the Regional Marine and Fisheries Agency), targeting: 1) the development of large-scale MPAs, approximately 9-12 million ha, 2) the expansion of existing MPAs in North Sumatra (e.g., MPA Muara Batang Toru covering approximately 70,000 ha), 3) the expansion of existing MPAs in West Sumatra (e.g., MPA Pulau Pagai Utara and Pulau Pagai Selatan covering approximately 643,000 ha), and 4) facilitating the legal recognition of OECMs. The targeted area is conservatively estimated at around 3 million ha; however, the actual area may vary based on ecological and socioeconomic surveys and public consultations. These factors will significantly influence the final designated size of the large-scale MPA.

This sub-activity will be implemented by Konservasi Indonesia (KI) with support from consultants and in close collaboration with MMAF and provincial Marine and Fisheries Agencies (DKP) to facilitate MPA expansion within WPP 572, which includes:

- Conducting ecological and socio-economic assessments to inform MPA zoning and management plans.
- Engaging local communities and stakeholders in consultations to finalize draft zoning and management plans.
- Assisting in the drafting process for legal designation of new MPAs (initiation, zoning, establishment decrees).
- Developing MPA management bodies in two targeted provinces within WPP 572.
- Conducting annual evaluations of MPA management effectiveness using the EVIKA tool.
- Strengthening surveillance practices through training and the development of patrolling SOPs for local government agencies and community surveillance groups (POKMASWAS).

Implementation Phase of Sub-activity 1.1.1.2

The following outlines the primary focus for each year.

Year 1 – Groundwork and Initial Expansion Phase.

The first year is focused on establishing the legal and operational foundation for MPAs. The key activities are:

Establishment of Working Groups: Form working groups for targeted new/expansion MPAs at national and provincial levels. Initial workshop/meetings to develop working groups for new MPAs.

Technical Meetings: Conduct technical meetings to discuss MPA initiation and MPA zoning plans. Technical meetings for Pokja to develop new provincial MPA initiative documents.

Evaluation of MPA Management: Utilization of the EVIKA tool by MMAF for ongoing evaluations in North Sumatra and West Sumatra. Two comprehensive reports will be compiled by year-end.

Training Workshops: Training workshops on MPA and sustainable fisheries management, and on MPA surveillance practices will be held targeting local government agencies and local communities in North Sumatra and West Sumatra.

Legal Foundation for New MPA Establishment: By year-end, the *Pokja* will develop three drafts of MPA initiative documents for 1 national MPA and 2 provincial MPAs.

Year 2 – Documentation, Consultation, and Capacity Building Phase. This year focuses on finalizing MPA documents and evaluating management effectiveness:

Technical Meetings: Conduct technical meetings to discuss MPA initiation and zoning plans. Continue technical meetings to discuss the enactment of new provincial MPA designation decrees.

Finalization of MPA Initiative Documents: Completion of three final MPA initiative documents by mid-year, detailing frameworks for the establishment and management of national and provincial MPAs.

Evaluation of MPA Management: Utilization of the EVIKA tool by MMAF for ongoing evaluations in North Sumatra and West Sumatra. Two comprehensive reports will be compiled by year-end.

Consultative Meetings on MPA documents: Three public consultation workshops will be held in each targeted province (target for 2 provinces) and for 1 national MPA to gather input and refine the MPA management strategies, with technical meetings accommodating 20 participants and workshops 50 participants.

Consultative Meetings on MPA Surveillance SOP: Two technical meetings will be held in each targeted province (North Sumatra and West Sumatra) to develop the MPA patrolling/surveillance SOP.

Training Workshops: Continued training workshops on MPA and sustainable fisheries management, and on MPA surveillance practices will be held targeting local government agencies and local communities in North Sumatra and West Sumatra.

MPA-PPP Policy Initiation: Begin stakeholder consultations and research to develop a national-level policy recommendation for PPP (Public-Pirvate Partnership) mechanism for MPA management.

Year 3 – Legislative Development and Continued Evaluations.

The focus extends to enacting new legal frameworks and conducting further evaluations:

Technical Meetings: Continue technical meetings to discuss MPA zoning plans. Hold technical meetings to discuss the enactment of new provincial MPA establishment decrees.

Legislative Support for MPAs: Enactment of decrees at both national and provincial levels by mid-year to designate new MPAs.

Continued Evaluations: Further use of the EVIKA tool to evaluate MPA management effectiveness, with comprehensive evaluations documented.

Meetings and Workshops: Continued series of technical meetings to discuss the enactment of decrees and evaluate MPA management, each accommodating 25 participants.

Consultative Meetings on MPA Surveillance SOP: Continued technical meetings and one public consultation will be held in each targeted province (North Sumatra and West Sumatra) to develop the MPA patrolling/surveillance SOP.

MPA-PPP Policy Development: Draft national-level policy recommendation for PPP mechanism for MPA management, incorporating lessons learned from provincial MPA management experiences.

Year 4 – Zoning Plans and Management Strategies.

Activities focus on developing zoning plans and updating management strategies:

Technical Meetings: Continue technical meetings to discuss MPA zoning plans for new MPAs.

Development of Zoning Plans: Preparation of national and provincial MPA zoning plan documents. Alignment of these plans with regional zoning plans will be updated.

Evaluations and Reporting: Continued evaluations using the EVIKA tool to assess the effectiveness of MPA management.

Engagement and Consultation: Three public consultation workshops will be conducted for community feedback on national and provincial MPA zoning plans.

Year 5 – Finalization and Implementation.

The final year emphasizes the implementation of the developed zoning plans and the continuous evaluation of MPAs:

Technical Meetings: Conduct final technical meetings to discuss MPA zoning plans and enactment decrees.

Public Consultation Workshops: Conduct final public consultation workshops for MPA zoning plans.

Technical Meetings on Enactment: Hold technical meetings to discuss the enactment of new provincial MPA establishment decrees

Implementation of Zoning Plans: Final zoning plans will be enacted by the heads of relevant agencies.

Ongoing Evaluation and Reporting: Continued use of the EVIKA tool for comprehensive evaluations of MPA management effectiveness.

Finalization of MPA Establishment: Complete legal establishment process for one new national MPA and two new/expanded provincial MPAs.

Deliverables for Sub-activity 1.1.1.2

- MPA-related interventions for 1 new national MPA and 2 new provincial MPAs, that comply with MMAF regulation No.31/2020 are facilitated (including working group development, technical meetings, document development, and enactment of decrees).
- A national-level policy recommendation to establish a Public-Private Partnership (PPP) mechanism for Marine Protected Area (MPA) management is developed.
- Evaluations of MPA management effectiveness by MMAF using EVIKA are facilitated for MPAs within North Sumatra and West Sumatra Provinces is performed
- Strengthening and enhancing surveillance practices for MPAs within North Sumatra and West Sumatra Provinces, including awareness-raising for local communities and fishers, and training on surveillance practices for local government agencies and community surveillance groups (POKMASWAS) are organized.

Sub-activity 1.1.1.3. Reinforce the current Fisheries Management Plan (Rencana Pengelolaan Perikanan - RPP), including its Fisheries Harvest Strategy at WPP 572.

This sub-activity will be key to ensure that the Fisheries Management Plan for WPP 572 and the associated Fisheries Harvest Strategy documents effectively contribute to reducing fish exploitation and promoting inclusive and sustainable management of fisheries resources. As emphasized in the discussion of the climate context (see **Section B.1**), fish stocks in WPP 572 are among the most overexploited in Indonesia. KI, with support from consultants, will organize workshops with the Fisheries Management Unit in WPP 572 to comprehensively address the challenges encountered in implementing various plans, strategies, and regulations in this regard. Based on the identified implementation challenges that emerge from these consultations, KI will provide technical assistance to the Fisheries Management Unit, in the form of a report recommending solutions to the identified fisheries management implementation barriers.

This sub-activity will focus on strengthening the implementation and institutional integration of the existing Fisheries Management Plan (RPP) and Harvest Strategy for WPP 572. Specifically, the project will: improve data inputs and stock assessment tools that underpin the Fisheries Management Plan (FMP) for WPP 572, build capacity of provincial-level institutions to enforce quotas and sustainable harvest levels, and align FMP implementation with MPA expansion. This reinforcement will ensure that fisheries management is both climate-responsive and aligned with conservation efforts, directly contributing to Component 2 adaptation and mitigation objectives.

Implementation Phase of Sub-activity 1.1.1.3

The following outlines the primary focus for each year.

Year 1 – Foundational Steps for Sustainable Fisheries Management.

The initial year focuses on laying the groundwork for sustainable fisheries management in the WPP 572 region. The activities include:

Establishment of Harvest Strategy Working Group: A working group, Pokja, is formed to develop Harvest Strategies for key fisheries.

Consultant Mobilization: Engage a Fisheries Policy Consultant to support strengthening of fisheries management plans and harvest strategies, with ongoing technical input throughout project implementation.

Socialization and Awareness Workshops: Workshops to raise awareness about sustainable fisheries practices are conducted, targeting both government and non-government stakeholders.

Training Workshops on Harvest Strategy Development: Conduct training workshops on Harvest Strategy development and evaluation

Year 2 – Capacity Building and Strategy Formulation.

This year aims to enhance stakeholder capacities and engagement in sustainable fisheries management practices.

Continued Fisheries Policy Consultant Support: Maintain engagement of Fisheries Policy Consultant.

Continued Socialization and Awareness: Workshops continue to provide a platform for enhancing understanding of sustainable fisheries management among diverse stakeholders.

Technical Meetings: Conduct technical meetings to discuss the fisheries harvest strategy for targeted fish commodities

Initiation of HS Document Development: The process begins to develop the Harvest Strategy document for targeted fisheries, with technical meetings planned to refine strategies. The harvest strategy will be formulated in the MMAF's regulation to ensure its sustainability and practice in the areas of WPP 572.

Year 3 – Enhanced Capacity Building.

Focus continues on strengthening stakeholder capacities and evaluating the Harvest Strategy document.

Continued Fisheries Policy Consultant Support: Maintain engagement of Fisheries Policy Consultant.

Ongoing Socialization and Awareness: Workshops are conducted to further promote sustainable fisheries management.

Continued Training on HS Development: Training sessions remain focused on enhancing the capability of stakeholders to develop and implement Harvest Strategies.

Harvest Strategy Document Completion: Finalize the Harvest Strategy (HS) document for targeted fish commodities (pelagic fishes) of WPP 572.

Year 4 – Harvest Strategy Evaluation.

Strategic meetings and workshops are organized to evaluate an effective Harvest Strategy.

Continued Fisheries Policy Consultant Support: Maintain engagement of Fisheries Policy Consultant.

Technical Meetings and Evaluation workshop: Two technical meetings and a workshop are held to evaluate the Fisheries Management Plan and the Harvest Strategy implementation for the targeted fish commodities.

Implementation Support: Provide technical assistance to the Fisheries Management Unit to address implementation challenges identified through consultations.

Year 5 – Effective Implementation and Sustainability.

The final year marks the effective implementation of the Harvest Strategy document.

Technical Meetings and Evaluation Workshop: Two technical meetings and a workshop are held to evaluate the Fisheries Management Plan and the Harvest Strategy implementation for targeted fish commodities.

Deliverables for Sub-activity 1.1.1.3

- A working group (Pokja) to develop a Fisheries Harvest Strategy (HS) for targeted fish commodities in WPP 572 is established.
- Workshops and technical meetings on socialization and awareness of sustainable fisheries management are organized.
- Trainings on Fisheries Harvest Strategy development are organized.
- A Harvest Strategy (HS) document for targeted fish commodities (i.e., pelagic fishes) of WPP 572 is developed and effectively implemented.

Sub-activity 1.1.1.4. Advance sustainable blue/green finance through the development of innovative financing mechanisms and the development of policies related to integrated protection–production and sustainable funding resources

This sub-activity will be key to establishing a sustainable blue financing mechanism for longer-term blue economy investments focusing on either North Sumatra or West Sumatra province. KI will collaborate with key government stakeholders, including Bappeda, DKP, and the Investment Board One-Stop Service (DPMPTSP), along with national government stakeholders (i.e. MMAF and the Ministry of Home Affairs). KI will provide consultative and capacity building workshops and technical assistance for relevant government staff at national and provincial levels.

Focused on the design and piloting of sustainable financing mechanisms to support long-term MPA management at the provincial level. The project will establish and operationalize BLUDs in selected provinces, which are legally recognized public service units with the authority to collect, retain, and reinvest revenues (e.g., from entry fees, tourism services) into conservation activities; and develop policies and technical guidelines (SOPs) at the provincial level for BLUD operations and financial governance.

Implementation Phase for Sub-activity 1.1.1.4

The following outlines the primary focus for each year:

Year 1 – Initiation Phase.

The first year is focused on establishing the foundation for sustainable blue financing initiatives either in North Sumatra or West Sumatra provinces.

Stakeholder Engagement: Organize meetings with provincial government stakeholders on sustainable blue financing mechanisms at North Sumatra or West Sumatra.

Knowledge Sharing Sessions: Conduct sessions to disseminate best practices and insights on BLUD establishment and operationalization.

Establishment of BLUD Pokja: Form a working group including experts from the Department of Fisheries and universities to draft decrees for BLUD implementation.

Year 2 – Capacity Building Phase.

This year aims to formalize structures that support sustainable blue financing, focusing on BLUD development.

Knowledge Sharing Sessions: Continue sessions to disseminate best practices and insights on BLUD establishment and operationalization.

Workshop Training for BLUD Staff: Conduct workshop training for BLUD staff to support improvement of BLUD operationalization.

Year 3 – Technical Document Development and Approval Phase.

Focus shifts to develop essential technical documents and secure endorsements necessary for effective BLUD operation.

Learning Exchange for BLUD Provincial Government: Facilitate learning exchanges to enhance understanding and proficiency of BLUD staff and provincial stakeholders, drawing on experiences from established BLUD operations.

Knowledge Sharing Sessions: Continue sessions on BLUD best practices and insights.

Technical Meetings: Organizing meetings to develop and review documents, with each session designed to foster detailed discussions and finalizations.

BLUD Establishment by Governor Decree: Facilitate the enactment of governor decrees to institutionalize the BLUD framework, culminating in the formal establishment of new BLUDs.

Year 4 – Final Endorsement and Approval Phase.

The final year focuses on completing the BLUD establishment process and ensuring sustainability.

Transition to Provincial Government Ownership: Ensure provincial governments have the capacity and legal frameworks to manage BLUD operations independently.

Knowledge Sharing Sessions: Continued sessions to disseminate best practices and insights on BLUD operationalization.

Capacity Building for BLUD Staff on Grant Access: Conduct targeted training for BLUD staff on how to access the BEAM Grant Facility. This training aims to equip BLUD staff with the skills to secure additional funding for MPA management and blue economy initiatives beyond the project's duration.

Year 5 – Capacity Enhancement Phase.

The final year focuses on enhancing the capabilities of stakeholders involved in BLUD operations through targeted learning and knowledge-sharing initiatives.

Capacity Building for BLUD Staff on Grant Access: Conduct targeted training for BLUD staff on how to access the BEAM Grant Facility. This training aims to equip BLUD staff with the skills to secure additional funding for MPA management and blue economy initiatives beyond the project's duration.

Knowledge Sharing Sessions: Conducting sessions to disseminate best practices and insights on BLUD establishment and operationalization, promoting continuous improvement and effective governance.

Deliverables for Sub-activity 1.1.1.4

- 1 (one) Sustainable Blue Financing Mechanism for MPA, such as BLUD, is developed in the provinces either in North Sumatra or West Sumatra, and the following BLUD-related development is facilitated: development of working group (Pokja), capacity building for government stakeholders, and endorsement of the targeted mechanism by the provincial government.

6.4.0.3 Measuring Impact of Activity 1.1.1

The TA's effectiveness will be assessed based on the credibility and reliability of the outcomes reported by stakeholders involved. Mid-term and end targets (11 improved policies and frameworks) for regulatory framework strengthening will include detailed reporting on achieving qualitative improvements.

6.4.0.4 Activity 1.1.2. Improve the production and use of data on fisheries and ecosystems by governmental and non-governmental entities

In Activity 1.1.2 KI aims to contract major national level research institutions, such as the national oceanography institute (BRIN) to refine the approach to systematic data collection, establishing a baseline in the first year. BRIN has already produced documentation through COREMAP on seagrasses. University

research organizations and government fisheries research institutions will work with key government agencies to determine how to manage, update and house the resulting online data.

Fisheries data will be under MMAF at the national level. A Fisheries Data Collection Consultant will be hired to strengthen and institutionalize fisheries data systems across WPP 572. This consultant team will support the design, supervision, and quality assurance of data collection aligned with MMAF's national logbook system. While data collection will be carried out by trained enumerators from local universities, government staff, and community members, the consultant ensures scientific rigor, integration across sites, and coordination with stakeholders including MMAF, BRIN (Indonesia national research agency), Komnas Kajiskan (Indonesia national commissions for fishery stock assessment), and provincial governments.

Marine ecosystem and MPA-related data will be owned by the MPA management unit, which could be at the provincial or national level, depending on the designated authority for the MPA (e.g., Provincial Marine and Fisheries (DKP) for provincial MPAs, or National MPA Management Unit (under MMAF) for national MPAs).

Data collectors (enumerators) will be recruited from local universities within WPP 572, government fisheries staff, and community members trained under the project. They will be paid by the project during implementation, and efforts will be made to institutionalize their roles. Capacity building is one of the key elements needed to support institutionalizing their roles, which is included in Activity 1.1.2.

In terms of data housing and sustainability, all data will be stored within government systems (provincial DKP databases and MMAF national systems). This will be accompanied by the development of data governance frameworks in collaboration with MMAF and provincial authorities.

Other national level non-governmental organizations might be contracted to support training to strengthen the understanding of how this data can be used not just for improved fisheries management but also for advancing understanding of how this data relates to climate action. For example, Climateworks, with the support of the Asian Development Bank through the Southeast Asia Framework for Ocean Action in Mitigation (SEAFOAM) project, recently scoped ocean-based mitigation opportunities in Indonesia, exploring a range of coastal and offshore mitigation options. Recent data is needed on many marine and coastal ecosystems, for example, to see the Climateworks' analysis of existing data on seagrass collected as part of seafoam. By including seagrasses into NDCs monitoring and reporting frameworks and committing to protection and restoration, there is potential to mitigate 17–60 metric tons of carbon dioxide-equivalent ($MTCO_2e$) emissions by 2030.

map image removed

Figure 66. Seagrass locations across Indonesia

Figure 78 shows that while only a small fraction of seagrass locations have been verified, their actual extent might be substantial. This activity will enhance data collection and management processes concerning coastal ecosystems like seagrass beds, ultimately improving existing regulatory frameworks.

Sub-activity 1.1.2.1 Support the Government of Indonesia's existing data collection initiatives to improve and utilize data on ecological and socioeconomic in MPAs and for areas for potential MPA expansion and OECMs.

This sub-activity aims to strengthen monitoring and data management to ensure more inclusive ecological and socioeconomic data for MPAs and areas of potential MPA expansion and Other Effective Area-based Conservation Measures (OECM). KI will bolster the effectiveness of data collection procedures by leveraging science-based approaches. KI, with the support of consultants, will conduct consultative and capacity building workshops and provide technical assistance to the key government stakeholders at national and provincial levels (i.e. MMAF, the National Research and Innovation Agency, and the Regional Marine and Fisheries Agency). This sub-activity will be linked to Sub-Activity 1.1.1.2 (MPA/OECM

development and management) by providing essential data and will also aid in monitoring nature restoration activities under Component 2. Data will be made publicly available to all GoI ministries and agencies operating in the marine environment and will be stored within the MMAF and maintained by the relevant technical units.

The sub-activity, with the support of GIS consultants and survey enumerators, will initiate geospatial analysis to estimate the extent, health, and biodiversity of seagrass, mangroves, and coral reefs in WPP 572. Ground-truthing missions aim to validate the findings. And participatory workshops will validate the newly produced data and proposed methods.

Implementation Phase for Sub-activity 1.1.2.1

The following outlines the primary focus for each year:

Year 1 – Baseline Data Collection and Training Phase.

The initial year focuses on establishing baseline ecological and socioeconomic data for MPAs. Key activities include:

Consultant Mobilization: Recruitment and deployment of ecological and socioeconomic data collection consultants to conduct baseline assessments for one new MPA, including evaluations of mangroves, coral reefs, seagrass, and surrounding community livelihoods.

Data Collection: Initiation of data gathering efforts for both new and existing MPAs to obtain a detailed understanding of their ecosystems and socio-economic dynamics.

Training Programs: Development and execution of training initiatives aimed at equipping MPA technical units and local universities with the necessary skills to conduct surveys and analyze data.

Stakeholder Engagement: Conduct technical meetings with North Sumatra and West Sumatra provincial governments to develop MPA data management systems.

Year 2 – Data Management System Development Phase.

This year is dedicated to the development of a tailored data management system designed to enhance the management of MPAs in targeted provinces. Key activities include:

Stakeholder Engagement: Collaboration with local universities, MPA technical staff, and community representatives to ensure the effectiveness of data collection and training efforts.

Database improvement: Creation of a data management system that integrates collection, storage, and analysis processes.

Pilot Testing: Initial implementation and testing of the system in select MPAs to assess functionality and gather feedback for improvements.

Training and Capacity Building: Continuing education for MPA technical units on the use of the new data management system.

Year 3 – System Establishment and Integration Phase.

The focus this year is on fully establishing the data management system, which will support efficient decision-making processes within the MPAs. Key activities include:

Stakeholder Engagement: Collaboration with local universities, MPA technical staff, and community representatives to ensure the effectiveness of data collection and training efforts.

Full System Rollout: Complete implementation of the data management system across all targeted MPAs.

Data Integration: Consolidation of existing data into the new system to ensure continuity and enhance analytical capabilities.

Review and Adjustment: Evaluation of the system's performance and making necessary adjustments based on stakeholder feedback and system requirements.

Year 4 – Follow up Data Collection Phase.

This year concentrates on periodic ecological and socioeconomic data collection for existing MPAs. Key activities include:

Data Collection: Conduct periodic ecological and socioeconomic data collection for two existing MPAs, including ecosystem and community-level indicators, to support adaptive management.

Data Analysis and Reporting: Use of collected data to generate reports that inform management decisions and strategic planning within MPAs.

Stakeholder Workshops: Organization of workshops to discuss survey results and their implications for MPA management.

Strategic Planning Sessions: Conducting sessions to refine and update strategic plans for MPA management based on the latest data and trends.

Year 5 – Sustainability and Expansion Phase.

The final year emphasizes ensuring the sustainability and expansion of the initiatives established in previous years. Key activities include:

System Enhancements: Upgrades and enhancements to the data management system based on technological advancements and evolving MPA needs.

Knowledge Transfer: Ensure MPA technical units and local universities can independently conduct surveys and manage data systems.

Strategic Planning Sessions: Conducting sessions to refine and update strategic plans for MPA management based on the latest data and trends.

Deliverables for Sub-activity 1.1.2.1

- Monitoring and data management systems for ecological and socioeconomic data are strengthened through multi-stakeholders' meetings or workshops, and technical assistance.
- Training for the MPA technical unit and local universities to conduct ecological and socioeconomic surveys and data analysis is organized within the provinces of North Sumatra and West Sumatra.
- Data of ecological and socioeconomic for the new targeted MPAs (at the sub-activity 1.1.2) and existing MPAs within North Sumatra are gathered.

Sub-activity 1.1.2.2. Gather data on the targeted fish commodities (biodiversity, volume, spatial distribution) to support sustainable fisheries management within WPP 572

This sub-activity aims to improve monitoring systems for the targeted fish commodities within WPP 572. The objective is to enhance fisheries data collection by identifying target species, examining their distribution of biodiversity and volume, and identifying their landing sites. A robust data collection plan will be developed for sampling fisheries at pivotal landing sites. KI will provide technical assistance to the staff of MMAF and to the staff of the Fisheries Management Unit of WPP 572 (LPP WPP 572), including its local enumerators.

This sub-activity, delivered in the form of technical assistance to the FMU of WPP 572, to enhance target fisheries data collection. The goal is to identify target species in terms of their extent, biodiversity, and volume, and to designate key landing sites. The sub-activity will provide a reinforced data collection plan for sampling fisheries at these crucial landing sites. Enumerators from the FMU of WPP 572 will receive TA in a report highlighting improved and more cost-efficient data collection methods. It will propose a data collection plan for catching small pelagic species annually for five years.

To ensure the selection of relevant target species, this sub-activity will begin with a comprehensive frame of survey covering the waters of WPP 572. This initial step aims to meticulously assess the ecosystem and species composition, providing a solid foundation for informed decision-making regarding target species. However, our current priority is to focus on small pelagic target fisheries, especially those with insufficient data or information on their stock status.

Implementation Phase for Sub-activity 1.1.2.2

The following outlines the primary focus for each year:

Year 1 – Survey Design and Stakeholder Engagement Phase:

Stakeholder Engagement: Conduct technical meetings with MMAF and the Fisheries Management Unit (LPP WPP 572) to align on data collection objectives and methodologies.

Workshop Coordination: Organize workshops to socialize the fisheries data collection plan with relevant stakeholders.

Year 2 – Data Management System Development Phase:

Workshop Coordination: Organize workshops to socialize the fisheries data collection plan with relevant stakeholders.

Data Management System Development: Complement the monitoring efforts by developing a data management system tailored to the specific needs of fisheries within WPP 572. This system will facilitate the organization, storage, and analysis of collected fisheries data.

Year 3 – Continued Data Management System Development Phase:

Workshop Coordination: Organize workshops to socialize the fisheries data collection plan with relevant stakeholders.

Continued Data Management System Development: Complement the monitoring efforts by developing a data management system tailored to the specific needs of fisheries within WPP 572. This system will facilitate the organization, storage, and analysis of collected fisheries data.

Year 4 – Data Collection and Capacity Building Phase:

Fishery Data Collection: Fishery data collection for the whole WPP 572 area, focusing on small pelagic target species.

Training and Workshops: Conduct training and workshops to improve the fishery data collection system within MMAF (e.g., MMAF's fishery logbook data system).

Year 5 – Project Consolidation and Sustainability Phase.

Continued Data Collection: Finalize fishery data collection activities.

Fishery Stock Assessment: Complete stock assessment for targeted commodities.

System Evaluation and Final Adjustments: Evaluate the effectiveness of fishery monitoring and data management systems and implement final adjustments based on feedback and observed needs.

Deliverables for Sub-activity 1.1.2.2

- Improved and more sustainable fishery monitoring system (i.e., fish landing monitoring by KI and data collection using a logbook by MMAF is supported) for the targeted fish commodities and data management system for fisheries within the WPP 572.
- Training for enumerators (including government stakeholders) on fisheries' data collection and training on fisheries data analysis, including the fish stock assessment, are organized for the fishery's technical unit and its relevant stakeholders.

6.4.0.5 Measuring Impact

This initiative involves collaboration with multiple divisions within the Ministry of Marine Affairs and Fisheries (MMAF), including:

- The Directorate General (DG) of Marine Management, which oversees marine ecosystem management.
- The DG of Capture Fisheries, tasked with managing fisheries data.
- The DG of Research and Human Development, which supports the incorporation of research findings into data enhancement efforts.

Additionally, the project will leverage partnerships with the Indonesia Research and Innovation Agency and several national and local universities, including, but not limited to IPB University, Universitas Indonesia, Universitas Padjajaran, Universitas Diponegoro, Universitas Syah Kuala, Universitas Bung Hatta, Universitas Sumatera Utara, Universitas Bengkulu, Universitas Lampung, and Universitas Sultan Ageng Tirtayasa. These institutions will provide diverse expertise and resources in research and data analysis.

6.4.0.6 Activity *1.1.3. Establish knowledge management and learning center for scaling and replication*

This activity will be directly executed by KI in close collaboration with MMAF, CMFA, and provincial governments within WPP 572. It will focus on collecting and curation of tacit and explicit knowledge with the purpose of sharing and amplification of information, capacity building, transferring lessons learned and replication. Agencies to be included in this extensive knowledge and capacity building include: regional government at fisheries offices: for 6 provinces and 23 coastal districts; enumerators at 21 fishing ports across WPP 572. Target to be included in the dissemination and amplification: Ministerial and provincial offices: at least 5 ministerial and 10 provincial government; Civil societies, non-government organizations and universities: at least 30 agencies; Young generation: approximately 10,000 students; and 5 international and 10 national media.

Concurrently, a knowledge center will be developed along with a comprehensive database system and a dissemination strategy. It aims to ensure that governmental agencies at all levels, private sector actors, and coastal communities, including women and other vulnerable groups, in WPP 572 have the thorough knowledge, understanding, technical training and capacity they need to protect ecosystems from degradation and adopt alternative livelihoods to fisheries. The knowledge obtained will be developed to extend support and build technical capacity from national to provincial and local levels. The activity intends to amplify, disseminate, and replicate lessons learned across provinces.

Sub-activity 1.1.3.1: Design and develop a knowledge center to enhance project knowledge sharing, capacity building, and replication efforts

This sub-activity will develop and establish a knowledge and learning center to showcase success stories and lessons learned for the BEAM Project. To this end, KI will collaboratively work with a local university. KI and the local university partner will build the center located at the university facility and obtain legal permits for its operations. The center will be supported by: Interior and exterior design consultant for the aesthetic and functional design of the center; IT expert to create and implementing knowledge management and database systems; and a design consultant will curate photos and videos to be featured within the center's installations.

A local university within WPP 572 is projected to manage the knowledge learning center. The BEAM Project will support the operation of the center for at least three years from Y1 to Y3. The local university is projected to manage and operate independently as the center from Y4 until beyond the BEAM project completion. The proposed location for the Knowledge Centre is Padang, West Sumatra, which is a strategic geographic focal point for knowledge exchange and collaboration within the region.

Implementation Phase for Sub-activity 1.1.3.1

The following outlines the primary focus for each year.

Year 1 – Groundwork and Development Phase.

The initial year is focused on establishing foundational elements for the Knowledge Center. Key activities include:

- *Comprehensive Assessments*: Initiate an assessment process to evaluate the requirements and potential areas for the Knowledge Center.
- *Stakeholder Engagement*: Conduct a series of workshops and meetings to gather input and foster collaboration. This includes introductory meetings with provincial government representatives and workshops/Focus Group Discussions (FGDs) at both national and provincial levels.
- *Consultant Mobilization*: GEDSI and inclusive communication consultants will be hired to develop practical guidelines related to GEDSI and to develop inclusive communication materials.
- *System Development*: Establish robust database and information management systems, led by IT consultants.
- *Interior Design Development of the KLC*: Design the Knowledge and Learning Center facility located at the local university (Bung Hatta) and initiate the hiring of a contractor.

Year 2 – Design and Facility Development Phase.

This year progresses towards the facility development and operational systems. Key activities include:

- *Advanced System Development*: Continue developing the Knowledge Management Information System (KMIS), implementing user testing protocols to refine functionality and ensure usability.
- *Content Management*: Establish Standard Operating Procedures (SOPs) for the collection, curation, and presentation of content within the Knowledge and Learning Center.
- *Continuing Interior Design Development of the KLC*: Continuing renovation and exhibition corridor setup.
- *Completion of the KLC facility*: Complete the development of the Knowledge and Learning Center facility in West Sumatra.

Year 3 – Finalization and Operational Preparation Phase.

The focus shifts to completing the construction and preparing for the operational launch of the Knowledge and Learning Center. Key activities include:

- *System Testing and Refinement*: Conduct the final phase of user testing for the KMIS to ensure optimal functionality.
- *Operational Guidelines Development*: Develop operational guidelines and an asset management system for the Center. Formulate a business model to ensure the sustainability and viability of the center.
- *Full Operationalization*: Launch the Knowledge Center, fully integrating it as a hub for knowledge dissemination and learning.

Year 4 – Impact Assessment Phase.

This year marks the transition to operationalizing the Knowledge Center and evaluating its impact. Key activities include:

- *Showcasing Impact*: Organize activities to highlight the project's success stories and its positive contributions to the community and the environment.

- *Stakeholder Review and Engagement*: Conduct meetings and workshops with various stakeholders to review project progress, discuss challenges, and plan for future sustainability.
- *Sustainability Planning*: Develop and implement a robust operational standard for the Knowledge and Learning Center to ensure continued functionality post-project.
- *Closing Ceremony and Transition*: Organize a closing ceremony to celebrate the achievements and transition of the operational responsibilities. The KLC will be fully managed independently by the appointed local university. This includes final coordination meetings with key stakeholders to solidify the ownership mechanism for the Knowledge Center.

Year 5 – Sustainability and Transition Phase.

As the project concludes, the focus is on ensuring the continuity and sustainability of the Knowledge Center. Key activities include:

- *Stakeholder Review and Engagement*: Conduct meetings and workshops with various stakeholders to review project progress, discuss challenges, and plan for future sustainability.
- *Future Planning*: Engage in strategic discussions with provincial government representatives and other key stakeholders to ensure the long-term viability and impact of the Knowledge Center.

Deliverables of Activity 1.1.3.1

- The Knowledge and Management Information System (KMIS) is developed and operationalized.
- A Knowledge and Learning Center to showcase success stories and lessons learned for the BEAM project is developed and sustained.

Sub-activity 1.1.3.2 Collaborate with Government of Indonesia (at the national, provincial, and local levels) and non-governmental agencies in amplifying, enhancing, and replicating lessons learned in other Fisheries Management Areas/WPPs through national and subnational awareness raising campaigns.

To enhance the Knowledge Center and project objectives, a Protection and Production Campaign will be launched. Discussions with the national government will be held to gather recommendations and gain buy-in for campaign implementation. KI, supported by consultants, will launch the campaign nationally and conduct roadshows in relevant areas, closely coordinating with the national government. During the campaign, KI will work with influencers and key opinion leaders to amplify key messages, building on lessons learned to replicate projects in other WPP areas. Support for the campaign will include a campaign firm for the launch and implementation, a branding and digital design consultant to strengthen communication assets, and a media consultant to enhance media engagement and collaborations.

Implementation Phase for Sub-activity 1.1.3.2

The following outlines the primary focus for each year

Year 1 – Initiation and Planning Phase.

The initial year focuses on laying out the groundwork for the Protection and Production Campaign by establishing foundational strategies and engaging key stakeholders.

Campaign Research and Design: Definition of campaign objectives and key messages and themes, based on social research to understand target audience and their perceptions. Development of M&E strategy.

Campaign Conceptualization: Development of the campaign's concept, emphasizing sustained public interest and citizen engagement in environmental issues through a multimedia approach. The campaign activities and key messaging will be developed based on the results of audience mapping, public perceptions, assessment on targeted beneficiaries' behaviors, political, social, and economic conditions in targeted areas.

*Stakeholder Engagemen*t: Identification and engagement of targeted universities and audiences through a mapping process, setting the stage for subsequent roadshows within WPP 572.

Content Strategy and Outreach: Recruitment of specialized consultants will be engaged to launch the campaign and craft tailored social media content. This includes creating social media posts, video reels, and infographics, alongside collaborations with influential figures. Social media content will focus on core key messages that introduce and profile the campaign's approach during the initiation phase, aiming to engage public attention and build early awareness.

Workshops and Meetings: Organization of at least two workshops and two coordination meetings with MMAF, CMFA, and provincial governments to facilitate collaboration and refine campaign strategies. Additionally, two media visits at the provincial level to generate interest and coverage.

Consultant Mobilization: GEDSI and inclusive communication consultants will be hired to develop practical guidelines related to GEDSI and to develop inclusive communication materials.

Workshop: Launch national protection and production campaign.

Year 2 – Execution and Engagement Phase.

This year is dedicated to executing the campaign through direct engagements and developing impactful outreach materials.

Roadshows and Seminars: Implementation of a series of roadshows, seminars, panel discussions, and interactive games at universities and high schools within WPP 572 to engage the youth demographic.

Material Development: Production of storyboards, fact sheets, print materials, and further social media content to communicate the campaign's key messages effectively.

Media and Public Relations: National media engagement to amplify the campaign's reach through strategic media partnerships and outreach, supplemented by a comprehensive social media strategy.

Stakeholder Coordination: Conduct regular coordination meetings with MMAF, CMFA, and provincial governments to ensure alignment and track progress.

Publish Success Stories: Begin publishing success stories from the field and research related to Components 1 and 2

Year 3 – Consolidation and Expansion Phase.

Activities from the second year continue with an emphasis on consolidating the campaign's reach and refining engagement strategies.

Continued Roadshows: Repetition of engaging roadshows featuring seminars, panel discussions, and interactive games at educational institutions.

Social Media and Influencer Strategy: Execution of a robust social media strategy involving regular posts, video reels, infographics, and influencer collaborations to maintain awareness and engagement.

Stakeholder Coordination: Regular coordination meetings with MMAF, CMMIA, and provincial governments to ensure alignment and effective progress tracking, alongside a media visit to enhance campaign visibility.

Year 4 – National Outreach and Storytelling Phase.

The focus shifts to broadening the campaign's impact through storytelling and national media engagement.

Storytelling and Media Engagement: Highlighting local narratives with broad appeal and crafting national stories with localized relevance to resonate with diverse audiences and galvanize support for environmental conservation.

Workshops and Meetings: Continuous coordination and collaboration through regular workshops and meetings with key stakeholders, including local and national media, to enhance media coverage and partnership strengths.

Year 5 – Finalization and Legacy Building Phase.

The final year emphasizes engaging policymakers and community leaders while showcasing the campaign's achievements.

Consolidation of M&E results from earlier years.

Multi-stakeholder Dialogs: Engagement in dialogs with various layers of policymakers and community leaders to address Protection and Production-related issues.

Success Showcasing: Organization of dissemination events to the public and meetings with media to share the project's achievements and success stories, aiming to inspire ongoing support for environmental conservation efforts.

Project Wrap-up: Consolidation of achievements, wrapping up of activities, and planning for sustained impact beyond the project's conclusion.

Deliverables of Activity 1.1.3.2

- Protection and production campaigns at the national level are launched.
- Roadshow seminars and panel discussions at local universities within WPP 572 are organized.
- Media engagements at the national level and at the 6 provinces are conducted.
- 12 Success stories from the field and research related to Component 1 and Component 2 are published.

Sub-activity 1.1.3.3 Capture and disseminate learning reports from project implementation amongst project stakeholders and partners to inform refinement, replication and scaling up.

Lessons learned from BEAM projects will be compiled, assessed, and disseminated by KI to promote adaptive management and improve BEAM project performance during project implementation. This will facilitate the uptake and scaling up of successful projects that will deliver an even larger impact when implemented in other WPP, and at the national level, including after the close of the GCF project. Lessons learned will be documented throughout project implementation in the form of bi-annual and annual reviews of the project.

Monitoring reports (internal and external) will be compiled and analyzed and shared with the Grant Committee and other key stakeholders. Technical Partner and/or additional consultants will be engaged to identify lessons learned and capture them for adaptive management strategies to be shared with the Grant Committee for reflection and evaluation.

One of the outputs of this activity is the development of lessons learned document for best practices supporting blue finance of protection-production activities. The key investment readiness roadmap will support the expansion of financial tools across WPP 572 to strengthen investment profiles of MSMEs enterprises that buy into the protection-production model. The second aspect of the lessons learned document is to define strategies for climate finance for projects that strengthen climate resilience with climate adaptation and mitigation activities in coastal and marine areas across WPP 572. The document will be developed to help investors understand the investment potential.

Implementation Phase for Sub-activity 1.1.3.3:

Year 1 – Baseline and Framework Development. The initial year focuses on establishing systems for capturing lessons learned and defining the framework for documentation and dissemination.

Establish M&E baseline data collection systems for lessons learned capture, including development templates and protocols for bi-annual and annual project reviews

Identify key themes for lessons learned documentation (blue finance, protection-production, climate resilience)

Engage Technical Partners (Penabulu and Standard Chartered Bank) to support lessons learned capture from their respective grant windows

Begin compiling initial lessons from project start-up and early implementation activities

Year 2 – Active Capture and Interim Documentation. This year focuses on systematic collection and analysis of lessons learned from ongoing project activities.

Conduct annual project reviews and document emerging lessons from Component 1 and Component 2 implementation

Compile and analyze monitoring reports (internal and external) and share findings with the Grant Committee

Capture lessons from grantee experiences under Grant Windows 1, 2, and Investment Readiness

Year 3 – Consolidation and Strategic Analysis. The focus shifts to consolidating lessons learned and developing strategic recommendations.

Complete annual reviews for Year 2 and Year 3.

Consolidate lessons from MPA management, fisheries sustainability, and innovative financing activities under Component 1

Consolidate lessons from adaptation and mitigation grant windows (Windows 1 and 2)

Consolidate lessons from Investment Readiness activities, including pipeline development and enterprise support

Develop draft lessons learned document for best practices supporting blue finance of protection-production activities

Year 4 – Finalization and Validation. This year focuses on finalizing the lessons learned document and validating findings with stakeholders.

Complete final annual reviews for Year 4.

Validate lessons learned with key stakeholders, including MMAF, CMFA, provincial governments, and grantees

Finalize the lessons learned document for best practices supporting blue finance of protection-production activities

Finalize the investment readiness roadmap for scaling financial tools across WPP 572

Share validated lessons with the Grant Committee and Project Steering Committee for reflection and evaluation

Year 5 – Dissemination and Scaling. The final year emphasizes dissemination of lessons learned to promote replication and scaling across Indonesia.

Publish and disseminate the lessons learned document to project stakeholders and partners.

Disseminate the investment readiness roadmap to investors, financial institutions, and government agencies to help them understand investment potential in the blue economy.

Conduct dissemination workshops and knowledge sharing events across WPP 572 provinces.

Share lessons and recommendations with other Fisheries Management Areas (WPPs) for replication and scaling

Deliverables of Sub-activity 1.1.3.3

- Lessons learned from project implementation are documented and disseminated for replication and scaling.

6.4.1.7 Measuring Impact of Activity 1.1.3

Activity 1.1.3 is designed to enhance, strengthen, and amplify the effective implementation of the frameworks outlined in activities 1.1.1 and 1.1.2 by offering essential, systematic and comprehensive knowledge management and learning. Activity 1.1.3 establishes a knowledge and learning center to serve as a hub for capacity building, knowledge exchange, and documentation of lessons learned, thereby enhancing the implementation of Activities 1.1.1 and 1.1.2. Impact is measured through two key indicators: (1) one knowledge and learning center established and operational by Year 2, hosted at a local university in West Sumatra; and (2) one lessons-learned document developed by project end, covering grant operations, pipeline development, and successful blue economy interventions for scaling and replication. The knowledge center will transition to independent university management from Year 4 onward, while the lessons-learned document will provide specific recommendations for replicating the protection-production model across Indonesia.

6.4.1 Component 2: Locally Led Climate Action + Investment Readiness

6.4.1.1 Overview

Component 2 establishes the BEAM grant facility, an on-granting financial mechanism designed to fund marine ecosystem restoration, fisheries management, alternative livelihood support, and coastal waste management for climate mitigation and adaptation. The facility consists of three complementary interventions: climate change adaptation (Window 1), climate change mitigation (Window 2), and investment readiness support. Windows 1 and 2 will directly support climate mitigation and adaptation projects. The Investment Readiness, provides in-kind technical assistance (services procured directly by KI) through two complementary interventions: (i) development of action-oriented research papers on sustainable blue economy themes to address critical knowledge gaps that deter investment in WPP 572; and (ii) technical assistance to BLU LPMUKP, the government's microcredit provider for the marine and fisheries sector, to digitize its loan management system, streamline disbursement procedures, and train extension officers, thereby expanding affordable credit access to small-scale fishers and fish farmers. Best practices and lessons learned from the various sectors will be gathered and disseminated for future replication and scaling up.

Sub-grants will be issued to a diverse range of beneficiary organizations, including Government of Indonesia public service agencies, NGOs, CSOs, research institutions, universities, and blue economy MSMEs operating in, or targeting, provinces within WPP 572. The primary beneficiaries of these grants will be local coastal communities and locally operating businesses (MSMEs).

Component 2 will enhance the climate resilience of coastal and marine ecosystems, fisheries, and local communities in WPP 572. It aims to facilitate the implementation of climate change mitigation and adaptation strategies and improve communities' capacity for securing additional long-term financing. This approach seeks to leverage funds for blue economy sector investments from various financial instruments and funding sources, promoting sustainable development and resilience in both ecological and community contexts.

The following sub-sections describe each of the grant windows in more detail.

6.4.1.2 Grant Window 1: Climate Change Adaptation (Adaptation Grant Window)

Under Output 2.1, this window will provide grants to assist vulnerable coastal communities in WPP 572 in adapting to the impacts of climate change on their livelihoods and food security. The grants will prioritize interventions to create alternative livelihoods, enhance fisheries' sustainability, enhance community-based economic activities, and create waste management initiatives that improve community resilience to climate change. Grantees will be required to demonstrate the impact of climate adaptation in their proposals. While emphasizing community-led adaptation, capacity building, TA, research, and monitoring, activities under this window will also deliver certain climate change mitigation co-benefits by improving the management effectiveness of MPAs or networks, strengthening marine and coastal ecosystems and so will also contribute to the success of mitigation activities under Grant Window 2.

Sub-Activity 2.1.1.1. Manage grants for ecotourism enterprises for community development. / Sub-Activity 2.1.1.2 Manage grants for collaborative MPA management. / Sub-Activity 2.1.1.3 Manage grants for sustainable and diversified fishing livelihoods (community-based economic activities). / Sub-Activity 2.1.1.4 Manage grants for sustainable waste management.

Grants will be issued to selected organizations for interventions that drive climate adaptation impact across the following four thematic areas:

Eco-tourism Development: Supporting businesses and communities in transitioning to, or incorporating, eco-tourism activities. Ecotourism is defined as responsible travel to natural areas that conserve the environment, sustains the well-being of the local people, and involves interpretation and education (TIES, 2015). This includes providing alternative income for coastal communities that are reliant on fishing during non-viable fishing seasons. The selected grantees will engage in training local communities in various eco-tourism activities, such as coral reef diving, tour management, and practices that ensure reef-safe tourism. Additionally, they will supply essential equipment for these eco-tourism activities.

Collaborative Support to Management of MPAs: Enabling locally led and co-management approaches that empower communities, traditional fishers, and local stakeholders to actively participate in MPA governance, planning, and enforcement. Grantees may implement activities such as establishing co-management committees, conducting participatory ecosystem mapping using local knowledge, delivering capacity-building programs and mentorship for community-based MPA managers, developing community-led surveillance systems and compliance mechanisms, and integrating traditional practices with scientific monitoring. This aligns with Component 1 sub-activities, and the grantees may facilitate the setting up of offices for monitoring ecosystems and fisheries, and will deliver monitoring equipment, including boats, buoys, laptops, and remote sensing tools.

Sustainable and Diversified Fishing Livelihoods: Enhancing community-based economic activities through the establishment of infrastructure for solar-powered cold storage and ice production infrastructure to optimize processing methods, reduce post-harvest losses, and improve product quality. This initiative expands income generation opportunities, strengthen climate resilience through renewable energy adoption, and empowers women and youth by integrating them into the fisheries value chain. By providing training, provision of appropriate post-harvest technologies, and support for market access and value chain integration ensure effective facility maintenance, thereby sustaining their long-term benefits.

Sustainable Waste Management Practices: Partnering with private sector entities for enhanced waste management and monitoring, projects will focus on developing waste management plans, providing training on waste management practices, and implementing data collection practices for monitoring waste management. The selected grantees will assess current waste management practices and marine pollution levels, facilitating the development of community-led waste management plans and the delivery of training sessions.

Deliverables of Sub-activity 2.1.1.1, Sub-activity 2.1.1.2, Sub-activity 2.1.1.3, and Sub-activity 2.1.1.4

- Sub-activity 2.1.1.1: 9 grants totaling US$ 1.8 million (at US$ 40,000 - 400,000 each) for ecotourism development, which consists of operator, logistics, transportation, and accommodation are awarded and managed.
- Sub-activity 2.1.1.2: 11 grants totaling US$ 1.88 million (at US$ 40,000 - 400,000 each) for collaborative MPAs management (with active participation of the local community) are awarded and managed.
- Sub-activity 2.1.1.3: 8 grants totaling US$ 1.4 million (at US$ 40,000 - 400,000 each) for sustainable and diversified fishing livelihoods (community-based economic activities) are awarded and managed.
- Sub-activity 2.1.1.4: 8 grants totaling US$ 1.4 million (at US$ 40,000 - 400,000 each) for sustainable waste management are awarded and managed.

Sub-activity 2.1.1.5. Establish and operate the adaptation and mitigation grant windows.

CI, as the AE, will adhere to financial management and procurement practices for this project in accordance with relevant and established CI policies and procedures, as well as the pertinent provisions outlined in the accredited master agreement (AMA) signed between CI and the GCF. In evaluating KI, CI has determined that they possess robust financial and procurement standards aligned with CI and GCF fiduciary standards. KI will undertake the legal and procedural steps to establish the BEAM's Adaptation and Mitigation grant window. It will also develop operational policies, procedures, and templates to create a grant manual, approved by the AE, that will govern BEAM granting. KI will issue calls for proposals; provide capacity building and technical assistance to grantees on preparing grant applications with support from Penabulu, a Technical Partner. KI and Penabulu will implement outreach to through targeted workshop, community meetings, and collaboration with local network to identify women-led and indigenous people organizations.

Deliverables of Sub-activity 2.1.1.5

- Adaptation and mitigation grant facility established and operational.

Sub-activity 2.1.1.6. Provide technical assistance and support to adaptation grantees on cross-cutting subjects (including GEDSI and Safeguards).

KI and Penabulu will provide technical assistance and support to grantees on cross-cutting subjects in grant Window 1, including training on proposal preparation, grant management, reporting, MEL, and cross-cutting issues such as GEDSI and Safeguards, in addition to thematic technical assistance related to sub-windows under both the Adaptation and Mitigation grants windows. This will be done through consultations, information sessions, trainings, and various other requested and relevant assistance delivered by KI, Penabulu, or specialized consultants engaged by KI. This technical assistance will help ensure grantees have the technical capacity to meet BEAM objectives and GCF requirements related to GEDSI, Safeguards and other cross-cutting subjects.

Deliverable of Sub-activity 2.1.1.6

- Technical assistance provided to 36 grantees throughout the grant process.

Sub-activity 2.1.1.7 Monitor adaptation grant window performance.

KI will provide the monitoring and evaluation of individual projects in their respective components, based on quarterly and/or annual reports. Projects will be monitored by grant managers to ensure financial and contractual compliance with the grant, in accordance with KI policies and procedures. KI will also monitor each grant's progress in meeting its objectives / indicators. KI will also monitor how the individual grants contribute to each grant window's targets and indicators as well as the Project's indicators. This project-level and BEAM portfolio-level M&E will feed into the overall project M&E systems managed by the PMU.

The requirements for grants management, reporting, monitoring, and grant close-out will comply with the procedures detailed in the BEAM grants manual to be refined and approved by the AE in Year 1.

Grantees will be required to report on all information necessary for progress monitoring and M&E, as included in their agreement with KI. Penabulu as a Technical Partner will provide support to grantees that require assistance to meet reporting requirements and will also assist in reviewing the financial and technical reports; however, final approval of reports will be KI´s responsibility. There will be internal reports as per KI's requirements and mid-term and final external evaluation will be hired.

Deliverable of Sub-activity 2.1.1.7

- 36 reports are developed on grant and funding window performance.

6.4.1.3 Grant Window 2: Restoration of critical coastal habitats and deployment of renewable energy technology (Mitigation Grant Window)

Under Output 2.2, Grants issued through this window will focus on promoting low-carbon pathways to achieve climate resiliency, aiming to strengthen the climate change mitigation capacity of marine ecosystems in WPP 572. The primary focus of this grant window will be on projects that are aligned with the project's mitigation objectives, involving the restoration of mangroves and seagrass beds, as well as the implementation of renewable energy solutions for local communities. While coral reefs are critical ecosystems for adaptation and biodiversity, they are not a net absorber of CO2 and therefore are not included as a primary source of GHG mitigation under this window.

Sub-activity 2.2.1.1 Manage grants for high carbon ecosystem restoration, & Sub-activity 2.2.1.2. Manage grants for small-scale renewable energy deployment/installation.

Grants will be issued to beneficiary organizations for interventions that contribute to climate change mitigation in two priority areas of focus:

- **Nature restoration**

  The restoration of seagrass and mangrove ecosystems in WPP 572 is important both for the ecosystem services they provide, but also as a key source of GHG mitigation potential.

  While coral reefs are not a net absorber of CO_2, they have a vital role to play in coastal environments as they serve as breeding grounds for many fish species and are important for local economic activity as a source of eco-tourism interest and revenue. Moreover, coral reefs provide ecosystem protection for blue carbon as evidence suggests that when coral reefs are damaged, the ability of nearby seagrass and mangrove ecosystems to absorb carbon is also diminished.[382]

  Grantees focusing on this priority area will deliver indicative services, such as the following: (1) collecting data on the existing extent and health of ecosystems through baseline assessments (informed by remote sensing, site visits to collect samples in known locations), data processing, and remote sensing; (2) developing ecosystem restoration or conservation plans for each relevant ecosystem; and (3) implementing on-the-ground restoration or conservation work based on the previously established plans.

- **Deployment of renewable energy**

  Renewable energy initiatives targeting local communities that provide beneficiaries with renewable energy equipment (e.g., solar panels, generators) and tools powered by renewable energy (e.g., ice production units using renewable technologies for fish processing) to increase the shelf life of fish products and contribute to increased livelihoods for fishers. Training in the utilization and maintenance

[382] Great Barrier Reef Foundation, "What is Blue Carbon?" Explainers, 26 July 2023.

of renewable energy equipment and hardware will also be provided. To ensure long-term sustainability, grant proposals will be required to include a clear plan for how income generated from the use of the equipment will be allocated toward its maintenance and eventual replacement. This approach reinforces beneficiaries' ownership and responsibility over the assets, while strengthening the resilience of coastal value chains through sustained access to renewable energy solutions. RE will be deployed for fishing operations to preserve shelf life of fish and increase livelihoods of fishers.

Deliverable of Sub-activity 2.2.1.1, and Sub-activity 2.2.1.2

- Deliverable of Sub-activity 2.2.1.1: 13 grants (villages) totaling US$ 1.96 million (at US$ 40,000 – 400,000 each) for the restoration of nature (roughly 285 hectares of mangroves and 6 hectares of seagrass beds) are awarded and managed.
- Deliverable of Sub-activity 2.2.1.2: 12 grants totaling US$ 1.56 million (at US$ 40,000 – 400,000 each) for small-scale renewable energy deployment/installation are awarded and managed.

Sub-activity 2.2.1.3. Provide technical assistance and support to mitigation grantees on cross-cutting subjects (including GEDSI and Safeguards).

KI and Penabulu will provide technical assistance and support to grantees on cross-cutting subjects (including GEDSI and Safeguards). This will be done through consultations, information sessions, trainings, and various other requested and relevant assistance delivered by KI or specialized consultants engaged by KI. This technical assistance will help ensure grantees have the technical capacity to meet BEAM objectives and GCF requirements related to GEDSI, Safeguards and other cross-cutting subjects.

Deliverable of Sub-activity 2.2.1.3

- Technical assistance provided to 25 grantees throughout the grant process.

Sub-activity 2.2.1.4. Monitor mitigation grant window performance.

KI and Penabulu will provide monitoring and evaluation of individual projects in their respective components, based on quarterly and/or annual reports. Projects will be monitored by grant managers to ensure financial and contractual compliance of the grant, in accordance with KI policies and procedures. KI will also monitor each grant's progress in meeting its objectives / indicators. KI will also monitor how the individual grants contribute to each grant window's targets and indicators as well as the Project's indicators. This project-level and BEAM portfolio-level M&E will feed into the overall project M&E systems managed by the PMU.

The requirements for grants management, reporting, monitoring, and grant close-out will comply with the procedures detailed in the BEAM grants manual to be refined and approved by the AE in Year 1.

Grantees will be required to report on all information necessary for progress monitoring and M&E, as included in their agreement with KI. Penabulu as a Technical Partner will provide support to grantees that require assistance to meet reporting requirements and will also assist in reviewing the financial and technical reports; however, final approval of reports will be KI´s responsibility. There will be internal reports as per KI's requirements and mid-term and final external evaluation will be hired.

Deliverable of Sub-activity 2.2.1.4

- 25 reports are developed on grant and funding window performance

6.4.1.4 Investment Readiness

The Investment Readiness responds directly to market failures identified in Section 5, which found that despite high liquidity in Indonesia's financial sector, WPP 572 blue economy enterprises remain unable to access finance due to limited enterprise capacity, weak pipeline, and the absence of structured financing

vehicles. Sub-national fiscal analysis in Section 5.3 further confirms that the provincial governments across WPP 572 cannot fill this gap from the public budget alone. The IRW uses GCF grant funding catalytically to make progress towards overcoming these barriers by (i) commissioning action-oriented research papers on market segmentation, enabling fisheries cooperatives, and marine tourism investment roadmaps to close critical knowledge gaps that deter private capital allocation; and (ii) providing technical assistance to BLU LPMUKP to digitize its loan management system and streamline disbursement procedures, thereby increasing affordable credit flows to small-scale fishers and fish farmers, both in WPP572 and across Indonesia. Through these two complementary interventions, the IRW strengthens the enabling environment for blue economy finance without establishing a blended finance vehicle as originally envisioned.

Sub-Activity 2.3.1.1 Provide technical assistance to BLU LPMUKP.

This sub-activity engages a specialized service provider to digitize the loan management system, streamline application and approval workflows, and train extension officers in simplified, climate-responsive disbursement methods. Specifically for digitizing the loan management system, this sub-activity will engage a service provider to conduct a diagnostic assessment of BLU LPMUKP's process and integrate with, extend, or otherwise complement BLU LPMUKP's Sistem Informasi Managemen Pembiayaan Berkelanjutan (SIPMB), currently under development by BLU LPMUKP, rather than developing a parallel or duplicative system. Where SIPMB functionality gaps exist, BEAM technical assistance will fund targeted modules, digitation support, or integration layers. The intervention increases the volume and speed of affordable credit disbursement to blue economy MSMEs in WPP 572, reducing reliance on informal lenders and complementing the direct adaptation and mitigation grants under Windows 1 and 2.

Deliverables of Sub-Activity 2.3.1.1:

- A service provider engaged to develop and deploy a digitized loan management platform for BLU LPMUKP, covering loan origination, disbursement, portfolio monitoring, and repayment tracking.
- BLU LPMUKP's loan application and approval procedures streamlined (reduced documentation, simplified forms, standardized workflows).
- At least 100 BLU LPMUKP extension officers trained in the use of the new IT system and in simplified, climate-responsive disbursement methods.

Sub-Activity 2.3.1.2 Develop action-oriented research papers on sustainable blue economy themes

Critical knowledge gaps deter private sector investment and informed policymaking in WPP 572's blue economy. This sub-activity commissions four action-oriented research papers on topics such as market segmentation of blue economy enterprises, enabling fisheries cooperatives to access finance and marine tourism investment roadmaps. Each paper provides actionable recommendations for financial intermediaries, development partners, and policymakers. Findings are actively disseminated through workshops, policy briefs, and the annual Blue Economy Forum.

Deliverables of Sub-Activity 2.3.1.2:

- Four service contracts totaling USD 600K for action-oriented research papers on sustainable blue economy themes in WPP 572 are awarded and managed.

Sub-Activity 2.3.1.3 Monitoring of investment readiness interventions performance

This sub-activity tracks the performance of the IRW interventions against agreed indicators, including BLU LPMUKP's loan processing volume and turnaround times, disaggregated by WPP 572 and national totals, the number of extension officers trained, the functionality of the IT system (alignment with the existing BLU LPMUKP's loan system, the SIMPB), and the uptake of research findings by target audiences. Because the IT system, SOP enhancements, and loan processing improvements supported under the Project are institution-wide rather than geographically restricted, monitoring will explicitly capture national-level disbursement and processing gains as direct Project Outcomes, alongside WPP 572-specific results. Regular reporting feeds into adaptive management and lesson-learning for replication across Indonesia.

Deliverables Sub-Activity 2.3.1.3:

- Reports are developed on BLU LPMUKP technical assistance and action-oriented research papers for wider dissemination and scaling across Indonesia.

6.4.2 *Component 2: Locally Led Climate Action and Investment Readiness*

GRANTING OPERATIONS AND GRANT CYCLE:

A Grants Manual based on KI procedures and BEAM design are included as Annex 27 to the Funding Proposal; it will be elaborated and further refined during project start-up and with the validation by the new BEAM Project staff. This document will govern all granting procedures of the project. Component 2 comprises two competitive subgrant windows for locally led adaptation and mitigation, together with pre-identified investment-readiness activities. Investment-readiness support will be directly managed or procured by KI and will not involve competitive subgranting.

The Grants Manual will include details on, *inter alia,* the Eligibility Criteria of grantees, application templates and processes, selection processes, contracting templates, and grants management during implementation. The manual will also ensure that GCF funds are used in a manner consistent with KI, CI, and GCF policies, including safeguards and prohibited practices.

BEAM will issue subgrants in specific climate-related thematic areas, and grantees will be selected based on their project's impact in these areas in accordance with Eligibility Criteria that explained in **Annex 26**. The grant mechanism for Adaptation (Window 1), and Mitigation (Window 2), will provide both small grants (up to USD 40,000), medium grants (more than USD 40,000 up to USD 400,000), respectively, with appropriate procedures - designed to be accessible for smaller organizations to facilitate locally led climate action. The Grant Facility is designed to provide support and technical assistance to potential grantees in order to increase accessibility and impact through Grant Window 1 and 2, All granting will be done via GCF-compliant grant agreements and in compliance with KI, CI, and GCF requirements through a granting manual that will be finalized during Project start-up.

A summary of the grant cycle is as follows:

Step 1: Solicitation and Call for Proposals.

KI will publish annually or every two years open public call for proposals, depending on the size of the expected proposals. Solicitation documents will be developed in the start-up period, supported by the Technical Partners, and validated by the Grants Committee. These documents will target the priority thematic areas identified for each grant window as part of a previous market assessment (Please refer to **Annex 2 Section 5: Blue Economy Market Context and MPA Financing**). The first application will be KI's publication of proposal.

Technical Partners´(Penabulu) support, will also organize grant awareness sessions and workshops (both online and offline) for potential applicants to explain BEAM and the application process to maximize the number and diversity of applicants. KI, supported by Penabulu, will conduct public calls, targeted outreach, and proposal-development support, including for women-led groups, community organizations, Indigenous Peoples where identified, persons with disabilities, and other underserved applicants. Technical assistance and capacity building to BEAM prospective applicants will be carried out by Technical Partner Grantees. Potential applicants will send their proposals to the appropriate Grant Window and theme. KI supported by Technical Partners, will assess and shortlist the proposals to identify promising project proposals that meet the eligibility criteria.

Step 2: Selection.

The PMU will check application completeness and eligibility. Eligible proposals will undergo technical, fiduciary, GESI, and environmental and social screening. After a shortlist of project proposals is created, the assessment will be reviewed by the Grants Committee (see composition in the Funding Proposal,

Section B.4. Implementation Arrangements). Selected proposals that need revision will be returned to applicants for resubmission. Technical Partner Grantees will assist applicants in the proposal revision process.

Step 3: Due Diligence.

To minimize organizational and implementation risks, KI will conduct administrative, legal and financial due diligence of all BEAM subgrantees to ensure capacity to implement the project and comply with KI, CI, and GCF compliance requirements (including AML/CFT, project management, and SEAH). The AE will approve due diligence procedures and templates included in the project's Grants Manual, which may vary according to the size and type of subgrants due to various risk profiles.[383]

For Windows 1 and 2, KI will conduct the technical due diligence with the support of Penabulu.

Step 4: ESS risk and involvement of indigenous people screening, categorization and implementation of mitigation measures.

To avoid or minimize environmental and social risks, KI under the AE´s supervision, will conduct ESS risk screening of all BEAM subgrantees to identify and address all ESS risks. Potential subgrantees will need to complete an Environmental and Social Safeguards (ESS) Screening Form. The Form will vary based on the potential grant size. During this stage, KI will analyze the forms and determine the ESS risks of the proposed interventions and confirm that no interventions are on the ESS exclusion list (see Eligibility Criteria, Annex 26).

For all applicable proposals, KI will assist potential subgrantees in designing risk mitigation measures and the AE will review the process / proposal as needed.

Step 5: Award and First Disbursement.

Following approval of the proposal by the GC, and due diligence and ES safeguards screening by KI, KI will enter into a sub-granting agreement (which will include GCF terms and conditions and the template for which will be pre-approved by the AE) with the subgrantee organization and will make first disbursement of grant funds following KI´s procedures and grant agreement terms. KI will provide training to subgrantees on grant terms and conditions and reporting requirements with support from Technical Partners, which will also support subgrantees' capacity building needs and implementation of required mitigation measures identified during the DD process.[384] Approved requirements will be included in the grant agreement. KI will monitor implementation, safeguards compliance, grievances, incidents, reporting, and corrective actions.

Step 6: Subgrant Implementation.

Throughout the grant cycle (**Figure 80**), KI will lead the grants administrative management, subsequent disbursement, and grant oversight consistency against the project proposals, the grant agreement and approved Grants Manual. KI will supervise the work done by the Technical Partners in providing guidance and capacity building to subgrantees, including on M&E processes, safeguards implementation, financial management, reporting, and technical aspects of the project. Technical Partners, under KI's supervision, will review financial and technical subgrantees´ reports, approval of reports will be KI´s responsibility. KI will manage and monitor Technical Partner´s funding—through reporting, site visits, and other monitoring procedures consistent with the Grant Manual approved via the AE.

Step 7: **Grant closeout.**

Towards the end of each grant cycle, KI and Technical Partners will facilitate learning workshops where subgrantees exchange their experiences in carrying out activities, challenges faced, successes achieved,

383 Due diligence for small and large grants on BEAM will be conducted

384 The Program Manager of BEAM Component 2 and the Grants & Monev Manager jointly submit an application for the issuance of a grant agreement. This application requires approval from the BEAM Component 2 Program Director

and lessons learned. The closing of the grant is marked by the signing of the grant close-out report (GCR) by KI and subgrantee.



Figure 67. BEAM Grant Cycle

DELIVERY PARTNERS

KI will lead the execution of Component 2 for Windows 1 and 2, with support of respective Technical Partner organizations, Penabulu, as illustrated in **Figure 68.**

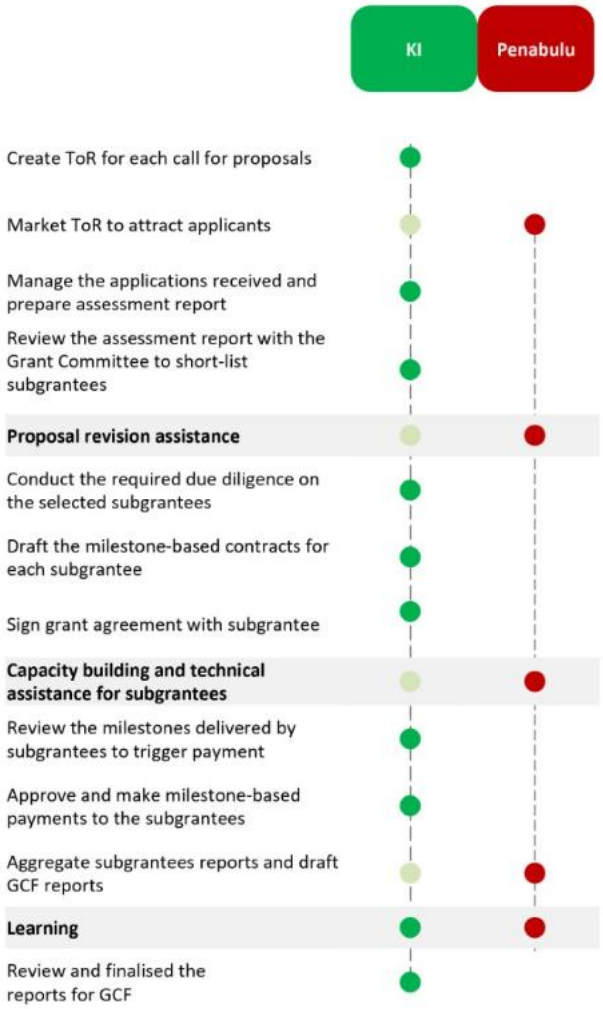


Figure 68. Delivery Partners of BEAM Grant Cycle

TYPES OF GRANTS

KI will deploy a range of granting instruments to meet the needs of the recipient grantee, which range from small local organizations to larger entities. The grant types and procedures are detailed in the Annex 26 Grants Manual but summarized here:

- **Cash-based Grants**. Financial awards provided directly to grantees, where funds are released through staged disbursements starting with an initial advance based on an approved budget and agreed disbursement schedule. Subsequent disbursements are made upon submission of financial reports, supporting documents, and satisfactory progress of implementation. Indirect costs are allowable up to a maximum of 10% of direct costs.
- **In-kind Grants**. Donations of goods and/or services procured directly by KI and provided to the grantee following the signing of a grant agreement. This modality is typically applied to low-risk or emerging partners, such as community-based organizations with limited administrative capacity. Technical reports are required on a regular basis; financial reporting is not required. Advance payments and indirect costs are not applicable, as KI procures goods and services directly on behalf of the grantee.
- **Fixed Amount Award (Milestone-based Disbursement)**. A grant mechanism where payments are released only after the completion of agreed milestones. Unlike other grant types, this mechanism does not require partners to submit receipts or detailed financial reports. Technical verification and compliance with safeguard requirements remain mandatory. An initial advance payment equal to the

budget associated with the first milestone is permitted. Indirect costs are allowable and must be included within the milestone budget.

In-Kind and Fixed Amount Awards are intended to simplify granting processes and to allow participation of lower-capacity local organizations.

There will be two grant sizes:

- Small: Up to USD 40,000, with an implementation period of 1 to 1.5 years on average.
- Medium: From USD 40,000 to USD 400,000, with an implementation period of 2 to 2.5 years on average.

Due Diligence process will vary depending on the type and size of the grants. Fixed Amount Awards will only be allowed for small grants.

Component 2 Design: Assumptions

- Governance and stakeholders are selectively arranged and carefully engaged to be functional.
- The roadmap is aligned from the national and sub national levels and based on learnings across the two components. Lessons are integrated with the design of the blue halo financing facility. It is developed with active participation of multi-stakeholders and considers the most vulnerable groups and ensures gender equality.
- The target is set for 1 at national and 6 at WPP 572 provinces. In the initial years (up to midterm) the activity will focus on identifying/building suitable projects for scaling finance over the long-term.
- The data is disaggregated by interventions (e.g., grants in ecotourism industries, sustainable and diversified fishing, etc.),
- The target is the number of Component 2 grantees. The target should be quantified and qualified in terms of geographic coverage, thematic area (e.g., fisheries, ecotourism, waste management), and expected outcomes such as enhanced climate resilience or emissions mitigation.
- The grant applications are thoroughly and fairly assessed and comply with the selection criteria developed.

Component 2 Design: Rationale for proposed grant ticket size

The BEAM project under component 2 allocates significant resources - USD 10 million; USD 6.48 million for Adaptation, and USD 3.52 million for Mitigation, over a 5-year timeframe (with six months for startup and six months for closeout in the overall 6-year implementation period). Therefore, it is necessary to carefully consider and determine the ideal project size, or “ticket size,” that can be realistically managed by potential proponents. This includes balancing the needs of local actors within WPP 572 with the expertise of national-level agencies with experience in the region. As a benchmark, the TFCA (Tropical Forest Conservation Action) program in Sumatra and Kalimantan can disburse USD 2.46 million in Sumatra and USD 2.13 million in Kalimantan for 20 grantees each within a 1-year project. The grants typically range from a minimum of USD 120,000 to a maximum of USD 500,000 per grantee per year. Other references for the ticket size are gathered from the government’s programs and a similar Marine and Coastal project from COREMAP-CTI which was carried out in 2020.

Referring to the development document of the MMAF’s Advanced Fishing Village (Kampung Nelayan Maju/KALAJU) program, the funds needed for the development of marine ecotourism can range from 121,000 USD to 150,000 USD, with estimated breakdowns of USD 20,000 – USD 30,000 for activities such as ecotourism site assessment, stakeholder engagement, or development of IEC materials to promote eco-tourism among fishers and other coastal community groups; and up to USD 65,000 per activity for capacity building for fishers and other vulnerable groups. Referring to the 2023 MMAF work plan document on policy

recommendation,[385] a program supporting collaborative management of Marine Protected Areas (MPAs) by national and sub-national governments carries a starting cost of USD 250,000 per area, ranging from USD 14,000 for gathering ecosystem data to USD 63,000 for developing robust policy frameworks. These frameworks involve creating national guidelines for local and provincial MPAs and establishing clear legal foundations for Other Effective Area-Based Conservation Measures (OECMs) through revisions to conservation acts and integration into national development plans.

Taking reference from the waste management project TPS3R, one project activity package of waste management in coastal areas, ranging from baseline studies including profiling materials recovery facilities to the development of waste banks, temporary waste disposal sites (TPST), or waste disposal sites with reduce, reuse, and recycle mechanisms (TPS3R) serving a minimum of 400 households[386] can reach up to 63,000 USD. However, if the project activities also include the construction of an integrated waste processing facility capable of managing sorted waste from many TPS3Rs, the cost requirement can reach USD 1 million.[387]

Regarding renewable energy, according to the Strategic Plan Document of the Directorate General of New, Renewable Energy and Energy Conservation, Ministry of Energy and Mineral Resources for 2020-2024: Energy Conservation Development, Supervision, and Business Activities, the development and implementation of renewable energy targeting local communities (such as solar panel installation, maintenance, and the use of renewable technologies for fishing practices and processing) can reach up to USD 250,000 per year. This allocation comprises activities such as assessment for potential renewable energy technology installation and maintenance planning, developing guidance and standard operating procedures (SOP) for the operationalization, capacity building for relevant stakeholders, as well as installation of renewable energy systems.

For nature restoration activities, based on the MMAF work plan document for 2023: Maritime and Maritime Affairs Policy, developing a nature restoration plan can cost approximately USD 22,000 per policy or area. Meanwhile, for the restoration and conservation of seagrass, mangrove, and coral reef ecosystems, as outlined in the MMAF work plan document for 2023: mangrove restoration, the cost is estimated at USD 3,600 per ha.[388] Therefore, to carry out restoration and protection for every 100 ha, a budget of USD 363,000 is required.

Aside from the government project, taking reference from a similar program to BEAM conducted by COREMAP-CTI in collaboration with the World Bank, from 2020 to 2022,[389] the total grant funds disbursed amounted to USD 5.77 million for a 19-month project period to 6 grantees. The smallest grant given was for managing and accessing Fisheries Resource Management Areas for sustainable fisheries, feasibility studies, baseline, capacity building, and mentoring for local communities totaling USD 598,000 by PILI Foundation, and the largest grant size was USD 1.34 million for a project supporting community surveillance groups (POKMASWAS) in marine conservation areas, from identification, module preparation, training, certification, and provision of supporting equipment for 26 POKMASWAS in 3 areas; Savu Sea, Raja Ampat, and Dampier Strait conservation areas by Yayasan Terumbu Karang Indonesia (TERANGI).

Other sample projects under the COREMAP-CTI program encompass a variety of activities. For instance, a collaboration with Yayasan TERANGI focuses on promoting sustainable utilization of Marine Conservation Areas (KKP) by communities in Raja Ampat, involving the preparation of media and learning aids for workshops, socialization, stakeholder coordination, site identification, surveys, and the preparation of Detailed Engineering Design (DED) and a Statement for Environmental Management (SPPL), with a

[385] Decree of the Minister of Marine Affairs and Fisheries No 85 of 2022 on the work plan of the Ministry of Marine Affairs and Fisheries for the year 2023.
[386] Letter of the Directorate General of Human Settlements Number 13/SE/DC/2022 concerning Technical Guidelines for the Implementation of Community-Based Infrastructure Activities of the Directorate General of Human Settlements.
[387] Based on discussion with APSI (*Asosiasi Pengusaha Sampah Indonesia* – Association of Indonesian Waste Entrepreneurs) during the National Consultative Meeting on 24 Oct 2023.
[388] other reference, if using World Bank calculation, the estimated cost for mangrove rehabilitation in Indonesia is between USD 1,640 - USD 3,900 per hectare [20] (world bank, 2023).
[389] https://www.icctf.or.id/wp-content/uploads/2021/08/Factsheet-COREMAP-CTI-WB-2020_Profil_Final_10.08.2021.pdf

budget of USD 1.24 million. Additionally, the implementation of Integrated Coastal Zone Management by PKPSL-IPB includes drafting an outline document for Integrated Coastal Zone Management (ICZM), conducting ICM Leader Forums, training, workshops, surveys, and public campaigns for 1500 communities, with a total allocated fund of USD 869,000. Another project focuses on marine ecotourism, aiming to enhance the effectiveness of marine conservation area management through marine ecotourism and sustainable fisheries in the Raja Ampat marine conservation area. This includes infrastructure improvement, capacity building, and livelihood development for communities around the marine conservation area, with a total allocated fund of USD 1.24 million for a project duration of 1.5 years

Another example taken as reference is the project conducted by Yayasan Konservasi Alam Nusantara (YKAN) to protect global marine biodiversity in the Bird's Head Seascape, Papua, Indonesia through the establishment and integration of marine conservation areas, small-scale fisheries management, and community livelihood enhancement.[390] This project received funding from the Blue Trust Fund amounting to 2.69 million Euros, with co-finance of 895,000 Euros for a project duration of 4.5 years (2020-2025). The main activities of this project include the governance of marine conservation areas (KKP), species conservation for sustainable fisheries, sustainable livelihoods for coastal communities and fisheries households, as well as conservation and restoration of three main habitats: mangroves, seagrass, and coral reefs. When converted to USD, YKAN manages a grant fund of USD 650,000 per year.

Currently, approximately 100 institutions are engaging in activities or programs within WPP 572, both at the local and national levels, focusing on environmental issues such as nature conservation, community empowerment, capacity building, and community-based economic development.[391] These institutions play a pivotal role in tackling diverse environmental challenges, promoting sustainable practices, and bolstering community resilience within WPP 572. Not all these institutions can manage large funds. Therefore, KI may need to categorize grants into two sizes: 1); Medium grants (with a grant value USD 40,000 and up to USD 600,000) and 2) Small grants (with a grant value of up to USD 40,000). Initially, it is anticipated that around 8% of the funds (USD 1.6 million) will be allocated for small grants, and 92% (USD 17.4 million) for medium grants. To support the quantity of grantees, 61 (for Windows 1 and 2) of potential grantees have been identified and are detailed in FS Appendix (a).

Medium grants are intended for implementing program outputs over one grant cycle, which spans from 2 to 2.5 years. Taking into account the activities typically involved in BEAM projects, which closely resembled those outlined in the COREMAP CTI project reference, as well as the comprehensive approach of the YKAN Blue Trust Fund program which includes community engagement methods, technical assistance, training, and infrastructure development, it can be inferred that the project ticket size for BEAM can be estimated within the range of more than USD 40,000 to 400,000 for a one grant-cycle program duration. The total volume for BEAM medium grants is up to USD 17,400,000.

It is crucial to acknowledge the increased risk associated with managing larger funds. Therefore, a thorough due diligence process for potential sub-grantees is very important. Nevertheless, involving local institutions within the WPP 572 area remains a priority. To bridge the gap for local institutions that cannot manage large grants, collaboration with community-based organizations through technical assistance and institutional strengthening is recommended during project implementation. This long-term approach aims to ensure ownership of the project, thereby ensuring its sustainability.

Small grants are tailored to accommodate activities with modest outputs and relatively short durations (several months to one-year duration), such as feasibility studies, seminars, workshops, or training sessions, typically organized by institutions prioritizing research or event management over direct community engagement. This focus on event-based initiatives comes from several factors: specialization,

[390] https://www.ykan.or.id/content/dam/tnc/nature/en/documents/ykan/fact-sheet/iop/bahasa/2304_Factsheet_YKAN_TNC_Indonesia_Bahasa_A4_final.pdf
[391] https://smeru.or.id/

where organizations excel in convening stakeholders and fostering discussions; resource allocation, enabling efficient execution within limited resources; timeliness, allowing quick responses to the needs of the BEAM projects; visibility and networking, enhancing organizational visibility and facilitating networking opportunities; and capacity building, contributing to skill development and collaboration among participants. In short, small grants support targeted activities aligned with organizational strengths, resource constraints, timeliness of issues, visibility goals, and capacity-building objectives. The total volume for small grants is up to USD 1,120,000 and each grant will be up to USD 40,000 per grantee. Like medium grants, small grants will follow the Call for Proposals (CfP) mechanism as outlined in KI Grants Manual.

Off cycle applications Proposals provide flexibility and adaptability in project implementation, this mechanism is intended for good proposals that will not reach the due date of Grant cycles, allowing potential grantees to keep working on their proposals with support from Technical Partner Grantees and present them later. This process will be only available for Windows 1 and 2. The total volume for off-cycle grants is up to USD 480,000 and each grant will be up to USD 40,000 per grantee.

Therefore, it can be assumed that the total number of recipients of W1 Adaptation grants is 36 (14 for medium grants, 14 for small grants, and 8 for off-cycle grants). Meanwhile, for W2 Mitigation grants, a total of 25 institutions assumed as grantees (7 medium grants, 14 small grants, and 4 off-cycle grants). By considering a variety of proposals, including the off-cycle applications, KI can better mitigate risks associated with project implementation. Diversifying project activities and approaches can help spread risks and increase the likelihood of project success. Potential grantees for the three funding windows can be identified as institutions at the national and regional/local levels. National-level agencies are those that operate programs spanning multiple provinces, such as YKAN, headquartered in Jakarta but with projects in Sorong, West Papua, or organizations like Yayasan Pesisir Lestari, based in Bali but operating projects in Kalimantan. An entity can be classified as a national level capacity to manage programs beyond provincial administrative boundaries. On the other hand, regional or local-level agencies are institutions based in the target area, actively operating, or implementing projects within WPP 572, such as Yayasan Gajah Sumatera (YAGASU), headquartered in Medan, with programs in North Sumatra and Aceh.

Table 92. Projected Grantees for Small and Medium Grants, On-cycle and Off-cycle Applications

Thematic Area/Grant type description	Number of grants/Service Providers	Grant size (USD)	Indicative total (USD)	Cycle
2.1.1. Adaptation Grant Window				
2.1.1.1. Ecotourism Development	4	Medium (400,000)	1,600,000	On-cycle applications
	3	Small (40,000)	120,000	On-cycle applications
	2	Small (40,000)	80,000	Off-cycle applications
2.1.1.2. Collaborative MPA Management	4	Medium (400,000)	1,600,000	On-cycle applications
	5	Small (40,000)	200,000	On-cycle applications
	2	Small (40,000)	80,000	Off-cycle applications
2.1.1.3. Sustainable and Diversified Fishing Livelihood	3	Medium (400,000)	1,200,000	On-cycle applications
	3	Small (40,000)	120,000	On-cycle applications
	2	Small (40,000)	80,000	Off-cycle applications
2.1.1.4. Sustainable Waste Management	3	Medium (400,000)	1,200,000	On-cycle applications
	3	Small (40,000)	120,000	On-cycle applications
	2	Small (40,000)	80,000	Off-cycle applications
		Total Grant Window 1	6,480,000	
2.2.1. Mitigation Grant Window				
2.2.1.1. Nature Restoration	4	Medium (400,000)	1,600,000	On-cycle applications
	7	Small (40,000)	280,000	On-cycle applications
	2	Small (40,000)	80,000	Off-cycle applications
2.2.1.2. Renewable Energy Deployment	3	Medium (400,000)	1,200,000	On-cycle applications
	7	Small (40,000)	280,000	On-cycle applications
	2	Small (40,000)	80,000	Off-cycle applications
		Total Grant Window 2	3,520,000	

6.5 Grant Window 1: Adaptation Activities

The adaptation grant window seeks to finance projects dedicated to supporting adaptation measures and enhancing resilience to climate change, primarily targeting vulnerabilities faced by coastal communities in WPP 572. While emphasizing community-led adaptation, capacity-building, technical assistance, research, and monitoring, activities under this window will also deliver climate change mitigation benefits by improving the management effectiveness of MPAs and/or networks.

The adaptation grant window ensures that project activities specifically benefit vulnerable coastal communities in WPP 572, complementing the mitigation grant window's focus on GHG emissions reductions through ecosystem restoration and renewable energy adoption. There are four sub-themes to be served by the adaptation window, namely (1) ecotourism development; (2) collaborative MPA management; (3) sustainable and diversified fishing livelihoods; and (4) sustainable waste management.

Criteria to identify priority areas of work and target geographies for needs-based targeted areas can be found in **Annex 26: Grant Facility Eligibility Criteria.**

This **climate adaptation grant window** seeks to finance small projects through the open call for grants under the four sub-themes. Grantees may be CSOs, NGOs, cooperatives, companies, MSMEs, universities and research institutions committed to establishing conditions that support adaptation measures and enhance resilience to climate variability and changes. The emphasis is placed on extensive community engagement and capacity-building, alongside technical assistance, research, and monitoring. Furthermore, this grant window is strategically designed to contribute to climate change mitigation by reinforcing the management effectiveness of MPAs or networks.

Four sub-themes were pre-selected based on market research and assessments of the regulatory regimes to identify achievable small and medium grant projects that could make an impact on local livelihoods and support climate adaptation. Moreover, these are areas that could attract post-grant private sector investment over the long term to scale up operations with appropriate finance.

For an illustration of adaptation target calculations, please refer to **Annex 24: Adaptation Beneficiary Calculations**.

6.5.0 Sub-theme 1. Ecotourism Development

Supporting businesses and communities in transitioning to or incorporating eco-tourism activities. This includes providing alternative income for coastal communities reliant on fishing during non-viable fishing seasons. The selected grantee will engage in training local communities in various eco-tourism activities, such as coral-reef diving, tour management, and practices ensuring reef-safe tourism. Additionally, they will supply essential equipment and/or supplies for these eco-tourism activities. Additional evaluation criteria specific to this thematic area: track record, volume of sales, sustainability rating of previous ecotourism ventures, etc.

This intervention will be delivered through grantees that are leading industry advocacy and network-building partners in marine ecotourism both at local and national level.

Table 93. Key criteria for Ecotourism Development

Overarching goals for sub-theme 1.	**Projects must aim to promote ecotourism as a means of generating income activities and improve the protection of marine ecosystems**
National policy alignment	All proposals must align with the government's sustainable ecotourism programs.
Key performance indicators	Percentage increase in incomes from ecotourism businesses and the number of ha under improved management. Number of eco-tourism-related job opportunities created in supported areas, Percentage increase in visitor/tourist due to positive and meaningful experience (quality).
Proposed grant amount	For medium grants an average of USD 400,000 For small grants an average of USD 40,000 For off-cycle proposals, the average will be USD 40,000
Percentage of costs covered (co-financing requirement)	Co-financing contributions are not required but encouraged.

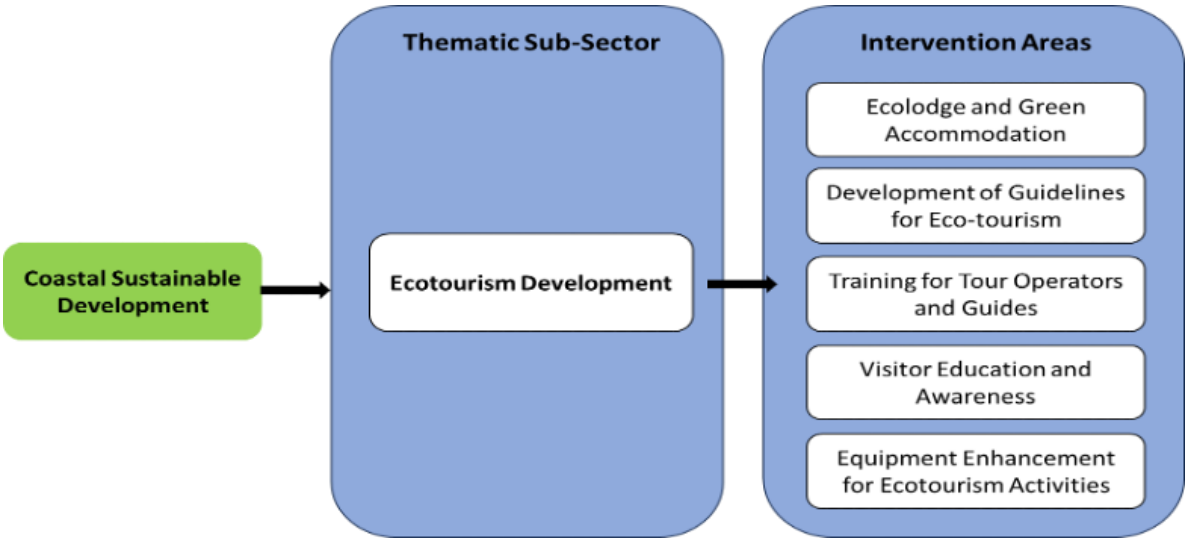


Figure 69. Intervention Areas for Coastal Sustainable Development Through Ecotourism

Ecotourism has a budget of USD 1,8 million. The project is considering five small grants and four medium grants, these numbers could change according to the project implementation needs. With the proposed type of grants, there is flexibility to allow a consortium to come together under a larger CSO or MSME to allow smaller groups to access grants as part of a consortium together with an entity with the capacity to manage GCF funds. Likewise, in-kind and fixed price type of grants will allow entities with less financial and administrative capacity to access GCF funds.

Marine and coastal ecotourism relies on a collaborative effort from a diverse range of stakeholders; some potential stakeholders are:

- Ministry of Tourism and Creative Economy of Indonesia, plays a crucial role in setting policy frameworks and regulations that promote sustainable practices.
- Indonesian Hotel and Restaurant Association (PHRI), industry associations like PHRI can help establish best practices and training programs for tourism business.
- Local tourism boards and associations contribute by promoting responsible tourism within their regions.
- Environmental NGOs such as Surfaid, YAPEKA, YKAN and local organizations such as Yayasan Ekowisata Aceh, Yayasan Masyarakat Penjaga Pantai Barat (YAMANTAB), Yayasan Pusaka Nias or Yayasan Ekosistem Leuser, bring expertise in sustainable resource management and can advocate for the protection of marine ecosystems through eco-tourism. These entities may also be potential grantees to promote sustainable marine ecotourism in WPP 572.
- Local communities residing in the proposed ecotourism target areas are key stakeholders as their active participation and cultural knowledge are essential for the success of the program. They could be engaged through BUMDES entities (village-owned enterprises).

Beyond this initial list, additional partners can further strengthen the development of marine and coastal ecotourism. Sustainable tourism organizations like the **Global Sustainable Tourism Council (GSTC)** provide certification programs for responsible businesses. Eco-lodge and green accommodation providers exemplify the type of tourism business that align with ecotourism principles. Including tourism training institutions, local tour operators and guides, and even equipment suppliers for eco-tourism activities will ensure a well-rounded approach that promotes responsible practices throughout the entire tourism experience.

Some of the key questions for potential grantees to address in the developing proposals on this thematic activity are presented in the table below. By answering these questions, the project proposals can effectively demonstrate the objective of supporting ecotourism to increase coastal community livelihood while at the same time minimizing impact to the coastal environment. Applicants with extensive portfolios of past projects and businesses supported will be prioritized.

Table 94. Project Detail Questions for Proposal Development on Ecotourism

Details	Supporting ecotourism enterprises for community development
Project background **Provide backgrounds as to why this project should be supported**	What are the current challenges faced by coastal communities, particularly during non-viable fishing seasons, and how will this ecotourism project address those challenges by providing sustainable alternative income sources?
Project outcomes	How will this project measure success in terms of improved livelihoods for local communities through ecotourism activities? (e.g., increased income levels, job creation, diversification of income sources)
Climate adaptation impact	Does the project incorporate strategies to promote sustainable tourism practices that minimize environmental impact and contribute to climate change adaptation (e.g., reef-safe diving, responsible waste management)?
Co-benefit	Beyond economic benefits for communities, what additional positive outcomes will this project generate? (e.g., increased environmental awareness, cultural preservation, community empowerment)

6.5.1 Sub-theme 2. Collaborative MPA Management

Enabling locally-led and co-management approaches that empower communities, traditional fishers, and local stakeholders to actively participate in MPA governance, planning, and enforcement. Grantees may

implement activities such as establishing co-management committees, conducting participatory ecosystem mapping using local knowledge, delivering capacity-building programs and mentorship for community-based MPA managers, developing community-led surveillance systems and compliance mechanisms, and integrating traditional practices with scientific monitoring. This aligns with component 1 sub-activities. The grantee may also facilitate the set-up of offices for ecosystem and fisheries monitoring, and deliver monitoring equipment and supplies, including boats, buoys, laptops, and remote sensing tools. Additional evaluation criteria specific to this thematic area: areas of previous work, success rates, total ha under improved management because of previous work, ties to the local communities, gender and social inclusion approach, and technologies to be used, innovations, etc.

This intervention will be delivered through grantees that are leading marine conservation advocacy and network building partners focused on strengthening MPA management support in Indonesia, particularly with experience in WPP 572.

Table 95. Key Criteria for Collaborative MPA Management

Overarching goals and example activities	**Projects must contribute to the effective implementation of newly established and existing MPAs/networks.**
National policy alignment	All proposals must align with the government's MPA vision 30 by 45 in this region.
Priority location areas	Existing MPAs are distributed equally in Aceh, West Sumatra and North Sumatra. Majority of newly proposed MPAs are in Lampung and North Sumatra
Key indicators used to measure project performance	Number of ha under improved management. Increased numbers of skilled surveyors and government staff members with improved knowledge and expertise in MPA monitoring practices Enhanced monitoring and data collection capabilities resulting in more accurate and comprehensive data. Increased compliance indicating improved management of MPAs/network.
Percentage of costs covered (co-financing requirement)	Co-financing contributions are not required but encouraged

Collaborative MPA management has a budget of USD 1,8 million. The project is assuming approximately seven small grants and three medium grants, but these numbers could change according to the project implementation needs.

The grant allocated to this sub-activity is to ensure that the community and MPA staff receive education, awareness, and technical training to actively participate in conserving the protected marine areas. This includes conducting monitoring, facilitating dialogues, or mediating conflicts that may arise in the MPA region. The funds for this sub-activity will also be used for collaborative research necessary to support better and sustainable MPA management, involving research institutions, universities, and other stakeholders.

Effective collaborative management of MPAs requires the support of a diverse group of stakeholders who can contribute their expertise, resources, and influence, some of the potential stakeholders are:

- Ministry of Marine Affairs and Fisheries of Indonesia (MMAF), is key to the WPP 572 MPAs' success, providing legal framework, enforcement, funding, and national level alignment.
- Government surveyors and officials, with their technical skills in mapping, resource assessment, and monitoring are crucial for the MPAs, ensuring data quality aligns with national standards and integrates with wider marine plans.
- Coastal communities' and local residents' knowledge of the local environment and traditions is vital for sustainable MPA management, allowing for plans that respect their livelihoods and cultural values.
- Environmental and conservation NGOs, especially with expertise in Marine and Coastal conservation such as CTC, YKAN, WWF, offer scientific knowledge, MPA experience, and funding, while raising awareness, promoting best practices, and championing the MPA's success. These organizations also have the potential as the grantees for this initiative. Local organizations to consider are Yayasan Ekowisata Aceh, YEL, YAGASU, YAMANTAB, Yayasan Pusaka Nias, Mitra Bentala, Yayasan Pesisir Lestari, Panglima Laot, Provincial WALHI.

In addition to the above list, there are other potential collaborators crucial for the success of this initiative. Capacity-building organizations specializing in surveying can significantly enhance the effectiveness of marine protected areas (MPAs) by providing training to government surveyors in advanced data collection, analysis techniques, and MPA-specific reporting, thus improving long-term monitoring and decision-making processes. Furthermore, development contractors engaged in nearby projects can play a vital role in ensuring sustainable development practices that minimize adverse impacts on the MPA. Collaborating with equipment suppliers specializing in surveying and monitoring technology offers the opportunity to use cutting-edge tools like underwater drones, facilitating more extensive data collection and providing a clearer understanding of the MPA's health. Moreover, partnering with local community-based organizations (CBOs) situated within MPA areas can bridge the communication gap between communities and MPA authorities, fostering a collaborative approach to management. CBOs facilitate co-management initiatives where local communities actively participate in decision-making processes and enforcement activities, thereby promoting greater community engagement and support for MPA conservation efforts.

Some of the key questions to address in developing a proposal on this theme are presented in the table below. By answering these questions, the project proposals can effectively demonstrate the objective of collaborative MPA management.

Table 96. Project Detail Questions for Proposal Development on Collaborative MPAs Management

Details	Collaborative MPAs management support
Project background **Provide backgrounds as to why this project should be supported**	Can you elaborate on the current state of marine protected areas (MPAs) and the challenges faced by national and sub-national governments in expanding and managing them? What are the potential benefits and positive impacts that providing equipment and supplies for MPAs could bring to the marine ecosystems and fisheries in the targeted area? How does supporting national and sub-national governments align with broader conservation and fisheries management goals?
Project outcomes	What specific outcomes does the project aim to achieve regarding the expansion and effective management of marine protected areas? Can you detail the expected improvements in ecosystem and fisheries monitoring, and the overall impact on the conservation of marine resources?
Climate adaptation impact	How does the provision of equipment and support for marine protected areas contribute to climate adaptation strategies in the context of fisheries management?

Details	Collaborative MPAs management support
	Are there specific climate-related challenges or vulnerabilities that this project aims to address within WPP 572?
Co-benefit	Beyond the direct impact on MPAs, what are the broader co-benefits anticipated, especially in terms of community engagement, gender and social inclusion, and technological innovation? How will the success of the project be measured in terms of total area (ha)under improved management and the engagement of local communities?

6.5.2 Sub-theme 3. Sustainable and Diversified Fishing Livelihoods

Projects proposed within this grant category must offer clear and explicit explanations of how they plan to achieve the primary objectives established for the grant program. For instance, grantees focusing on community-based activities must present a well-defined strategy for engaging and empowering local communities. This includes establishing mechanisms to ensure the equitable distribution of benefits among community members and promoting inclusiveness.

This intervention will be delivered through grantees that are leading industry advocacy and network-building partners such as CTC or YKAN that specialize in marine conservation, fisheries management, and community development. Also, WWF Indonesia collaborates on sustainable fisheries and community projects, offering technical and financial support. SFP (Sustainable Fisheries Partnership), although an international entity, could be a potential partner as it focuses on enhancing fishing practices and market access for small-scale fishers, providing expertise in sustainable fisheries management.

Table 97. Key Criteria for Sustainable and Diversified Fishing Livelihoods

Overarching goals for sub-theme 3.	**Projects must lead to a reduction in the impacts of climate change on fishing communities.**
National policy alignment	All proposals must align with the government's community-based economic programs.
Priority location areas	Priority locations will be situated in the provinces, which have high poverty rates and are sensitive to climate change. Aceh, Lampung, and North Sumatra are the top three vulnerable provinces. Lampung, Bengkulu, and West Sumatra are projected to be the three consecutive provinces facing the most severe future climate impacts. Lampung and Bengkulu provinces, which have high poverty rates and sensitivity to climate change, display the need to focus on vulnerable coastal farmers and inhabitants who lack resources for climate adaptation, linking social and environmental concerns.
Key performance indicators	Number of new low-carbon innovations and technologies that lead to improved economic value for fish products. Reduction in the number of spoiled fish catch due to improved ice production infrastructure. Number of fishers with increased in households' income.

Percentage of costs covered (co-financing requirement)	Co-financing contributions are not required but encouraged

Sustainable and diversified fishing livelihoods have a budget of USD 1,4 million. The project is considering approximately 5 small grants and 3 medium grants, but these numbers could change according to the project implementation needs. Since this initiative prioritizes community engagement, local organizations are crucial extensions. They empower fishing families by reaching out, engaging with them, and building their capacity. To achieve this, potential grantees with substantial funding capabilities should actively involve CBOs. These CBOs possess a deep understanding of local social and economic realities. They can implement activities directly at the household level, providing targeted support and assistance. Collaboration with CBOs ensures initiatives are tailored to the specific needs and realities of coastal communities, fostering sustainable and inclusive development. All participating provinces (those adjacent to WPP572) will be able to access this sub-window.

Some potential stakeholders for this initiative are:

- Ministry of Maritime Affairs and Fisheries (MMAF), plays a critical role in establishing policies and regulations that support sustainable fishing practices. Their involvement ensures initiatives align with national fisheries development strategies and can potentially benefit from government funding or resource allocation.
- Local and provincial fisheries departments and authorities have a direct understanding of local fisheries and can provide crucial data on fishing practices, resource availability, and community needs. Collaboration allows for tailoring initiatives to specific contexts and facilitates communication with local fishing communities.
- Fisher cooperatives and associations represent the collective voice of fishers and provide valuable insights into their challenges and aspirations. They can act as channels for reaching out to fishing families, promoting participation, and ensuring initiatives address their practical needs.
- Environmental NGOs focusing on community development especially on the topic of sustainable fisheries such as Yayasan Bina Desa, Yappika Action aid, Yayasan Holianaa Nias, YAPEKA, YKWS (Yayasan Konservasi Way Seputih) etc., offer expertise in fisheries management and best practices for sustainable fishing while accompanying local communities to improve their awareness toward sustainable fishing. NGOs can contribute to capacity building initiatives, raise awareness about sustainable fishing methods, and advocate for policies that support these practices.
- Community-Based Organizations (CBOs) are crucial partners due to their deep understanding of local social and economic realities. CBOs can build trust with fishing communities, facilitate communication with authorities, and mobilize community participation in project implementation. They are key to ensuring initiatives are culturally appropriate and address the specific needs of local families.

Other potential collaborators vital for the success of this initiative include solar energy companies, which offer solutions for cleaner, more sustainable fishing practices through the provision of solar-powered equipment. Partnering with training institutions specializing in ice production and maintenance equips fishers with essential skills, enhancing fish quality and market access. Collaboration with quality fish preservation experts ensures proper handling techniques, reducing post-harvest losses and strengthening the value chain. Engaging with small fishing vessel manufacturers promotes the development of fuel-efficient boats, minimizing operating costs and environmental impact. By partnering with these diverse entities, the initiative aims to foster sustainable fishing livelihoods while safeguarding marine ecosystems.

Some of the key questions to address in developing a proposal on this thematic activity are presented in the table below. By answering these questions, the project proposals can effectively demonstrate the objective of this initiative.

Table 98. Project Detail Questions for Proposal Development on Sustainable & Diversified Fishing Livelihoods

Details	Sustainable and diversified fishing livelihoods
Project background **Provide backgrounds as to why this project should be supported**	What specific challenges are currently faced by local communities in preventing fish spoilage within WPP 572, and how do these challenges impact the community and the environment? What factors or conditions motivated the need for establishing community-based economic activities, particularly focusing on solar-powered cold storage rooms and ice production units?
Project outcomes	Can you outline the primary expected outcomes of this project in terms of local economic development and the reduction of fish spoilage, emphasizing the impacts on the community and the environment? How does the training of local communities align with the project's goals and contribute to the sustainable maintenance of solar-powered cold storage rooms and ice production units?
Climate adaptation impact	In what specific ways does the establishment of cold storage and ice production contribute to climate adaptation, and how does it address the challenges posed by changing environmental conditions within WPP 572? Are there targeted measures or adaptations within the project design that address climate-related challenges, and what strategies ensure the project's resilience to climate impacts?
Co-benefit	Considering gender and social inclusion, what measures will be implemented to ensure equal participation and benefits for all members of the community, and how will disparities be addressed? What specific role is envisioned for commercial actors, and how will their involvement be structured and financed to promote sustainability for both the community and commercial partners? How will the project integrate with existing supply chains and value chains in the fisheries management context, ensuring a comprehensive and interconnected approach?

6.5.3 Sub-theme 4. Sustainable Waste Management

Inadequate waste management practices on land coupled with low public awareness about waste management exacerbate the issue of marine waste. According to the report released by the National Coordinating Team for Marine Waste Management (TKN-PSL) as of the end of 2022, the progress in marine waste management stands at a mere 35.36%, significantly below the targeted goal of 70% by 2025.[392] With the nation generating 36,183,837.60 tons of marine waste annually, the current rate of waste reduction stands at a meagre 14.24% per year, while the potential for managed waste per annum stands at 63.5%. These statistics underscore the urgent necessity for project initiatives focused on marine and coastal waste

[392] https://sipsn.menlhk.go.id/sipsn/

management, aiming to strengthen efforts towards achieving the national target of reducing marine waste by 70% by 2025.

The project will partner with private sector entities for enhanced waste management and monitoring. Projects will focus on developing waste management plans, providing training on waste management practices, and implementing data collection practices for monitoring waste management at the provincial level. The selected grantee will assess current waste management practices and marine pollution levels, facilitating community-led waste management plans and training sessions. Additional evaluation criteria specific to this thematic area: volume of sales and years of experience in the industry, ties to local community, ESMP (Environmental and Social Management Plans) to ensure sustainable solutions, how the communities will be trained or incentivized to participate, what benefits do companies anticipate, and what revenues they anticipate generating.

This intervention will be delivered through grantees that are industry leaders in waste management particularly, in marine and coastal areas.

Table 99. Key Criteria for Sustainable Waste Management

Overarching goal for sub-theme 4	**Projects must result in a reduction of the damage caused by climate-driven waste pollution to coastal environments and communities.**
National policy alignment	All proposals must align with the government's national action plan for marine littering as a follow-up to the Indonesian government's commitment to reduce waste going to sea.
Key indicators used to measure project performance	Percentage reduction of the quantity and weight of waste disposal prevented in coastal areas and at sea. Increased knowledge and awareness of local communities regarding proper waste management. Number of successful developments and implementation of community-led/community-based waste management practice (e.g., Waste Bank/*Bank Sampah*).
Priority location areas	Projects will be prioritized in projects will be prioritized in the northern provinces of WPP 572, specifically Aceh, where the impact of climate-driven waste pollution on coastal environments and communities is significant.
Proposed grant amount	For small grants an average of USD 40,000 For off-cycle grants an average of USD 40,000 For medium grants an average of USD 400,000
Percentage of costs covered (co-financing requirement)	Co-financing contributions are not required but encouraged

Sustainable waste management practices have a budget of USD 1,4 million. Under the proposed grant cycles, the amount will be disbursed for 2 types of grants. The project is considering approximately five small grants and three medium grants, but these numbers could change according to the project implementation needs. Alternatively, grants can be distributed to organizations to act as the lead of a consortium consist of smaller organizations that will deliver these initiatives as sub-grantees.

Awarding larger grants to a big organization that can serve as consortium lead to be able to deliver a suite of services or to improve social inclusion is encouraged. This will enable less established organizations, women and other vulnerable groups to have opportunities to engage without the burdens of managing larger grants. Based on market assessments, large numbers of smaller organizations in communities across WPP 572 could benefit from this potential structure. These smaller organizations would then become part of proposal bids to KI from the larger organizations.

Some potential stakeholders for this initiative are:

- Ministry of Environment of Indonesia (MOE) holds primary responsibility for establishing and enforcing national waste management policies and regulations. Their involvement is crucial for securing legal frameworks, potentially acquiring funding, and aligning local efforts with national strategies for tackling marine waste.
- The Ministry of Maritime Affairs and Fisheries (MMAF) issued a decree concerning an action plan for plastic waste management in the maritime and fisheries sector.
- Local and provincial environmental offices possess a direct understanding of local waste management challenges and infrastructure. Collaboration allows for tailoring solutions to specific regional contexts and facilitates communication with local communities on waste management practices.
- Environmental NGOs or associations working on waste management such as Hivos, SNV Indonesia, Yayasan, Masyarakat Penjaga Pantai Barat, YEL, YKWS (Yayasan Konservasi Way Seputih), Mitra Bentala, Yayasan Pesisir Lestari bring expertise in waste reduction, recycling, and responsible disposal techniques. They can raise awareness, promote best practices, and advocate for policies that support sustainable waste management in coastal areas. These organizations also can be considered as potential grantees for this initiative.
- Local communities and community-based organizations play a critical role in waste management behavior change. CBOs can build trust, encourage community participation in waste collection and segregation initiatives, and ensure solutions are culturally appropriate and address their specific needs.
- Waste management companies, offer expertise in waste collection, transportation, and treatment/disposal, such as Waste4change, APSI (Indonesia Waste Entrepreneur Association). Collaboration with the entities will enable us to identify the most sustainable and cost-effective waste management solutions for the specific marine and coastal environment.

Other potential partners to consider are waste management planning consultants who offer specialized expertise in crafting comprehensive waste management strategies tailored to coastal regions, encompassing infrastructure development and stakeholder engagement. Collaborating with training institutions for local communities empowers community members with waste management skills, which then fosters active participation in environmental stewardship. Lastly, partnering with infrastructure and equipment suppliers for waste management ensures access to suitable technologies and resources for effective waste collection and processing, promoting sustainable practices within the region. These partnerships collectively advance the initiative’s goal of achieving cleaner coastlines and healthier marine ecosystems.

Some of the key questions to address in developing proposals on this theme are presented in the table below. By answering these questions, the project proposals can effectively demonstrate the objective of this initiative.

Table 100. Project Detail Questions for Proposal Development on Sustainable Waste Management

Details	Sustainable waste management practices
Project background **Provide backgrounds as to why this project should be supported**	What are the main waste management challenges in WPP 572, and how do you contribute to addressing these challenges? How do private sector entities play a crucial role in addressing waste management challenges, and what motivates their involvement in such projects?
Project outcomes	What are the expected outcomes of the project in terms of waste management plans, training sessions, and data collection practices? How will the assessment of current waste management practices inform community-led plans, and what is the grantee's role in facilitating these plans?
Climate adaptation impact	In what specific ways does partnering with private sector entities for enhanced waste management contribute to climate adaptation, and how does it address the challenges posed by changing environmental conditions within WPP 572? What measures or adaptations are incorporated into the waste management plans to ensure resilience to climate impacts, and how does the project align with broader climate adaptation goals at the provincial level?
Co-benefit	How will communities be trained or incentivized to actively participate in waste management practices, and what strategies will be employed to ensure sustained community engagement throughout the project? What benefits do private sector companies anticipate deriving from their involvement in waste management and monitoring projects, and how are these benefits aligned with the broader goals of sustainability and corporate social responsibility? What revenues are anticipated to be generated from the project, and how will these revenues contribute to the sustainability of waste management solutions and community benefits in the long term?

6.6 Grant Window 2: Mitigation Activities

This mitigation grant window will finance projects that allow for low-carbon, resilient development pathways, to mitigate climate change impact. This grant window will primarily target projects that will respond to the project's mitigation objectives through nature restoration and provision of renewable energy for local communities. The objective of having a distinct mitigation grant window to complement the adaptation grant window is to ensure that natural ecosystems are reinforced and restored and that any of the project's activities that require power or electrification have access to renewable options to ensure that this project not only sequesters emissions (through restored ecosystems) but also does not create the conditions (through new economic activities) for fossil-based energy consumption.

Given that this grant window will fund projects that could also deliver climate adaptation benefits, grantees will have the opportunity to select their preferred window based on the type of work proposed. This grant window, as opposed to grant window 1, will provide the needed natural and technological infrastructure needed for long-term investments and climate mitigation. The wider goal of this grant window is to ensure that ecosystems are sufficiently healthy for certain activities in grant window 1 (further described in this section), such as eco-tourism activities, to be effectively implemented. Indeed, several activities in grant

window 1 depend on the health and extent of mangroves, and seagrass, to deliver the expected adaptation benefits under grant window 1. This grant window will also provide financial de-risking benefits for grant Investment Readiness by providing more assurances that ecosystems have the necessary resilience to climate change to harbor investable economic activities.

Criteria to identify priority areas of work and target geographies for needs-based targeted areas can be found in **Annex 26: Grant Facility Eligibility Criteria.**

In addition to the considerations above, eligibility criteria for this grant will be defined to initially evaluate the alignment of potential grantees with the established standards set by KI. Furthermore, the proposed projects seeking funding through this grant window must not only adhere to these eligibility criteria but also provide explicit and comprehensive explanations of how their initiatives will effectively address the key targets outlined for this grant opportunity. Taking nature restoration activities as an example, potential grantees are required to showcase how their projects, encompassing aspects such as site selection, restoration methodologies, and potential for scalability, will yield optimal carbon sequestration benefits at the lowest feasible cost. The eligibility criteria are further described in Annex 26.

Output 2.2. Restoration of critical coastal ecosystems, protection of restored areas, and adoption of renewable energy technologies Under output 2.2, grants issued through the mitigation grant window will focus on promoting low-carbon, resilient development pathways, aiming to strengthen the climate change mitigation capacity of marine ecosystems in WPP 572. The primary focus of this grant window will be on projects aligned with the project's mitigation objectives, involving the restoration of mangroves, and seagrass beds, as well as the implementation of renewable energy solutions for local communities. The mitigation grant window will concentrate on projects contributing to climate change mitigation in two priority areas of focus identified through consultations and vulnerability analyses.

6.6.0 Sub-theme 1. Nature Restoration

Projects within this thematic area will contribute to the ecosystem restoration and conservation of seagrass and mangroves in WPP 572, offering essential carbon sequestration services crucial for low-carbon development.

This activity may be proposed by NGOs focusing on marine biodiversity, coastal conservation, ecosystem restoration, as well as marine research institutions, universities, community-based organizations and environmental consultants, such as CTC, YKAN, WWF, YAPEKA, Wetlands Indonesia, PILI Foundation, WALHI, and Yayasan Rekam Indonesia. Some NGOs present in WPP 572 to consider are: Yayasan Ekowisata Aceh, YEL, YAGASU, YAMANTAB, Yayasan Pusaka Nias, Mitra Bentala, Yayasan Pesisir Lestari, Panglima Laot, Provincial based WALHI. Other private stakeholders, such as environmental consultants like Smiling Indonesia, Reef Check, or local diving centers may partner for the project implementation. The nature restoration initiative focuses on three critical ecosystems that strengthen its ocean economy in WPP 572: the restoration of seagrass and mangrove ecosystems, including the assessment of blue carbon stocks. Economically, mangroves and seagrass play crucial roles in the life cycles and growth of various fish species, including commercial fishes that are vital for fishers' catches and support food security. Projects within this thematic area will contribute to the ecosystem restoration and conservation of seagrass and mangroves in WPP 572, offering essential carbon sequestration services crucial for low-carbon development.

Mangrove restoration. Mangrove forests are a major natural carbon storage and store about 50-90% of carbon dioxide they sequester below ground. Worldwide, about 81,792.93 square kilometers, or about 8.2 million ha of mangrove forests remain in 2017. Meanwhile, about 154,022 ha of mangrove was lost between 2000 and 2017, causing about 320.3 million tons of carbon dioxide emissions ($MtCO_2$).[393]

[393] Silver, Lars & Berggren, Björn & Veghohn, Fatima. (2010). The Impact of Investment Readiness on Investor Commitment and Market Accessibility in SMEs. Journal of Small Business & Entrepreneurship

However, the benefits of mangrove conservation and rehabilitation go well beyond carbon. Services such as storm protection, reduction of abrasion and erosion, water quality maintenance, and climate regulation are also important. Moreover, mangroves are important fishing grounds, and they provide vital habitat for fish nurseries on which marine fishing depends. They can also be sources of traditional medicines, provide tourism opportunities, and other cultural services can be associated with mangroves. As such, conservation, restoration, and expansion of mangroves are strategic to increase resilience of the coastal communities whose livelihoods depend on the ecological services of mangroves, as well as to mitigate climate change by increasing coastal nature-based carbon sequestration and storage.

Indonesia is home to about 3.3 million ha of existing mangroves – about 20% of the total mangroves worldwide – and restoration could increase that area by about 756,183 ha[394]. However, with 70,766 ha of mangroves lost between 2002 and 2017, Indonesia is the highest emitter of carbon dioxide from mangrove destruction, with about 38-152 million (mega) tons of carbon dioxide ($MtCO_2$), contributing about slightly less than half of mangrove losses worldwide[395].

The losses in carbon stocks from mangrove conversion are estimated at about 1.46 kT CO_2 per ha, about 5.35 kT CO_2 per ha, according to a published study in the Pantanos De Centla, Mexico. This is seven times larger than conversion of typical tropical dryland forests and three times of that of the Amazon forest[396]. Conserving remaining mangroves would avoid the release of about 15.5 gigatons of carbon dioxide (GT CO_2) worldwide that could be achieved at carbon prices of somewhere between USD 3 and USD 13 per Ton CO_2. Meanwhile, restoring mangroves can sequester up to 0.32 GT CO_2 worldwide and could be achieved at carbon prices between USD 4.5 and USD 18 per Ton CO_2[397].

Through the peatland and mangrove restoration agency (*Badan Restorasi Gambut dan Mangrove*, BRGM), the Government of Indonesia is setting and ambitious target to restore 600,000 ha of mangroves by 2024 and the establishment of 200 "Independent Villages caring for mangroves" (*Desa Mandiri Peduli Mangrove*)[398]. BRGM is optimistic that the target will be achieved in 2024 with a yearly target of restoration of 355,000 ha in 2024 alone[399]. This is significantly higher than the 152,000 ha of 600,000 ha targeted by the BRGM in its 2021-2024 strategic plan[400]. Prior to the establishment of the BRGM (or before mangrove was included in its mandate in 2020), the Ministry of Environment and Forestry managed to rehabilitate a total of 49,216 ha between 2011 and 2020. Other non-governmental entities and the private sector also contributed to mangrove restoration efforts[401]. The only province that is included in the BRGM strategic plan 2021-2024 that is also a part of WPP 572, however, is North Sumatera.

Seagrass conservation, restoration, and enhancement. Seagrass, along with other vegetated coastal habitats, are a key carbon sink and storage, albeit much less studied compared to their terrestrial counterparts[402]. Seagrass grows best in shallow waters of less than 90 meters deep, notably in subtidal and intertidal areas and around coral islands. Worldwide, there are about 15-60 million ha of seagrass areas[403]. Some estimates even cited about 432 million ha[404]. Meanwhile, seagrass provides various vital ecosystem services and supports coastal biodiversity and fisheries. Some of the services include hydrological stabilizers, sources of nutrition for many coastal biota, primary production, providing key habitat for various fauna, and playing key functions in the nutrient cycle and rare elements in the coastal

[394] ADB Brief, Indonesia, Nov 2022
[395] Indonesia Agro-Value Chain Assessment, World Bank, 2020
[396] Replication of Intellecap's ecosystem based approach in East Africa, 2018
[397] Design of a Blended Blue Finance Facility for Marine Protected Areas in Southeast Asia
[398] Design of Asia Aquaculture Facility (AAF)
[399] Design of Restoration Insurance Service Company (RISCO)
[400] Design of Dual Blended Finance Structure I ("DBFS") to invest in community-focused regenerative agroforestry projects in Indonesia
[401] Sankalp Forum
[402] State of Blended Finance, Convergence, 2024
[403] Mastercard Sustainability Article, 2024
[404] Impact-focused enterprises, the BOP, and the future, 2019

and oceanic ecosystems.[405] Seagrasses also provide important habitats for threatened (including endangered) species such as turtles and dugongs.[406] As a key carbon sink and store, the conservation, restoration, and expansion of seagrass areas is a strategic measure to mitigate climate change through nature-based solutions while increasing resilience of the coastal communities against the impacts of climate change.

In Indonesia, seagrasses occupy an area between 150,000-300,000 ha.[407] In the WPP 572 area, seagrasses are found mainly in the northern part of Nias, Mentawai, Lampung (all are unhealthy with coverage of about 30-60%) and in Central Tapanuli (poor, coverage of less than 30%) (Figure 87). Overall, nationwide coverage of seagrasses is slightly less than 42%[408] and its existence is greatly threatened. While the world has lost about 29% of seagrasses since the 19th century, Indonesia has witnessed about 25% of seagrass cover loss between 1999 and 2004 mainly due to massive development.[409]

Threats to seagrasses come from both natural and anthropogenic causes. Natural causes include cyclones, typhoons, tidal waves, volcanic activity, shifting sediments, and pests and diseases. Meanwhile, mining activities, coastal aquaculture, runoff due to inland deforestation, population and community interactions, and blast fishing are among the anthropogenic causes of the threats to seagrasses.[410]

Better management of seagrass areas is important for ensuring that seagrass continues to serve its ecological functions and to increase the resilience of the coastal communities whose livelihoods depend on seagrass ecosystem services. Knowing where seagrass areas are is important for improving seagrass management, and as such seagrass mapping is a strategic first step. BEAM has targeted the mapping of about 4 to 8 million ha of seagrass areas in WPP 572, starting with remote sensing mapping as a part of the one map initiative. Protection of existing seagrass in MPAs as the least expensive option and may be prioritized. Meanwhile, reducing the threats by mitigating the anthropogenic underlying causes is also important. Rehabilitation of disturbed and altered seagrasses, while costly, may also be needed in some, if not all, areas. About USD 22,800 – USD 684,000 per ha may be needed to return the ecosystem function of seagrasses. Reducing the causes of destruction appears to be much more financially feasible.

map image removed

Figure 70. Seagrass distribution in WPP 572, showing presence in Nias, Mentawai, Central Tapanuli, and Lampung (yellow and red circles).[411]

The Financing Approach

The estimated cost for mangrove rehabilitation in Indonesia is between USD1,640 – USD3,900 per ha (World Bank, 2023) and USD 3,600 per ha (MMAF Plan, 2023). The median cost of seagrass restoration was estimated at USD 106,782 per ha based on 64 published studies (Bayraktarov et al., 2016). For comparison, the restoration of a 600-square-meter seagrass area in the Sangkarang Islands, South Sulawesi, Indonesia, costs approximately USD100,000 for planning, planting, and monitoring over three years[412]. It is important to note that these calculations are highly dependent on restoration techniques, damage level, and location. To optimize impact, it is recommended to implement the rehabilitation of these three ecosystems where these ecosystems are already extant. We also consulted the amount of seagrass

[405] Sottini, A., Ciambotti, G., & Littlewood, D. (2022). Engaging symbiotic ecosystems to build community centred business models for the BoP: Evidence from small social enterprises in East Africa. International Small Business Journal, 40(8), 935-965
[406] Article by Insignia Ventures Partners, 2024
[407] The economic impact of capture fisheries development in Indonesia, AACL Bioflux, 2019
[408] Place-based Innovation: A Bottom-up Approach to Boost Competitiveness, The Global Federation of Competitiveness Councils, 2022
[409] Roadmap for the development and strengthening of Venture Capital Firms, OJK Indonesia
[410] Anggraeni, Shanti & Maarif, Mohamad & Sukardi, Sukardi & Raharja, Sapta. (2021). Prospective Strategy for Strengthening the Fish Processing Innovation System in Banten Province
[411] Hernawan et al., 2021
[412] Association of Business Incubation

restoration with the Indonesia National Research and Innovation Agency (BRIN), as they have similar projects that have been implemented in several locations in Indonesia. According to BRIN, the seagrass restoration cost could vary between IDR 300M to 700M (about USD 18,750 - 43,750). Therefore, using the references above along with the experience with KI and incorporating the 20% operational costs for grantees to implement restoration and rehabilitation, it is assumed that the average cost for mangrove restoration is USD 4,730 - USD 4,825 per ha, the average cost for seagrass restoration is USD 66,944 per ha. The allocated grant for this activity is USD 1.96 million and will support approximately 285 ha of mangrove, and 6 ha of seagrass restoration.

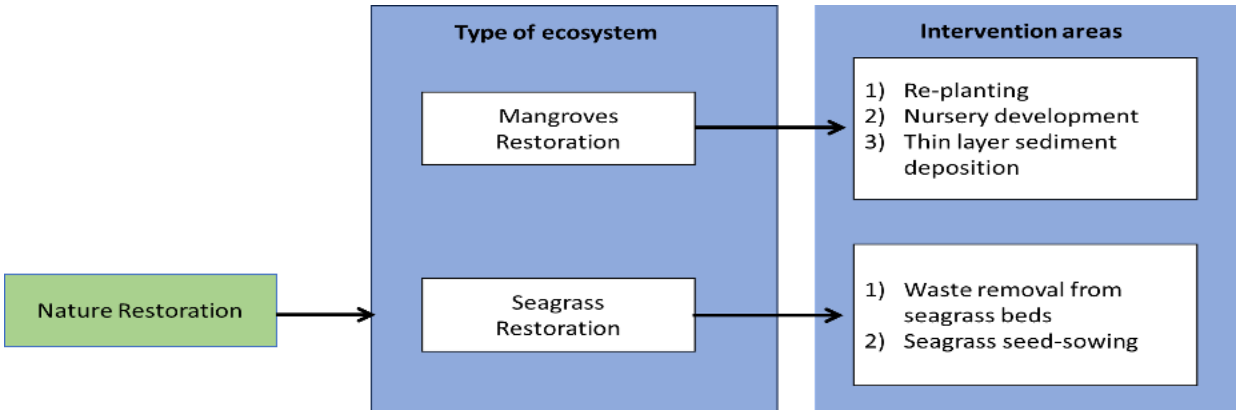


Figure 71. Overview of Intervention Strategies for Ecosystem Restoration

The restoration activities for the three main ecosystems mentioned above are expected to be carried out collaboratively with the participation of all stakeholders, including local communities. These activities are selected to be implemented collectively with the involvement of local communities, aiming to instill a sense of ownership, thus fostering a desire to preserve and sustain what has been accomplished together. Furthermore, the anticipated impacts are aimed at improving degraded ecosystems, maintaining environmental balance to enhance the environment, and providing significant economic benefits. Concurrently, they are expected to offer ecological benefits and contribute to the project's mitigation targets (mangroves and seagrasses).

Mangroves:

Re-planting mangroves should be carried out by propagating and planting mangrove seedlings in degraded areas, and this activity requires nurseries, transportation, and planting tools.

Nursery development, this activity is establishing or expanding nurseries to raise mangrove seedlings and will need infrastructure, seeds, and expertise.

Thin layer sediment deposition is done by enhancing degraded mangrove areas by pumping sediment slurry, requiring specialized equipment and trained personnel.

Seagrass:

Waste removal may be conducted by organizing community clean-up drives and using manual tools or boats to collect debris from seagrass meadows.

Seagrass seed-sowing, this can be done by collecting, processing, and sowing seagrass seeds in suitable areas, demanding specialized equipment and ecological knowledge.

The following are some explanations for the required resources and potential budget considerations when developing project activities by project applicants.

Table 101. Resource Requirements and Cost Estimates for Coastal Ecosystem Restoration Projects

Mangroves	
Re-planting	*Resources:* mangrove seedlings, transportation, planting tools, labor, fencing (optional). *Cost range:* USD 0.5 – USD 5 per seedling (depending on species and size), USD 100-USD 500 for transportation per trip (depending on distance and quantity), USD 20-USD 50 per tool, USD 50-USD 100 per day for labor
Nursery development	*Resources:* land, fencing, shade cloth, water source, irrigation system, tools, seeds or propagules, expertise. *Cost range:* USD 5,000-USD 20,000 for basic infrastructure, USD 0.10-USD 1 per seed/propagule, ongoing maintenance costs depending on size and complexity.
Thin layer sediment deposition	*Resources:* specialized equipment (e.g., barge, pump), sediment source, trained personnel, permits. *Cost range:* highly variable depending on project scale and location, typically USD10,000-USD50,000 per ha.
Seagrass	
Waste removal	*Resources:* boats, manual tools (e.g., gloves, trash bags), transportation, waste disposal facilities. *Cost range:* USD20-USD50 per volunteer per day, USD50-USD100 per boat per day, waste disposal fees vary depending on location and volume.
Seagrass seed-sowing	*Resources:* seagrass seeds, collection and processing equipment, boats, labor, expertise. *Cost range:* USD10-USD20 per kilogram of seeds, USD500-USD1,000 for basic processing equipment, USD20-USD50 per volunteer per day, USD50-USD100 per boat per day, ongoing monitoring costs.

The resources needed and the actual costs for each of the activities may vary significantly. The proposal should specify the approach and basis for cost calculation to ensure the efficient development of activities with sustained impacts.

The following are some details that applicants need to include in their proposals for consideration of eligibility and meeting the criteria to qualify for mitigation grant funding.

Table 102. Project Detail Questions for Proposal Development on Nature Restoration

Details	Nature restorations
Project background **Provide backgrounds as why this project should be supported**	What is the relevance to climate change mitigation and contribution to carbon reduction? How does this contribute to coastal community resilience? What is the contribution to biodiversity conservation? What stakeholders will be involved in the design and implementation of the intervention? How will protection of restored areas be ensured after completion of restoration activities?

Details	Nature restorations
	Is there any existing local/traditional knowledge in practice? If yes, how do you plan to incorporate such knowledge into the project implementation?
Project outcomes	Provide details of the project goal and how it will contribute to the project outcomes. Elaborate on the ultimate objective of nature restoration and protection to strengthen the resilience of the ecosystem.
Climate mitigation impact	Describe what are the current conditions of the ecosystem, the challenges it faces, and reduce its capacity to store carbon. Provide the details on how the mangrove and seagrass restoration, and protection measures will contribute to carbon storage and reduce GHG/carbon emission.
Co-benefit	Are there any other benefits that the project may contribute (other than climate mitigation impact)?

6.6.1 Sub-theme 2. Renewable Energy Deployment

The activities are to develop and implement renewable energy targeting local communities (solar panel installation, maintenance, and use of renewable technologies for fishing practices and processing). The implementation of renewable energy initiatives aimed at local communities includes supplying beneficiaries with a range of renewable energy equipment and/or supplies (e.g., solar panels, generators) and tools powered by renewable energy (e.g., ice production units utilizing renewable technologies for fish processing). Additionally, training on the utilization and maintenance of renewable energy equipment and hardware is provided. Providing technical assistance and equipment/supplies to communities intending to use renewable energy technologies for their alternative livelihoods, such as ice-production units for fishing communities, is essential. This ensures that these communities can proficiently operate, maintain, and repair solar-powered energy units for sustained functionality. Funding recipients to promote the use of green energy can come from local community cooperatives and fishermen's associations, as well as from NGOs focusing on sustainable energy and community development, such as Hivos, WWF, YIC (Yayasan Indonesia Cerah), Yayasan Javlec Indonesia, and GIZ. Local organizations at WPP 572 to consider for this thematic project are Yayasan Ekowisata Aceh, Yayasan Geutanyoe, YEL, YAGASU, YAMANTAB, Yayasan Pesisir Lestari, CKS, Yayasan Holianaa. Other entities to consider from private sector as service providers for trainings and capacity building in solar energy deployment are solar energy providers such as PT LEN Industri, Warung Energi, IEA, AESI, IESR, and PT PJB services.

Table 103. Key Components of Renewable Energy Deployment for Local Community Development

Renewable energy	
Over-arching goals and example activities	Developing and implementing renewable energy targeting local communities, such as solar panel installation, maintenance, and use of renewable technologies for fishing practices and processing
National policy alignment	All proposals must align with Paris Agreement and Indonesia's NDC.
Key Indicators Used to Measure Project Performance	Resulting improvements in livelihoods for fishers and processors

Renewable energy	
	Expected tons of carbon dioxide equivalent for fossil fuel technology not deployed
Proposed grant amount	For medium grants an average of USD 400,000 For small grants an average of USD 40,000 For off-cycle grants an average of USD 400,000
Percentage of costs covered (co-financing requirement)	Co-financing contributions are not required but encouraged.

This activity will be carried out by empowering local communities and encouraging them to play a crucial role in the success of the initiative so that more will emulate and replicate such initiatives. Funding recipients to promote the use of environmentally friendly energy can come from local community cooperatives and fishermen's associations, as well as from NGOs focusing on sustainable energy and community development.

The renewable energy initiative envisions a total grant of USD 1.56 million, with the primary goal of providing sustainable climate change mitigation in coastal communities. The project is planning for approximately nine small grants and three medium grants, but these numbers could change according to the project implementation needs.

This flexible funding range allows each grantee to tailor their project proposals based on the unique complexities and anticipated impacts, ensuring that the financial support is proportionate to the scale and scope of their initiatives. By providing this range, the grant may accommodate a diverse array of projects, from smaller-scale, targeted interventions to larger, more intricate endeavors, thereby responsive to the specific needs and challenges of each proposed initiative.

The first intervention area focuses on solar panel installation and electricity connections. Some actionable efforts under this category include, (but are not limited to:

Site assessment and planning: before initiating the solar panel installation, a comprehensive site assessment needs to be conducted, involving evaluation of the specific locations for solar panel placement, considering factors such as sunlight exposure, shading, and proximity to the electricity network. Planning will include designing the layout to optimize energy capture and efficiency. The project should clearly define how the assessment will identify any potential obstacles or challenges that need to be addressed during the installation process.

Procurement and quality assurance: this sub-activity involves procuring the necessary solar panels and associated equipment. Rigorous quality assurance measures will be implemented to ensure that the procured equipment meets industry standards and specifications. This includes verifying the certifications of the solar panels, assessing their durability, and confirming compliance with safety standards. Some companies and organizations provide solar panel installation as well as necessary training, such as:

- PT LEN Industri: offers commercial and community-scale solar solutions alongside training programs.
- PT PJB Services: provides off-grid solutions and customized training options for communities and businesses.
- Yayasan Indonesia Cerah (YIC): a prominent NGO actively promoting renewable energy in coastal communities. They offer training and connect users with suitable providers.

- World Wildlife Fund (WWF) Indonesia has experience designing and implementing solar projects in coastal areas and might offer training or guidance.

Installation and grid connection: the actual installation of solar panels will be carried out by skilled technicians and professionals. This process involves mounting the solar panels securely, connecting the electrical wiring, and integrating the system with the electricity network. Specialized tools and equipment will be used to ensure precision and efficiency during installation. Following the physical installation, the connection to the electricity grid will be established, allowing the generated solar energy to be fed into the network. This phase includes testing and commissioning to ensure the seamless integration of the solar panel system with the existing electricity infrastructure.

Maintenance and repair workshops to provide hands-on training to individuals responsible for the upkeep of solar panel systems. Participants will learn about routine maintenance tasks, including cleaning, checking for damage, and ensuring proper connections. The training will also cover troubleshooting common issues and making minor repairs to maximize the lifespan and efficiency of the solar panels.

Efficient energy use training programs involves educating end-users, communities, or technicians on best practices for optimizing energy production and consumption. Training sessions may cover topics such as understanding energy consumption patterns, adjusting usage behaviors, and utilizing monitoring systems to track performance. The goal is to empower individuals with the knowledge and skills needed to make the most effective use of solar energy, ultimately enhancing the sustainability and impact of solar panel installations.

Table 104. Technical Considerations for Renewable Energy Development for Community

Technical	Details
Maintenance and repair workshops	
Technical personnel	A skilled trainer or facilitator with expertise in solar panel systems, with experience in installation, maintenance, and repair. Technicians or individuals responsible for solar panel maintenance in the target communities. 2-3 trainers for 10-15 people per workshop.
Duration	Varies based on the complexity of the training A basic workshop can span 2-3 days, including both theory and practice.
Estimated cost	May range from USD5,000-USD10,000, depending on the scale and location Costs include trainer fees, venue rentals, training materials, and equipment for hands-on practices.
Potential collaboration	NGOs: HIVOS, GIZ, YIC (Yayasan Indonesia Cerah) Solar panel training provider: Warung Energi/PT Blue, PT PJB Services.
Energy efficient use training	
Technical personnel	Energy efficient experts or trainers with knowledge of solar panel systems and energy consumption patterns. The person is encouraged to also have community engagement skills to facilitate discussion and interact with participants. 2 – 3 trainers for 15 – 30 participants per session.

Technical	Details
Duration	This may be organized as one-day workshops or multiple sessions over a week. Ongoing awareness campaigns and follow-up sessions can be planned throughout the implementation period
Estimated cost	May range from USD7,000 to USD15,000 Costs include trainer fees, venue rental, training materials, and promotional materials
Potential collaboration	NGOs: Yayasan Cerah Indonesia, WWF, HIVOS, GIZ Energy efficient champion/campaigner: the International Energy Agency (IEA), Indonesia Solar Energy Association (ISEA): Institute for Essential Services Reform (IESR),

The sub-activities serve as a reference providing an overview of the form of activities and their operationalization in the field. These sub-activities can evolve in line to achieve environmentally friendly, affordable, and sustainable clean energy for coastal communities in WPP 572. The operationalization of activities and potential partnerships will also develop based on needs, activity locations, and participant targets. For the development of proposed projects, some important considerations are shown in the table below.

Table 105. Project Detail Questions for Proposal Development on Renewable Energy Deployment

Details	Renewable energy
Project background **Provide backgrounds as to why this project should be supported**	How the deployment of renewable energy aligns with climate mitigation efforts How will the project impact the resilience of coastal communities (especially fishers): Is technology or innovation solving the problem? Does it bring positive changes to the community?
Project outcomes	Provide details of the project goal and how it will contribute to the project outcomes. Elaborate on the ultimate objective of the clean energy transition in the coastal community process.
Climate mitigation impact	Describe how and to what degree the proposed area (the local practice) contributes to increasing GHG/carbon emissions. Describe how technology or the innovation in renewable energy can contribute to reducing GHG/carbon emissions.
Co-benefit	Are there any other benefits that the project may contribute (other than climate mitigation impact)?

6.7 Investment Readiness

Investment readiness programmes seek to improve enterprise bankability while simultaneously building the confidence and capacity of financial institutions – a feedback dynamic documented in the OECD's

Discussion Paper on Investment Readiness Programmes.[413,414] The IRW design draws on this framework, contextualized for the WPP 572 blue economy context.

- **Customized approach:** Solving for the dual demand-side challenges of the quality and quantity of the deal-flow in WPP 572 will require engaging with both MSMEs (through the Adaptation and Mitigation Windows) and the financial institution mandated with providing these MSMEs with concessional finance (BLU LPMUKP).
- **Localized solutions:** Most investment readiness programs are understood and designed for the high growth enterprises targeting equity investments. Localization of IRW to the context of WPP 572 and blue economy sub-sectors will require alignment of this approach to enable MSMEs (including fisheries cooperatives) to access financing.
- **Knowledge and Networks:** Prioritization of evidence-based interventions and action-oriented knowledge products to engage the private and public sector stakeholders that create enterprise-to-enterprise, enterprise-to-investor, and enterprise/investors-to-government linkages, thus building an enabling blue economy ecosystem.
- **Sustainability**: Ensure long-term sustainability of the project by building the capacity of local institutions to better serve their constituents in perpetuity.

The IRW operates through two complementary interventions, each targeting a distinct layer of the market failure identified in Section 5:

- **Action-oriented blue economy research** – four practitioner-oriented research papers on topics such as market segmentation of blue economy enterprises in WPP 572, enabling fisheries cooperatives, green shipping opportunities, and marine tourism investment roadmaps. These papers address critical knowledge gaps that currently deter investor capital allocation and are actively disseminated to financial intermediaries, development partners, and policymakers.
- **Technical assistance to BLU LPMUKP** – targeted operational support to the Marine and Fisheries Business Capital Management Agency (BLU LPMUKP), KKP's microcredit aim for the fisheries sector. Current outreach is constrained by limited extension officers and complex loan procedures. The IRW will engage a service provider to streamline LPMUKP's processes, introduce an IT loan management system, and train staff on simplified disbursement methods – increasing the flow of affordable credit to small-scale fishers and fish farmers in WPP 572. The Project will serve as 'matchmaker' and capacity builder for MSMEs in WPP572 and the BLU LPMUKP to ensure that effective MSMEs have access to concessional finance to grow their operations and the overall blue economy in WPP572.

Detailed sub-activity descriptions, timelines, and delivery milestones for all three sub-interventions are provided in Section 6.7.1-6.7.3.

6.7.1 Description of Investment Readiness Sub-Activities

The Investment Readiness addresses barriers that prevent blue economy enterprises in WPP 572 from accessing finance – namely, high perceived risk, limited enterprise capacity, and weak institutional lending mechanisms. The IRW has two complementary objectives: (i) to generate actionable knowledge on blue economy investment opportunities through targeted research; and (ii) to strengthen the operational capacity of a key government microcredit provider serving coastal communities.

The IRW consists of two interlinked interventions. First, the IRW commissions action-oriented blue economy research papers. Four studies will be produced on topics such as market segmentation of blue economy enterprises in WPP 572, enabling fisheries cooperatives and marine tourism investment roadmaps. These papers are designed to bridge critical knowledge gaps for investors, provide

[413] Silver, Lars & Berggren, Björn & Veghohn, Fatima. (2010). The Impact of Investment Readiness on Investor Commitment and Market Accessibility in SMEs. Journal of Small Business & Entrepreneurship
[414] Discussion Paper on Investment Readiness Programmes, OECD

evidence-based policy recommendations to government, and disseminate lessons learned for replication across other WPPs.

Second, the IRW provides technical assistance to the Marine and Fisheries Business Capital Management Agency (BLU LPMUKP) under the Ministry of Marine Affairs and Fisheries. BLU LPMUKP is the government's microcredit arm for the fisheries sector, but its outreach is constrained by limited extension officers and complex loan application procedures that require extensive handholding. The IRW will engage a service provider to assess and streamline LPMUKP's operational processes, introduce an IT system for loan management, and train its staff on simplified, client-friendly disbursement methods. This intervention is expected to increase the flow of affordable credit to small-scale fishers and fish farmers across WPP 572.

The Project will work with private sector grantees under Component 2's Adaptation and Mitigation grant windows (e.g. ecotourism operators) and as part of their capacity building, the Project will support their applications for loan finance through BLU LPMUKP.

6.7.2 Project Management Unit

The Project Management Unit (PMU) is based in Jakarta and responsible for overall project management, coordination with national government and project partners, and reporting to the Accredited Entity (CI). KI serves as the Executing Entity for the IRW and retains overall accountability for grant management, contracting, due diligence, and compliance with GCF, CI, and Indonesian regulations. For the research component, KI procures qualified research organizations (e.g., Danareksa Research Institute, SMERU, Systemiq) through competitive calls for proposals. For technical assistance to BLU LPMUKP, KI engages a service provider with expertise in microfinance operations and IT systems. The PMU coordinates closely with all partners to ensure that research dissemination and institutional strengthening proceed according to the phased timeline. KI will establish a fully staffed PMU with clear authority and dedicated capacity for grant management, finance, procurement, safeguards, GESI, M&E, grievance management, and government coordination, overseeing screening, appraisal, contracting, monitoring, incident reporting, grievances, and corrective actions under CI-GCF oversight.

6.7.2.1 Roles and Responsibilities

For the Blue Economy Studies, KI procures qualified research organizations (e.g., Danareksa Research Institute, SMERU, Systemiq) through competitive calls for proposals. These service providers deliver four action-oriented research papers on topics such as market segmentation of blue economy enterprises in WPP 572, enabling fisheries cooperatives, green shipping opportunities, and marine tourism investment roadmaps. Each study is actively disseminated to financial intermediaries, development partners, and policymakers.

For the Technical Assistance to BLU LPMUKP, KI engages a service provider with expertise in microfinance operations and IT systems. This provider assesses LPMUKP's existing loan disbursement processes, recommends and helps implement improvements – including an IT system for loan management and simplified application procedures – and trains LPMUKP staff on client-friendly methods.

6.7.3 Implementation Plans

The IRW follows a phased implementation plan. The research and TA to LPMUKP run continuously from Year 1. Phase 1 (Years 1-2) focuses on establishing the foundation for both interventions. KI will launch the first call for research proposals and initiate the diagnostic assessment and process improvement for BLU LPMUKP. The diagnostic assessment and process improvement recommendations are completed within the first 18 months, followed by IT system implementation and staff training by the end of Year 2, with brief follow-up support in Years 3 and 4.

Phase 2 (Years 3-6) covers continued implementation and consolidation. Research papers are commissioned annually (total 4 studies) and the LPMUKP technical assistance is implemented within the first two years, with follow-up support and training provided as needed. The full implementation timeline, milestones, and responsible parties are provided in Annex 28 and Annex 5.

6.7.3.1 Technical Assistance to BLU LPMUKP

The IRW provides targeted technical assistance to the Marine and Fisheries Business Capital Management Agency (BLU LPMUKP), the government's microcredit arm under the Ministry of Marine Affairs and Fisheries. This intervention proceeds from Year 1. KI engages a service provider with expertise in microfinance operations and information technology to: (i) conduct a diagnostic assessment of LPMUKP's existing loan disbursement processes, assess whether current product terms (repayment schedules and collateral requirements) match the cash-flow realities of small-scale capture fisheries, including testing alternatives such as harvest-cycle-aligned repayment and alternative collateral instruments; (ii) assess the feasibility and cost of a limited outreach-extension pilot (e.g., agent-based or para-extension model) in 1-2 provinces, including BLU LPMUKP's institutional appetite and budget pathway to absorb it; (iii) recommend and help implement an IT system for loan management and simplified application procedures; and (iv) train LPMUKP staff on the new processes and systems, including a module on client-relationship-based, field-based engagement and collection methods. Recommendations on product terms and a decision on whether to scale and formally transition the extension-outreach pilot to BLU LPMUKP will be made at the mid-term transition review, contingent on BLU LPMUKP's confirmed institutional commitment. The objective is to increase the flow of affordable credit to small-scale fishers and fish farmers across WPP 572. The technical assistance is delivered within the first two years, with follow-up support provided as needed.

6.7.3.2 Blue Economy Studies (Action-Oriented Research)

The IRW commissions action-oriented research papers on sustainable blue economy themes. KI procures qualified research organizations (e.g., Danareksa Research Institute, SMERU, Systemiq) through competitive calls for proposals. Four studies are produced over the project period, covering topics such as market segmentation of blue economy enterprises in WPP 572, enabling fisheries cooperatives, green shipping opportunities, marine tourism investment roadmaps, and blended finance innovations. Each study is actively disseminated to financial intermediaries, development partners, policymakers, and potential investors. These research papers bridge critical knowledge gaps, provide evidence-based policy recommendations, and document lessons learned for replication across other Fisheries Management Areas (WPPs) in Indonesia. The research component proceeds from Year 1.

6.7.4 Delivery Plan

The delivery of the Investment Readiness Window follows a timeline that reflects the distinct nature of its two components. For the Technical Assistance to BLU LPMUKP, the delivery is from Year 1 to Year 4 of project implementation. The diagnostic assessment and process improvement recommendations are completed within the first 18 months, followed by IT system implementation and staff training by the end of Year 2, with brief follow-up support in Years 3 and Year 4.

For the Blue Economy studies, the delivery spans from Year 1 to Year 4, with one to two research papers commissioned each year. Each study follows a standard cycle: call for proposals, selection of research organization, conduct of research (6-9 months), peer review, and dissemination. A total of four papers is targeted by the end of Year 4. Indicative cost ranges are provided in Annex 2, section 6.8.2.

Table below summarizes the key delivery targets for each component. Quarterly and annual targets – including number of BLU LPMUKP staff trained and research publication dates – are detailed in the project's annual work plans and the M&E plan (Annex 11). The PMU reviews progress quarterly and reports annually.

Table 106. Illustration of Delivery Plan

Component 2: Investment Readiness	Measure of Delivery	Y1	Y2	Y3	Y4	Y5
Technical Assistance to BLU LPMUKP						
Technological support for operational processes	# of government agencies supported	0.25	0.25	0.25	0.25	
Blue Economy Studies (Action-Oriented Research)						
Research papers commissioned	# of papers	1	1	1	1	
Research papers published and launched	# of papers	1	1	1	1	

6.7.5 Impact Reporting

Impact reporting for the IRW follows the project-level M&E plan (Annex 11). Key performance indicators tracked include the number of BLU LPMUKP extension officers trained in simplified disbursement methods and the use of the new IT system, the successful deployment and operationalization of the digitized loan management system, the volume of loan applications from WPP 572 provinces received, processed, and reaching a formal credit decision by BLU LPMUKP, the number of action-oriented research papers produced and disseminated to financial intermediaries, development partners, and policymakers, and the documented uptake of research findings by target audiences. Service providers receiving contracts report quarterly on their progress against deliverables. KI compiles these data, verifies them through site visits and third-party audits, and includes them in the Annual Performance Reports to the Accredited Entity and the GCF. The PMU's M&E specialist oversees indicator tracking, and a final independent evaluation assesses the IRW's contribution to paradigm shift and long-term sustainability.

Table 107. Illustration of Impact Measure Matrix

Project Activities	Means of Verification	Baseline	Target		Assumption
			Mid	Final	
1. Action-Oriented Research Papers	# of research papers produced and disseminated to financial intermediaries, development partners, and policy makers	0	2	4	Sufficient demand exists for actionable market intelligence on blue economy opportunities in WPP 572; research consultants are procured on time and deliver high-quality, practitioner-focused outputs.
2. Technical Assistance to BLU LMPUKP	# of BLU LPMUKP extension officers trained in simplified disbursement methods and use of the new IT system	0	30	100	Officers are available and willing to participate; training materials are appropriate for local literacy and digital skill levels.
	Deployment of digitized loan management system operational and actively used to process loan applications	No IT system exist	IT system operational for pilot cohort (50 loan applications)	IT system fully operational with simplified SOPs adopted for at least 200 loan applications	IT system is successfully deployed and adopted by extension officers; streamlined procedures do not compromise prudent credit risk assessment.
	# of additional loans awarded from WPP572 provinces by BLU LPMUKP	0	50	200	BLU LPMUKP continues to receive government budget allocations for loan capital; adequate replenishment of the revolving fund supports new disbursements. NPL recovery and loan repayments from existing debtors contribute sufficiently to revolving fund availability for the new lending cycle.

6.8 Appendices

Appendix 1: Examples of Potential Project Options and Cost Estimation

Sector	Adaptation activity	Sub-activity	Cost estimation
Ecotourism (coastal tourism)	Supporting enterprises and local coastal communities transition into, and/or integrate eco-tourism activities.	Eco-tourism site assessment: Conduct a comprehensive assessment of potential eco-tourism sites within the ecosystem, considering ecological sensitivity, accessibility, and cultural significance (profiling). Develop the inclusive eco-tourism plan and engage stakeholders in the plan development	IDR 300 Mio/area Referring to the development of advanced fishing villages from MMAF: learning about coastal ecosystem restoration
		Stakeholder engagement: engage with local communities (including women and other vulnerable groups), indigenous groups, and relevant authorities to gain their input and ensure that eco-tourism initiatives align with their needs and preferences	IDR 500 Mio/area referring to the development of advanced fishing villages from MMAF: smart fisher village (mentoring, counseling, institutional strengthening, certification, and education)
		Capacity building for fishers and other coastal community groups, especially small-scale fishers, women, and other vulnerable group to promote and develop eco-tourism services	IDR 1,000 Mio/area Referring to the MMAF work plan document for 2023 for marine tourism infrastructure
		Develop EIC (education, information, and communication) materials to promote the eco-tourism among fishers and other coastal community groups, including women and vulnerable groups	IDR 100 Mio/area

Sector	Adaptation activity	Sub-activity	Cost estimation
Collaborative marine protection and conservation	Support national and sub-national governments expand new MPAs, increase the extent of existing MPAs, and strengthen MPA collaborative management	Gathering ecosystem data (seagrass, mangrove, and coral reef ecosystems)	IDR225 Mio/area Referring to the MMAF work plan document for 2023 for agriculture and fisheries policy
		Develop and create of inclusive national framework of national guidelines for local-provincial areas on MPA's	IDR 1,000 Mio/policy Referring to the MMAF work plan document for 2023 for policy recommendation development
		Develop clear legal basis for OECM e.g., through conservation act revision and integrate OECMs as part of a conservation strategy in the national development plan	IDR 1,000 Mio/policy Referring to the MMAF work plan document for 2023 for policy recommendation development
		Governors' KPI establishment: establishing and effectively managing marine protected areas (MPAs) as a KPI for provincial governors to promote vertical alignment.	IDR 750 Mio/document Referring to the MMAF work plan document for 2023: recommendations for marine tourism policy and management of valuable objects originating from the cargo of sunken ships (BMKT)
		Capacity building of provincial MPA management unit to improve understanding of GESI mainstreaming and its importance in MPA management	IDR 500 Mio/area referring to the development of advanced fishing villages from MMAF: smart fisher village (mentoring, counseling,

Sector	Adaptation activity	Sub-activity	Cost estimation
			institutional strengthening, certification, and education)
	Nature restoration activities for seagrass and mangrove ecosystems in WPP 572	Develop the nature restoration plan	IDR 350 Mio/plan or policy Referring to the MMAF work plan document for 2023: maritime and maritime affairs policy
		Restoration and conservation of seagrass, mangrove, and coral reef ecosystems	IDR 57 Mio/ha Referring to the MMAF work plan document for 2023: mangrove restoration
Marine fishing (capture fisheries) **Marine fish processing (seafood processing** **Sustainable marine aquaculture**	• Enhancing fisheries sustainability management through fishery improvement programs and capacity building for the fisherman. • Establish community-based economic activities and assist fishers in preserving fish from spoilage. • Enhancing marine aquaculture sustainability through the integrated aquaculture farm, sustainable feed production, and disease management.	Study to update the data and information on fisheries data	IDR 750 Mio/area
	Providing access to innovative blue financing instruments and funds to	Develop a comprehensive fisheries management plan considering the GESI aspect	IDR 150 Mio/area

Sector	Adaptation activity	Sub-activity	Cost estimation
	local, coastal communities and MSMEs in WPP 572	Capacity building for fishers and other coastal community groups, especially small-scale fishers, women, and other vulnerable groups on sustainable fisheries.	IDR 500 Mio/area referring to the development of advanced fishing villages from MMAF: smart fisher village (mentoring, counseling, institutional strengthening, certification, and education)
		Development of inclusive communication materials to disseminate relevant result of the survey to fishers and other coastal community groups, including women and other vulnerable groups	IDR 100 Mio/area
Sustainable waste management	Effective waste management to address climate impacts by working with private sector partners to improve waste management, data management of waste, and monitoring, maintenance, and evaluation of waste management practices	Baseline study to assess the existing waste management condition including profiling the materials recovery facilities (waste banks/TPST/ TPS3R)	IDR 200 Mio/area
	Provision of capacity building, training, and support on ecosystem management and sustainable fishing practices.	Development of the materials recovery facilities (waste banks/TPST/ TPS3R) with widespread social inclusion in the training of waste management practices.	IDR 600 Mio/ TPS3R[53] IDR 135,334,108 per initiative, which covers scales, chopping machine, motorbike cart, and training
		Capacity building to the waste management/operator to proceed with the waste	IDR 200 Mio/ TPS3R

6.9 Additionality of GCF Grant Funding for The Project

BEAM is designed to support the Government of Indonesia's (GoI's) goal of transforming its marine and coastal economy to respond to the impacts of climate change while driving sustainable growth and development. Targeting 94.3 million hectares across six provinces along the western coast of Sumatra i.e., Aceh, North Sumatra, West Sumatra, Bengkulu, Lampung and Banten, the project will contribute to a government-directed national blueprint to develop Indonesia's blue economy, achieve climate change and biodiversity conservation targets, and contribute to positive socioeconomic outcomes at scale.

Indonesia is a developing country with potential in blue economy of USD 1,334 billion, equivalent to IDR 19,371 trillion[415]. Its coastal communities and the ecosystems they rely on are directly impacted by climate change. Continued degradation of these ecosystems from climate and non-climate factors are projected to result in higher GHG emissions, higher disaster risk for its coastal populations, and lower economic productivity. Despite the GoI's commitment to introduce and implement required policies and strategies for climate adaptation, efforts are currently hindered by inadequate management policies and underinvestment in the region. GCF funding through BEAM will overcome these hurdles and complement Indonesia's ongoing efforts by enabling the respective governments, local authorities, and communities to implement concrete actions that increase climate resilience long-term. In addition, BEAM will deploy GCF funding strategically as a catalytic grant to scale up the program nationally.

The project's Economic analysis (Anex 3) demonstrates the positive economic benefits that the BEAM project will bring to society. While the project has been designed as a grant program on the basis that it is not intended to be financially profit-making. However, as shown in Annex 3, activities supported through the grant making windows in Component 2 are expected to be financially viable from the perspective of the beneficiaries. The Project's ability to generate both economic and financial benefits that exceed costs underscores its potential for sustainable impact. This assessment highlights the need for concessional support, to be structured as GCF grant funding, to amplify BEAM's impact on beneficiaries such as local communities and provincial and national governments, and to create enabling conditions and regulations for the blue economy. The budget for BEAM will be allocated to address policy, regulatory, and financing barriers to project implementation, including but not limited to, inadequate support from relevant stakeholders (e.g. GoI, provincial government, and local communities, political barriers), as well as capacity and technology gaps.

It is crucial for the GoI to optimize its fiscal capacity to deliver adequate public services that maximize impact on local communities. However, in practice, the government often faces challenges in providing necessary financial support and lacks the technical capacity to fund and implement projects efficiently at scale. In the context of Indonesia's efforts to deliver its climate commitments, achieving the 2030 NDC targets will require USD 365 billion – USD 479 billion, of which the government is anticipating paying only 20%. The government has issued statements acknowledging the need to consider designs for policies and frameworks to ensure public-private national and global partnerships can help to fill the financing gap.[416] The blue economy primarily consists of MSMEs and local communities that are considered high-risk for the private sector; most communities are not able to access private funds, and some of the necessary adaptation and mitigation measures generate public goods that do not generate financial revenues and therefore financial returns on investment. With the GCF grant funding, BEAM will be able to address financial needs of local communities that are particularly vulnerable to the impacts of climate change. GCF's grant is required to establish a funding window under BEAM that can drive needed climate-smart development in micro, small, to medium-scale fisheries and aquaculture with an ecosystem-based approach to the management of the wider blue economy. Considering the huge financing needs for the

[415] Bappenas (2021), Blue Economy Development Framework for Indonesia's Economic Transformation. Jakarta: Ministry of National Development Planning/National Development Planning Agency).
[416] https://www.thejakartapost.com/news/2021/08/06/sri-mulyani-calls-for-global-help-to-foot-365b-emissions-reduction-bill.html

BEAM, grant funding from GCF is necessary to leverage public funds and other potential donors, as well as private investors.

By providing and leveraging this grant funding, BEAM will strengthen ownership of the Program through the support of national policies and collaboration among relevant stakeholders. It will promote cross-sectoral broad approaches that drive a sustainable paradigm shift towards climate-resilient development and enhances the sustainable development benefits anticipated from BEAM's measures and activities.

The BEAM Project requires GCF grant funding because the climate adaptation, mitigation, and enabling environment activities needed in WPP 572 are not commercially viable and face significant market failures that private capital alone cannot address. As detailed in the Funding Proposal (Section B.5), current government spending on marine protected area (MPA) management in Indonesia is estimated at USD 8.3 million per year against an estimated need of USD 50.7 million, leaving a substantial financing gap that GCF resources can help close (para 128). At the same time, the economic analysis (Annex 3) demonstrates that the Project generates strong positive economic returns – an NPV of USD 42.3 million, an economic internal rate of return of 29.1%, and a benefit-cost ratio of 1.67 – but these returns accrue to society, particularly to vulnerable coastal communities and ecosystems, not to private investors (para 130). GCF grant funding is therefore the appropriate instrument.

The Government of Indonesia has committed USD 35.5 million in co-financing, primarily in-kind from MMAF and provincial governments. However, without GCF support, this co-financing would not be leveraged to attract private capital. The private sector currently perceives WPP 572 as high risk, while government microcredit institutions such as BLU LPMUKP are constrained by complex paper-based procedures, limited extension officer capacity, and the absence of an integrated digital loan management system. The Investment Readiness will provide targeted technical assistance to BLU LPMUKP to digitize its loan management system, streamline disbursement procedures, and train extension officers, enabling affordable credit to reach thousands of previously unreached small-scale fishers and fish farmers. In parallel, GCF funding will commission action oriented research papers that address critical knowledge gaps currently deterring private investment and informed policymaking in WPP 572. Furthermore, GCF grant resources are essential to fund ecosystem restoration (e.g., ~285 ha of mangroves and ~6 ha of seagrass) and to strengthen the operational capacity of government agencies and local institutions, activities that have no direct financial return but generate significant public goods. In summary, GCF grant funding is not only additional but indispensable to unlock existing domestic capital, address market failures, and achieve the paradigm shift toward a climate-resilient blue economy in WPP 572.

6.9.1 Adequacy of Financing Structure

BEAM lays the essential groundwork for Indonesia's blue economy through an integrated and comprehensive marine conservation and fisheries management approach that closes the ecological and economic loop between ocean production and protection. BEAM introduces transformative climate-resilient coastal initiatives and infrastructure while ensuring the lasting sustainability and self-sufficiency of eligible projects, focusing on climate-vulnerable coastal communities within the WPP 572 region spanning six provinces.

The initial funding requested for the Project is a grant for a 6-year program with adequate proposed mechanisms and governance to ensure sustainability of the project. This grant-based mechanism is both adequate and appropriate for achieving the project goal. The EFA results further support this, indicating that this program needs grant funding to be viable. There is limited public funding available (e.g. fiscal support) for the types of activities proposed and where it does exist or if it becomes available during the Project lifetime the Project will work towards ensuring complementarity. Some publicly available funding is provided as co-finance.

To ensure the efficient delivery of all grant windows, a specific Activity was designed to address BEAM cross-cutting needs. This activity focuses on identifying optimal approaches and support mechanisms to stimulate investment in climate change adaptation and mitigation for MSMEs, CSOs, and private sector stakeholders. It also aims to identify critical leverage points for building effective financial tools to unlock

Indonesia's blue economy of. Activity 1.1.3 will ensure that lessons learned are effectively disseminated, thereby maximizing the impact, replication, and scaling of BEAM interventions. The Project is strategically designed as a forward-thinking blueprint for scaling up of the blue economy sector nationally. This approach empowers government entities at both sub-national and national levels to actively foster the development of a robust and economically viable blue economy sector.

The financing structure of BEAM – a grant-based mechanism – is fully adequate for achieving the Project's objectives. As explained in the Funding Proposal (Section B.5), the Project is not designed to be financially profitable for the GCF or its implementing partners. Instead, grant assistance is deployed to reduce the costs of ecosystem restoration and adaptation interventions, which would be substantially higher in the future if no action is taken today. Scenario modelling cited in the FP shows that as ecosystems become more degraded, the required investments nearly double, from about USD 121.5 billion per year to about USD 208.3 billion per year under a high depletion scenario. Grant funding now therefore avoids much larger future expenditures.

Moreover, the Project's two components are structured to complement each other: Component 1 builds the enabling regulatory and institutional conditions (e.g., BLUD establishment, fisheries data systems, harvest strategies) that reduce long-term management costs and attract follow-on investment. Component 2 uses grant resources to support locally-led adaptation and mitigation projects that are not commercially viable, while the Investment Readiness provides technical assistance to strengthen the operational capacity of BLU LPMUKP and commissions action-oriented research papers to address critical knowledge gaps that deter private investment. The adequacy of the financing structure is further demonstrated by the confirmed co-financing from MMAF, four provincial governments, a local university, and Konservasi Indonesia (USD 36.25 million), the detailed budget (Annex 4), and the positive economic analysis (Annex 3). No debt, equity, or NGI instruments are required because the activities funded by BEAM generate public goods and societal benefits, not financial returns to the GCF. The grant-only structure is therefore both necessary and sufficient to achieve the Project's climate adaptation, mitigation, and paradigm shift goals.

6.10 Sustaining BEAM: Ensuring Long-Term Impact through Strategic Exit Mechanisms

The BEAM Project is designed to generate lasting impacts beyond the six-year implementation period by embedding sustainability into each component through capacity building, institutional strengthening, and self-sustaining financial mechanisms. The Project's exit strategy is not a single event but a phased transfer of ownership, aligned with the approach described in the Funding Proposal (Section B.6). Supporting the paradigm shift potential of BEAM, scalability, replicability and sustainability are embedded into the integrated protection and production model from the beginning.

A key exit mechanism is the transformation of MPA management units into Regional Public Service Agencies (BLUDs), which are legally mandated to retain and reinvest revenues from entry fees, service charges, and grants. By Year 5, each BLUD is expected to cover at least 50% of its annual operating costs from own-source revenue, reducing dependence on external funding. This is supported by technical assistance and the commitment of provincial governments.

Sustainability will be supported through a phased close-out of project activities that will come to a planned end (i.e. enabling environment and grant-funded interventions), whilst substantive outputs and outcomes of BEAM will be sustained by partners that are involved and embedded as project owners from the outset. Sustained outcomes include a more favorable enabling context, enhanced knowledge and demonstration effects, and strengthened demand and supply-side infrastructure for blue economy investment in coastal regions. Beyond the lifetime of the Project, these results will unlock further financing solutions that will continue to protect blue carbon and biodiversity, build climate resilience and promote sustainable livelihoods.

Sustainability outcomes and metrics - linked to capacity building and the strengthening of the enabling environment - are core elements of the Project, reflected in its Theory of Change and Log Frame (Section E) and MEL plan (**Annex 11**).

Sustainability will be ensured through three main exit mechanisms:

- **Through the capacity building of communities and government institutions** to identify (sustainable) climate-smart opportunities, and implement climate adaptation and mitigation interventions.
- **Through action research, which will share blue-prints for the sustainable protection-production model** to enable its replication across other regions, alongside the demonstration of multi-stakeholder benefits - including livelihoods benefits for coastal communities. The sharing and ownership of these assets will be supported through embedded MEL activity and the dissemination of evidence across regions.
- **Through strengthening the long-term enabling context for blue economy protection-production**, including (i) the institutional capacity and coherence/coordination of Government, (ii) Indonesia's policy and regulatory frameworks for ocean and coastal protection, (iii) enhanced data collection, surveillance and evidence-sharing, and (iv) the development of sustainable sources of innovative finance for blue economy investment.

The Knowledge and Learning Center, hosted by Bung Hatta University under a signed memorandum of understanding, will be handed over to the university by Year 5. The university is committed to funding at least 50% of the center's operating costs from its own budget thereafter, while the knowledge management information system is maintained and updated. Fisheries data systems developed under Activity 1.1.2 will be institutionalised within MMAF and provincial DKP offices, with trained enumerators ensuring that data are updated annually and used for harvest strategy adjustments without project support.

For community-led adaptation and mitigation grants under Windows 1 and 2, sustainability is built into project designs. Grantees are required to demonstrate how their interventions (e.g., ecotourism cooperatives, waste banks, renewable energy equipment) will continue generating benefits after grant close-out, with user fees or income streams financing maintenance. Post-project surveys are planned to verify that at least 80% of funded projects remain active two years after completion, as detailed in the M&E plan (Annex 11). Policy recommendations, standard operating procedures, and harvest strategies developed under Component 1 are designed for adoption into government regulations and work plans, ensuring they remain in force and are implemented with government budget allocations beyond the project.

The Project does not assume that all activities will become financially self-sustaining. Public goods – such as policy reforms, ecosystem protection, and core MPA management – remain the responsibility of the Government of Indonesia, which has committed co-financing (Funding Proposal Section C). The technical assistance provided to BLU LPMUKP under the Investment Readiness is designed to be sustained through the agency's existing government budget allocations and the recycling of loan repayments into new lending, creating a self-sustaining cycle that does not depend on future donor support. The action-oriented research papers produced under the IRW will remain accessible and can inform future policy and investment decisions beyond the project period.

6.10.0 Overall Project Impact and Scaling Potential

As a result of BEAM, and subsequent increase in investor confidence, the GoI, blue economy investors and communities will be incentivized to further expand and finance the coastal ecosystem protection and production model - locally and nationally - while established blue economy businesses will expand their footprint into other regions of Indonesia.

BEAM's exit strategy stands as a comprehensive blueprint designed to ensure the long-term sustainability of Indonesia's blue economy. It intertwines the principles of community empowerment, the active engagement of local stakeholders, the achievement of financial independence, the effective integration of regulatory frameworks, the ongoing maintenance of assets, and the enhancement of value chains. The

inclusion of financial mechanisms, such as blue loans tailored for MSMEs, financial derisking strategies, and the strategic development of fiscal policies that favor the blue economy, constitute indispensable components of this exit strategy. These facets collectively underpin financial sustainability and lay the foundation for the sustained growth of the blue economy sector even after the end of the implementation period of the GCF grant.

The BEAM Project is designed to deliver measurable, lasting impacts across both its components, addressing climate adaptation, mitigation, and the enabling conditions for a sustainable blue economy. By the end of the six-year implementation period, the Project is expected to achieve the following higher-level outcomes, as set out in the logical framework and the economic analysis (Annex 3).

Under Component 1, 11 improved policy and regulatory frameworks on ecosystem protection, fisheries sustainability, and innovative financing will be adopted at national and provincial levels, including harvest strategies for pelagic fisheries, MPA establishment and management decrees, and sustainable blue financing mechanisms such as BLUDs. These institutional changes will permanently embed climate-responsive management into government operations, reducing illegal fishing, improving fish stock sustainability, and enabling long-term budget allocations for marine conservation.

Under Component 2 (Window 1), a total of 355,800 direct beneficiaries (50% women) will experience improved food security and climate-resilient livelihoods through grants for ecotourism, collaborative MPA management, sustainable fishing practices, and waste management. These interventions will diversify income sources, reduce post-harvest losses, and strengthen community-based natural resource management.

Under Component 2 (Window 2), the Project will reduce the loss of blue carbon ecosystems by approximately 44% for mangroves and 50% for seagrass compared to baseline, resulting in total avoided GHG emissions of 483,322 tCO_2e over the implementation period and 1,298,901 tCO_2e over the project's 20-year lifespan. Direct restoration of approximately 285 hectares of mangroves and 6 hectares of seagrass will sequester additional carbon while enhancing coastal protection and fisheries habitats.

Under Component 2 (Investment Readiness), the Project will provide technical assistance to BLU LPMUKP to digitize its loan management system, streamline disbursement procedures, and train extension officers, enabling the agency to process at least 200 loan applications from WPP 572 enterprises. Additionally, four action-oriented research papers will be produced and disseminated to financial intermediaries, development partners, and policymakers, addressing critical knowledge gaps that deter private investment and informed policymaking in WPP 572. Action-oriented research papers will build investor confidence and market linkages, while technical assistance to BLU LPMUKP will improve access to microcredit for small-scale fishers.

The Project's impact will extend beyond WPP 572 through multiple scaling and replication pathways. Policy recommendations, standard operating procedures, and harvest strategies developed under Component 1 will be integrated into national regulations and provincial work plans, enabling replication across other Fisheries Management Areas (WPPs) in Indonesia. The Knowledge and Learning Center, hosted by Bung Hatta University, will serve as a permanent repository of best practices, accessible to policymakers, practitioners, and investors nationwide. BLUD mechanisms provide financially sustainable models for MPA management that can be adopted by other provinces. By demonstrating the protection-production model at scale in one of Indonesia's most climate-vulnerable and under-invested regions, BEAM will provide a blueprint for a climate-resilient blue economy that can be replicated across the archipelago, amplifying its adaptation and mitigation benefits indefinitely.

7 Section 7 Rationale for Grant Funding for BEAM and the Options Assessment

7.1 Introduction

The blue economy is a significant contributor to Indonesia's economy, with the potential to grow even larger with further development. This holds particular importance for the nation's coastal communities, most of whom depend on the sea for their livelihoods. However, these communities face a dire threat – climate change. Marine and coastal ecosystems, the foundation of the blue economy, are highly susceptible to its effects. As the oceans absorb around 90% of Earth's rising temperatures, the blue economy faces significant disruptions and potential income reduction for coastal communities. While some adaptation and mitigation measures may offer opportunities for increased productivity and income, others, particularly those focused on adaptation, come with significant costs. The public sector often bears these costs, while communities experience them through decreased livelihoods and disaster expenses. Although mitigation efforts like green technologies might hold potential for increased income, they often require additional commercial funding. Ultimately, the costs of inaction outweigh the potential costs of adaptation and mitigation efforts, making them crucial investments for safeguarding the blue economy and the communities it sustains.

In Indonesia, there is a substantial funding gap for grant-based blue economy initiatives, particularly within the Fisheries Management Area (FMAs/WPP) framework and the establishment of Marine Protected Areas (MPAs). The ambitious target set by the Indonesian government, aiming for the blue economy to contribute 12.5% of the national GDP by 2045, demands significant investment. However, the costs associated with managing MPAs only, estimated at US$1.4 per hectare, pose a considerable challenge. With plans to expand MPAs to cover 97.5 million hectares by 2045, the projected management costs are set to reach US$45.5 million by 2030. At present, the annual funding, including contributions from international NGOs, barely reaches US$7.5 million, resulting in a substantial financial gap.[417] This is specifically for MPA Management activities.

To help meet the financing gap, Blue Halo S BEAM is seeking a grant from the Green Climate Fund (GCF) for a 6-year program, which will be used as a pilot project in the WPP572 region. The GCF funds will be used for two Project Components. Component 1 aims to enhance the enabling environment for blue economy investments by supporting national and sub-national governments in developing and managing regulatory frameworks for ecosystem protection and sustainable fisheries management. It addresses regulatory weaknesses through technical assistance and capacity building, aiming to improve coordination among government agencies for effective ecosystem protection and fisheries management. Component 2 will see the creation of a Grant Facility to establish a financial mechanism with three grant windows—climate change adaptation, climate change mitigation, and investment readiness—to fund marine restoration, fisheries management, alternative livelihoods, and coastal waste management in WPP572. Support will be provided to Indonesian public agencies, NGOs, CSOs, research institutions, financial intermediaries, and blue economy MSMEs, with local communities and businesses as the ultimate beneficiaries. The Grant Facility will disburse funds to projects proposed by applicants that support climate mitigation and adaptation, enhances investment readiness, and fosters a supportive environment for marine conservation and sustainable development, aiming to improve climate resilience and capacity for long-term financing.

[417] Summarized from Report of A4.1 and A4.2 and tailored to the need for financing gap analysis for grant-based activities financing mechanism

7.2 Rationale for grants

Several key factors underlie the need for grant funding in the blue economy sector in Indonesia:

- *Catalyzing Innovation*: Grants encourage experimentation and the development of new, sustainable blue economy initiatives. This is essential for a sector as vast and complex as Indonesia's marine and coastal environment. Traditional financing models often favor established practices, which can hinder the adoption of groundbreaking solutions.
- *Risk mitigation*: blue economy ventures, particularly those led by communities and small businesses, often face high perceived risks for conventional investors. MSMEs contribute more than 60% of the Indonesian economy, provide 97% of employment, and account for 99% of existing businesses.[418] Indonesia also records a high volume of loans from commercial banks, at more than 90%. Non-bank institutions provide about 7–8% of loans, with a small proportion of loans (0.14% in 2019) coming from microfinance.[419] However, fisheries, which is one of the major blue economy components, receive only a small portion of this financing, about IDR 6–11 trillion in 2021, or about 1% of total MSME loans.[420] Grants help offset this risk, making projects more viable and attracting further investment.
- *Addressing Market Failures:* Market mechanisms alone will not adequately support sustainable practices in the blue economy. Availability of grant funding along with investment capital is required to support the cost of acceleration programs, investment readiness, market building, impact measurement, and reporting.[421] Grants can be used to fund projects with strong environmental or social impact (including those addressing climate change impacts), which have low, or no direct, financial returns.
- *Capacity Building*: While the Government of Indonesia (GOI) acknowledges the importance of the Blue Economy, the existing budget allocations fall short of meeting ambitious growth targets. This insufficiency hampers the development of essential infrastructure, research initiatives, and capacity-building programs.[422] Grants provide funding for training, awareness campaigns, and technical assistance, which are crucial to developing the knowledge and skills required for a thriving blue economy sector in Indonesia.
- *Partnership development:* Grants can facilitate collaborations between government agencies, research institutions, NGOs, and the private sector which are essential for tackling complex challenges in marine and coastal management.

7.3 Grant mechanisms and their suitability

Based on the funding needs for BEAM, several grant options were considered, such as: direct grants, reimbursable grants, revolving grants, direct technical assistance grants, and performance-based grants, especially in regard to Component 2. Component 1 will be implemented through the provision of direct services of technical assistance, research and data production, and stakeholder engagement activities.

To determine the most suitable grant option for BEAM, key criteria were analyzed including relevance to climate change adaptation and mitigation activities, encouragement of blue economic growth, and fostering sustainability-oriented innovation. By applying these criteria to the various grant options, the grant option that best aligns with BEAM's goals can be identified.

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[418] Indonesia Investments (2022) 'Micro, Small, and Medium Enterprises in Indonesia: Backbone of the Indonesian Economy', Indonesia Investments (July 16, 2022). Available at: https://www.indonesia-investments.com/finance/financial-columns/micro-smallmedium-enterprises-in-indonesia-backbone-of-the-indonesian-economy/item9532 (2022).
[419] CPI 'Indonesia Blue Finance Landscape' (2022).
[420] ibid
[421] Market insights report, LID (2024)
[422] ibid

Key criteria considered in stakeholder discussions and feasibility assessment for project design include:

- Ease of implementation[423]
- Administrative complexity[424]
- Risk mitigation[425]
- Encouragement of innovation[426]
- Capacity building[427]
- Sustainability[428]
- Scalability[429]
- Flexibility[430]
- Financial accountability[431]
- Attractiveness to investors[432]

Comparative metric for grant options

To assess the suitability of each grant option, a comparative metric has been developed based on the key criteria adapted and compiled from MDPI and OECD evaluation criteria and also from a reference journal.[433] This metric is summarized in the table below:

Mechanism	Direct Grant	Reimbursable Grant	Revolving Grant	Direct Technical Assistance	Performance-Based Grant
Ease of Implementation	High	Medium	Medium	Medium	Medium
Administrative Complexity	Low	Medium-High	High	Medium-High	Medium-High
Risk Mitigation	High	Medium	Medium	Medium	Medium

[423] Refers to how straightforward it is to deploy the grant mechanism without significant hurdles. Simplifying the process ensures timely utilization of funds and encourages greater participation from SMEs and local communities, leading to more efficient resource use
[424] The degree of bureaucratic and procedural steps involved in managing and utilizing the grant. Lower administrative burdens enable grantees to focus more on project execution rather than paperwork, which is associated with higher project efficiency and success rates
[425] The ability of the grant mechanism to reduce financial and operational risks for the grantee. Effective risk mitigation mechanisms increase the willingness of SMEs and local businesses to participate in development projects, encouraging them to undertake innovative and high-impact projects
[426] Measures the extent to which the grant mechanism fosters creativity and the development of new solutions. Innovation-driven grants are critical for addressing complex and evolving challenges, particularly in the Blue Economy, leading to more sustainable and impactful outcomes
[427] The grant's ability to enhance the skills, knowledge, and capabilities of grantees. This ensures long-term sustainability and scalability of projects, which is essential for developing resilient communities and successful initiatives
[428] Refers to the potential for the project to continue delivering benefits after the grant period ends. Ensuring sustainability aligns with environmental and social goals, attracts further funding, and enhances the overall impact of projects
[429] The ability to expand the project's scope and impact over time. Scalable projects maximize the reach and benefits of successful initiatives, making them more likely to attract additional funding and partnerships
[430] Refers to the ease with which the project can adapt to changing circumstances and needs. Flexible grant mechanisms allow for responsive adjustments to unforeseen challenges and opportunities, which is crucial for dynamic and unpredictable environments
[431] The mechanisms in place to ensure transparent and responsible use of funds. High financial accountability builds trust among stakeholders, reduces the risk of mismanagement, and enhances project credibility. For more insights, refer to the World Bank document on enhancing financial accountability
[432] Measures the potential of the grant mechanism to draw interest from private and institutional investors. Attractive grant mechanisms facilitate additional funding and partnership opportunities, leveraging private investment and enhancing project sustainability
[433] The key criteria developed and compiled from 1) MDPI: Rocha, W.L.L.; Almeida, M.F.L.; Calili, R.F. Measuring and Evaluating Organizational Innovation Capacity and Performance from Systemic and Sustainability-Oriented Perspective. Sustainability 2023, 15, 682. https://doi.org/10.3390/su15010682 and 2) Tomas Hellström, Centres of Excellence and Capacity Building: from Strategy to Impact, Science and Public Policy, Volume 45, Issue 4, August 2018, Pages 543–552, https://doi.org/10.1093/scipol/scx082 3) https://web-archive.oecd.org/temp/2024-05-13/81829-daccriteriaforevaluatingdevelopmentassistance.htm

Mechanism	Direct Grant	Reimbursable Grant	Revolving Grant	Direct Technical Assistance	Performance-Based Grant
Encouragement of Innovation	High	Medium	Low	Medium	Medium
Capacity Building	High	Medium	Medium	High	Low-Medium
Sustainability	Medium	Medium-Low	High	Medium	Medium
Scalability	Medium	Medium	Potentially High	Medium	Medium
Flexibility	High	Medium	Medium	Medium	Medium
Financial Accountability	Medium	High	High	High	High
Attractiveness to Investors	Low	Potentially High	Low	Low	Potentially High

Explanation of Ratings:

- *High: Indicates that the option excels in this criterion, providing significant benefits or performance.*
- *Medium: Indicates that the option performs adequately but has some limitations.*
- *Low: Indicates that the option has significant drawbacks or challenges in this criterion.*

Direct Grant: Easiest to implement with a low administrative burden. Provides high risk mitigation for recipients and fosters innovation. Offers good capacity building but limited long-term funding sustainability. Scalability is moderate, and flexibility is high. Financial accountability is moderate due to no repayment requirements. Low attractiveness to investors as there's no return on investment.

Reimbursable Grant: Moderately easy to implement but with more administrative complexity compared to direct grants. Offers moderate risk mitigation and potential for attracting investment if structured with attractive repayment terms. Innovation is moderately encouraged, and capacity building is possible. Sustainability can be high if repayments are successful. Scalability is moderate. Flexibility is moderate. Financial accountability is high due to repayment requirements.

Revolving Grant: Moderately easy to implement but requires complex administration for managing the revolving fund. Offers moderate risk mitigation for initial recipients, but lowers with subsequent grants as the fund relies on repayments. Discourages innovation due to the need for projects to generate revenue for repayment. Capacity building is possible for initial rounds. Sustainability can be high if repayments are successful. Scalability can be high if the fund grows, but limited if repayments are low. Flexibility is moderate. Financial accountability is high due to the revolving nature of the fund. Low attractiveness to investors as there's no direct return.

Direct Technical Assistance Grant: Provides targeted expertise and resources for project implementation, complementing other funding mechanisms. Requires careful needs assessment but doesn't directly address project funding needs. Offers high potential for capacity building and supports project success. Sustainability and scalability are moderate, depending on the project's long-term impact. Financial accountability is high due to grant management procedures. Low attractiveness to investors as there's no direct financial return.

Performance-Based Grant: Rewards successful projects and incentivizes efficiency, but requires complex monitoring and evaluation systems. Risk mitigation is moderate, as funding is contingent on

achieving performance targets. Innovation can be discouraged if grantees prioritize short-term results over long-term goals. Capacity building is possible through training and feedback based on performance assessments. Sustainability is moderate, as funding is tied to project performance. Scalability is potentially high, as successful projects can serve as models for others. Flexibility is moderate, as performance targets may limit project adaptability. Financial accountability is high due to the performance-based nature of the grant. Potentially high attractiveness to investors, as performance-based grants can align with impact investing goals.

Based on the key criteria described above, direct grants emerge as a strategic choice for BEAM due to their ability to address immediate action, innovation, or capacity building as shown in the table below.

Mechanism	Advantages	Disadvantages	Suitability for BEAM
Direct Grant	• Front-end funding • Flexibility in project design and implementation • Encourages innovation and allows some risk-taking • Supports capacity building through training and technical assistance • Suitable for supporting projects where financial returns are low (or zero) but that address climate change impacts through strong environmental and/or social goals	• No repayment requirement • Low financial risk to recipient means there is little incentive to focus on cost controls and financial returns • There is limited long-term funding sustainability if financial returns are low • Funding available is depleted because it is not replenished.	High
Reimbursable Grant	• • May attract some investors with attractive repayment terms allowing for combining grants and soft loans for project financing	• Administrative burden for reporting and managing repayments • Potential for non-repayment • Limited long-term funding sustainability for BEAM • Only suitable for projects that can generate revenue for repayment	Medium
Revolving Grant	• Sustainable funding source in theory (grants are reimbursed and then the funding re-used) • Encourages project planning oriented towards profitability for fund replenishment	• Complex administration for managing the revolving fund • Potential for limited funding pool depending on repayment rates • Discourages innovation due to the need for revenue generation • Excludes projects that have strong focus on climate change impacts but low possibility for financial returns	Medium-Low

Mechanism	Advantages	Disadvantages	Suitability for BEAM
Direct Technical Assistance	• Provides targeted expertise and resources for project implementation • Builds capacity of local communities and organizations • Complements other funding mechanisms	• Requires careful needs assessment to ensure relevance • May not directly address project funding needs • Funding available is depleted because it is not replenished.	High
Performance-Based Grant	• Rewards successful projects, incentivizes efficiency • Suitable for projects with measurable performance targets	• Can discourage innovation or risk-taking • Complex monitoring and evaluation to assess project performance • Limited focus on capacity building • Requires recipient to have sufficient financial capacity and capital to be able to fund up-front costs since payments are paid after performance is achieved • Funding available is depleted because it is not replenished.	Medium

Direct grants offer several advantages over other funding mechanisms for the following reasons:

1. **Front-end funding:** Direct grants provide funding upfront, allowing project implementation to commence without the burden of debt or the need for prior financial resources. For example, a community-led project aiming to restore a degraded mangrove ecosystem. A direct grant would allow the project to purchase necessary equipment, hire labor, and initiate restoration activities immediately.
2. **Flexibility and adaptability:** Direct grants offer more flexibility in project design and implementation, enabling adjustments as needed to address unforeseen challenges or changing circumstances. For example, a project promoting sustainable aquaculture practices. Unexpected weather conditions might necessitate changes in the project's timeline or methodology. Direct grants provide the flexibility to adapt to such situations without the constraints imposed by rigid repayment schedules.
3. **Encouraging innovation and risk-taking:** Direct grants encourage experimentation and the development of innovative solutions without the pressure of immediate financial returns. As an example, a project testing a new, eco-friendly seaweed processing method. The project might not guarantee immediate profitability but could lead to significant environmental benefits and long-term cost savings or a new revenue source. Direct grants allow for such risk-taking, fostering innovation in the blue economy sector.

7.4 Evidence supporting demand-led grant mechanisms

Examples of similar projects to BEAM that have specific focus on both climate change adaptation and the blue economy are limited, though there are a few Indonesian projects that utilize direct grants and share similarities with BEAM's goals:

1. Coral Triangle Initiative (CTI) – Indonesia, the project focuses on managing marine and coastal resources in six countries, including Indonesia, and employs direct grants to support local

communities in sustainable fisheries management, coral reef conservation, and marine protected areas.[434]

Key activities under CTI include:

- Sustainable Fisheries Management: Implementing best practices to ensure the long-term viability of fish stocks and the fishing industry.
- Coral Reef Conservation: Protecting and rehabilitating coral reefs to maintain biodiversity and ecosystem services.
- Marine Protected Areas: Establishing and managing MPAs to conserve marine ecosystems and biodiversity.
- Community Engagement: Empowering local communities with knowledge and resources to participate actively in conservation efforts.

2. The GEF Small Grants Programme (SGP), the project provides grants to NGOs and community organizations for environmental projects. In Indonesia, SGP has funded projects on mangrove conservation, sustainable seaweed farming, and community-based marine protected areas.[435]

   In Indonesia, the SGP has funded numerous projects, focusing on areas such as:

   - Mangrove Conservation: Protecting and restoring mangrove forests to enhance coastal resilience, support biodiversity, and provide ecosystem services.
   - Sustainable Seaweed Farming: Promoting environmentally friendly seaweed farming practices to improve livelihoods and reduce pressure on marine resources.
   - Community-Based Marine Protected Areas (MPAs): Supporting the establishment and management of MPAs led by local communities to conserve marine ecosystems and ensure sustainable use of marine resources.

The Coral Triangle Initiative (CTI) and the GEF Small Grants Programme (SGP) illustrate the effectiveness of demand-led grant facilities in driving impactful environmental and community-based projects. In both cases, the demand-led approach has been instrumental in supporting local communities through grants that enhance sustainable fisheries management, coral reef conservation, and marine protected areas (MPAs). The initiative has shown positive outcomes by fostering community participation and ensuring that the funded projects align with the local ecological and socio-economic contexts.[436] [437] While their focus might not be exactly the same as BEAM, they offer valuable insights into the successful implementation of demand-led direct grant mechanisms.

7.5 Conclusion

Demand-led direct grants are the most suitable funding mechanism for most grant making planned in the BEAM project due to their ability to provide immediate resources, flexibility, and support for innovation and capacity building. The proposed call for proposal mechanism ensures a transparent and efficient allocation of funds, addressing the critical funding gap in Indonesia's Blue Economy sector. By leveraging grant funding, the BEAM project aims to foster sustainable development and resilience in coastal communities, contributing to the broader goals of climate change adaptation and mitigation.

Based on the Feasibility study results, discussions with the Executing Entity KI based on their past experience managing Grant Facilities, the BEAM grant funds will be distributed using the call for proposal

[434] https://www.coraltriangleinitiative.org/
[435] https://www.thegef.org/what-we-do/topics/gef-small-grants-programme
[436] https://www.coraltriangleinitiative.org/library/summary-indonesia-state-coral-triangle-report
[437] https://www.thegef.org/projects-operations/projects/9086

mechanism (see end of chapter for details on process). Grant programs utilize "call for proposals" for several crucial reasons. It adopts an **open and fair** application process by ensuring transparency and allowing everyone to compete on equal footing. This method also promotes **efficiency** by streamlining application management and facilitating comparisons between standardized proposals. The call allows the program to **target specific needs and expertise** by attracting projects most aligned with their goals. Additionally, it helps **ensure quality assurance** by setting clear proposal expectations and receiving detailed applications. The call can serve as a tool for **public engagement**, generating interest and potentially fostering collaboration among stakeholders. KI as the proposed Executing Entity (EE) for Component 2, have a strong track record in successfully managing several large grant facilities and decades of experience working with various stakeholders for environmental programs toward sustainability in Indonesia.

In addition to direct grant making, direct technical assistance grants will also be used by BEAM to address capacity building needs. Direct grants can jumpstart the project, while technical assistance grants can fill capacity gaps through targeted training and expertise (e.g., sustainable fishing management workshops, MPA management workshops, blue economy business development, etc.).

As individual businesses working in the blue economy mature, they can explore transitioning to market-based solutions by attracting private investors based on their proven track record from direct grants. This transition to private sector investments is an anticipated downstream pathway after BEAM has addressed the barriers that are currently preventing blue economy enterprises from reaching commercial/conventional finance.