

Implementation Completion Report

COREMAP - CTI

2017 - 2022



LOAN IBRD 8336-ID



EXECUTIVE SUMMARY

Coral Reef Rehabilitation and Management Program (COREMAP) was established in 1998 to fully support ecosystem monitoring and complementary projects that could boost coastal ecosystem conservation. The COREMAP-CTI was designed with three phases: (1) Initiation; (2) Acceleration; and (3) Institutionalization. The purpose of the Implementation Completion Report (ICR) is to provide a comprehensive assessment of the COREMAP-CTI performance financed by the World Bank, including problems and issues faced by the Project Implementing Agency during the implementation of COREMAP-CTI from 2017 to 2022.

A number of achievements of COREMAP-CTI have been seen from a series of activities that include observing marine ecosystems, education, and scientific research, including the launch of Indonesia's outer islands expeditions results. These activities are also included in the Government of Indonesia's development program targets. The implementation of this program involved a variety of higher education institutions across various regions in Indonesia and empowered both senior and junior researchers.

First, **Component 1:** *Institutional Strengthening for Coastal Ecosystems Monitoring*

- The RHM activity has applied the Coral Reef Health Index at 39 monitoring sites and has 12,719,840 ha area under continuous monitoring. The team has conducted a cumulative total of 78 coastal ecosystem monitoring surveys, including 22 surveys in 2021.
- BRIN is accredited by National Agency for Professional Certification (BNSP) as the national certification entity for six coastal ecosystem schemes, exceeding the overall target of five schemes. A total of 13 assessment centers for training and certification of surveyors and assessors (*Tempat Uji Kompetensi*, TUKs) have been established (with the issuance of the TUK Establishment Decree), exceeding the end-Project target. A cumulative of 639 surveyors and assessors have been certified, exceeding the end-Project target.
- A total of 20 technical staffs were awarded master's degree scholarship in Coastal Ecosystems Monitoring and Management. Additional short training courses have been delivered to 85 participants from agencies including BAPPENAS, MMAF, and regional marine and fishery agency, on topics related to marine spatial planning, sustainable fisheries management, and bio-economics.
- Construction of six new laboratory and marine stations have been completed.

Second, **Component 2:** *Support for Demand-Driven Coastal Ecosystems Research*

- Demand-driven research grants were allocated in 2022 for a cumulative 60 grants in total.
- A total of 131 scientific research papers have been published throughout COREMAP. There was a significant increase in international journal publications between 2021-2022 (36 publications) compared to 20 international journal publications prior to 2021.
- A cumulative of 523 researchers have been trained in coastal ecosystems research techniques, therefore exceeding end-project target.

- Eight sub-national data nodes for storing coastal ecosystems data are complete therefore meeting the end-Project target.

Third, **Component 3: Management of Priority Coastal Ecosystems**. Progress in activities includes:

- **Sub-component 3.1. Management effectiveness of marine conservation areas and conservation of threatened species:**
 - Nine eco-tourism infrastructure assets are completed.
 - An additional 5 infrastructures built by the project to support fisheries and livelihood were completed in 2021.
 - A total of 21 activities supporting the National Action Plan for Cetaceans, Sharks, and Rays have been implemented including genetic sampling and satellite tagging of cetaceans; manta ray population assessment; socialization, awareness, and education workshops; feasibility study on development of species-based tourism; and conducting training on handling method for stranded marine mammals.
- **Sub-component 3.2. Integrated Coastal Zone Management, ICZM:**

Seventeen activities from the West Papua ICZM Action Plan are completed or fully underway, include: capacity building training for community surveillance; mangrove ecosystem rehabilitation; diving certification for MPA managers; district decrees for protection of tenurial systems for indigenous community groups; capacity building for *Masyarakat Hukum Adat* (MHA) sustainable management of marine and coastal resources; and socialization, awareness, and education workshops.
- **Sub-component 3.2. Community stewardship of coastal resources:**

Twenty-two community surveillance groups (POKMASWAS) in West Papua and Savu Sea have been officially registered and conducted regular patrols since April 2021 with 1 additional POKMASWAS registered and waiting for decree letter, therefore exceeding the end-project target of 18 operational groups.

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FOREWORD

Praise be given to God for the grace and permission that the Coral Rehabilitation and Management Program-Coral Triangle Initiative (COREMAP-CTI) program can be carried out well and the report has been completed.

The COREMAP-CTI program has entered the final year of the third stage in June 2022. A number of achievements have been attained from a series of activities, including observation of marine ecosystems, education and training, scientific research, and developing coastal ecosystem data center. The program also involves several institutions and researchers in Indonesia. This program provides benefits to the people of Indonesia in general and to the local communities who are specifically involved in the program implementation.

The COREMAP-CTI is capable of being an enabler for national monitoring of coastal ecosystems (nationwide monitoring on coastal ecosystems) using the same standards and methods. The data and results from this activity are then used to initiate and support the Marine Protected Area (MPA) acceleration program.

Increased awareness of Indonesian people about the importance of coastal ecosystems has been successfully carried out during COREMAP-CTI. Increasing public awareness needs to be done through marine literacy and scientific diplomacy. Awareness efforts are very relevant to the Ocean Decade and the SDGs.

In the context of human resource capacity development and scientific contributions, the contributions COREMAP-CTI have also received considerable attention.

We hope that this program will improve local community's welfare, especially the people who depend on the sea for their livelihood. Finally, we would like to thank all parties who have been involved and contributed to this program.

Prof. Ocky Karna Radjasa

Head (*ad interim*) of Earth Sciences Research Organization, BRIN

CHAPTER 1. INTRODUCTION

1.1. Background

As an archipelagic country located within the Coral Triangle, Indonesia has immense natural resources from the seas and coastal areas that can prosper local communities. In this case, fisheries, ecotourism, pharmaceutical industries, and the existence of small islands rely on the condition of coastal ecosystems. For example, coral reefs can supply fish and secondary metabolite compounds for drug discoveries. Seagrass meadows also become fish-supplying habitats after coral reefs. Mangrove forest is also very important to maintain marine biodiversity, such as fish, crustaceans, molluscs, and other marine creatures that inhabit the forest. Furthermore, the three ecosystems are connected, which means the degradation of one habitat may impact other habitats. They also greatly contribute to protecting the islands from abrasion and the adverse effects of global warming, especially the increasing sea surface level. Approximately 60 million people live in Indonesia's coastal areas, which are within 30 km of a coral reef, and rely on the ecosystems for their livelihoods and as an important food source for several centuries.

However, the expansion of global trade networks and greater demand for products originating from coral reef ecosystems have increased the exploitation rate and affected those natural resources' sustainability. This pressure is compounded by the rapid growth of population and development, especially in coastal areas, and global issues such as climate change and ocean acidification. Conserving the coastal ecosystems is vital, considering the great advantages from them.

One of the basic conservation elements is reliable data obtained through periodical monitoring. This element will inform whether the ecosystems remain the same or change during the management period. Therefore, the management regime can strongly consider responding to the ecosystem conditions. In this case, the consideration shall emphasize the ecosystem's sustainability and the benefits for local communities.

Reef health monitoring has been conducted since 1993 by an initiation from the Research Center for Oceanography supported by the National Development Planning Agency (BAPPENAS). Coral Reef Rehabilitation and Management Program (COREMAP) was established in 1998 to fully support ecosystem monitoring and complementary projects that could boost coastal ecosystem conservation. The COREMAP-CTI was designed with three phases: (1) Initiation; (2) Acceleration; and (3) Institutionalization.

This document aims to provide a comprehensive assessment of the performance of COREMAP-CTI financed by the World Bank (WB), including issues and challenges faced by the Project Implementing Agency. This report is important for the Government of Indonesia and WB because the project has entered the final stage of the implementation period, which was designed for sixty months from July 2017 to June 2022. A number of achievements have been seen from a series of activities that include observing marine ecosystems, education, and scientific research, including the launch of Indonesia's outer islands expeditions results. These activities are also included in the Government of Indonesia's development program targets. The implementation of this program involved a variety of higher education institutions across various regions in Indonesia and empowered both senior and junior researchers. This program provides many benefits.

This report will focus on the achievement of the program in 2017—2022 in five chapters. The first chapter describes the background of the program, its objectives, and the beneficiaries. The second chapter discusses the program's approach to achieving its objectives. The third chapter analyses the achievements of the first three components. The fourth chapter examines the last component (project management), providing the lessons learned from this program. The fifth chapter is the conclusions and recommendations from this program's series of activities.

1.2. Project Objectives

The general purpose of this program is to improve the sustainability of coastal ecosystems. COREMAP-CTI Phase 3 (2017—2022) aims to strengthen the institutional capacity of monitoring and researching coastal ecosystems to produce evidence-based information on resource management and improve the effectiveness of managing priority coastal ecosystems. In general, this program aims to institutionalize the approach formed in the previous project phases so that the impact of the activities sustainably takes place in the long term.

The Government of Indonesia has established National Development Agenda as stated in the National Mid-Term Development Plan (RPJMN) 2015–2019. The objectives of COREMAP-CTI are aligned with the RPJMN, where natural resources and the environment have been designated as priority sectors. It is also in line with LIPI's (now part of the National Research and Innovation Agency/BRIN) long-term goal, which is to become a regional center of excellence for coastal ecosystem research and monitoring.

1.3. Project Stakeholders and Beneficiaries

Other than the World Bank, the implementation of COREMAP-CTI programs was also supported by the Asian Development Bank (ADB). The ADB supported sustainable coral reef management in three locations in the Lesser Sunda region, i.e., Water Tourism Park (TWP) Nusa Penida, Bali; Gili Matra Marine Conservation Area (KKP), and Gili Balu Small Island Park (TPK) in West Nusa Tenggara. The program ran from March 2020 to December 2022. Aside from the coral reef management program, the ADB also supported other COREMAP-CTI agendas, i.e., Discussion of Grant Agreements Amendments; Kick-Off of COREMAP-CTI ADB Program Implementation; Consultant Procurement; and Master Degree Scholarship Program.

The implementation of the COREMAP-CTI program will be beneficial for the people of Indonesia and the global community in general. This document identifies four categories of project beneficiaries in Indonesia, e.g., the government, civil society, private sector, and academia.

a. Government

Government beneficiaries will include central and local government levels and will encompass:

- Improved institutional capacity for (1) coastal ecosystem monitoring; (2) demand-driven coastal ecosystems research; and (3) coastal ecosystems monitoring and research data management and dissemination.
- Improved availability of infrastructure facilities for monitoring and research.
- Improve Management of Priority Coastal Ecosystems and conservation of threatened species.
- Improved human resource capacity.

b. Civil Society

Civil society beneficiaries will include coastal communities and organizations that benefit from the long-term impacts of improved coastal ecosystem monitoring and research, including increased understanding and awareness of coastal ecosystem resources and their management.

c. Private Sector

Private sector beneficiaries will include small and medium enterprises that utilize coastal ecosystem resources, including

- Improved access to information and data related to the distribution of healthy coral reefs and the status of threatened species.
- Improved provision of research and monitoring services that are responsive to stakeholder needs.
- Employment opportunities for the private sector and community through infrastructure and renovation activities.

d. Academia

Academia beneficiaries include public and private universities, including

- Improved participation and technical support for coastal ecosystem surveys and associated training.
- Increased capacity for coastal ecosystem research via engagement in competitive grants programs.
- Improved access to quality training and education services.
- Enhanced human resources for coastal ecosystem monitoring through certification against national standards.
- Supporting Higher Education Programs (university) related to marine-scholar (college student) competency certification.

CHAPTER 2. PROJECT APPROACH

2.1. General Description

The Coral Reef Rehabilitation and Management Program-Coral Triangle Initiative (COREMAP-CTI) represents Phase 3 of this program. It aims to institutionalize approaches established under previous phases to ensure long-term sustainable impacts. The project went through two restructuring processes. The first restructuring was in 2017, shifting the executing agency for loan financing from the Ministry of Marine Affairs and Fisheries (MMAF) to Indonesian Institute of Sciences (LIPI). The second one was in 2018, re-introducing improvement efforts for management effectiveness of priority coastal ecosystems and shifting the executing agency for Global Environment Facility (GEF) Grant financing from MMAF to BAPPENAS with the Indonesia Climate Change Trust Fund (ICCTF) as the implementing unit.

The original project development objective (PDO) is aimed to institutionalize the COREMAP-CTI approach as a sustainable, decentralized, and integrated framework for the management of coral reef resources, ecological systems, and related biodiversity for community welfare in selected districts in each province in Indonesia. After the restructuring, the PDO is adjusted to better reflects the mandate and functions of LIPI as a research institution. The new PDO aimed to strengthen institutional capacity in coastal ecosystems monitoring and research to produce evidence-based resource management information, and to improve management effectiveness of priority coastal ecosystems. It is then derived into four main components of activities, i.e., (1) Institutional Strengthening for Coastal Ecosystem Monitoring; (2) Support for Demand-Driven Ecosystem Research; (3) Management of Priority Coastal Ecosystems; and (4) Project Management.

In the context of grant activities, the revised PDO still relevant with the original PDO which supports the sustainable management of coastal ecosystem for the benefit of community in target locations, as reflected in the Project Component 3. The restructuring of grant activities also resulted in new implementation arrangement which allows ICCTF to subgrant the funding to NGOs and other organizations to implement defined work packages at the community level and involved community in marine conservation area management and utilization. The component 3 revision also reflects the targets from the original component 3 which focus to the infrastructure development and sustainable enterprise establishment at local targets. In revised component 3, the focus is wider with additional targets to support the national policy regarding the implementation of integrated coastal zone management action plan and the national plan of action for endangered species.

Despite their exit from the COREMAP-CTI, the MMAF through the Directorate General of Marine Spatial Management is still part of the Steering Committee of COREMAP-CTI Program. The Steering Committee is responsible for overall policy direction and general oversight of the program. Aside from that, several COREMAP-CTI projects involved agencies under the MMAF, e.g., the BKKPN Kupang and LKKPN Pekanbaru for the development of national sub-national data nodes.

2.2. Scope of the Project

In general, the key activities and outputs of this program are:

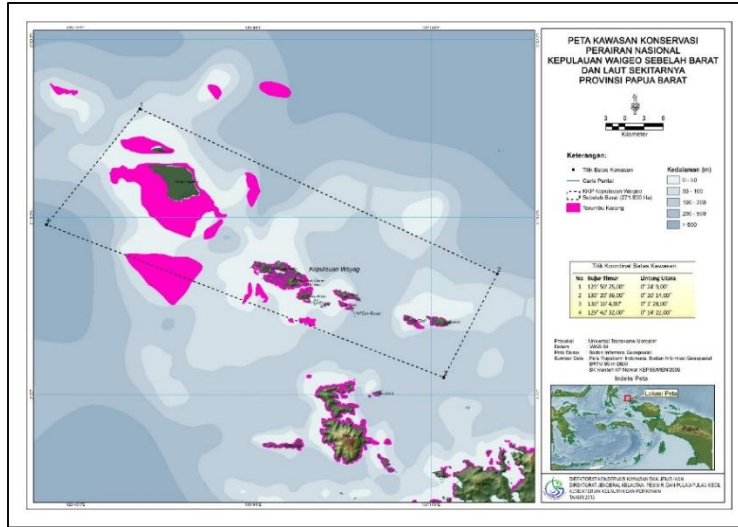


Figure 2. Map of National Marine Conservation Area in West Waigeo

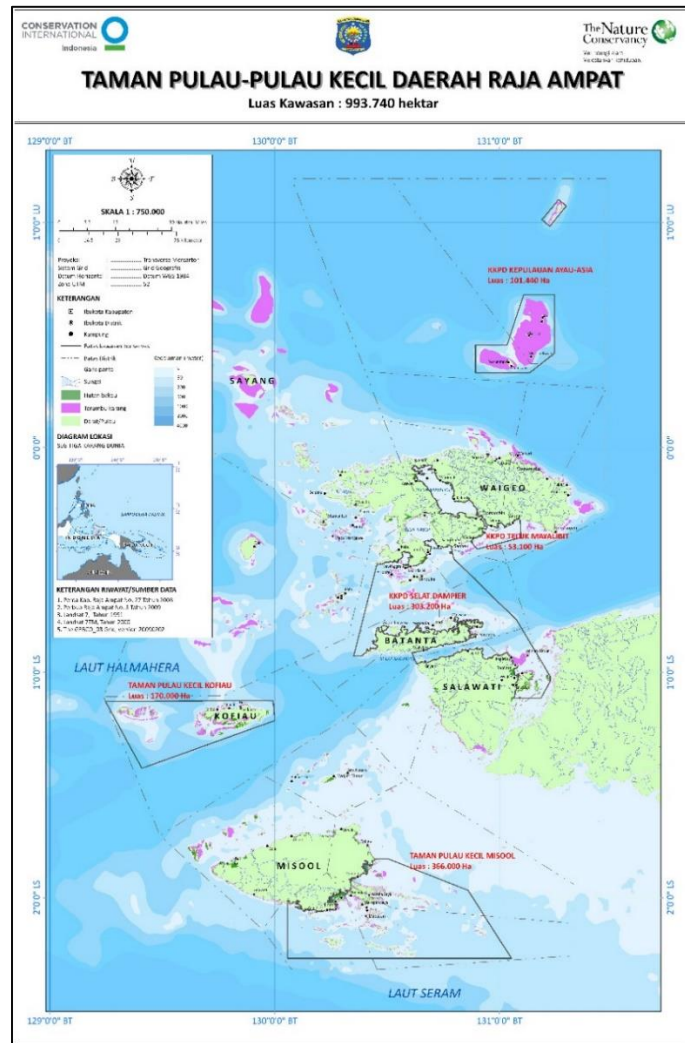


Figure 3. Small Islands Park Area in Raja Ampat

Works, Training and Workshops, Consultants Services, Goods, Incremental Operating Costs (pro-memoria)	12,502,542	12,502,542	100%
Grants (pro-memoria)	-	-	0%
Scholarships (pro-memoria)	444,677	444,677	100%
Works, Training and Workshops, Consultants Services, Non-consulting Services, Goods, Scholarships, and Incremental Operating Costs under Part 1, 2, and 4 of the Project	34,432,781	29,363,614.56	85.28%
TOTAL EXPENDITURE	47,380,000	42,310,833.28	89.30%

GEF Grant is disbursed by ICCTF via sub-grant mechanism to NGOs and other eligible organizations following the sub-grant manual of COREMAP-CTI and Ministry of National Development Planning Regulation No. 3/2020 on the general guidance of government grant channeling to address climate change. The sub-grant is put under category 2 in project financing budget.

Under sub-grant mechanism, ICCTF developed 6 work packages based on the PDO level indicators and intermediate indicators, and selected the sub-grantee through call for proposal which include the administrative and in-depth assessment by independent experts. Each sub-grantee implemented the work packages within 20 months and funding was given based on term mechanism. The 6 sub-grantees and amount of funding for implementing work packages as follows:

1. Work Package 1: Yayasan Terangi (US\$ 1,245,300)
2. Work Package 2: YAPEKA (US\$ 751,600)
3. Work Package 3: Yayasan Reef Check Indonesia (US\$ 967,000)
4. Work Package 4: PKSPL-IPB (US\$ 869,000)
5. Work Package 5: Yayasan Terangi (US\$ 1,344,300)
6. Work Package 6: PILI (US\$ 598,000)

The accumulative project expenditure and financing for Component 3 as presents in the table below:

Table 2. Cumulative Project Expenditure and Financing for Project Component 3

CUMULATIVE PROJECT EXPENDITURE AND FINANCING AS OF 31 MAY 2022				
Cat No.	Description	Threshold (in USD)	Actual Cumulative (in USD)	
1	Works, Training and Workshops, Consultants Services, Goods, Incremental Operating Costs (pro-memoria)	3,803,112.00	3,775,550.75	99%

2	Sub-grants under Part 3 of the Project	5,775,200.00	5,708,751.42	99%
3	Training and Workshops, Consultants Services, Non-consulting Services, Goods and Incremental Operating Costs under Part 3 of the Project	421,688.00	347,191.41	82%
TOTAL EXPENDITURE		10,000,000.00	9,831,493.58	98%

Category 1 is activities that was managed and disbursed by MMAF until 2017, while ICCTF-BAPPENAS is only responsible to manage and disburse category 2 and 3 from 2019 to 2022.

2.4. Project Implementation Arrangement

COREMAP-CTI implementation is coordinated by LIPI as Project Management Office (PMO) established within the Research Center for Oceanography (RCO). Since the second amendment of the agreement in 2019, the Project Implementing Units (PIU) consist of RCO, Indonesia Climate Change Trust Fund (ICCTF-BAPPENAS), and the Center for Planners Development, Education, and Training (CPDET-BAPPENAS).

- **Research Center for Oceanography – LIPI**

Following the merger of research institutions to the National Research and Innovation Agency (BRIN), there has been structural shifts in the institutions, including the Research Center of Oceanography-LIPI. As of October 1, 2021, the RCO is known as the Research Center of Oceanography (RCO) under the Research Organization (OR) of Earth Sciences and Maritime-BRIN. The RCO is responsible for implementing Component 1: Institutional Strengthening for Coastal Ecosystem Monitoring, specifically sub-component 1.1: Support for robust coastal ecosystem monitoring, and sub-component 1.3: Strengthen institutional capacity for coastal ecosystem monitoring. RCO is responsible for developing a protocol or regulation approved for monitoring coral reefs and coastal ecosystems, strengthening the technical capacity of the implementers through training curricula and collaboration with technical experts. LIPI endorses coral reef and fisheries monitoring protocols and provides training to partners to monitor and collect data. LIPI will also update the Coral Reef Management Information System (CRMIS) data and make the necessary modifications to the system. RCO is also responsible for Component 2: Support for Demand-driven Coastal Ecosystems Research and Component 4: Project Management.

- **Center for Planners Development, Education, and Training (CPDET-Bappenas)**

Center for Planners Development, Education, and Training (CPDET)-BAPPENAS is responsible for implementing sub-component 1.2: Strengthen technical capacity for end-users and target coastal monitoring by facilitating master's degree scholarships abroad following the required target competencies.

- **Indonesia Climate Change Trust Fund (ICCTF)-Bappenas**

The ICCTF-BAPPENAS handles and manages the implementation of Component 3: Management of Priority Coastal Ecosystems. There are three sub-components handled by ICCTF, i.e., 3.1: Effectiveness of management of marine protected areas and conservation of threatened species; 3.2: Integrated coastal

zone planning; and 3.3: Community stewardship of coastal resources. The third component aims to improve the management of priority coastal ecosystems in four target areas in Eastern Indonesia: TNP Savu Sea, KKPN/SAP Raja Ampat, KKPN/SAP West Waigeo, and KKPD Raja Ampat. ICCTF is responsible to develop small-scale infrastructures for ecotourism; strengthen community surveillance group to conduct regular patrol; implement the NPOA threatened species and implement provincial ICZM action plan.

CHAPTER 3. PROJECT ACHIEVEMENT

As an archipelagic country, Indonesia has enormous natural resources originating from the sea and coast that can prosper the local community. In this case, fisheries, ecotourism, pharmaceutical industry, and the existence of small islands depend on the condition of the coastal ecosystem. For example, coral reefs can supply fish and even secondary metabolites for drug discovery. Seagrass beds are also a habitat for fish suppliers after coral reefs. Mangrove forests are also very important for maintaining marine biodiversity such as fish, crustaceans, molluscs, and other sea creatures that inhabit the forest. In addition, these three ecosystems are interrelated – degradation in one habitat can affect other habitats – and have a major contribution in protecting islands from abrasion and the adverse effects of global warming, especially sea level rise.

There are around 60 million people living in the coastal areas of Indonesia and are highly dependent on the ecosystem for their livelihoods. Given the great advantages of coastal ecosystems, it is very important to preserve the ecosystem. One of the basic elements of conservation is reliable data that can be obtained through regular monitoring. This will inform whether the ecosystem remains the same or changes during the management period. Therefore, the management regime can have strong considerations to respond to these ecosystem conditions. In this case, the consideration should be on ecosystem sustainability and benefits for local communities.

3.1. PDO 1: Strengthened monitoring capacity for producing evidence-based coastal ecosystem management information

The goal of Project Development Objective (PDO) 1 is to strengthen the institutions for coastal ecosystem monitoring to reflect national and international standards. In the implementation, there are three sub-components, where each one of them carry specific activities.

1.Support for robust coastal ecosystem monitoring

Proper management is required to protect the highly vulnerable coastal ecosystems and ensure their sustainability. Both natural and anthropogenic threats can be equally damaging if there is no action to protect them. To implement the protection plan, trend, or changes over time are analyzed to determine management and policy directions to ensure the sustainability of coastal ecosystems. Changes or trend over time of coastal ecosystem usually are obtained through monitoring and/or survey activities.

a. Coastal Ecosystem Monitoring Surveys (Reef Health Monitoring/RHM)

Reef Health Monitoring (RHM) activity is an essential part of the COREMAP-CTI program. The monitoring areas in RHM represent various sites across Indonesia, i.e., western Indonesia, eastern Indonesia, the National Water Conservation Area (KKPN), and several national priority marine areas. A total of 39 sites covering an area of 12,719,840 ha are under continuous monitoring since 2015 (Table 3). Figure 5 shows the cumulative number of stations during the RHM from 2015 to 2021, which reaches 1588 stations by the end of the activity. It is equivalent with the number of monitoring records that is collected by the RCO, as one station represent one data point. The results of RHM are used to analyze temporal changes and update the data and information on the health of coral reefs and other related ecosystems through the

submission of their status every year and the development of an ecosystem health index. In the implementation, the RCO collaborated with several institutions, i.e., universities, government agencies, and NGOs.

In 2020, RCO–LIPI could implement only one out of 22 planned sites for reef health and associated ecosystem monitoring, which is in Biak Numfor. Therefore, the monitoring data from 2020 will not be discussed in details and excluded from the trend graph for each ecosystem to prevent bias. The average coverage for coral reef, seagrass, and mangrove in Biak Numfor can be found in Appendix 3.

In RHM, five components were assessed to determine ecosystem health, i.e., live coral cover, reef fish community, megabenthic community, mangrove community, and seagrass cover. The activity was carried out with non-destructive monitoring methods for all ecosystems.

Table 3. RHM Sites and Number of Station 2015—2021

No.	Sites	Study Area (Ha)	Year						
			2015	2016	2017	2018	2019	2020	2021
1	Bakauheni - Lampung Selatan	3,072	10	10	10	10	10	x	10
2	Batam	66,867	19	19	19	19	x	x	19
3	Belitung	66,033	11	11	11	11	x	x	11
4	Biak Numfor	46,983	13	13	13	13	x	13	x
5	Bintan	472,905	14	14	14	14	14	x	x
6	Buton	154,899	x	15	15	15	x	x	15
7	Karimun Jawa	110,117	x	x	x	x	x	x	10
8	Kendari	21,336	9	9	9	9	x	x	9
9	Kepulauan Derawan	493,188	x	x	x	x	11	x	11
10	Kepulauan Mentawai	172,191	9	9		9	9	x	9
11	Kepulauan Selayar	9,001	12	12	12	15	15	x	x
12	Kepulauan Seribu	210,494	x	x	x	x	x	x	14
13	KKPN SAP Kepulauan Aru Bagian Tenggara	114,000	x	12	x	x	x	x	x
14	KKPN SAP Raja Ampat	60,000	9	x	x	x	9	x	x
15	KKPN SAP Waigeo Barat	129,495	8	x	x	x	x	x	x
16	KKPN TNP Laut Sawu (Sumba Timur)	3,355,353	x	x	x	10	x	x	10
	KKPN TNP Laut Sawu (Tablolong & Rote Ndao)		12	x	x	x	x	x	x
17	KKPN TWP Anambas	1,262,686	12	x	x	x	12	x	x
18	KKPN TWP Kapoposang	50,000	13	x	x	x	x	x	x
19	KKPN TWP Laut Banda	2,500	12	x	x	x	x	x	x

No.	Sites	Study Area (Ha)	Year						
			2015	2016	2017	2018	2019	2020	2021
20	KKPN TWP Padaido	183,000	13	x	x	x	13	x	x
21	KKPN TWP Pieh	39,900	x	x	x	x	13	x	x
22	Komodo	345,032	x	x	x	x	12	x	x
23	Lingga	191,258	11	11	x	11	x	x	12
24	Makassar	56,690	13	13	13	13	x	x	13
25	Merauke	188,437	x	x	x	x	0	x	x
26	Moyo dan Teluk Saleh	234,228	x	x	x	x	x	x	32
27	Natuna	142,997	20	18		19	19	x	19
28	Nias Utara	29,000	8	8	10	10	x	x	x
29	Pangkep	176,531	15	15	15	15	x	x	x
30	Raja Ampat	300,048	12	12	12	12	12	x	12
31	Sabang	95,963	x	x	x	12	x	x	12
32	Sekotong - Lombok Barat	13,141	12	12	12	12	12	x	12
33	Sikka	42,250	14	14	14	14	x	x	13
34	Takabonerate	530,765	x	x	x	x	12	x	x
35	Tapanuli Tengah	81,243	13	13		13	x	x	13
36	Teluk Cenderawasih	1,453,500	x	x	x	x	x	x	12
37	Ternate, Tidore & Halmahera Barat	273,001	14	14	14	14	x	x	14
38	Tual	151,736	x	x	x	x	10	x	10
39	Wakatobi	1,390,000	15	15	15	15	15	x	x
Total		12,719,841	323	269	208	285	198	13	292

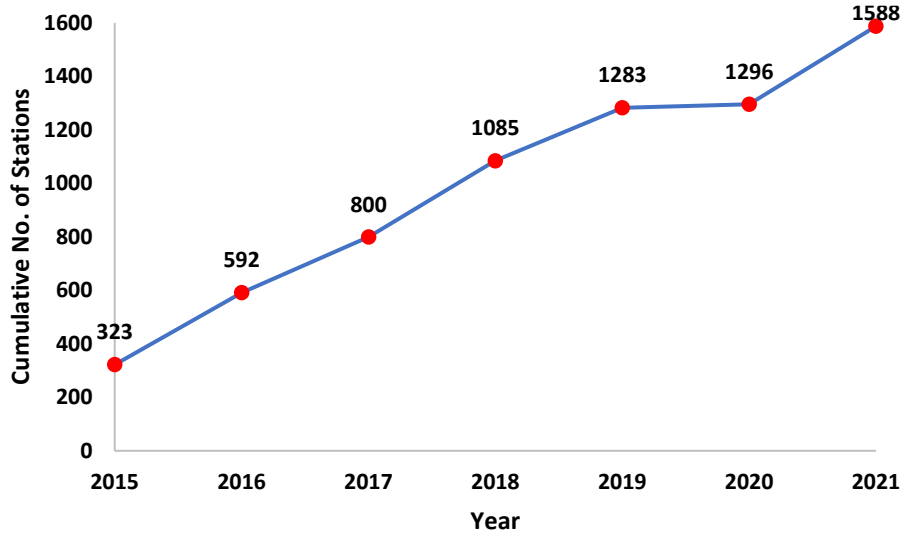


Figure 5. Trend of cumulative number of stations during the RHM from 2015 to 2021 (equivalent to the number of monitoring records)

Coral Reefs

Generally, coral reefs at the monitoring sites are classified as either fringing or patch reefs. Genus that are commonly found including *Acropora*, *Porites*, *Favia*, and *Pocillopora*. They are mostly found in massive, sub-massive, branching, encrusting, and foliose lifeforms. Aside from hard corals, soft corals and sponges are benthic biotas commonly found at all monitoring sites.

The coral reefs' health index (RHI) represents the health condition of coral reefs. The value is calculated by measuring and combining the reef current factor (live coral cover), resilience level (fleshy seaweed and rubble cover), and associated biota (reef fish biomass). In this case, the coral reefs' health can be observed according to their recovering ability after degradation and their ecological function to provide habitat for reef fishes. Thus, a healthy coral reef is defined as a coral reef with high live coral cover, high resilience level, and high reef fish biomass.

In 2018, the monitoring activities were carried out in 22 sites. In general, the average hard coral cover is 27.41% with RHI of 5. Pangkep has the highest coral cover among the sites with 39.74% and RHI of 6. On the other hand, Nias has the lowest coral cover with 9.66% and RHI of 3 (Appendix 1).

RHM 2019 is carried out in 17 sites with total area of 5,758,099.72 Ha. Data from Merauke site is excluded because they are not appropriate to be analyzed and therefore, also excluded from the average calculation. Due to high turbidity in the waters, the team could not implement the LIT method, but they found some organisms, such as sponges and soft coral. The corals they found are mostly non-reef building or solitary coral. In general, the condition of coral reefs in 2019 is categorized as "sufficient" with coral reef cover of 29.9% over 16 monitoring sites and average RHI of 5. Bintan has the highest coral cover of 43.82%, which is an increase from last year monitoring (37.6%), and RHI of 4. On the other hand, Sekotong has the lowest coral cover of 13.58%, which is a decrease from last year monitoring (15.21%), and RHI of 3. The average live coral cover is seen to increase each year, although not significantly, but this proves that coral reefs in Indonesia show an improvement (Appendix 2).

In 2020, the RHM could only carry out monitoring in Biak Numfor due to the COVID-19 situation in Indonesia. In general, the condition of coral reefs in the Biak Numfor Regency is fair, with a hard coral cover percentage of 28.46%.

The improvement of COVID-19 situation in 2021 led to the successful implementation of RHM activity in 22 sites. Overall, the average coral cover is 34.25% and RHI of 5. Karimunjawa has the highest coral cover among the monitoring sites with 60.47% and RHI of 6 (Appendix 4). On the other hand, Mentawai Islands has the lowest coral cover with 9.02%. Over the past years, some sites show increasing trend of live coral coverage, while some others show decreasing trend. The proportion of dead coral with algae at all monitoring sites is also quite high, indicating damages to the coral reef ecosystems. But some of the sites show ongoing recovery process. The low number of other benthic coverage, e.g., soft corals, sponges, or fleshy seaweed means there is less spatial competition, which will allow new coral recruitments to thrive.

Figure 6 below shows the annual coral cover from 2017 to 2021.

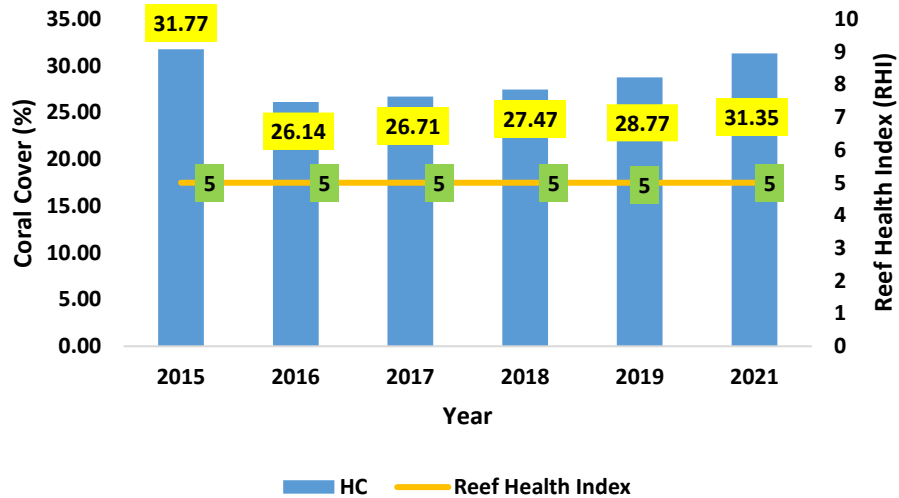


Figure 6. Live coral cover and reef health index (RHI) in COREMAP-CTI sites from 2017 to 2021 (except 2020)

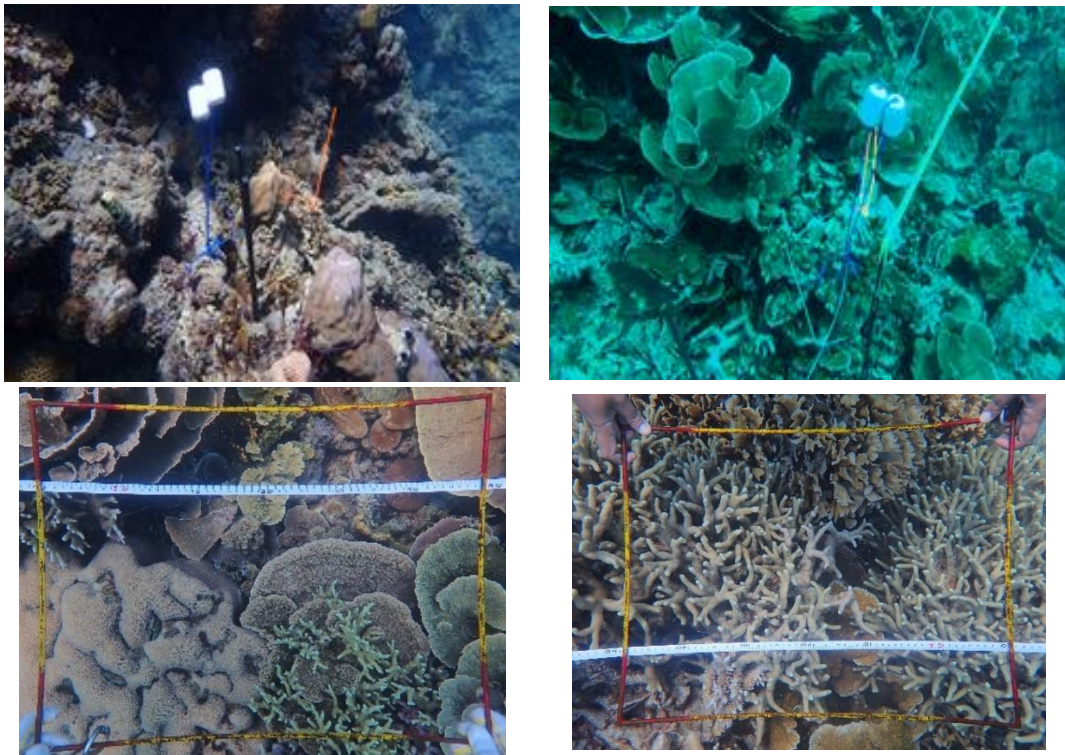


Figure 7. Documentation of coral reef survey and monitoring

Seagrass

Seagrass is the only flowered plant (Angiospermae) that live underwater. Currently, there are 14 species of seagrass that have been found in Indonesia, and 2 more species preserved in herbarium. The species that are commonly found at the sites are *Enhalus acoroides* (Ea), *Thalassia hemprichii* (Th), *Cymodocea rotundata* (Cr), *Cymodocea serrulata* (Cs), *Halophila ovalis* (Ho), *Halodule pinifolia* (Hp), *Halodule uninervis* (Hu), *Syringodium isoetifolium* (Si), *Thalassodendron ciliatum* (Tc), and *Halophila spinulosa* (Hs).

Seagrasses in Indonesia form monospecific and multispecific seagrass beds with an average of 4-5 species of seagrass and a maximum of 9 species in one monitoring site. Seagrass beds in Indonesia are generally composed of seagrass species with different survival strategies, namely persistent (e.g., *E. acoroides* and *T. hemprichii*) that are resistant to disturbance, opportunistic species (e.g., *C. rotundata*), and pioneering (e.g., *Halophila* sp. and *Halodule* sp.) which recovers quickly after a disturbance. With the diversity of species and variations of life strategies, seagrass ecosystems in Indonesia have high ecosystem resilience or are able to survive when disturbances or inappropriate environmental conditions occur, and are able to recover from these stressful conditions.

Seagrass monitoring refers to a standardized method published by the RCO – BRIN (Rahmawati *et al.*, 2017). Monitoring from 2015-2017 was carried out only referring to the RCO standard method with targets for species diversity, seagrass cover, and cover per seagrass species and status based on the Decree of Minister of Environment (KepMen LH) No. 200 of 2004 concerning standard criteria standard criteria for damage and guidelines for determining the status of seagrass beds (Table 4). Then, for the monitoring in 2018-2021, the standard method was assessed with Seagrass Ecosystem Quality Index (SEQI) (Table 5) to determine the ecosystem health, so that there were six parameters, namely the diversity of seagrass species, seagrass cover, macroalgae cover, epiphytic cover, and water brightness. The SEQI parameters is more comprehensive in determining the health of seagrass ecosystems, because it is expected to capture changes in the condition of seagrass ecosystems that are more comprehensive, encompassing communities and the aquatic environment so that they are able to describe environmental pressures on seagrasses.

Table 4. Seagrass Status based on the KepMen LH No. 200 of 2004

Criteria		Seagrass Cover (%)
Good	Rich/Healthy	≥60
Degraded	Less Rich/Less Healthy	30 – 59.9
	Poor	≤29.9

Table 5. Seagrass Criteria based on the SEQI Parameters

SEQI Value	Status of Seagrass Ecosystem
0 – 0.36	Very Poor
0.37 – 0.52	Poor
0.53 – 0.68	Moderate
0.69 – 0.84	Good
0.85 – 1	Very Good

In 2018, the average seagrass coverage in 22 monitoring sites is 42±19%, macroalga cover of 10±10%, and epiphyte of 17±18%. Overall, the average SEQI value is 0.69±0.1, which is categorized as Good. The monitoring results were delivered in a workshop, which was part of the launching of the Status of Indonesian Seagrass 2018 in Jakarta. In addition to the Status of Indonesian Seagrasses 2018 (vers.02), there is also a summary of the Digestion for Policy Makers: Potential of Indonesian Mangrove & Seagrass Ecosystem Carbon Reserves and Absorption (vers.01) 2018.

In 2019, the average seagrass cover is $40\pm 17\%$, macroalga cover of $11\pm 11\%$, and epiphyte of $28\pm 19\%$. Overall, the average SEQI value is 0.67 ± 0.1 , which is categorized as Moderate. Of the 17 COREMAP-CTI sites, only 15 sites have seagrass beds. Seagrass is absent in Merauke and Pieh, which may be due to unfavorable environmental conditions, such as high turbidity in Merauke and high energy wave in Pieh.

In 2020, the seagrass condition in Biak Numfor Regency has coverage of 49.19%, which is categorized as less healthy according to KepMen LH No. 200 of 2004.

In 2021, the average seagrass cover is $34\pm 18\%$, macroalga cover of $10\pm 10\%$, and epiphyte of $34\pm 19\%$. Overall, the average SEQI value is 0.66 ± 0.1 , which is categorized as Moderate.

The health condition or ecological quality of seagrass beds in Indonesian waters (national level) for the 2018-2021 period experienced a significant decline, which was 0.01 per year with variations in the decline at the site (district) level. Almost all monitoring sites experienced a decline in health which was described by a decrease in the SEQI value. However, a significant decrease was only recorded in Natuna and Buton at a rate of 0.03 and 0.05 per year, respectively. Seagrass ecosystem health increased only at three sites, namely Bintan, Lingga, and Tual, but this increase was not significant (Appendix 5). The decline in health conditions that occur at the national and district levels must receive attention to maintain ecosystem functions and the services provided.

The sites where the health of the seagrass ecosystem is maintained in Good condition include Belitung, Sikka, Makassar, and Wakatobi. In the four years of monitoring, the proportion of good seagrass beds has decreased. In 2018 and 2019, around 60% of the monitoring sites had Good condition, while in the last monitoring more than 70% of the monitoring sites had a fairly Good status.

Figure 8 below shows the annual coverage of seagrass from 2017 to 2021.

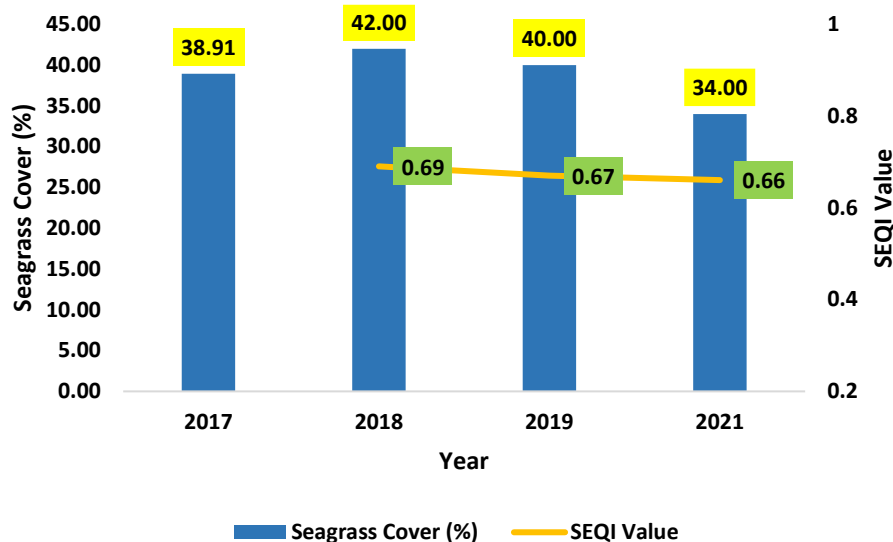


Figure 8. Seagrass Cover and SEQI Value in COREMAP-CTI sites from 2017 to 2021 (except 2020)

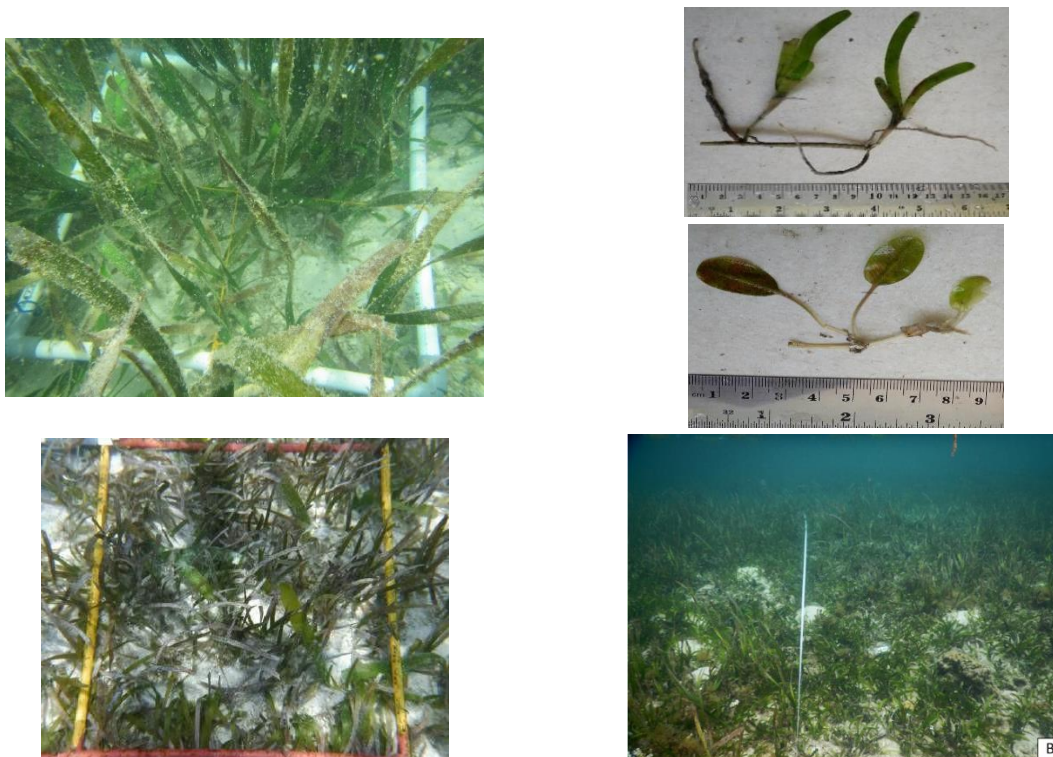


Figure 9. Documentation of seagrass survey and monitoring

Mangrove

Indonesia has quite high diversity of mangrove species, where approximately more than 40 species have been found. Most common species including *Rhizophora apiculata*, *Rhizophora mucronata*, *Rhizophora stylosa*, *Brugueira gymnorrhiza*, *Sonneratia alba*, and *Ceriops tagal*.

To assess mangrove forest condition in Reef Health Monitoring sites, the indicators used are based on the Decree of Minister of Environment (KepMen LH) No. 201 of 2004 about criteria and standard for measuring mangrove degradation (Table 6). These indicators were used from 2017 to 2019. In 2019 onward, the team used Mangrove Health Index (MHI) developed by the Research Center for Oceanography, BRIN. The MHI is considered more comprehensive because it explains the ecological processes in the ecosystem better compared to the KepMen LH (Table 7).

The following table is the criteria for both indicators:

Table 6. Mangrove Criteria based on the KepMen LH No. 201 of 2004

	Criteria	Canopy Cover (%)	Density (stand/ha)
Good	Very dense	≥75	≥1500
	Moderate dense	≥50 - <75	≥1000 - <1500
Degraded	Scarce	<50	<1000

Table 7. Mangrove Criteria based on the Mangrove Health Index (MHI)

Criteria	MHI (%)
Excellent	67-100
Moderate	34-66
Poor	0-33

In 2018, the average mangrove canopy in all monitoring sites is 76.88%, which is categorized as Good based on the KepMen LH No. 201 Of 2004. Central Tapanuli has the highest mangrove canopy with 84.03%, while Lingga has the lowest canopy with 64.76% (Appendix 1).

The mangrove forests in 2019 is in Excellent condition based on the Mangrove Health Index (MHI), which can be seen from the average canopy cover of 15 sites of 76.04% (Appendix 2). There are 2 sites that did not have mangrove forest, namely Takabonerate and Pieh.

In general, the condition of the mangrove community in Biak Numfor Regency in 2020 can be categorized as Excellent, with an average canopy cover of 75.94% (Appendix 3).

In 2021, all monitoring sites shows Excellent condition with average cover of 76.9%.

Over the past 5 years, canopy cover at the monitoring sites has been fluctuated with some show decreasing trend, while other show increasing trend. All monitoring sites showed stability of the mangrove ecosystem, indicating by high number of trees. Deforestation has been observed in several sites, e.g., Central Tapanuli, East Sumba, and Sabang. However, low tree density in Derawan has been acknowledged as caused by the mangrove composition rather than deforestation. Mangroves in Derawan are dominated with old trees with large size.

In general, mangrove stands in the monitoring plots (10x10 m²) were in an excellent condition and relatively stable within the monitoring period between 2017 and 2021. This conclusion is valid in a small area, just to be mindful that Indonesia's mangroves are extensive (3.4 million Ha). Also, there are mangrove degradation in one area but natural regeneration occurring in another. Most degraded areas of mangroves occurred because of land conversion into aquaculture ponds and oil palm plantations with a wider area than the area of monitoring plots. Therefore, in a national level, this monitoring data should be combined with the National Mangrove Map that is also updated every year, and then a thorough conclusion can be made.

Figure 10 below shows the annual mangrove canopy from 2017 to 2021.

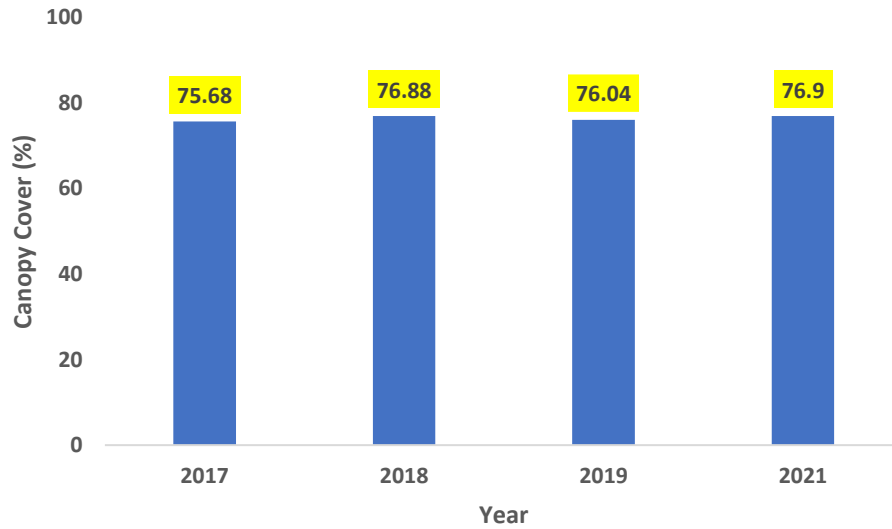


Figure 10. Mangrove canopy in COREMAP-CTI sites from 2017 to 2021 (except 2020)



Figure 11. Documentation of mangrove survey and monitoring

Reef Fish

Reef fish diversity at the monitoring sites are categorized into three main groups based on the fish food preferences, i.e., carnivorous, herbivorous, and corallivorous. Carnivorous and herbivorous groups are classified as target fish groups because they are usually caught commercially by fishermen, while the corallivorous group is an indicator fish group. In RHM, there are 8 groups of interest which consists of 7

target groups (herbivorous and carnivorous fish), i.e., Acanthuridae, Scaridae, Siganidae, Serranidae, Lutjanidae, Lethrinidae, and Haemulidae, and 1 indicator group (corallivorous fish), i.e., Chaetodontidae.

In 2020, the reef fish community in Biak Numfor Regency generally consists of corallivorous (1 family), herbivorous (3 families), and carnivorous (4 families) groups. Carnivorous and herbivorous groups are classified as target fish groups because they are usually caught commercially by fishermen, while the corallivorous group is an indicator fish group.

Generally, the status of reef fish based on the biomass of the target groups in 2021 are medium to high, with several sites have low status, i.e., Belitung, Lingga, Makassar, and Sikka. At most monitoring sites, the abundance and diversity of corallivorous fish is always lower compared to herbivorous and carnivorous fish. The presence of corallivorous group is significantly correlated to the condition of coral reefs. Thus, its lower abundance and diversity may be caused by the damaged or less healthy coral reef ecosystem.

In 2021, Kendari has the highest diversity of reef fish with 138 target species (herbivorous and carnivorous). On the other hand, Batam has the lowest reef fish diversity with total of 19 species (3 species corallivorous and 16 herbivorous and carnivorous species). Natuna Island has the highest biomass of all the monitoring sites, with a total of 20,763 kg/Ha of target fish. The lowest biomass is found in Belitung with 234 kg/Ha. Meanwhile, the highest abundance of target fish is found in Raja Ampat with 7708 individuals/Ha, and the lowest is in Batam with 714 individuals/Ha (Appendix 6).



Figure 12. (Top) Carnivorous fish found at the monitoring sites (left to right): *Plectorhinchus chaetodonoides*, *Lutjanus decussatus*, *Cephalopholis cyanostigma*; (Bottom) Herbivorous fish found at

the monitoring sites (left to right): *Scarus ghobban*, *Scarus rivulatus*, *Siganus virgatus* (Doc: Risandi Dwirama Putra and Muin Sinaga)

Megabenthic

Eight groups of megabenthic were determined as monitoring target in this activity. They are sea urchins (Echinoderms), blue sea star (*Linckia laevigata*), corallivorous snails (*Drupella* sp.), crown-of-thorns starfish (*Acanthaster planci*), giant clams (Cardiidae), trochus snails (Trochidae), sea cucumbers (Holothuridae), and lobsters (Palinuridae). Of the eight megabenthic associated with coral reef ecosystems, it can be divided into groups that have economic value and groups that play a role in ecological functions. Economically important groups are giant clams, sea cucumbers, lobsters, and trochus snails. While groups that ecologically important are crown-of-thorns starfish, sea urchins and corallivorous snails, which become reef health indicators. In addition, blue starfish associated with coral reef ecosystems were also observed. The following table presents the results of megabenthic monitoring at all sites.

In 2020, 8 out of 8 target types were found in Biak Numfor Regency with a total of 633 individuals. Sea urchin is the dominating megabenthic group with 286 individuals (45.18%), followed by blue sea star with 116 individuals (18.33%).

In 2021, all 8 groups were found at 5 out of 22 monitoring sites, i.e., Derawan Islands Regency, Sabang Island, Sikka Regency, Ternate Island, and Tual Regency. Megabenthic groups found at other sites ranged from 3–7 groups/site. Generally, sea urchin (*Diadema* sp.) dominated at all monitoring sites (9,371 individuals), followed by *Drupella* sp. (2,819 individuals), while lobster is the scarcest group as it only found at 8 sites with low number of total individuals (22 individuals).

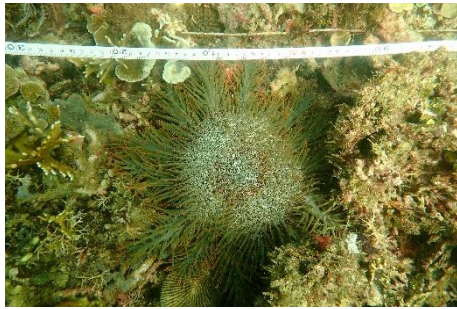
There are several factors controlling the diversity and abundance of megabenthic at the monitoring sites, i.e., sedimentation, frequent waves, habitat preferences, and food availability. Some benthic groups can be found in areas with extensive coverage of dead coral with algae, while others prefer live hard coral. Aside from that, the seabed rugosity can also be a factor that determine the diversity of benthic in certain areas. Anthropogenic activities such as fishing and tourism also contributes to the presence of economically important megabenthic groups. Low abundance of giant clams, sea cucumbers, lobsters, and trochus snails are caused by exploitation from local communities as fishery commodities and/or sold as raw materials for accessories and ornaments (shells).



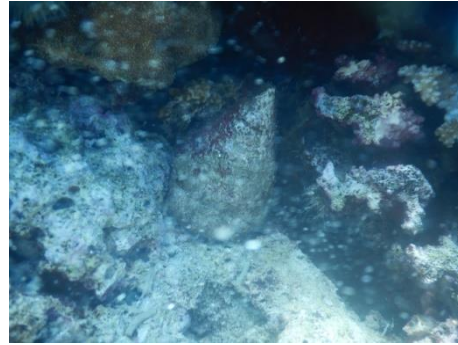
Giant clam (*Tridacna* sp.)



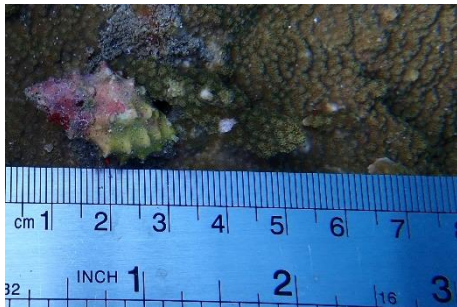
Blue starfish (*Linckia laevigata*)



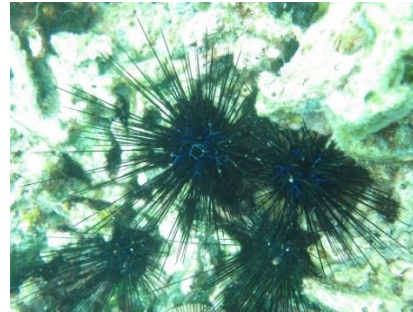
Crown-of-thorn starfish (*Acanthaster planci*)



Trochus snail (*Trochus* sp.)



***Drupella* sp.**



Sea urchin (*Diadema* sp.)



Sea cucumber



Lobster

Figure 13. The megabenthic species found at the monitoring sites

The implementation of RHM over the years has also produced a number of outcomes, such as the development of coastal ecosystems health index, status of coral reefs and seagrass beds, and handbook for coastal ecosystems monitoring.

- Status of Indonesia's Coral Reefs

The book of Indonesian Coral Reef Status is one of national contributions from BRIN, as well as the responsibility of BRIN as Coral Reef Data Guardian. This book contains information on the condition of coral reefs in Indonesian waters with data collected from COREMAP activities. The status of Indonesia's coral reefs is used as a reference in the management of coral reefs on a national and international scale. As of December 1, 2021, this book has been cited 55 times (Google Scholar). The beneficiaries are MMAF, MEF, observers of coastal ecosystems, and other related parties (Giyanto *et al.*, 2017; Hadi *et al.*, 2018; Hadi *et al.*, 2019).

- Status of Seagrass Beds in Indonesia

The book of Indonesian Seagrass Beds Status contains information about the condition of seagrass beds in Indonesia, including the cover (%), distribution of species, and the extent of seagrass. The data used in this book was compiled from COREMAP activities and other references from several universities. The status of Indonesian seagrass beds is used as a reference in the management of seagrass beds on a national and international scale. As of December 1, 2021, this book has been cited 45 times (Google Scholar). The beneficiaries are MMAF, observers of coastal ecosystems, and other related parties (Sjafrie *et al.*, 2018).

- Handbook for Monitoring Coral Reefs and Other Related Ecosystems

To date, BRIN has successfully published four guidebooks on coastal ecosystems monitoring, i.e., the Guidelines for Monitoring Coral Reef Health (Giyanto *et al.*, 2014), Guidelines for Monitoring Megabenthos (Arbi & Sihaloho, 2017), Guidelines for Monitoring Seagrass Fields (Rahmawati *et al.*, 2017), and Guidelines for Monitoring Mangrove Community Structure in Indonesia (Dharmawan *et al.*, 2020) (Figure 13). The guidelines become national references in monitoring coral reefs and other related coastal ecosystems.

As of December 1, 2021, the Coral Reef Health Monitoring Guidebook has been cited 13 times (Google Scholar) and read 4,641 times (ResearchGate), while the Megabenthic Monitoring Guide has been read 2,851 times (ResearchGate). Two other books, namely the Seagrass Monitoring Guide, have been cited once and read 620 times (ResearchGate) and the Guide to Monitoring Mangrove Community Structure in Indonesia has been read 846 times (ResearchGate).



Coral Reef Monitoring Guidelines
(Giyanto *et al.*, 2014)



Megabenthic Monitoring Guidelines
(Arbi & Sihaloho, 2014)



**Seagrass Monitoring Guidelines
(Rahmawati *et al.*, 2017)**



**Mangrove Community Monitoring Guidelines
(Dharmawan *et al.*, 2020)**

Figure 14. Books on the Guidelines of Coastal Ecosystems Monitoring

- Ecosystem Health Index

In the context of implementing the coral reef health monitoring survey and related ecosystems, 3 tools have been developed and utilized that can estimate the health of coral reefs, seagrasses, and mangroves. The standard for assessing the condition of coral reefs is known as the Reef Health Index (RHI). For Seagrass, it is called the Seagrass Ecological Quality Index (SEQI), while for mangrove it is known as the Mangrove Health Index (MHI). All three indexes were developed after going through a long review process by taking into account the many factors that affect the health of the ecosystem. As of December 01, 2021, RHI has been cited 1 time and read 1,445 times (ResearchGate), while SEQI has been cited 6 times (Google Scholar) and MHI has been read 130 times (ResearchGate).

b. Professional Certification Institute (LSP RCO)

The Professional Certification Institute (LSP RCO or LSP) is a professional institution established in 2016. It has specific functions, namely (1) preparing and developing certification schemes; (2) creating assessment devices and competency tests; (3) providing assessors; (4) carrying out the certification activity; (5) carrying out the certification maintenance; (6) setting requirements, verifying, and establishing competency test sites (TUK); (7) maintaining assessors and TUK performance; and (8) developing certification services.

In 2017, LSP has developed a Specific Work Competency Standards (SKKK) for five ecosystems and licensed through the Decree of the Director General of Training and Productivity Development of the Ministry of Manpower of the Republic of Indonesia Number KEP.310/LATTAS/XI/2017 concerning Registration of Special Standards for Assessing the Condition of Coral Reefs and Related Ecosystems. The five ecosystems are: (1) Assessor of Coral Reefs Condition; (2) Assessor of Reef Fish Biodiversity; (3) Assessor of Megabenthic; (4) Assessor of Seagrass Beds Condition; and (5) Assessor of Mangrove Community. The SKKK is a set of competency standard of monitoring and assessment methods that is developed and used only by LIPI. Then, in 2019 the SKKK is upscaled into Indonesian National Work Competency Standards

(SKKNI), where the methods are acknowledged nationally, and available for six standards. This achievement has exceeded the target set in 2019 of only 3 standards. The complete SKKNI of LSP can be found in the following table.

Table 8. The SKKNI Licensed to LSP

No	Establishment Number	Name of SKKNI
1	Decree of the Minister of Manpower of the Republic of Indonesia No. 227 of 2019	SKKNI Category Professional Scientific and Technical Services Main Group Research and Development of Science in the Field of Assessment of Mangrove Community Conditions
2	Decree of the Minister of Manpower of the Republic of Indonesia No. 185 of 2019	SKKNI Category Professional Scientific and Technical Services Main Group Research and Development of Science in the Field of Assessment of Seagrass Conditions
3	Decree of the Minister of Manpower of the Republic of Indonesia No. 179 of 2019	SKKNI Category Professional Scientific and Technical Services Main Group Research and Development of Science in the Field of Assessment of Megabenthic Condition
4	Decree of the Minister of Manpower of the Republic of Indonesia No. 154 of 2019	SKKNI Category Professional Scientific and Technical Services Main Group Research and Development of Science in the Field of Assessment of Coral Reef Fish Community Structure
5	Decree of the Minister of Manpower of the Republic of Indonesia No. 139 of 2019	SKKNI Category Professional Scientific and Technical Services Main Group Research and Development of Science in the Field of Assessment of Coral Reef Conditions
6	Decree of the Minister of Manpower of the Republic of Indonesia No. 116 of 2019	SKKNI Category Professional Scientific and Technical Services Main Group Research and Development of Science in the Field of Marine Biology Scientific Diving

Until the end of 2019, the LSP has certified 290 human resources in coastal ecosystems monitoring. The LSP also has verified the candidates for Competency Test Sites (TUK) based on established administrative and technical requirements and BNSP guidelines. Based on verification, LSP has established 3 institutions as TUK, namely Halu Oleo University in Kendari, Mataram University in Lombok, and Hassanuddin University in Makassar.

In 2020, following the COVID-19 situation in Indonesia, the activities of LSP are limited to coordinating the preparation for the certification schemes through virtual meetings. Certified assessors and surveyors in 2020 only reached 290 from the target of 350 people (83%). Similarly, the competency test sites (TUKs) only reached 7 out of 8 (87%) target sites cumulatively.

Up to 2021, cumulative number of assessors and surveyors certified in coastal ecosystems monitoring already reached 639 people, consist of 543 surveyors and 96 assessors (Table 9 and 10). The LSP has also accredited as the national certification entity for the six schemes of coastal ecosystems. The certifications were licensed by the National Professional Certification Board (BNSP). Aside from that, the LSP also successfully established 13 new sub-national assessment centers (TUK) from the cumulative target of 10 TUKs (Figure 15).

Table 9. Number of Surveyor Certified by the LSP

Scheme	Unit	Number	Male	Female
Assessor of Coral Reefs Condition	people	129	109	20
Assessor of Reef Fish Biodiversity	people	57	50	7
Assessor of Megabenthic Condition	people	39	31	8
Assessor of Seagrass Condition	people	158	79	79
Assessor of Mangrove Community Condition	people	160	91	69
Total	people	543	360	183

Table 10. Number of Assessor Certified by the LSP

Year	Unit	Total Number	Male	Female
2016	people	16	71	25
2017	people	19		
2018	people	17		
2021	people	44		
Total	people	96		



Figure 15. Sub-national assessment center (TUK) across Indonesia (Green: Verified TUK; Red: Newly Verified TUK)

2. Strengthening technical capacity for marine and coastal management and monitoring

To strengthen the technical capacity of the human resources within the program, COREMAP-CTI conducts capacity building through master's degree scholarship and short courses/training. These activities are expected to support responsible decision-making processes and produce competent human resources in coastal and marine planning and management. The capacity building enables better governance in the marine and coastal area, conservation, and fisheries with a solid scientific foundation and knowledge.

Master Degree Scholarship and Short Course/Non-Degree Training (CPDET-BAPPENAS)

The COREMAP-CTI Overseas Master Scholarship is aimed to improve the capacity, quality, and competence of technical staff of the program, especially those related to Oceanography, Marine (Marine Biology, Ecology, and Biotechnology), Marine Policy/Marine Affairs, Fisheries and Sea Cultivation, Coastal Management, Natural Resource Economics, and Environmental Science. In the implementation, the CPDET-BAPPENAS cooperates with universities abroad.

In June 2022, a total of 20 technical staffs have been graduated from their respective programs (Figure 15). All 20 awardees continue to contribute in marine and coastal management and monitoring at their institutions (i.e., MMAF, NRIA, Bappenas, MCGA, MEF, North Sulawesi Province, and West Papua Province). As a note on the capacity building implementation, one staff transferred their study and two staffs withdrew from the program.

Aside from degree program, the project also implemented short course/non-degree training program with a total of 188 participants. RCO-BRIN and CPDET-BAPPENAS cooperated with the University of Rhode Island, USA to conduct short course training program of leadership in blue carbon initiative (2018, 15 participants) and sustainable fisheries policy professional (2021, 13 participants). Other training programs in 2021 and 2022 including Marine Spatial Planning and Management in three different levels, i.e., National Basic Level (26 participants), National Intermediate 1 Level (19 participants), and National Intermediate 2 Level (27 participants), National Training on Bioeconomic Analysis to Improve Fisheries Management Practice (58 participants), Management of Sustainable Fisheries (15 participants), and Economic Valuation of Marine and Coastal Ecosystem Services for Decision Making (15 participants).

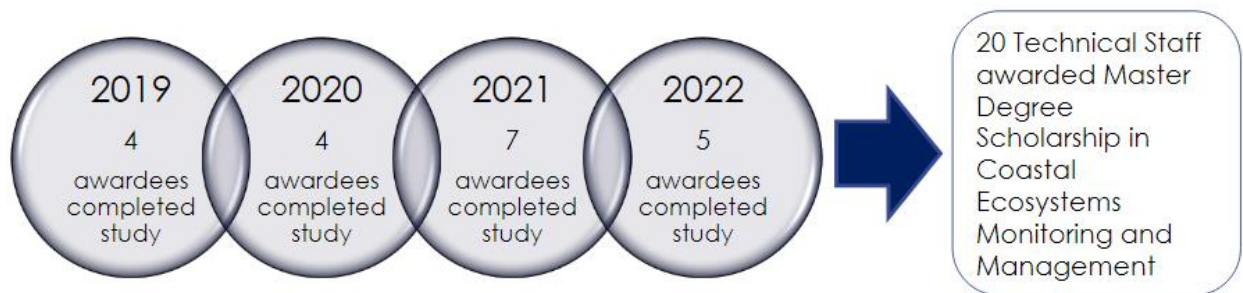


Figure 16. Project Achievement on Intermediate Results Indicator 1.5

3. Strengthen institutional capacity for coastal ecosystems monitoring

RCO is the trustee for coastal ecosystems data in Indonesia, especially coral reefs and seagrass. In the implementation, RCO will carry out the monitoring of coastal ecosystems and maintain the data and other

related information. Therefore, RCO needs to have an excellent institutional capacity, including support from adequate infrastructures, facilities, human resources, and institutional governance.

a. COREMAP-CTI Infrastructures

Infrastructure is one of the most important components in supporting the COREMAP-CTI program. Through the COREMAP-CTI project, six laboratory and office buildings for marine research have been built and renovated, which include buildings in Ancol-Jakarta, Raden Saleh-Jakarta, Lombok, Pari Island, Tual, and Ternate. A total of 6 infrastructures have been built during the course of COREMAP-CTI program.

- **Ternate Research Station**

The Ternate research station was established as an effort to expand research activities in eastern Indonesia, which has high marine biodiversity. Despite its status as a research station, the construction of this building was also aimed to improve laboratory research in Ternate. The utilization of the building is collaborated with the University of Khairun, through a mutual agreement in 2021 (still under LIPI's administration). Following the merger of LIPI to BRIN, a new agreement is still being processed.



Figure 17. Ternate Research Station

- **UPT LKBL Tual**

The Tual Marine Biota Conservation Workshop (LKBL) was established in 2002 with the main task of conserving the Kei Islands and surrounding waters, providing information on coral reefs and marine biota, and aquaculture. Activities carried out include bioecological research on coastal ecosystems, cultivation of especially endangered biota (trocha snail and clams) and economically important (seaweed), post-harvest, and dissemination of research results through the establishment of a dissemination center. The UPT also involved in the fostering community groups and MSMEs in the field of cultivation and post-harvest processing for seaweed, embal cassava, and processed fish commodities. Aside from research activities, the building is also utilized (through collaboration) as the office of the Government of Southeast Maluku Regency.



Figure 18. UPT LKBL Tual

- **UPT LPKSDMO Pari Island**

The Oceanographic Human Resources Competency Development Workshop (LPKSDMO) on Pari Island was established as a research station in the Seribu Islands, DKI Jakarta which later developed into a UPT to be able to facilitate the specific goal of improving the quality of human resources in the field of oceanography. The infrastructure has been improved so that it can accommodate training activities in the maritime sector on a regional scale.



Figure 19. UPT LPKSDMO Pari Island

- **Marine Bioindustry Center (BBIL) Mataram**

The Marine Bioindustry Center (BBIL) in Mataram, Lombok was developed to conduct research related to the cultivation and development of marine products, especially pearl oysters and sea cucumbers. The building is equipped with laboratories and office, as well as various laboratory and research equipment. After the construction of laboratory and office buildings are finished, the echelon status of the BBIL is upgraded to Research Center of Marine and Terrestrial Bioindustry.



Figure 20. The Research Center of Marine and Terrestrial Bioindustry in Mataram

- **Raden Saleh Building Jakarta**

From 2017 to 2019, the Raden Saleh building was transformed to accommodate the activities of RTRC-MarBEST, which is more focused on training activities both on a national and regional scale. After 2019, the building is used by the Directorate General of Informational Application, Ministry of Communication and Information Technology, and the Center of Technology Services, BRIN in the first floor.



Figure 21. RTRC-MarBEST Building at Jalan Raden Saleh

- **Oceanographic Research Integrated Laboratory (Laterio) Ancol**

The Laterio Building in Ancol, Jakarta is a laboratory building that is used as a national marine research reference laboratory. Apart from being a laboratory building for oceanographic research, there are also facilities for marine research, both internal and external. The Laterio and BBIL buildings are one of the impact of institutional strengthening for coastal ecosystems research under COREMAP-CTI.

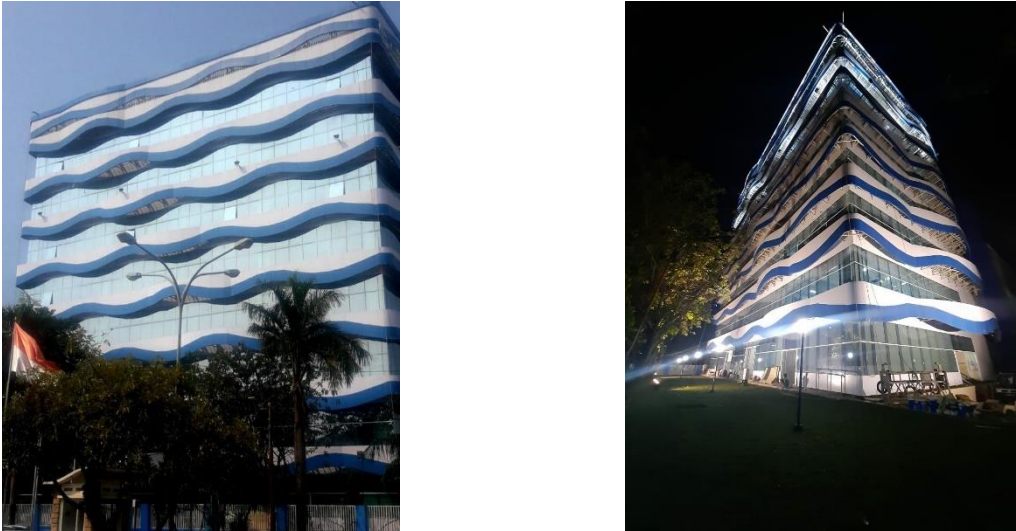


Figure 22. Laterio Building, Ancol

3.2. PDO 2: Strengthened research capacity for producing evidence-based coastal ecosystem management information

The focus of PDO 2 is to support coastal ecosystem research that answers and solves real problems faced by the government and public. In implementing the component, RCO designs the demand-driven research program based on the public's needs and assigns them priority research. The following three sub-components are determined to implement this project component.

1. Strengthening institutional systems for demand-driven coastal ecosystems research

To strengthen the institutional system for demand-driven coastal ecosystem research, several missions are determined, including increasing participation and engagement with end-users to determine research priority and dissemination of research products, and a community's demand-driven competitive coastal ecosystems research grant system that funds at least ten research per year.

Demand-driven Research (DDR) for Coastal Ecosystems

Demand-driven research (DDR) is a research management based on the demand or need for research, development, and innovation that usually comes from actual problems in the coastal ecosystems. The goal of DDR is to offer immediate solutions for the problems. Thus, the scope of DDR includes research and development activities that are aimed at:

- Produce strategic solutions for long-term national/international problems, having wide-range impacts on specific scientific sectors.
- Produce discoveries and inventions that bring Indonesia towards the global flow of science and technology.

The DDR consists of four research schemes, i.e., Demand-driven Research (DDR, competitive, for external partner institutions, such as universities and other research centers), Priority Research (RP), Leading Research (RU) – Capacity Building Research (RPK), and RHM Development Research (carried out solely by RCO).

The DDR determined 8 research themes, i.e., (1) coastal conservation and rehabilitation; (2) utilization and management of coastal resources; (3) study of Indonesian marine policy; (4) management and management of marine tourism; (5) control of pollution of the coastal and marine environment; (6) management of independent small island areas; (7) adaptation and mitigation of disasters and climate change; and (8) strengthening marine information and data systems.

Between 2018—2020, there are a total of 68 research papers published as output under the Demand-driven Research and Priority Research schemes. In 2021, as many as 63 scientific papers have been published as the output of Leading Research (Riset Unggulan/RU) and Capacity Building Research (Riset Pengembangan Kapasitas/RPK) schemes. Thus, by the end of Project, there are a total of 112 research projects (14 DDR; 17 RP; 60 RU-RPK; 11 RHM) and 131 research papers that have been published under the COREMAP-CTI activity. Figure 23 shows the trend of published research papers between 2018-2022 (Research in 2018-2020 are under the DDR, RP, and RHM research schemes, while in 2021-2022 is under the RU-RPK scheme). It is shown that the number of international publications is increasing from 2018 to 2022, which is due to a mandatory regulation for researcher to publish more international papers.

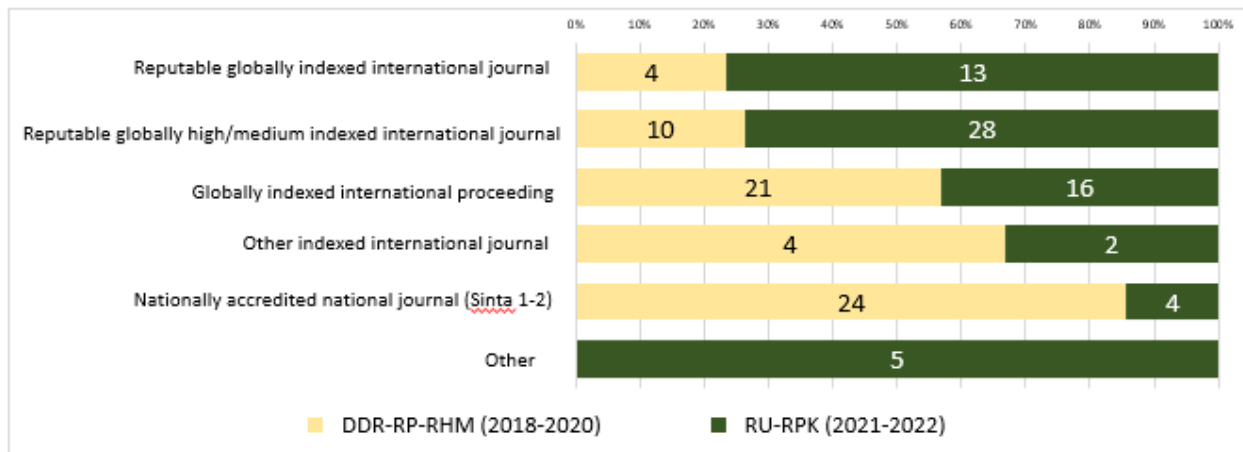


Figure 23. Research output between 2018-2022

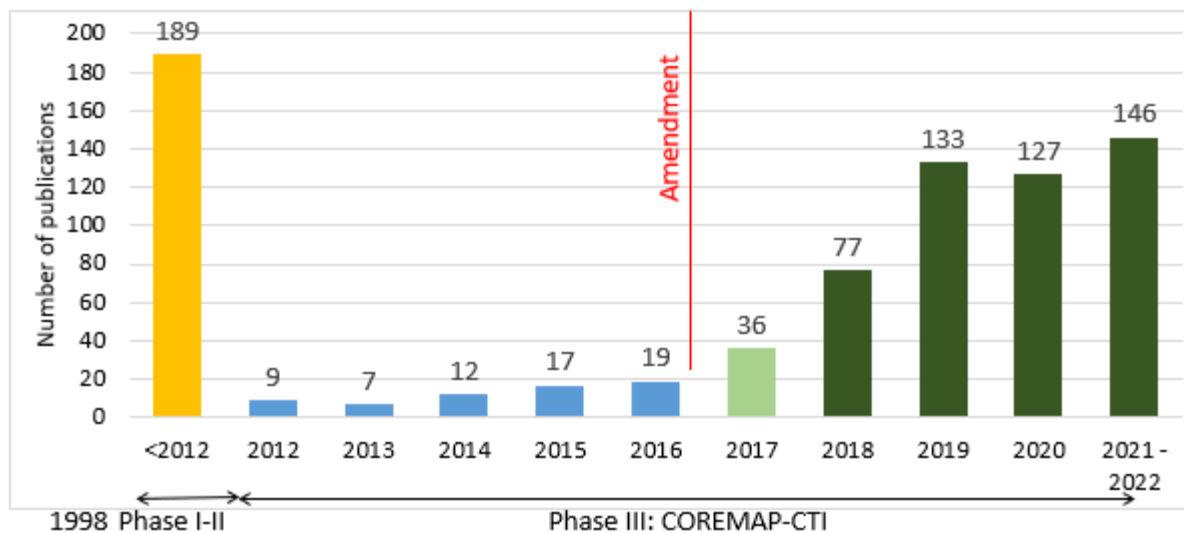
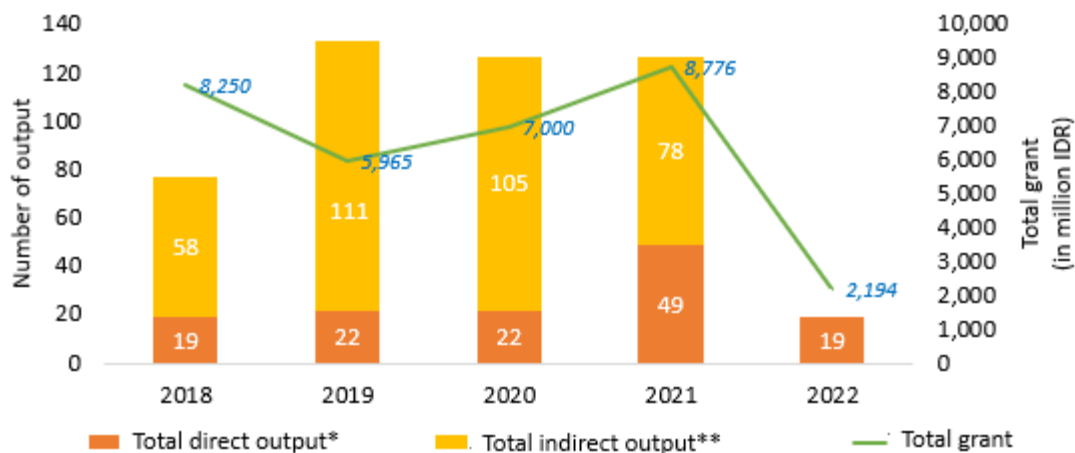


Figure 24. Number of research papers published from before 2012 until 2022

During the COREMAP phase I, II, and COREMAP-CTI (1998 to present), there are a total of 772 publications related to COREMAP (Figure 24). Data were processed from 709 scientific publications filtered from a total of 1420 documents (COREMAP keywords: Crossref =20, Scopus=16, Google Scholar=600; COREMAP-CTI keywords: Crossref=600, Scopus=4, Google Scholar=560). A total of 349 are peer-reviewed articles in national and international journals and a total of 360 are non-peer-reviewed publications. From this number, a total of 63 papers is contributed by the DDR scheme (2018-2020). Then, there is an addition of 68 papers from the RU-RPK scheme, which tallied up to 772. This figure also shows that generally, the number of published papers is increasing from phase I to the end of phase III of COREMAP program.

Table 11. Details of Total Research Grant and Output in 2018-2022

No	Year	Total Grant (IDR)	Number of Direct Output*	Number of Indirect Output**	Total Output
1	2018	8,250,000,000	19	58	77
2	2019	5,965,000,000	22	111	133
3	2020	7,000,000,000	22	105	127
4	2021	8,776,000,000	49	78	127
5	2022	2,194,000,000	19	-	19
	TOTAL	32,185,000,000	131	352	483
Budget/Output Ratio			245.7	91.4	66.6



Note:

* Outputs that are produced/claimed directly from research activities

** Outputs from the contribution of COREMAP-CTI to research in Indonesia (Data from Scopus and Google Scholar)

Figure 25. Budget and output ratio (in million IDR)

Figure 25 shows the number of direct and indirect output, compared to the total grant. It can be observed that the number of indirect outputs is quite large compared to the direct output, which means that the COREMAP data highly contributes to the coastal ecosystems research in Indonesia. Directly, the allocation of CCTI research funds has contributed to the achievement of outcomes i.e., IDR 245.7 million per research output. This ratio is quite realistic for marine research, which mostly requires research funding and field observations. CCTI research funds are able to become a leverage for national marine research outputs with an efficient fund of IDR 66.6 million per research output.

A number of COREMAP-CTI research has contributed to the research ecosystem in Indonesia. The benefits of the research can be categorized into several groups, i.e., national, regional, general public, and scientific communities. In national level, COREMAP-CTI research has been contributed to the CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora), low carbon development, plastic waste, harmonization of regulations and the status of coastal ecosystems (more in Chapter 4).

2. Strengthening technical capacity for coastal ecosystems research

LIPI has established continuous supports in prioritizing coastal ecosystems while also strengthening the network and national research capacity. The efforts include targeted training for at least 100 researchers annually and develop national and international training programs run by the Regional Training and Research Center for Marine Biodiversity and Ecosystem Health (RTRC–MarBEST).

Strengthening Human Resources (Training)

RTRC-MarBEST is established on 17 October 2016 to support the effort to upgrade the research capacity and competency of human resources at LIPI. In line with RCO’s long-term goal to become a regional center of excellence for research and monitoring of coastal ecosystems, RTRC-MarBEST is established for strengthening research in coastal ecosystems, such as international-scale training in taxonomy, blue carbon, and marine molecular genetics.

In 2020, RTRC–MarBEST conducted five training, which consisted of one regional IOC training and four national training. The national training was conducted to support the LSP RCO. Due to COVID-19 situation in Indonesia, face-to-face training programs could not be implemented. All training programs were conducted through online learning alternatives. Two training, namely (1) the National Mangrove Monitoring and (2) Mangrove Health Index, were conducted using LIPI's Learning Management System (LMS) and can be accessed through <http://elearning.lipi.go.id>. The training programs were running between October to December 2020, where 103 participants were involved actively. For the IOC regional training, participants come from 11 countries.

In 2021, RTRC–MarBEST conducted five training, which consisted of one international training (mangrove monitoring) and four national training (coral, seagrass, reef fish, and mangrove schemes). Following the improvement of COVID-19 situation in Indonesia, the five national training were conducted offline, while the international training was conducted online.

COREMAP-CTI also held an International Workshop on Fish Taxonomy in Bali, 9-19 June 2022. This workshop was conducted in classrooms and fieldwork for 20 participants consisting of 16 Indonesians and 4 from overseas. The 20 participants consisted of 8 women and 12 men. There are 4 sub-themes included in this workshop, namely: 1. Fish taxonomy approach using morphometric and meristic techniques; 2. Fish taxonomic approach using DNA Barcoding method; 3. Fish Larvae Taxonomy to understand the early history of fish life; and 4. Underwater Visual Census Approach for monitoring fish in coral reef ecosystems. This training is equipped with a pre-test before the training started, which came with a result of 38%. Then, at the end of the training, a post-test was conducted, where the result increases to 78%. This means that this training has helped the participants to improve their capacity and knowledge on fish taxonomy.

3. Strengthen coastal ecosystems monitoring and research data and knowledge networks

Strengthening coastal ecosystems monitoring and research is essential to improve the management. The stipulation of RCO as the national guardian of coral reefs and seagrass data is contained in the Decree of the Head of Geospatial Information Agency (BIG) No. 54 of 2015 and was later updated through the Decree of the Head of Geospatial Information Agency (BIG) No. 27 of 2019. This determination is based on an agreement between ministry institutions and equivalent institutions (K/L) at the technical coordination meeting of the Marine Thematic Geospatial Information (IGT) working group coordinated by BIG and the Ministry of Maritime Affairs and Fisheries (MMAF). The agreement is based on the availability of data owned by each Ministry/Agency, especially RCO which has been managing data on coral reefs and related ecosystems for a long time through the support of the COREMAP program starting from phase I.

Currently through Presidential Regulation No. 23 of 2021 concerning Amendments to Presidential Regulation No. 9 of 2016 concerning the acceleration of one map, a total of 158 IGT from 24 K/L guardians including RCO are mandated to update data to support national development. This shows the importance of data needs for coral reefs and other related ecosystems in national development policies. Therefore, data management through the national database system developed in COREMAP-CTI becomes very strategic to be developed and maintained for its sustainability.

a. Coastal Ecosystem Data Center and Data Nodes Infrastructure

In order to strengthen institutions and to initiate the establishment of a national data center for coastal ecosystems in accordance with the mandate, the strategies adopted are: 1) Strengthening institutional capacity for research and monitoring of coastal ecosystems, and 2) Strengthening the national network of research and monitoring of coastal ecosystems. Strengthening the capacity of research institutions and monitoring coastal ecosystems is carried out through the development of databases and research infrastructure such as buildings and laboratory facilities, while strengthening the national network of research and monitoring of coastal ecosystems is carried out by building partnerships through several local universities that have the Faculty of Marine Affairs and Fisheries and RCO internal work units in area.

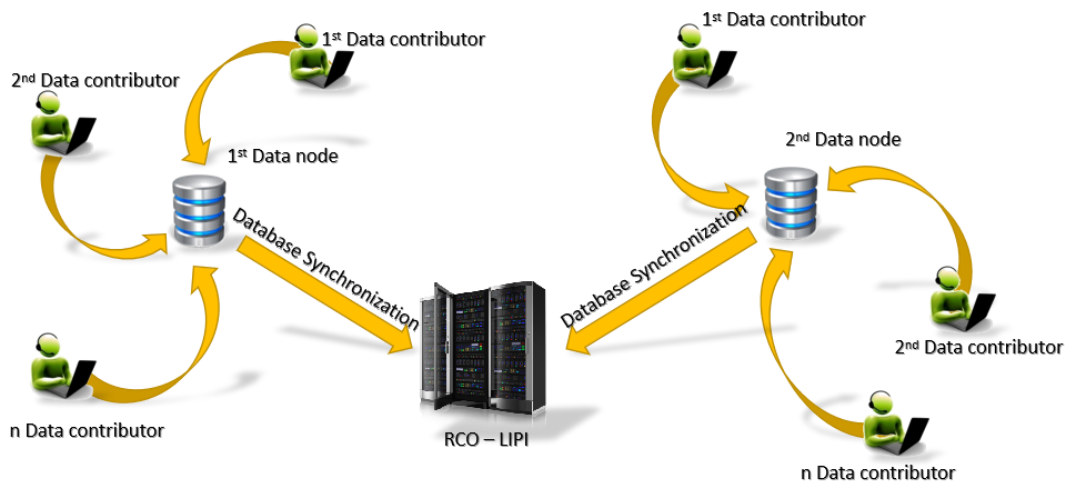


Figure 26. Coral reef database network scheme and related ecosystems

The information system built on COREMAP-CTI is an update from the previous application in COREMAP phase II, namely CRMIS (Coral Reef Management Information System). Updates are made by increasing data accessibility and integration with other systems already owned by RCO, so that the information presented is more varied.

The progress of developing coastal ecosystem data network in the COREMAP-CTI program until 2022 can be described as follows:

2017	2018	2019	2022
<ul style="list-style-type: none"> • Server provision and upgrade • Integration and system development • Capacity building (training on database) • Data node establishment (1 node) 	<ul style="list-style-type: none"> • System development • Data node establishment (3 nodes) • Technical guidance (data node managers) • Delivery of the system (Coral Reef Management Information System/CRMIS) 	<ul style="list-style-type: none"> • Data system developed (pusdata.oseanografi.lipi.go.id) • Data node establishment (1 nodes) • Delivery of the manual and protocol • Technical guidance (data node managers) • Monitoring and maintenance 	<ul style="list-style-type: none"> • Data node establishment (2 nodes/KKP) • Node server relocation (1 node/BKBL Bitung to UNSRAT)

Figure 27. Progress in Developing Data Centers (Coastal Ecosystem Data)

Currently, there are four different types of compiled data in COREMAP-CTI and available publicly. Table 12 presents the list of the currently available type of data, data source, scope, and period as compiled by RCO.

Table 12. Data Availability in Coastal Ecosystem Data Center

Type of Data	Data Source	Scope	Description
Ecological Data (Coral Reef, Mangrove, and Seagrass)	Field survey (monitoring program)	39 sites across Indonesia (COREMAP-CTI sites)	Data available from 2004 to 2019
Map of Coral Reef Distribution (Scale 1:250.000)	Satellite images (contribution from several ministries and agencies in Coastal and Ocean IGT Working Unit)	Indonesia (complete)	One-map policy (data integration in 2014)
Map of Seagrass Distribution (Scale 1:250.000)	Satellite images (contribution from several ministries and agencies in Coastal and Ocean IGT Working Unit)	Indonesia (requires updates)	Data integration in 2018
Map of Shallow Water Habitat (Scale 1:50.000)	Satellite images and field survey	30 sites across Indonesia (COREMAP-CTI sites)	The latest update in 2018

Other activities related to the coastal ecosystem data center management include updating data on the pusdata.oseanografi.lipi.go.id and obis.org websites, as well as updating information on the

indoasting.lipi.go.id. Figure 28 shows the current data infrastructure within the coastal ecosystems data center.

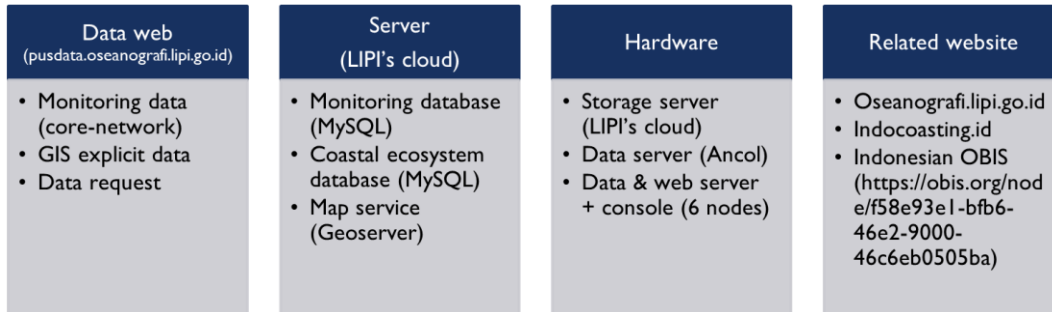


Figure 28. Data infrastructure within the coastal ecosystems data center



Figure 29. The coastal ecosystem data center display shows the distribution of national coral reef conditions

This web-based information system application not only presents data on the results of monitoring coral reefs and other related ecosystems, but also presents their condition status. Data is presented interactively through graphs and webGIS technology. Since the launch of this website, from August 2018 to May 2021, the total visits to this website based on Google Analytics data have reached 90,758 visitors.

Figure 30 shows the number of data access and requests accepted by RCO-BRIN. It shows that the data request is highest in 2020, but generally the number increases since 2015 to present. The benefactors of the coastal ecosystem data center include ministries, research centers, universities, NGOs, regional governments, and private companies with a total number of 75 institutions as of April 2022 (Figure 31). The data are mainly incorporated for research. In government level, the MMAF mainly used the data as the basis or reference for the preparation of Coastal Zone and Small Islands Zoning Plan (RZWP3K), while the MEF used it for the acceleration of development plan in Papua and West Papua.

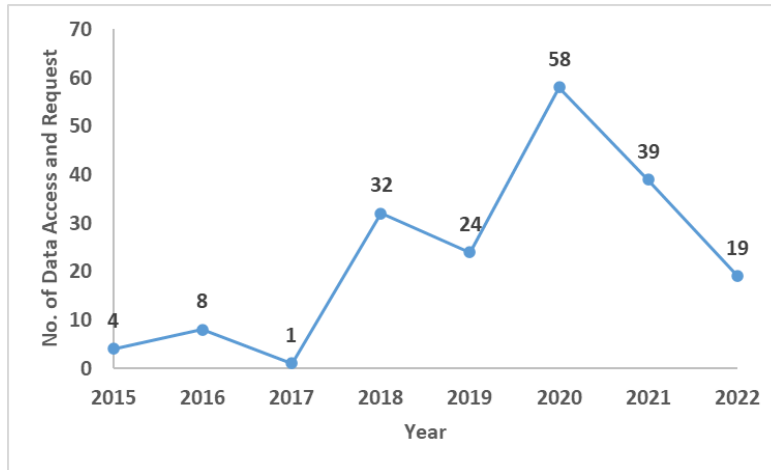


Figure 30. The number of coastal ecosystems data access and requests from 2015 to 2022

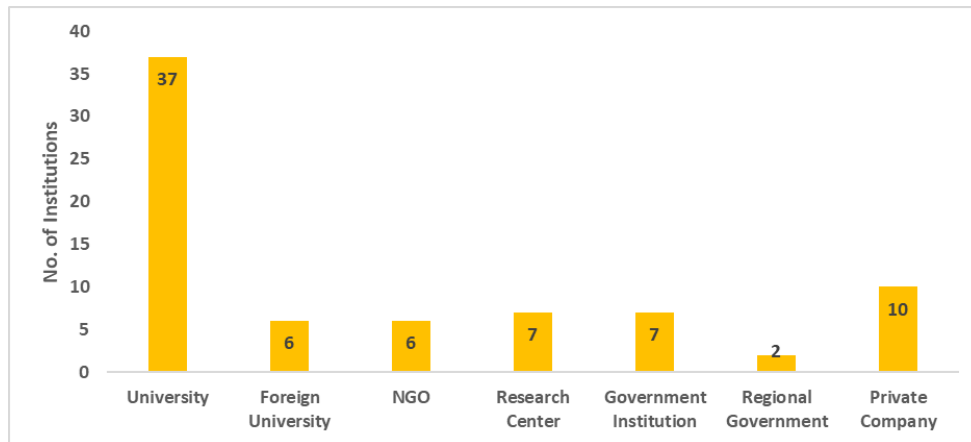


Figure 31. The number of coastal ecosystems data access and requests from 2015 to 2022

To support the implementation of coastal ecosystem data network, the data collection is carried out through partnership with other institutions, where data nodes are established in these partner institutions. Currently, RCO has developed 8 data nodes, where 3 data nodes have been built at three universities (UMRAH, UNHAS, and UNDIP), 3 more at BRIN work units (Bitung, Mataram, and Ambon), and 2 more through partnership with the MMAF (LKKPN Pekanbaru and BKKPN Kupang) (Figure 32). In 2022, following the dynamics within the organization, data node server in Bitung is relocated to UNSRAT (University of Sam Ratulangi), even though the management is still carried out by staffs from Bitung unit. With the existence of data infrastructure in regional nodes, it is expected to increase awareness of the importance of good data management. Data supply from regional nodes also plays an important role in fulfilling and updating data nationally mandated to RCO in the frame of coral reef and seagrass trusteeship.

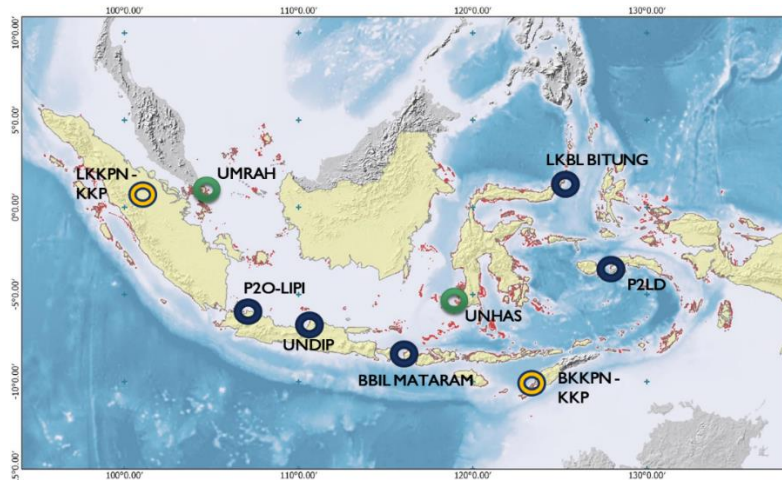


Figure 32. Data nodes spread across Indonesia

3.3. PDO 3: Improved management effectiveness of marine protected areas

Following the restructuring in 2017, ICCTF-Bappenas is appointed to implement Component 3 of the COREMAP-CTI program. This component aims to improve the management of the priority coastal ecosystems in four target-MPAs i.e., TNP Savu Sea, KKPN/SAP Raja Ampat, KKPN/SAP West Waigeo, and KKPD Raja Ampat. Activities are carried out through sub-grants to selected institutions. Four non-governmental organizations (NGOs) and one university research center were selected to carry on the activities, i.e., Yayasan Terangi, YAPEKA, Yayasan Reef Check Indonesia (YRCI), PKSPL-IPB, and Yayasan PILI. Following is a description of achievement for PDO indicator 4.

PDO Indicator 4: Target MPAs with a Blue Level Management Effectiveness Score of at least 75%)

PDO indicator number 4 required the four target MPAs to achieve blue level management effectiveness at least 75% using EKKP3K tools. The blue level scoring refers to the EKKP3K category used by MMAF to assess each MPA management effectiveness. In 2020, MMAF change the assessment tools from EKKP3K to EVIKA which has a slightly different approach to assess the effectiveness of MPA management in Indonesia. EKKP3K used the building block system with 5 colour represents the difference of effectiveness level for MPA. Meanwhile the EVIKA builds on four criteria's including input, process, output and outcome and three level of management i.e., minimum, optimum and sustainable. EVIKA is applied to MPA that has been designated while the EKKP3K could be applied to MPA that have not yet designated.

As the PDO Level Indicator requested to achieve 75% blue level in EKKP3K which is not applicable at this period, COREMAP-CTI WB needs to synchronize with the new regulation of EVIKA. Thus, the project was identified means to convert EKKP3K level into EVIKA criteria and therefore the COREMAP-CTI result can be identified and acknowledged. The project utilizes available data of EKKP3K status in 2018 and 2019 as the baseline and preliminary assessment for EVIKA 2019 and 2020 based on MMAF presentation. The calculation was using data available for 6 MPAs (4 MPAs are WB project sites and 2 MPAs are ADB project sites). We performed the simple regression from the available data to obtain the equation that can be used to identify the score which can represent the approximate score for EKKP3K.

From data available and the regression applied, we identified the 75% blue level in EKKP3K has the approximate score of 44.96% in EVIKA. Thus, to measure the achievement at PDO level, we will use the bench mark score of 44.96% EVIKA. Every MPA that is assessed using EVIKA and receives score equal to 44.96% or more, will be recorded has achieved target indicator 75% blue level. The PDO level appraisal will use EVIKA score and management category from the latest assessment published by MMAF.

In 2021, MMAF conducted assessment on MPA management effectiveness 2020 and published the result in December 2021. The result for COREMAP-CTI target MPAs as follows:

Table 13. Results of MPA Management Effectiveness in 2020

MPA	EVIKA 2020/2021	MANAGEMENT
TNP Savu Sea	54.46%	Optimum
KKPN/SAP West Waigeo	61.11%	Optimum
KKPN/SAP Raja Ampat	66.26%	Optimum
KKPD Raja Ampat	83.78%	Optimum

Four MPAs demonstrate the EVIKA score more than 44,96% which indicated that all MPA have exceeded 75% blue level in 2020/2021 and have been managed with optimum category. This achievement may not be attributable to the project, because the project implementation was just started in August 2020 and only few activities that has been implemented. However, the result can be a baseline for EVIKA assessment 2021 that will be conducted in 2022. Referring to the recommendation made for the improvement management based on EVIKA 2020 results, four MPA's should establish the infrastructure that can support the management of MPA, and enhance the community empowerment as well as the involvement of community in conservation activities. Those recommended activities are aligned with the COREMAP-CTI activities and implemented by the subgrantee in 2021. Thus, it can be predicted that the COREMAP-CTI WB could have contribution to increase the EVIKA scoring in four targeted MPAs.

EVIKA status 2021 for each MPA will be assessed in 2022 and the result is estimated will be available in the late of 2022. In the meantime, the COREMAP-CTI project will close in June 2022 and there is a need to provide evidence that COREMAP-CTI grant have contribution in improving the management effectiveness of four target MPAs. In response to the needs while waiting for the assessment result of 2021, ICCTF with subgrantees have conducted EVIKA self-assessment workshop to estimate the EVIKA score that already incorporated the output from grant packages activities. The self-assessment result is expected to be an intermediate reference before the official assessment result announced by MMAF in end of 2022.

The result from EVIKA self-assessment as follows:

Table 14. Results of Self-Assessment EVIKA in 2021

MPA	EVIKA 2020/2021	Estimate EVIKA 2022 (self-assessment)	% Estimated increase from 2021	Management
TNP Savu Sea	54.46%	66.15%	11.69%	Optimum

KKPN/SAP West Waigeo	61.11%	66.23%	5.12%	Optimum
KKPN/SAP Raja Ampat	66.26%	73.50%	7.24%	Optimum
KKPD Raja Ampat	83.78%	89.76%	5.98%	Sustainable

The result is indicated that COREMAP-CTI grant activities can contribute to the improvement of management effectiveness status of four target MPAs. The increasing score identified from three criteria i.e., Input, Process, and Output. COREMAP-CTI activities mainly contribute to several indicators such as human resources, infrastructures, surveillance, management of infrastructure, community empowerment, management guidance/SOP, including compliance level, community knowledge, and data and information. For example, the grant packages support the development of SOP for capture fisheries and ecotourism based on carrying capacity analysis. This SOP is provided to be used by MPA management body for utilization zone and completed the existing SOP. The increasing score between 5% to 11% shows that COREMAP-CTI intervention which mainly applied for three criteria above mentioned is effective to increase the EVIKA scoring. Even though it cannot be compared to other MPA which not received intervention from COREMAP-CTI but may receive intervention from other institution. Moreover, the other MPAs outside COREMAP-CTI has not been conducted the self-assessment and MMAF has not been yet conduct the official assessment in 2022, therefore we cannot compare the increasing rate with other MPA.

An MPA to be optimum manage or sustainable manage would need a huge amount of funding to fill in all requirement to be operationalize effectively. However, funding could also become a problem and hinder the implementation of management plan which will resulted on the low scoring of EVIKA. The intervention which COREMAP-CTI implemented is aimed to support the MPA to be able to implement their management plan and effectively managed. For instance, the budget to manage SAP West Waigeo and SAP Raja Ampat from the APBN is IDR 830,404,000.00 for 2020–2021 which may not enough to implement all activities in management plan. While, the contribution of COREMAP-CTI in these two MPA from the solely grant package 1 is amounted of IDR 7,090,685,451.00 for 2020–2021 which almost nine folds of APBN budget. It shows that the COREMAP-CTI intervention have a good value for money which can be effective to enhance the effectiveness management of MPA with increasing rate of 5–7% respectively through the implementation some of the management plant.

In summary, the PDO level indicator #4 improvement of management effectiveness has been achieved based on the assessment result 2020 and self-assessment estimation 2021.

Small ecotourism infrastructure assets, built in target MPA areas, as per MPA management plans

The target for this indicator is 8 small ecotourism infrastructures developed based on management plan. Until March 2022, this indicator has been achieved and exceeded the target with 9 small infrastructures have been completed develop in three target MPAs as follows:

Table 15. Ecotourism Infrastructures in Target MPAs

Infrastructures	Number of Unit	Location
Cetacean sighting tower	1	TNP Savu Sea
Ecotourism information center	4	TNP Savu Sea; SAP Raja Ampat; KKPD Raja Ampat

Manta Sighting station	2	SAP Raja Ampat; KKPD Raja Ampat
Hiking track for Jelly fish lacustrine lake	1	KKPD Raja Ampat
Floating jetty	1	SAP Raja Ampat

There is no infrastructure developed in SAP West Waigeo due to some issues related with land allocation for construction. In early project implementation, the indigenous community that owned the land has agreed to voluntarily give a permit to subgrantee to use their customary land for infrastructure development, i.e., hiking track, floating jetty and information center. However, when construction went to start, some elites in the community asked for the conditions which subgrantee had to fulfill. The conditions were beyond subgrantee authority as COREMAP-CTI implementing partner. Responding to this issue, the subgrantee consulted to ICCTF-BAPPENAS, BKKPN Kupang, BLUD UPTD Raja Ampat, and local government to move the location of infrastructure to the location under BLUD UPTD management. Therefore, only SAP West Waigeo that has no construction activity.

Development of those infrastructures were conducted in closed coordination with MPA management body, i.e., BKKPN Kupang and BLUD UPTD Raja Ampat. Coordination and communication were established to decide the location of infrastructure, development of Detailed Engineering Design (DED), interior and equipment to be provided in each infrastructure as well as the beneficiaries that will receive and manage the infrastructure. These infrastructures constructed by subgrantees have followed and implemented the environmental and social safeguard framework as required by the Bank. The rapid assessment of environmental and social impact assessment has been taken before the construction as the prerequisite for environmental permit. Most of the infrastructure need SPPL as its environmental permit, however, the hiking track in Misool needs a UKL/UPL due to the jellyfish lacustrine lake location, which is categorized as the reserves forest under BKSDA management. During the construction all workers applied the safety procedure such as using Personnel Protective Equipment (PPE) and followed the HSE plan for emergency situation.

Regarding the compliance of infrastructure development with the MPA management plan can be seen from the location of infrastructure that is aligned with the allocation of zonation. For example, the cetacean sighting tower is located at cetacean conservation subzone. It will support the establishment of sustainable use of cetacean and its habitat. Another example is the manta sighting stations are located in the utilization zone at both MPA, SAP Raja Ampat and KKPD Raja Ampat and will support the establishment of ecotourism program.

All of infrastructures will be managed and used by community group under supervision by head of village, or MPA management body and or fisheries agency. The handover notes (*Berita Acara Serah Terima – BAST*) will be signed by ICCTF-BAPPENAS with the beneficiaries at the end of project. However, the infrastructure can be utilized by community since the contractor has completed the construction, and subgrantee has signed the temporary custodian notes (*Berita Acara Penitipan-BAP*) with the community group or local office as the beneficiaries. Each infrastructure complies with utilization and maintenance manual and has been shared with the community group. As the means of verification documents each infrastructure has an engineering completion report.

Following are the beneficiaries that managed and utilized the infrastructures and the pictures of infrastructures:

Table 16. Activity Beneficiaries for the Infrastructures

Infrastructures	Locations	Beneficiaries
Cetacean sighting tower	Naikean Village, Kupang District	Pokdarwis Karsiba (tourism community group)
Ecotourism information center - Oesina	Lifuleo Village, Kupang District	BUMDes Damai Lifuleo, tourism business unit
Ecotourism information center - Mebba	Tulaika, Mebba Village, Sabu Raijua District	Pokdarwis Mata Pado Mara
Ecotourism information center – Meosarar kecil	Meosarar Kecil Village, Raja Ampat District	Masa Dimawa Community group
Ecotourism information center – Yellu	Yellu Village, Misool, Raja Ampat District	Yellu Village
Manta Sighting station – Yef Nabi Kecil	Yef Nabi Kecil Island, Raja Ampat District	Masa Dimawa Community group
Manta Sighting station – Dayan	Dayan Island, Raja Ampat District	BLUD UPTD Raja Ampat
Hiking track for Jelly fish lacustrine lake	Tomolol Village, Raja Ampat District	Aine Ama community group
Floating jetty	Meosarar Kecil Village, Raja Ampat District	Masa Dimawa Community group



Figure 33. Infrastructures built by subgrantee. Upper left and right: Information center in Oesina, Kupang; Lower left: Information center in Yellu, Misool; Lower right: Information center in Small Meosarar

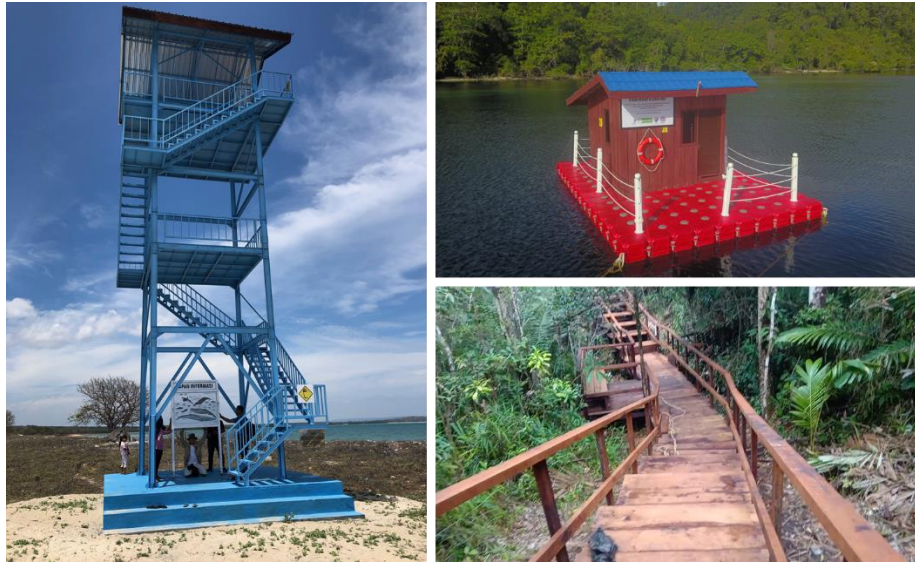


Figure 34. Infrastructures built by subgrantee. Left side: Cetacean sighting tower, Naikean; Upper right: Manta sighting station, Meosasar; Lower right: Hiking track to jelly fish lake, Misool

Community surveillance groups (POKMASWAS) strengthened that are carrying out regular surveillance in target MCA areas

Target for indicator 3.2 is 18 community surveillance groups (Pokmaswas) registered in provincial marine and fisheries agency, and conducted regular patrols in targeted MPAs. The evidences for this indicator are decree letter from head of marine and fisheries agency in province level, and the surveillance logbook and report. During period of 2020 to 2021, 23 community surveillance groups/Pokmaswas have been registered in province office and obtained the decree, and 1 group is waiting the decree letter to be finalized. Meanwhile, only 22 community surveillance groups have been conducted regular patrols in their working area as agreed, and another 2 group were never given their patrol activity report which indicates these two groups may not conduct regular patrol. List of community-based surveillance group is presented in Appendix 7. Pokmaswas also received three level trainings related to basic surveillance, advance surveillance and aerial surveillance which aimed to increase their capacity in conducting regular patrol and involve in conservation activity.

This achievement is attributable to the project, because all Pokmaswas were identified and assisted by subgrantee to obtain decree letter from provincial office and improve their capacity on community-based surveillance system. The representatives from each surveillance groups were trained for three topics of community-based surveillance i.e., basic surveillance, advance surveillance and aerial surveillance. To strengthen the community surveillance group to conduct regular patrol, the grant package also provides the facilities and equipment to support the group activities. The facilities are including surveillance tower, patrol boat, and surveillance equipment. During the project implementation, the subgrantee also support the operational cost for conducting regular patrol with reimbursement mechanism that will be given after group submit their surveillance activity report.

Four surveillance towers were built in TNP Savu Sea, 2 towers were built in KKPD Raja Ampat and 1 tower built in SAP Raja Ampat. Nine surveillance boats were distributed to Pokmaswas in TNP Savu Sea, SAP Raja

Ampat, and KKPД Raja Ampat. While 24 equipment were distributed to 24 Pokmaswas to support their activities. The location of surveillance towers and photo of surveillance boats present below:

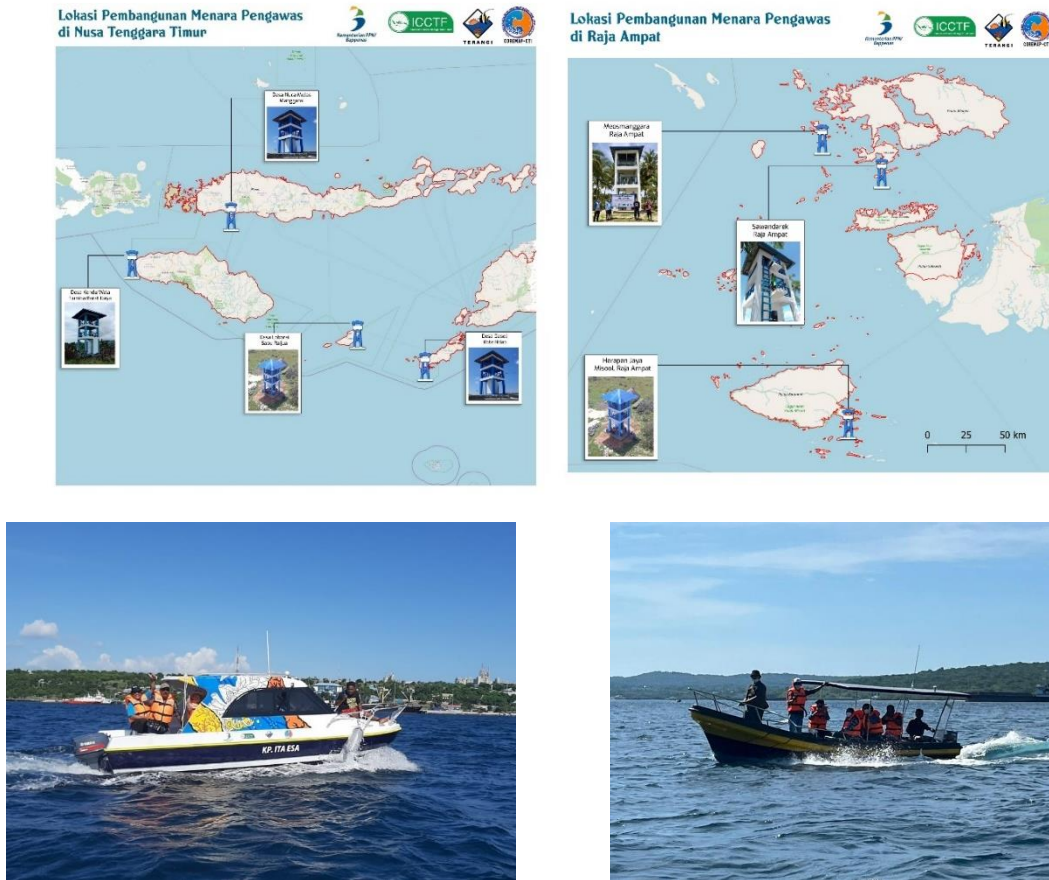


Figure 35. Location of surveillance towers and pictures of the surveillance boats

Based on surveillance report from Pokmaswas in Raja Ampat and Rote Ndao, the average of Pokmaswas conducted surveillance activity is three times a week for each group with total activity is 260 and 239 surveillances, respectively (Figure 34). While for the Pokmaswas in Manggarai, Sabu Raijua, and Sumba, the number of surveillance activities are 49, 96, and 84 surveillances, respectively. From these activities, several findings were recorded and reported, for instance during the regular patrol in Manggarai, Southwestern Sumba, and Rote, they found destructive fishing activities such as blast fishing and poison fishing. The frequency of findings for destructive fishing were 7 in Manggarai, 8 in Rote Ndao, and 19 in Southwestern Sumba (Figure 35). The action taken for destructive fishing activities were reporting to head of village, and the police or PSDKP. Pokmaswas has a role to hear, to observe, and to report for all activities they found during the surveillance activity. Pokmaswas does not have right to arrest or investigate their findings.

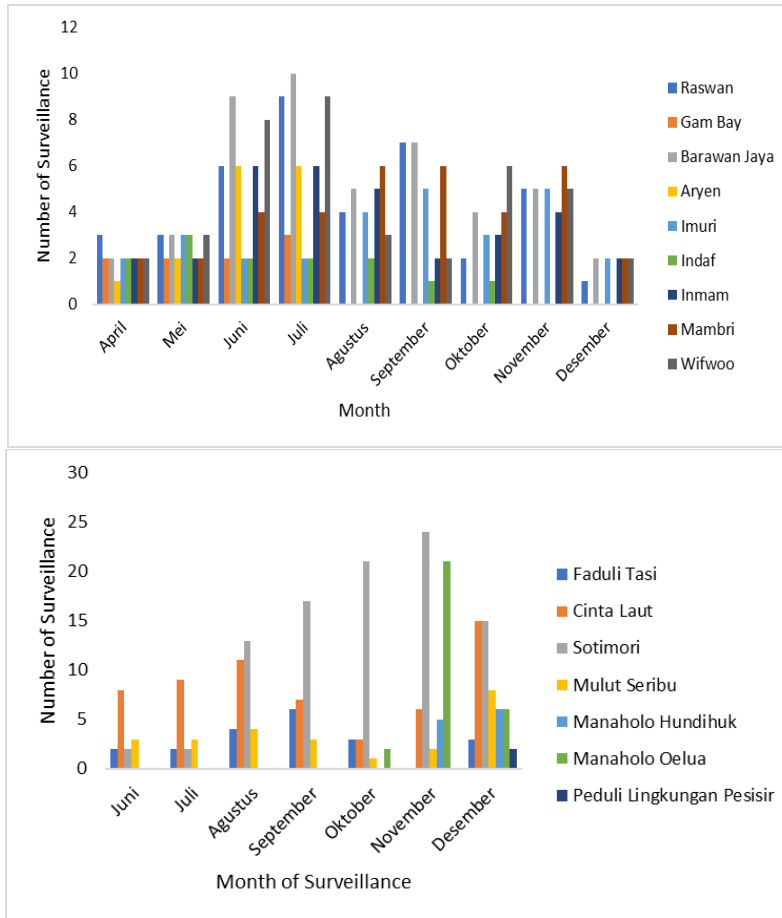


Figure 36. Number of surveillance activities conducted by Pokmaswas. Upper: Surveillance activity in Raja Ampat; Lower: Surveillance activity in Rote Ndao

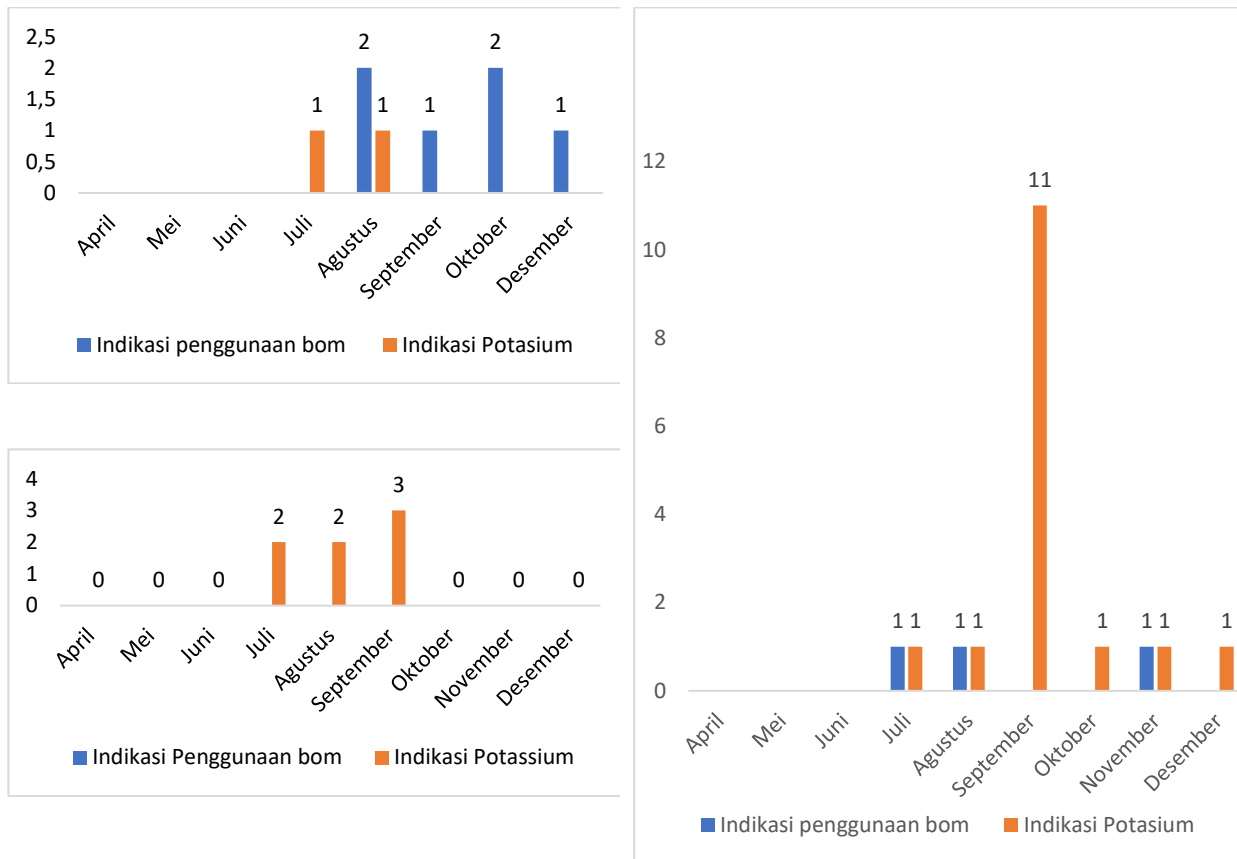


Figure 37. The frequency of finding of destructive fishing during Pokmaswas surveillance patrol for three districts in TNP Laut Sawu, East Nusa Tenggara. Upper left: Rote Ndao District; Lower left: Manggarai District; Right: Southwestern Sumba

With regard the destructive fishing finding, we do not have a comparison data which can be used to explain how effective the Pokmaswas intervention in reducing the destructive fishing. The reason is due to no recorded data can be obtained from related stakeholder before intervention period that collected from the same location with the surveillance area of Pokmaswas. The available data, if any, may not be comparable since it comes from different location. However, it can be explained that because the regular patrol conducted by Pokmaswas, data related to destructive fishing in certain area are available and can be used as the baseline to evaluate the impact of Pokmaswas existence in the area in the future. If we refer to the anecdotal information, the destructive fishing activity was reduced after the Pokmaswas actively conduct the surveillance. The people that would attempt to commit destructive fishing will avoid the area where the Pokmaswas exist.

Provincial ICZM action plan activities implemented in target MPA areas

This result indicator has a target to implement 14 activities listed in Action Plan ICZM West Papua. The activity conducted by 5 subgrantees in Raja Ampat were recorded as the achievement for this indicator. Until March 2022, this indicator has been achieved with 17 activities implemented. The list of activity which aligned with ICZM action plan of West Papua is presented in the table below.

Table 17. Activities Aligned with ICZM Action Plan for West Papua

ICZM/RZWP3K Action Plan		COREMAP-CTI ACTIVITIES		STATUS
No	Activities	Grant Package	Output	
Customary Community (Masyarakat Hukum Adat)				
1	Enhance capacity of MHA to support the sustainable management of marine and coastal resources	GP 6	Enhance the KMHA capacity on reef fisheries governance implementation with RBSFM principle and business development	Training RBSFM for MHA Completed
2	Facilitate the acknowledgement of existing MHA and related to coastal and marine in West Papua	GP 6	POKJA KMHA for acknowledgment and protection of KMHA tenurial system established by Governor or Head of district decree	<ul style="list-style-type: none"> • SK Pokja KMHA available • Working Mechanism Available
3	Development of regulation on natural resources utilization at MHA sites	GP 6	Right-based sustainable fisheries management plan	RBSFM Plan for MHA available
TOURISM ZONE				
4	Improve tourism attraction and destination	GP 3	Sustainable community-based species tourism business (and supporting industries) in at least 3 selected locations in Raja Ampat and Savu Sea TNP	<ul style="list-style-type: none"> • Community-based species tourism group is established and tourism package with attraction and destination is available and has been testing. • Assessment of species-based tourism establishment completed
5	Improve the ecotourism infrastructure and facility	GP 1	Development of Manta Sighting station	Completed
			Hiking track development	Completed
			Floating jetty development	Completed
			Ecotourism and information centre with solar panel development	Completed
6	Development code of conduct for charismatic species interaction/tourism	GP 3	Code of conduct for sustainable tourism of shark, manta and Cetacea based on the literature study of scientific based code of conduct	Code of conduct available for Manta ray, Shark and Cetacean
CAPTURE FISHERIES ZONE				
7	Implemented cold chain technology post harvesting to improve the quality of fisheries product	GP 1	Development of PV for cold storage mobile	Cold storage mobile with solar pv available

AQUACULTURE ZONE				
8	Improve aquaculture infrastructure and facility	GP 1	Support to aquaculture development in KKPD Selat Dampier	Fisheries Floating cage (Keramba Jaring Apung-KJA) completed built
MANGROVE FOREST ZONE				
9	Research and development	GP 4	Rehabilitation of coastal ecosystem	Study report for critical habitat available
10	Mangrove ecosystem rehabilitation	GP 4	Rehabilitation of coastal ecosystem	Mangrove rehabilitation completed and fully underway with support from community
11	Enhance capacity of MPA management body staff	GP 4	Integrated coastal management governance platform (ICZM) which contains rules and procedures in the management of coastal areas and small islands.	Workshop ICZM governance platform conducted and attended by BLUD UPTD Raja Ampat staff (completed)
			Stakeholders whose capacity is enhanced in integrated coastal area management in the fields of marine spatial planning, tourism, fisheries and/or conservation.	<ul style="list-style-type: none"> • training ICZM for local staff/stakeholder completed • training GIS completed
		GP 1	Increased stakeholder capacity on coastal ecosystem rehabilitation	Workshop on coastal ecosystem rehabilitation completed
		GP 3	Capacity building for stakeholders in carrying out population studies and conservation of sharks, manta rays and cetaceans	Workshop completed
		GP 5	Increase the capacity of community and local staff on diving certification	Diving training completed
12	Development of regulation and SOP for MPA management in MPA sites	GP 4	Technical plan (SOP) for the utilisation based on carrying capacity in MPA	SOP based on Carrying capacity available
13	Development of MPA Management infrastructures and facility	GP 5	Surveillance tower	Completed
			Surveillance operational equipment for POKMASWAS	Completed
			Surveillance boat for POKMASWAS	Completed
14	Monitoring and evaluation	GP 4	Development of RZWP3K implementation Monitoring and evaluation system	Monitoring system fully underway
15	Habitat and fish population rehabilitation	GP 4	Rehabilitation of coastal ecosystem	Seagrass, Coral Reef and Mangrove rehabilitation fully underway

16	Surveillance and controlling marine protected area	GP 5	Enhance the capacity of POKMASWAS on the surveillance and MPA management in Laut Sawu and Raja Ampat	Training completed
			Support the POKMASWAS weekly operation	Operational support fully underway – until March 2021
17	Socialization, awareness and education on marine protected area	GP 4	Enhance community knowledge through awareness activity, publication and communication of project implementation	Campaign and socialisation completed
		GP 3	Enhanced stakeholder capacity on shark and rays, manta and cetacean conservation	Socialisation on manta, shark and cetacean conservation completed

All of activities were conducted in Raja Ampat which becomes one of the location targets in RZWP3K action plan. These activities have been inputted to web-based monitoring and evaluation system for RZWP3K developed by PKSPL-IPB as subgrantee to support West Papua government monitor the implementation of RZWP3K and compliance to the spatial allocation.

Number of management objectives from MMAF's National Plans of Action that have been implemented for Sharks, Cetaceans, and Manta-Rays in target MCA areas

The implementation of indicator 3.4 carried out by sub-grantee from Reef Check Foundation. From this grant package activities also produce policy briefs related on marine spatial used for cetacean; code of conduct for cetacean, code of conduct for shark and manta rays, population dynamic of shark and rays for fisheries management and Manta Ray marine spatial used. These policy briefs have been disseminated to key stakeholder to be adopted in MPA management plan.

There is one innovative method has been applied to study cetacean movement pattern and the project became the first that used this method in Indonesia. Using satellite tag to track down the movement pattern of whale has contributed in understanding the corridor used by whale to migrate from Southern Australia to Eastern Indonesia. These findings will be useful to design the MPA management plan and zonation.

For the indicator 3.4, the target is implemented 9 activities listed in NPOA Sharks and Rays, Manta Rays and Cetacean. For 20 months implementation, the subgrantee has been able to implement 21 activities listed in three NPOAs (Cetacean: 8 Activities; Manta: 8 activities, and Shark: 5 activities), and obtained endorsement from MMAF based on their NPOA monitoring. All activities carried out in both provinces, i.e., East Nusa Tenggara and West Papua. The implemented activities are present in the table below.

Table 18. Implemented activities for NPOA Cetacean

NPOA CETACEAN		COREMAP-CTI WB Activities		STATUS	
No	No	Strategy	Activities	Output	
1	1.1	Strengthen research capacity and enhance cetacean related research activity	Conduct survey and monitoring on sighting distribution, threat, migration route and distribution of important cetacean habitat	Study on the relative abundance and habitat suitability of cetacean in Savu sea	Survey completed and study result available including distribution map of cetacean in TNP Laut Sawu
				Study on Cetacean movement pattern in TNP Laut Sawu to support the improvement of management effectiveness MPA	Tagging completed and study result available including migratory map from satellite tagging
				Study on hotspots of stranded cetacean in Indonesia to better understand the relationship between stranding events and variables such as oceanographic factors and human activities such as fisheries, sea lanes or oil and gas, especially in the Savu Sea and Raja Ampat TNPs.	Hotspot Map and Result Analysis available
2			Conduct capacity building for researcher	Capacity building for stakeholders in carrying out population studies and conservation of sharks, manta rays and cetaceans	Capacity building has been done with 1 researcher from university, and 2 Staff from BKKPN Kupang attended the capacity building
3	4.1	Designated of cetacean important habitat as marine protected area	Conduct assessment on important habitat including cetacean corridor	Study on the relative abundance and habitat suitability of cetacean in Savu sea	Study results available with distribution map
4			Conduct mapping on important habitat including cetacean migration corridor	Study on Cetacean movement pattern in TNP Laut Sawu to support the improvement of management effectiveness MPA	Study results available including migratory map

No		NPOA CETACEAN		COREMAP-CTI WB Activities		STATUS
No	Strategy	Activities	Output			
5	5.1	Cetacean ecotourism development	Establishment pilot activity for cetacean ecotourism	Sustainable community-based species tourism business (and supporting industries) in at least 3 selected locations in Raja Ampat and Savu Sea TNP	<ul style="list-style-type: none"> Assessment on species-based tourism establishment available. Community group to implement species-based tourism established Tourism package on dolphin watching developed and has been piloting 	
6			Conduct technical training for the implementation of cetacean ecotourism	Increase the capacity of tourism actors to establish the sustainable species-based tourism	Training for community group completed	
7	6.1	Strengthen and enhance the capacity of marine mammal stranding network	Conduct technical training on handling method for stranded marine mammal	Module and training for handling stranded marine mammal and the module uses as training material for stakeholder	<ul style="list-style-type: none"> Marine mammal stranding training for veterinary Marine mammal stranding training for stakeholder 	
8	7.1	Increase the capacity of community to handle stranded marine mammal	Prepare the curricula and training module for the trainer of marine mammal stranding training	Module and training for handling stranded marine mammal and the module uses as training material for stakeholder	Module for handling stranded marine mammal available and has been used during stakeholder training	

Table 19. Implemented activities for NPOA Manta Rays

No		NPOA MANTA RAYS		COREMAP-CTI WB Activities		STATUS
No	Strategy	Activities	Indicators	Output		
1	1.1	Strengthen the activity of population survey, monitoring and data collection on manta ray migration	Baseline survey and population status monitoring of manta ray in four locations	Baseline data and time series population status available	Movement pattern assessment and population census on manta ray in Raja Ampat to improve management effectiveness of MPA	Assessment result for population census using PhotoID available
2			Manta tagging in four locations	Data on migration pattern of manta ray is available	Movement pattern assessment and population census on manta ray in Raja Ampat to improve	Assessment result available and fully underway for acoustic tag

NPOA MANTA RAYS			COREMAP-CTI WB Activities			STATUS
No	No	Strategy	Activities	Indicators	Output	
					management effectiveness of MPA	data collection for movement pattern while satellite tag is completed
3	3.1	Enhance the capacity of community on manta ray conservation	Prepare and disseminate socialisation material	Socialisation material available and distributed to location with violence indication	Strategy and communication product to enhance the stakeholder knowledge on shark, manta and cetacean management	Poster and factsheet on Manta ray conservation available
4			Conduct socialisation on manta ray protection regulation to fisherman and trader.	Stakeholder knowledge on manta ray regulation increased	Enhanced stakeholder capacity on shark and rays, manta and cetacean conservation	Socialisation on Manta, Shark and Cetacean conservation conducted
5	4.1	Increase the role and involvement of community on manta tourism	Developed assessment on community-based manta tourism model	Ecotourism model to be implemented available	Sustainable community-based species tourism business (and supporting industries) in at least 3 selected locations in Raja Ampat and Savu Sea TNP	<ul style="list-style-type: none"> Assessment on species-based tourism establishment available. Community group to implement species-based tourism established
6			Development of manta ecotourism guideline	Technical guidance on manta ecotourism	Code of conduct for sustainable tourism of shark, manta and Cetacea based on the literature study of scientific based code of conduct	Code of conduct available
7			Established and enhanced the capacity of community group on manta ecotourism	Community group capacity increased	Increase the capacity of tourism actors to establish the sustainable species-based tourism	Training for community group has been conducted
8			Prepare the equipment, infrastructure and assistance to community group	The equipment, infrastructure and assistance for manta ecotourism implemented	Sustainable community-based species tourism business (and supporting industries) in at least 3 selected locations in Raja Ampat and Savu Sea TNP	Equipment for community group provided Community group piloting tourism package

Table 20. Implemented activities for NPOA Sharks

NO	NPOA Shark			COREMAP-CTI WB Activities		STATUS
	No	Strategy	Activities	Indicators	Output	
1	3.2	Optimization of shark and rays' fisheries production data at primary landing sites	Conduct catch-landing record for shark and ray fisheries which included genus/species at the primary landing sites	Data recording report	Elasmobranch population dynamic assessment based on fisheries data in West Papua	Monthly data recorded at landing site available
2	4.2	strengthening research on fisheries management aspects	Assessment on sustainable fishing gear/environmentally friendly fishing gear	Assessment report	Assessment on effectiveness LED light as elasmobranch bycatch mitigation tools in Laut Sawu	Report assessment available
3	1. 2	Preparation of supporting regulation on sustainable shark and ray fisheries management	Conduct FGD, public consultation, and workshop on shark and ray management	Report and recommendation on shark and ray fisheries management	National Policies recommendation based on inputs from meetings and activity results in Package 3 ICCTF	Policy briefs on population dynamic available
4	7.1	Enhance the awareness on management and conservation	Preparation publication and socialization material	Printed publication and socialization material	Strategy and communication product to enhance the stakeholder knowledge on shark, manta and cetacean management	Strategic communication and communication product available
5			Socialization implementation	Socialization report	Enhanced stakeholder capacity on shark and rays, manta and cetacean conservation	Socialization on manta, shark and cetacean conservation conducted

3.4. Project Intermediate Results

Table 21. Results Framework of COREMAP-CTI Program 2022

No.	PDO Indicators	Unit	Target	2022 Achieved	%
1	Sites at which Indonesia's new Coral Reef Health Index is applied	Sites	39	39	100
2	Coastal ecosystems area under continuous monitoring according to defined criteria	Ha	11,241,405	12,719,840	113
3	Coastal ecosystems scientific research papers published by LIPI and research grant recipients that meet the need for evidence-based resources management information	Scientific Paper	57	131	230
4	Target MPAs with a Blue Level Management Effectiveness Score of at least 75 percent)	MPA	4	4	100
Intermediate Result Indicator Component 1: Institutional Strengthening for Coastal Ecosystems Monitoring					
1.1	Coastal ecosystems monitoring surveys completed	Site	78	78	100
1.2	Specific coastal ecosystems schemes for which LIPI is accredited as the national certification entity	Scheme	5	6	120
1.3	Assessors and surveyors certified in coastal ecosystems monitoring by LIPI	Person	500	639	128
1.4	Sub-national assessment centers established by LIPI	TUK	10	13	130
1.5	Technical staff awarded Master Degree Scholarships in coastal ecosystems monitoring and management)	Person	20	20	100
1.6	Sub-national data nodes within existing institutions established by LIPI	Sub-node	8	8	100
1.7	LIPI coastal monitoring and research infrastructure assets upgraded	Building	7	6	86
Intermediate Result Indicator Component 2: Support for Demand-driven Coastal Ecosystems Research					
2.1	Researchers trained by LIPI in coastal ecosystems research techniques	Person	340	523	154
2.2	Demand-driven coastal ecosystems research grants awarded by LIPI	Award	30	60	200
Intermediate Result Indicator Component 3: Management of Priority Coastal Ecosystems					

No.	PDO Indicators	Unit	Target	2022 Achieved	%
3.1	Small ecotourism infrastructure assets, built in target MPA areas, as per MPA management plan	Infrastructure	8	9	113
3.2	Registered community surveillance groups (Pokmaswas) that are carrying out regular surveillance patrols in target MPA areas	Pokmaswas	18	22	122
3.3	Provincial ICZM action plan activities implemented in and around target MPA areas	Activity	14	17	121
3.4	Number of management activities from MMAF's National Plans of Action that have been implemented for Sharks, Cetaceans, and Manta-Rays in target MPA areas	Activity	9	21	233

CHAPTER 4. LESSONS LEARNED

4.1. Project Management

The aim of Component 4 (Project Management) is to provide support for project implementation, which consists of: (1) monitoring and evaluation of project performance; (2) monitoring compliance on safeguards and fiduciary management; and (3) coordination with partners.

In 2020, the outbreak of COVID-19 pandemic severely affected how the program was carried out, especially programs which need on-site activities, such as the Reef Health Monitoring. While some activities can be transferred to virtual alternatives, others must be postponed to reduce the infection risk. However, there are activities that cannot be postponed, such as construction of COREMAP-CTI infrastructures. To reduce the infection risk, the team must follow mitigation plan and health protocol enforced by the Ministry of Health. The Protocol to Prevent the Spread of Coronavirus Disease 2019 includes the following activities:

- Establishing an internal task force at the construction project site.
- Identifying potential hazards at the construction project site.
- Providing health facilities at the construction project site.
- Implementing the mitigation steps at the construction project site.

The situation of COVID-19 in Indonesia improved a lot in 2021, which then allows the team to carry out the remaining program activities. The activities were carried out by following health protocol and safety precautions.

During the implementation of the Reef Health Monitoring, the common constraint is that the use of underwater photography method caused prolonged data analysis due to difference in analysis capacity between surveyor from RCO and surveyor from local partner institutions. The gap could be reduced by increasing the fieldwork intensity. On the other hand, the coral reef monitoring method always follows the technological development (from LIT to UPT), therefore the number of documented data is also higher. The advanced method allows the data to be accessed anytime and can be used by anyone who need it.

With the project completion approaching in 2022, the Project Management Office (PMO) will establish a task team to prepare the COREMAP-CTI project completion report. The project has 4 PDO level indicators. Indicators for PDO 1, PDO 2, and PDO 3 have achieved end-project targets (June 2022). PDO 4 appears to be on track to achieve its end-of-project target, which is 75% blue level or minimum of 44.96% with EVIKA. The current estimated EVIKA score for 2022 depicts a self-assessment by ICCTF together with MMAF and the management team of the MPA to report on the project as official assessment scores from MMAF for 2022 are only going to be released in December 2022.

The following criteria was used for improvement of the self-assessment of MPA effectiveness with EVIKA metrics: (i) input such as human resources and infrastructure indicators, (ii) process such as surveillance, management of infrastructure and community empowerment indicators, (iii) output such as compliance

level, community knowledge, data and information. Based on the EVIKA scoring of 2020/2021 all four MPAs scored between 54.46–83.78%. Estimated self-assessment EVIKA result for 2022 so far is between 66.15–89.76% for all four MPAs. Thus, management effectiveness is “*Sustainable*” for KKPD Raja Ampat and “*Optimum*” for the three other MPAs. Intermediate results indicators are on track to meet a majority of end-of-Project targets (explored below).

In the context of grant implementation, the current funding mechanism via subgrant to NGO and another eligible organization which selected using call for proposal mechanism is the main component of the successful implementation. The subgrant mechanism allows the implementation in grassroots or community level and provide more opportunity for community to be involved in the project. However, during the implementation there were many challenges in terms of the administration process, including the disbursement budget to NGO due to delay on DIPA approval which influence the activities in the field. Some activities delayed and should reschedule due to funding availability. Furthermore, the subgrantee human resources availability and capacity also posed another challenge. Financing reporting mechanism that complies with APBN mechanism also slow down the process in the beginning of implementation, however, it started to be in place over the time. The PIU management team should provide assistance and closed monitoring the subgrantee activities to ensure all is aligned with the workplan and aimed to achieve the target indicators.

Regarding the effectiveness and the value of money from the COREMAP-CTI PDO 3 implementation, it shows that the activity could effectively increase the EVIKA scoring if it aligned with the management plan and focus on the process criteria which become the responsibility of management body. Meanwhile, the budget allocation for the project should reflect the support to the MPA with minimum funding to implement management plan to have a good value of money.

4.2. Project Outcome and Impact

The Mission noted that the project has made good progress towards achieving, and in several cases exceeding, its targeted objectives, with implementation and disbursement proceeding well at US\$44.26 million or 93.4% under the Loan and US\$9.97 million or 99.7% under the Grant. Nevertheless, as the Project’s June 30, 2022 Closing Date is approaching, there are several key priority issues which require attention. These issues include: (i) the ability of all post-graduate students to successfully graduate before the project closes; (ii) the publication by MMAF of updated MPA EVIKA management effectiveness scores (to confirm current value of PDO 4); (iii) the completion of several major procurement packages related to infrastructure furnishing and equipping; (iv) the need to accelerate spending rate (the actual expenditures as of November 18, 2021 is US\$36.67 million or 77% for the loan and US\$8.48 million or 85% for the grant); and (v) the need for BRIN to prepare a long term coastal ecosystems monitoring strategy as a contribution to the institutionalization of the COREMAP approach to coastal ecosystems monitoring.

During COREMAP-CTI activities, there have been several significant impacts on the management of Indonesia's coastal and marine areas. The impact is expected to be a learning material to carry out the same or similar activities in the future. The description of the impacts presented in this chapter is limited to activities from COREMAP-CTI (2017–2022), although in practice there have been adjustments due to changes in implementing institutions.

In project scale, the implementation of coastal ecosystems monitoring (RHM) through partnership with local universities saw positive impacts. This activity has contributed to the improvement of the local partner's monitoring capacity. The RHM activity allows knowledge and skill transfer of the students and lecturer who were involved.

Other than that, the monitoring data during COREMAP-CTI also contributed in the Status of Coral Reefs of the World: 2020, specifically in Chapter 7 about the status and trends of coral reefs of the East Asian Seas region. This is a joint project led by the Global Coral Reef Monitoring Network, International Coral Reef Initiative, Australian Government, and Australian Institute of Marine Science.

The LSP, which initially established to fulfill internal requirement for certified monitoring survey and assessor (top-down), received positive responses from external institutions. Some universities would like to use the national standards (SKKNI) licensed to the LSP to fulfill their academic requirement for their students, in the form of diploma companion certificate specifically in the field of coastal ecosystems monitoring (bottom-up). This initiative then implemented in the form of TUK establishment with universities as partners.

In national scale, the COREMAP program has successfully contributed to the following activities.

➤ Nusa Manggala Expedition

The Nusa Manggala Expedition is a research activity that aims to explore data, information and knowledge about living and non-biological natural resources in the coastal areas of the outermost small islands of Indonesia, which are located in the Pacific Ocean. The eight islands are Yew, Budd, Fani, Miossu, Fanildo, Bras, Bepondi, and Liki Islands.

The Nusa Manggala expedition has revealed many finds on the outermost small islands in the Pacific Ocean. Despite the relatively small size of the islands, the researchers noted the incredible variety of coastal and underwater natural resources. The beauty and natural wealth of these islands cannot be denied is a great potential to be developed. Some of these islands also have cultural historical sites and World War II. Local cultural wisdom becomes a strong asset for its citizens to stay alive in the midst of all limitations, and dependence on nature.

Its remote location with very limited access to transportation from/to the mainland, plus minimal basic infrastructure, is a burden for this area. At the same time, threats from environmental stresses (e.g., microplastic pollution) and global change (e.g., sea level rise) are apparent.

Wealth and natural beauty and cultural diversity need to get more concentration in their management, both from the government and community support. Nusa Manggala Expeditions recommends the following:

- The provision of basic infrastructure, such as power plants, clean water supply, communication networks and health facilities are very important and needs to be accompanied by education to local residents about how the equipment works and its maintenance.
- Amid the threat of environmental pressure, natural and historical wealth in the outer islands needs to be protected and conserved through the establishment of marine conservation areas or maritime

conservation areas. The traditional/customary wisdom of the local community, commonly known as Sasi, is a strong asset to protect nature.

- The outermost islands are the front gates in the sovereignty of the Republic of Indonesia. The patrol of security officers (military) to maintain the sovereignty of the Republic of Indonesia needs to be supported by a proper patrol fleet.

In the end, management in this area must be directed to be able to utilize natural resources optimally, but still be sustainable, environmentally friendly and without leaving the wisdom of the local community.

➤ Changes in Community Behavior

From the community side, the Community Awareness component of the COREMAP program greatly influences changes in mindset and behavior by increasing public awareness of the importance of saving coral reefs or conservation activities of coastal and marine ecosystems in general. In addition, the public is also more aware of using fishing gear that is more environmentally friendly and stopping the use of bombs, cyanide/potash, and tiger trawls (Widayatun & Hidayati, 2021). This condition was created as a result of COREMAP's socialization activities through various media.

On the other hand, the Community Empowerment component also has an impact on changes in community behavior. Communities in COREMAP locations find it easier to collaborate, form certain groups, express opinions and criticize an activity that is considered inappropriate for the community. Another positive impact is the increased understanding of the management of productive economic businesses so as to increase the income of fishermen and local communities as well as the desire of the community to carry out supervision independently and voluntarily (Farida, Irham, Supriyono, personal communication, 2021). In some locations this mindset has been formed, making it easier for the community to accept the existence of new similar programs, the willingness of the community to be actively involved in activities and support the achievement of program targets.

➤ Research of Coastal Ecosystems

During the COREMAP and COREMAP-CTI programs, many studies have been carried out and have had a positive impact. The benefits of the research results can be grouped into several groups, namely national, regional, general public and scientific communities. Some examples of useful research are as follows:

- Sharks and Rays Management in Indonesia

The book "Guidelines for the Preparation of Non-Detriment Findings (NDF) for Sharks in Indonesia" has been prepared to provide convenience in assessing the condition of the population, utilization and management of sharks in all Indonesian waters. In addition, the book "Guidelines for Determining Quotas for Shark Catching in Indonesia, through Case Studies of Lanjaman Sharks (*Carcharhinus falciformis*)" has been published. These two guidelines can be used as guidance for all stakeholders and support the management of shark fisheries in Indonesia (Octaviyani *et al.*, 2019a; Oktaviyani *et al.*, 2019b). Not only guidebooks, the study also produced NDF documents for Lanjaman sharks (*Carcharhinus falciformis*) and rays of the Rhinidae family (wedgedfishes) from Indonesian waters (LIPI, 2019; Oktaviyani *et al.*, 2020). Based on this document, the use of CITES Appendix II sharks and rays can still be carried out, including for the benefit of international trade. The beneficiaries of the NDF guidelines and documents are the MMAF

as the management authority, fishermen, traders, collectors and other parties involved in the shark business chain and management.

- Contribution to Low Carbon Development

Research on seagrass blue carbon began in early 2013 and in 2020 succeeded in developing a model formulation for calculating the carbon balance of seagrass beds in Indonesia. It is estimated that the total carbon stock stored in Indonesia's seagrass ecosystems is around 1,005 kilo tons of carbon with the potential for carbon sequestration of 7.4 megatons of carbon per year. The average carbon stock of seagrass in Indonesia is recorded at a maximum of 0.36 and 0.79 tons of carbon per hectare, for the above and below the surface carbon stocks, respectively. The model formula used to convert basic data related to seagrass beds (biomass, density, and percentage cover) to carbon balance values is available in the publication *Ocean Science Journal* (Wahyudi *et al.*, 2020). The beneficiaries of the development of this model are BAPPENAS and MEF (Wahyudi & Afdal, 2019).

- Contribution to Marine Debris Management

Research related to marine debris initiated by RCO-LIPI (now RCO-BRIN) since 2015 has produced a policy text for marine waste management. The first policy brief entitled "Academic Papers on the Initiation of Indonesian Marine Debris Data to complement the National Action Plan for Handling Marine Debris in accordance with Indonesian Presidential Regulation No. 83 of 2018", is used as the national plastic waste data baseline according to the Coordinating Ministerial Meeting on December 12, 2019. The second policy brief entitled "Policy Paper for Application of Garbage Nets in Rivers as a Strategic Action for Waste Management from Land in the Presidential Regulation of the Republic of Indonesia Number 83 of 2018 concerning Marine Waste Management" is used as one of the technical procedures for handling plastic waste that enters Indonesian seas from activities at sea in accordance with the National Marine Debris Management Strategy 5, research and development for strategy 2, handling marine debris originating from land. The beneficiaries of this policy brief are the Ministry of Environment and Forestry and the Coordinating Ministry for Maritime Affairs and Investment.

- Contribution to Regional Marine Protected Areas (KKLD)

Research on the Harmonization of Laws and Regulations on Conservation Institutions in the Era of Regional Autonomy after Law No. 23 of 2014 concerning Regional Government spawned a choice of institutional forms that will manage regional conservation areas in the form of Regional Technical Implementation Units (UPTD), Service Branches, and Branches. The criteria for selecting the institutional form for KKLD management refers to two parameters, namely the area index (area, distribution, distance, and accessibility) and the conservation target index which contains the number of conservation targets. This is a solution to the problem of regional conservation area management. The beneficiaries of the results of this research are the MMAF and regional MAF offices (Solihin, 2019).

- MonMang App

In 2020, RCO launched MonMang, an Android-based application for mangrove monitoring. This application contains procedures for mangrove monitoring and an introduction to MonMang in general,

such as procedures for using and the latest features of the application (Figure 38). As of December 01, 2021, the application guide has been read 50 times (ResearchGate).



Figure 38. MonMang App

In local scale, the COREMAP program has successfully contributed to the following activities.

- a) Policy brief submitted to the Department of Environment and Population of Tanjung Pinang City, Riau Islands Province regarding Microplastic Mitigation in the Riau Islands Coastal Ecosystem (COREMAP-CTI DDR Report, 2018).
- b) Policy brief submitted to the Regional Government of Bintan Regency on Adaptation of Water Resource Management to Population Growth and Climate Change in Small Islands: A Case Study of Bintan Island (Narulita, 2019).
- c) Policy brief submitted to the Regional Government of Probolinggo Regency regarding the Carrying Capacity of Potential Groundwater Resources on a Small, Densely Populated Island Case Study: Gili Ketapang Island, Probolinggo, East Java (COREMAP-CTI DDR Report, 2018).
- d) Policy brief submitted to the Bengkulu Provincial Government regarding vulnerability to shoreline changes, erosion and coastal abrasion (Lubis, 2019).
- e) Modeling the sustainability of small island socio-ecological systems in the perspective of marine cultural ecosystem services (case study of the Tidung Island Cluster, DKI Jakarta) (Adrianto, 2019).

The outcomes of COREMAP-CTI program also reached community scale, as follows:

- a) Fish dryer with portable hybrid solar cell technology to extend the shelf life of salted fish that has been given to four villages in Belitung Regency (Suryandaru, 2019).
- b) Ten machines with nanobubble technology for supra-intensive shrimp cultivation have been given to 20 vaname shrimp farmers in Sidoarjo Regency (Rochman, 2019).

4.3. Project Sustainability and Exit Strategy

As COREMAP-CTI Project approaching its completion in 2022, it is necessary to define strategies for post completion. Strategies have been drafted in order to accommodate all related activities that should be

implemented even though the project is terminated. Coastal Ecosystem Research and Monitoring, specifically coral reefs and its associated ecosystem has become a priority and an influential program in COREMAP-CTI LIPI. Officially appointed as data custodian for coral reefs and seagrass ecosystem in Indonesia, it is crucial that LIPI regularly updates data on the status of coral reefs and seagrass to provide current information regarding the development of ecosystem conditions over the management regime applied. Strategies are divided into short-term and long-term plan, as shown in the table below.

Table 22. COREMAP-CTI Exit Strategy

Short-Term Plan			
Time Plan	Target	Output	Strategy
2020—2022	Improving networking and involving potential partners for sustain research and monitoring (RHM Activities)	Commitment and legal Agreement with MMAF, MFE, also BIG concerning RHM activities	Defining gap analysis related to RHM activities (benefit and data management sharing among parties), each partner will have different tasks in order to avoid overlapping works between one partner to others.
	RHM institution established	Joint secretariat for RHM. Member of the secretariat will be from related institution above.	LIPI would act as coordinator for joint secretariat. Strong point for justification is that LIPI has been officially appointed as data custodian for coral reefs and seagrass. Institutions who conduct similar activities with RHM should give the reports to LIPI.
	Data governance	Standardized Data and Information	Develop annual national report, research, guideline, standard, training institution, dissemination tools (website, policy brief),

			data center (database), and network.
	Capacity building for locals	Competent local people for RHM	Conduct training course through RTRC-MarBEST, certification by LSP, and recruiting volunteer from communities.
Long-Term Plan			
Time Plan	Target	Output	Strategy
2020—2030	Sustainability fund	National project concerning RHM activities	Propose a possibility project which can be delivered to national development planning
	Sustainability program	RHM as strategic plan in Indonesia’s Medium Term Development Plan 2025—2030 (RPJMN 2025—2030).	Continuation of RHM activities and ensure that baseline data and information as result from the activities are being used for policy makers both local and national scales.
	Data governance	Availability, usability, consistency of Data and Information resulting from RHM activities.	Strengthening local capacity, network, conducting annual coordination, data standardization and compilation
	Sustainable coastal ecosystem and benefits	Sustainable benefits for coastal communities (tourisms, fishery, culture, and education) while maintaining the ecosystem conditions.	Improving the MPA functions, engaging locals to participate in ecosystem conservation, restoring the degraded ecosystem.

In the context of grant implementation, some lesson learned has been obtained from sub grantee and community and based on this lesson learned, ICCTF Bappenas develop the exit strategy to ensure the sustainability of activity, as follows:

1. Facility and Infrastructures Asset Management

- Integrate existing groups (POKDARWIS, POKMASWAS, and KUB) into BUMDes to ensure the sustainability of activities related to facilities and infrastructure operation and maintenance.
- Integrate surveillance activities into village work plan and allocated funding for the surveillance activity. This mechanism should be discussed and approved by the villagers.
- Integrating COREMAP-CTI Activities with Activities at Ministries/Agencies to be able to obtain grant from line ministries or funding assistance.
- Encouraging access to funding through special allocations for other infrastructure facilities that are still needed as well as provincial and district/city government budgets for the operation and maintenance of facilities and infrastructure.
- Linking groups with private sectors to access CSR to be able to implement the rehabilitation and livelihood activities.
- Increase the group's capacity in managing facilities and infrastructure and accessing funding for the sustainability of activities.

2. Knowledge Exchange

- Document the achievements of the project results (policy briefs, studies, lessons) properly and ensure that the documents can be accessed by all parties
- The results of the study, policy briefs and learning documentation are submitted to relevant stakeholders (national government, local government, universities and the community) to be used as input in the preparation of policies and development planning.

So far, RCO has been in collaboration with Ministry of Marine Affairs and Fisheries, Ministry of Environment and Forestry, universities, and NGOs in terms of monitoring in their locations. For example, RCO, universities, and NGO's conduct monitoring in Marine Conservation Areas that belong to MMAF and MEF. It benefits both sides especially the data that is very essential for us to understand and respond regarding the trend condition of coastal ecosystem at local or national scales. The information and suggestion provided by the scientists at RCO, universities, and NGOs are very important for them to issue science-based policies which not only consider the sustainability the ecosystems, but also the benefits for local societies. However, such collaboration is not integrated yet and establishing RHM joint secretariat to accommodate the future monitoring is crucially needed.

In order to prepare competent human resources while improving the capacity building, Regional Training and Research Center for Marine Biodiversity and Ecosystem Health (RTRC-MarBEST) was established. It is important to make sure the capabilities of our partners as we also provide the certification program to ensure the competency of the trainee after the training. Both of the training and the certification can be funded by our partners in terms of their capacity building. The training and certification program also can be used by anyone who needed to upgrade their skill in the field of reef health monitoring, by register and pay the fee of the training package and the certification. In the end of the training and certification program the partners can produce the scientific paper and science-based policy for the sake of the country, based on the work of the trained competent scientist.

At the larger scale, the benefit of reef health monitoring is providing the updates on the status of the coral reefs and sea grass beds in Indonesia that is crucial for stakeholders in national levels and international levels. The update on the status of the coral reefs could be used as source for development planning and policy in coastal region. The update of the coral reef's status in Indonesia is also become the part of global coral reef's health issue that had been impacted by climate change. To accommodate the sustainability of the status, the collaboration among stakeholders is certainly needed. A joint program must be held to include or to accommodate the research in coral reef health monitoring as well as coral reef-restoring program. The programs may offer more benefits than the monitoring itself such as the mapping of the coral in better dimension for ministry of Marine and fisheries affairs Coordinating ministry for maritime, and for the Ministry of Defense and also to maintain the condition by restoring the degraded reefs. In short, a national support is crucially needed to organize all the national or local elements in an integrated management system that not only prioritizes the sustainability of the ecosystems, but also the benefits to communities.

CHAPTER 5. CONCLUSION AND RECOMMENDATION

5.1. Conclusion

The COREMAP-CTI which started in 2017 until 2022 has produced several outputs and outcomes, the results of which can be utilized by government institutions, universities, NGOs, communities, and other stakeholders. From the outputs and outcomes produced from the COREMAP program, it is a legacy that needs to be maintained for its sustainability, especially for saving coral reefs and related ecosystems that can provide benefits to the community, local government and at the national level.

From several outputs and outcomes of COREMAP activities, there are important achievements which are exit strategies that need to be considered for the sustainability of activities after the COREMAP program ends, namely:

- 1) National Database for Coral Reef Coastal Ecosystems and Associated Ecosystems that provides information on the condition of coral reefs and related ecosystems in Indonesian waters. This national database was built through strengthening the national network of research and monitoring of coastal ecosystems in collaboration with several universities in each location of COREMAP activities, the results of which are used for government decision-making in the environmental sector.
- 2) The Professional Certification Institute (LSP) RCO is an institution for certifying assessors and surveyors in the field of assessment schemes for the condition of coral reefs and related ecosystems. The LSP network has established Competency Test Places (TUK) at several universities to conduct competency tests for assessors and surveyors. Therefore, in the future the TUK can independently conduct competency tests in the field of assessing the condition of coral reefs and related ecosystems.
- 3) The Coral Reef, Seagrass, and Mangrove Health Index Standard Document is the result of the COREMAP program that can be utilized by institutions, universities, NGOs, and other stakeholders in monitoring the health of coral reefs, seagrasses, and mangroves based on the standard methodologies that have been prepared.
- 4) Another important achievement is the infrastructure of marine research laboratory buildings located in Ancol, Jakarta, Pari Island, Lombok, Tual, Ternate, and Raden Saleh Jakarta which can be utilized by the community and related institutions in conducting marine research.
- 5) The implementation of national action plan for endangered and threatened species by COREMAP-CTI has been acknowledged by MMAF and meet the indicators requested by the Bank
- 6) Several activities in RZWP3K Papua Barat have been implemented by COREMAP-CTI and has been endorsed by Papua Barat provincial government
- 7) Pokmaswas has been registered and conducted regular patrol in TNP Laut Sawu, East Nusa Tenggara and Raja Ampat, Papua Barat
- 8) Small scale Infrastructures Ecotourism have been completely developed and utilized by beneficiaries

- 9) Four MPAs have been identified will obtain higher EVIKA scoring due to COREMAP-CTI intervention

5.2. Recommendation

Based on the outcomes produced during the implementation of the COREMAP-CTI program, the suggestions made to maintain the sustainability of the program after the project ends are:

For Component 1:

- 1) Development of technology to support efficiency in coastal ecosystems monitoring, such as the development of artificial intelligence (AI) for coral reefs and remote sensing with high accuracy for mangrove ecosystem.
- 2) The monitoring activities during the COREMAP-CTI has provided many data utilized by various users (national and local government). At the same time, it is well-known that ocean does not have regional boundary. Therefore, it will be better to upscale the monitoring activity to regional level (Southeast Asia or Coral Triangle area). The regional level monitoring should be using the standard monitoring framework (monitoring and data analysis method, as well as human resources capacity). This can be done through regional trainings.
- 3) Partnership with IOC Indonesia to manage regional trainings in RTRC-MarBEST, to ensure continuous training programs.
- 4) The LSP needs an institutional “umbrella” before becoming independent. To do so, strong commitment and support (in the form of budgeting policy) from BRIN leaders as parent institution is needed.
- 5) As per BRIN's policy, research laboratory infrastructure is managed through an open facility scheme (open platform) with science e-services (ELSA). This service platform enables continued use not only by BRIN but also by universities, industry, and others. The scale of its utilization can also reach regional and international scales through various cooperation schemes.

For Component 2:

- 1) Research and innovation facilitation: publication costs (proofreading, publishing proceedings, journal APC) contributes to increase the number of outputs; It is estimated that <15% of research funding is quite realistic for facilitation, so it is recommended that this kind of funding/facilitation opportunity continues to be carried out, although it does not have to be within a special research scheme.
- 2) The research cost package should be flexible for the following expenses: materials, travel, supplies/equipment, and publications. Funding flexibility encourages output-based research interest.
- 3) Data and information from research and monitoring of coastal ecosystems are integrated with the National Scientific Repository (RIN) as a National Ocean Data Center (NODC) so that it can be widely utilized by stakeholders.
- 4) As the RCO has been appointed as data trustee for seagrass and coral reef ecosystems, they have to maintain the availability of coastal ecosystems data. Therefore, continuous monitoring after COREMAP-CTI ended has to be taken care of, especially related to budget for monitoring and maintaining the coastal ecosystem data center and data nodes servers.

For Component 3:

- 1) Cooperation with related institutions needs to be strengthened and maintained such as universities, local governments, and other stakeholders in monitoring the health of coral reefs and related ecosystems.
- 2) The integration of activity and assets into local government financing scheme or village budgeting and program is one of the strategies to ensure the sustainability of program that can be replicated into other projects or location
- 3) Baseline data are important to be able to assess the impact of the project. Thus, the identification of baseline data at the beginning of the project should be in place and consistent with the indicator that will be developed and measured. For example, baseline on the IUU fishing activity in the MPA targets should be collected during the project result framework design to be able to compare with the intervention during the implementation.

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APPENDIX

Appendix 1. Summary of Coral Reef, Seagrass, and Mangrove Coverage in RHM 2018

No.	Site	HC (%)	RHI	SC (%)	MC (%)
1	Sabang	32.91	5	8.47	77.54
2	Central Tapanuli	24.77	2	27.45	84.03
3	Nias	9.66	3	38.03	68.51
4	Batam	36.58	4	14.16	80.76
5	Bintan	37.6	6	22.74	81.22
6	Belitung	37.5	4	18.08	83.33
7	Ternate	32.54	5	35.26	75.46
8	Buton	35.76	6	49.57	75.38
9	Spermonde Islands	27.83	5	23.81	81.82
10	Wakatobi	27.85	7	52.92	77.87
11	Kendari	36.1	6	33.6	77.88
12	Sawu	19.35	5	36.27	69.67
13	Biak	16.45	7	65.37	73.9
14	Natuna	21.96	5	31.44	77.72
15	Mentawai Islands	15.77	3	36.02	80.8
16	Sekotong	15.21	3	15.33	77.82
17	Lingga	35.74	6	40.7	64.76
18	Raja Ampat	22.91	2	35.08	82.54
19	Lampung	31.22	5	22.99	70.44
20	Sikka	16.65	1	63.04	68.09
21	Selayar	29.02	2	44.23	78.86
22	Pangkep	39.74	6	13.7	82.94
Average		27.41	5	33.1	76.88

Appendix 2. Summary of Coral Reef, Seagrass, and Mangrove Coverage in RHM 2019

No	Location	Area (ha)	HC (%)	SC (%)	MC (%)	RHI
1	Bintan	472905	43,82	29,79	79,58	4
2	Wakatobi	1390000	29,48	48,23	80	9
3	Natuna	142997	24,53	11,78	76,49	5
4	Mentawai	172191	14,87	25,04	81,09	3
5	Sekotong	13140,52	13,58	13,39	74,58	3
6	Raja ampat	300047,87	27,57	30,2	76,33	2
7	Lampung	3072,38	31,78	22,04	75,68	5
8	Selayar	9001	26,02	44,39	72,78	4
9	Tual	151736,48	34,73	45,42	76,06	2
10	SAP Raja Ampat	60000	34,54	31,51	78,28	2
11	Anambas	1262686	40,35	18,14	80,58	6
12	Pieh	39900	38,42	-	-	6
13	Takabonerate	530765	24,62	54,52	-	3
14	Padaido	183000	35,25	52,14	82,27	8
15	Komodo	345032	30,84	39,19	73,34	5
16	Derawan	493188,46	28,04	37,05	57,54	5
17	Merauke	188437	-	-	66,05	-
	average	-	29,90	33,522	76,043	5
	Total	5758099,72	-	-	-	-

Appendix 3. Summary of Coral Reef, Seagrass, and Mangrove Coverage in RHM 2020

No.	Site	HC (%)	RHI	SC (%)	MC (%)
1	Biak Numfor	28.46	9	49.19	75.94

Appendix 4. Summary of Coral Reef, Seagrass, and Mangrove Coverage in RHM 2021

No.	Site	HC (%)	RHI	SC (%)	MC (%)
1	Batam	31.09	-	24.63	88.26
2	Belitung	45.26	6	26.41	76.71
3	Buton Island	32.38	6	35.45	69.01
4	Derawan Islands	31.79	-	40.22	70.33
5	Karimunjawa	60.47	6	29.58	79.00
6	Kendari	42.41	-	35.36	72.60
7	Seribu Islands	32.13	4	30.53	73.65
8	Mentawai Islands	9.02	-	39.30	78.85
9	South Lampung	19.2	5	24.08	71.97
10	Lingga	45.79	5	26.65	75.37

No.	Site	HC (%)	RHI	SC (%)	MC (%)
11	West Lombok	14.15	4	26.89	77.70
12	Makassar	27.33	-	31.92	79.79
13	Moyo Island	27.25	-	32.90	76.35
14	Natuna	25.87	4	20.68	73.36
15	Raja Ampat	29.44	4	29.97	89.23
16	Sabang	31.26	5	<10	80.77
17	Sikka	19.65	5	64.03	72.02
18	East Sumba	27.49	5	36.64	79.15
19	Central Tapanuli	33.02	5	23.15	81.6
20	Cendrawasih Bay	36.13	-	28.17	-
21	Ternate Island	37.41	5	35.34	73.95
22	Tual	29.97	5	60.16	76.12
23	TWP Padaido	35.85	-	32.20	-
24	TWP Banda Sea	56.08	-	48.93	-
25	TWP Kapoposang Islands	53.06	-	25.03	-
26	TWP Gili Matra	48.46	-	-	-
27	TNP Savu Sea	20.77	-	35.70	-
28	SAP Raja Ampat Islands	40.28	-	-	-
29	SAP West Waigeo	42.44	-	-	-
30	TWP Pieh	38.41	-	-	-
31	TWP Anambas	37.83	-	21.43	-
Average		34.25	5	31.9	76.9

Appendix 5. Annual change rate of SEQI value and its parameters in 2018-2021

ID	Lokasi	IKEL	Jenis	Tutupan(%)	Macroalga(%)	Epifit(%)
	Indonesia	-0.01*	0.03	-0.92*	0.32	5.04*
3	Tapanuli Tengah	-0.01	0.27	0.85	1.17	7.73*
4	Mentawai	-0.02	-0.46*	2.33	0.24	3.16
5	Batam	-0.006	0.08	-2.15	-0.3	9.5*
6	Bintan	0.001	0.13	6.04	0.1	12.32*
7	Lingga	0.02	0.26	-4.67*	-7.69*	-6.78*
9	Natuna	-0.03*	-0.5	0.41	1.76	5.96
10	Belitung	-0.01	0.33	2.09	-0.57	12.32*
11	Lampung	-0.005	0.18	-0.78	-0.84	-6.78*
17	Sumba Timur	-0.003	-0.05	-0.08	-0.1	0.88
19	Sikka	-0.001	0	0.178	0.65	-2.06
20	Derawan	-0.01	0.04	-2.48	0.83	3.9
23	Makassar	-0.02	-0.15	-1.94	0.93	2.91
24	Selayar	-0.03	0.21	2.94	5.61	31.80*
26	Kendari	-0.01	0.33	0.55	2.69*	12.65*
27	Buton	-0.05*	-0.25	-6.14*	3.47	12.98*
28	Wakatobi	-0.003	0.43	-6.42	-0.44	-12.94
30	Tual	0.008	0.15	7.24*	1.65	6.19
32	Ternate	-0.02	-0.03	0.19	3.14	15.19*
34	Salawati	-0.021	-0.24	-2.97	3.5*	5.80*

Appendix 6. Summary of reef fish abundance and biomass from RHM 2021

Site	Indicator Fish		Target Fish			Status
	Avg. Abundance (ind/ha)	No. of Species	Avg. Abundance (ind/ha)	Total Biomass (kg/ha)	No. of Species	
Batam	976	3	714	1,184.57	16	Medium
Belitung	-	4	1003	234	22	Low
Buton Island	2420	28	7410	9198	80	High
Derawan Islands	1688	29	4982	1197	72	Medium
Karimunjawa	480	7	1086	1601	30	Medium
Kendari	-	-	-	1509.14	138	Medium
Seribu Islands	1431	12	4184	5130.46	56	High
Mentawai Islands	400	12	1916	3908	50	High
South Lampung	203	19	2037	3700	41	High

Site	Indicator Fish		Target Fish			Status
	Avg. Abundance (ind/ha)	No. of Species	Avg. Abundance (ind/ha)	Total Biomass (kg/ha)	No. of Species	
Lingga	829	2	517	808.93	20	Low
West Lombok	543	28	1177	1189.75	43	Medium
Makassar	519	13	1870	482.6	42	Low
Moyo Island	1072	-	3915	996.16	-	Medium
Natuna Islands	771	24	5522	20763	74	High
Raja Ampat	2110	37	7708	14519.03	97	High
Sabang	2479	24	6121	8535.22	73	High
Sikka	509	23	893	958	39	Low
East Sumba	863	23	2428	2078	40	High
Central Tapanuli	316	9	4945	5075.75	44	High
Cendrawasih Bay	1194	26	4681	-	81	-
Ternate Island	1514	27	6225	10851.6	70	High
Tual	701	25	4330	5553	83	High

Appendix 7. Status of the technical staff awarded the COREMAP-CTI Master Degree Scholarship

No.	Name	Institution	Remarks	Status
1	Agus Setiyawan	MMAF	Jan 2018 - Dec 2019	Alumni
2	Deky Rahma Sukarno	MMAF	Jan 2018 - Dec 2019	Alumni
3	Prita Aulia Novita	MMAF	Jan 2018 - Dec 2019	Alumni
4	Yonatan Novario Ady	West Papua Government	Jan 2018 - Dec 2019	Alumni
5	Ifan Martino	Bappenas	Aug 2018 - Aug 2020	Alumni
6	Adiguna Rahmat Nugraha	MMAF	Jan 2019 - Dec 2020	Alumni
7	Aditya Herry Ernawan	MMAF	Jan 2019 - Dec 2020	Alumni
8	Lutfi Felanie	MMAF	Jan 2019 - Dec 2020	Alumni
9	Fauzan Hidayat	MMAF	Jan 2020 - Dec 2021	Alumni
10	Fawzan Bhakti Soffa	NRIA	Jan 2020 - Dec 2021	Alumni
11	Hariono	MMAF	Jan 2020 - Dec 2021	Alumni
12	Joyke Fredy Bastian Rumajar	North Sulawesi Government	Jan 2020 - Dec 2021	Alumni
13	Kristina Resmi Setiani	MMAF	Jan 2020 - Dec 2021	Alumni
14	Rizkie Satriya Utama	LIPI	Jan 2020 - Dec 2021	Alumni
15	Samuel Radityo Adiprabowo	MCGA	Jan 2020 - Dec 2021	Alumni
16	Alan Ray Farandy	NRIA	Sep 2020 - May 2022	Alumni
17	Desak Made Pera Rosita Dewi	MCGA	Sep 2020 - May 2022	Alumni
18	Ita Wulandari	NRIA	Sep 2020 - May 2022	Alumni

19	Meydar Hapsary Saleh	MEF	Sep 2020 - May 2022	Alumni
20	Restya Rahmaniar	MMAF	Sep 2020 - May 2022	Alumni

Appendix 8. Registered Pokmaswas in Target MPAs

No	MPA/District	POKMASWAS GROUP	LOCATION
1	TNP Savu Sea/Sabu Raijua	Try Jaya	Desa Loborai
2		Hidup Rukun	Desa Eilogo
3		Taruna Selat Raijua	Desa Lederaga
4	TNP Savu Sea/Sumba Barat Daya	Ngamba Daha	Desa Ate Dalo
5		Humma	Desa Kenduwela
6	TNP Savu Sea/Rote Ndao	Sotimori	Desa Sotimori
7		Mulut Seribu	Desa Daiama
8		Faduli Tasi	Desa Oeseli
9		Cinta Laut	Desa Holulai
10		Peduli/Pecinta Lingkungan Pesisir Pantai	Desa Onatali
11		Manaholo Oelua	Desa Oelua
12		Manaholo Hundihuk	Desa Hundihuk
13	TNP Savu Sea/Manggarai	Nuca Molas	Desa Nuca Molas
14		Satar Lenda	Desa Satar Lenda
15	SAP Raja Ampat/Raja Ampat	Raswan	Kampung Meosrar
16		Indaf	Kampung Meosmanggara
17		Manggara M Koen	Kampung Meosmanggara
18		Berawan Jaya	Kampung Mutus Timur
19		Mambri	Kampung Mutus Timur
20	KKPD Selat Dampier/ Raja Ampat	Inmam	Kampung Sauwandarek
21		Imuri	Kampung Sauwandarek
22	KKPD Misool/Raja Ampat	Wifwoo	Kampung Harapan Jaya
23	Waigeo Barat Daratan /Raja Ampat	Baus Star	Kampung Waisilip
24	Waigeo Barat Kepulauan /Raja Ampat	Korufor	Kampung Fam