State of The Bird's Head Seascape Marine Protected Area Network 2019

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ABBREVIATIONS

BHS	: Bird's Head Seascape
BPS	: Badan Pusat Statistik, the Indonesian Bureau of Statistics
CI	: Conservation International
CP	: Coastal Park
COTs	: Crown of Thorns Starfish
E-KKP3K	: Technical Guidelines for Evaluating the Management Effectiveness of Aquatic, Coastal, and Small Island Conservation Areas
FAO	: Food and Agriculture Organization of the United Nations
FGD	: Focus Group Discussion
IPCC	: Intergovernmental Panel on Climate Change
MMAF	: Ministry of Marine Affairs and Fisheries, Republic of Indonesia
MPA	: Marine Protected Area (including provincial and national MPAs)
NMPA	: National Marine Protected Area (KKPN)
LSM	: Lembaga Swadaya Masyarakat = Local Non-Governmental Organisation
NGO	: Non-Governmental Organisation
SAP	: Suaka Alam Perairan – an MPA with strict nature reserve status
SK	: Decree (Surat Keputusan)
SOP	: Standard Operating Procedures
TWP	: Taman Wisata Perairan - an MPA with marine tourism park status
UNIPA	: Universitas Papua/University of Papua
WWF	: World Wildlife Fund for Nature
YKAN-TNC	: Yayasan Konservasi Alam Nusantara – affiliate of The Nature Conservancy

EXECUTIVE SUMMARY

The Bird's Head Seascape (BHS) in Papua is the global centre of marine biodiversity and a conservation priority. By 2020, marine conservation efforts led by the Indonesian government in partnership with civil society and local communities had brought more than 23.6 million hectares under protection, including 5.2 million through the establishment and management of Marine Protected Areas (MPAs) within the BHS.

Since 2008, University of Papua government agencies, and non-governmental organisations (NGOs) have worked together to develop rigorous methods to monitor the ecological and social conditions in the Bird's Head Seascape MPA Network. This report, which is updated periodically, provides a scientific assessment of the status and trends of key ecological and social conditions across the entirety of the Bird's Head Seascape MPA Network. The indicators used in this report serve as a scientific benchmark for coral reef ecosystem health, marine capture fisheries, and human wellbeing (including economic well-being, health, empowerment, education, and culture). In addition, this report also describes the MPA management and marine resource governance status for each MPA.

At the overall seascape level, two ecosystem health indicators remained stable and once showed an improvement. Although the trend was stable for biomass of the functional fish group, there was an improvement compared to the conditions reported by the previous monitoring. Human well-being indicators varied greatly. The economic well-being indicator was stable, health and education, increased; conversely, political empowerment and culture showed a negative trend. This indicates that driving factors may include political and economic conditions and other social dynamics in the BHS region, and may not be limited to dynamics at a smaller, local scale.

Management effectiveness was evaluated using two methods: the World Bank scorecard and the Indonesian E-KKP3K standards. The World Bank scorecard assessment indicates that overall MPA management effectiveness is continuing to improve, though the rate of improvement varies among the MPAs within the BHS. The assessment based on E-KKP3K standards showed that a plurality of the BHS MPAs (Raja Ampat Regional MPA Network, Kaimana, SAP Raja Ampat, SAP Waigeo Sebelah Barat were at the Green level, conservation area minimally managed. Each MPA requires a different set of measures to improve their management status. The scores for most marine resource governance indicators had remained low with a tendency towards further decline, apart from the conflict resolution indicator which had remained stable.

Some recommendations to improve the status and management effectiveness of MPA in BHS are increasing monitoring and surveillance activities, increasing community participation, increasing public awareness and always considering sustainability on coastal development for human welfare.

1. INTRODUCTION

1.1. The Bird's Head Seascape

Recognised as the global centre of Marine biodiversity, the Bird's Head Seascape (BHS) in West Papua is a national and international conservation priority. With more than 2,500 islands and 225,000 km2 (or 22.5 million hectares), the BHS is home to around 75% of the world's scleractinian coral species (Veron et al., 2009; Wallace et al., 2011). At the same time, the waters of the BHS provide critical habitat for globally threatened sea turtles and cetaceans (Mangubhai et al., 2012). These natural riches support the livelihoods and food security of approximately 273,897 people living in coastal communities (Badan Pusat Statistik, 2017). The coastal communities of the BHS are heavily dependent on marine resources; with capture fisheries providing the main source of monetary income for almost a third of households and the main source of dietary protein for 69% of households (Glew et al., 2012). Consequently, it is critical to maintain the health and productivity of BHS coastal marine ecosystems to continue to sustain coastal livelihoods in the region.

1.2. History of the Marine Protected Area (MPA) Network

The globally unique marine biodiversity in the BHS has made the region a strategic conservation priority. Over the past decade, marine conservation efforts led by the Indonesian government in partnership with civil society and local communities have brought more than 5.2 million hectares under protection, through the establishment and management of Marine Protected Areas (MPAs). This effort began in 2004, when local communities, government, and non-governmental organizations (NGOs) began the process of formally designating a network of MPAs across the region, to secure the long-term effective management of marine resources, to ensure food security and sustainable economic benefits, and to conserve biodiversity. By 2009, 12 MPAs had been established, stretching from Teluk Cenderawasih National Park in the east of the Seascape, to the Raja Ampat MPA Network in the west. In 2010, a government decree designated Raja Ampat as a shark and ray sanctuary, the first of its kind in the Coral Triangle. By 2019, the BHS MPA network had been expanded to 23 MPAs. Since the establishment of the MPA network, efforts to build management capacity have been ongoing, engaging communities in the conservation of the BHS and its resources.

1.3. Social Context

Approximately 52,000 individuals are resident in more than 142 coastal communities within the BHS MPA network. The number of people living within each of the MPAs varies, from approximately 1,500 families in Buruway MPA to over 26,000 families in the Teluk Cenderawasih National Park. Household heads range in age from 17 to 98 years old (averaging 46 years). Households are relatively large, compared to the Indonesian average of 3.9, with a typical household containing 6 individuals. Communities are relatively stable, with surveyed households resident in the same settlement for an average of 31.46 years. Average household residency varies slightly among the BHS MPAs, ranging from 27.34 years in Teluk Mayalibit MPA to 36.97 years in Kofiau-Boo Islands MPA.

The population of the BHS MPA Network is predominantly Christian (76% of households surveyed), followed by Muslims (23.95%) and a small minority of Hindus (0.04%). The population of the BHS is ethnically diverse, with more than 209 distinct ethnic identities reported by residents between 2010 and 2019. Major ethnic groups include Biak (including Biak-Numfor, Numfor), Maya (including Sailolof, Sawati, and Samate), and Waigeo (including Ambel, Amber). There are small minorities of individuals reporting ethnic identities associated with other communities in Papua Barat, Papua and Maluku Provinces.

The majority of coastal households resident in the BHS MPA Network rely on agriculture as their primary occupation (37.37% of households surveyed). Typically, these households grow crops such as sweetcorn (maize), soybeans, cassava, and sweet potatoes on small plots, both for subsistence (home consumption) and to generate cash income (Firman & Azhar, 2006). Primary occupations other than agriculture among the resident households surveyed were other salaried labour (30.64%) and marine capture fisheries, (26.27%), while a small minority (5.72%) had other occupations. The proportion of households reliant on fisheries as their primary source of income was highest in Teluk Cenderawasih National Park (37.05%) and lowest in South and East Misool (16.03%) and Kofiau-Boo Islands (13.14%).


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1.4. Marine Resource Use

Approximately one quarter (25.37%) of households in the BHS MPA Network rely on marine capture fisheries as their primary occupation (i.e. the most important way to fulfil household needs). An additional 35.53% of households in the BHS MPA Network rely on fishing as a secondary occupation, supplementing other income-generating activities (e.g. agriculture). Overall, nearly two-thirds of coastal households in the MPA Network are substantially reliant on marine fisheries to meet their basic livelihood needs.


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Fishing activity is highly variable, with 32.85% of households fishing several times per week, while only 6.54% of all households fish infrequently (e.g. once in six months or never). Households resident in Teluk Cenderawasih National Park fish most frequently, with 7.9% of households fishing several times per week. Kofiau-Boo Islands MPAs had the lowest frequency of fishing activity, with only 3.95% of households fishing several times a week.

Hand-held gear (e.g. gleaning equipment, hook and line, and spear guns) are the most commonly used fishing gear in the BHS MPA Network, with 64.85% of households choosing such gears as their primary fishing gear. Key target species include groupers (Family Serranidae), snappers (Family Lutjanidae), sea cucumbers or trepang (Holothuroidea) and Spanish mackerels (genus Scomberomorus).

Fishing effort varies with the seasons and is highly dependent on sea conditions. The fishing seasons vary between the MPAs within the BHS. The low season for fishing in the Raja Ampat MPA is from June to August, due to the rough sea conditions associated with the southeast monsoon which are not conducive to fishing. Conversely, in the Teluk Cenderawasih National Park the months from June to August are favourable for fishing.

1.5. Marine Resource Dependency

Although fishing is not the primary occupation of the majority of coastal households in the BHS MPA Network, marine resource dependence is relatively high with approximately 25.37% of households are dependent on marine capture fisheries for their everyday needs. Fishing generates most of the cash income received by 19.89% of households in the BHS. Marine fisheries also make a substantial contribution to the dietary intake and nutrition of local people, with around half of households surveyed (49.68%) eating fish several times a week. Even more importantly, 48.28% of households obtain most of their daily protein intake from fish or other marine animals. This may indicate limited alternative protein sources or a strong cultural preference for fish. The dependency of households on fish as a source of protein varied between the MPAs within the BHS. For example, in the South and East Misool MPA relatively few households (29.49%) rely on fish for their protein intake. In contrast, households in the Teluk Etna MPA had the highest dependency, with almost all their protein intake coming from fish and other marine resources.

1.6. Ecological Context

The BHS MPA network supports extensive and highly diverse coral reef ecosystems, including more than 600 species of coral, and more than 1,700 coral reef fish species (Mangubhai et al., 2012). At the same time, the region also contains some of the world's most extensive mangrove forests and seagrass beds, as well as globally important leatherback turtle (Dermochelys coriacea) nesting beaches, used by the majority of turtles in the Western Pacific region (Mangubhai et al., 2012).

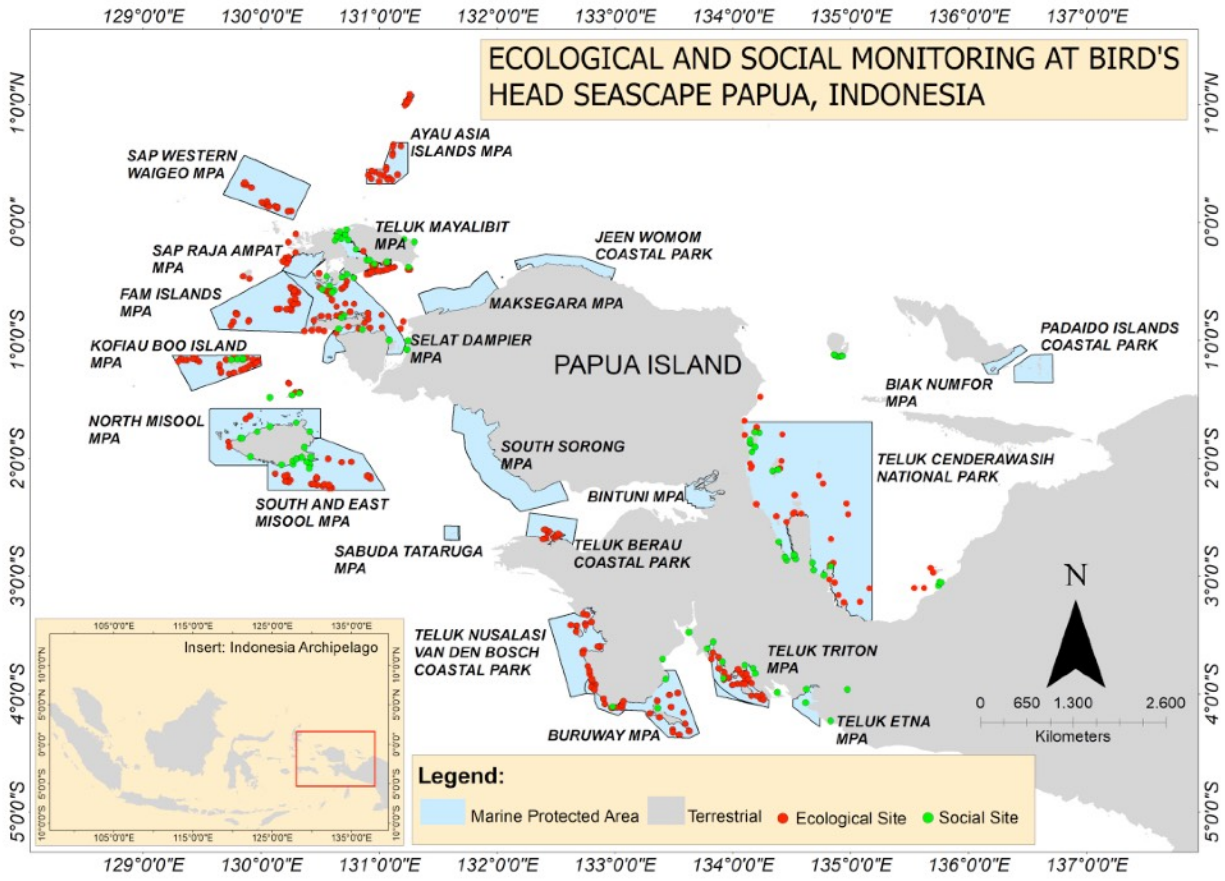
The BHS MPA Network provides critical habitat for many species of conservation concern, including 17 recorded cetacean species and many species of shark and ray (Mangubhai et al., 2012). Of the 154,881 ha of coral reefs and 49,976 ha of mangrove habitat within the BHS MPA Network, approximately 24% of coral reefs and 34% of mangroves are covered by no-take zones. In 2016, the average critical habitat score for MPAs within the BHS network was 88 (out of a possible 100), based on MPA guideline targets of protecting a minimum of 20% of critical habitat within no-take zones (DeVantier et al. 2009). Critical habitat scores ranged from 36 to 100, with seven MPAs scoring 100.

1.7. State of the Bird's Head Seascape MPA Network Report

This report provides a scientific assessment of the status and trends of key ecological and social conditions across the Bird's Head Seascape MPA Network, as well as documenting the social and ecological status of each individual MPA. The first State of the Bird's Head Seascape MPA Network report was published in 2015 (Glew et al., 2015), and concluded that six of the nine key indicators of ecosystem health and human well-being with sufficient data (between 2010 and 2015) to allow the analysis of trends over time were either stable or increasing at the Seascape level. Similarly, World Bank Scorecard management assessments indicate that in general, management effectiveness of MPAs is slowly improving over time. The State of the Bird's Head Seascape MPA Network Report also covers the management effectiveness status of each MPA.

Information from the most recent State of the Bird's Head Seascape MPA Network report published in 2016 (Ahmadia et al., 2016) has been presented in several forums, including the annual BHS meeting in 2018. Detailed summaries for each individual MPA have also been disseminated to complement the seascape level report. The reason for producing reports at different spatial scales was to support and guide MPA management strategies from local to regional levels of governance. In this edition we have updated the study results presented in the 2016 BHS Status Report through the inclusion of ecological and social data collected between 1st January 2017 and 30st November 2019.

2. MONITORING IN THE BIRD'S HEAD SEASCAPE MPA NETWORK



Map of monitoring Ecology and Social at BHS

Since 2008, local universities, government agencies, and non-governmental organisations (NGOs) have worked together to develop rigorous methods to monitor the ecological and social conditions in the Bird's Head Seascape MPA Network. The partner organizations (University of Papua, Conservation International, Yayasan Konservasi Alam Nusantara as the local affiliate of the The Nature Conservancy, and the World Wildlife Fund) conduct scientific monitoring of coral reef conditions in nine MPAs, and human well-being in eight MPAs across the Seascape. The partners also monitor the management effectiveness of 14 Bird's Head Seascape MPAs and document marine resource governance in eight MPAs. This report, which will be updated on a regular basis, provides a scientific assessment of the current status and trends of key ecological and social conditions across the Seascape's MPA network, and documents the management status of each MPA. In this section, we briefly outline the monitoring protocols used to generate the data synthesized in this report.

2.1. Ecological Monitoring

Bird's Head Seascape MPA Network Ecological Monitoring Program is a partnership between Conservation International, Yayasan Konservasi Alam Nusantara as local affiliate of The Nature Conservancy, the World Wide Fund for Nature (Indonesia), the World Wildlife Fund (United States of America), and the University of Papua. Since 2010, the partnership (initially CI, YKAN-TNC, WWF) has implemented ecological monitoring in twelve MPAs or MPA networks (Kaimana MPA Network: Buruway and Teluk Triton MPA Network; Raja Ampat Marine Tourism Park MPA Network: Asia and Ayau Islands, Teluk Mayalibit MPA; Selat Dampier MPA; Misool Islands MPA; Kofiau-Boo Islands MPA; Fam Islands MPA; SAP Western Waigeo; Teluk Cenderawasih National Park; Teluk Nusalasi Van Den Bosch Coastal Park and Teluk Berau). Ecological monitoring focuses on two components of the coral reef ecosystem: fish populations (density and biomass) and benthic cover (percentage cover). Ecological MPA monitoring takes place every 2-3 years following the protocol of Wilson and Green (2009) as updated by Ahmadia et al. (2013).

In this report, we have analysed the data on three ecological indicators, i.e. coral reef condition key fishery species populations, and herbivorous fish populations, which were used to evaluate management targets, to inform policy makers, and to serve as indicators of ecosystem health and fish populations. These indicators are aligned with indicators used in the Indonesian MPA Management Assessments Guidelines (Directorate for Spatial and Fish Species Conservation, 2012). Other criteria can also be included as ecological indicators; e.g. differences in trophic and functional

groups, life-histories, and home-ranges. Based on these criteria the BHS ecological monitoring program chose to focus on the following indicators:

Coral reef fisheries: these artisanal or small-scale fisheries are traditional fisheries involving fishing households (as opposed to commercial companies), using a relatively small amount of capital and energy, relatively small fishing vessels (if any), making short fishing trips, close to shore, with most of the fish catch consumed locally. Artisanal fisheries may also feed into commercial supply chains, through fish traders, providing products for local consumption or export (FAO, 2015).

Indicators: Key fisheries species (Fish families: Lutjanidae (snappers), Haemulidae (sweetlips), and Serranidae (groupers)}.

Reef resilience and ecosystem function: ecological resilience can be defined as the capacity of an ecosystem to absorb recurrent disturbances or shocks and adapt to change while retaining essentially the same ecosystem function and structure (Holling 1973, McClanahan et al. 2012)..

Indicators: Fish functional groups (Fish Families: Acanthuridae (surgeonfishes, tangs, and unicornfishes), Scaridae (parrotfishes), Siganidae (rabbitfishes))

Coral reef condition: the composition or condition of the coral reef benthic community (substrate) influences “bottom up ecological processes” and has cascading effects on the dynamics and function of the entire reef ecosystem. Stony or “hard” (scleractinian) reef building corals make up a substantial proportion of a coral reef’s three-dimensional structure providing critical habitat for many reef-dwelling organisms.

Indicator: hard coral cover (%)

2.2. Social Monitoring

The Bird’s Head Seascape MPA social monitoring program is a partnership between the University of Papua, Conservation International, and World Wildlife Fund (US). Since 2010, the partnership has monitored human well-being in eight MPAs (Buruway MPA, Kofiau-Boo Islands MPA, South and East Misool MPA, Selat Dampier MPA, Teluk Cenderawasih National Park, Teluk Etna MPA, Teluk Mayalibit MPA, and Teluk Triton MPA) spread across four districts in West Papua and Papua. The University of Papua has conducted household surveys in a representative, random sample of households resident within the MPA boundaries, collecting data on economic well-being, health, empowerment, education, and culture. Some MPAs were monitored in 2010, 2012, 2014, and 2017; in 2011, 2013, 2015, and 2018; or in 2012, 2014, 2016, and 2019. Baseline data were collected between 2010 and 2012. From now on, the MPAs will be monitored every three years. In this report, we synthesize data on five attributes of human well-being commonly identified in human development policy goals. One leading indicator has been selected for each of these dimensions as follows:

Economic well-being: the resources people use to meet basic consumption and material needs, and access to other sources of well-being (Sen, 1999).

Indicator: Household material assets

Health: a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity (World Health Organization, 1946).

Indicator: Household food security

Empowerment: people’s ability to participate in the decision-making processes that affect their lives (United Nations Development Program et al., 2005)

Indicator: Household marine tenure

Education: the structures, systems, and practices used to transfer knowledge and skills in a society (Stephanson & Mascia, 2009).

Indicator: School enrolment rate

Culture: encompasses art, ways of living together, value systems, traditions, and beliefs (UNESCO, 2001).

Indicator: Place attachment.

2.3. Management Assessments

In the Bird's Head Seascape, there are two tools currently used to assess MPA management: the World Bank Scorecard (World Bank, 2004) and the 'E-KKP3K': Technical Guidelines for Evaluating the Management Effectiveness of Aquatic, Coastal and Small Island Conservation Areas (Directorate for Spatial and Fish Species Conservation, 2012). The World Bank Scorecard has been used to assess MPA management in the BHS MPA Network since its establishment, allowing users to track changes in MPA management over time and to make global comparisons among MPAs. The E-KKP3K was developed by the Indonesian Ministry of Marine Affairs and Fisheries (MMAF) in 2013. The E-KKP3K provides a standardized assessment across Indonesia as a guide to help the MMAF develop management strategies and set priorities.

World Bank Scorecard: The World Bank Scorecard was specifically developed to assess progress in achieving management goals for marine protected areas. These management assessments were conducted annually until 2017 in ten MPAs Kaimana MPA Networks: Buruway MPA and Teluk Triton MPA; Raja Ampat Marine Tourism Park: Asia and Ayau Islands MPA, Teluk Mayalibit MPA, Selat Dampier MPA, Kofiau and Boo Islands MPA, South and East Misool MPA; SAP Western Waigeo; Teluk Cenderawasih National Park, and Jeen Womom Coastal Park. In 2019, assessments were also carried out in the Fakfak MPA, South Sorong MPA, and North Misool MPA

In this report, we synthesize data on the six distinct stages of 'good protected area management': (1) context, (2) planning, (3) inputs, (4) processes, (5) outputs, and (6) outcomes. We report the total score across these elements.

E-KKP3K: The E-KKP3K was specifically developed to: (1) evaluate the management of marine conservation across Indonesia; and (2) serve as a set of guidelines for self-evaluation of the management of a particular marine conservation area, and for making plans to improve management. These management assessments have been carried out annually in the Kaimana MPA Network, Raja Ampat MPA, Jeen Womom Coastal Park, and Teluk Cenderawasih National Park. In 2018 they were also carried out in the South Sorong and North Misool MPAs and the Fakfak MPA Network.

In this report we synthesise the data to determine the management effectiveness "level" of each MPA. The MPAs are classified based on a five level scale: Level 1 (Red), Level 2 (Yellow), Level 3 (Green), Level 4 (Blue), and Level 5 (Gold). Classification is determined by the responses given to 74 questions posed to managers. The parameters used include the status of the MPA's institutions, management and zoning plans, and infrastructure.

2.4. Monitoring the Governance of Marine Resources

In addition to monitoring human well-being, the Bird's Head Seascape MPA social monitoring program monitors patterns and trends in marine resource governance in selected MPAs (Kaimana MPA Network, Kofiau-Boo Islands MPA, South and East Misool MPA, Selat Dampier MPA, Teluk Mayalibit MPA, and Teluk Cenderawasih National Park) across four districts in West Papua and Papua Province.

Marine resource governance establishes the processes by which marine resources are managed, including how authority for making decisions is allocated; how management decisions are made; and how management decisions are enforced (Mascia et al., 2017). Marine resource governance can influence the social and ecological outcomes of policy interventions (Persha et al., 2011; Fox et al., 2012) such as MPAs, and successful governance regimes have been found to have shared characteristics (Ostrom et al. 1990). These include participatory decision-making arrangements, context-dependent rules, active and accountable systems for monitoring and enforcement, and accessible conflict resolution mechanisms (e.g., low-cost, rapid processes for resolving disagreements which can be implemented at the local level).

The University of Papua (UNIPA) has been conducting focus group discussions and key informant interviews in each monitored settlement to understand marine resource governance in each MPA. The focus group discussions (FGDs) and key informant interviews focus on how decisions are made, the rules governing the use of marine resources, how the marine resource rules are monitored and enforced, and how conflicts over marine resources are resolved.

Focus groups and key informant interviews are conducted in Some MPAs were monitored in 2010, 2012, 2014, and 2017; in 2011, 2013, 2015, and 2018; or in 2012, 2014, 2016, and 2019. Baseline data were collected between 2010 and 2012. From now on, the MPAs will be monitored every three years. This process provides a comprehensive assessment of marine resource governance every four years. In this 2019 report, we have documented the marine resource governance status and trends based on data from 148 FGDs. We synthesized data on four key attributes of marine resource governance in the seascape as follows:

Participation:

Indicator: User group participation in decision-making

Resource Use Rules:

Indicator: Context-dependent rules

Monitoring and Enforcement:

Indicator: Graduated sanctions

Conflict Resolution:

Indicator: Accessible conflict resolution mechanisms

2.5. Interpreting the Bird's Head Seascape MPA Network Status Report

The State of the Bird's Head Seascape MPA Network report documents the status and trends in ecological and social conditions over time. Observed changes to ecological and social conditions over time may be caused by many different social and ecological processes. For example, a change in live coral cover (an important indicator of coral reef health) may be linked to changes in fishing pressure, natural variation in fish populations, the impacts of disturbance (e.g. coral bleaching) or MPA establishment – or a combination of these factors. Similarly, changes in household food security may be due to economic growth, extreme weather events affecting the availability of key foods, fuel price fluctuations, MPA establishment or a combination of these factors. Without additional data, these alternative explanations may be equally plausible.

In this report, we interpret the trends in ecological and social conditions by describing the possible explanations for the patterns observed in the data. As we only monitor conditions within MPAs, we cannot conclusively state that MPA establishment caused these trends. Instead, we provide subjective assessments to interpret our findings, based on expert judgment about the relative plausibility of alternative explanations for each trend. Consequently, positive trends in ecological and social conditions should not be interpreted as positive MPA impacts. Similarly, negative trends should not be interpreted as negative MPA impacts.

To understand whether MPAs cause the changes in social and ecological conditions, the Bird's Head Seascape monitoring program is also monitoring conditions in similar non-MPA control areas (using the same standard protocols used in the MPAs). By monitoring changes over time both inside the MPAs and in the corresponding control settlements and coral reef habitats not affected by MPA establishment, we should be able to determine which social and ecological changes are directly caused by MPA establishment - and which changes are caused by other processes (e.g., market shifts, natural disturbances). We expected to be able to provide data on the short-term social and ecological impacts (i.e. the changes in social conditions due to MPA establishment and/or implementation) in early 2020. We now expect that future reports will contain information on MPA impact.

2.6. Understanding and Interpreting Uncertainty

- Characterizing Uncertainty

Scientific monitoring always involves uncertainty. Uncertainty may occur at each step of the monitoring process - from developing methods to data collection, analysis and interpretation. Some uncertainties (e.g., measurement error) are easily documented and quantified, while others remain unknown (e.g., whether an indicator is an accurate representation of an unknown, true state). The relative magnitude of uncertainty can be quantified through statistical analysis or other techniques.

- Treatment of Uncertainty in the State of the BHS MPA Network Report

For each finding in this report, we provide the likelihood term in quotation marks (e.g. "virtually certain") and the exact probabilistic likelihood in parentheses. For example, if there is less than 1% chance that the trends documented for a specific indicator would arise by chance alone, we describe the trend as "virtually certain" (P = 0.01). Here, the p-value expresses the probability of obtaining a result equal to, or more extreme than what was actually observed in the data.

In this report, we adopt the Intergovernmental Panel on Climate Change's (IPCC) standard classification for describing quantified measures of uncertainty (IPCC, 2013). Based on statistical analysis of monitoring data, we express a probabilistic likelihood (i.e. the chance that a specific trend or outcome would occur) to describe the conditions and trends in the Bird's Head Seascape MPAs (Table 2.1).

Likelihood terminology (Table 2.1.)

Term used	Likelihood of the outcome	Associated probabilistic likelihood (P value)
Virtually certain	99-100%	p< 0.01
Extremely likely	95-100%	p< 0.05
Very likely	90-100%	p< 0.1
Likely	66-100%	p< 0.33
About as likely as not	33-66%	p> 0.33 and < 0.66
Unlikely	0-33%	p> 0.66
Very unlikely	0-10%	p> 0.90
Exceptionally unlikely	0-1%	p> 0.99

Note:
The categories under 'Likelihood of the Outcome' are not mutually exclusive, and reflect standard scientific convention when reporting a probabilistic likelihood.

2.7. Understanding and Interpreting Figures

The State of the Bird's Head Seascape MPA Network Report synthesizes monitoring data on the status and trends over time for key ecological, social, and management conditions in the Seascape's MPAs (e.g. Teluk Cenderawasih National Park, Kaimana MPA Network, Raja Ampat MPA Network). For each key ecological, social, and marine resource governance or management indicator, the dashboard provides an assessment of current status and trends.

MPA STATUS

We document the status of each indicator in the most recent monitoring year, relative to the average conditions observed in monitored MPAs across the Seascape at baseline (i.e. the time when the MPA was first monitored). We classify current status into three broad categories (see Figure 2.1), as follows:

- **High:** conditions observed during the most recent monitoring year are substantially higher than the average conditions observed in monitored Seascape MPAs at baseline. We define this as current conditions exceed mean Seascape baseline conditions plus one standard error.
- **Medium:** conditions observed during the most recent monitoring year are within the same range as the average conditions observed in monitored Seascape MPAs at baseline. We define this as current conditions fall between the range bounded by mean Seascape baseline conditions plus or minus one standard error.
- **Low:** conditions observed during the most recent monitoring year are substantially lower than the average conditions observed in monitored Seascape MPAs at baseline. We define this as current conditions are less than the mean Seascape baseline conditions minus one standard error.

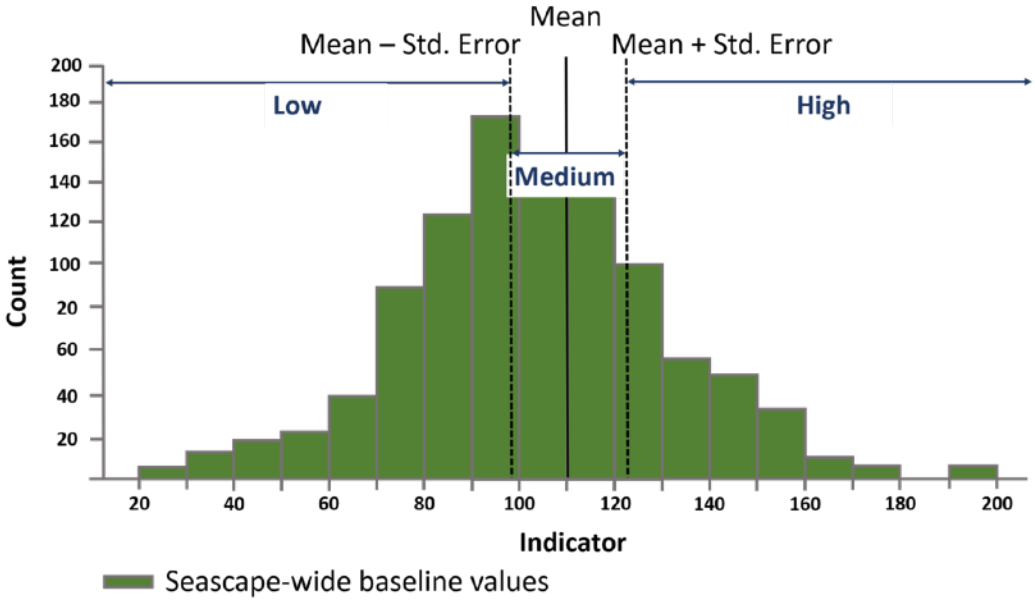


Figure 2.1. Classification of MPA Status

MPA TRENDS

We conduct statistical analysis on the trends in key social, ecological, governance and management conditions over time. We classify trends into four broad categories as follows:

- **Increasing:** average conditions observed in the particular MPA or MPA Network improved over the monitoring year.
- **Stable:** average conditions observed in the particular MPA or MPA Network did not change significantly during the monitoring year.
- **Decreasing:** average conditions observed in the particular MPA or MPA Network worsened over the monitoring year
- **No Data:** there are no or insufficient time-series data available to detect trends in a particular condition.

We describe the confidence level (Table 2.1) of the trends for all indicators, with the exception of the management effectiveness assessment, as follows:

Confidence Level	Description
Virtually certain	The chance of the change (increase or decrease) being observed if in fact there was no change in the indicator in question is less than 1% ($p<0.01$)
Extremely likely	The chance of the change (increase or decrease) being observed if in fact there was no change in the indicator in question is less than 5% ($p<0.05$)
Highly likely	The chance of the change (increase or decrease) being observed if in fact there was no change in the indicator in question is less than 10% ($p<0.1$)

We describe the confidence level (see Table 2.1) for the management effectiveness assessment as follows:

Confidence Level	Description
Virtually certain	There is an increase of more than 15% in the management effectiveness assessment score over the time period
Extremely likely	There is an increase of more than 10% in the management effectiveness assessment score over the time period
Highly likely	There is an increase of more than 5% in the management effectiveness assessment score over the time period

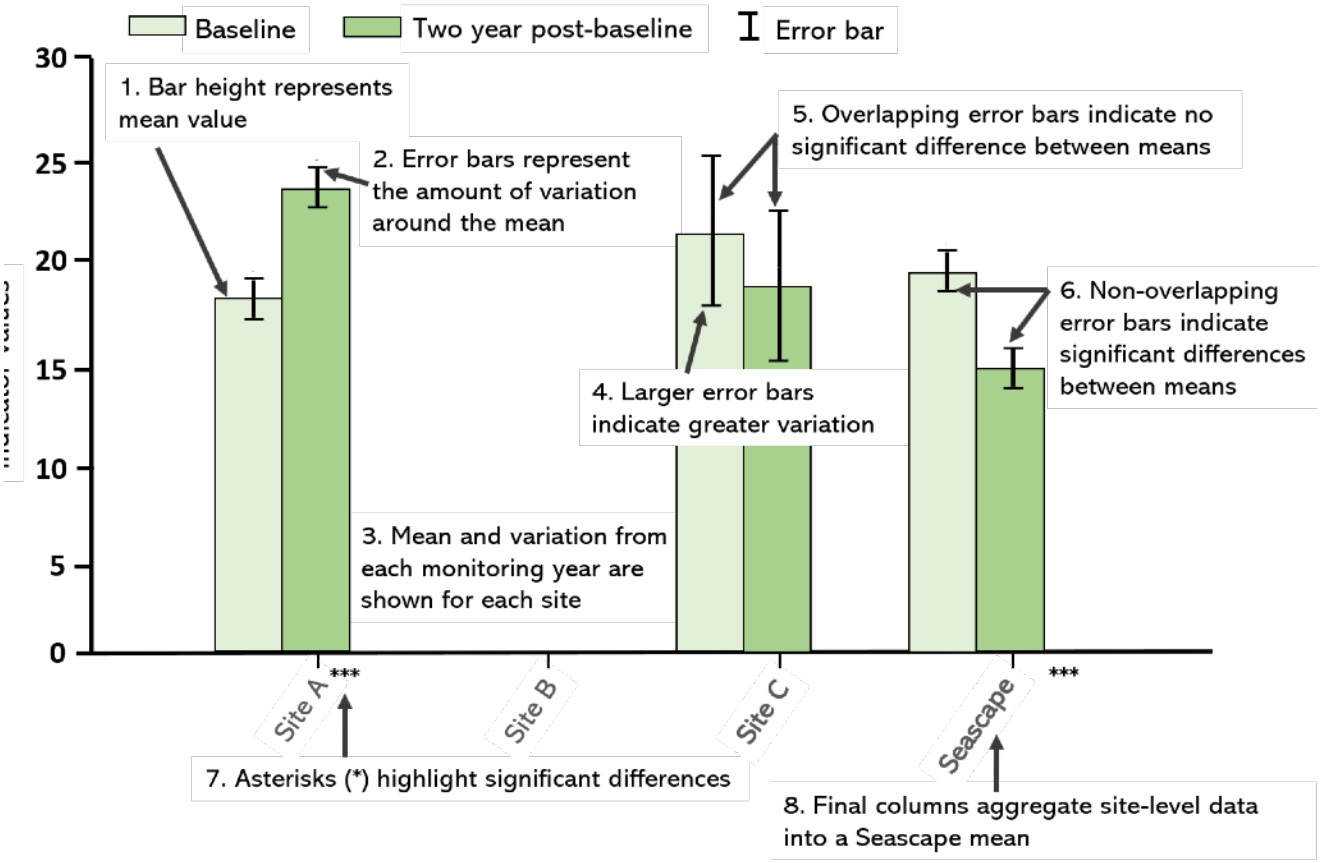
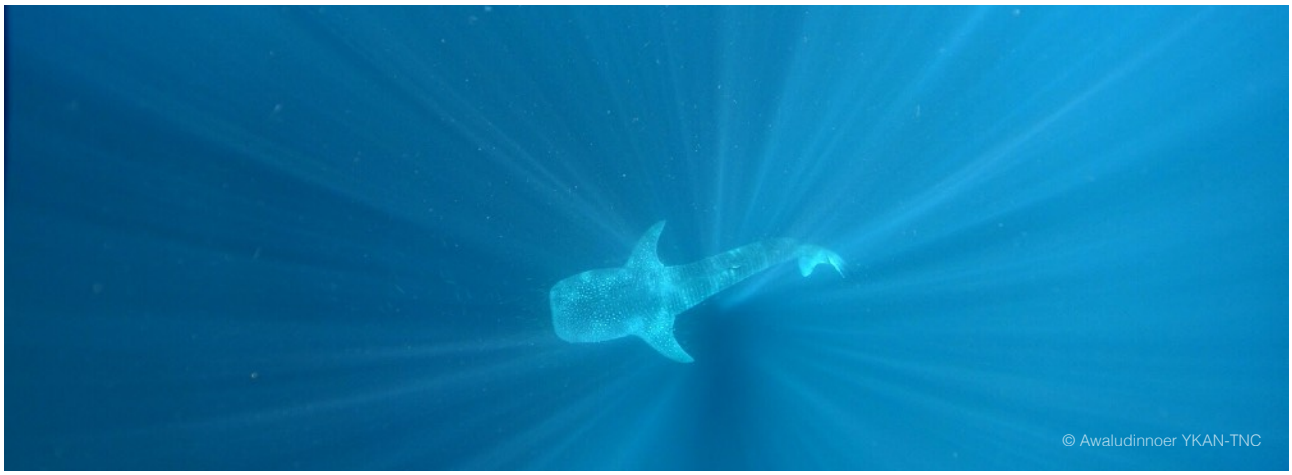


Figure 2.2. Understanding and Interpreting Figures

3. BIRD'S HEAD SEASCAPE MPA NETWORK DASHBOARD



	STATUS	RECENT TRENDS AND CONFIDENCE
ECOSYSTEM		
Benthic Composition Percentage live hard coral cover	H	↑ ***
Key Fisheries Species Biomass of key fisheries species	M	—
Fish Functional Groups Biomass of fish functional groups	L	—
HUMAN WELL-BEING		
Economic Well-Being Household material assets index	M	—
Health Food security index	H	↑ ***
Political Empowerment Marine tenure	L	↓ ***
Education School enrollent rate	H	↑ ***
Culture Place attachment index	L	↓ ***
MANAGEMENT		
World Bank MPA Score Card World Bank MPA management effectiveness score	H	↑ *
EKKP3K Indonesian management effectiveness score	H	↑ ***
GOVERNANCE		
Participatory Decision-Making Proportion of users actively participating in design of marine harvest rules	L	↓ ***
Resource Use Rules Proportion of important habitats subject to appropriation rule	L	↓ ***
Monitoring and Enforcement Number of sanctions employed to enforce compliance with appropriation rules	L	↓ ***
Conflict Resolution Mean time required to resolve conflict between users or users and officials	M	—

STATUS SCORE

H High M Medium L Low

RECENT TREND

↑ Increasing — Stable ↓ Decreasing

CONFIDENCE LEVEL

*** Virtually Certain
** Extremely Likely
* Very Likely

4. SYNTHESIS OF STATUS AND TRENDS IN THE BIRD'S HEAD SEASCAPE MPA NETWORK

4.1. Status and Trends in the BHS

The current status of ecosystem health, human well-being, MPA management and marine resource governance is variable in the Bird's Head Seascape MPA Network. At the Seascape level, two ecosystem indicators remain stable and one shows improvement. While ecological trends vary among MPAs, across the Seascape both hard coral cover and the biomass of fish functional groups show a slight increase. These trends suggest that coral reefs of the BHS MPA Network are on a better trajectory than many coral reef ecosystems globally (e.g. Jackson et al., 2014). However, although the percentage of corals affected is still low (<1%), coral diseases and coral bleaching were recorded, as well as sedimentation, algal domination of substrate cover at several sites, and predation of corals by COTS - Crown of Thorn Starfish (*Acanthaster plancii*); all these threats require serious consideration from the MPA managers. Continued progress in MPA management will be needed to sustain and improve ecological conditions across the Seascape, with particular emphasis on developing strategies to minimise the negative impacts of coastal development and tourism while enhancing fisheries management and mitigating the effects of climate change.

Trends in human well-being are highly variable across the Seascape, both between different human well-being domains and among the Seascape's MPAs. Household food security and school enrolment rates are continuing to increase. In contrast, household material assets and marine tenure are seeing variable trends across MPAs with declining trends in some MPAs and some recovery from earlier declines in others. Place attachment (i.e., the emotional connection between an individual and an MPA) showed modest declines but in the main it still remains high.

Trends in household food security and school enrolment varied greatly among the BHS MPAs, suggesting that regional-scale political, economic or social processes may be driving these changes, rather than finer local-scale dynamics. For example, the ability of households to access safe, nutritious and socially acceptable foods (as measured by house-hold scale food security) may be linked to Provincial and Regency Government policies (e.g., agricultural extension or programs to support education), as well as increasing assess to transportation, enabling the more remote communities to access markets and purchase wider diversity of foods. For the first time since monitoring records began in 2010, the average households in two BHS MPAs (Selat Dampier and Teluk Triton) are classified as food secure, meaning that they do not experience concerns about accessing sufficient, safe and nutritious food for their families.

Similarly, government policies and investments in education within the BHS may be linked to the ongoing increase in school enrolment, which is now at a high level. The changes in average school enrolment rate from 2010 to 2019 range from 0.33% in the Selat Dampier MPA and South and East Misool MPA to 4% in Teluk Cenderawasih National Park. Indeed, school enrolment rates in Teluk Cenderawasih National Park increased faster than the Indonesian national average (0.99%).

The factors influencing the observed fluctuations in economic well-being (as measured by household material assets) varied between households living in the BHS. Factors mentioned by survey respondents as drivers of the changes in their economic well-being included bad weather conditions; a reduction in time spent at sea because of participation in village level activities or organisations; distance to markets, affecting the frequency of opportunities to sell and transportation costs; reductions in the selling price of their produce (both fisheries catch and plantation harvests); household income limited to working on plantations and gathering forest products; dependence on development programs and government assistance; education and health needs of family members; inability to work due to age; and social contributions such as dispute resolution or customary fines and religious activities

In contrast to the decreasing trend in household marine tenure reported in the 2016 State of the Bird's Head Seascape MPA Network Report (Ahmadia et al. 2016), marine tenure (measured as the number of rights a household exercises over marine resources in the 12 months prior to survey) is beginning to increase across many BHS MPAs. This is mainly due to a 22% increase in the proportion of households exercising the right to harvest marine resources between the two most recent monitoring years (year 4 and year 7 monitoring). While we cannot conclusively identify the processes generating this trend, it may be that the reallocation of fishing rights linked to MPA establishment lead to a short-term decline in the proportion of households exercising their rights over marine resources. However, these declines may only have been short-lived, as an increasing proportion of households were once again exercising their rights to access and harvest resources from the MPAs during the most recent monitoring period (2017-2019)

World Bank Scorecard management effectiveness assessments indicate that, in general, MPA management is continuing to improve, although the rate of improvement varies among MPAs within the BHS. The highest scores were observed in the Raja Ampat MPA Network, with Misool Islands MPA achieving the highest management score in the Seascape. There was a substantial improvement in management score between 2018 and 2019 in the SAP Western Waigeo. As of 2019, the MPA with the lowest management effectiveness score was the North Misool MPA. World Bank scorecard assessments were conducted for the first time in five MPAs: the Nusalasi Van Den Bosch Coastal Park, the Fam Islands MPA, the North Misool MPA, the SAP Raja Ampat and the Sorong Selatan MPA.

Management assessments were also conducted using the E-KKP3K standards. The evaluation level for the Raja Ampat MPA Network is Green (Conservation Area Minimally Managed). This network will move to level four (Blue, Optimally Managed) when zoning boundaries are installed. The North Misool MPA is at the Red level (Conservation Area Initiated) and will achieve the 100% initiated level once the MPA initiation documents are submitted to the central government together with proofs of the support and coordination of the relevant agencies and the results of an identification and inventory study for the MPA.

Participation in marine resource management (user group participation in determining marine harvest rules) varied between the BHS MPA Networks, with levels lower than in the first yearly survey in almost all MPAs. This relatively low participation may be linked to many influencing factors. Factors such as MPA size; the number of settlements; and the intensity of efforts to engage communities in determining the rules regulating marine resource use are all thought to have contributed to the low level of community participation in determining resource use regulations.

The proportion of important species and habitats subject to specific regulations also varied between the MPAs in the BHS. The proportion of habitats with one or more resource use rules increased compared to the baseline year in Buruway MPA, Teluk Etna MPA, Selat Dampier MPA and Teluk Mayalibit MPA. Significant increases of 26.47% and 32.06%, respectively, occurred in Selat Dampier MPA and Teluk Mayalibit MPA. Habitats with specific regulations in place by or during 2017-2019 were corals and coral reefs, mangroves, mudflats, sandy substrates and seagrass beds.

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The time spent on marine resource conflict resolution varied greatly between MPAs in the BHS. The average conflict resolution time increased to around 15 and 10 days respectively in Buruway MPA and Teluk Etna MPA, but decreased from 15 to around 2-3 days in Selat Dampier MPA. Despite these changes in individual MPAs, the time currently spent on conflict resolution over the BHS as a whole is still similar to that recorded during the baseline data collection period.

The reason for this is that in most of the villages where FGDs were held there were no conflicts, or if there were any then they were resolved through amicable means.

On average, 3 sanction types were employed to enforce compliance with marine resource use rules in the Seascape during the monitoring period. The most common types of sanctions were verbal warnings, the seizure of assets and fines, which were reported as possible penalties in 27.30%, 19.58%, and 18.40% of focus discussion groups respectively. Overall, the number of sanctions handed out declined significantly at the BHS level, and the sanction status was generally low. There are two possible reasons for this decline in sanctions. On the one hand, it could be due to an improvement in surveillance effectiveness in the majority of the MPAs (i.e. monitoring and enforcement of regulations became very efficient in the early stages of MPA initiation and implementation, so that people tend to obey the regulations in vigour). On the other hand, to could be that the amount or level of surveillance in the BHS MPAs has decreased, so that the number of sanctions imposed also decreased. A more in-depth analysis is needed to determine the reason(s) for the decline in sanctions across the BHS MPA Network.

4.2. Caveats and Limitations

The Bird's Head Seascape MPA Network monitoring program continues to mature, improving from year to year; however, limitations remain in our ability to detect change in social and ecological conditions. Monitoring of ecological conditions across the Seascape began in 2007, while monitoring of social and marine resource governance began in 2010. Consequently, the available time-series of ecological and social data is short in comparison with the timescales over which many ecological, economic, political and social processes occur. This, coupled with the natural variability of social and ecological systems, can limit the ability to detect change within the BHS MPA Network. For example, the lag time needed to detect an ecosystem level response to the establishment of MPAs exceeds the lifespan of the BHS monitoring program. Similarly, for long-lived marine species, we may not see large changes in populations for several decades or longer after protection began.

Monitoring populations of highly mobile fish species poses additional challenges. For example, reef areas with very high fish populations (sometimes described as 'fishy sites') are often not monitored in the BHS ecological monitoring program because of the difficulty in accurately recording fish populations when they occur in large aggregations. Despite these limitations, we would expect to detect increases in fish biomass outside these 'fishy sites', due to the movement of fish to neighbouring reef sites (a process known as spill-over).

5. KEY INDICATOR STATUS AND TRENDS

5.1. Ecosystem Health

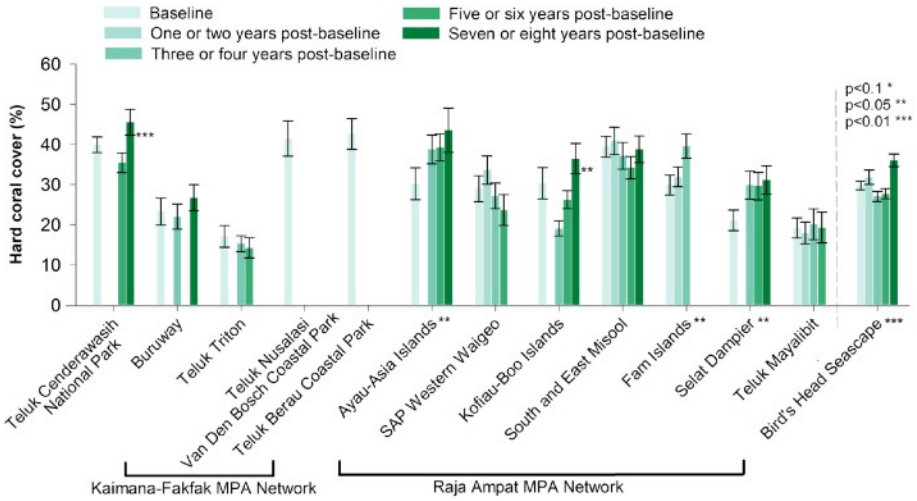


Figure 5.1. Percentage Coral Cover

Note: Significance stars above bars indicate significant differences between the two most recent monitoring surveys for an MPA, while significance stars with the MPA name below the x axis indicate overall significant trends through all years of monitoring. Years of baseline survey and subsequent monitoring for each MPA: Teluk Cenderawasih National Park: 2011, 2016, 2018; Buruway Management Area: 2012, 2015, 2019; Teluk Triton Management Area: 2013, 2016, 2019; Nusalasi Van Den Bosch Bay Coastal Park MPA: 2018; Ayau Asia MPA: 2010, 2014, 2016, 2018; SAP Western Waigeo: 2012, 2014, 2016, 2018; Kofiau-Boo Islands MPA: 2010, 2014, 2016, 2018; Misool Islands MPA: 2011, 2013, 2015, 2017, 2019; Fam Islands MPA: 2015-2016, 2017-2018, 2019; Dampier Strait MPA: 2010, 2014, 2016, 2018; Teluk Mayalibit MPA: 2012, 2014, 2016, 2018

- It is "virtually certain" ($p < 0.01$) that hard coral cover across the Bird's Head Seascape MPAs changed during the monitoring period. Initial baseline surveys for each MPA showed average hard coral cover of 30 ± 1% (mean ± SE) across the BHS. The most recent surveys in MPAs across the BHS around five-six years later indicate hard coral cover of 36 ± 2%. This increase in coral cover is a sign of good ecosystem health and management success in the Bird's Head Seascape, and contrasts with widespread declines in coral cover around the world (e.g., Jackson et al., 2014).
- It is "virtually certain" ($p<0.01$) that hard coral cover increased in Teluk Cenderawasih National Park from 2016 to 2018). Hard coral cover was 40 ± 2% in baseline surveys in 2011, declined to 35 ± 2% in 2016, and increased to 46 ± 3% in 2018. Attributing drivers to such rapid changes in hard coral cover is difficult but the results suggest that the benthic communities of Teluk Cenderawasih National Park are healthy.
- It is "extremely likely" ($p<0.01$) that hard coral cover increased in the Kofiau-Boo Islands MPA between 2016 and 2018. Coral cover was 30 ± 4% in baseline surveys in 2010, before declining to 19 ± 2% in 2014, and then steadily increasing to 26 ± 2% in 2016 and 36 ± 4% in 2018. It is suspected that the decline in coral cover in Kofiau-Boo Islands between 2010 and 2014 is related to destructive fishing practices (e.g. blast fishing) which were widely observed during this period within the MPA, as well as several severe storms and large waves which damaged many

branching and table corals. The most recent survey results suggest the reefs of the Kofiau-Boo Islands MPA are recovering from these impacts.

- It is "extremely likely" (p=0.01) that hard coral cover increased in the Fam Islands MPA between 2015 and 2018. Coral cover was 30 ± 2% in baseline surveys in 2015-2016, increased to 32± 2% by 2017-2018, and increased again to 40 ± 3% by 2019. It is thought that this increase in coral cover is due to the consistent security patrol activities as well as the increased community awareness, and has lead to the proposal of the Fam Islands as a new MPA, declared under Decree of the Governor of West Papua (SK No. 523/195/10/2017) in 2017.
- It is "extremely likely" (p=0.03) that hard coral cover in Selat Dampier MPA increased over the monitoring period (2010-2018) compared to the baseline in 2010. Hard coral cover in the Selat Dampier MPA was 21 ± 3% in 2010, increasing to 30 ± 3% in 2014, remaining stable at 30 ± 3% from 2014 to 2016, with a slight increase to 31 ± 4% in 2018.

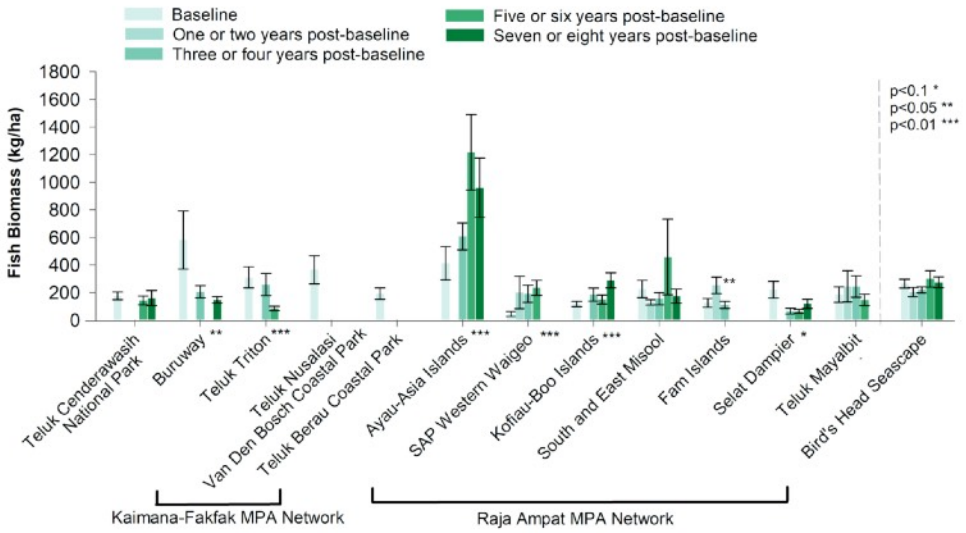


Figure 5.2. Biomass of Key Fisheries Species

Note: Significance stars above bars indicate significant differences between the two most recent monitoring surveys for an MPA, while significance stars with the MPA name below the x axis indicate overall significant trends through all years of monitoring. Years of baseline survey and subsequent monitoring for each MPA: Teluk Cenderawasih National Park: 2011, 2016, 2018; Buruway Management Area: 2012, 2015, 2019; Teluk Triton Management Area: 2013, 2016, 2019; Teluk Nusalasi Van Den Bosch and Teluk Berau MPAs: 2018; Ayau Asia MPA: 2010, 2014, 2016, 2018; SAP Western Waigeo: 2012, 2014, 2016, 2018; Kofiau-Boo Islands MPA: 2010, 2014, 2016, 2018; Misool Islands MPA: 2011, 2013, 2015, 2017, 2019; Fam Islands MPA: 2015-2016, 2017-2018, 2019; Dampier Strait MPA: 2010, 2014, 2016, 2018, 2019; Teluk Mayalibit MPA: 2012, 2014, 2016, 2018.

- It is "about as likely as not" (p=0.58) that key fisheries biomass across the Bird's Head Seascape MPAs remained unchanged during the monitoring period. Changes were identified in six of the MPAs, with three showing increases, and three showing declines in key fisheries biomass. Initial baseline surveys for each MPA showed mean key fisheries biomass of 265 ± 32 kg/ha (mean ± SE) across the BHS. The most recent survey for MPAs across the BHS, around seven to eight years after the baseline data were collected, gave a mean key fisheries biomass of 274 ± 39 kg/ha. Stable key fisheries biomass is a sign of good ecosystem health in the Bird's Head Seascape. This contrasts with the widespread declines in fish biomass reported for many of the world's reefs (e.g., Jackson et al., 2014).
- It is "virtually certain" (p<0.01) that key fisheries biomass increased in Ayau Asia MPA over the monitoring period from 2010 to 2018. Key fisheries biomass was 413 ± 121 kg/ha based on the baseline surveys in 2010, increasing to 607 ± 97 kg/ha in 2014 and 1,217 ± 274 kg/ha in 2016, before declining somewhat to 960 ± 215 kg/ha in 2018. It is thought that the increase in key fisheries biomass is due to the consistent efforts of the security patrols which deterred large scale fishing operations by fishers from outside the area.
- It is "extremely likely" (p=0.03) that key fisheries biomass increased in Western Waigeo MPA between 2012 and 2018. Key fisheries biomass increased from 45 ± 18 kg/ha in the 2012 baseline survey to 234 ± 54 kg/ha in 2018. It is thought that this increase in key fisheries biomass is due to the consistent efforts of the security patrols as well as intensive tourism, both of which deterred fishermen from fishing.
- It is "virtually certain" (p<0,01) that key fisheries biomass in the Kofiau-Boo Islands MPA increased between 2010 and 2018. The baseline key fisheries biomass in 2010 was 117 ± 18 kg/ha, rising to 185 ± 47 kg/ha in 2014, followed by a slight decrease to 150 ± 32 kg/ha in 2016 and increasing again to 289 ± 55 kg/ha in 2018. It is thought that the increase in key fisheries biomass is due to the consistent efforts of the security patrols which deterred large scale fishing operations by fishers from outside the area.

- It is “extremely likely” (p=0.02) that key fisheries biomass in the Fam Islands MPA changed between 2017-2018 and 2019. The baseline key fisheries biomass in 2015-2016 was 126 ± 32 kg/ha, increasing slightly to 253 ± 60 kg/ha in 2017-2018, and declining somewhat to 111 ± 26 kg/ha in 2019.
- It is “extremely likely” (p=0.03) that key fisheries biomass in the Kaimana MPA Buruway Management Area decreased from 2012 to 2019. The baseline key fisheries biomass in 2012 was 582 ± 211 kg/ha, decreasing to 206 ± 44 kg/ha in 2015 and decreasing further to 147 ± 24 kg/ha in 2019. It is thought that the decrease in key fisheries biomass is due to disruptions of the security patrol activities, enabling large scale fishing by fishers from outside the BHS, e.g. fishing vessels from Seram, Halmahera and Sulawesi.
- It is “virtually certain” (p<0.01) that key fisheries biomass in the Kaimana MPA Teluk Triton management area decreased from 2013 to 2019. From a baseline value of 311 ± 76 kg/ha in 2013 key fisheries biomass decreased to 259 ± 80 kg/ha in 2015 and further decreased to 86 ± 15 kg/ha in 2019. It is thought that the decrease in key fisheries biomass is due to disruptions of the security patrol activities, enabling large scale fishing by fishers from outside the BHS, e.g. fishing vessels from Seram, Halmahera and Sulawesi.
- It is “very likely” (p=0.099) that key fisheries biomass in the Selat Dampier MPA decreased from 2010 to 2018. From a baseline value of 221 ± 61 kg/ha in 2010, key fisheries biomass decreased to 66 ± 21 kg/ha in 2014 and further decreased to 64 ± 14 kg/ha in 2016, followed by an increase to 118 + 33 kg/ha in 2018. It is thought that the decrease in key fisheries biomass was due to fishing pressure from local communities seeking to fulfil the demand for foodfish in Sorong as well as to feed the tourists staying in the many homestays in the Selat Dampier MPA.

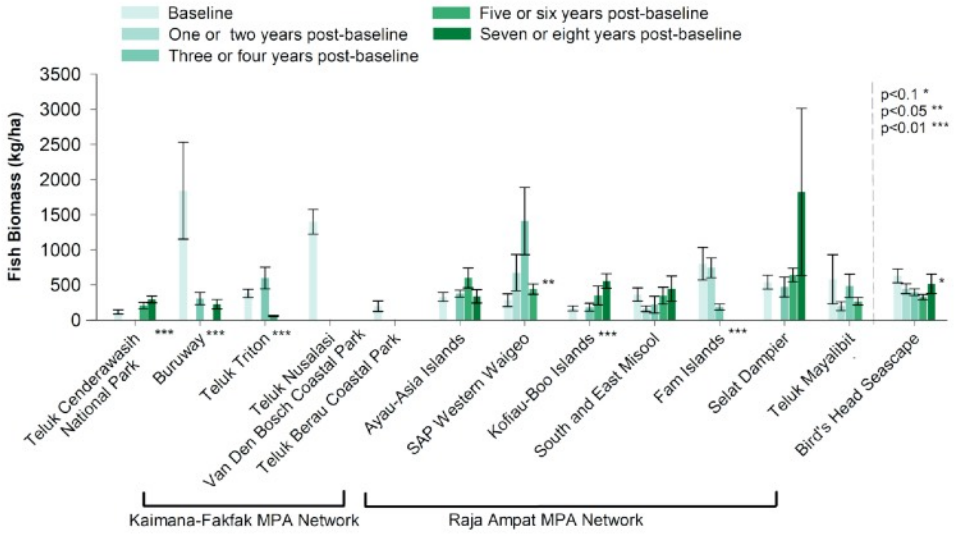


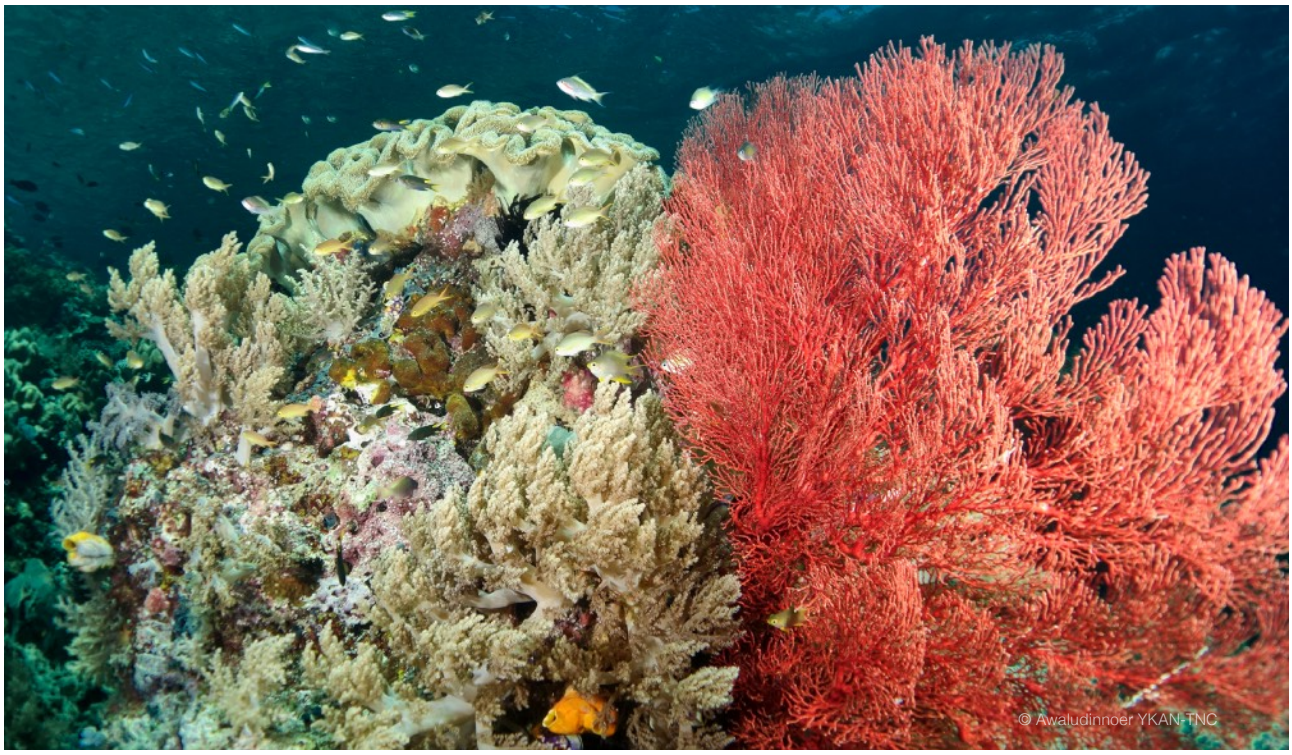
Figure 5.3. Functional Fish Group

Note: Significance stars above bars indicate significant differences between the two most recent monitoring surveys for an MPA, while significance stars with the MPA name below the x axis indicate overall significant trends through all years of monitoring. Years of baseline survey and subsequent monitoring for each MPA: Teluk Cenderawasih National Park: 2011, 2016, 2018; Buruway Management Area: 2012, 2015, 2019; Teluk Triton Management Area: 2013, 2016, 2019; Teluk Nusalasi Van Den Bosch MPA: 2018; Ayau Asia MPA: 2010, 2014, 2016, 2018; SAP Western Waigeo: 2012, 2014, 2016, 2018; Kofiau-Boo Islands MPA: 2010, 2014, 2016, 2018; Misool Islands MPA: 2011, 2013, 2015, 2017, 2019; Fam Islands MPA: 2015-2016, 2017-2018, 2019; Selat Dampier MPA: 2010, 2014, 2016, 2018; Teluk Mayalibit MPA: 2012, 2014, 2016, 2018.

- It is “very likely” (p=0.08) that functional fish biomass has increased across the Bird’s Head Seascape MPAs during the most recent monitoring period. Changes were identified in six MPAs, with three MPAs showing increases, and three showing declines. The baseline functional fish biomass across the BHS as a whole averaged 650 ± 103 kg/ha (mean ± SE). The most recent monitoring data, around six-seven years post-baseline, gave a functional fish biomass of 517 ± 139 kg / ha across all MPAs in the BHS. At the seascape level, an increase in functional fish biomass is a good sign of increasing ecosystem health in the Bird’s Head Seascape. This contrasts with the widespread declines in functional fish biomass reported for many of the world’s reefs (e.g. Jackson et al., 2014).
- It is “virtually certain” (p<0.01) that functional fish biomass increased between 2011 and 2018 in Teluk Cenderawasih National Park. Biomass was 115 ± 31 kg/ha in baseline surveys in 2011, increasing to 207 ± 46 kg/ha in 2016, and 294 ± 49 kg/ha in 2018. These increases fish functional group biomass are thought to be due to a decline in the capture of functional fishes as communities in the area tend to target key fisheries species (groupers and snappers) and pelagic fishes for both consumption and trade.
- It is “virtually certain” (p<0.002) that functional fish biomass increased in the Western Waigeo MPA between 2012 and 2018. In 2012, the baseline functional fish biomass was 282 ± 92 kg/ha, increasing to 675 ± 259 kg/ha in 2014 and 1,410 ± 478 kg/ha in 2016, followed by a decline to 441 ± 72 kg/ha in 2018. The increase in functional fish biomass up to 2016 is thought to be due to the consistent efforts of the security patrols as well as intensive tourism, both of which deterred fishermen from fishing in the MPA. Security patrol activities between 2016 and 2018 were disrupted

due to demands by the people of Saleo and Salpele Villages, as traditional owners of West Waigeo, for the distribution of the proceeds from the MPA tourist entrance fees. It is thought that this disruption enabled fishing activities within the MPA, resulting in the decline in fish biomass recorded in 2018.

- It is virtually certain ($p<0.001$)that between 2010 and 2018 functional fish biomass increased in the Kofiau-Boo Islands MPA. The baseline functional fish biomass in 2012 was 164 ± 35 kg/ha, rising to 183 ± 56 kg/ha in 2014, 351 ± 135 kg/ha in 2016, and 556 ± 103 kg/ha in 2018. It is thought that the increase in key fisheries biomass is due to the consistent vigilance of the security patrols, which has reduced the previously massive volume of fish caught by fishers from outside the Kofiau MPA, e.g. fishing vessels from Seram, Halmahera and Sulawesi.
- It is virtually certain ($p<0.005$) that functional fish biomass decreased between 2012 and 2019 in the Kaimana MPA Buruway Management Area. From a baseline of 1.841 ± 689 kg/ha in 2012, functional fish biomass had fallen to 307 ± 87 kg/ha by 2015 with a further decrease to 226 ± 66 kg/ha in 2019. It is thought that the decrease in key fisheries biomass is due to disruptions of the security patrol activities, enabling large scale fishing by fishers from outside the BHS, e.g. fishing vessels from Seram, Halmahera and Sulawesi.
- It is virtually certain ($p<0.001$) that functional fish biomass decreased between 2013 and 2019 in the Kaimana MPA Teluk Triton Management Area. From a baseline of 378 ± 59 kg/ha in 2013, functional fish biomass increased to 597 ± 154 kg/ha in 2015 then decreased sharply to 56 ± 9 kg/ha in 2019. The fluctuation and decline in functional fish biomass are thought to be related to the activities of the security patrols; when the security patrol activities were disrupted there was heavy fishing by fishers from outside the BHS, e.g. fishing vessels from Seram, Halmahera and Sulawesi.
- It is virtually certain ($p<0.005$) that functional fish biomass decreased between 2015-2016 and 2019 in Fam Islands MPA. From a baseline of 803 ± 231 kg/ha in 2013, functional fish biomass decreased to 744 ± 140 kg/ha in 2015 and decreased sharply to 185 ± 43 kg/ha in 2019. This decline in biomass is thought to be due to the catching of functional fish for local consumption.



5.2. Human Well-being.

5.2.1. Economic well-being.

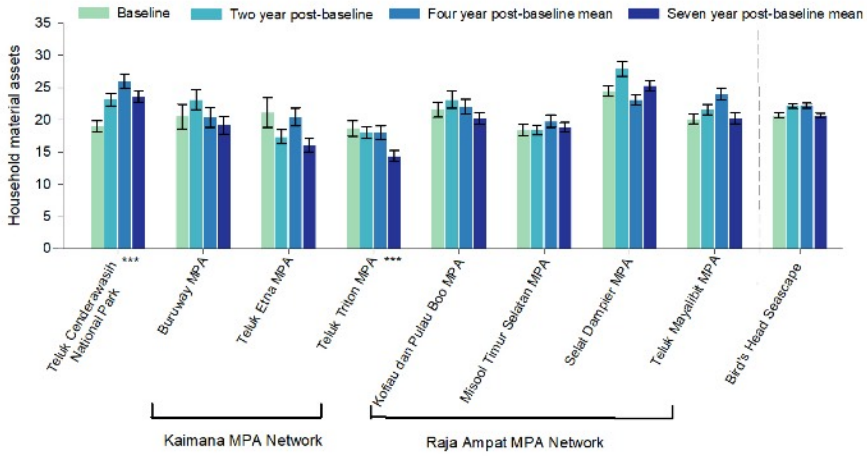


Figure 5.4. Household Material Assets Index

Note: Initial (baseline) survey and monitoring years in each MPA: Teluk Cenderawasih National Park: Baseline 2010, Monitoring: 2012, 2014, 2017; Kaimana MPA Network: Baseline 2012, Monitoring 2014, 2016, 2019; Kofiau-Boo Islands MPA: Baseline 2011, Monitoring: 2013, 2015, 2018; Misool Islands MPA: Baseline 2011, Monitoring: 2013, 2015, 2018; Selat Dampier MPA: Baseline 2012, Monitoring 2014, 2016, 2019; Teluk Mayalibit MPA: Baseline 2010, Monitoring: 2012, 2014, 2017.

- It is "likely" (p =0.161) that the material assets owned by the average household in the BHS MPAs fluctuated significantly during the monitoring period. Initially, average household material assets increased between the baseline monitoring year, and two years post-baseline, but subsequently declined somewhat between two and four years post-baseline. However, there was a significant decrease in the average material assets owned by households in the seven years post-baseline monitoring. The decline observed between two and four years post-baseline (2014-2016 data) was likely linked to a decline in household purchasing power, driven by rapid fuel price inflation in the region following a shift in national government fuel subsidies in 2014.
- It is "virtually certain" (p<0.001) that household ownership of material assets increased across the monitoring period in Teluk Cenderawasih National Park, while it is "virtually certain" (p<0.001) that household material assets decreased across the monitoring period in Teluk Triton MPA. In other MPAs trends in household material assets were variable year to year, and further analysis is required to identify possible causes for these trends.
- It is "virtually certain" (p<0.001) that household ownership of material assets varied across the BHS MPAs during the most recent year of monitoring for each MPA respectively (2017-2019). The average household owned significantly more goods in Teluk Cenderawasih National Park (mean: 23.6) and Selat Dampier MPA (mean: 25.2) relative to the overall average across the seascape (mean: 20.7). Meanwhile, the average household owned significantly fewer goods in Teluk Etna MPA (mean: 16.0) and Teluk Triton MPA (mean: 14.4) relative to the overall average across the seascape.

5.2.2. Health

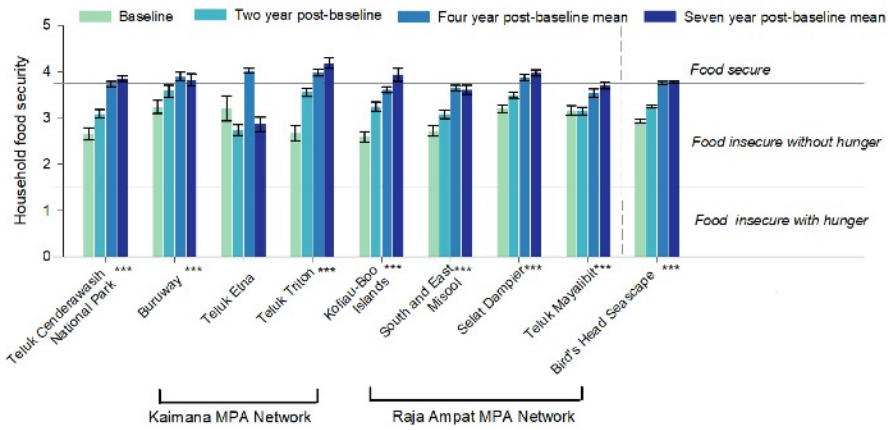


Figure 5.5. Household Food Security Index

Note: Initial (baseline) survey and monitoring years in each MPA: Teluk Cenderawasih National Park: Baseline 2010, Monitoring: 2012, 2014, 2017; Kaimana MPA Network: Baseline 2012, Monitoring 2014, 2016, 2019; Kofiau-Boo Islands MPA: Baseline 2011, Monitoring: 2013, 2015, 2018; Misool Islands MPA: Baseline 2011, Monitoring: 2013, 2015, 2018; Selat Dampier MPA: Baseline 2012, Monitoring 2014, 2016, 2019; Teluk Mayalibit MPA: Baseline 2010, Monitoring: 2012, 2014, 2017.

- It is "virtually certain" ($p<0.001$) that household food security (i.e. the ability of households to access safe, nutritious food in socially acceptable ways) increased for the average household across the BHS MPAs between 2010 and 2019. These increases may be linked to multiple factors, including increased access to fish in the BHS MPA Network, provincial government policies and programs, and increased market access.
- In most BHS MPAs, household food security has increased consistently since baseline. At baseline, the average household in the BHS MPA Network was 'food insecure without hunger', meaning that they experienced anxiety about accessing safe, nutritious and socially acceptable foods, or adopted coping mechanisms (e.g. reduced portion sizes, skipped meals) to ensure access to sufficient food. Food security for the average household in the Seascape has increased consistently since the baseline year, with the average household in an increasing number of BHS MPAs approaching the 'food secure' threshold. Since baseline, the percentage of households across the BHS MPA Network above the 'food secure' threshold has increased from 37.8% to 67.8% (roughly equivalent to 2,200 households achieving food security during this seven year time period). Simultaneously, the percentage of households across the Seascape that experienced periods of hunger (food insecure with hunger) decreased from 15.7% to 4.9%.
- In the most recent monitoring year, the average household in Teluk Triton MPA and Selat Dampier MPA was 'food secure', meaning that the household members had sufficient access to safe, nutritious and socially acceptable foods. This is the first time since the BHS MPA social monitoring program began in 2010 that the average household in one or more MPAs had achieved food security.
- The pattern of increasing food security was not uniform across the Seascape. It is "virtually certain" ($p<0.001$) that households in the Teluk Etna MPA experienced a substantial decline in household food security between the four years and seven years post-baseline monitoring; however, the reason for this decline remains unknown and requires further investigation.

5.2.3. Political Empowerment

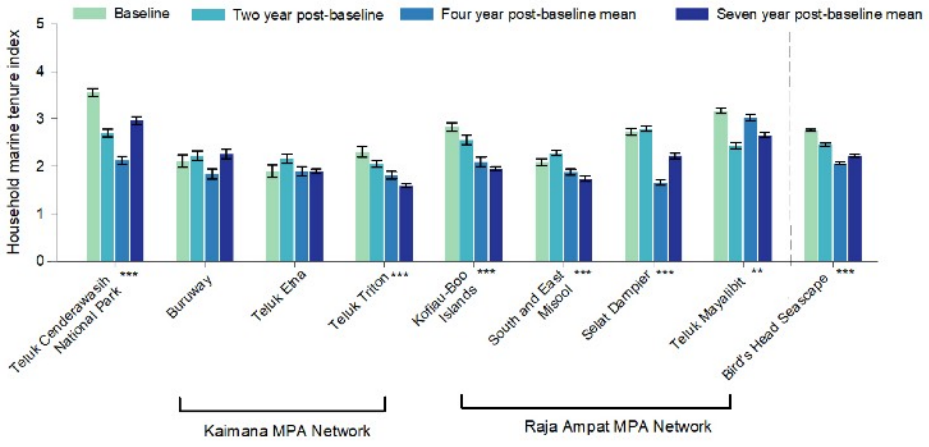


Figure 5.6. Household Marine Tenure Index

Note: Initial (baseline) survey and monitoring years in each MPA: Teluk Cenderawasih National Park: Baseline 2010, Monitoring: 2012, 2014, 2017; Kaimana MPA Network: Baseline 2012, Monitoring 2014, 2016, 2019; Kofiau-Boo Islands MPA: Baseline 2011, Monitoring: 2013, 2015, 2018; Misool Islands MPA: Baseline 2011, Monitoring: 2013, 2015, 2018; Selat Dampier MPA: Baseline 2012, Monitoring 2014, 2016, 2019; Teluk Mayalibit MPA: Baseline 2010, Monitoring: 2012, 2014, 2017.

- It is "virtually certain" ($p<0.001$) that household marine tenure in the BHS MPA has decreased since social monitoring began in 2010. The household marine tenure Index records whether surveyed households have actively exercised one or more rights over marine resources in the 12 months prior to the survey. These rights include the rights to enter the MPA, the right to harvest resources from the MPA, the right to make decisions about marine resources in the MPA, the right to exclude others from the MPA, and the right to transfer their marine resource rights to other individuals (Glew et al, 2012). The decrease in the household marine tenure Index reflects a decline in the active use of marine resource rights, not a decline in the possession of those rights by the households. The decline in household marine tenure may be associated with the establishment of the MPA, reflecting changes in fishing behaviour or in the roles played by individual households in managing the marine resources in the MPAs; it may also reflect a major occupational shift (from fishing towards wage labour) in and around the BHS (Claborn et al. 2017).

- While Seascape-wide household marine tenure has declined since baseline, the household marine tenure index had increased in the most recent monitoring period (2017-2019) compared to the previous period (2014-2016). It is virtually certain ($p<0.001$) that Teluk Cenderawasih National Park experienced substantial increases in household marine tenure between four years and seven years post-baseline (although the average household marine tenure remains below the baseline value for the MPA). Furthermore, it is also virtually certain ($P<0.001$) that Buruway MPA experienced a large increase in marine tenure between 2016 and 2019, with average household marine tenure now exceeding the 2012 baseline. Almost all of these increases in marine tenure appear to be primarily linked to a recovery in the percentage of households who can and are accessing and harvesting marine resources from the MPAs. Furthermore, all around Teluk Cenderawasih, the percentage of households who are exercising their rights to manage the marine resources and exclude others from taking marine resources in and around the MPA is also increasing significantly.
- It is "virtually certain" ($p<0.001$) that the household marine tenure index during the most recent year of monitoring varied between MPAs. Teluk Cenderawasih National Park (mean: 2.97 marine resource rights exercised) and Teluk Mayalibit MPA (mean: 2.66) had higher household marine tenure indices relative to the average across the seascape as a whole (mean: 2.23). Teluk Etna MPA (mean: 1.89), Teluk Triton MPA (mean: 1.59) and South and East Misool MPA (mean: 1.74) had lower household marine tenure indices relative to the overall average across the seascape, due to fewer households managing marine resources or excluding others from taking marine resources compared to other MPAs.

5.2.4. Education

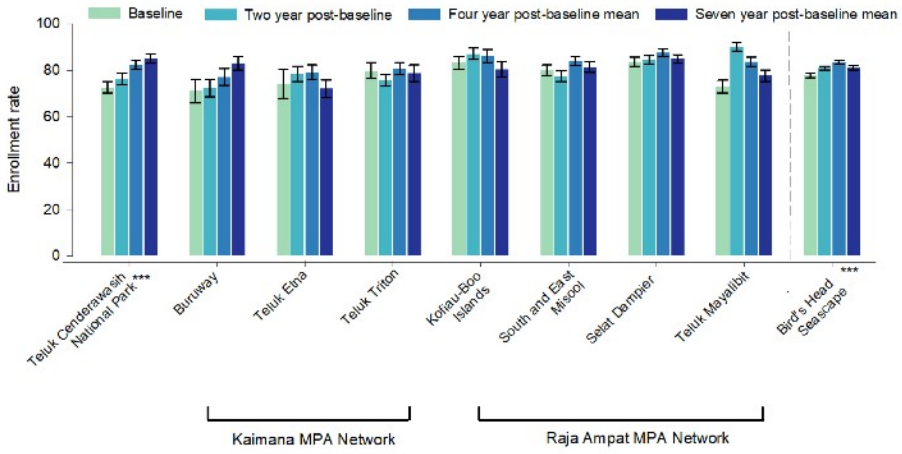


Figure 5.7. School Enrolment Rate

Note: Initial (baseline) survey and monitoring years in each MPA: Teluk Cenderawasih National Park: Baseline 2010, Monitoring: 2012, 2014, 2017; Kaimana MPA Network: Baseline 2012, Monitoring 2014, 2016, 2019; Kofiau-Boo Islands MPA: Baseline 2011, Monitoring: 2013, 2015, 2018; Misool Islands MPA: Baseline 2011, Monitoring: 2013, 2015, 2018; Selat Dampier MPA: Baseline 2012, Monitoring 2014, 2016, 2019; Teluk Mayalibit MPA: Baseline 2010, Monitoring: 2012, 2014, 2017.

- It is "virtually certain" ($p<0.001$) that school enrolment for the average household living in the Bird's Head Seascape increased during the monitoring period. While we cannot conclusively identify the processes generating this trend, it may be linked to government policies and initiatives intended to improve education in West Papua Province, as well as increasing community awareness of the importance of education across the Bird's Head Seascape.
- It is "virtually certain" ($p<0.001$) that school enrolment varied between the MPAs in the Bird's Head Seascape and Teluk Cenderawasih National Park over the most recent monitoring period. For example, the average school enrolment rate was higher in the Teluk Cenderawasih National Park (mean: 84.9%) than over the BHS as a whole (mean 81.1%)

5.2.5.Culture

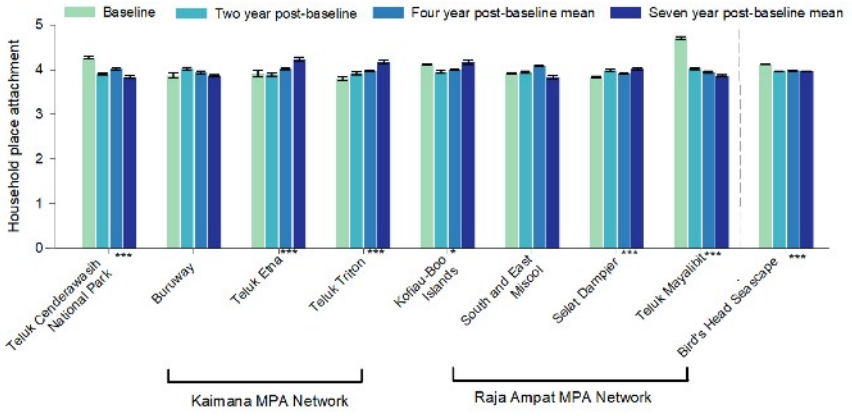


Figure 5.8. Place Attachment Index

Note: Initial (baseline) survey and monitoring years in each MPA: Teluk Cenderawasih National Park: Baseline 2010, Monitoring: 2012, 2014, 2017; Kaimana MPA Network: Baseline 2012, Monitoring 2014, 2016, 2019; Kofiau-Boo Islands MPA: Baseline 2011, Monitoring: 2013, 2015, 2018; Misool Islands MPA: Baseline 2011, Monitoring: 2013, 2015, 2018; Selat Dampier MPA: Baseline 2012, Monitoring 2014, 2016, 2019; Teluk Mayalibit MPA: Baseline 2010, Monitoring: 2012, 2014, 2017.

- It is "virtually certain" ($p<0.001$) that place attachment (i.e., the emotional connection of individuals to the MPA in which they are resident) decreased for the average household across the BHS MPAs during the monitoring period. While we cannot conclusively identify the processes underlying this trend, it may be linked to broader economic or demographic shifts within a specific MPA as well as in other MPAs across the BHS MPA Network.
- While Seascape-wide place attachment is in decline, there is considerable variation in place attachment trends among the BHS MPAs. For example, it is "virtually certain" ($p<0.001$) that place attachment increased for the average household resident in Teluk Etna MPA, Teluk Triton MPA, and Selat Dampier MPA. In contrast, it is "virtually certain" ($p<0.001$) that place attachment decreased for the average household resident in Teluk Cenderawasih National Park and Teluk Mayalibit MPA. Given this variation among MPAs, it is likely that the trends in place attachment reflect local social, economic, or political trends. For instance, in Teluk Etna MPA and Teluk Triton MPA, we saw large increases in the frequency of fishing and reliance on local marine resources for income that match the increase in place attachment.
- During the most recent year of monitoring, it is "virtually certain" ($p<0.001$) that place attachment varied among the BHS MPAs. Average place attachment index values for Teluk Etna MPA (mean: 4.23), Teluk Triton MPA (mean: 4.17), Kofiau-Boo Islands MPA (mean: 4.17) and Selat Dampier MPA (mean: 4.01) were higher than the overall average across the seascape (mean: 3.96). Meanwhile, average place attachment was lower than the overall average across the Seascape in Teluk Cenderawasih National Park (mean: 3.84), South Misool MPA (mean: 3.83), and Teluk Mayalibit MPA (mean: 3.86).

5.3. MPA Management Evaluation

Unlike the reduction in marine tenure rights reported in the 2016 State of the Bird's Head Seascape MPA Network Report (Ahmadia et al. 2016), household marine tenure rights (measured as the number of rights a household exercises over marine resources in the 12 months prior to survey) are starting to increase again at the level of the Bird's Head Seascape. This change is largely due to the 22% increase in the proportion of households exercising their rights to take marine resources between the two most recent monitoring periods (monitoring in the 4th and 7th year post-baseline).

While it is not possible to draw any definite conclusions regarding the causes of this change, it is likely that the reallocation of fishing rights associated with the establishment of the MPA caused a temporary decline in the proportion of households exercising their marine resource use rights. However, it would seem that this decline probably only lasted a short time, seeing as the proportion of households exercising their rights to access and take marine resources had increased by the time of the most recent monitoring (2017-2019).

5.3.1. World Bank Scorecard

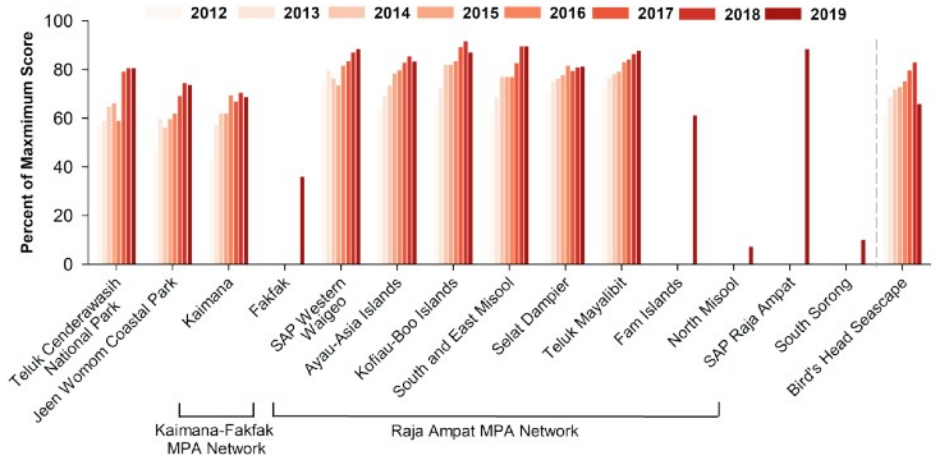


Figure 5.9. World Bank Scorecard MPA Management Effectiveness Score

World Bank Scorecard management assessments indicate that, in general, management of MPAs is improving over time, even though the rate of improvement varies between MPAs within the BHS. In the most recent assessment, the highest scores were observed in the Raja Ampat MPA Network, with Misool Islands MPA achieving the highest management score in the Seascape. The most substantial improvements in management scores between 2018 and 2019 were in the SAP Western Waigeo. In 2019, the North Misool MPA had the lowest score. Five MPAs were evaluated for the first time using the World Bank Scorecard: Nusalasi Van Den Bosch Coastal Park, Fam Islands MPA, North Misool MPA, SAP Raja Ampat and South Sorong MPA.

5.3.2. E-KKP3K

Management effectiveness was also assessed based on the Indonesian E-KKP3K standards. The evaluation showed that the Raja Ampat MPA Network was at the Green level (conservation area minimally managed). This MPA could advance to the Blue level (optimally managed) once the boundaries have been fully established. The North Misool MPA is in the early stages of initiation (Red level) and will advance to 100% initiated once the MPA initiation documents are submitted to the central government together with proofs of the support and coordination of the relevant agencies and the results of an identification and inventory study for the MPA.

1. Raja Ampat MPA

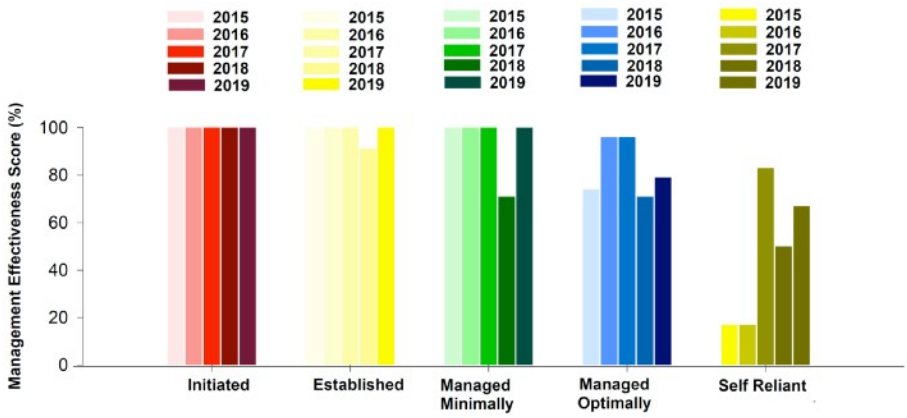


Figure 5.10. E-KKP3K MPA Management Effectiveness Assessment for the Raja Ampat MPA

Management Effectiveness Level/Stage: **Green;** conservation area minimally managed

Recommendations:

- Compile SOPs for research and education
- Compile SOPs for aquaculture/mariculture
- Compile SOPs for capture fisheries

2. Kaimana MPA

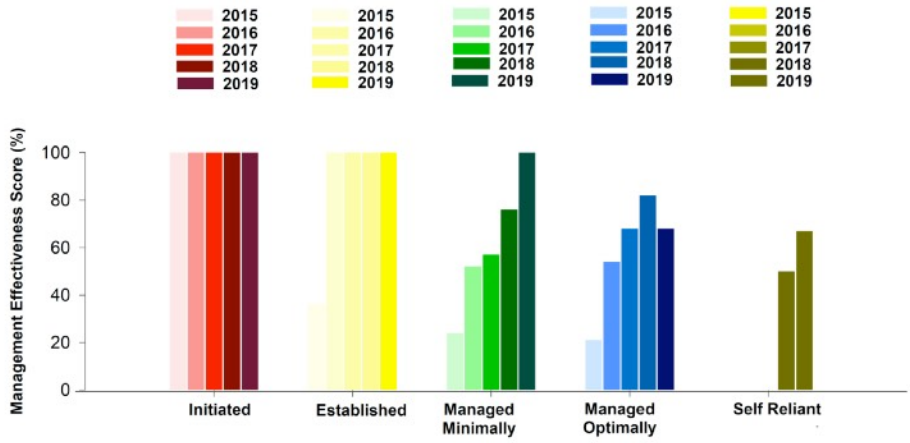


Figure 5.11. E-KKP3K MPA Management Effectiveness Assessment for the Kaimana MPA

MPA Management Effectiveness Level/Stage: **Green;** conservation area minimally managed

Recommendations:

- Carry out checks to ensure that all necessary facilities and equipment are present/complete
- Compile SOPs for research and education
- Compile SOPs for implementing marine nature-based tourism

3. Jeen Womom Coastal Park

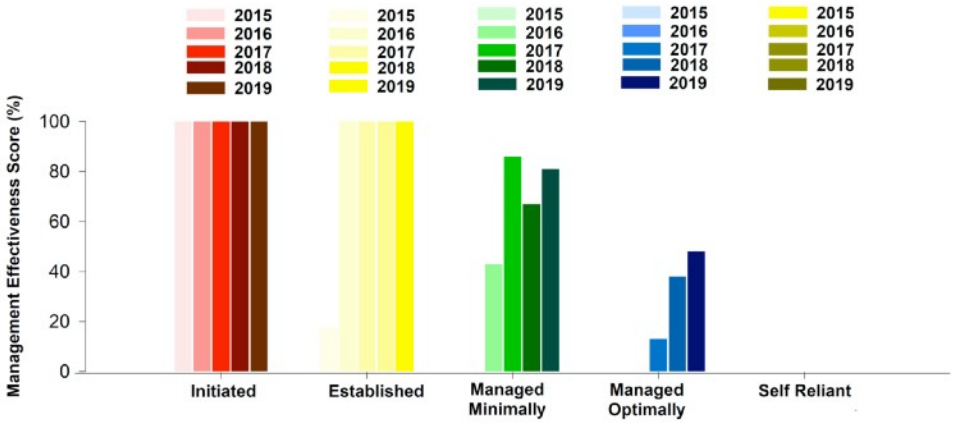


Figure 5.12.E-KKP3K MPA Management Effectiveness Assessment for the Jeen Womom Provincial Coastal Park

MPA Management Effectiveness Level/Stage: **Yellow;** conservation area established

Recommendations:

- Undertake planning to ensure sufficient financing is available to cover the MPA Budget
- Submit the final management plan to the Ministry of Marine Affairs and Fisheries for approval

-

4. Teluk Cenderawasih National Park

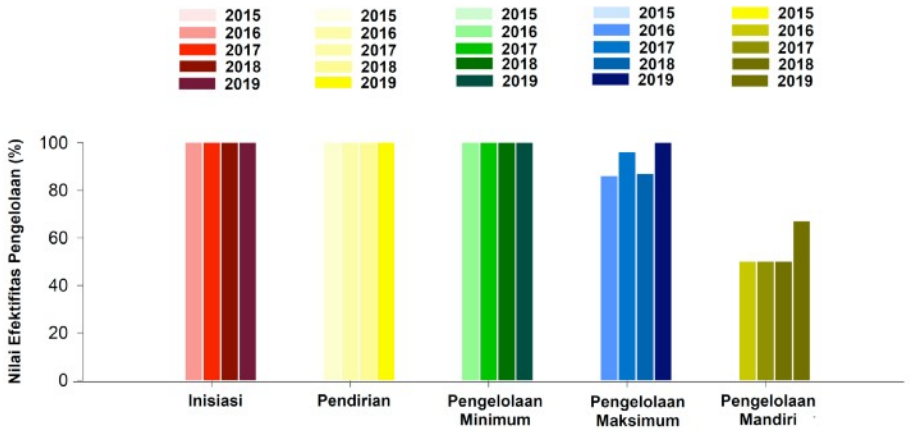


Figure 5.13. E-KKP3K MPA Management Effectiveness Assessment for the Teluk Cenderawasih National Park

MPA Management Effectiveness Level/Stage: **Blue;** conservation area optimally managed

Recommendations:

- Undertake studies to evaluate the increase in income (purchasing power) of people living within the MPA as a positive impact of MPA management
- Undertake studies to evaluate whether the rise in incomes has had an effect on community awareness as regards support for sustaining the resources within the MPA

5. Fakfak MPA

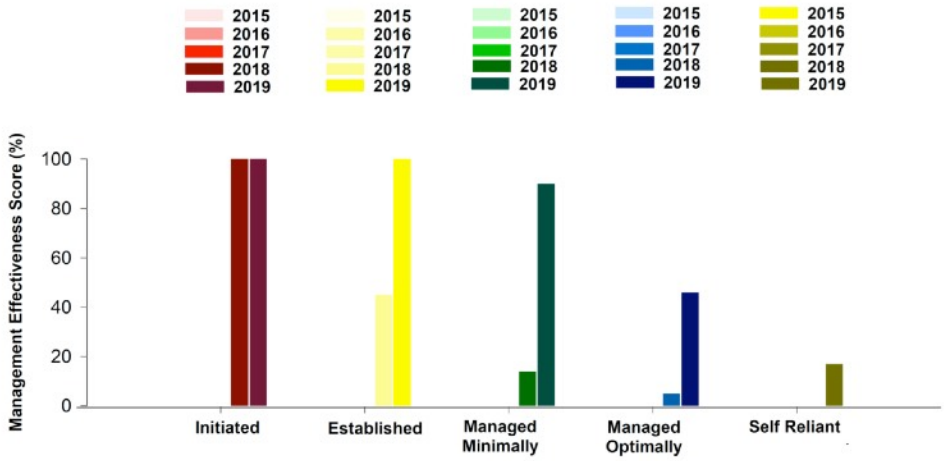


Figure 5.14. E-KKP3K MPA Management Effectiveness Assessment for the Fakfak MPA

MPA Management Effectiveness Level/Stage: **Yellow;** conservation area established

Recommendations:

- Implement use of the MPA resources (at least one use type)
- Check to ensure that the MPA has been formally established by the Minister of Marine Affairs and Fisheries

6. Sorong Selatan MPA

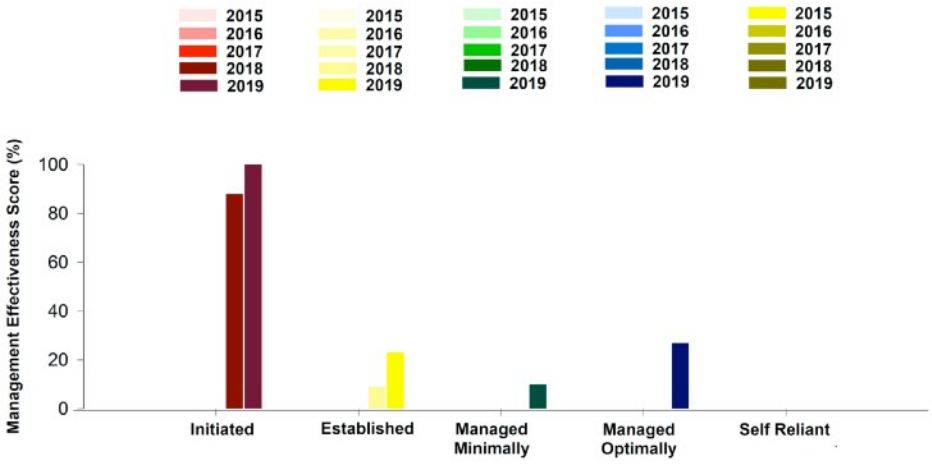


Figure 5.15. E-KKP3K MPA Management Effectiveness Assessment for the Sorong Selatan Provincial MPA

MPA Management Effectiveness Level/Stage: **Red;** conservation area initiated

Recommendations:

- Allocate MPA management staff
- Place the staff nominated in the official document (SK) in the management organisation unit
- Undertake a study to ensure that the number of staff allocated to the management organisation unit is sufficient to run the unit

7. North Misool MPA

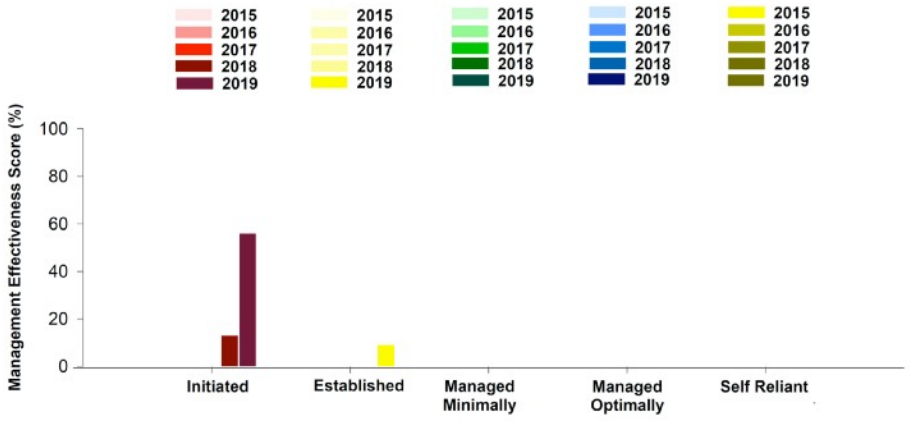


Figure 5.16. E-KKP3K MPA Management Effectiveness Assessment for the North Misool Provincial MPA

MPA Management Effectiveness Level/Stage: **Red;** conservation area initiated.

Recommendations:

- Submit the conservation area establishment proposal to the central government or provincial government
- Coordinate with appropriate line agencies regarding the proposed conservation area following the guidelines in MMAF Ministerial Regulation(s) PerMen KP 02/2009 and/or PerMen KP 17/2008
- Make use of the results of the identification and inventory study to recommend the proposed MPA based on MMAF Ministerial Regulation(s) PerMen KP 02/2009 and/or PerMen KP 17/2008

8. SAP Raja Ampat MPA

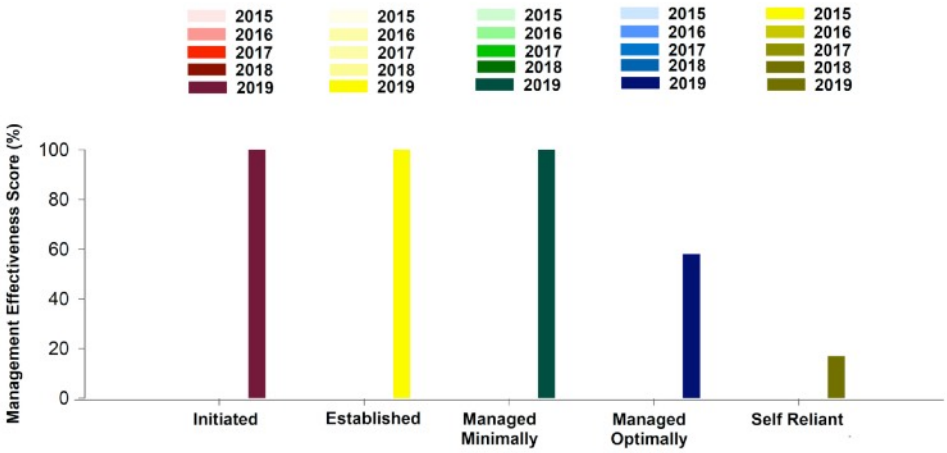


Figure 5.17. E-KKP3K MPA Management Effectiveness Assessment for the SAP Raja Ampat MPA

MPA Management Effectiveness Level/Stage: **Green;** conservation area minimally managed

Recommendations:

- Carry out checks to ensure that all necessary facilities and equipment are present/complete
- Carry out a study to ensure that the MPA management budgetary requirements can be met according to the management plan
- Establish boundaries following the guidelines in MMAF Ministerial Regulation PerMen KP 02/2009

9. SAP Western Waigeo MPA

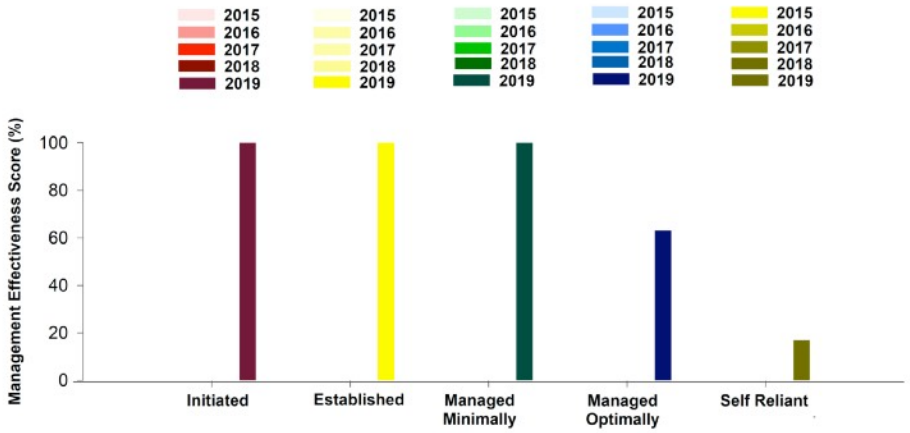


Figure 5.18. E-KKP3K MPA Management Effectiveness Assessment for the SAP Western Waigeo MPA

MPA Management Effectiveness Level/Stage: **Green;** conservation area minimally managed

Recommendations:

- Carry out checks to ensure that all necessary facilities and equipment are present/complete
- Carry out a study to ensure that the MPA management budget can be met according to plan
- Establish boundaries following the guidelines in Ministerial Regulation PerMen KP 02/2009

10. Maksegara MPA, Sorong District

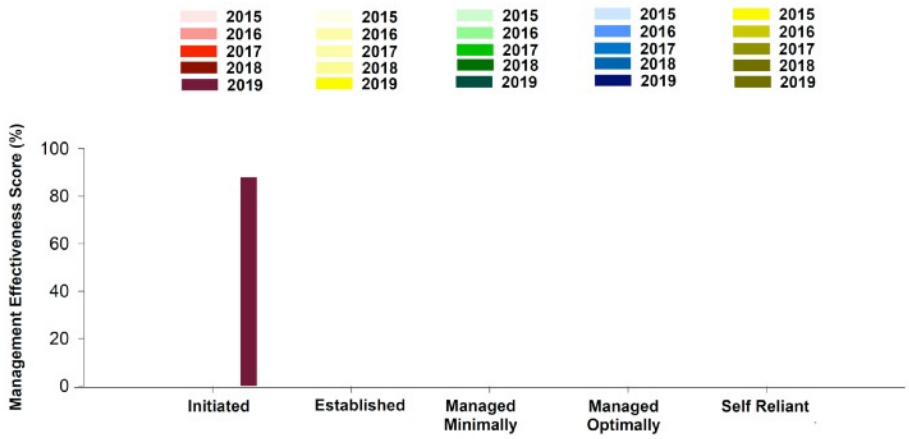


Figure 5.19. E-KKP3K MPA Management Effectiveness Assessment for the Maksegara MPA, Sorong District

MPA Management Effectiveness Level/Stage: **Red;** conservation area initiated

Recommendations:

- Establish the MPA based on the procedures set out in MMAF ministerial regulations PerMen KP 02/2009 and/or PerMen KP 17/2008

5.4. Marine Resource Governance

5.4.1. Participation

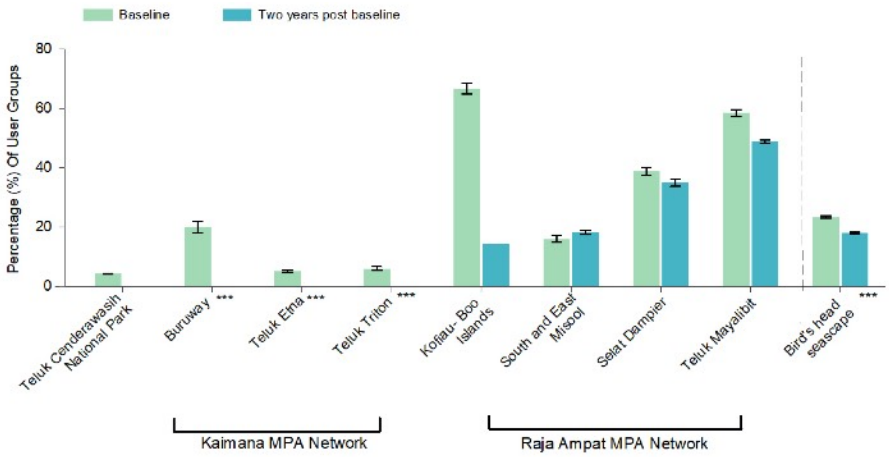


Figure 5.20. Participation of Marine Resource User Groups in Determining Marine Resource Management Rules

Note: Years of baseline and repeat monitoring at each MPA: Teluk Cenderawasih National Park: baseline 2010-2012, monitoring: 2014-2018; Kaimana MPA Network: baseline 2012-2014 and first repeat monitoring in 2015-2018; Kofiau-Boo Islands MPA: baseline 2011- 2013 and first repeat monitoring in 2015-2018; South and East Misool MPA: baseline 2011-2013 and first repeat monitoring in 2015-2018; Selat Dampier MPA: baseline 2012-2014 and first repeat monitoring in 2016-2019; Teluk Mayalibit MPA: baseline 2010-2012, and first repeat monitoring in 2014-2018.

- It is “extremely likely” ($p<0.01$) that within the BHS MPA Network as a whole the user group participation in determining management rules decreased compared to baseline over the first repeat monitoring period. On average, 19.65% of user groups participated in determining marine resource use rules across the Seascape in the first repeat monitoring period. The participation percentage varied between MPAs within the BHS. The high variation in user group participation in marine resource management may be linked to MPA size, the number of settlements within the MPA, and the intensity of community engagement efforts by civil society and district governments.
- There is considerable evidence that user group participation varies between the MPAs. For example, in the first repeat monitoring year, the number or proportion of user groups taking part in decisions related to management regulations was higher in the Teluk Mayalibit MPA (mean: 48.72%) and Selat Dampier MPA (mean: 38%) than in the Kofiau-Boo Islands MPA (mean: 14.29%) and South and East Misool MPA (mean: 18.18%).
- During the first repeat monitoring period, focus group discussion (FGD) participants reported that there was no participation of user groups in establishing marine resource management regulations in the Teluk Cenderawasih National

Park and the Kaimana MPA Network. It is thought that this lack of user group involvement in establishing management regulations in these two MPAs was due to the fact that the management regulations were established by the Teluk Cenderawasih National Park Management Body in collaboration with customary bodies (Badan adat) and local government agencies from the village and district levels.

5.4.2. Monitoring and Enforcement of Regulations

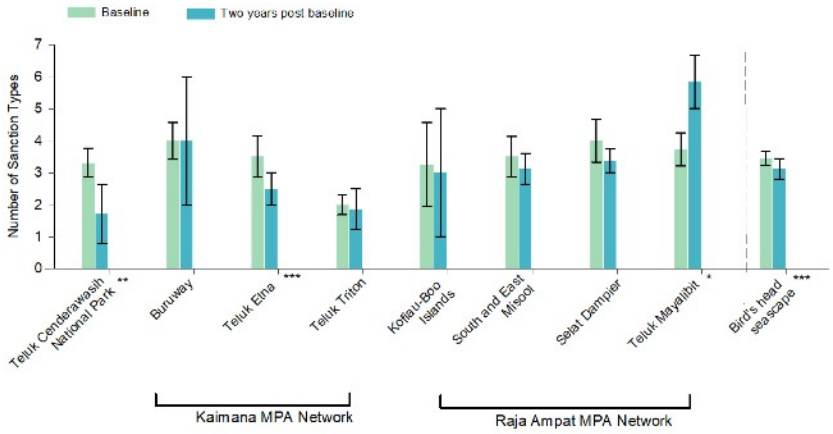


Figure 5.21. Sanctions applied to enforce compliance

Note: Years of baseline and repeat monitoring at each MPA: Teluk Cenderawasih National Park: baseline data in 2010-2012 and first repeat monitoring in 2014-2018; Kaimana MPA Network: baseline data in 2012-2014 and first repeat monitoring in 2016-2019; Kofiau-Boo Islands MPA: baseline data in 2011-2013 and first repeat monitoring in 2015-2018; South and East Misool MPA: baseline data in 2011-2013 and first repeat monitoring in 2015-2018; Selat Dampier MPA: baseline data in 2012-2014 and first repeat monitoring in 2016-2019; Teluk Mayalibit MPA: baseline data in 2010-2012 and first repeat monitoring in 2014-2018

- It is "extremely likely" ($p<0.01$) that the number of sanction types (e.g. verbal warnings, written warnings, loss of access to marine resources, fines, confiscation of equipment, and prison sentences) decreased in the Bird's Head Seascape during the first monitoring period compared to the baseline. The number of sanctions and their use to enforce rules and regulations on marine resource use may reflect the frequency of surveillance activities, customary marine tenure practices in a community, and the MPA management status.
- On average, 3.1 sanction types were employed to enforce compliance with marine resource use rules in the Seascape during the first monitoring period. The most common types of sanctions were verbal warnings (79%), confiscation of equipment (55%) and fines (55%).
- It is "very likely" ($p=0.05$) that the number of sanction types employed to enforce compliance with marine resource rules in the Teluk Mayalibit MPA (mean: 5.83) was unchanged between the baseline and the first monitoring period, and It is extremely likely ($P=0.04$) that there was also no change in the number of sanctions employed in the Teluk Cenderawasih National Park (mean 1.71 in the first monitoring period).
- It is "virtually certain" ($p<0.01$) that the number of sanction types employed in Teluk Etna MPA had decreased at the time of the first monitoring (mean 1.71) compared to the baseline.

5.4.3. Conflict Resolution

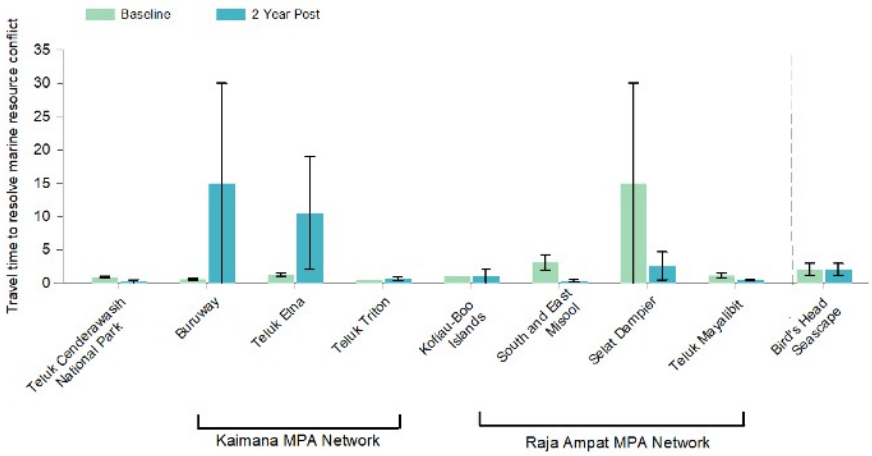


Figure 5.22. Mean conflict resolution time

Note: Years of baseline and repeat monitoring at each MPA. Teluk Cenderawasih National Park: baseline data in 2010-2012 and first repeat monitoring in 2014-2018; Kaimana MPA Network: baseline data in 2012-2014 and first repeat monitoring in 2016-2019; Kofiau-Boo Islands MPA: baseline data in 2011-2013 and first repeat monitoring in 2015-2018; South and East Misool MPA: baseline data in 2011-2013 and first repeat monitoring in 2015-2018; Selat Dampier MPA: baseline data in 2012-2014 and first repeat monitoring in 2016-2019; Teluk Mayalibit MPA: baseline data in 2010-2012 and first repeat monitoring in 2014-2018.

- It is "very unlikely" (p=0.96) that there was any real change between the baseline and the first monitoring period in the travel time required to resolve conflicts over marine resources among users, or between users and officials in the Bird's Head Seascape. Based on the output from the focus group discussions, the time necessary to resolve conflicts was heavily dependent on the severity of the offence. It was also noted that conflict resolution mechanisms through official legal channels require longer travel to district court offices (typically in cities such as Sorong and Manokwari), while local or customary mechanisms that occur in each settlement typically require much less time.
- On average, resolving a conflict over marine resources among users or between users and officials required two days. The shortest time taken was in the Teluk Cenderawasih National Park (0.25 days) and the longest was in Buruway MPA (15 days).

5.4.4. Marine Resource Use Regulations

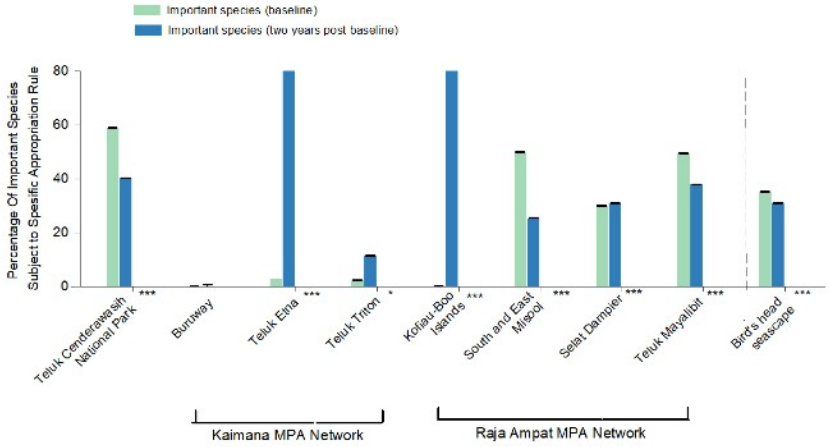


Figure 5.23. Proportion of species subject to a harvest rule

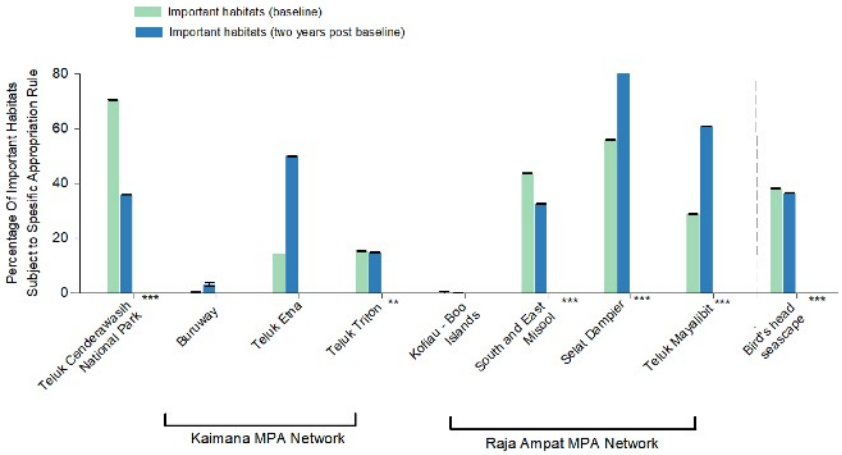


Figure 5.24. Proportion of habitats with specific resource use rules

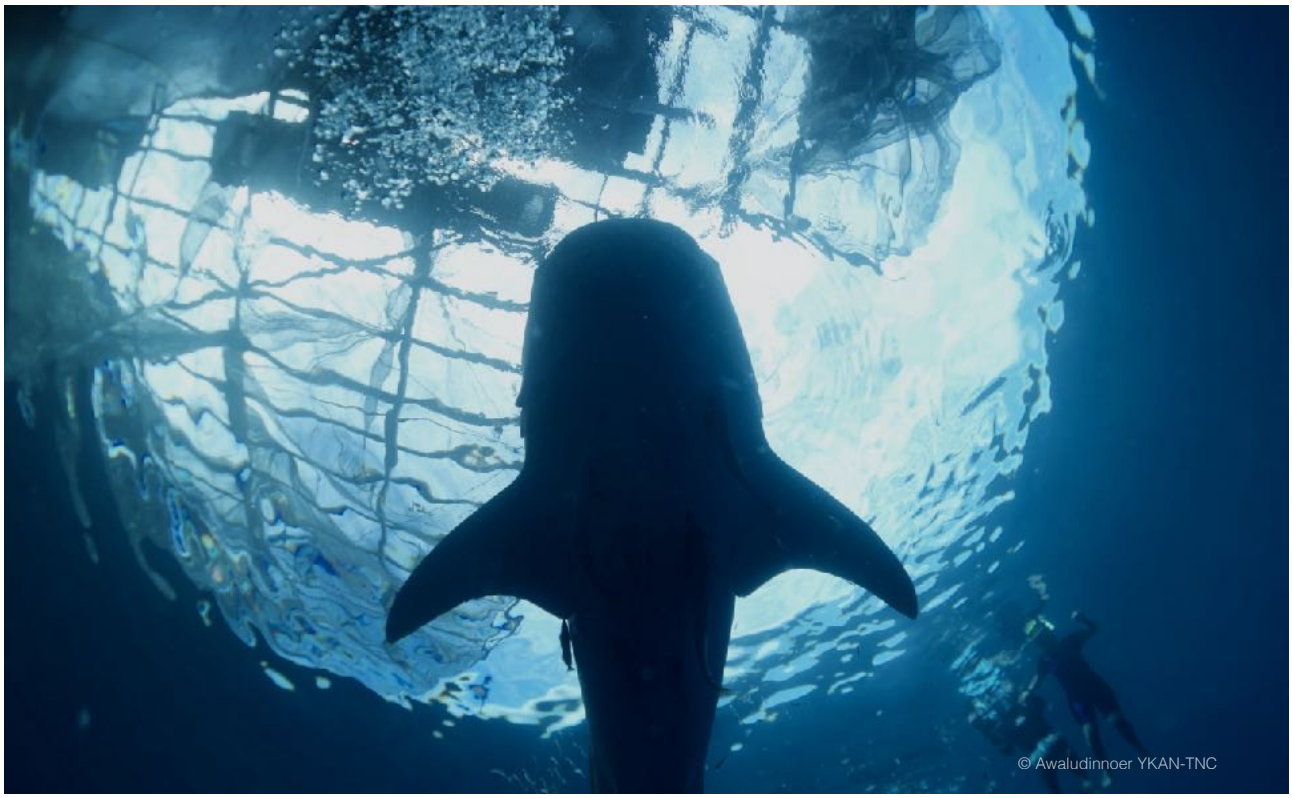
Note: Years of baseline and repeat monitoring at each MPA. Teluk Cenderawasih National Park: baseline data in 2010-2012 and first repeat monitoring in 2014-2018; Kaimana MPA Network: baseline data in 2012-2014 and first repeat monitoring in 2016-2019; Kofiau-Boo Islands MPA: baseline data in 2011-2013 and first repeat monitoring in 2015-2018; South and East Misool MPA: baseline data in 2011-2013 and first repeat monitoring in 2015-2018; Selat Dampier MPA: baseline data in 2012-2014 and first repeat monitoring in 2016-2019; Teluk Mayalibit MPA: baseline data in 2010-2012 and first repeat monitoring in 2014-2018

- It is "virtually certain" (p<0.01) that the proportion of species and habitats with specific resource use rules in the BHS MPAs decreased between the baseline and the first repeat monitoring period. It is considered likely that this decrease in species and habitats with specific resource use rules is due to the decline in economic value of certain species and habitats. The proportion of species and habitats subject to one or more specific use rules varied among the MPAs within the BHS. Variations in rules on the use of species and habitats may be linked to local norms and

customs, some of which may recognize particular species or places as holding religious or cultural significance, as well as shifts in the economic value of some species and habitats.

- On average, in the first repeat monitoring year, 31.1% of the five most important species mentioned in the focus group discussions and 36.57% of the five most important habitats were subject to specific use rules in the Seascape's MPAs during the first monitoring period. The Selat Dampier MPA had the highest proportion (82.35%) of the five most important habitats with resource use rules, while Kofiau-Boo Islands MPA and Teluk Etna MPA had such rules for the highest proportion (100%) of the five most important species.
- At both the baseline and first monitoring focus group discussions, it was noted that there were no resource use rules for important species in the Buruway MPA or for important habitats in the Kofiau-Boo Islands MPA. It is suspected that this lack of specific regulations regarding key habitats or species in these two MPAs is due to the greater community involvement in regulating the management area, and they do not set specific rules for important habitats and species.

6. RECOMMENDATIONS FOR MANAGEMENT



6.1. Monitoring and Surveillance

Sustainable monitoring, patrols and surveillance.

Maintain existing monitoring, patrol and surveillance activities, and ensure reliable law enforcement and resolution of fishing and illegal fishing cases. Build the capacity of MPA management staff by involving local partners, local government, law enforcement agencies and NGOs.

Prioritize increasing patrols and surveillance in partnership with all elements of the community across the Papua BHS MPA Network. This helps build community support for and compliance with MPA regulations. Align patrol effort with important zones that are vulnerable to illegal fishing (with particular emphasis on no–take zones). The Kaimana MPA network currently has the weakest management effectiveness of all the MPAs monitored in the seascape. Building capacity here is an important step in sustaining marine ecosystems in Kaimana District. Communication between provinces and districts is necessary to suppress illegal fishing such as that occurring in the Kofiau MPA where the illegal fishers come from Sorong and Halmahera.

Mitigate the threat of blast fishing

Field observations show that destructive fishing practices (i.e., blast fishing) still occur in BHS waters, particularly in remote areas far from community surveillance and in the newer MPAs. Targeted management strategies should include an increase in the numbers of patrol surveillance trips in each MPA. Another strategy which could be implemented is partnerships with the private sector, marine police, PSDKP and navy to routinely conduct joint patrols in high risk areas.

Establishment of new marine protected areas (MPAs)

The BHS MPA network continues to expand, with 23 MPAs in various stages of implementation or establishment in the BHS as of 2020. It is crucial that ecological, social, governance, and management effectiveness monitoring is expanded to these new MPAs.

Manage increasing demand for high value species in the Raja Ampat MPA Network

Increasing prosperity in major urban centres such as Sorong and Manokwari is driving a growing demand for high-value reef species (e.g. groupers and snappers). Improved transportation and accessibility is a driver of overexploitation. To ensure that these commercially important stocks are sustainable in the long-term, local government and civil society need to develop and enforce stricter management of key fisheries species within BHS MPAs.

6.2. Community Participation

Foster community empowerment by inviting participation in marine resource management processes, particularly in the Seascape's newer MPAs

Participation in the management of marine resources varies across the Seascape, with greater participation by important user groups in the older MPAs. Targeted efforts are needed to ensure that important user groups have the opportunity and incentive to participate in MPA management in the long-term, especially for newer MPAs where there is an initial drop after establishment in the number of users exercising their marine tenure rights. The next step is to support the creation of settlement-level or village-level regulations governing marine resource use that align with MPA management priorities

Develop zonation plans integrating customary regulations

Develop and implement management plans and zonation for new BHS MPAs jointly with local communities, in particular customary bodies. Work with local communities to support customary ('adat') regulations to be integrated or established into MPA zonation.

Set targets to foster active and representative participation, particularly by women

Creating many and varied opportunities for participation by representative stakeholder groups (fishers, farmers, freelancers) in MPA management will help provide legitimacy to MPA authorities, promote compliance with MPA regulations, and increase the emotional connection to place expressed by community members. The establishment of local groups in each of the MPA settlements is one way to provide dedicated platforms for such participation. These participation opportunities should also aim to foster greater participation by women.

6.3. Awareness Building (regulations and impacts, conflict resolution mechanisms and education)

Socialize MPA zonation plans across the BHS

Over the past few years, government, civil society and local communities have made considerable progress in the development of appropriate zonation plans and in the enforcement of MPA regulations. These MPA zonation plans and regulations must continue to be socialized, especially in newly established MPAs, to ensure that all stakeholders are aware of the regulations. Support is needed for local communities to socialize customary regulations alongside formal zonation plans. Further dissemination efforts are needed to communicate these regulations to local communities, business actors within the MPA, and those user groups residing outside of MPA boundaries.

Increase awareness of the impact of coral mining in the Raja Ampat MPA network

The extraction of coral for construction materials poses a substantial threat to coral reef ecosystems and to the fisheries sector. In the Raja Ampat MPA network, there is a need to raise awareness among all local stakeholders regarding the impacts of coral mining. At the same time, local governments should promote the use of viable alternative building techniques and materials that are more environmentally friendly (do not require the extraction of coral).

Improve accessibility and mechanisms for resolving conflict over marine resources

Mechanisms for resolving disputes among MPA users, or between users and the BHS MPA Network management authorities, are relatively hard to access, frequently requiring individuals to travel considerable distances to reach an appropriate authority. There is a need to develop conflict resolution mechanisms or processes for disputes over marine resources which are more accessible or easier to apply. For example, a first step would be to establish advisory boards (dewan penasehat) for marine resource use at the village or customary body level.

Improve education systems across the Seascape

From 2010 until 2019 (the school enrolment rate has increased among MPA communities in the Bird's Head Seascape. This is an opportunity which can be seized to integrate nature and environmental education into primary and secondary (middle and high) school curricula. Raja Ampat District has already initiated this step by developing a local knowledge curriculum (muatan lokal) which provides an introduction to marine ecosystems, tourism and climate change for pupils in classes IV, V and VI.

6.4. Sustainable Development and Human Well-being

Sustainable infrastructure development

There is a need to strengthen coastal and land-use planning to ensure that infrastructure development is sustainable. For example, infrastructure development in the BHS has led to increased illegal logging, and poorly designed and constructed roads have caused damage to coastal areas. Sound planning should ensure that land-based development does not result in excessive water run-off and sedimentation, which can affect the health of coral reef ecosystems

Sustainable tourism

Tourism is a rapidly growing industry in Indonesia and in particular in the BHS. The increasing numbers of tourists must be managed carefully to ensure that they do not exceed MPA carrying capacity. Careful management must be implemented to ensure that increasing tourist numbers do not increase fisheries demand within the seascape. Some communities and islands have also constructed homestays and hotels for guests. Consideration must be given to ensuring proper waste management (sewage, waste management plants/landfill, etc.) to avoid adverse impacts on the reef. In

recent years the impacts of poor sanitation and sewage disposal have become visible, for example the emergence of COTS outbreaks in Raja Ampat and algal overgrowth on reefs close to settlements.

Continue to Improve Food Security across the Seascape

Across the Seascape, food security is increasing, with more households gaining access to safe, nutritious and socially acceptable foods. To sustain these improvements, there is a need to develop 'safety net' programs that ensure access to basic food supplies is maintained during adverse weather conditions, and to foster the diversification of foods available in more remote settlements. Additionally, continued sustainable infrastructure development can increase access to a larger diversity of foods via improved market-integration

Strive to mitigate the recent decline in economic well-being across the Seascape

The recent decline in household material assets, which may have been caused by fuel price inflation acting in concert with other processes, could be mitigated by improving market access for settlements across the Seascape; improving access to financial institutions and services in more remote settlements; and facilitating improved communication regarding commodity prices for marine and agricultural products among local fishers and farmers.

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8. APPENDIX

Since 2008, local universities, government agencies, and non-governmental organizations (NGOs) have worked together as part of the Bird's Head Seascape Consortium to develop rigorous methods to monitor the ecological and social conditions in the Bird's Head Seascape Marine Protected Area (MPA) Network. The partner organizations (University of Papua, Conservation International, The Nature Conservancy, and World Wildlife Fund) regularly conduct scientific monitoring of coral reef conditions in nine MPAs across the Seascape and human well-being in eight MPAs. The partners also monitor the management effectiveness of 12 Bird's Head Seascape MPAs and document marine resource governance of 8 MPAs.

The twenty three MPAs in the Bird's Head Seascape are briefly described in the table below.
Table list of monitoring MPAs for ecological and social.

English name	Indonesian / official name	Area (ha)	Management authority
Ayau-Asia Islands	Taman Wisata Perairan Raja Ampat Area I, Kepulauan Ayau-	101,440	UPTD-BLUD, MMAF - West Papua Province
Teluk Mayalibit	Taman Wisata Perairan Raja Ampat Area II, Teluk Mayalibit	53,100	UPTD-BLUD, MMAF - West Papua Province
Selat Dampier	Taman Wisata Perairan Raja Ampat Area III, Selat Dampier	336,000	UPTD-BLUD, MMAF - West Papua Province
South and East Misool	Taman Wisata Perairan Raja Ampat Area IV, Perairan Kepulauan Misool	366,000	UPTD-BLUD, MMAF - West Papua Province
Kofiau -Boo Islands	Taman Wisata Perairan Raja Ampat Area V, Perairan Kepulauan Kofiau dan BooBi	170,000	UPTD-BLUD, MMAF - West Papua Province
Fam Islands	Taman Wisata Perairan Raja Ampat Area VI, Kepulauan Fam	357,282	UPTD-BLUD, MMAF - West Papua Province
North Misool	Kawasan Konservasi Perairan Daerah Misool Utara	311,064	Local Community
SAP Western Waigeo	Suaka Alam Perairan Waigeo Sebelah Barat	266,695	MMAF - National Government
SAP Raja Ampat Islands	Suaka Alam Perairan Kepulauan Raja Ampat	60,002	MMAF - National Government
Jeen Womom Coastal Park	Taman Pesisir Jeen Womom	32,250	MMAF - West Papua Province
Teluk Berau Coastal Park	Taman Pesisir Teluk Berau	101,138	MMAF - West Papua Province
Teluk Nusalasi Nusalasi Van Den Bosch Coastal Park	Taman Pesisir Teluk Nusalasi - Van Den Bosch	253,961	MMAF - West Papua Province
Buruway	Taman Wisata Perairan Buruway	232,062.54	MMAF - West Papua Province
Teluk Triton	Taman Wisata Perairan Kaimana	121,742.41	MMAF - West Papua Province
Teluk Etna	Taman Wisata Perairan Teluk Etna	110,523.32	MMAF - West Papua Province
Teluk Arguni	Taman Wisata Perairan Arguni	35,475.86	MMAF – West Papua Province
Teluk Cenderawasih National Park	Taman Nasional Teluk Cenderawasih	1,453,000	MoEF - National Government
South Sorong	KKP Laut Seribu Satu Sungai Teo Enebikia, Sorong Selatan	338,000	MMAF - West Papua Province
Maksegara	KKP Maksegara, Kabupaten Sorong	147,589.7	MMAF - West Papua Province
Sabuda and Tataruga Islands	Cagar Alam Laut Pulau Sabuda dan Pulau Tatruga	5,000	MoEF - National Government
Teluk Bintuni	Cagar Alam Teluk Bintuni	135,101.59	MoEF - National Government
Padaido Islands	TWP Kepulauan Padaido	183,000	MMAF - Papua Province
Biak Numfor	KKP Kabupaten Biak Numfor	24,910	MMAF - Papua Province

Note:

- UPTD-BLUD = Unit Pelaksana Teknis Dinas – Badan Layanan Umum Daerah, is MPA Implementation Unit
- MMAF = Ministry of Marine Affairs and Fisheries
- MoEF = Ministry of Environment and Forestry

This report, which will be expanded and updated annually, provides a scientific assessment of the current status and trends of key ecological and social conditions across the Seascape's MPA networks, and documents the management status of each MPA. In this section we provide an overview of the monitoring protocols and methods used to obtain the data synthesised in this report.

A. ECOLOGICAL MONITORING

The Bird's Head Seascape MPA Ecological Monitoring Program is a partnership program between Conservation International, The Nature Conservancy, World Wide Fund for Nature (Indonesia), World Wildlife Fund (United States), and the University of Papua. Since 2010, this partnership (initially CI, TNC, WWF-ID) has applied the ecological monitoring protocols in nine MPAs (Kaimana MPA Network: Buruway and Teluk Triton MPA; Raja Ampat MPA Network: Ayau-Asia MPA, Kawe MPA, Kofiau-Boo Islands MPA, South and East Misool MPA, Selat Dampier MPA, Teluk Mayalibit MPA, and Teluk Cenderawasih National Park). Ecological monitoring focuses on two components of the coral reef ecosystem: fish populations (abunandce and biomass) and benthic cover (percentage hard coral cover). Each MPA is monitored at intervals of 2-3 years using the following protocols in Wilson and Green (2009) as amended by Ahmadia et al. (2013).

In this report, we synthesised data on three ecological indicators selected to reflect evaluations of management target, provide information to policy makers, and to serve as indicators of ecosystem and fish population health. These indicators were harmonised with indicators used in the MPA Management Evaluation (70), including coral reef condition as well as the populations of key fisheries species and non-target species. Other criteria include indicators of ecological characteristics (e.g. differences in functional and trophic groups, life history, and home range). Taking all this information into account, we chose the following indicators:

- REEF FISHERIES. Artisanal or small-scale fisheries are traditional fisheries involving individual fishers or fishing households (as opposed to commercial companies), using a relatively small amount of capital and energy, relatively small fishing vessels (if any), making short fishing trips, close to shore, with most of the fish catch consumed locally. Artisanal fisheries may also feed into commercial supply chains, through fish traders, providing products for local consumption or export (FAO, 2015).

Indicators: Key fisheries species

Three fish families were selected to represent fisheries status: Lutjanidae (snappers), Haemulidae (sweetlips), and Serranidae (groupers). These fish are usually quite large and have a high market value. Total biomass was calculated for all species belonging to these three families; biomass is a function of combined fish abunandce and size.

- CORAL REEF RESILIENCE AND ECOSYSTEM FUNCTIONS: ecological resilience can be defined as the capacity of an ecosystem to absorb recurrent disturbances or shocks and adapt to change while retaining essentially the same ecosystem function and structure (Hollings 1973, McClanahan et al. 2012).

Indicators: Fish functional groups

Representative herbivorous fish families were choses to reflect the reef resilience and ecosystem function status: Acanthuridae (surgeonfishes, tangs, and unicornfishes), Scaridae (parrotfishes), and Siganidae (rabbitfishes). The abunandce of these species can be used to measure the stability and resilience to disturbance of a coral reef (cite). The total cumulative biomass of all species within these three families is a function of both fish abunandce and fish size.

- CORAL REEF CONDITION: the composition or condition of the coral reef benthic community (substrate) influences "bottom up ecological processes" and has cascading effects on the dynamics and function of the entire reef ecosystem. Stony or "hard" (scleractinian) reef building corals make up a substantial proportion of a coral reef's three-dimensional structure providing critical habitat for many reef-dwelling organisms.

Indicators: Hard coral cover (%)

Hard coral cover is the most commonly used coral reef condition indicator. Coral cover is the proportion (%) of the reef substrate which is covered by live hard corals rather than dead coral rubble or rock, algae, sponges, or other substrate categories.

B. SOCIAL MONITORING

The Bird's Head Seascape MPA social monitoring program is a partnership between the University of Papua, Conservation International, and World Wildlife Fund (US). Since 2010, the partnership has monitored human well-being in eight MPAs (Buruway MPA, Kofiau-Boo Islands MPA, South and East Misool MPA, Selat Dampier MPA, Teluk Cenderawasih National Park, Teluk Etna MPA, Teluk Mayalibit MPA, and Teluk Triton MPA) spread across four districts in West Papua and Papua. The University of Papua has conducted household surveys in a representative, random sample of households resident within the MPA boundaries, collecting data on economic well-being, health, empowerment, education, and culture. MPAs are monitored every two years, with baseline data collected between 2010 and 2012.

In this report, we synthesized data on five attributes of human well-being commonly identified in human development. One key indicator was chosen to represent each attribute dimension, as follows:

ECONOMIC WELL-BEING: the resources people use to meet basic consumption and material needs, and access to other sources of well-being (Sen, 1999).

Indicator: Household material assets

Household material assets are a relatively reliable and widely used indicator of economic well-being. We adopted the "goods basket" method which evaluates whether households possess certain assets (e.g. a boat, a telephone, or a television). The eleven assets comprised within the "basket" vary from relatively cheap goods (e.g. a mobile phone) to expensive goods (e.g. a car, a vessel with an inboard motor). Each asset type is weighted.

- HEALTH: a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity (World Health Organization, 1946)

Indicator: Household food security

Household food security is the ability of households to access safe, nutritious food in socially acceptable ways (Bickel et al. 2000). The Bird's Head Seascape monitoring program adopted an internationally recognised standard scale (Bickel et al. 2000) which groups households into the following three food security categories:

- Food secure: the household show very few signs of food insecurity, meaning that they have access to safe, nutritious food in socially acceptable ways.
- Food insecure without hunger: The household members show signs of food insecurity; they express anxiety about accessing sufficient food and/or adopt coping mechanisms such as reducing food quality and other changes in food management. They only reduce portion sizes or skip meals occasionally or to a limited extent.
- Food insecure with hunger: the food intake of family members is reduced to the point where household members often physically experience hunger (feel hungry).

- EMPOWERMENT: people's ability to participate in the decision-making processes that affect their lives (United Nations Development Program et al., 2005)

Indicator: Household marine tenure

Marine resource rights can be divided into five functional categories (Mascia & Claus, 2009 as follows: the right to enter or access the MPA; the right to harvest resources from the MPA; MPA management rights (e.g. making decisions regarding the ways in which resources are used); the right to exclude other people from the MPA (e.g. making decisions on who is or is not allowed to enter the MPA); and the right to transfer marine resource rights to other people (e.g. the right to sell or to rent these rights).

The Bird's Head Seascape Sociological Monitoring Program used a resource rights use index to evaluate the rights exercised by each household over the 12 months prior to the survey. This index (from zero to 5) counts the number of rights available to and exercised by each household over the 12 months prior to the survey.

- EDUCATION: the structures, systems, and practices used to transfer knowledge and skills in a society (Stephanson & Mascia, 2009). 2014 in the English draft

Indicator: School enrolment rate

We measured the percentage of school-age children (5 to 18 years of age, inclusively) receiving formal education in each household.

- CULTURE: encompasses art, ways of living together, value systems, traditions, and beliefs (UNESCO, 2001).

Indicator: Place attachment

Place attachment is "an emotional connection between an individual and a specific place" (Williams & Vaske, 2003). Research has shown that place attachment is a strong predictor of environmentally responsible behaviour and can influence environmental stewardship (Vaske & Kobrin, 2001; Gosling & Williams, 2010).

We measured the emotional connection of each household living in each MPA using a standard scale (adapted from Gosling & Williams, 2010). This scale ranged from zero to 5, where a higher value indicates a greater emotional attachment to the MPA in question.

C. MANAGAGEMENT EVALUATION

In the Bird's Head Seascape, there are two tools currently used to assess MPA management: the World Bank Scorecard (World Bank, 2004) and the 'E-KKP3K': Technical Guidelines for Evaluating the Management Effectiveness of Aquatic, Coastal and Small Island Conservation Areas (Directorate for Spatial and Fish Species Conservation, 2012). The World Bank Scorecard has been used to assess MPA management in the BHS MPA Network since its establishment, allowing users to track changes in MPA management over time and to make global comparisons among MPAs. The E-KKP3K was developed by the Indonesian Ministry of Marine Affairs and Fisheries (MMAF) in 2013, and is a relatively new tool for monitoring changes in MPA management. The E-KKP3K provides a standardized assessment across Indonesia as a guide to help the MMAF develop management strategies and set priorities.

1. WORKD BANK SCORECARD

The World Bank Scorecard was specifically developed to assess progress in achieving management goals for marine protected areas. These management assessments were conducted annually until 2017 in ten MPAs Kaimana MPA Networks: Buruway MPA and Teluk Triton MPA; Raja Ampat Marine Tourism Park: Asia and Ayau Islands MPA, Teluk Mayalibit MPA, Selat Dampier MPA, Kofiau and Boo Islands MPA, South and East Misool MPA; SAP Western Waigeo; Teluk Cenderawasih National Park, and Jeen Womom Coastal Park. In 2019, assessments were also carried out in the Fakfak MPA, South Sorong MPA, and North Misool MPA.

In this report, we synthesize data on the six distinct stages of 'good protected area management': (1) context, (2) planning, (3) inputs, (4) processes, (5) outputs, and (6) outcomes. We report the total score across these elements.

2. E-KKP3K

The E-KKP3K was specifically developed to: (1) evaluate the management of marine conservation across Indonesia; and (2) serve as a set of guidelines for self-evaluation of the management of a particular marine conservation area, and for making plans to improve management. These management assessments have been carried out at the MPA Network level, i.e. in the Kaimana MPA Network and the Raja Ampat MPA Network.

In this report we synthesise the data to determine the management effectiveness "level" of each MPA. The MPAs are classified based on a five level scale, from lowest to highest: Level 1 (Red), Level 2 (Yellow), Level 3 (Green), Level 4 (Blue), and Level 5 (Gold). There are 17 criteria which are evaluated through 74 questions posed to the MPA managers. The parameters used cover the status of the MPA's institutions, management and zoning plans, and infrastructure.

D. MONITORING THE GOVERNANCE OF MARINE RESOURCES

In addition to monitoring human well-being, the Bird's Head Seascape MPA sociological monitoring program monitors patterns and trends in marine resource governance in six MPAs (Kaimana MPA Network, Kofiau-Boo Islands MPA, South and East Misool MPA, Selat Dampier MPA, Teluk Mayalibit MPA, and Teluk Cenderawasih National Park) across four districts in West Papua Province.

Marine resource governance establishes the processes by which marine resources are managed, including how authority for making decisions is allocated; how management decisions are made; and how management decisions are enforced (Mascia et al., 2017). Marine resource governance can influence the social and ecological outcomes of policy interventions (Persha et al., 2011; Fox et al., 2012) such as MPAs, and successful governance regimes have been found to have shared characteristics (Ostrom et al. 1990). These characteristics include: participatory decision-making arrangements, context-dependent rules, active and accountable systems for monitoring and enforcement, and accessible conflict resolution mechanisms (e.g., low-cost, rapid processes for resolving disagreements which can be implemented at the local level). Focus group discussions and key informant interviews are conducted in each monitored settlement to understand marine resource governance in each MPA. The focus group discussions (FGDs) and key informant interviews focus on how decisions are made, the rules governing the use of marine resources, how the marine resource rules are monitored and enforced, and how conflicts over marine resources are resolved.

Focus groups and key informant interviews are conducted in around half of the settlements in each MPA every two years. This process provides a comprehensive assessment of marine resource governance every four years. As a result, in the first edition of the Bird's Head Seascape MPA Network Status Report, we documented the governance of marine resources through data from 100 focus group discussion and key informant interviews conducted in eight MPAs across the seascape. In the second and future editions we will be able report the governance status and trends. We synthesized data on four key attributes of marine resource governance in the seascape as follows:

- PARTICIPATION IN DECISION-MAKING

User group participation in decision-making has been associated with positive social and ecological outcomes in a variety of contexts (Ostrom et al., 1990; Persha et al., 2012). We monitored a proportion of the various user groups (e.g. groups of individuals using marine resources in a similar manner) participating in designing marine resource management rules for the six MPAs monitored.Indicator: Participatory decision-making

- RESOURCE USE RULES

Rules (setting out when, where, how, or by whom resources can be used) which are based on local conditions have a greater likelihood of achieving positive social and ecological outcomes compared to rules which are unsuited to local conditions (Ostrom et al., 1990). We monitored the proportion of important species and habitats (based on the outputs from the focus group discussions) with specific resource use rules in the six monitored MPAs. Species and habitat were identified as being "important" based on social, economic, cultural and spiritual values. Indicator: Context-dependent rules

- MONITORING and ENFORCEMENT OF REGULATIONS

Governance systems which apply graduated sanctions (e.g. sanctions which increase over time, based on the type or severity of the infraction) result in positive social and ecological outcomes more often than systems which do not impose sanctions or apply the same sanction to a variety of different types or levels of infraction.Indicator: Sanctions imposed

- CONFLICT RESOLUTION

It is widely recognised that the ability of resource users and law enforcement agencies to resolve conflicts over marine resources or their management in rapid and inexpensive ways is associated with more positive social and ecological outcomes (Ostrom et al., 1990). We monitored the average time required to resolve conflicts or disputes between resource users or between resource users and law enforcement agencies in six MPAs across the seascape.Indicator: Accessible conflict resolution mechanisms

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