

Identify gaps to achieving marine spatial management in Kimbe Bay, West New Britain Province, Papua New Guinea: A review of past work



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Cover image: Fishers in outrigger canoes in Kimbe Bay, West New Britain Province, Papua New Guinea.
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Kimbe Bay Network of Locally-Managed Marine Areas, West New Britain Province

Located in the Bismarck Sea, Kimbe Bay comprises 13,794 square kilometres of sea and 560 kilometres of coastline off the northern coast of West New Britain Province (Figure 1; Green *et al.*, 2008). The volcanic terrain of the New Britain mainland forms the eastern and southern shores of Kimbe Bay; the Willaumez Peninsula, which juts northwards from New Britain Island, comprises the bay's western flank. Situated within the Coral Triangle ecoregion, Kimbe Bay's marine and coastal habitats have a high biodiversity status (Green *et al.*, 2008). The bay also supports a regional tuna fishery (Langley *et al.*, 2006) and is an important area for endangered turtles, sea birds and marine mammals (WWF, 2003). Many of the 100,000 residents inhabiting Kimbe Bay's coastal zone rely on the local marine environment for seafood, livelihoods and traditional practices, and maintain customary ownership over their local marine resources through traditional tenure rights. During recent decades, regional population growth, eroding customary governance systems, more efficient and destructive fishing methods*, and anthropogenic climate change have impacted Kimbe Bay's marine ecosystems and the human population that rely on marine ecosystem goods and services (Green *et al.*, 2007; Foale, 2009).

The Nature Conservancy (TNC) worked in West New Britain Province from the mid-1990s to 2013. TNC's work included conducting marine ecological monitoring and rapid biological assessments of the Kimbe Bay region in collaboration with scientists from James Cook University (JCU), based in Queensland, Australia. TNC also worked with local communities to establish locally-managed marine areas (LMMAs) and developed an education and awareness programme, which was delivered to local communities in partnership with Mahonia Na Dari (MND), a non-governmental organisation (NGO) focused on marine conservation education in West New Britain Province. From 2004 to 2007, TNC conducted marine ecological assessments and arranged technical workshops, the outcomes from which were used to establish conservation targets and objectives that would provide guiding principles for establishing a network of marine managed areas within Kimbe Bay. The rationale was to identify priority locations in which to expand the existing network of locally-managed marine areas (LMMAs) in Kimbe Bay that would effectively conserve biodiversity through a representative network[†] The aim of the LMMA network was to protect certain areas of biological and ecological interest, including fish aggregating sites and turtle nesting areas (Green *et al.*, 2007).

In 2004, during the first technical workshop, thirty scientists, partners, TNC staff and local representatives met to decide on the conservation targets, objectives, boundaries and design principles for the LMMA network. Conservation targets included: (i) shallow water habitats; (ii) deep water habitats; (iii) islands;

* Destructive fishing methods include the use of chemicals and derris root.

[†] According to Jupiter *et al.* (2014) an LMMA is "An LMMA is an "area of nearshore waters being actively managed by local communities or resource-owning groups, or being collaboratively managed by resident communities with local government and/or partner organizations". Thus, an LMMA is a form of marine management through customary or co-management arrangements.



Figure 1: Kimbe Bay, located in the Bismarck Sea off the northern coast of West New Britain Province, Papua New Guinea, and the 12 LMMAs within Kimbe Bay, which were active as of July 2022. (Source: Nate Peterson, 2018; ProDoc GEF6, 2018, Sustainable Finance of Papua New Guinea's Protected Area Network)

(iv) rare and threatened species; (v) species with limited distributions; (vi) commercially-important reef species; and (vii) large pelagic fishes. The objectives were to: (i) conserve the marine biodiversity and natural resources of Kimbe Bay; and (ii) address local marine resource management needs. Design principles for the LMMA network were also established, which encompassed both local biophysical and socioeconomic factors. The biophysical design principles included: (i) risk spreading (through representation and replication); (ii) protecting key species; (iii) incorporating patterns of connectivity within and among marine ecosystems; and (iv) the effective management of natural systems. The socioeconomic data to be considered during network design consisted of: (i) general socioeconomic factors; (ii) fisheries factors; (iii) nature-based ecotourism; and (iv) shipping. Once the network design principles had been established, emphasis was placed on identifying and conducting high priority research, which included: (i) identifying special and unique marine and coastal ecosystems; (ii) obtaining physical oceanographic information concerning ocean currents and bathymetry; and (iii) collecting socioeconomic information, which ranged from how community residents use and value their marine resources through to assessing local marine biological knowledge and understanding (Green *et al.*, 2007).

When designing the Kimbe Bay network, emphasis was placed on assessing the marine habitats and biological communities in the bay. Community outreach and engagement was initially carried out by MND (in partnership with TNC) and focused on conducting awareness on environmental issues, including harmful fishing methods. TNC also undertook community engagement while collecting biological data and information concerning areas of cultural significance. In addition, socioeconomic surveys were conducted in six coastal communities (Koczberski *et al.*, 2006). Socioeconomic data formed part of the network design process, which aimed to address the interests and needs of local communities. Note that other design processes sometimes do not include socioeconomic data, recognising that data collected are likely to be coarse proxies for true costs and may not represent the full suite of ways that users value the marine environment (Weeks & Jupiter, 2013).

TNC considered several options for involving communities in the network design and developmental stages, which included: (i) full community engagement in the design process; (ii) limited community engagement on certain issues considered strategically important; and (iii) engagement following the completion of the scientific design and research processes (Green *et al.*, 2007). TNC decided to conduct community engagement once the scientific design process had been finalised for the following reasons:

1. Concerns regarding high expectations at the community level, especially concerning the preconceived benefits of the network and the potentially large number of communities that may push for their customary marine areas to be included within the network, which would have surpassed the resources of TNC;
2. Potential sources of conflict that may arise within or between communities if local expectations were not met during the network design process;
3. The possibility of community support for marine conservation beyond the areas that were deemed to be biologically significant;

4. The cultural diversity of Kimbe Bay, and the complex and often overlapping customary tenure rights to marine resources, which could have caused difficulties when attempting to capture community views and opinions during the scientific design process; and
5. The technical complexity of the scientific design process, which was considered impractical for community participation.

As is good practice when utilising a decision-support tool to assist in the design of marine spatial management, TNC used the outputs of Marxan analysis to initiate conversations with local rights-holders about their willingness to manage the marine environment and where it would be optimal to do so to get benefits for biodiversity. TNC engaged with communities located in the priority areas of biological significance (which were identified during the scientific design phase) through a community-based planning process. Biological and socioeconomic data were assessed using Marxan marine reserve design software, which uses hexagonal planning units to consider and compare ecological and socioeconomic standards listed in the design principles. The design principles focused on the biodiversity goals and socioeconomic costs within each planning unit, enabling a selection process to occur based on different scenarios. The software spatially organised the design principles, resulting in an optimal LMMA network for the Kimbe Bay region, with maximum benefits to biodiversity protection and minimum socioeconomic costs to coastal communities. Following the Marxan data analysis, fifteen* areas of biological interest were identified as appropriate choices for conservation, which encompassed 17 villages (Green *et al.*, 2008). TNC worked with communities that have customary marine tenure rights in each of the fifteen areas of interest through the community-based planning process. Efforts were made by TNC to ensure the areas of biological interest did not encompass more than two customary marine tenure limits to reduce potential sources of community conflict. (Green *et al.*, 2007). The community-based planning process developed by TNC comprised the following components:

1. Community engagement: To introduce the planning process to communities, as well as the concepts of networks of marine managed areas;
2. Community visions: To identify locally-managed marine area (LMMA) boundaries and to develop consensus concerning a realistic vision for managing local marine resources;
3. Participatory conservation planning: To identify ecosystems or areas of biological significance that are considered priorities for communities to protect, and to refine such information based on local knowledge;
4. Community development of LMMA plans and their agreement: To help communities achieve their visions for the long-term management of their marine resources;
5. Preparation of draft LMMA plans and their agreement;
6. Stakeholder consultation and finalisation of the LMMA plans and their agreement by the communities.

* One of the fifteen areas of biological interest, named 52 Fathoms, was later removed due to insufficient biological data obtained from the area.

TNC aimed to obtain full community agreement on the LMMA plans in each of the fifteen areas of biological interest identified during the scientific design process (Koczberski *et al.*, 2006).

In 2004, TNC assisted with the development of three LLG bills, which became the Talasea, Bialla and Hoskins Marine Environment Management laws.* Together, the three LLG laws were developed to enforce the proposed network. The three LLG laws also formed the basis for the community LMMA management plans in each LLG jurisdiction (Weeks *et al.*, 2014). A steering committee comprising government, private sector and NGO stakeholders was established to take ownership of the network implementation process. A memorandum of understanding (MoU) was signed between TNC and the West New Britain Provincial Government to establish the Kimbe Bay Marine Management Area governance structure, which included a governing secretariat. The Kimbe Bay LMMA communities also became part of the PNG Learning and Training Network, which aimed to showcase community resource management and conservation tools being implemented by community residents, which could be shared through learning exchange networks (Weeks *et al.*, 2014). However, following the 2008 global financial crisis, TNC reduced work levels in PNG, and by 2013, TNC had left the Kimbe Bay region. During the 2010s, limited information was made available as to whether the three LLG laws were actively enforcing the network. Since 2013, MND continued the education and awareness programme within the priority areas where the LMMAs had been established, and certain reef and fish monitoring studies were conducted by JCU. According to Wise *et al.* (2016), the LMMAs in Kimbe Bay may have led to ecosystem improvements, but are no longer managed.

Evaluation of the Kimbe Bay Network of Locally-Managed Marine Areas

Because of the customary marine tenure rights PNG communities have over their local marine resources, community engagement is critical to ensure residents are committed to marine management in their waters. Communities should have a voice in marine management decision-making processes, including decisions made on establishing management rules and penalties. To achieve successful marine management compliance, all communities must feel a sense of ownership over the management measure; otherwise, the management initiative is likely to fail. In Kimbe Bay, prior to the development of the three LLG laws, scientific data were collected and analysed to identify fifteen areas of biological significance and low socioeconomic cost. The communities living in each identified area were approached following the scientific assessments, with community engagement occurring only within the areas of interest (and not in adjacent communities). An assumption that communities would be willing to embark on the LMMA establishment process following the scientific assessments may have been detrimental to the success of the LMMA network. Similarly, neglecting communities outside the designated areas of scientific interest may have also lead to local contention.

* Talasea, Bialla and Hoskins LLGs are all located in West New Britain Province and collectively form the coastline of Kimbe Bay.

A marine conservation community engagement plan should include an education and awareness component that focuses on (i) the biology of marine resources, (ii) the threats that can impact marine resources, (iii) measures for managing marine resources, and (iv) possible legal options for enforcing different management measures. According to available information, an education and awareness programme was conducted by TNC in fourteen of the fifteen priority areas of scientific interest*. When TNC ended its work in Kimbe Bay in 2013, MND continued the education and awareness programme within the priority areas where LMMAs had been established.

According to the Wildlife Conservation Society (WCS) Papua New Guinea's Programme experience, extensive consultations and trust building with key stakeholders should occur, including representatives from national, provincial and local level government, fisheries, the private sector, law and order, local resource owners and other interested groups. Regular stakeholder consultations can steer the direction and development of an MPA or other marine management initiative and assist with conflict resolution. In Kimbe Bay, during the LMMA development phase under TNC, stakeholder consultations occurred primarily through scientific workshops, following which the communities living in priority areas of interest, identified during the scientific workshops, were engaged. The Conservation and Environment Protection Authority (CEPA) was also aware of the establishment of the MPA network and a steering committee was initially formed. However, from information made available, it is not apparent that broad-scale stakeholder consultations occurred.

A successful MPA requires defined boundaries, rules and penalties, as well as a clear governance structure. Similarly, a suitable legal mechanism should be enacted to enforce the MPA rules and penalties and to formalise the MPA boundaries. In Kimbe Bay, TNC and other specialists determined clear boundaries for the fourteen LMMAs. The three LLG laws developed to enforce the network also included rules and penalties to be applied across the broader LLG jurisdictions.[†] However, there is no record of a long-term governance structure in place for managing the network collectively, and although LLG laws were submitted for approval, it is not known whether they were validated, implemented and enforced. Furthermore, the Kimbe Bay LMMA rules were viewed by some community residents as a means for generating money: for example, there are reports that the Kulungi LMMA representative attempted to fine JCU PGK 2,000 because one scientist was completing reef monitoring within the local LMMA, while the Patanga LMMA representative wanted to charge JCU reef monitors PGK 700 per person per annum before reef monitoring could be conducted within the Patanga LMMA.[‡] These two instances of unrealistic

* The fourteen areas of scientific interest in Kimbe Bay became LMMAs, which collectively formed the network of protected areas.

[†] The Thalasias, Bialla and Hoskins LLG laws, which were implemented in 2004, all include the following marine management rules: (i) restrictions on collecting, taking, and killing of fish, shellfish and other marine resources; (ii) restrictions on fishing; (iii) prohibitions on destruction to reefs; (iv) prohibitions on disposal of refuse; (v) prohibitions of swimming and diving; (vi) prohibitions on dynamiting; (vii) prohibitions on the use derris root; and (viii) breaches of management plans.

[‡] Information and personal comments provided by Cecilie Benjamin, based at Mahonia Na Dari in Kimbe Bay, in October 2021.

expectations and lack of understanding of what NGOs and research institutions can and cannot pay for are evidence of a poorly implemented engagement and awareness process, and community selection process.

A lack of control and surveillance occurred once the Kimbe Bay network of LMMAs had been implemented, and therefore there was an absence of documented MPA management rule violations. TNC did initially train and equip LMMA representatives to conduct biological monitoring and JCU has conducted ecological monitoring and research* in the region†, although there are few records of fisheries monitoring occurring within the LMMAs. Furthermore, it is not known whether people and nature benefited from the establishment of the network in Kimbe Bay. A youth-focused education and awareness programme has been conducted by MND – which typically provides outreach and marine conservation to some 10,000 residents each year – which has increased local awareness and understanding regarding marine conservation and management issues. JCU has also published academic papers on tropical marine ecology, which included work conducted within the Kimbe Bay region.‡ Despite this, it is unclear whether the residents of Kimbe Bay have directly benefited from the implementation and enforcement of the network. Since the start of the 2010s, the Kimbe Bay network appears to have been somewhat neglected (Wise *et al.*, 2016), with only MND continuing the education and awareness programme in the fourteen LMMA sites.

* In 1999, the Kobograde LMMA was formed, which was established by TNC, MND and the National Fisheries Authority (NFA) and comprises four reefs that JCU have been monitored since 1998 (see Jones *et al.*, 2004, for further information). Since 2004, JCU scientists have examined reef fish population connectivity through larval dispersal studies in Kimbe Bay, the outcomes from which could inform marine management. The research focused on two live aquarium trade fish species: the orange clownfish (*Amphiprion percula*) and the vagabond butterflyfish (*Chaetodon vagabundus*). See Almany *et al.* (2017) for further information about the study.

† A team from the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) has been working in New Britain since 2010 in support of the Coral Triangle Initiative, which explored opportunities for sustainable development. This included the potential for nature-based tourism in Kimbe Bay and better management for the regional LMMAs. In 2017, the West New Britain Provincial Administration and the Australian Government arranged a two-day workshop to assess the benefits and costs of nature-based tourism and to review the effectiveness of the LMMAs. A group called HoBiTa (derived from the first syllables of the Hoskins, Bialla and Talasea LLG administrative jurisdictions that flank Kimbe Bay) was established during the 2010s, the members of which received training from TNC in reef monitoring; however, there is no indication that the group remains active. During the early 2010s, master's students from Macquarie University – located in New South Wales, Australia – visited Kimbe Bay to conduct marine ecological assessments; however, similar visits from Macquarie University did not continue. (Information provided by Maya Srinivasan from James Cook University, Australia, and Cecilie Benjamin, Mahonia Na Dari).

‡ Information and personal comments provided by Cecilie Benjamin, based at Mahonia Na Dari in Kimbe Bay, during October 2021.

Identifying gaps and best practices

The initial stages of the establishment of the LMMA network in Kimbe Bay began with a community engagement and education and awareness programme. However, apart from occasional outreach conducted by local NGO Mahonia Na Dari, the community engagement and education programme did not continue in the fourteen sites of interest identified by TNC following the implementation of the Network. Continuing the community engagement and education programmes through the implementation phase of the marine management process requires personnel on the ground, staff capacity building, logistics and financing. An ongoing community engagement programme can help build local capacity to support local monitoring, control and surveillance, while a tailored education programme can further empower community residents to manage their local resources. Whether establishing an marine protected area (MPA), LMMA or other spatial marine management initiative, extensive community engagement and active community involvement is required to allow residents to: (i) understand the management process; (ii) appreciate the advantages and disadvantages of different marine management measures; (iii) take part in decision-making processes; and (iv) develop a sense of ownership for the management initiative. As well as community consultation, regular stakeholder meetings, comprising key representatives from government agencies, local organisations and other interested groups, are an integral part of the marine management development and implementation process. Technical working groups or steering committees that meet every six months can guide and drive the development and implementation processes required for successful spatial marine management, which includes providing consensus during decision-making stages and assisting with conflict resolution.

An MPA, LMMA or other marine management initiative requires clear and defined rules, penalties and boundaries, which are agreed upon through consensus by local community residents and other stakeholders. Similarly, any marine management area or network of areas requires a suitable governance structure to ensure the long-term success of the management measure, with appropriate legal mechanisms in place for the enforcement and formalisation of the management initiative. The Kimbe Bay LMMAs were established with clear boundaries and local governance, but there was no overall governance structure for the network. A steering committee was formed for the Kimbe Bay network; however, the committee did not meet after 2008. LLG officers have the mandate to enforce rules within LLG jurisdictions: the LLG laws developed for Kimbe include management rules and penalties for non-compliance; however, there is no indication that local communities or other stakeholders were involved during the decision-making processes required for developing the rules and penalties. Furthermore, it is not clear whether the rules and penalties listed in the three Kimbe Bay LLG laws were enforced. Recommendations would include setting simple, clearly defined management rules and penalties during the development phases of future spatial marine management initiatives that are agreed upon by local communities, as well as boundaries that define the proposed management area*. For an LLG law to be

* If an LLG law is to be used to enforce an MPA, the external boundaries of the management area must remain within the jurisdictional boundaries of the LLG.

enacted in order to enforce marine management rules, penalties and boundaries at the LLG level, an MEMCC should be established to oversee the implementation of the rules applied to an MPA within the LLG jurisdictional boundary, and – with stakeholders – the MEMCC should develop and implement an accompanying MPA management plan. The MEMCC should meet regularly before and after the declaration of the MPA or other spatial marine management initiative. The MEMCC should also collaborate with the Ward Development Committees within the LLG*, which can then link the MPA management plan to the Ward Level Development Plans that have been implemented within the LLG jurisdiction.

It is unknown whether all of the rules for the LMMAs and LLG laws for Kimbe Bay were fully implemented, thus it is difficult to comment whether monitoring, control and surveillance took place, and therefore whether offenders receiving punishment. These components are necessary for (i) ensuring the longevity of an MPA, LMMA or network of management areas, (ii) for indicating the success of the marine management approach, and (iii) for providing avenues for adaptive marine management. Lessons can be learned from the implementation phase of the Kimbe Bay network, including the need for a robust monitoring programme, focused on biological (including fish abundance and diversity assessments), socioeconomic (through household surveys, focus groups and key informant interviews) and fisheries (such as catch-per-unit-effort studies) components that can be compared to baseline data. Control, surveillance and enforcement procedures should be established and implemented, which are linked to local village courts, peace officers and provincial police personnel. In addition, the documentation of rule infringements and punishments issued for non-compliance should be kept, updated and maintained. A regular assessment of community benefits gained from marine management following implementation should also be conducted to gauge the public perceptions of the MPA and to provide opportunities for adaptive marine management.

Lessons learned from the assessment of the Kimbe Bay Network of Locally-Managed Marine Areas

The following points outline key lessons learned from the assessment of the Kimbe Bay network of LMMAs. Although this is not an exhaustive list, it contains major themes and recommendations that may be of assistance to marine managers and community resource owners, especially when establishing and implementing future spatial marine management initiatives in PNG.

1. **Purpose, support and funding:** A clear understanding of the purpose for establishing an LMMA or marine management initiative needs to be known, which may include biodiversity protection, fisheries management or improving local climate change resilience. Whether the managed area

* The Ward Development Committees are responsible for linking an MPA management plan to the five-year Ward Development Plans. The Ward Development Committee can supervise the implementation of an MPA management plan through the Ward Development Plans.

is a government, community or external group decision – or an objective for an international NGO – the justification for such an undertaking needs to be clear and with sufficient external support and prolonged financing to ensure the long-term lifespan of the management area.

2. **Location:** A wealth of marine and coastal habitats are located around the shores of PNG, most of which support small-scale fisheries and are important sites for cultural and customary practices. When establishing an LMMA, MPA or other spatial management, consideration should be given to how the management initiative will benefit marine biodiversity, while also sustainably increasing local fish yields and enabling traditional practices to continue.
3. **Engagement and education:** An extensive community engagement programme should be undertaken in all communities located within the proposed marine management area. The engagement programme should be coupled with a tailored education and awareness strategy to inform community residents about marine management and enforcement options, as well as the direct and indirect benefits and constraints of implementation. Efforts should also be made to ensure local expectations are not raised.
4. **Community engagement protocol:** All community engagement should be conducted through the free, prior and informed consent (FPIC) process. Appropriate grievance mechanisms should be in place to allow communities to report any complaints or disservices encountered during the development and implementation phases of the LMMA, MPA or other marine management initiative.
5. **Stakeholder consultation:** Technical working groups and management committees, comprising representatives from national, provincial and local level governments, including the fisheries and environment sectors, as well as education institutes, the private sector, community representatives, law and order, local NGOs and other stakeholders, should be established with regular meetings to provide consensus on the development and implementation processes required for establishing a LMMA, MPA or other marine management initiative.
6. **Rules, regulations, penalties and boundaries:** Proposed marine management boundaries, rules and penalties should be agreed upon – or receive majority consensus support – by the members of the stakeholder working groups and management committees and through the community consultation process. Zones for specific marine management purposes should also be agreed upon prior to implementing a LMMA, MPA or other marine management initiative.
7. **Involvement and ownership:** Community residents – and especially local fishers – should be involved with the development of the marine management rules and penalties and the setting of the MPA boundaries; such an approach can provide communities with a sense of ownership and local pride for the marine management initiative.
8. **Representation:** All decision-making activities conducted at the community-level – and with other stakeholders – should include opportunities for both women and men to voice their concerns, opinions and interests. Youth representatives should also be included in all decision-making activities, especially at the community level. Similarly, when collecting socioeconomic or fisheries data for monitoring purposes, emphasis should be placed on collecting disaggregated data from a broad spectrum of society, including women and youth.
9. **Governance structure:** A defined and responsible governance body should be established – which is built on existing traditional governance structures – for managing the implementation phase. The governing body should comprise key representatives appointed from the area that is to be managed or protected. An example could be a Marine Environment Management and Conservation Committee (MEMCC), which is a requirement for establishing an LLG marine management law.

10. **Policy options:** Situation analyses and legal reviews of potential policy and legislation options should be conducted before the design and development phases, allowing the most suitable legal mechanism to be utilised in order to formalise and enforce the proposed LMMA, MPA or spatial marine management initiative.
11. **Management plan:** A management plan should be developed based on the rules and regulations. The plan should include instructions and guidelines for management, work plans for activity implementation, the roles and responsibilities for the governing body and other stakeholders, options for fund raising, and timelines for reviewing the monitoring plan. The MEMCC is responsible for overseeing the implementation of the management plan. The management plan should also be linked to the Ward Development Committee plans.
12. **Enforcement and compliance:** Surveillance plans should be developed to ensure the rules and regulations are adhered to. The surveillance plans should be linked to the village court system, and local village court magistrates and peace officers should receive training on how to enforce the rules and ensure rule-breakers are appropriately penalised. All offenses should be documented for future reference and to assist with adaptive management.
13. **Monitoring teams:** Capacity building and appropriate training should be provided to all biological, socioeconomic and fisheries monitoring personnel. Resources and funding should be sourced and allocated to monitoring staff, enabling a robust and feasible monitoring regime to be developed and implemented.
14. **Understanding benefits:** A biological, socioeconomic and fisheries monitoring programme should be implemented following the enactment of the managed area, with outcomes compared to baseline data collected before management was established. The monitoring plan should also include annual assessments of how coastal residents perceive the benefits of their management. The outcomes from the monitoring programme should provide a basis for local adaptive management.
15. **Adaptive management:** The outcomes from the monitoring and enforcement programmes should be assessed every five years or so by the governing body and other stakeholders. The outcomes, together with feedback from local communities and other stakeholders, can be used for adaptive management, enabling the management plan to be reviewed and adjusted accordingly.
16. **Communications:** Information concerning the managed area, including the rules, penalties, boundaries, and outcomes from the monitoring and surveillance programmes, should be disseminated back to the communities and publicised through relevant media channels, which may include posters, handouts, pamphlets, radio broadcasts, social media posts, newspaper articles and academic journal entries.
17. **Helping others:** Lessons learned reports should be produced concerning the development and implementation challenges and successes encountered during the planning and implementation processes, and shared with all stakeholders to assist future marine managers in PNG.

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List of acronyms

AARES	Australian Agricultural and Resource Economic Society
CEPA	Conservation and Environment Protection Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
FPIC	Free, prior and informed consent
JCU	James Cook University
LLG	Local level government
LMMA	Locally managed marine area
MEMCC	Marine Environment Management and Conservation Committee
MND	Mahonia Na Dari
MoU	Memorandum of understanding
MPA	Marine protected area
NFA	National Fisheries Authority
NGO	Non-governmental organisation
PGK	Papua New Guinea kina
PNG	Papua New Guinea
TNC	The Nature Conservancy
WCS	Wildlife Conservation Society
WNBP	West New Britain Province
WWF	World Wide Fund for Nature