

Shifting Perception on the impacts of MPAs



A Case Study of Qoliqoli Cokovata, Macuata

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INTRODUCTION

Both, natural processes and human activities in general threaten coral reefs. In reviewing the status of Coral reefs of the world, a recent report by the [Global Coral Reef Monitoring Network \(GCRMN\)](#) highlighted that up to 35% of the world's existing reefs may be lost in the next 20-40 years due mainly to overfishing, pollution, coral disease and predation, global climate change causing warmer ocean waters, and rising ocean acidification (Wilkinson, 2008). Findings of the GCRMN (2008) have shown that over recent decades there has been a growing recognition of the degradation of these reefs by these extreme natural processes acting synergistically with a number of anthropogenic impacts.

In spite of having one of the best-developed coral reef systems in the Pacific (Biodiversity Conservation Network, 1999), Fiji has reefs that are under severe pressure. The bleaching event for instance, of 2000, provided an interesting starting point, in that coral health was affected across the country with 40 to 80% loss of hard coral (Sykes, 2007). Natural causes of reef degradation, along with human impacts pose a real threat to their survival. Whilst little can be done about natural disturbances, human or anthropogenic disturbances can however be controlled and regulated (Koonjul *et al.*, 2003).

The establishing of Locally-Managed Marine Areas (LMMAs) or Marine Protected Areas (MPA), was therefore officially developed in 2001 as a tool to help in the sustainable management of coastal fisheries resources; where resident communities collaborate with local government and/or partner organizations (Tawake *et al.*, 2007) in formulating and implementing resource management programmes. The setting-up of the Fiji LMMA (FLMMA) network work promotes and advocates the use of an adaptive management approach as the basis of improving marine conservation efforts (Tawake *et al.*, 2005). Communities are thus empowered and assisted to evaluate the effectiveness of their management actions and adapt their approaches accordingly.

Responsive action at the community level is currently and continually being undertaken to identify methods of reducing and replenishing fisheries stocks (Chambers 1992, Veitayaki 2002). Engaging local communities has been a prerequisite for the success of community-based management systems particularly because of the immense dependence of local communities on environmental resources and because of their ownership of these resources.

There are over 217 FLMMA sites to date, distributed throughout the main islands (Figure 1) and of the 400 traditionally managed fishing grounds (qoliqoli), at least 70 are considered over-exploited while a further 250 are fully developed (Hand et al. 2005).

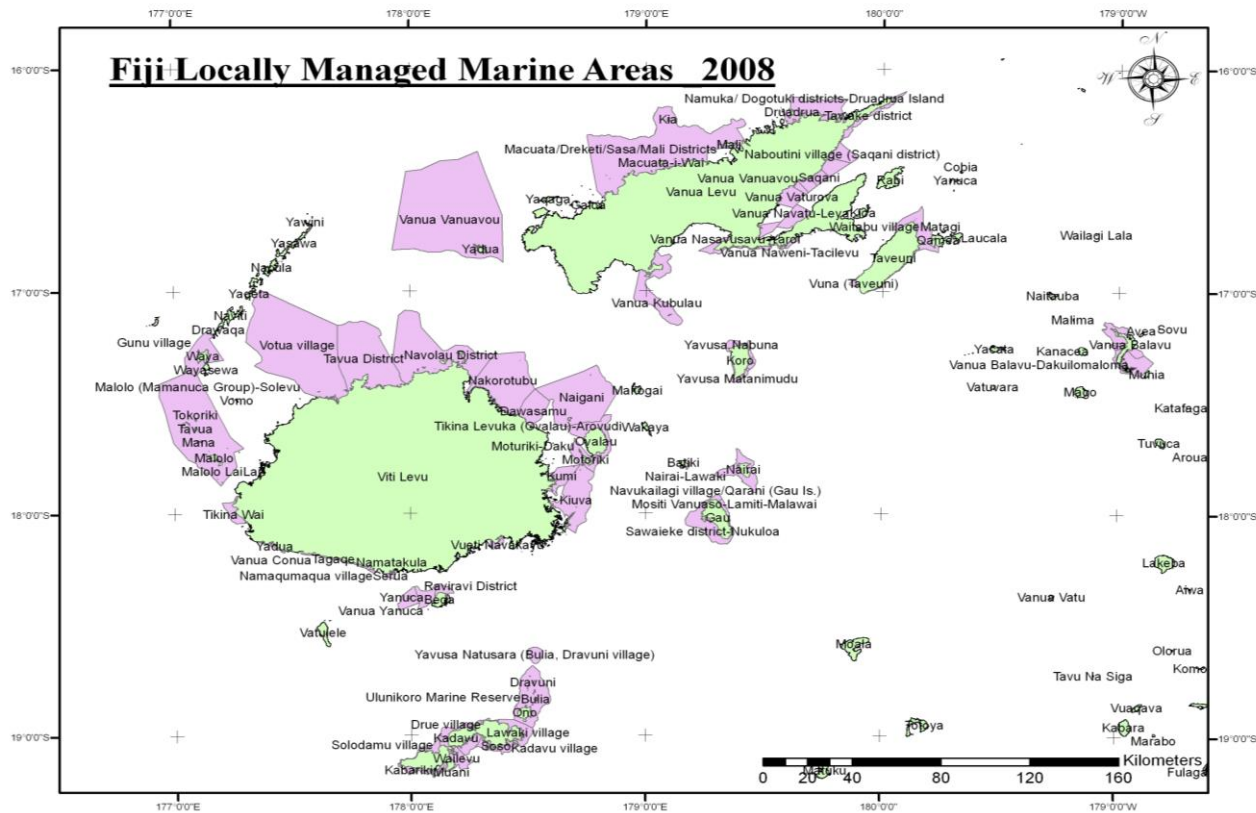


Figure 1: FLMMA sites in Fiji

The districts of Mali and Dreketi are FLMMA sites and are located in the Macuata province of Vanua levu. These two northern districts (along with Sasa and Macuata districts) share the same traditional fishing grounds, namely the *Qoliqoli Cokovata* (Macuata). This *qoliqoli* is bounded on the north west seaward side by the reef system known as '*Cakaulevu*', the Great Sea Reef which continues towards Udu point to the north east, towards Bua to the west and the coastline to the south, as in Figure 1 below.

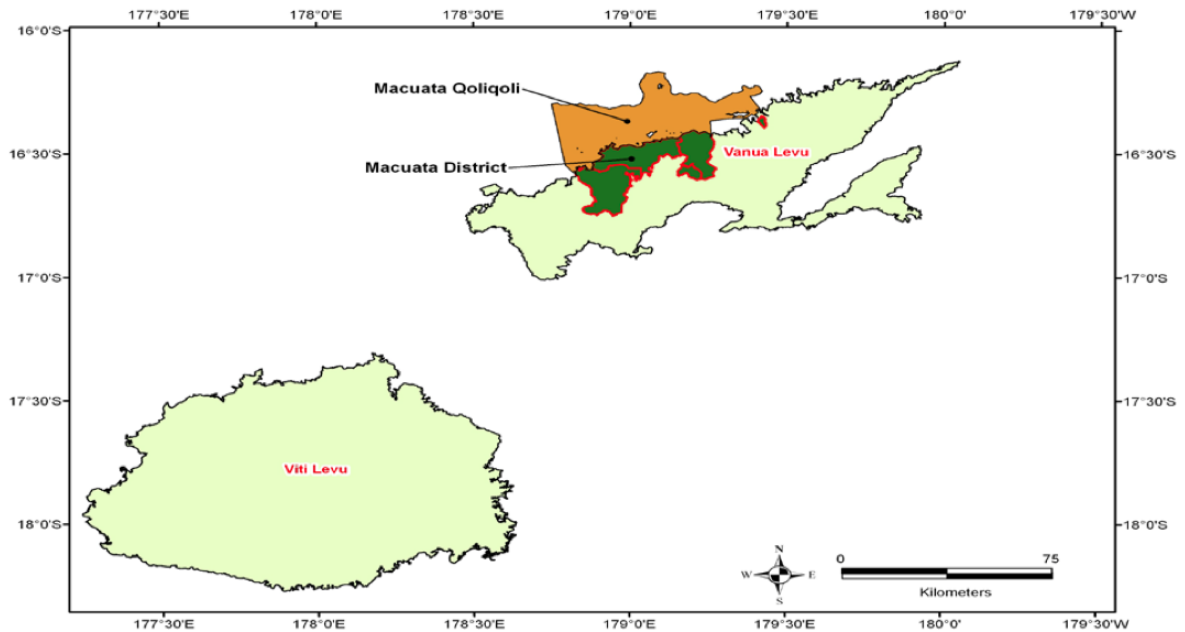


Figure 2: The Macuata qoliqoli (Cokovata) covers four coastal districts

The total area for the Dreketi, Macuata, Sasa & Mali districts in the *Qoliqoli Cokovata* traditional fishing area is 1,344 sq. kms, with current total MPA areas covering 13 % of total fishing area.

This report is a collation of findings on a perception study carried out with a number of community representatives over a one-week period (April 9 to April 13, 2014), in the province of Macuata, compared against surveys conducted in the same area in 2009. This perception study is intended to provide indications of changes perceived by the fishermen of the districts of Mali and Dreketi, with respect to their fisheries resources and associated socio-economic returns, from intervention applied in the area through sustainable marine resource management.

Available information on MPA management success stories and their perceived benefits

to the local communities is scarce (Cinner 2005). In Fiji, however, there are reports that empowerment, opportunity, and ownership are improving for the involved communities (Lees 2007). In order to retain community involvement, it is vital that the communities perceive benefits from their investment in management activities. This is because in general, communities are still more likely to place a greater significance on their perception than on generated scientific data such as the actual biological outcome measure of community management (Fisk 2007; Seidel 2009; Egli *etal* 2010).

The socio-economic baseline survey for the focal area carried out in 2009 (Bolabola *etal*) clearly depicted a clear and direct link or correlation between the livelihood of inhabitants of the 4 districts to the land, forest, freshwater and marine resources immediately surrounding the communities. The main purpose of this work is to see whether general perceptions of the MPA and responses of the respective communities have changed over time.

In order to evaluate the willingness of the Mali and Dreketi community members to continue to implement their management plan, WWF conducted socioeconomic surveys in 2009 and more recently in 2014 to examine how the communities of the *Qoliqoli Cokovata* perceived the benefits of their management efforts. The specific objectives were:

1. Examine whether the communities' perception of state of their marine and fisheries resources has changed after the establishment of the MPA network;
2. Examine their dependence and use of fish from their *Qoliqoli*; and examine their engagement and satisfaction with the management process

METHODOLOGY

This report serves to compare results with that collected in 2009 in the same area. Nine villages across four districts (Mali, Sasa, Dreketi and Macuat) were surveyed in 2009 and a total of 84 fishermen were interviewed. The results collated in the 2014 surveys however focused on eight villages in only two districts (Mali and Dreketi) and 58 fisherfolk were interviewed; these were community people whose main source of income came from fishing or related activities.

The questionnaire used includes 75 closed ended questions and 16 open ended questions. Open-ended questions were analyzed using pre-determined categories with specific criteria used to rate the responses to the questions, while the closed ended questionnaire were analyzed using frequency tables.

The interviews were tailored to address and answer the following 5 key questions. These were questions that were asked in the baseline survey (2009) and in this survey (2014).

- 1. What is the level of Fishermen's knowledge of MPA concept?*
- 2. Has there been a change in the quality of key environment components since the establishment of protected areas/managed areas?*
- 3. What is the level of understanding the purpose of MPA and natural resource issues and values relating to the natural environment?*
- 4. Has the network of MPA in Macuata reduced community identified threats?*
- 5. Has the Ecosystem Based Management Project been successful in improving awareness levels for the Macuata Communities?*

The data resulting from this survey is expected to be used in the continuing design of an effective education and communication programme to improve knowledge and influence attitudes and perception. At the conclusion of this process, the areas that need to be addressed will be clearly identified and will assist the *Qoliqoli Cokovata* Management Committee in reviewing their management plan through adaptive management.

RESULTS

Years of Fishing

The majority of fishermen (51.7%) interviewed have been fishing for more than 10 years (Figure 1); only 8.6% of the respondents have been fishing for less than 5 years. Varying perceptions were noted during the survey probably because of different levels and years of fishing experience in the *Qoliqoli Cokovata*.

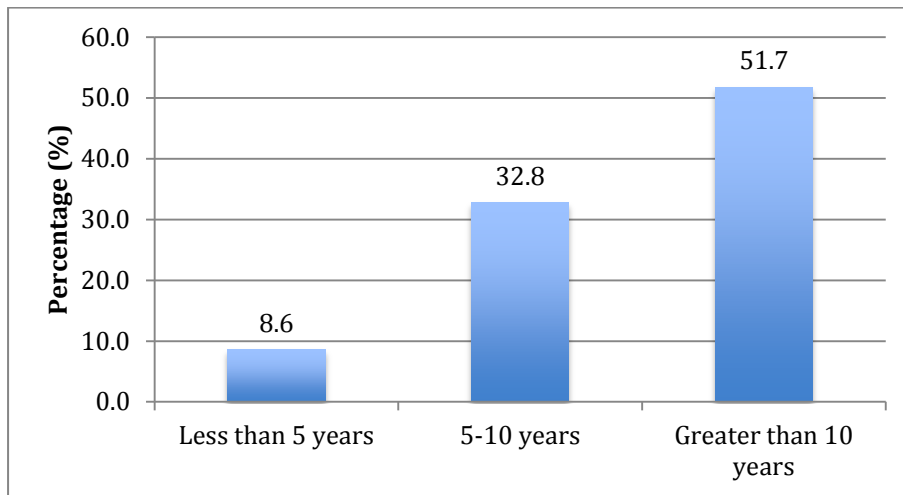


Figure 3: Number of years of fishing

Fisherman's knowledge of MPA concept

Approximately 92% of the fishermen are knowledgeable of the areas in their *qoliqoli* that are classified as marine protected areas. In 2014, 75.8% of the fishermen indicated that the MPA boundaries were visible and properly demarcated compared to 90% in the 2009 survey; the remaining 24.2% suggested otherwise. Most of the fishermen noted that the boundaries of the MPA were not physically visible which provided conflicting assumptions on the exact size and dimensions.

About 95% of the respondents mentioned that decisions and governance plans regarding the MPAs are well communicated to the community members; the remaining 5% either do not know of these decisions or claim that decisions are not communicated well throughout the community with regards to the MPA boundaries, laws etc.

Fishermen knowledge of Protected Areas

When assessing how perceptions have changed since the survey in 2009, it is quite obvious that general perceptions have remained the same, except for a few (Figure 2). Some prominent changes in perception between 2009 and 2014 are:

1. Economic needs are a barrier to MPAs. In 2009, 72% of respondents agreed compared to 56% in 2014
2. In 2009, 62% of fishermen mentioned that MPAs helped them feel safer in difficult times, in 2014, about 90% agreed

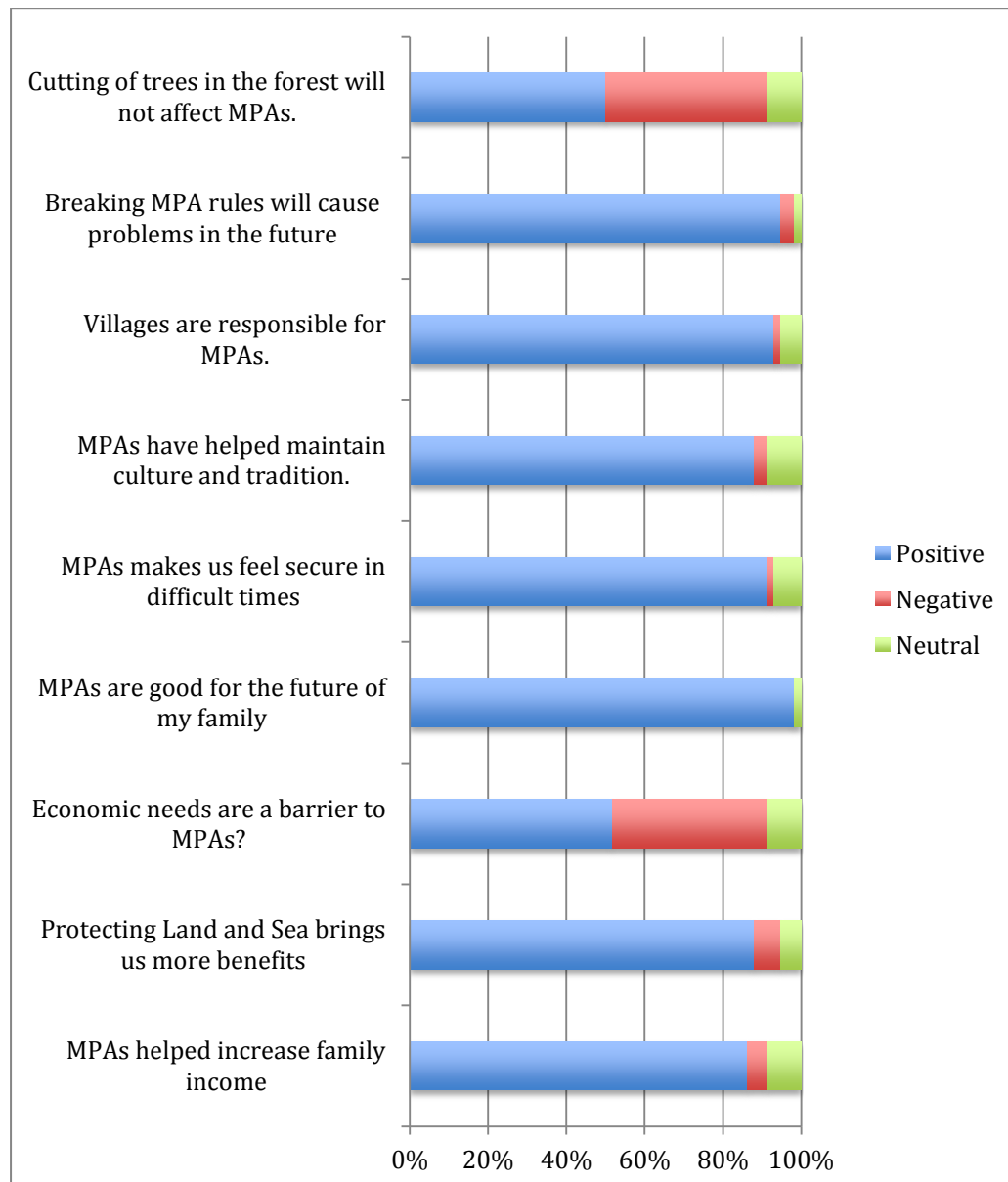


Figure 4: Fishermen knowledge of Protected Areas

Perceived Threats to *Qoliqoli* Integrity after MPA establishment

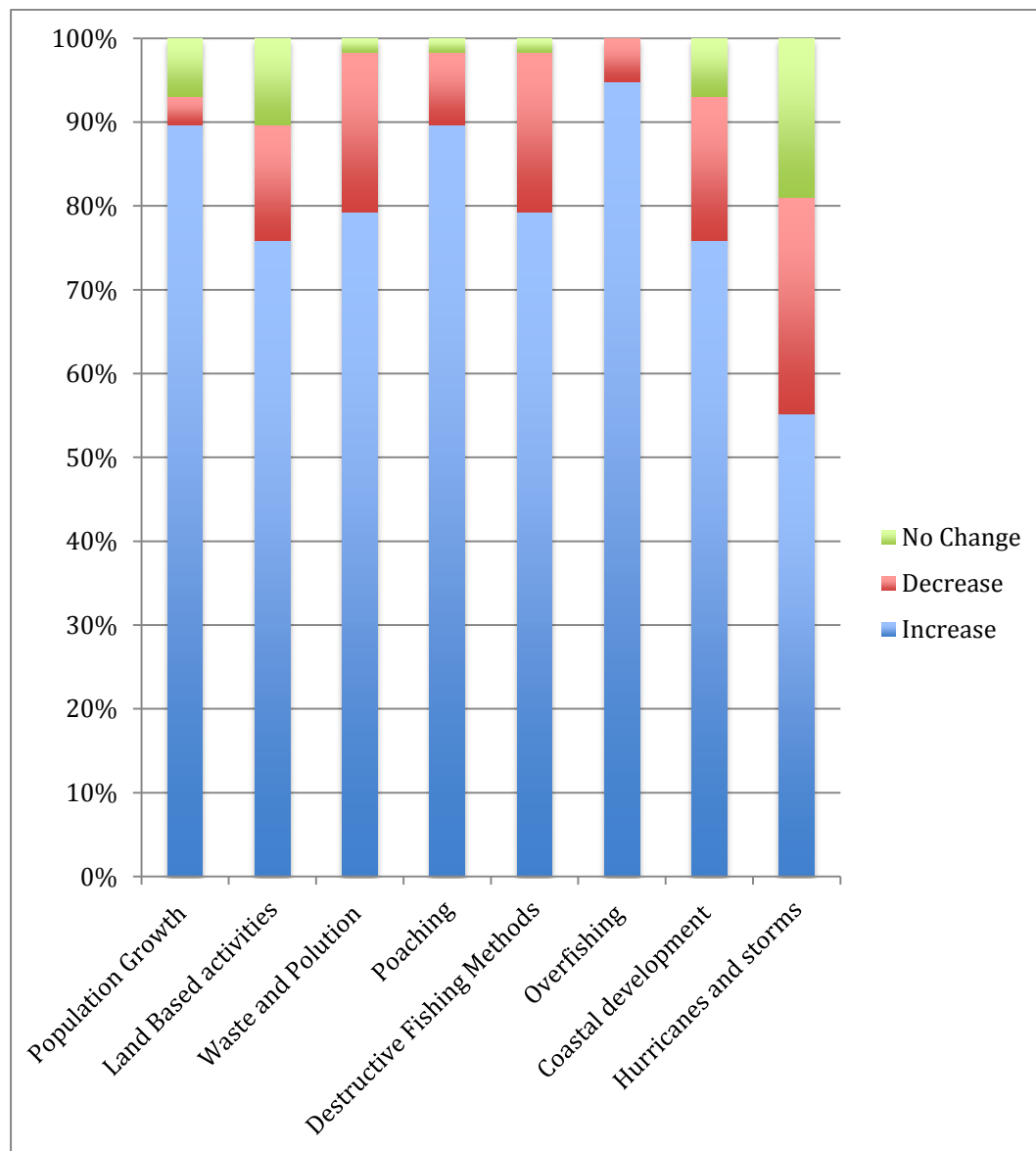


Figure 5: Response to Threats to the *Qoliqoli*

The *Qoliqoli Cokovata* Network of Protected Areas was set up primarily in response to community-identified threats. The threats were of a degraded and overfished *qoliqoli* resulting in diminished fish catches, decreasing size of catch and an increasing length of fishing time for sale and or family consumption. Another major contributing factor to diminished stocks in the area was pollution from poor or unrestricted waste management. Part of the set up was the development of a management plan to address the threats which included areas set aside as no fishing areas to function as breeding and nurturing areas and from where adult fish would emerge to restock the entire *qoliqoli* and beyond.

The prediction made at the start of setting up MPA's in the *Qoliqoli Cokovata*, were that threats such as increasing use of destructive fishing gear, overfishing, unlicensed or illegal fishing and waste pollution would be reduced. In checking the status of these threats, each fisherman was asked to give their assessment based on their perception of the eight major threats listed in Figure 5.

The results recorded in 2009 show that since the establishment of MPAs, destructive fishing was the most reduced threat, followed by overfishing and coastal development.

In 2014, the major claims that the greatest threats to the integrity of the *qoliqoli* and MPA effectiveness were overfishing, followed by population growth and poaching (Figure 5).

Fishing near the MPA

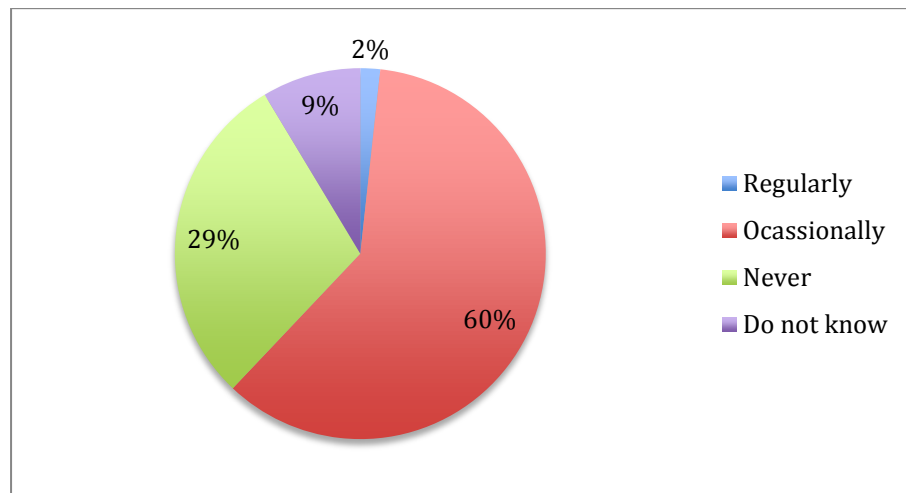


Figure 6: Percentage of people fishing near the MPA

Figure 6 suggests that two percent of the respondents are regularly fishing near the MPA boundaries. A significant number of fishermen occasionally fish close to the MPA boundaries, whilst 29% claim that they never fish near the MPA. The remaining nine percent are probably unaware of the MPA boundaries.

Regardless, the following results (Figure 7) illustrate that about 60% of the respondents that is the majority, would fish more near the MPAs if it were technically feasible. This becomes cause for concern if technical feasibility is the only factor that prevents fishing activity from taking place in the MPAs.

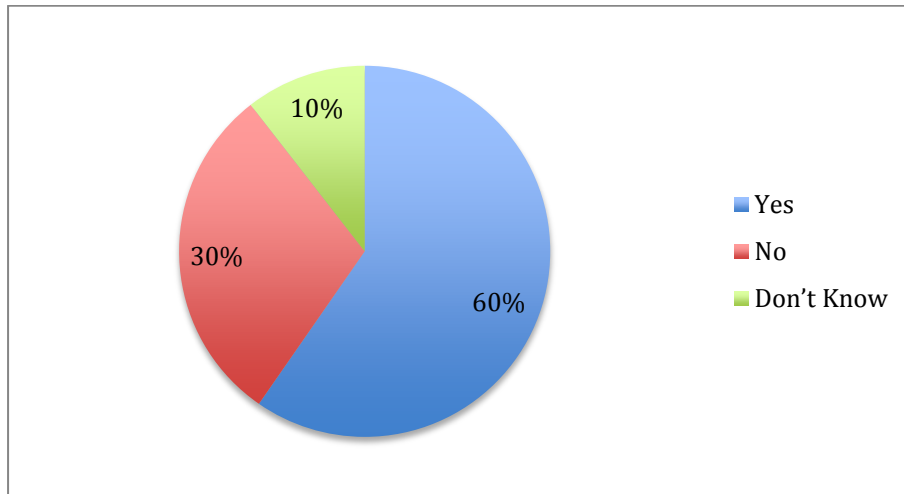


Figure 7: Fishing near the MPA if it were technically feasible

Perception on the change in quality of various components of the environment since the establishment of protected areas/managed areas

In general, when comparing 2009 and 2014 survey results, the perception of the impact of protected areas on the quality of the forested uplands, river freshwater habitats, mangroves, sea grass, live coral abundance, fish abundance, fish size, fish diversity, invertebrate abundance, invertebrate size, invertebrate diversity and water quality were positive and very similar. 62% of the fishermen interviewed acknowledged that they were very dependent on local natural resources and that MPAs played a significant role in their livelihood provisions. The other 38% claimed that they are less dependent on the MPAs for livelihood and that MPAs do not affect their dependence on natural resources. The following illustration (Figure 1) shows the level of dependence of fishermen in the eight villages on the available natural resources and MPAs.

Community dependence on natural resources and MPA effects on resources

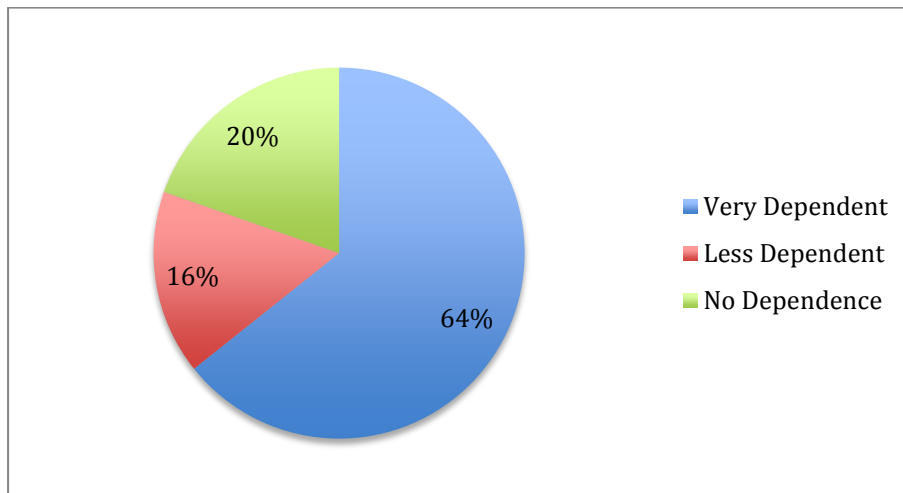


Figure 8: Percentage of dependence on natural resources

The majority of fishermen interviewed mentioned their high dependence on the natural resources in their villages and that MPAs supported their dependence on these resources. 20% of the respondents suggested that MPAs do not threaten their dependence on their natural resources.

Perceived impacts of MPA on fish diversity

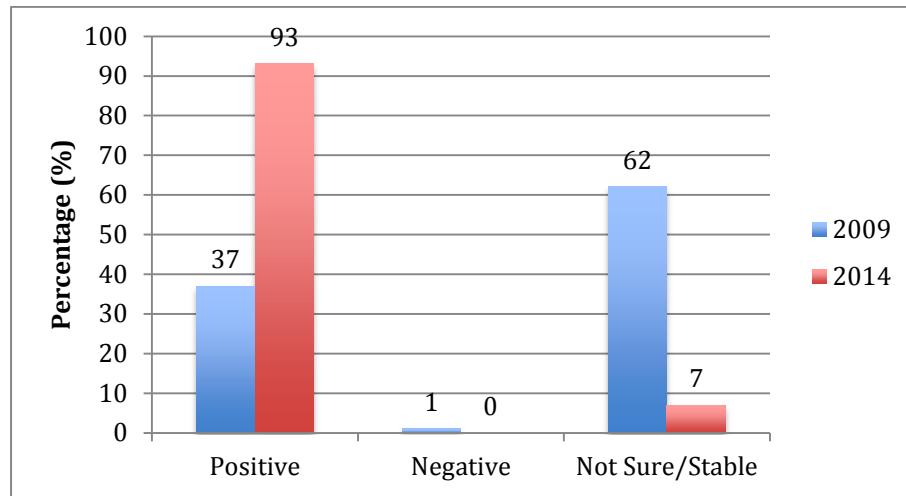


Figure 9: Perceived impact of MPA on fish diversity in the qoliqoli cokovata

Figure 9 suggests that in 2014, more people (93%) agreed that the MPAs have a positive influence on fish diversity compared to the response in 2009 (37%); there was almost no negative perception of MPA impact on influencing fish diversity. Survey results also show that more people are more 'certain' of MPA impacts in 2014 (7% not sure) than in 2009, where 62% of the respondents indicated that they were either unsure or that they did not see any change in fish diversity after MPA establishment.

Perceived impacts of MPA on fish and invertebrate sizes

Overall perception on the impact of MPA on fish size has increased since 2009. Survey results show that in 2009, 67% of fishermen believe that fish sizes were larger because of MPA presence; in 2014, 91% indicated that an increase in fish size was attributed to MPA presence. 93% of respondents also suggested that fish populations have increased because of the MPA. A similarly significant percentage of respondents also agree that there has been an overall increase in size of targeted invertebrates in the *Qoliqoli Cokovata*.

A significant proportion of the coastal communities are unanimous in saying that there has been an increase in invertebrate size and abundance as a result of the setting up of the MPA. In 2009, 49% of fishermen claimed to have experienced an increase in size of invertebrate species. In 2014, 83% of the respondents made the same claim. This general perception and positive trend could be a possible indicator of MPA effectiveness, and sustainable fisheries.

Selecting a fishing spot

The following table (Table 1) implies that the majority of fishermen select their fishing spots based on fish population abundance and habitat; in fact many mentioned that fish abundance and habitat suitability were synonymous, and that catch per unit effort would be higher at sites and locations with suitable habitats.

Factor	Percentage
Fish Abundance	91.4
Suitable Habitat	41.4
MPA Proximity	5.2
Artificial reefs	1.7
Regulations	8.6
Harbour Proximity	19.0
Personal Experience	12.1
No other or few fishermen	1.7

Table 1: Factors that influence fishing spot selection

General perceptions on reef ecology: fish, invertebrates and coral

Table 2 illustrates general perceptions and observations that were captured during the socio-economic surveys on the types of changes that have been observed in the *qoliqoli* since the establishment of the MPA.

Perceptions	Individuals
Restocking of fish populations	4
Larger fish	2
Higher fish abundance	6
Higher fish number and diversity	10
Higher general diversity	5
Higher counts of fish and inverts	25
Higher counts of Inverts	1
More corals and more fish	2
Decrease in fish abundance	1
Other comments	2
TOTAL RESPONDENTS	58

Table 2: General perceptions on observed changes

Results suggest that a high percentage of the perceptions are positive and indicate MPA effectiveness. The general observations by fishermen indicate that the MPA presence in the *Qoliqoli Cokovata* has probably increased the number of fish and invertebrate populations and species diversity. Most of the interviewed individuals mentioned that the MPAs also have a positive affect on coral abundance; a higher percentage of people in 2014 (88%) than in 2009 (55%) acknowledged the same – a potential indicator of a recovering fishery.

Effects of the MPA on fishing efforts

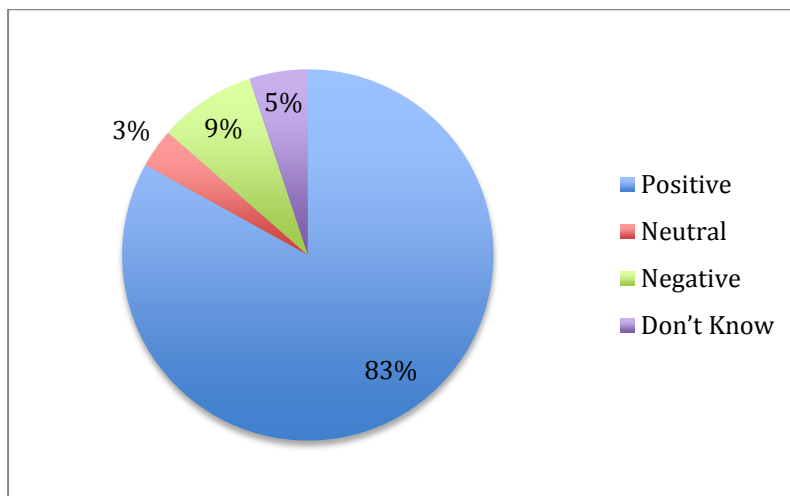


Figure 10: Effects of the MPA on fishing efforts

According to the coastal communities, there was a dominant positive consensus (83%) that MPAs improved fishing efforts. This positive feedback could mean a possible 'spill-over' effect of fish and invertebrates from the MPAs into the harvested areas, increasing catch per unit effort. A few respondents (9%) indicated that MPAs had a negative effect on their fishing efforts, perhaps because they had to go further distances for fishing etc.

Perception on the Impact of Permanent and Seasonal MPAs on fisheries

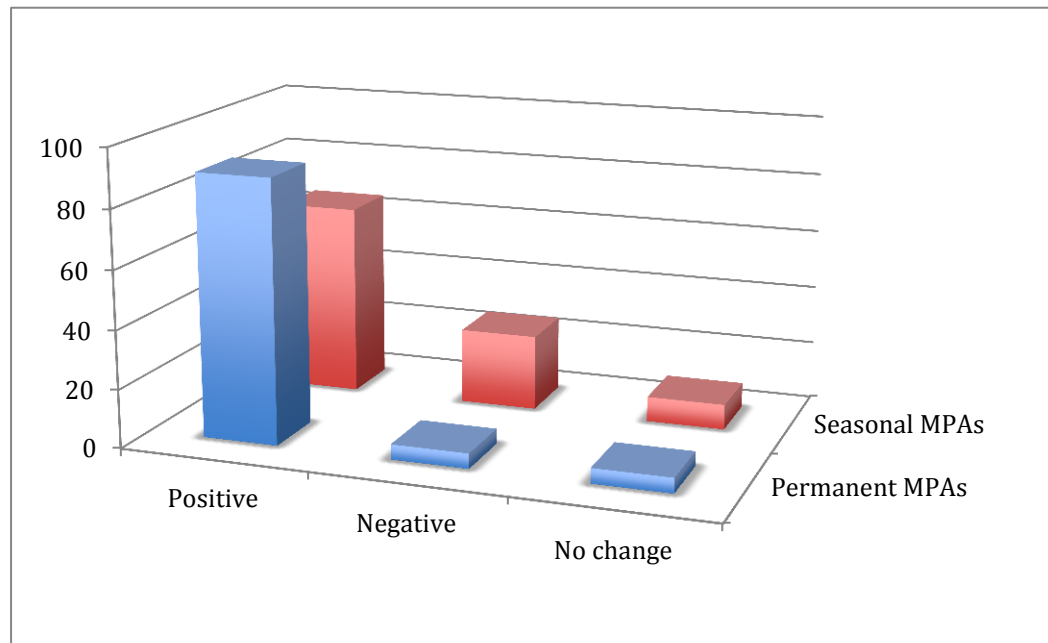


Figure 11: The impact of Permanent and Seasonal MPAs on fisheries

A high percentage of the respondents agree that regardless of whether the protected areas were permanent or seasonal, they were an effective means of fisheries management. A higher percentage of community participants (90%) nevertheless perceived that Permanent MPAs were more effective in fisheries management than the seasonal MPAs (66%) (Figure 11). Naturally, a higher percentage of fishermen (26%) had a negative response in mentioning that seasonal MPAs were not as effective for fisheries management, compared to permanent MPAs.

Percentage of fishermen catching Humphead Wrasse and Bumphead Parrotfish

Out of the 21 fishermen interviewed for this particular question, about half claimed that they never catch Humphead wrasse (HHW) or Bumphead parrotfish (BHP), especially because they were well aware of the laws that protect the species. 36% of the respondents nevertheless acknowledged that they fished the two species for home consumption, and special feasts and family gatherings. The remaining 14% had no response; perhaps they were not sure of the species and the laws that protect them (Figure 12).

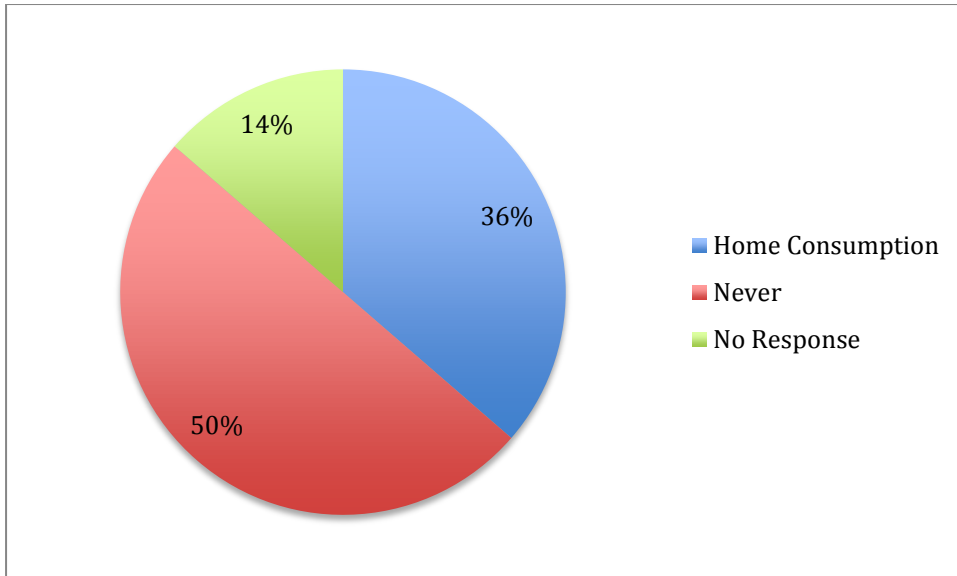


Figure 12: Fishing of HHW and BHP

Type of Information about MPAs received since MPA establishment

Figure 13 suggests that a high percentage of interviewed community members have a good understanding of MPA boundary and location and have received rules and regulations on MPA use.

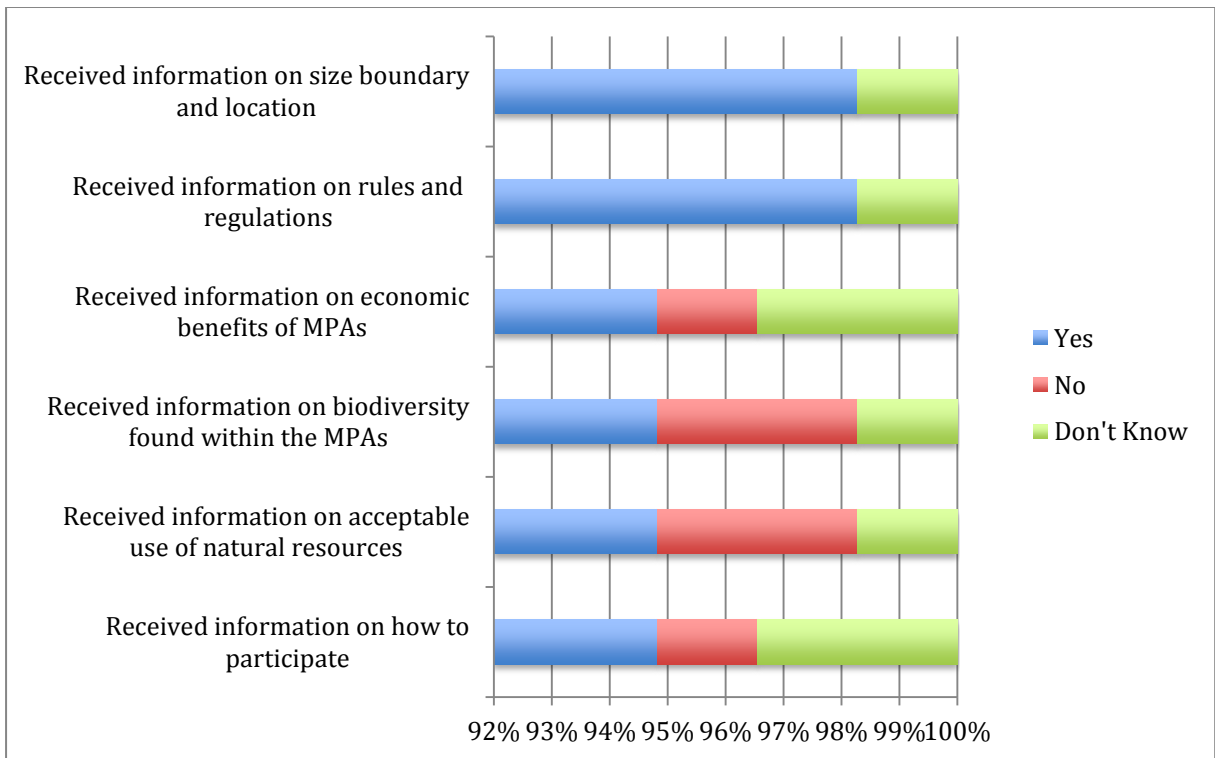


Figure 13: Type of information about MPAs received

Mode of receiving MPA information

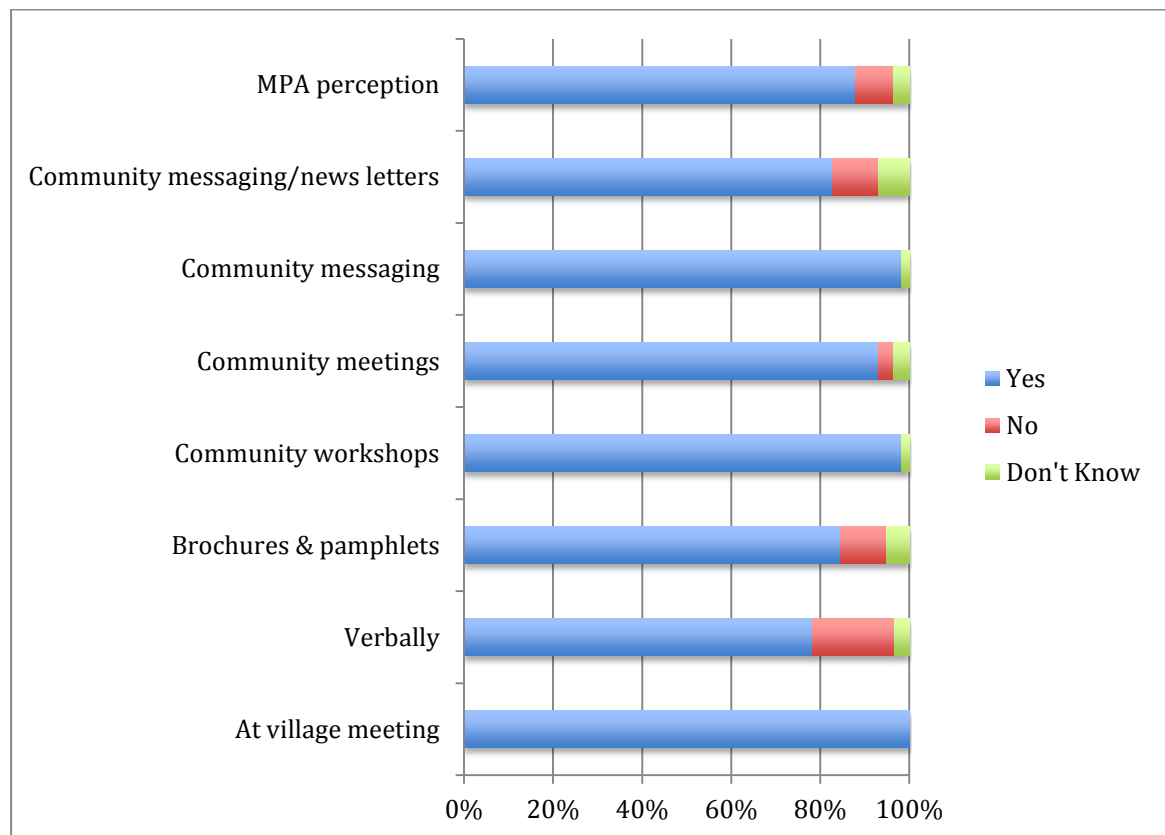


Figure 14: Mode of receiving MPA information

The highest percentage of respondents received information about MPA use and purpose at the village meetings, at community workshops and through community messaging. Approximately 90% responded by saying that their perceptions on MPA use have changed, and that the information gathered at these meetings has changed the way they use the MPA (Figure 14).

DISCUSSION

The results of this study indicate that communities in Mali and Dreketi generally have a high degree of involvement but are not fully satisfied with the management efforts of marine resource protection in the *Qoliqoli Cokovata*. The community members generally have a strong perception that the MPA network is providing direct benefits to them since it has been established, but also believe that more benefits and far greater success can be achieved from more effective MPA management. In comparing and evaluating community MPA perceptions recorded in 2009 against 2014 results, more focused management strategies could be implemented for the future.

Changes in Ecological state

The general response from the previous survey (2009) showed that the majority of people perceive that the ecological condition of their coastal area has improved. Whilst, Marine Protected Areas offer a range of benefits for fisheries, people and the marine environment such as providing safe havens for depleted fish stocks to recover and repopulate the *qoliqoli*, improving sources of income for local people, maintaining biodiversity, preventing habitat loss and much more (Short & Bladen, 2010), recovery of exploited species in no-take areas generally takes a considerable amount of time, sometimes on the order of decades (Russ & Alcalá 2004). For effective decision-making, perception and belief needs to be confirmed by biological reality.

Since the setting up of the MPA in the *Qoliqoli Cokovata* of Mali and Dreketi (including Sasa and Macuata), there has been a perceived increase in fish abundance, diversity and size; invertebrate abundance, diversity and size; live coral abundance; improved mangrove and river/freshwater status. A large number of those interviewed in 2014 perceived an increase in fish and invertebrate resources compared to the response in 2009.

Biological reef assessment results conducted in Mali in April 2014 (WWF report) suggests that the overall status of the finfish resources in the Mali back reef area has changed very little over the past 10 years. With the exception of a few species, the low overall finfish relative abundances and insignificant changes over time could also be indicative of poor MPA management and enforcement.

Invertebrate survey results showed a significant decrease in species abundance and diversity in 2014, when compared to 2004 and 2009 figures. General observations nevertheless indicate that in spite of insignificant changes in species density over time, relative abundances of finfish, invertebrates and hard coral cover recorded during the back reef surveys in April 2014 are comparatively higher in the MPA than in the adjacent harvested area. The MPA seems to have a positive impact on the Mali back reef area on a spatial scale; however in assessing change over time it is clearly evident that changes in species densities are too low to confirm MPA effectiveness.

Perceived decreases in relative abundances of fish and invertebrate populations may be attributed to the 2014 perception survey results, where most of the respondents claimed that the highest threats to MPA management in the *qoliqoli* Cokovata came from:

- a) Overharvesting of marine resources,
- b) Increase in population in the coastal communities and
- c) Poaching from other villagers and nearby settlements.

Threats and Issues affecting MPA effectiveness

Studies have shown that anthropogenic threats that affect ecological systems and MPA effectiveness are usually connected to a lack of livelihood options. Short and Balden (2010) actually emphasize that establishing MPAs may initially be costly and fishers may need compensation for loss of fishing grounds, until other livelihood options have been secured. Biodiversity targets take secondary prominence in most local coastal communities; the primary focus for MPA management in most of these communities, such as the people of Mali and Dreketi are primarily related to food security and meeting immediate livelihood needs. Generally, most threats that affect MPA objectives and *qoliqoli* integrity arise when provisions for basic livelihood needs of these coastal communities are compromised.

Developments in the coastal areas to accommodate population growth affects the frequency and intensity of marine resource harvest and puts pressure on the Cokovata *qoliqoli* and MPA network; this in turn affects surrounding villages and settlements creating added pressure on the coastal fisheries, which result in overharvesting and poaching activities. The dominant perceived threats highlighted by the survey

respondents are interconnected and may be directly or indirectly related to food security needs and limited livelihood options.

Results show that close to 70% of respondents regularly and occasionally fish near the MPA boundaries, and would continue to do so if it were technically feasible. 62% of the fishermen interviewed acknowledged that they were very dependent on local natural resources for survival and that MPAs played a significant role in their livelihood provisions.

Community people of the two districts mention the reason behind establishing a seasonal MPA was to take harvesting pressure off the permanent MPAs, and reduce overharvesting problems. While 66% of respondents agreed that seasonal MPAs were effective for fisheries management, it is widely acknowledged, as a provision for emergency food security needs. In 2009, 62% of fishermen mentioned that MPAs helped them feel safer in difficult times, in 2014 about 90% agreed to the same; perhaps the seasonal MPAs have enhanced the level of food security for these coastal communities.

The percentage of 'the knowledge of demarcated MPA boundaries' has decreased between 2009 (90%) to 2014 (75.8%). More fishermen mentioned that MPA boundaries were not clearly visible and hence a possible excuse for poaching. Clear demarcation of MPA boundaries and consistent policing of the *qoliqoli* would potentially reduce poaching activity and unregulated harvesting. The erecting of the MPA warden watchtower in Mali to monitor fishing activities in the *qoliqoli* is an effective step towards confronting and reducing poaching and destructive fishing actions, and should be promoted and encouraged across the communities of the Cokovata *qoliqoli*.

Socioeconomic benefits of MPAs

The perception that economic needs are a barrier to MPAs was higher in 2009, (72% of respondents) compared to 2014 (56%), which could probably indicate that alternative means of finances and generating income are now accessible and/or available to the communities. Both datasets confirm that while most community members have said that threats to the integrity of the Cokovata *qoliqoli* are increasing, they also claim that MPAs have helped increase their family income, and are good for the future of their families.

A large number of fishermen (62%) mentioned in the most recent survey (2014) that they regularly or occasionally fish close to the MPA area; this possibly indicates a

spillover effect from the MPAs into the adjacent waters either as juvenile recruitments and spawning locations or as adults, providing food and a source of income. Perception survey results also show an increase in fish and invertebrate diversity, size and abundance in the MPA, which is a biological and socioeconomic benefit.

A large number of participants in the 2014 survey mentioned that MPA importance and management issues continue to be discussed and reviewed at the village meetings, and during community workshops with laws that protect endangered species such as the Humphead Wrasse (HHW), Bumphead Parrotfish (BHP), turtles etc. These species are protected at community level, and community people are encouraged to observe protection laws; the HHW and BHP are sometimes harvested for special feasts and for subsistence use. Constant reminders at these meetings and enforcement of these laws further enhance MPA protection.

Some attempts to promote the socioeconomic benefits of MPAs in the Cokovata *qoliqoli* have taken place over the past few years through:

- Establishing seasonal protected areas, for rotational harvest of marine resources and relieves focus on the permanent MPAs;
- Developing alternative income generation methods that utilize non-extractive resource use such as tourism and snorkeling/SCUBA tours to the MPAs and surrounding reef systems (Mali Great Sea Reef Divers);
- Sustainable land management and backyard gardening
- Using MPAs to help maintain and promote culture and tradition, indicated by a 90% survey response, could potentially be an effective tool for increasing socioeconomic benefits for the communities of Dreketi and Mali eg. The recent Vorovoro tribal eco-tourism project.

Perception results for 2009 and 2014 show that, there is also growing resentment that illegal fishers are benefiting from MPAs as they are exploiting the protected areas. While these perceptions may be fostered by several circumstances, the main contributing factors are lack of enforcement and surveillance driven by lack of capacity and weak political and legislative support. This is borne out in a way by the 43% (2009) and 90% (2014) of fishers who perceived an increase in poaching and a corresponding 20% in an increase in non-compliance by some local fishermen.

The studies were similar in noting that while fishermen knew of the existence of MPAs

within the *qoliqoli*, there was hesitancy in admitting to fishing in protected areas. An assumption could be made that the number of illegal fishing in the MPAs may be higher from anecdotal evidence gathered in the course of the project. More time is needed to verify these claims.

CONCLUSION & RECOMMENDATIONS

General observations and perceptions have been recorded whilst comparing the results of the 2009 and 2014 surveys; while most of these perceptions and belief systems need to be verified through biological and similar research it is quite encouraging to see more positive response and changes from the communities of Dreketi and Mali with regards to their perceptions of MPA and *qoliqoli*. Perhaps a key result from this recent (2014) survey is that the perceived correlation that fishermen have observed between setting up MPAs and increase in marine resource abundance, size and diversity, general increase in household income and socioeconomic and ecological benefits. The threats experienced in the *Qoliqoli Cokovata* such as unregulated harvesting and poaching are commonly faced in coastal communities across Fiji, and because of its magnitude and complexity, need to be dealt with at a site-specific level; particularly engaging traditional leaders, community members, relevant government authorities and other stakeholders.

Based on general perceptions received from surveys conducted in 2009 and 2014, the following recommendations are suggested for more effective and sustainable marine resource management for the communities of Mali and Dreketi:

1. Clear demarcation of MPA boundaries and consistent policing of the *qoliqoli* would potentially reduce poaching activity and unregulated harvesting.
2. Good governance and firm leadership probably needs to be revived in the Mali district because this affects the entire system. The success of community management objectives relies heavily on the degree and strength of governance.
3. Consistent meetings at village and district levels highlighting MPA management agenda will only contribute to strengthening the MPA network. The vision needs to be endorsed, embraced and owned by the respective communities, to reduce division and conflict
4. Proper outlining of MPA management objectives and policies need to be documented, gazetted and circulated throughout relevant communities, stakeholders and authorities for recognition and endorsement. This would strengthen the enforcement procedures.

5. The need for more awareness and educational programmes on the ridge to reef system and the role and connectivity of coastal and reef ecosystems with human livelihood.
6. In addition, communities need to know their rights to their resources and their ownership boundaries. Awareness and reviews of current environmental, land management, and fisheries law for Fiji legislation should aid local communities in reducing environmental threats, providing the legislative framework within which resources can be managed. A critical step in this process is explaining the reasoning behind the respective legislations to the communities.
7. Threat reduction assessments (TRA) may not necessarily be qualitative, it can nevertheless be used as a tool that assists communities in identifying acute and chronic stresses to the environment, so that appropriate responsive actions could be taken for mitigation and adaptation.
8. Encourage and create awareness in other coastal communities on the findings of this work, lessons learnt and the importance of effectively establishing, monitoring and managing MPAs. The use of this dataset though limited, may be used towards improving resource management in other coastal communities around Fiji.
9. Development of Fisheries Management Plan for specific fisheries.

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APPENDIX

Marine Protected Areas in Macuata Qolioli Cokovata Area

Protected Site	Site Description
1. Utulei Reef	<ul style="list-style-type: none"> • Fishing with hook and line method allowed • Night diving Prohibited • Net fishing Prohibited • Commercial fishers prohibited
2. Yawea Reef	<ul style="list-style-type: none"> • Fishing with hook and line method allowed • Night diving Prohibited • Net fishing Prohibited • Commercial fishers prohibited
3. Talailau Reef	<ul style="list-style-type: none"> • Permanent <i>Tabu</i> or Marine Protected Area • No take zone
4. Macuata-i-Wai Magrove Area	<ul style="list-style-type: none"> • Half the area to be closed or protected as fish and marine resource nursery.
5. Vatuka Reef	<ul style="list-style-type: none"> • Remain and continue as <i>tabu</i> area • Corals diversity and success. • Fish and invertebrates abundance.
6. Basa Bay and surrounding reef	<ul style="list-style-type: none"> • Pearl farming • <i>Tabu</i> observed by the members of Raviravi village.
7. Naseva Reef	<ul style="list-style-type: none"> • Fish spawning aggregation site
8. Qarilumi Reef and extended to Nakera passage at Kia	<ul style="list-style-type: none"> • Moved towards Qarilumi • Patrolling and policing challenge for current <i>tabu</i> sites. • Proposed area could be looked after (Patrol and policing could be done here)
9. Batiratamo Reef	<ul style="list-style-type: none"> • Fish spawning aggregation site • Fish and invertebrates abundance. • 100 metre buffer zone.
10. Naliu Beach	<ul style="list-style-type: none"> • Turtle nesting site
11. Nukulekaleka Beach	<ul style="list-style-type: none"> • Turtle nesting site
12. Cakaba Reef	<ul style="list-style-type: none"> • Remain and continue as <i>tabu</i> area • Fish and invertebrates abundance.
13. Moka ni Vonu Reef	<ul style="list-style-type: none"> • Remain and continue as <i>tabu</i> area. • Turtle foraging area. • Turtle resting area.

14. Savutadrai	<ul style="list-style-type: none"> • Forest reserve
15. Cuqeni Reef	<ul style="list-style-type: none"> • Half reef system to be protected and alternate with open half every 5 years.
16. Korotubu Mangrove area	<ul style="list-style-type: none"> • Mangrove cutting or clearing prohibited. • Crab harvest allowed.
17. Matailabasa Mangrove area	<ul style="list-style-type: none"> • Mangrove cutting or clearing prohibited. • Crab harvest allowed
18. Bulewa Reef	<ul style="list-style-type: none"> • Fish Spawning Aggregation area
19. Deladravu	<ul style="list-style-type: none"> • Fish Spawning Aggregation area
20. Vuata Reef	<ul style="list-style-type: none"> • Remain and continue as <i>tabu</i> area
21. Mali Outer Reef, part of Great Sea Reef (Cakau Sese e Mali)	<ul style="list-style-type: none"> • Trochus abundance site
22. Nakadraniu	<ul style="list-style-type: none"> • Turtle nesting site.
23. Mangroves between Nakawaga and Ligaulevu	<ul style="list-style-type: none"> • Crab and fish nursery.
24. Vatasikoa	<ul style="list-style-type: none"> • Invertebrates and fish nursery.
25. Macayamena	<ul style="list-style-type: none"> • Freshwater <i>tabu</i>
26. Nabukadogo reef patch	<ul style="list-style-type: none"> • To be included in the traditional <i>tabu</i> areas list
27. Mali Passage	<ul style="list-style-type: none"> • Fish Spawning Aggregation area