

Perception surveys of coastal resource use and changes following establishment of a marine protected area network in Kubulau, Fiji



Daniel P Egli, Thomas Tui,
Stacy D Jupiter, Akanisi Caginitoba

This study was supported by grants from the David and Lucile Packard Foundation (2007-31847) and the Gordon and Betty Moore Foundation (540.01).

© Wildlife Conservation Society

This document should be cited as:

Egli DP, Tui T, Jupiter SD, Caginitoba A, (2010) Perception surveys of coastal resource use and changes following establishment of a marine protected area network in Kubulau, Fiji . Wildlife Conservation Society - Fiji Technical Report no. 07/10. Suva, Fiji, 16 pp.

Cover photo © 2009 Daniel Egli: The coral reef of Namana MPA at low tide with visibilities underwater up to 40 m.

EXECUTIVE SUMMARY

Research for this study was carried out under a four-year project to assist communities in Kubulau district of Vanua Levu in Fiji to establish networks of marine protected areas within their large, traditional fishing grounds (*qoliqoli*). In 2005 and 2009, socioeconomic household surveys were conducted in villages of the Kubulau district to examine coastal marine resource use and participation in the management process. Results from three of the villages (Navatu, Kiobo, Nakarovou) with traditional fishing rights within the three established district-wide, no-take MPAs (Namena, Namuri, Nasue, respectively) are compared with one village (Natokalau) without fishing rights in these areas but with high observed levels of community organization. The three objectives were:

- Examine whether the communities' perception of state of their marine and fisheries resources has changed after the establishment of the MPA network;
- Examine their dependence and use of finfish from their *qoliqoli*;
- Examine their engagement and satisfaction with the management process; and
- Discuss how differences among villages may affect relative success of the district MPAs

We found that the results from the community surveys generally portray a high degree of involvement and satisfaction with the management process in the Kubulau district. The community members perceive that there are direct benefits to them since the MPA network has been established. There are, however, a few notable individuals largely from Navatu village who are in disagreement with the management process and outcomes and this has resulted in direct infringement of management rules in Namena. External arbiters may be required to reduce the conflict within Navatu and between other villages.

Results of the perception surveys also demonstrated a high degree of dependency on coastal resources for household consumption with the average household eating fish more the 4 times a week. However, varying levels of importance for fishing as a source of income were found. The contribution of fishing to household income ranged from 4% in the inland community of Nakorovou to 67% in the coastal community of Navatu.

The participation information indicates a general positive perception of the MPA network and the management process. However, the strong perception that fish size, abundance and diversity has increased during the four years since the establishment was not confirmed by biological survey data. We therefore recommend caution when basing management decision on perceptions only, as they can may not reflect actual biological processes.

TABLE OF CONTENTS

Executive Summary	1
Table of Contents	2
Introduction	3
Methods	4
Study Site	4
Data Collection	6
Results	7
Changes in Ecological State	7
Fish Consumption and Income Generation	7
General Management Participation	9
Discussion	11
Changes in Ecological State	11
Fish Consumption and Income Generation	13
General Management Participation	13
Conclusions and Recommendations	14
References	15

INTRODUCTION

Fiji's inshore coral reefs are the major source for subsistence and artisanal fisheries of local communities. However, fisheries data are often uncertain and there has been an increasing level of pressure on coastal fisheries in the past few decades (Teh et al. 2009). 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). Rising prices for fish and fishery products have contributed to declines in artisanal catches from 1996 to 2002 (Raj and Evans 2004), while percentages of catches sold are increasing: catch per unit effort (CPUE) from recent surveys of village catch from locations across Fiji suggest that >70% of catch is being sold (IAS 2009).

In Fiji coastal resources are largely governed by customary marine tenure and customary management. Community-based natural resource management (CBNRM) has been a feature of Pacific islands for centuries (Veitayaki 2000). More recently, the community engagement in resource management has been fostered through the Fiji Locally Managed Marine Areas (FLMMA) network. Local stakeholders are being encouraged to establish and implement coastal inshore resource management strategies to ensure sustainability and food security. The main tool used for this approach of marine coastal resource management is the establishment of traditional tabu areas (areas closed from fishing with the option of periodic opening) or networks thereof.

To recognise and strengthen local ownership and responsibility, a *qoliqoli* resource management committee was established in the Kubulau district in 2005. This committee is made up of representatives from each village whose management decisions require authorization from the high council of chiefs (*Bose Vanua*) in each region. The resource management committee make broad decisions over regulations for the *qoliqoli* (including the 3 large district MPAs), while village chiefs retain the rights to determine gear restrictions, temporary closures and other local regulations in the 17 individual village tabu areas (Clarke & Jupiter in press).

Any information on the success of such management measures and their perceived benefits to the local community members 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).

In order to evaluate the willingness of Kubulau residents to continue to implement their management plan, WCS conducted socioeconomic surveys in 2005 and more recently in 2009 to examine how the communities in Kubulau perceived the benefits of their management efforts. The specific objectives were:

Examine whether the communities' perception of state of their marine and fisheries resources has changed after the establishment of the MPA network;

Examine their dependence and use of fish from their qoliqoli; and
Examine their engagement and satisfaction with the management process.

Finally the results from the perception survey are discussed in the light of concurrent biological and CPUE surveys of the coastal resources from the same area that were gathered between May 2008 and June 2009. These data are synthesized both here and in other recent technical reports (Jupiter et al. 2010a,b) to evaluate how differences in socioeconomic conditions and perceptions across villages has influenced the effectiveness of management actions within the Kubulau qoliqoli.

METHODS

STUDY SITE

Kubulau District is an administrative unit of Bua Province in south-west Vanua Levu, Fiji Islands (Figure 1). The total district land area is 97.5 km², while the qoliqoli covers 261.6 km² extending from the coastline to the outer edge of the barrier reefs. The total population of Kubulau district is approximately 1,000 people. There are ten villages in the district, including three inland villages and seven coastal villages. Households in Kubulau are highly dependent on fishing and farming to meet their subsistence needs, and thus have differential dependency on fishing, farming and copra harvesting for cash income (WCS, unpublished data).

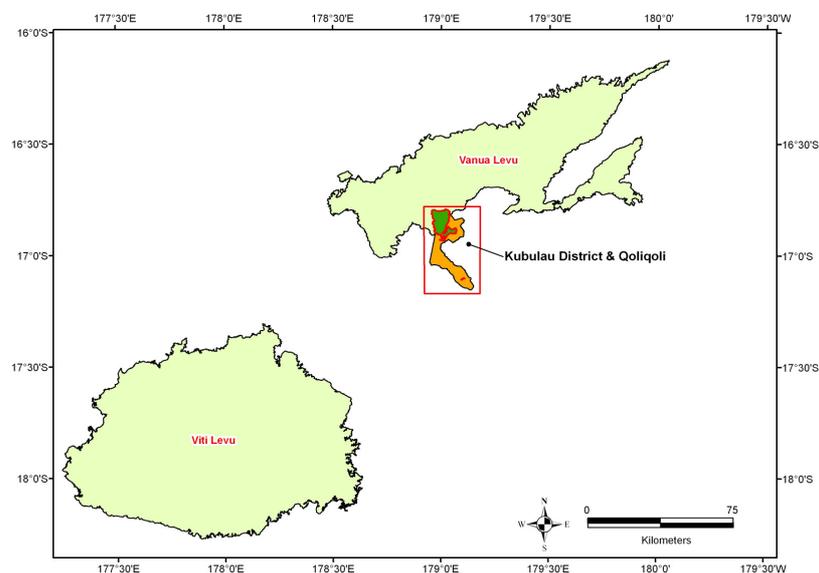


Figure 1. Kubulau District and traditional fisheries management area (qoliqoli) located within Bua Province on Vanua Levu, Fiji.

Of the ten villages in Kubulau, we focused our perceptions study specifically on differences between the three villages (Nakorovou, Navatu and Kiobo) to gain information in order to evaluate how differences in socioeconomic factors may have influenced differences in biological effectiveness of the three district-wide, no-take MPAs of Kubulau (Figure 2). Each

of the district MPAs (Namena, Namuri, Nasue) is located within the traditional fishing areas (i kanakana) of these villages. All of these MPAs are governed by the Kubulau Resource Management Committee (KRMC), comprised of representatives from each of the ten villages in the districts, and the Kubulau hierarchy council of chiefs. Meanwhile, each district MPA is subject to different levels of compliance due to various factors, both physical (i.e. proximity to adjacent districts) and socioeconomic (i.e. access to markets). Responses were additionally compared with those from Natokalau village, which does not have traditional fishing areas in any of the three district MPAs, but has been noted to have a high level of community organization (S Jupiter, pers. obs.).

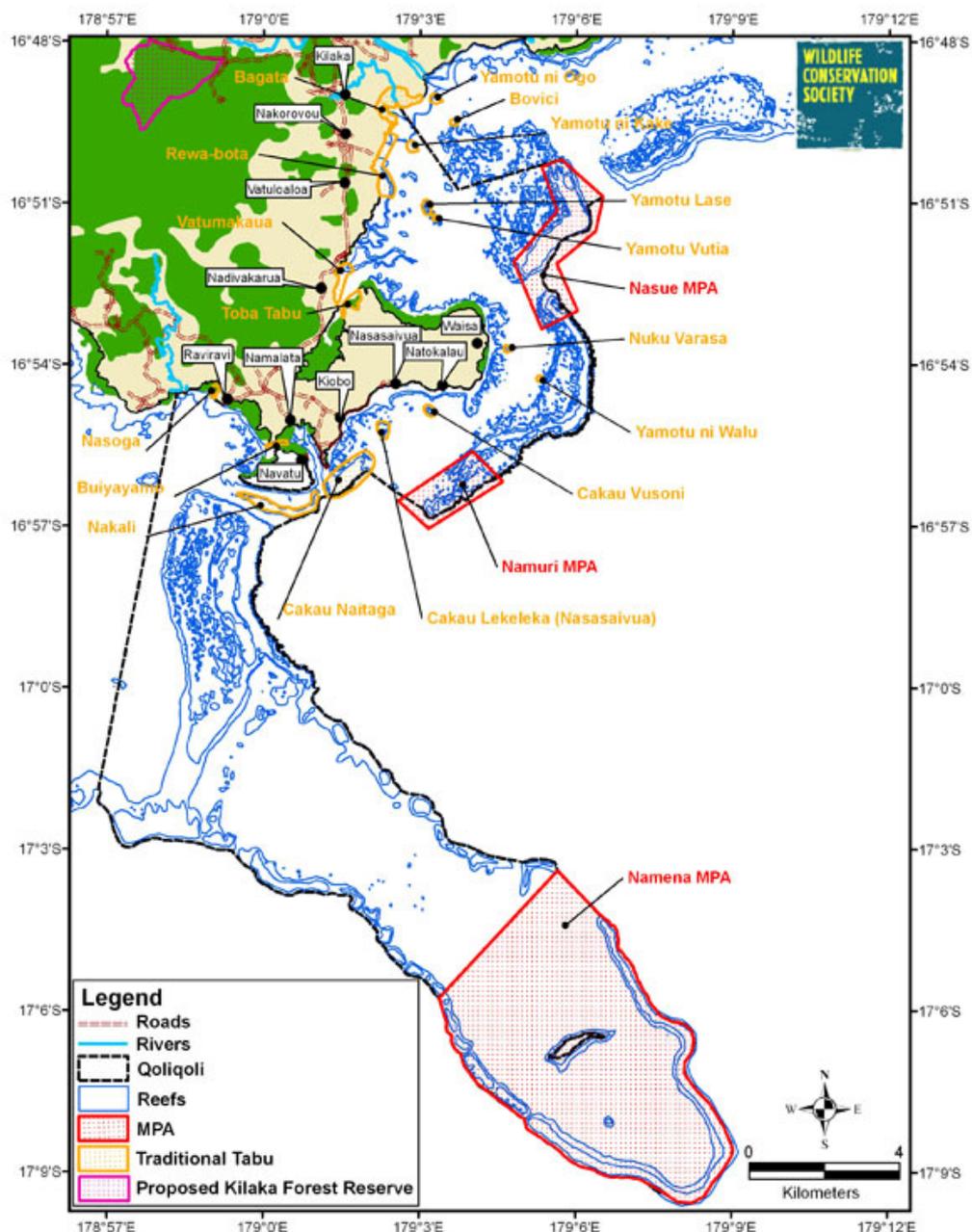


Figure 2. Map of the Kubulau qoliqoli with the locations of all ten villages, district no-take MPAs (outlined in red), and village-managed tabu areas.

DATA COLLECTION

We surveyed residents of four villages in the Kubulau district in August 2005 and September 2009. To ensure minimal language barriers and appropriate cultural context the data was collected by local project officers. We conducted household surveys and semi-structured interviews in communities, which included specific questions related to perceptions of ecosystem state, participation in management and dependency on coastal and marine resources (Table 1). A total of 45 household surveys in 4 villages (6-16 in each community) were collected. The household sampling was conducted by staff from the Wildlife Conservation Society-Fiji and trained community representatives, and was conducted in Fijian.

Table 1. Questions from household surveys asked to gauge perceptions of ecosystem state, participation in management and dependency on coastal and marine resources.

Question	Options for response
In your opinion, how has the overall quality of [health of coastal habitat, abundance of fish, size of fish, diversity of fish] in your area changed after the establishment of the protected areas?	Increased No change Decreased Don't know
List and rank the sources of income (e.g. fishing, farming, salary, etc) from your household. Identify the proportion of your total income from each activity.	Ranked list with proportions of income earned for each activity
How many days last week did you eat fin fish? How was this fish obtained?	Number of days out of 7 Caught, exchanged, purchased
Do you agree with the following statements: 1. Members of my family take part in community meetings more frequently since protected areas have been established; 2. Women take part in community meetings more frequently since protected areas have been established; 3. My interests and views are adequately represented when it comes to management decisions made since protected areas have been established.	Strongly agree Agree Neutral Disagree Strongly disagree Don't know
Do you or does anyone in your family have a role in the decision-making process in regards to the management of the Kubulau qoliqoli?	Yes No
If you are not a decision maker, do you have access to them to state your opinions and express your views?	Yes No
Have you participated in the drafting and implementation of the management rules and/or the selection of tabu and MPA sites?	Full participation Some participation No participation
Has your level of involvement and participation in the management of Kubulau's resources changed since 2005?	Increased No change Decreased

RESULTS

CHANGES IN ECOLOGICAL STATE

The responses regarding the general state of the marine environment and fish resources show a much more positive perception in 2009 compared with 2005 for all villages surveyed (Figure 3).¹ In particular, the respondents indicated a much more optimistic view about the general state of the marine habitat (Figure 3a). Most households surveyed also indicated that the fish abundance, size and diversity are increasing (Figure 3b-d). In contrast, during the first survey in 2005 the general view was that there was little change in the resources and the general state of the marine environment was seen as declining. In most cases, Natokalau residents had the most favourable initial and current perception of the status of resources. Navatu residents initially had the least favourable initial perception across all cases, though their perceptions improved the most by 2009.

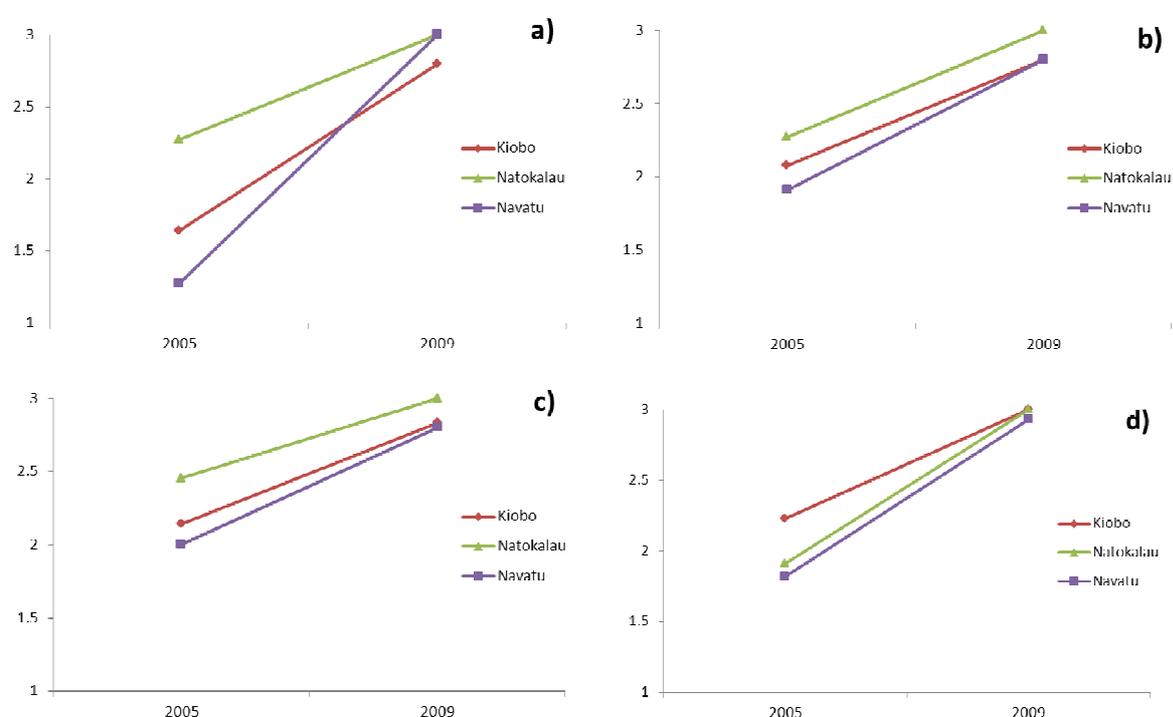


Figure 3. Changes in perception of 3 villages on the state of their coastal resources from 2005-2009: a) Health of the coastal habitat, b) Abundance of fish, c) Size of fish, and d) Diversity of fish. Y-axis values range from 1 = decline, 2 = no change, and 3 = Increase.

FISH CONSUMPTION AND INCOME GENERATION

The dependency on income from fishing varies greatly throughout the Kubulau district (Table 2). Some inland villages, such as Nakorovou, earn very little income through fishing activity. By contrast, in Navatu considerably more than half of the household income is generated from fishing. The other two communities indicated that fishing represents an import but not dominant part of their income.

¹ There were no data available from Nakorovou in 2005.

Table 2. Average percentage of reported total income derived from fishing for each village in 2009

Village	Percentage income from fishing
Kiobo	28%
Nakorovou	4%
Natokalau	17%
Navatu	67%

All villages indicated that the majority of the fish they consume comes from their own catch (Figure 4). The biggest difference between the villages was found to be the percentage of fish consumed that was purchased. The residents of Nakorovou, being the only inland village, purchase nearly half the fish they consume. In contrast to the other three communities they also consume lower percentage of fish that has been exchanged.

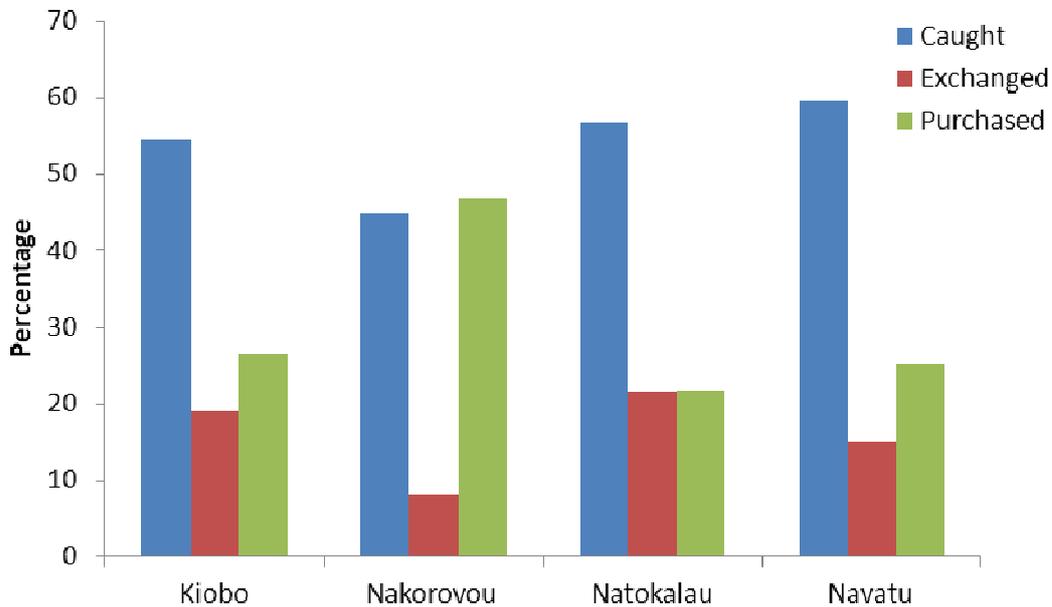


Figure 4. Percentage of fish eaten in the village that was caught, exchanged or purchased in 2009.

The number of days fish was consumed did not show much variability between the four communities (Figure 5). It ranged from 4.6 to 6.3 days per week. This result confirms the importance of healthy coastal ecosystems for food security and income of the communities in the Kubulau district. Even inland villages, such as Nakorovou, indicated that they were consuming fish more than 5 days per week.

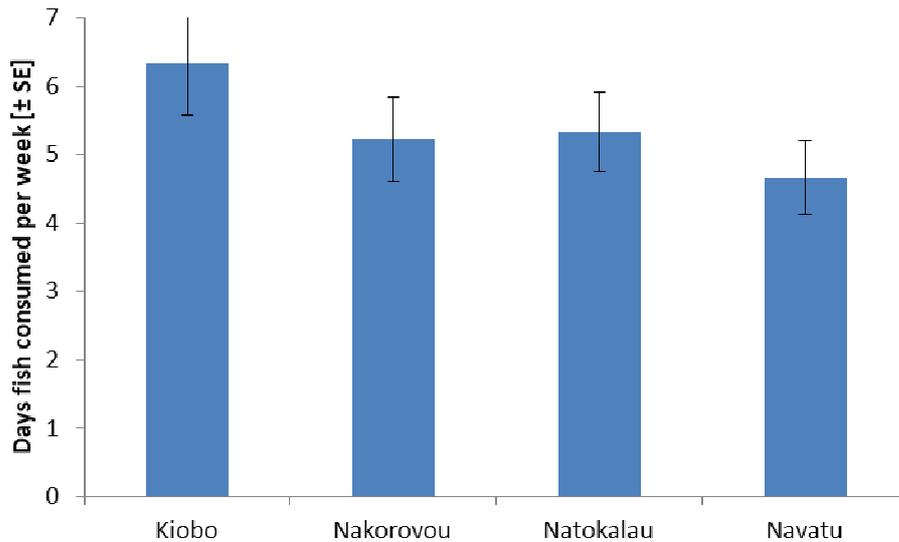


Figure 5. Average days of fish consumption per week for each village from the 2009 survey data.

GENERAL MANAGEMENT PARTICIPATION

In 2009 the responses showed a high degree of general community management participation (both meeting and women participation, Figure 6). Notably, the chiefly village (Kiobo) showed the highest level of participation and also satisfaction regarding the representation of the household's interests. In contrast, Navatu stands out as the only village where a few individuals indicated that they are not taking part in meetings but also were unhappy about their interests being represented. This is also the village where most respondents admitted to infringements in protected areas (Jupiter et al. 2010b).

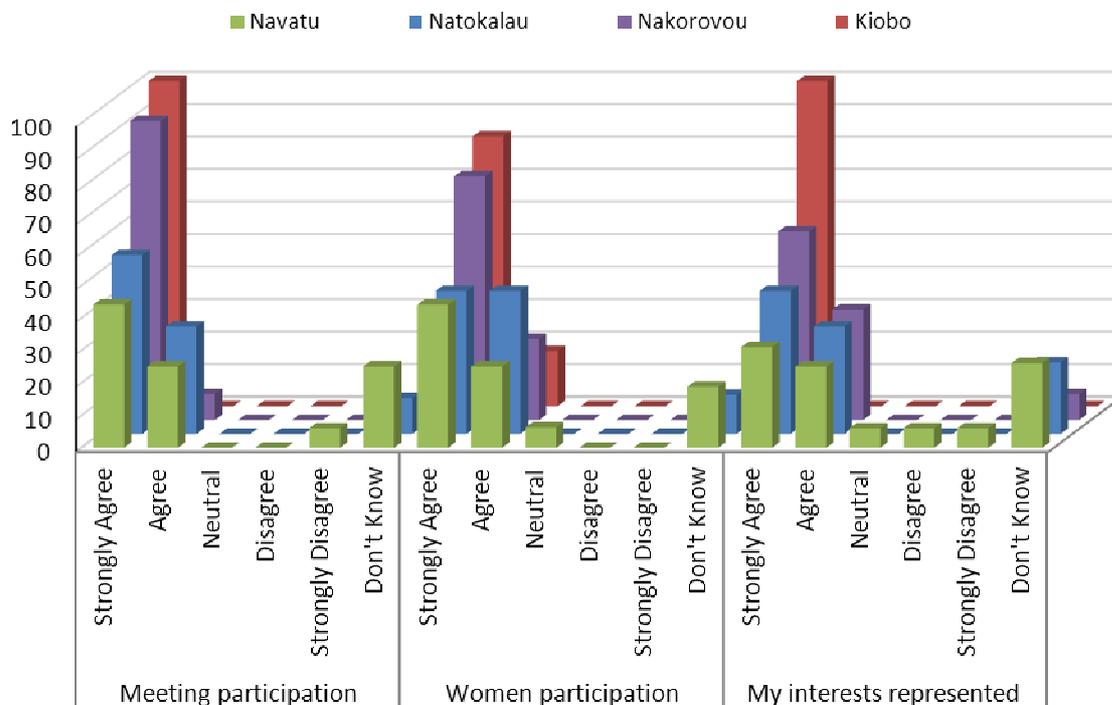


Figure 6. Responses from four villages on their perceived participation and representation in the community decision process.

When looked at in more detail, the data show that half the households in Kiobo and Navatu perceive that they don't have a role in decision making (Table 3). In Nakorovou 75% believe they have a role in decision making. Apart from Navatu residents, all heads of households indicated that they have at least access to decision makers to express their views on management decisions.

Table 3. Percentage of community members that have a) a role in decision making and b) access to decision-makers in the village.

	Role in decision making		Access to decision-makers	
	No	Yes	No	Yes
Kiobo	50%	50%	0%	100%
Nakorovou	25%	75%	0%	100%
Natokalau	33%	67%	0%	100%
Navatu	50%	50%	19%	81%

Over all the level of participation in the drafting and implementation of the Kubulau MPA network was high (Figure 7). The majority of community members indicated at least some participation in the process. The responses regarding the community member's involvement since the inception of the MPA network in 2005 confirm a general increase. Only households from Nakorovou and Natokalau indicated some decrease in their involvement, however it is unknown at what level they were participating in 2005.

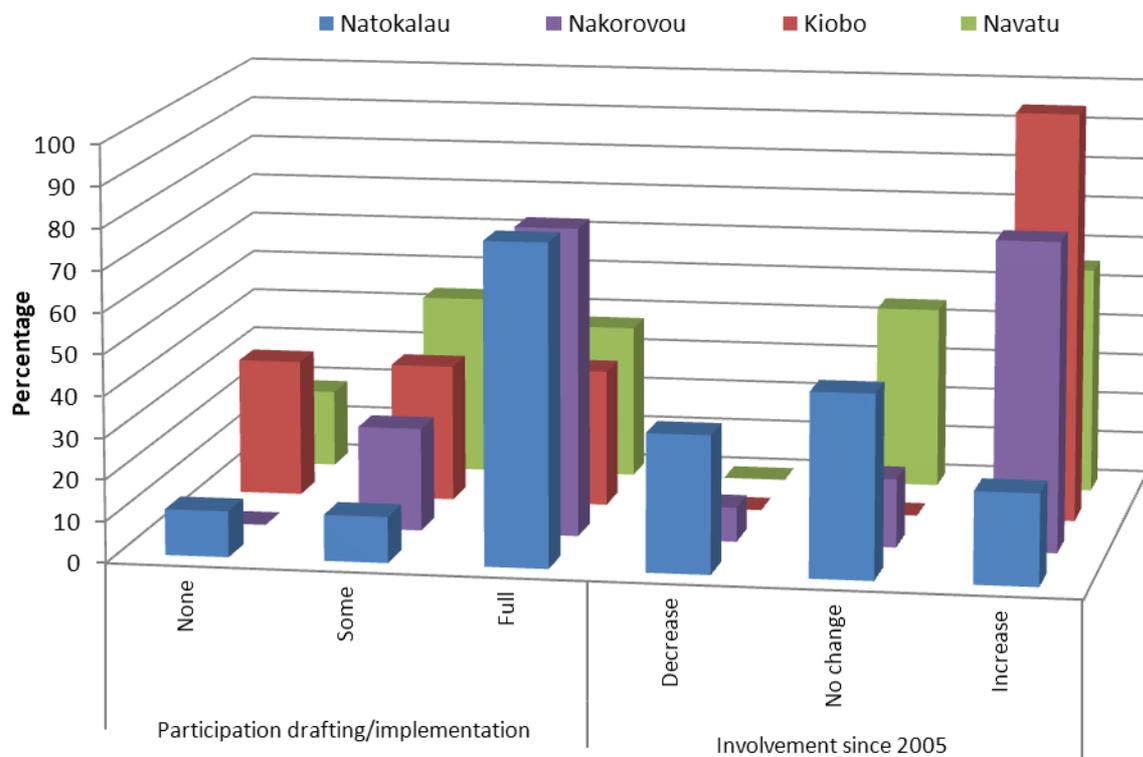


Figure 7. Community member involvement in a) drafting and implementation of the Kubulau management plan and b) the change of general involvement in management since 2005.

DISCUSSION

The results of this study indicate that communities in Kubulau generally have a high degree of involvement and satisfaction with the management process in the Kubulau district. The community members additionally strongly perceive that the MPA network is providing direct benefits to them since it has been established.

CHANGES IN ECOLOGICAL STATE

Responses from the most recent survey (2009) showed that the majority of people perceive that the ecological condition of their coastal area has improved. One major question that is not necessarily address in many perception studies is whether residents beliefs match biological reality. Recovery of exploited species in no-take areas generally takes a considerable amount of time, sometimes on the order of decades (Russ & Alcala 2004). Only once such population have recovered would density dependent processes lead to spillover of adult fish into adjacent fished areas (Kramer & Chapman 1999). This process would reduce the ratio of abundance or more likely biomass between the protected area and the fished area (Figure 8). Where long-term monitoring data is available from biological surveys, this prediction can be tested to show whether there is any biological evidence supporting the perceived benefits from the MPA network.

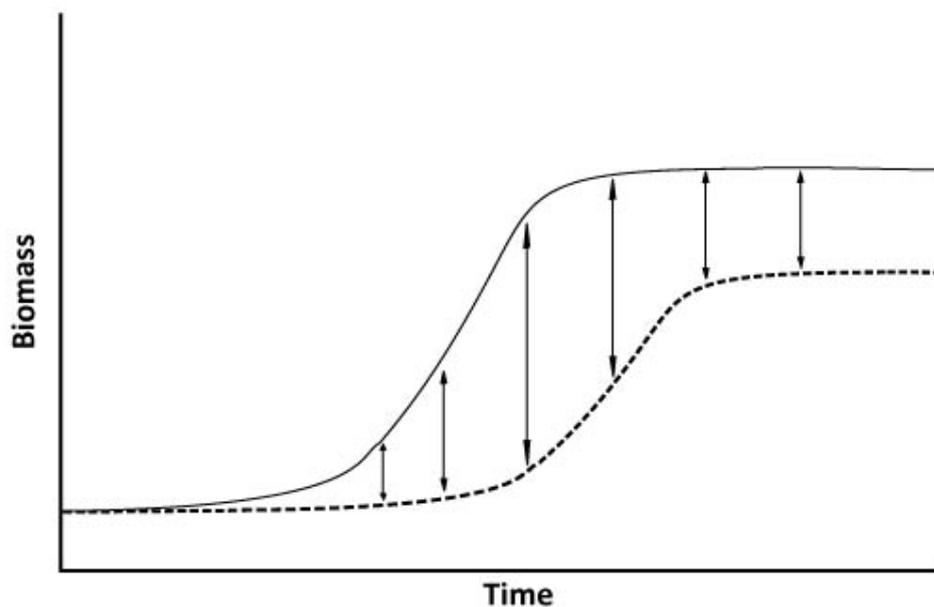


Figure 8. Conceptual model showing the recovery of biomass in permanent no-take areas (solid line) and the delayed response of the surrounding exploited area (dashed line).

Data collected from catch per unit (CPUE) surveys conducted from May 2008 to June 2009 in Kubulau qoliqoli showed no evidence of increasing trends in fish biomass, size or abundance (Cakacaka et al. 2010), though we note that it may be difficult to capture longer term trends with only one year of catch data. However, biological monitoring surveys conducted between 2007 and 2009 additionally do not show a consistent increase in abundance or biomass within or adjacent to any MPA over time (Jupiter et al. 2010a). The ratio of the biomass of all fish from protected areas to open areas from the period of 2007-09 showed

no conclusive trend that would confirm the occurrence of density dependent spillover (Figure 9).

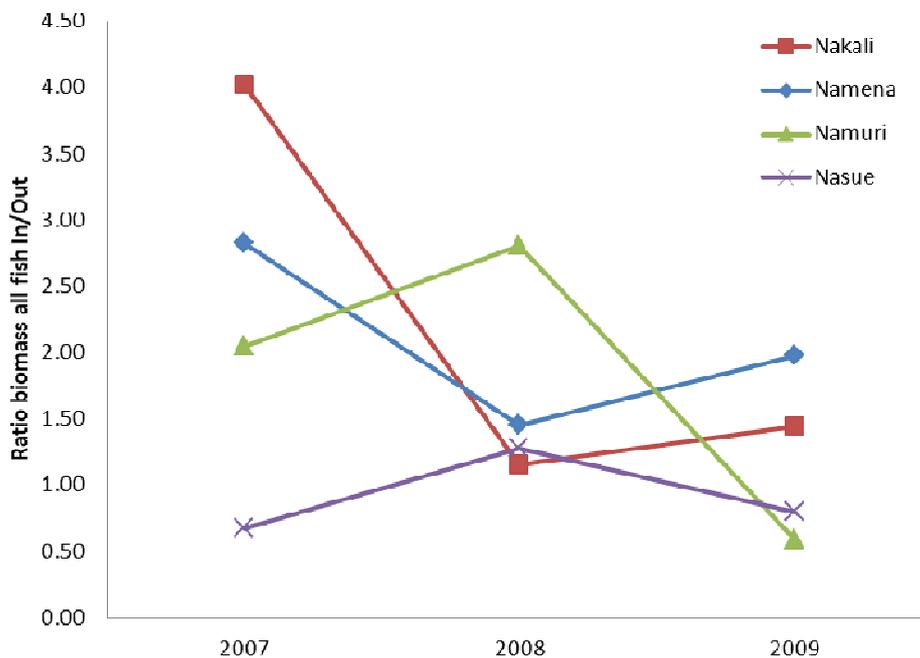


Figure 9. Ratio of fish biomass inside MPA versus control areas from 2007-2009.

Even if we look only at the ratio of exploited fish or primary targets, where the process of density-dependent spillover would likely be more pronounced, there is no decrease of the ratio between biomass of closed versus open areas (Figure 10). In contrary, the ratios in 2007 showed a wide range and all decreased to similar levels the following year and thereafter increased again.

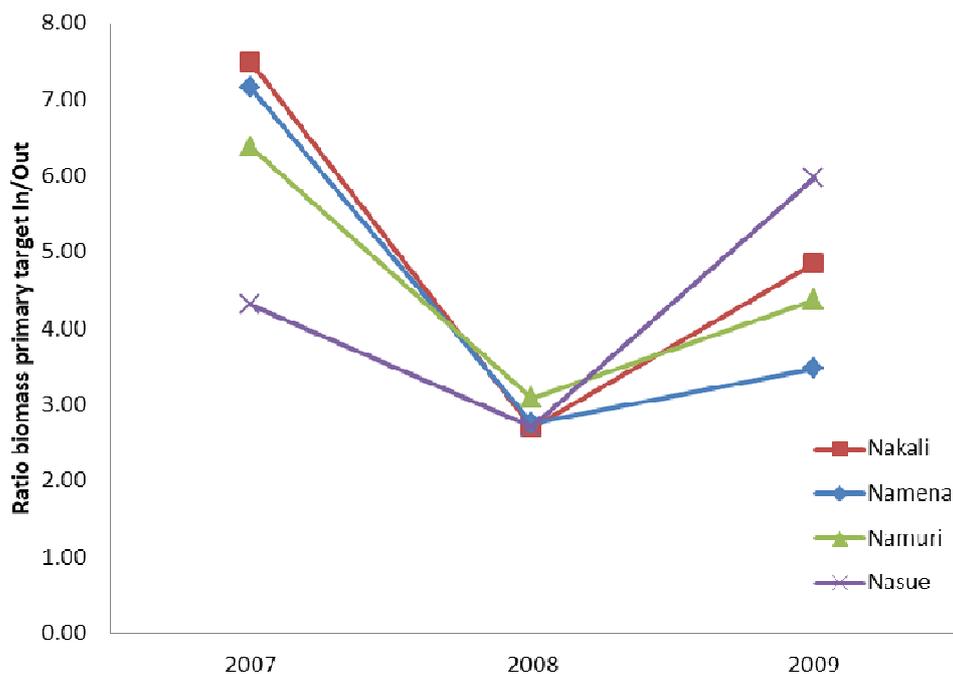


Figure 10. Ratio of primary target fish biomass inside MPA versus control areas from 2007-09.

The most likely explanation for the perceived increase in fish resources would be the periodic harvesting of traditional tabu areas. These areas are declared no-take areas for varying periods of time and only opened according to the community's management regime. Because some of the benefits of protection can occur relatively fast (Halpern & Warner 2002) and are most likely supported by the so called "spill-in" effect where targeted fish move into protected areas for safety (Eggleston & Parsons 2008), these areas can harbour higher densities of exploited species than other open areas. In addition, fish behaviour that has been altered by fishing can revert to a more curious behaviour which makes catching fish easier (Gotanda et al. 2009). These combined factors can influence the perception through unusually good fishing experience within the protected areas.

FISH CONSUMPTION AND INCOME GENERATION

The results from the surveys revealed that fishing is only the major source of income in one of the four villages (Navatu). This can largely be explained by the location of the Navatu, its limited land area, access to boats by Navatu residents, and the presence of a middle man in the village who regularly purchases fish (Cakacaka et al. 2010). The number of days fish was consumed by households, however, showed a strong reliance on fish as a food source across the district. This finding closely reflects the results from the CPUE survey (Cakacaka et al. 2010), where Navatu caught by far the highest biomass (which was mostly sold) and Nakorovou had a much lower total catch (which was mostly consumed in the village).

GENERAL MANAGEMENT PARTICIPATION

In the Pacific, compliance with local resource management rules relies to a significant extent on respect for traditional authority and decision-making processes (Aswani 2005). Management planning processes that respect and reinforce the roles of traditional leaders, while providing opportunities for broad community engagement, strengthen long-term prospects for community-based resource governance (Lal 2005). The level of participation of community members in the management process in the Kubulau district appeared to be fairly high, which bodes well for continued management implementation. However, there was notable resistance to participation, and dissension from management decisions (Jupiter et al. 2010b), by several residents of Navatu village.

Perceptions of inequity, exclusion from decision-making processes or failure to respect traditional resource rights may result in challenges to traditional authority, such as continued poaching of Namena MPA by Navatu residents despite calls from the high chief (Tui Kubulau) and the Bose Vanua to leave the area closed to fishing (Clarke and Jupiter in press). Navatu village has the highest dependency on fishing for income and the money earned from fishing is likely reducing their willingness to participate and follow a management process that appears to curb their access to this resource. Customary institutions, already undermined by a range of historical factors, may be further eroded by access to new markets for natural resources (Cinner et al. 2007): as Navatu fishers have direct access to a market, there is strong financial incentive to ignore customary management rules. By contrast, Kiobo, where the Tui Kubulau is based and where the dependency on marine resources for income is much lower, showed the highest degree of participation and satisfaction with their leaders.

CONCLUSIONS AND RECOMMENDATIONS

The results from the present study indicate that there is a clear overall positive perception that management intervention has directly benefited coastal resources in Kubulau District. This high level of satisfaction with perceived management outcomes is likely to continue to increase or maintain high levels of implementation of Kubulau's customary management rules.

While the majority of households specified some degree of involvement and a high degree of satisfaction with the management process, there were a few respondents, largely from Navatu village, that were unsatisfied. These appear to be the same households that have been repeatedly commit infringements. Because even a few individuals that do not follow the rules set out by the management committee can negatively influence the effectiveness of the MPA network, it will be important to consider conflict resolution approaches to peacefully address this issue using traditional approaches that are sanctioned by Fijian legal frameworks.

While the resource use revealed by the survey is in accordance with other data from catch records in Kubulau (Cakacaka et al. 2010), the perception of the state of fish stocks is likely more optimistic than the result from biological surveys suggest. Therefore, we recommend using caution before recommendation that management decisions by based solely on people's perceptions. While we recognize that in the absence of other data, perceptions can provide valuable indication on likely success of management measures (Johannes 1998), they can be misleading if not grounded in reality.

REFERENCES

- Aswani S (2005) Customary sea tenure in Oceania as a case of rights-based fishery management: Does it work? *Reviews in Fish Biology and Fisheries* 15:285-307
- Cakacaka A, Jupiter SD, Egli DP, Moy W (2010) Status of fin fisheries in a Fijian traditional fishing ground, Kubulau District, Vanua Levu. Wildlife Conservation Society - Fiji, Technical Report no. 06/10, Suva, Fiji, 21 pp
- Cinner J (2005) Socioeconomic factors influencing customary marine tenure in the Indo-Pacific. *Ecology and Society* 10:36
- Cinner JE, Sutton SG, Bond TG (2007) Socioeconomic thresholds that affect use of customary fisheries management tools. *Conservation Biology* 21: 1603-1611
- Clarke P, Jupiter SD (in press) Law, custom and community-based natural resource management in Kubulau District, Republic of Fiji Islands. *Environmental Conservation*.
- Eggleston DB, Parsons DM (2008) Disturbance-induced 'spill-in' of Caribbean spiny lobster to marine reserves. *Marine Ecology Progress Series* 371:213-220
- Fisk DA (2007) Review of monitoring practises from FSPI and affiliate activities (South Pacific). Report to FSPI International.
- Gotanda KM, Turgeon K, Kramer DL (2009) Body size and reserve protection affect flight initiation distance in parrotfishes. *Behavior, Ecology and Sociobiology* 63:1563-1572
- Halpern BS, Warner RR (2002) Marine reserves have rapid and lasting effects. *Ecology Letters* 5:361-366
- Hand T, Davis D, Gillett R (2005) Fisheries sector review: Republic of the Fiji Islands. Asian Development Bank
- IAS (2009) A nation-wide survey of village-based fishing pressure in Fiji. In: Jenkins AP, Prasad SR, Bacchiochi J, Skelton P, Yakub N (eds), *Proceedings of the Inaugural Fiji Islands Conservation Science Forum, Wetlands International-Oceania, Suva, Fiji*.
- Johannes RE (1998) The case for data-less marine resource management: examples from tropical nearshore finfisheries. *Trends in Ecology and Evolution* 13:243-246
- Jupiter SD, Egli DP, Jenkins AP, Yakub N, Hartley F, Cakacaka A, Tui T, Moy W, Naisilisili W, Dulunaqio S, Qauqau I, Prasad S (2010a) Effectiveness of marine protected area networks in traditional fishing grounds of Vanua Levu, Fiji, for sustainable management of inshore fisheries. Wildlife Conservation Society-Fiji and Wetlands International-Oceania Technical Report no. 03/10. Suva, Fiji, 59 pp
- Jupiter SD, Clarke P, Prasad SR, Egli DP, Tui T, Caginitoba A, Qauqau I (2010b) Non-compliance with management rules and its implications for traditional fisheries in Fiji. Wildlife Conservation Society - Fiji, Technical Report no. 04/10, Suva, Fiji, 29 pp
- Kramer DL, Chapman MR (1999) Implications of fish home range size and relocation for marine reserve function. *Environmental Biology of Fishes* 55:65-79
- Lal P (2005) Information, institutions and conflict management in the natural resource sector. *Peace Building and Conflict Prevention Workshop*
- Lees A (2007) Review and Analysis of Fiji's Conservation Sector- Final Report. The Austral Foundation. Background paper. Pacific Islands Regional Ocean Forum, 15 pp
- Russ GR, Alcalá AC (2004) Marine reserves: long-term protection is required for full recovery of predatory fish populations. *Oecologia* 138:622-627
- Seidel H (2009) The role of science in community-based adaptive management of coastal resources in Fiji. M.Sc thesis, University of Bremen, Germany

Teh LCL, Teh LSL, Starkhouse B, Sumaila UR (2009) An overview of socio-economic and ecological perspectives of Fiji's inshore reef fisheries. *Marine Policy* 33:807-817

Veitayaki J (2000) Fisheries resource-use culture in Fiji and its implications. In: Hooper A (ed) *Culture and sustainable development in the Pacific*. Asia Pacific Press, Canberra, Australia, p 116-130