

# Marine tenure and the role of marine protected areas for sea cucumber grow-out in the Pacific region

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## Abstract

Many Pacific island countries are reviving longstanding customary marine resource management systems and traditional tenure through the locally managed marine area (LMMA) approach. The customary tenure systems vary: some are formally recognised in national laws, while for others the recognition is informal. These practices include seasonal bans on harvesting, temporarily closed (no-take) areas, and restrictions placed on certain times, places, species or classes of persons. The LMMA demonstrates the shared vision of stakeholders that promotes the success of adaptive management, as evidenced by healthy ecosystems and communities, abundant marine and fish stocks, sustainable fisheries utilisation, protected marine biodiversity, sustainable development in coastal communities, an understanding of what communities are doing and can do in managing marine areas, and an understanding of ecological and socioeconomic responses to LMMA and coastal management implementation. The LMMA approach helps to ensure that benefits from marine conservation efforts will accrue to the local community, generally in an equitable manner, benefiting them spiritually, culturally, communally, socially and economically. A Fijian site in Verata district revealed that, since 1997, there has been a 20-fold increase in clam density in the *tabu* areas, a 200–300% increase in harvest in adjacent areas, a tripling of fish catches, and a 35–45% increase in household income. Similar trends have also been observed in the other *tabu* areas across Fiji in a range of potential marine commodities, such as giant clam, seaweed and coral transplanting. Currently, there are more than 200 traditionally imposed LMMAs, including *tabu* areas, and numbers continue to grow.

In Fiji, application of the LMMA approach at Natuvu village on the island of Vanua Levu has demonstrated how a customary tenure system can be integrated with sea ranching of sandfish in a closed area. The entire process can be governed by Fijian customary institutions and laws that incorporate local socioeconomic considerations, and provide more diverse and culturally appropriate approaches to enforcement, compliance, monitoring and restitution. The effectiveness of traditional practices is a reflection of the strength and viability of the customary law regime. There may also be issues regarding enforcement, the viability of a closed area in the long term, and the roles taken by governments, communities and traditional leaders. Traditional practices are generally accompanied by strategies and resources to support sustainable use, viable livelihoods and equitable sharing of benefits.

## Introduction

Customary tenure in the Pacific region has been well documented by Hickey (2006), and a comprehensive compilation of the different types of tenure system and their implications is set out in case studies for

Pacific island countries by Vierros et al. (2010). In summary, the tenure systems are diverse and unique to the traditions and cultures across the island nations. However, a few of these countries are either beginning to lose or are phasing out fundamental elements of their traditions in modern times (Vierros et al. 2010). Although some of the Pacific island nations still hold onto strong traditional tenure, there are variations in management influenced by modern practices and efficient technology. The locally managed marine

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area (LMMA) approach is one that seeks to retain and revive traditional approaches in marine tenure, and facilitate their use as a means to provide solutions for modern-day marine resources management issues confronting coastal communities.

This paper provides an overview of the tenure systems across the Pacific region, the associated initiative of LMMA and the opportunities it presents, and suggestions for how the grow-out process of cultured sea cucumber could be carried out successfully. The geographical areas under LMMA across the region are highlighted. Further, the ability of *tabu* areas to protect sedentary marine organisms sharing the same habitats and ecosystem as sea cucumbers is discussed, based upon qualitative and anecdotal information collected. *Tabu* areas are portions of traditional fishing grounds that have been consensually approved by the community owners to be closed to fishing or harvesting. The paper also provides an account of how the traditional marine tenure system in one Fijian community could be mobilised, via the LMMA approach, to integrate the management of sea ranching of sea cucumbers.

## Customary tenure systems

Customary marine resource management practices have long been used in some Pacific island communities in accordance with traditional spiritual beliefs. These practices include seasonal bans on harvesting, temporarily closed (no-take) areas, and restrictions placed on certain times, places, species or classes of persons. Closed areas include the *tabu* areas of Fiji, Vanuatu and Kiribati, the *ra'ui* in the Cook Islands, the *kapu* in Hawaii, the *tambu* in Papua New Guinea, the *bul* in Palau, the *mo* in the Marshall Islands, the *tapu* in Tonga and the *rahi* in New Zealand.

In Palau, the *bul* can be put in place to close an area of reef to harvesting on a short-term basis, such as during periods of fish spawning. Vanuatu also has networks of spatial-temporal refugia created as part of a range of customary practices, such as the ordination or death of a traditional leader, the death of a clan member, grade-taking rituals, and agricultural and ritualised exchange cycles (Hickey 2006). Such area closures may be off limits to fishing for as long as 7 years. Historically, Hawaiians also used a variety of traditional marine resource management practices, which included *kapu* (fishery closures). These closures were often imposed to ensure catches

for special events, or as caches for when resources in the regular fishing grounds ran low.

In Fiji, traditional marine practices still exist, even though they have been eroded to some degree over the years. For example, when a high chief dies, certain marine areas are restricted for approximately 100 nights. Moratoriums are also put in place for traditional ceremonies or funerals; once the restriction period has ended, the area is reopened for public use. Bans also exist for seasonal harvesting; for example, the yellowing of the traditional Fijian beach trumpet tree (*Cordia subcordata*) indicates the octopus mating and spawning season, at which time a temporary ban on catching octopus is put in place. Recently, such practices have been strengthened through the codification of traditional ownership of rights to harvest fish in coastal areas of Fiji.

During the past decade, many Pacific island countries have experienced a revitalisation of traditional management systems and tenure (Johannes 1998; Govan et al. 2008). In some cases, customary tenure systems are recognised in national law, while recognition of others is informal. Fiji is one of the few countries that have demarcated boundaries, to legally recognise a total of 410 fishing-rights areas or *I qoliqoli*—pronounced ‘ng-go-lee, ng-go-lee’—which are communally owned fishing grounds passed down through generations (Figure 1). These records of the ownership of fishing areas are one of the strengths of the traditional marine management system in Fiji. The demarcation process took approximately 20 years (1974–94) and has been applied to the customary fishing areas, which are generally inshore (from the high-water mark to the reef outer edges).

Interestingly, in the context of the current debate in the United Nations relating to governance of the high seas, the traditional fishing grounds in Fiji extended as far offshore as one could go, which could be a considerable distance in a fishing boat. The present-day *I qoliqoli* can range from 0.5 to more than 10 km out to sea from the high-water mark. Beyond the *I qoliqoli* boundaries are Fiji's archipelagic waters, over which the government has legal control. Every Indigenous Fijian must be registered to a clan to have the right to fish in the *I qoliqoli*. As a token of respect, permission from the chief must be sought to fish in another *I qoliqoli*, even if the individual has an ancestral connection to that area. While demarcation of boundaries is perceived to be positive, it can also create conflict: if an area is overfished, people tend to move out to other *I qoliqoli* (Aalbersberg et al. 2005).



Figure 1. Map of the *Iqoliqoli* or traditional fishing areas in Fiji

## Locally managed marine areas (LMMA) network

The LMMA network is a group of marine conservation practitioners who have joined together to learn more about and increase the success of their implementation efforts. The network trains practitioners and community members how to collect comparable monitoring data from their project sites, and assists these groups in sharing and systematically learning from one another about LMMA project implementation across the region. It is active in eight Asia–Pacific countries, including the Philippines, Indonesia, Papua New Guinea, Solomon Islands, Vanuatu and Fiji. There are more than 400 active conservation sites and the level of interest in the network is growing. The LMMA network envisions providing an enabling environment for its respective member-country networks and its various stakeholders to facilitate community-based adaptive management in their own countries.

Fiji's LMMA (FLMMA) network, consisting of over 200 communities, protects about 30% of Fiji's nearshore reefs. The FLMMA network, in collaboration with other national stakeholders, is working towards establishing community resource management action plans in the 410 *Iqoliqolis* around the country and, at the same time, achieving national goals of effectively managed areas in its

jurisdiction's fishing areas. Noticeable declines in coastal resources have prompted communities in Fiji to take action to protect their valuable natural and cultural coral reef resources, specifically to replenish fish stocks. The FLMMA network has established 149 LMMAs (*Iqoliqoli*) with about 216 *tabu* areas covering 17,726 km<sup>2</sup> of inshore area. The community benefits of LMMAs and corresponding *tabu* areas are far-reaching, and explain why the LMMA community has expanded across the region. The success of LMMAs is linked with fisheries, coastal protection, waste assimilation, research and education, as well as bequest values (IUCN 2009), and is attributed more or less to ecological, socioeconomic, political and traditional culture advancements.

## Intertidal sedentary marine species in *tabu* areas

Ecological benefits from LMMAs and associated *tabu* areas for species associated with inshore intertidal areas have been described in the literature. In the Verata district, Tawake (2004) recorded an approximately 20-fold increase in *Anadara* clam density in *tabu* areas, and about 200–300% increase in harvest in adjacent fished areas. Other flow-on effects were attributed to the tripling of fish catches, and a subsequent 35–45% increase in household income. Aalbersberg et al. (2005) detail how, in one LMMA, mangrove lobster (*Thalassina anomala*) increased by

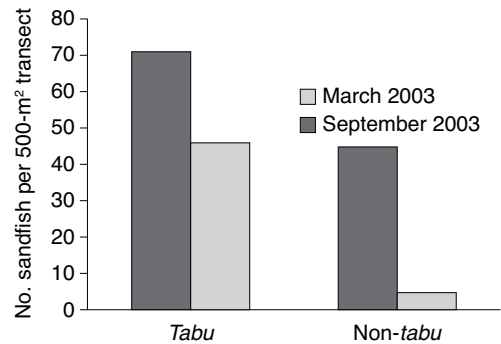
approximately 250% annually, with a spillover effect of roughly 120% outside the protected area. Perhaps more importantly, the study describes how weekly household income in three Fijian communities with LMMAs increased by an average 43% from 2000 to 2003. The study authors noted that 'a successful locally managed marine area is, in effect, an alternative income source. The increase in fishery resources not only improves nutrition but also raises household income through market sales'. Tawake et al. (2001) noted that results such as these in other places have led communities to establish no-take areas in the mangroves and coral reefs to encourage lobsters and coral fish production. Sedentary marine species such as trochus, giant clam, seaweed and sandfish have been the focus of other LMMAs and *tabu* areas in the Pacific islands region.

Social and economic studies in LMMA communities reveal that the social cohesion among the community members, the perceived condition of the fishery resources, the condition of the terrestrial and village environment, the community's understanding of the values of their marine environment, and the amount of marine resources have all greatly improved (Fong 2006). They also conclude that the average catch per unit of effort and the income level of fishers have increased significantly compared with non-LMMA communities.

### Monitoring capacity in LMMA sites

LMMA communities, in the process of collecting data, gain skills and experience in simple underwater reef monitoring, measuring key indicator species that indicate the effect of their management actions. Communities with *tabu* areas in intertidal zones often select sea cucumber as an indicator of change, and carry out monitoring of their abundance. Sandfish (*Holothuria scabra*) were monitored twice in a *tabu* area and an adjacent harvest area in Navakavu in Fiji within a 6-month period (Meo and Mosley 2003). Community monitors took the lead to carry out surveys, analyse data and present results to be used for adaptive management (Figure 2).

The *tabu* area had higher numbers of sandfish than an adjacent harvested area during both times of the survey. An LMMA site with its associated *tabu* area may provide the enabling environment and the opportunity for a cultured sea cucumber grow-out phase; however, there needs to be careful consideration of the *tabu* habitat type and characteristics. It strongly suggests that the criteria for selecting



**Figure 2.** Survey results of sandfish abundance (no. individuals/500 m<sup>2</sup>) in a *tabu* locally managed marine area versus an adjacent non-*tabu* harvest area

suitable habitats are extremely important in ensuring that the environment supports each life-cycle stage. The community of Natuvu, through the technical and advisory support of the FLMMA network and the Australian Centre for International and Agricultural Research researchers, has taken an advanced step in applying aquaculture techniques combined with the LMMA approach (Hair et. al. 2011). The initiative demonstrates how restocked sandfish can be managed, and how the restocking was, in itself, a trigger to initiate such management via traditional means. On the other hand, it also narrows a gap in knowledge about how the necessary link or partnership can be established between the community and the investing partner in producing cultured organisms.

The marine tenure system in the Pacific region is dynamic and contemporary. It is essential that the principles of good governance, including a participatory and inclusive approach, are upheld. The community-based management system provides flexibility to integrate traditional and science-based knowledge systems harmoniously.

Resource governance in LMMA communities is quite pronounced compared with non-LMMA communities (Fong and Aalbersberg 2011). Hence, these communities are able to use existing arrangements to organise and orientate them to take the lead in any resource-related project such as grow-out of hatchery-produced sea cucumber (e.g. restocking or sea-ranching activities). However, input from technical resource organisations is essential, as most communities will not have the capacity to undertake such a project alone.

## Natuvu village case study

In Fiji, application of the LMMA approach at Natuvu village on the island of Vanua Levu has demonstrated how a customary tenure system can be integrated with the sea ranching of sandfish in a *tabu* area (Hair et al. 2011). In this case, a number of advantageous factors coincided—overseas aid funding and technical support, the availability of cultured juvenile sandfish, suitable physical conditions on the ground and the will of the community—to provide the trigger to institute such management via traditional means. The FLMMMA network, local Fisheries officers, Natuvu community leaders, outside technical experts and local private-sector partners collaborated to carry out a trial sea-ranching project within the Natuvu *tabu* area.

The project's aim was to transfer sandfish-hatchery technology to local government and private hatcheries, increase juvenile production, and conduct sea-ranching trials within a local coastal community. The initiative collectively engaged a range of stakeholders from national and local government, community-based resource management advocates, the private sector and the community. The partnership was perceived as deliberate and essential in achieving the goal of the initiative. The juveniles produced in a privately owned hatchery were sea ranching in the *tabu* area in Natuvu and the communities were engaged in various components of the rearing processes from pen deployment, monitoring and enforcement. The community had a very strong sense of its ownership in the use of their *I qoliqoli*, and felt obliged to be engaged and to drive the initiative forward. The community-based adaptive management knowledge and skills of the FLMMMA network engaging the Natuvu community over the past years was quite fitting, and prepared them for this aquaculture initiative.

Although the sea cucumbers did not reach commercial size (due to the destructive effects of a cyclone), the trial demonstrated that there is potential for this approach to succeed. The application of the LMMA approach at Natuvu demonstrated how a customary tenure system can be integrated with the sea ranching of sandfish in a closed area.

## Discussion and recommendations

Aquaculture skill and technique is still new to most Pacific island communities; however, a community in Fiji has been exposed to this activity with positive

outcomes. Although it is a relatively new activity, one important issue in the process is the transfer of knowledge and technology at different levels. The aquaculture stages of sea cucumber culture are interdependent. One stage that relies on local knowledge is the location of broodstock animals (i.e. suitably sized adults) in their fishing ground. The hatchery phase requires specialised technical expertise to conduct successful spawning and larval rearing. All stakeholders should have a sound understanding about the importance of each stage in the entire process. In doing so, assessment of any capacity gaps in acquired skills can be carried out, and knowledge of different stages can be established. Appropriate training can then be arranged. Outside technical assistance must be accessible when needed.

The grow-out (or sea ranching) stage requires the cooperation of community members (and their neighbours) to allow the animals to survive and grow, and to resist poaching. This stage has been shown to be technically feasible in certain suitable areas, but needs to be proven economically feasible before proceeding. The *tabu* LMMA provides suitable habitat for culture of sandfish and, with other supporting evidence, these areas would be prioritised for this purpose. After successful research work at this stage, a checklist can be prepared of the conditions required for optimal productivity and maximum benefits for the sandfish in *tabu* sites. Technical expertise is required to further research these conditions.

Community-based initiatives are often unsustainable in the Pacific region. This is a major issue, as managers and practitioners unwittingly fail to include community goals and aspirations in the project. Communities must be collectively involved, and their daily lives need to be influenced by the initiative in order to get their active participation and engagement. LMMAs become active sites as communities work their way towards setting their resource management governance, and establishing new management units in committees and corresponding provincial networks, the operation of which ensures the sustainability of projects at the local level. The main reason that communities engage in sea cucumber culture projects is for alternatives to secure their livelihood and food security. The communities' expectations are raised once they get involved in sea cucumber aquaculture, and this imposes a risk if it fails to succeed. These factors should be studied further.

At the moment, sandfish is commonly used because it is a well-established culture species (see papers in

these proceedings). However, expanding the list of culture species would be useful, given that most *tabu* areas comprise reefs and lagoon ecosystems. In Kiribati, the culture of white teatfish (*Holothuria fuscogлива*) in the hatchery has been achieved, but it is not known about its survival rate after release into the wild, since monitoring has been problematic. Further research into the culture and grow-out of this and other sea cucumber species would assist communities and ecosystems of the Pacific islands region, where *tabu* areas could be used to optimise management and provide maximum benefits.

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