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# Annotated Bibliography on Socio-economic and Ecological Impacts of Marine Protected Areas in Pacific Island Countries



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ReefBase Pacific

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# Preface

This collection contributes to the work of the ReefBase Pacific project ([pacific.reefbase.org](http://pacific.reefbase.org)) which aims to improve accessibility and availability of information to support effective management of reef resources in the Pacific. Impacts of marine protected areas, that extend beyond biodiversity and habitat conservation tend to receive less popular attention, and yet are of significant importance. The aim here is to highlight, in particular, **impacts on fisheries and livelihoods** attributed to coral reef marine protected areas in Pacific Island Countries and territories<sup>1</sup>.

The term "marine protected area", is used broadly here to describe this collection of literature. With consideration to the definition adopted by the International Union for Conservation of Nature (IUCN) and other international and national bodies, a marine protected area is:

*Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment<sup>2</sup>.*

Included in this collection is literature that reports various forms of reef area management practiced in Pacific Island countries: reserves, sanctuaries, permanent or temporary closed areas, community and traditional managed areas.

The literature presented here includes peer-reviewed journals, book chapters, institutional technical papers and unpublished reports. The literature has been sourced from physical and digital repositories of Pacific regional organizations, namely, those of the Secretariat of the Pacific Community, the Secretariat of the Pacific Regional Environment Programme (SPREP) and the University of the South Pacific (USP). In addition, appropriate literature from nongovernment organizations (NGOs), scientific institutes and Pacific Island countries' government agencies has been gathered through searches of both web-based and physical repositories. This collection provides an overview of impacts, influences and effectiveness of marine protected areas, observed and reported in Pacific Island Countries and territories. An annotation is provided in italics where necessary to highlight the reports' relation to the theme.

There are a huge range of "impacts" that emerge from literature reviewed and presented here – e.g., biological and ecological impacts include changes in biodiversity and changes in size and densities of reef organisms. Economic and livelihood benefits have been reported. There are observations of impacts on social, institutional and governance systems including conflict and the practice of conflict resolution strategies, strengthening of traditional marine tenure and of traditional enforcement mechanisms. Developments and improvements of mechanisms for communication and the sharing of knowledge have also been reported among regional organizations, NGOs, governments and communities. It is clear that ecological and social sciences are supported by many initiatives to assist the establishment or monitoring of marine protected areas, resulting in increased knowledge and awareness of scientists, managers and communities. Traditional knowledge has increasingly been documented and incorporated into area management practices thereby developing a greater respect and consideration of traditional knowledge in the scientific community.

The literature available in the public domain tends to be dominated by documentations of implementation with a general scarcity of reports of impacts following establishment. Reports of positive impacts appear more common and of higher profile than documentation of little, no or negative impact of marine protected areas on social-ecological systems.

This document you are now reading includes the collection of references as of June 2008; however, the collection continues to grow and is regularly updated on the Internet at [pacific.reefbase.org](http://pacific.reefbase.org). Authors of relevant studies are encouraged to submit them for inclusion in the online collection.

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<sup>1</sup> The Pacific Island Countries and territories considered here are those 22 members covered by the programs of the Secretariat of the Pacific Community.

<sup>2</sup> Kelleher, G. and R. Kenchington. 1992 Guidelines for establishing marine protected areas. A marine conservation and development guide. IUCN, Gland, Switzerland. vii+ 79 pp.

# Overview: Reclaiming “Protected Areas” as a Livelihood Tool for Pacific Island People

Hugh Govan

## Pacific Islands at risk

The future of Pacific Island peoples is inextricably linked to the region’s coastal ecosystems. Unsurprisingly and with the exception of inland populations in Papua New Guinea, fish provides and is expected to provide the major source of protein for a rapidly growing population for at least the next 20 years (CEC 2000, UNDP 2002, Bell 2007).

The role played by Pacific Island reef ecosystems extends far beyond that of sustenance or income generation and includes such vital functions as protection from extreme natural phenomena and providing a central element of Island society and culture – the very identity of Pacific Islanders (Johannes 1981, Hviding 1996, Whittingham et al. 2003).

The increasing pressure on these life-supporting ecosystems has been a cause for concern for decades now and the region has seen numerous efforts to sustain or improve people’s livelihoods on the one hand and to support the conservation of coral reef systems on the other. After the many millions of dollars spent on these initiatives, what prospects are there for Island peoples?

## What has been done?

Projects, such as aquaculture, tourism, handicrafts and offshore fishing, which attempt to diversify livelihoods in order to reduce the extractive pressure on coastal resources, have not achieved even a fraction of their intended impact. Instead, it appears that these projects may even distract both donors and communities from addressing more effective forms of resource management (World Bank 2000, Gillett et al. 2007).

Several decades of conservation funding seem to have underperformed with respect to intended impacts and amounts invested (e.g., Foale 2001, Baines et al. 2002, 2006, Lees and Siwatibau 2007) accomplishing largely theoretical gains and less certain tangible benefits. For example, numerous “paper” protected areas (i.e., legislated but not functional; cf. World bank 2000, Huber and McGregor 2002), the development of largely unenforced and unenforceable policy and legislation, at the regional level such as the unimplemented Pacific Islands Regional Oceans Policy or the Action Strategy for Nature Conservation (Tortell 2007) or the national level (Healy 2006). The accumulation of research studies that do not address priorities as expressed by leaders or communities have even led the Prime Minister of Papua New Guinea and the Chair of the Pacific Islands Forum to comment that “... too much emphasis, indeed unfair focus, is placed on conservation with little regard for the economic and social development needs of our peoples. ... An appropriate balance needs to be found in the debate on this issue.”

The particular characteristics of the region account for some of the challenges faced by conservation and livelihood projects as evidenced above – isolation, distance from markets or even government institutions, restricted human capacity, natural hazards and civil unrest have all played their parts. However, an important and recurring theme is that many interventions are not grounded in local reality nor do they respond to the priorities of local people (Govan 1993, 1997, Lal and Keen 2002).

## Integrated resource management as the basis for sustainable livelihoods?

The realization that local aspirations, livelihoods, conservation and inshore fisheries management should be integrated has seen an increasing emphasis on collaborative and participatory approaches worldwide (Govan 1997, Whittingham et al. 2003). In many respects, the Pacific has taken the lead with hundreds of communities in Fiji, Vanuatu, Solomon Islands, Samoa, Papua New Guinea, Tuvalu and Micronesia now proactively managing their coastal resources. Approaches range from customary or traditional to complex multistakeholder comanagement (Johannes 2002, Govan et al. 2006, LMMA 2006, FSPI 2004–2006).

These approaches are known by many names: LMMA, VBRMA, CBRM, CCA, CBFM, VFMP<sup>3</sup> to name a few. A comprehensive review and analysis of progress made is overdue but there is now sufficient evidence to discern a path towards sustainable livelihoods and reef conservation. The following livelihood benefits seem reasonably achievable and have been documented:

- Biodiversity conservation: localized recovery or protection of vulnerable species such as large food fish or marine turtles (Johannes and Hickey 2004, LMMA 2006, McClanahan et al. 2006).

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<sup>3</sup> Locally managed marine areas, village-based resource management areas, community-based resource management, community conservation area, community-based fisheries management, village fisheries management plans.

- Improved fishery landings: experiences from within the region and nearby Philippines show that, depending on species, catches may be sustained or increased (Tawake 2001, Russ et al. 2004, Abesamis and Russ 2005, but see concerns in Foale and Menele 2004, Hillborn et al. 2004).
- Governance: communities may improve decision-making processes, link to other organizations and institutions, influence policy development, reduce internal conflicts and, central to resource management, improve compliance and enforcement (LMMA 2006, Leisher et al. 2007, Pomeroy et al. 2007, Tawake, in prep ).
- Community organization: simple resource planning and facilitation processes are being used to support community endeavors in other fields (Chambers 1992, Inglis et al. 1997). Community institutions established for management may be used for other purposes or be adapted to handle other types of projects<sup>3</sup>.
- Resilience and adaptation: supporting local stewardship and promoting understanding of people's potential impact on resources provides a basis for response to new threats in the context of adaptive management and help provide local security (Thaman et al. 2005, Cinner et al. 2006).
- Health: improving or securing the supply of marine protein has a direct impact on community well-being aside from the potential to use the same planning process for other community priorities including health (Leisher et al. 2007).
- Integrated resource management: addressing a wide range of issues such as watersheds, waste management, community events and so on (Thaman et al. 2005, FSPI 2006).
- Cultural survival: the considered use of traditional management measures and knowledge may slow the loss of valuable aspects of culture and improve management success, for example the use of, and respect for, tabu areas or other traditional closures (FSPI 2006, LMMA 2006).
- Security of tenure: Pacific Island communities usually regard the traditional rights of ownership and access to resources as vital to their livelihoods, and indeed identity, and perceive that these are being eroded. Community-based management may be seen as a means of re-asserting these rights.

Although all these benefits will by no means necessarily accrue in all cases the proliferation and endurance of a great many sites across the region with relatively little outside support strongly suggests that communities do feel that the approaches have an overall beneficial impact on their livelihoods – quantitative evidence of these wider benefits is becoming available (Leisher et al. 2007).

### Characteristics of community-based adaptive management initiatives

The approach that can be broadly termed community-based adaptive management (CBAM) (Govan et al. 2008) seems to hold much promise for reefs and livelihoods but it is worth outlining what seem to be some of the vital components of the successful and enduring initiatives:

**Community-based:** The management is carried out primarily by the community and the relevant user groups and also involves appropriately the locally and nationally relevant institutional and private stakeholders. This makes optimum use of social capital such as existing (or assigned) resource rights, local governance, traditional and local information, self-interest and self-enforcement capacity.

**Adaptive management:** The local community sets priorities and establishes objectives and proposed actions based on the available, and usually local, information, actions are implemented and results are checked periodically<sup>4</sup>. Plans represent a community agreement and are frequently simple one-page documents. Results of checking/monitoring and any new information are used to review the plan and modify the plan as appropriate. Management tools selected tend to be simple to implement or enforce such as area or seasonal closures, restrictions on specific fishing techniques, waste management and restoration activities. Experience suggests that some benefits should be tangible and prompt in order to fuel continued management but these need not be monetary.

It is clear that CBAM is a simple and not even alien concept given its similarity to many traditional resource management approaches (Hickey 2006, Cinner et al. 2007). What is relatively new, or at least so far not widely accepted<sup>5</sup>, is the proposal that this approach should form the basis for securing the well-being of both reefs and communities of the Pacific Islands.

### The way forward for people and reefs in the Pacific

Of course, a few hundred communities practising adaptive management across the region are unlikely to make a wide impact on livelihoods or reefs. Furthermore, recent calls to promote marine protected areas (MPAs), citing some of the above list of benefits in support, miss the point in confusing a specific management tool with wider sustainable management.

<sup>3</sup> FSPI 2006 (cf. Paonangisu, Vanuatu): participatory marine resource planning exercises have been used subsequently by other projects, e.g., Small Grants programs in Solomon Islands.

<sup>4</sup> In Fiji, many villages even define quantitative goals and then monitor them scientifically.

<sup>5</sup> See, for example, Johannes (1998) and the case for data-less management.

The potential of the Pacific Island experience is not so much to attain a “representative network of MPAs” but rather the much more widely called for systems of integrated coastal (or island) management (ICM) that address livelihoods, development, inshore fisheries and conservation as a whole (Whittingham et al. 2003, Bell et al. 2006, World Bank 2006). The MPA enthusiasts should not fret though; these community-based approaches usually generate the most enforceable examples of closed areas/MPAs in the region and often serve as stepping stones to larger systems of protected areas or conservation initiatives (Aswani and Hamilton 2004, Tawake, in prep.).

Achieving the potential of ICM based on CBAM will involve developing strategies that integrate hitherto separate conservation, fisheries and livelihood sectors and address some relatively neglected but vital areas:

- **Strengthen and adapt national and subnational policy and institutional frameworks** in support of ICM based on community-driven adaptive management. This is vital to provide robustness to external drivers such as population increases, market pressure and terrestrial impacts. The strengthening of institutional capacity will require innovative approaches from NGOs and donors, imaginative and tailored institutional structures that may adapt or hybridize traditional or national institutions. Bridges between these and other stakeholders can be built using networks and umbrellas, examples of which are now established in the region (Ostrom 1990, Anderies et al. 2004, Berkes 2004, Cinner and Aswani 2007, Cinner et al. 2007, Tawake, in prep.). These support networks or umbrellas have proven useful in the advancement of national community-based management in Fiji and also in Solomon Islands and Micronesia (Fiji Locally Managed Marine Area Network, Solomon Island Locally Managed Marine Area Network, and Pacific Islands Marine Protected Areas Community).
- **Strive for highly cost-effective and locally appropriate approaches.** These should not require expensive technical inputs or analysis (e.g., natural or social sciences) at the outset. Local government, community or NGO staff can facilitate and initiate management at the earliest opportunity based on experiences elsewhere, rules of thumb and community knowledge. Any new information can later be incorporated into cycles of adaptive management in which progress is evaluated and improvements sought. The costs of establishing and supporting communities must be in the order of hundreds of dollars per year for them to be sustained in the long run by government – emerging data suggest that this is achievable<sup>7</sup>.
- **Research needs to be more responsive to the needs of the managers**, i.e., communities and their support agencies. At present, research and capacity priorities are often derived from outside the region and based on models of management that are not applicable. There is now considerable technical support capacity in the region but agencies face the challenge of discerning priorities on the ground. New approaches to improving communication between communities and their support agencies on the one hand and research institutions on the other are needed<sup>8</sup>.
- **Avoid raising unrealistic expectations.** Communities are getting involved because they want to better manage their resources for their own benefit. Unrealistically promoting the benefits of MPAs or providing “incentives” are common strategies despite the lack of demonstrable long-term success. Not only are these financially unsustainable in a national ICM framework but they also erode the vital empowerment and ownership communities achieve when they observe the connection between their actions and accrued benefits.
- **Encourage interdisciplinary and cross-sectoral approaches.** A number of agencies have overlapping responsibilities (e.g., environment, fisheries and disaster preparedness/adaptation) which could interface with communities through a single community-based adaptive management approach, cutting costs and ensuring “holistic” and integrated approaches.

In conclusion, one of the untapped riches of the Pacific has begun to show its true potential: villages, communities, tribes, clans and districts are planning, implementing and enforcing management at the local level. The challenge for policymakers, scientists, government and non-government institutions is to support and promote this decentralized island way as a vital foundation in a truly regional approach to integrated island management that can address the pressing issues associated with sustaining the region’s reefs and livelihoods<sup>9</sup>.

<sup>7</sup> Data from FLMMA and SI FSP/SIDT sites suggest that currently village sites can be supported for around US\$2,000 per year during their startup phase (maybe 3 years). The bulk of cash expenditure is in transport and salaries. There is every reason to suppose that this can be substantially reduced at economies of scale.

<sup>8</sup> Wilson (2007) warns that self-interest frequently clouds the priority setting capacity of researchers.

<sup>9</sup> The following are acknowledged for their valued discussion and contribution: Daniel Afzal, Zaidy Khan, Bob Gillett and Bill Aalbersberg, and of course all the communities across the region who actually do this work.



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# Annotated Bibliography of Literature of the Pacific Islands

**Aalbersberg, B., A. Tawake and T. Parras. 2005. Village by village: recovering Fiji's coastal fisheries. In World Resources 2005: the wealth of the poor: managing ecosystems to fight poverty. World Resources Institute, Washington D.C. 144-152.**

In the early 1990s, residents of Ucunivanua Village, on the eastern coast of Fiji's largest island, realized that the marine resources they depended on were becoming scarce. Village elders remembered when a woman could collect several bags of large kaikoso clams - a food staple and important source of income - in just a few hours. By the 1990s, however, a woman could spend all day on the mudflats and come home with only half a bag of small clams. The decline of Ucunivanua's marine heritage reflects a larger pattern of depletion repeated throughout the Fiji islands. A combination of greater commercial fishing and larger local subsistence harvests have left most of Fiji's coastal waters overfished, sometimes heavily so. Rural Fijians, who constitute half of Fiji's population of nearly 900,000, have been hurt. Most of these villagers still lead a traditional subsistence-based livelihood, communally drawing on local marine resources for at least part of their daily protein and income. In the past, the abundance of the marine catch meant a moderate level of affluence and food security. With that abundance gone, the pressure on village economies has mounted, leaving 30-35 percent of rural households in Fiji below the official poverty line. But Fijians are fighting back, village by village, linked by a network of communities that carefully regulate the use of their coastal waters, slowly restoring their productivity. Although these locally managed marine areas (LMMAs) are an innovation of the last decade, they call on a rich tradition of village management of ocean resources. In this new incarnation, traditional local conservation practices are blended with modern methods of monitoring and energized by the full participation of members of the community, who design and implement the marine management plans. The goal is to bolster local incomes and traditions by replenishing local waters - a grassroots approach to rural development.

*The residents of Ucunivanua worked with the University of the South Pacific (USP) to establish a locally managed marine area, and its results have been reported as being dramatic. As its success story spread through the local media, villages throughout Fiji facing declines in their inshore fishery approached USP for help in setting up locally managed marine areas in their traditional fishing areas. The authors note that "to date, nearly 60 LMMAs involving 125 communities with a tabu, or prohibition, on fishing for certain species, have been declared in Fiji, covering about 20 percent of the country's inshore fishery."*

[http://pdf.wri.org/wrr05\\_lores.pdf](http://pdf.wri.org/wrr05_lores.pdf)

**Aalbersberg, W.G.L. 2003. The role of locally-managed marine areas (LMMAs) in the development of eco-tourism in Fiji. Institute of Applied Science, Faculty of Islands and Oceans, University of the South Pacific, Suva, Fiji. 10 pp.**

*This report provides an overview of the characteristics and implementation of locally-managed marine areas (LMMA) in the Pacific region, and outlines the status of LMMA activities in Palau, Fiji, Tonga, Kiribati, the Marshall Islands, Samoa, Tuvalu, Vanuatu and the Federated States of Micronesia. The report provides a case study of the Fiji LMMA Network, presenting the process that was followed and the outcomes achieved. It has been observed that "small community-based protected areas can yield significant increase in biological productivity and associated biodiversity also seems to increase in undisturbed (protected) areas." Socioeconomic benefits from LMMAs have also been observed; in one area a significant increase in household income has been reported as well as an increase in catch rates. Community and cultural pride have increased with spread of the successes being experienced, and interest has been developed in the younger generations in both scientific and traditional ways. Community cohesion has increased and skills developed in resource planning, monitoring, analysis and communication. The report reveals that "some individual LMMA sites have already discovered the mutual benefits of having the tourism industry closely involved in these community-based conservation effort" and suggests a hope that the involvement of the tourism industry in the LMMA Network will continue and develop.*

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=C0000000075>

**Afioga, L. 2002. Prohibition of fish traps in the Aleipata Marine Protected Area in Samoa. PICCC case studies: case studies from the 2002 Pacific Island community-based Conservation course, Institute of Applied Science, Faculty of Science and Technology, USP. Suva, Fiji. 7-12.**

*The District of Aleipata, on the island of Upolu in Samoa, consists of 11 villages that have all agreed to work on the project of establishing a multi-use community-based marine protected area (MPA). "The main focus is on empowering the community to manage their marine environment so that they can protect, conserve and use their marine resources sustainably." Each of these villages has a selected member to represent them on the District Committee. This committee, after consultation with fishers, decided to establish a ban on the use of fish traps within the marine protected area. "This case study describes the challenges faced and the process of consultations involved in removing one of the fish traps in the MPA. The process included the exercising of traditional authority and cultural protocol. This example shows how enforcement of rules in a MPA can be effective through the support and reliance on traditional authority and decisionmaking systems."*

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=A0000003637>

**Aswani, S. and M. Lauer. 2006. Benthic mapping using local aerial photo interpretation and resident taxa inventories for designing marine protected areas. *Environmental Conservation* 33 (3): 263-273.**

Given the frequent socio-economic, political and concomitant ecological failures of science-driven marine protected area (MPA) programmes, it is now important to design MPAs by integrating natural and social science research more comprehensively. This study shows how indigenous peoples assisted in the design of MPAs by identifying marine substrates and related resident taxa on aerial photos, information which was then incorporated into a geographical information system (GIS) database, along with dive survey data. Two questions were asked: (1) Is indigenous ecological knowledge accurate enough for mapping the benthos and associated taxa? (2) Is such an approach an appropriate way for assisting in the biological and social design of MPAs in Oceania? Conventional quadrat field dive surveys were used to measure the accuracy of substrate identification by local informants and a visual survey was used to test hypotheses formulated from local knowledge regarding the spatial distribution and relative abundance of non-cryptic species within certain benthic habitats. Equivalence rates between indigenous aerial photo interpretations of dominant benthic substrates and in situ dive surveys were 75-85% for a moderately detailed classification scheme of the benthos, which included nine locally-defined abiotic and biotic benthic classes for the MPA seabed. Similarly, the taxa inventory showed a strong correspondence between the qualitative predictions of local fisherfolk and the quantitative analysis of noncryptic species distribution, including their relative abundance and geophysical locations. Indigenous people's predictions about the presence or absence of fish in different benthic habitats corresponded to 77% and 92% of the time (depending on scoring schema) with in situ visual measurements. These results demonstrate how incorporating local knowledge of benthic heterogeneity, existing biological communities, and particular spatio-temporal events of biological significance into a GIS database can corroborate the production of scientifically reliable base resource maps for designing MPAs in an environmentally and culturally sound fashion. This participatory approach was used to design and then establish MPAs in the Roviana and Vonavona region of the Western Solomon Islands. Under appropriate conditions, interdisciplinary work can complement the design of scientific fishery management and biodiversity conservation prescriptions for coastal Oceania.

**Aswani, S. and M. Lauer. 2006. Incorporating fishermen's local knowledge and behavior into geographical information systems (GIS) for designing marine protected areas in Oceania. *Human Organization* 65 (1): 81-103**

Drawing on our experience in establishing marine protected areas (MPAs) in the Roviana and Vonavona Lagoons, New Georgia, Solomon Islands, this paper shows how a geographical information system (GIS) database can be used to incorporate sociospatial information, such as indigenous knowledge and artisanal fishing data, along with biophysical and other information to assist in MPA design. We argue that converting peoples' knowledge and socioecological behavior into geo-spatial data allows researchers to formulate hypotheses regarding human responses to inter- and intra-habitat variability, along with other marine ecological processes, and helps in the designing and implementation of resource management strategies in a cost-effective and participatory way, bridging the gap between indigenous and Western cognitions of seascapes. More generally, we show the significance of combining spatial tools, anthropological fieldwork, and social and natural science methods for studying artisanal fisheries with the goal of aiding the design of marine protected areas.

<http://www.anth.ucsb.edu/faculty/aswani/articles/Aswani-Lauer-HO-2006.pdf>

**Aswani, S. and P. Weiant. 2003. Shellfish monitoring and women's participatory management in Roviana, Solomon Islands. SPC Women in Fisheries Information Bulletin 12. 9 pp.**

This paper summarizes the results of a women's community-based marine protected area that has been successful in sustaining invertebrate biological resources and in promoting strong community support. In 1999, the women of Baraulu and Bulelavata villages in Roviana Lagoon, Solomon Islands, created a spatiotemporal marine closure to sustain marine resources that are valuable for nutritional and income-generating purposes. The aim of this paper is three-fold: 1) to outline the project and the associated biological results; 2) to describe the process involved in attaining a committed level of community participation; and 3) to review additional lessons that have been learned during the project. We find that a high level of community involvement is achieved when positive scientific results generated by the monitoring protocol are returned to the community. This educational process, which cross-fertilizes indigenous and Western knowledge, has increased women's interest in the project and their direct participation in monitoring and enforcement. Also, the initiative's perceived success has encouraged several nearby villages, which otherwise would have no marine protection strategies, to launch other conservation initiatives. We hope that the project's findings can be generalized to other regions of the world and help to increase the effectiveness of establishing community-based marine protected areas (CBMPAs) across the Pacific region.

<http://www.spc.int/coastfish/News/WIF/WIF12/Aswani.pdf>

**Aswani, S. and R. Hamilton. 2004. The value of many small vs. few large marine protected areas in the Western Solomon Islands. SPC Traditional Marine Resource Management and Knowledge Information Bulletin 16: 3-4.**

In this article, we describe our effort to establish a network of marine protected areas in the Western Solomon Islands and summarise the biological and social rationale employed for setting multiple small reserves within a biogeographical region. We argue that in the case of the Western Solomons, a network of small MPAs is a more biologically effective and socially attainable strategy than establishing a few large reserves. We also suggest that practitioners need to pay more attention to economic factors (e.g. McClanahan 1999) and social sustainability issues (e.g. Mascia 2003) when establishing MPAs, rather than concentrating on their intrinsic biological and ecological value alone. Finally, we outline some lessons learned and the necessary steps involved in attaining a committed level of community participation in order to sustain the MPAs over the long term.

[http://www.spc.int/coastfish/sections/reef/PROCFish\\_Web/Modules/Library/GetDocument.aspx?File=pdf/InfoBull/TRAD/16/TRAD16\\_03\\_Aswani.pdf&Hit=1&ID=6ef23a9a-3484-456c-ad89-76bf5f245536](http://www.spc.int/coastfish/sections/reef/PROCFish_Web/Modules/Library/GetDocument.aspx?File=pdf/InfoBull/TRAD/16/TRAD16_03_Aswani.pdf&Hit=1&ID=6ef23a9a-3484-456c-ad89-76bf5f245536)

**Aswani, S. and T. Furusawa. 2007. Do marine protected areas affect human nutrition and health? A comparison between villages in Roviana, Solomon Islands. Coastal Management 35 (5): 545-565.**

The implementation of marine protected areas (MPAs) for fisheries management has increased recently due to the perceived role of MPAs in conserving biodiversity, increasing fish stocks, and enhancing the food security of coastal communities. However, it is unclear whether MPAs may restrict the availability of marine resources and decrease overall food security and the health of the people. In the Roviana Lagoon of the Solomon Islands, we conducted cross-comparisons of villages with MPAs and a village without an MPA to assess whether MPAs influenced local perceptions of governance, environmental change, livelihood strategies, and actual human nutrition and health. Results showed that residents of villages with effective MPAs had higher energy and protein intake than those who had no MPA or an ineffective MPA. We conclude that "no-take" marine reserves do not have adverse effects and that when MPAs are effectively sustained they may enhance local nutrition and health.

**Aswani, S., M. Lauer, P. Weiant, R. Hamilton and N. B. Tooler. 2004. The Roviana and Vonavona Lagoons Marine Resource Management Program: Final Report (Phases 1 and 2) 2000-2004. 151 pp.**

This is the final summary of research and marine resource management activities conducted in the Roviana and Vonavona Lagoons between 2000 and 2004. The MacArthur and Packard Foundations funded "The Roviana and Vonavona Lagoons Marine Resource Management Project " (2000-2002) and "Establishing Marine Protected Areas and Spatio-temporal Refugia in the Roviana and Vonavona Lagoons, Solomon Islands" (2002-2004), respectively. The projects brought together scholars from various institutions and combined anthropological and marine biological research to study various maritime practices in the Roviana and Vonavona Lagoons. The over-arching goal of these projects was to create a network of marine protected areas (MPAs) in southwestern New Georgia, Solomon Islands.

[http://www.anth.ucsb.edu/faculty/aswani/packard/final\\_report/Final\\_report2000-2004.pdf.pdf](http://www.anth.ucsb.edu/faculty/aswani/packard/final_report/Final_report2000-2004.pdf.pdf)

**Benyes, I. 2005. Analysis of the Program for Maritime Management (PGEM) as a coral reef conservation tool on Moorea. Wageningen University, Holland. 53 pp.**

For about a decade now the discussion of a marine areas management program (PGEM) (in French programme the gestion de l'espace maritime) to regulate activities and protect the coral reefs of Moorea has been on the negotiation table, finally after some drawbacks in 2004 this conservation tool has had the green light to be implemented. However, the efficiency of this tool could be at peril due to certain stakeholder conflicts, perception, compliance level and misunderstandings of how a common pool should be managed. Two approaches are used to address this question, common resource pool and socio-economic analysis. Property rights - as a response for ensuring the efficiency of the PGEM - in their different forms are not powerful if the socio-economic-political factors of the milieu where it is implemented are not taking into account. The goal of this paper is to objectively analyze the socio-economic-political dynamics present in the society of Moorea in order to compare them with a set of principles that are necessary to have robust institutional arrangements that will enhance the capacity of user to manage common pool resources - like coral reefs - in a sustainable way.

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=D000000010>

**Berdach, J.T. 2003. Case Study: The Funafuti Conservation Area, Funafuti Atoll, Tuvalu: drawing lessons for future marine conservation planning and management. Asia Development Bank for the Government of Tuvalu, Manila, Phillipines. 78 pp.**

Marine protected areas (MPAs) have gained wide acceptance among coastal planners, managers, researchers, and scientists as an effective tool that can be utilized to protect threatened marine and coastal ecosystems. MPAs allow depleted breeding stocks of important food fish and invertebrate species to regenerate and become re-established, providing a foundation for sustainable fisheries. Typically, the MPA model comprises a core "no-take" conservation area, within which harvest of fish and other consumable resources is strictly prohibited, and a surrounding "buffer zone" in which non-intensive fishing practices are permitted. The full commitment and participation of the local community in planning, design, and implementation can ensure the long-term viability of such projects. An MPA project, the Funafuti Conservation Area (FCA), was initiated at Funafuti, the main atoll and lagoon system of Tuvalu, in 1996. The FCA was established with the support of the South Pacific Biodiversity Conservation Programme (SPBCP), and administered by the South Pacific Regional Environment Programme (SPREP), in response to reported increases in fishing pressure, and the threat of deteriorating environmental quality in Funafuti lagoon. The FCA has been regarded as highly successful by local residents, but information about the project has not been widely disseminated outside of Tuvalu. As part of the Asian Development Bank (ADB) Pacific Region Environmental Strategy (PRES), a case study was prepared to evaluate the performance of the FCA project. One of the primary objectives of the case study, and of the PRES, was to gather "lessons learned" that could be applied in other contexts, and to determine ways in which environmental management could be effectively mainstreamed into government policy-making and economic planning.

*The report notes that the MPA set up in Funafuti Lagoon has "yielded tangible benefits in terms of improved community awareness, increased fish biomass, and the sustained viability of biodiversity resources". Traditional fisheries management in Funafuti may not be as effective as Tuvalu's outer island communities, due to the "heterogenous and populous communities".*

[http://www.adb.org/Projects/PRES/pres\\_case\\_funafuti.pdf](http://www.adb.org/Projects/PRES/pres_case_funafuti.pdf)

**Birkeland, C., A. Green, C. Mundy and K. Miller. 2004. Long term monitoring of Fagatele Bay National Marine Sanctuary and Tutuila Island (American Samoa) 1985 to 2001: summary of surveys conducted in 1998 and 2001.**

Long-term monitoring of the coral and fish communities in Fagatele Bay National Marine Sanctuary and at other sites around Tutuila Island has been under way since 1982. Permanent transects in Fagatele Bay were re-surveyed in 1998 and 2001 to assess changes in coral and fish communities through time. Coral communities in Fagatele Bay generally show improved condition both in the 1998 and 2001 surveys. The coral communities on the reef slope have increased in the number of colonies, in colony size and in coral cover, although communities are still dominated largely by fast growing, opportunistic species.

The results indicate that the coral communities in Fagatele Bay are well on the way to recovery from the major disturbances of the last few decades, and are in the best condition that they have been in since the Crown-of-Thorns outbreak in the late 1970s. In contrast to the coral communities, the fish communities appear to be taking longer to fully recover from the habitat destruction caused by the major disturbances of the last few decades in Fagatele Bay. As with the coral communities, we have seen a gradual increase through time both in fish abundance and species richness, although communities are still below levels recorded in 1985.

Shallow water communities on the reef flat in Fagatele Bay appear to have suffered from the effects of a severe low tide event that led to a mass die-off of reef flat corals around the island in 1998. We have recorded a decline in the number and size of coral colonies as well as a decline in fish abundance and species richness on the reef flat. Reef communities at key locations around Tutuila Island also appear to be gradually recovering from the effects of Crown-of-Thorns and hurricanes Val and Ofu. Notably however, coral communities at Cape Larson (severely affected by COTs) and Pago Pago Harbour (severely affected by pollution) are still in poor condition, but seem to be showing signs of recovery.

[http://fagatelebay.noaa.gov/html/docs/birkeland\\_report2001.pdf](http://fagatelebay.noaa.gov/html/docs/birkeland_report2001.pdf)

**Bleakley, C. 2004. Review of critical marine habitats and species in the Pacific Islands region. Secretariat of the Pacific Regional Environment Programme, Apia, Samoa. 47 pp.**

The terms of reference of this report specify for this review to include: an analysis of the trans-boundary dimensions of issues identified in the review; analyses of the impact of traditional ownership and customary use rights to marine resources, particularly in coastal and atoll areas and how these may be changing as a result of settlement patterns, community and economic development; identify the root causes of trans-boundary problems, potential solutions, any knowledge gaps and what should be done to address these gaps; identify current attempts to address the issues and suggest new approaches; suggest priorities for action, including sectoral interventions and national and regional institutional mechanisms for their implementation.

*The report provides information on current approaches in the Pacific used for management of habitats and species; the use of MPAs is discussed. The author comments that observations (Kelleher et al. 1995) of established MPAs in the South Pacific indicate that "the level of management effectiveness is generally low". Also suggested is that "many areas exist on paper only, lacking local support. MPAs are not well established in the Pacific islands as an effective conservation tool." The report goes on to detail factors that influence the level of success and impact of efforts to establish MPAs, with reference to specific initiatives in the Pacific region.*

[http://www.sprep.org/att/publication/000365\\_Bleakly\\_Report.pdf](http://www.sprep.org/att/publication/000365_Bleakly_Report.pdf)

**Cinner, J., M. J. Marnane, T. R. McClanahan and G. R. Almany. 2006. Periodic closures as adaptive coral reef management in the Indo-Pacific. Ecology and Society 11 (1). 34 pp.**

This study explores the social, economic, and ecological context within which communities in Papua New Guinea and Indonesia use adaptive coral reef management. We tested whether periodic closures had positive effects on reef resources, and found that both the biomass and the average size of fishes commonly caught in Indo-Pacific subsistence fisheries were greater inside areas subject to periodic closures compared to sites with year-round open access. Surprisingly, both long-lived and short-lived species benefited from periodic closures. Our study sites were remote communities that shared many socio-economic characteristics; these may be crucial to the effectiveness of adaptive management of reef resources through periodic closures. Some of these factors include exclusive tenure over marine resources, a body of traditional ecological knowledge that allows for the rapid assessment of resource conditions, social customs that facilitate compliance with closures, relatively small human populations, negligible migration, and a relatively low dependence on fisheries. This dynamic adaptive management system, in which communities manage their resources among multiple social and ecological baselines, contrasts with western fisheries management practices, centered on maintaining exploited populations at stable levels in which net production is maximized.

<http://www.ecologyandsociety.org/vol11/iss1/art31/>



**Cinner, J., S. Sutton and T. Bond. 2007. Socio-economic thresholds that affect use of customary fisheries management tools. *Conservation Biology* 21 (6): 1603-1611.**

Customary forms of resource management, such as taboos, have received considerable attention as a potential basis for conservation initiatives in the Indo-Pacific. Yet little is known about how socio-economic factors influence the ability of communities to use customary management practices and whether socio-economic transformations within communities will weaken conservation initiatives with a customary foundation. We used a comparative approach to examine how socio-economic factors may influence whether communities use customary fisheries management in Papua New Guinea. We examined levels of material wealth (modernization), dependence on marine resources, population, and distance to market in 15 coastal communities. We compared these socioeconomic conditions in 5 communities that used a customary method of closing their fishing ground with 10 communities that did not use this type of management. There were apparent threshold levels of dependence on marine resources, modernization, distance to markets (<16.5 km), and population (>600 people) beyond which communities did not use customary fisheries closures. Nevertheless, economic inequality, rather than mean modernization levels seemed to influence the use of closures. Our results suggest that customary management institutions are not resilient to factors such as population growth and economic modernization. If customary management is to be used as a basis for modern conservation initiatives, cross-scale institutional arrangements such as networks and bridging organizations may be required to help filter the impacts of socioeconomic transformations

**Cinner, J.E. and S. Aswani. 2007. Integrating customary management into marine conservation. *Biological Conservation* 140 (3-4): 201-216.**

In many parts of the world, there is increasing interest among scientists, managers, and communities in merging long-enduring customary practices such as taboos that limit resource use with contemporary resource management initiatives. Here, we synthesize the literature on the customary management of coral reefs emerging from diverse disciplines including anthropology, common property economics, and ecology. First, we review various customary management strategies and draw parallels with Western fisheries management. Secondly, we examine customary resource management and conservation. We argue that, while resource conservation often appears to be an unintended by-product of other social processes, customary management can, in fact, conserve marine resources. In the third section, we examine the resilience of customary management institutions to socio-economic transformations. We suggest that in conditions of high population and commercialization of marine resources, property rights may become strengthened but arrangements that rely on self-restraint become weakened. Finally, we examine the commensurability of customary management and conservation. We emphasize that practical and conceptual differences exist between customary management and contemporary conservation which have often led to failed attempts to hybridize these systems. However, when these differences are understood and acknowledged there exists a potential to develop adaptive management systems that are: (1) highly flexible; (2) able to conserve resources, and; (3) able to meet community goals. In each section, we provide research priorities. We conclude by developing six key features of successful hybrid management systems.

**Fay-Sauni, L. and S. Sauni. 2005. Women and the Anadara fishery: a case study in South Tarawa, Kiribati. *Pacific voices: equity and sustainability in Pacific Islands fisheries Institute of Pacific Studies, University of the South Pacific, Suva, Fiji* 64-79.**

The clam *Anadara holoserica* plays an important role in the lives of many women and their families in Kiribati. Women harvest it from intertidal zones and shallow waters for household consumption or small-scale commercial purposes. Some families rely solely on the clams for protein, so reports of a decrease in density and size has caused concern in recent years. A study comparing the density and size of *Anadara* in a heavily fished area of South Tarawa and in an area of low fishing on nearby Abaiang Island was conducted in 1999 to test these reports. Counting all *Anadara* clams inside randomly placed quadrats along transects from the beach to the lagoon provided estimates of the population and characteristics of clams over both study areas. The average number of *Anadara* per square metre on South Tarawa (2.9) was lower than on Abaiang (5.2) and the average length at Abaiang (50.7 mm) was also greater than that of urban Tarawa (38.2 mm). Larger shells were found closer to shore on Abaiang but this pattern was reversed on Tarawa. Fishing pressure is a very likely contributor to the differences between *Anadara* populations at the two sites. Other influences such as habitat differences, recruitment variations, sediment size and composition and seagrass cover cannot be ruled out. Overexploiting *Anadara* would greatly affect the fishers who rely upon it, who are mainly women. A precautionary management approach is recommended, with measures including marine protected areas, rotational closures and minimum size limits. An awareness campaign would also help to increase the participation of women fishers at the grassroots level in resource management, considered very important for the sustainability of *Anadara* in Kiribati.

**Foale, S. 2007. Social and economic context of Marine Resource depletion in Gagil and Maap, Yap State, FSM. Secretariat of the Pacific Regional Environment Programme, Apia, Samoa. 45 pp.**

The central aim of the International Waters Project (executed by the Secretariat of the Pacific Regional Environment Programme) is to address the root causes of coastal and marine environmental degradation in each of the 14 participating countries. In Yap State, which serves as the pilot location for IWP in the Federated States of Micronesia (FSM), IWP proposes the use of MPAs as a marine resource management tool. The present study is aimed at determining both the social and economic context of resource depletion in Yap State, as well as the socioeconomic impact of the implementation of MPAs. The project is focused on four clusters of villages on the main island group, in the districts of Rumung, Maap, Gagil and Gilman.

The population of the main group of islands in 2000 was 7,391. With a total land area of 100.4 km<sup>2</sup> this gives a population density of 73.6 people/km<sup>2</sup>. However, prehistoric population densities are likely to have been at least four times this figure. Population growth is slow compared to less developed Pacific states. The economy is heavily subsidized by US aid, under the Compact of Free Association, which has meant that higher levels of education and health care have been available in FSM than in many other Pacific countries. This has a significant bearing on the likely level of community support for MPAs as a fishery management tool. However the state-supported Customary Marine Tenure system, which will be examined closely in this study, means that any lack of cooperation between tenure-holding groups could potentially pose problems for MPAs.

[http://www.sprep.org/att/publication/000549\\_IWP\\_PTR41.pdf](http://www.sprep.org/att/publication/000549_IWP_PTR41.pdf)

**Gell, F.R. and A. Tawake. 2002. Community-based closed areas in Fiji. The fishery effects of marine reserves and fishery closures, WWF, Washington, DC. 59-62.**

*This chapter presents a summary of a project of the University of the South Pacific and the Biodiversity Conservation Network with the village of Ucunivanua in the Verata district of Fiji. In response to declines in marine resources and fishing catches, several management measures were implemented. These included the establishment of a species specific fishery closure and bans on mangrove cutting, coral extractions and fish poisons. In addition, an alternative income generation enterprise was developed. The key results observed at the site were: species closures led to large increases in clam numbers inside closed areas and in nearby fishing areas; catch per unit of effort increased in the area adjacent to a closed area; certain species that had disappeared locally returned to the area; and habitat health improved within the closed areas. Broader impacts were that communities now adopt fully no-take areas in preference to single species closures and that this small village project has acted as a catalyst for similar management approaches in Fiji. The strength and success of the closed area approach in Fiji was noted as being due to "the strong tradition of community resource ownership and management and the ability of communities to make decisions about local management."*

**Gilman, E. 1997. Community-based and multiple purpose protected areas: a model to select and manage protected areas with lessons from the Pacific Islands. Coastal Management 25: 59-91.**

Overuse and misuse of coastal systems in the Pacific Islands are causing natural resources to dwindle. During the past two decades, governments have attempted to establish protected areas in recognition of the limits to growth on islands and the negative impacts to the coastal zone from anthropogenic activities. However, protected areas have not always been successful because most models used by these governments to create protected areas have been flawed. This article presents a model to select and manage protected areas in the Pacific Island that proposes two changes to traditional concepts of protected areas where the aims primarily have been to provide recreational opportunities, protect areas with aesthetics, and protect nature from humans. The two new concepts proposed by this model are community based decision making and permitting multiple purpose protected areas whose main goals are determined by the local community: (1) Representatives of interest groups and local level agencies collaborate to coordinate the processes to establish and administer protected areas, and to make decisions; (2) the model's process to select and manage a protected area considers the social, economic, environmental, and political context. Protected areas established using this model permit multiple uses that are compatible with the goals of the protected area.

This method presents a comprehensive process to establish protected areas. Examples are drawn from several political entities of the Pacific Islands: the Commonwealth of the Northern Mariana Islands, the Philippines, the Federated States of Micronesia, Guam, the Republic of Palau, Hawaii, and American Samoa.

*The case of the Guam Territorial Seashore Park is discussed under the heading of "Attempts to establish protected areas" – "Failures". Issues relating to the establishment and implementation of the park are discussed, and the role they have played in determining the level of impact and success of the area with respect to the park's goals.*

**Graham, T., N. Idechong, A. Eledui and C. Cook. 1997. Cost-effective management of marine conservation areas in Palau, Micronesia. pp. 106-117. In S. Miller and J. Sim, (eds.) Sixth South Pacific Conference on Nature Conservation and Protected Areas Vol. 3. Secretariat of the Pacific Regional Environment Programme, Apia, Samoa.**

Palau has a substantial and growing system of locally managed marine conservation areas. The challenge now is to devise cost-effective means of managing these areas. In those areas where marine-based tourism is a substantial use, management costs can be covered by fees collected from tourists, with revenue left over as resource rent for local communities. But in Palau's more remote areas, opportunities for revenue generation from conservation areas are fewer, making it more difficult to justify both the costs of management and the protected status of the areas. Tourist-based sport fishing is one opportunity being explored in some of the more remote areas.

[http://www.sprep.org/att/publication/000157\\_Pohnpei\\_Vol\\_3.pdf](http://www.sprep.org/att/publication/000157_Pohnpei_Vol_3.pdf)

**Hickey, F.R. 2006. Traditional Marine Resource Management in Vanuatu: Acknowledging, Supporting and Strengthening Indigenous Management Systems. SPC Traditional Marine Resource Management and Knowledge Information Bulletin 20: 11-23.**

Much of the marine related traditional knowledge held by fishers in Vanuatu relates to increasing catches while managing resources of cultural, social and subsistence value. Traditional beliefs and practices associated with fisheries and their management follow natural cycles of resource abundance, accessibility, and respect for customary rules enshrined in oral traditions. Many management related rules that control fishers' behaviours are associated with the fabrication and deployment of traditional fishing gear. A number of traditional beliefs, including totemic affiliations and the temporal separation of agricultural and fishing practices, serve to manage marine resources. Spatial-temporal refugia and areas of symbolic significance create extensive networks of protected freshwater, terrestrial and marine areas.

The arrival of Europeans initiated a process of erosion and transformation of traditional cosmologies and practices related to marine resource management. More recently, the forces of development and globalisation have emerged to continue this process. The trend from a primarily culturally motivated regime of marine resource management to a more commercially motivated system is apparent, with the implementation and sanctioning of taboos becoming increasingly less reliant on traditional beliefs and practices.

<http://www.spc.int/coastfish/News/Trad/20/Traditional20.pdf>

**Hoffman, T.C. 2002. The re-implementation of the Ra'ui: coral reef management in Rarotonga, Cook Islands. Coastal Management 30: 401-418.**

This research focuses on coral reef health in the South Pacific region, an area of high global coral diversity. Coral reef health surrounding two study sites in Rarotonga, Cook Islands, has been assessed in areas that have not been previously surveyed. Each study site has distinct differences based upon marine management practices. Marine management practices are identified and described and some historical reasons as why they exist are discussed. Data are also presented on the ecological condition (coral coverage, number of coral species, clonal condition, disease, and presence and absence of bioindicators). This interdisciplinary research methodology includes both ecological and social data collection to further understand human-environment interactions. In comparing the reefs with different management practices, I argue that the implementation of traditional marine social institutions as exemplified in this case study of the Ra'ui in Rarotonga, Cook Islands, is an effective conservation management tool and is improving coral reef health. The Ra'ui site has significantly higher species diversity/Mortality Index ( $F = 2.63$ ).

**Huber, M. and K. McGregor. 2002. A synopsis of information relating to marine protected areas. IWP Technical Report 2002/01. International Waters Programme, Secretariat of the Pacific Regional Environment Programme, Apia, Samoa. 132 pp.**

*This report provides a synopsis of information related to marine protected areas with an emphasis on the fourteen Pacific Island Countries participating in the International Waters Programme. "Information presented in the report includes international experience with MPAs, the status of MPAs in the participating countries, and general lessons learned about factors in the success and failure of MPA initiatives. Case studies from Polynesia, Micronesia, and Melanesia are presented, and resources available to those interested in the development of MPAs in the Pacific are identified. Finally, various types of project activities that might be undertaken under the IWP are outlined. This report also emphasizes community-based MPA initiatives. Community participation in coastal resource management and conservation is widely accepted as essential to the success of MPAs."*

*Three case studies are provided within the report; Safata in Samoa, Kimbe Bay, Papua New Guinea and Lenger Island Marine Reserve, Pohnpei. Each case study discusses the approach to implementation, the impacts observed and the lessons learned.*

[http://www.sprep.org/att/publication/000191\\_Volume\\_1\\_MPA.pdf](http://www.sprep.org/att/publication/000191_Volume_1_MPA.pdf)

**Jenkins, A.P., C.L. Jenkins and J.B. Reynolds. 2007. Successes and challenges of managing coral reefs in Papua New Guinea through locally managed marine areas. Alternate Visions LLC. 7 pp. Accessed 10 June 2008. <http://www.alternatevisions.org>.**

Our six- year study evaluated the effectiveness of local management using a marine Wildlife Management Area (WMA) in a peri-urban lagoon environment in Madang, Papua New Guinea. Our results suggest that small (~12 ha), clan-level, WMAs can work to significantly increase density and diversity of fishes within and in adjacent unmanaged areas. Significant changes in density of fishes ( $P < 0.05$ ) in the WMA and in harvested areas less than 1 km away were observed in 3 years. Patterns of diversity enhancement are less clear with species poor sites showing significant increase in 2 years. Site-attached herbivorous and planktivorous fishes showed the most significant change in density and diversity. Large mobile predators failed to show significant increases in density. Despite local increases in density and diversity of fishes, general reef health is declining due to system wide effects of nutrient loading, poor recovery from bleaching events and the socio-economic effects of overpopulation. Changes in fish community structure in the study area reflect the combined effects of management and system wide habitat change characterized by significant increases in macroalgae and live coral loss. We suggest that reserve network design needs to encompass the full mosaic of land, wetland and sea habitats from the outset of conservation program development. The major social issues identified as hindering local management of marine areas in Madang Lagoon are; low income, high inflation, poor governance, overpopulation (completed fertility 5.3, 1996), in-migration from elsewhere (17% resident non-resource owners), fishing mainly for food, poor enforcement and unequal participation for women and youth in decision-making and implementation. For long-term sustainability, conservation programs need to work both at active protection at the local scale while more broadly addressing fundamental socio-economic influences on ecosystems through a working relationship with civil society, public health institutions and commercial development interests.

<http://www.alternatevisions.org/publications/coralreefmanagement.pdf>

**Jennings, S. and N.V.C. Polunin. 1996. Impacts of fishing on tropical reef ecosystems. *Ambio* 25(1): 44–49.**

Fishing is the most widespread human exploitative activity on tropical reefs and the survival of many coastal societies is dependent on the productivity of their fisheries. Existing fishery management strategies focus primarily on target fish populations, but they may not be appropriate when fishing initiates shifts in the reef ecosystem. Such shifts may not be reversible, and can impair the processes which guarantee future fish production. We describe a number of alternative approaches to management and consider which of these may help to maximize yield whilst minimizing the probability of unwanted ecosystem shifts. One of these approaches is already adopted by a number of island societies but, ironically, it has proved to be incompatible with many fishery development programs.

**Johannes, R.E. 2002. The renaissance of community-based marine resource management in Oceania. *Annual Review of Ecology and Systematics* 33: 317-340.**

Twenty-five years ago, the centuries-old Pacific Island practice of community-based marine resource management (CBMRM) was in decline, the victim of various impacts of westernization. During the past two decades, however, this decline has reversed in various island countries. Today CBMRM continues to grow, refuting the claim that traditional non-Western attitudes toward nature cannot provide a sound foundation for contemporary natural resource management. Limited entry, marine protected areas, closed areas, closed seasons, and restrictions on damaging or overly efficient fishing methods are some of the methods being used. Factors contributing to the upsurge include a growing perception of scarcity, the restrengthening of traditional village-based authority, and marine tenure by means of legal recognition and government support, better conservation education, and increasingly effective assistance, and advice from regional and national governments and NGOs. Today's CBMRM is thus a form of cooperative management, but one in which the community still makes and acts upon most of the management decisions.

<http://www.botany.hawaii.edu/faculty/cunningham/CunninghamCourse/Johannes%202002%20Ann%20rev%20ecol%20syst.pdf>

**Johannes, R.E. and F.R. Hickey. 2004. Evolution of village-based marine resource management in Vanuatu between 1993 and 2001. *Coastal regions and small islands papers* 15, UNESCO, Paris. 49 pp.**

A 1993 study of coastal villages in Vanuatu, an archipelago in the tropical western Pacific revealed that, within the previous three years, marine resource management measures, designed to reduce or eliminate overfishing or other damaging human impacts on marine resources, had rapidly increased. The main impetus for these events was the Vanuatu Department of Fisheries' promotion of a voluntary village-based trochus management programme. Trochus is a large marine snail whose shell is sold for making buttons, inlay in fine wood carvings and as an ingredient in certain paints, and is rural Vanuatu's largest commercial marine export. Initially the programme involved only a few fishing villages and the Department surveyed their community trochus stocks and advised villagers on the benefits of regular several-year closures of their trochus fishery, followed by brief openings. It was left to the villagers to decide whether or not to act on this advice. The 1993 study revealed that villages that followed this advice found it so profitable that other villages quickly followed suit. Furthermore, observing what conservation could do for their trochus stocks, many villages decided to implement their own conservation measures to protect other marine animals, including finfishes, lobsters, clams, bêche-de-mer (sea cucumbers) and crabs, as well as to ban or restrict certain harmful fishing practices such as night spearfishing and the use of nets, especially gillnets. One of the surveyed villages had also set up a marine protected area and stocked it with giant clams (*Tridacna* spp.). In 2001, 21 of the villages originally surveyed in 1993 were revisited in order to determine how successful these community-initiated management measures had been in the eyes of the villagers. The main criterion for assessment was based on determining how many marine resource management measures had lapsed and how many new ones had been initiated. The results revealed that village-based marine resource management measures had more than doubled between 1993 and 2001 (extracted from Executive Summary).

<http://unesdoc.unesco.org/images/0013/001354/135465e.pdf>

**Jones, G.P., M.I. McCormick, M. Srinivasan and J.V. Eagle. 2004. Coral decline threatens fish biodiversity in marine reserves. In *Proceedings of the National Academy of Sciences of the United States of America* 101 (21): 8251-8253.**

The worldwide decline in coral cover has serious implications for the health of coral reefs. But what is the future of reef fish assemblages? Marine reserves can protect fish from exploitation, but do they protect fish biodiversity in degrading environments? The answer appears to be no, as indicated by our 8-year study in Papua New Guinea. A devastating decline in coral cover caused a parallel decline in fish biodiversity, both in marine reserves and in areas open to fishing. Over 75% of reef fish species declined in abundance, and 50% declined to less than half of their original numbers. The greater the dependence species have on living coral as juvenile recruitment sites, the greater the observed decline in abundance. Several rare coral-specialists became locally extinct. We suggest that fish biodiversity is threatened wherever permanent reef degradation occurs and warn that marine reserves will not always be sufficient to ensure their survival.

<http://www.pnas.org/cgi/reprint/101/21/8251>

**Kaly, U.L., C.M. Ludescher, K. Talakatoa, S. Alefaio and T.M. Alefaio. 1999. Second marine survey of Funafuti conservation area, Tuvalu. Funafuti Town Council. 22 pp.**

*A conservation area or reserve encompassing marine and terrestrial habitats has been established on the capital atoll of Funafuti in Tuvalu since mid-1997. This report provides results of the baseline survey and subsequent monitoring in the reserve and at control sites. The following general observations are discussed: 1. The reserve islands of Tefala and Fuafatu appeared to have larger food fish than during the baseline survey or at any of the controls. 2. The reserve island of Fualopa appears to still be heavily fished. 3. Some of the longer-lived species of fishes (40+ years) and corals show steady declines over all sites.*

**Kareiva, P. 2006. Conservation biology: beyond Marine Protected Areas. Current Biology 16 (14): R533-R535.**

Socio-economic and ecological analyses of eleven coral reef conservation efforts make clear that marine protected areas are not the answer, and that in fact support of local communities is far more important than some government mandated 'fishing closure'. Apparently there are marine 'paper parks' just as there are terrestrial 'paper parks'.

*Commentary on the use and impacts of marine protected areas is provided here, in particular on the study of McClanahan et al. (2006).*

**Kelleher, G., C. Bleakley and S. Wells (eds.). 1995. A Global Representative System of Marine Protected Areas. 4. The World Bank, Washington, DC. 212 pp.**

*The regions included in this volume are the South Pacific, Northeast Pacific, Northwest Pacific, Southeast Pacific and Australia/New Zealand. Provided for each region is an overview of the regions biogeography and marine biodiversity, an assessment of existing MPAs and an assessment of representation of biogeography regions. Where data were available, the management effectiveness of each MPA has been evaluated.*

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=11568>

**King, M. and U. Faasili. 1998. Village fisheries management and community-owned marine protected areas in Samoa. Naga 22 (2): 34-38.**

As in many tropical countries, subsistence fishers in Samoa live in discrete communities which have a high level of marine knowledge and some degree of control of adjacent waters. These factors provide an ideal basis for motivating communities to manage their marine resources. In Samoa, a community-based fisheries extension program encouraged each village community to define its key problems, discuss causes, propose solutions and take appropriate actions. Various village groups provided information which was recorded as problem/solution trees. The extension process culminated in a Village Fisheries Management Plan which listed the resource management and conservation undertakings of the community. Undertakings range from enforcing laws banning destructive fishing methods to protecting critical marine habitats. Within the first eighteen months, the extension process commenced in 57 villages of which 40 have produced Village Fisheries Management Plans. An unexpectedly large number (32) of these villages chose to establish Marine Protected Areas, the first community-owned marine reserves in the country.

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=A0000002622>

**King, M.G. and U. Faasili. 1998. A network of small, community-owned fish reserves in Samoa. Parks 8 (2): 11-16.**

Under a community-based fisheries extension programme in Samoa, 44 coastal villages have developed their own Village Fisheries Management Plans. Each plan sets out the resource management and conservation undertakings of the community, and the servicing and technical support required from the government Fisheries Division. Community undertakings range from enforcing laws banning destructive fishing methods to protecting critical habitats such as mangrove areas. An unexpectedly large number of villages (38) chose to establish small Village Fish Reserves in part of their traditional fishing areas. Although by social necessity many of the community-owned reserves are small, their large number, often with small separating distances, forms a network of fish refuges. Such a network may maximise linking of larval sources and suitable settlement areas and provide the means by which adjacent fishing areas are eventually replenished with marine species through reproduction and migration. As the Fish Reserves are being managed by communities which have a direct interest in their continuation and success, prospects for continuing compliance and commitment appear high. Results confirm our belief that the responsible management of marine resources will be achieved only when fishing communities themselves accept it as their responsibility.

[http://www.iucn.org/themes/wcpa/pubs/pdfs/PARKS/Parks\\_Jun98.pdf](http://www.iucn.org/themes/wcpa/pubs/pdfs/PARKS/Parks_Jun98.pdf)

**King, M.G., U. Faasili and A. Mulipola. 2000. Community-based management of subsistence fisheries in Samoa. Fisheries Division, Ministry of Agriculture, Forests, Fisheries and Meteorology, Apia. 10 pp.**

Many subsistence fishers in tropical regions live in discrete communities, which have a high level of marine awareness and some degree of control of adjacent waters. These factors provide an ideal basis on which to motivate communities to manage their own marine resources. A fisheries extension programme in Samoa encouraged each village community to define its key problems, discuss causes, propose solutions and take appropriate actions. Various village groups, including women's and untitled men's groups, provided information which was recorded (as problem/solution trees) on portable white-boards. The extension process culminated in a community-owned Fisheries Management Plan, which listed the resource management and conservation undertakings of the community. Undertakings ranged from enforcing laws banning destructive fishing methods to protecting critical marine habitats. Of the first three years, the extension process commenced in 65 villages, of which 64 produced Village Fisheries Management Plans so far. A large number (54) of these villages chose to establish community-owned Marine Protected Areas.

*The report suggests that "the main benefit of community-based fisheries management to a government is that conservation actions necessary to exploit seafood resources on a sustainable basis become a community responsibility. Thus the actions, being less dependent on public funding, become more sustainable and the costs of enforcing fisheries regulations are reduced. As activities and regulations listed in the individual Village Fisheries Management Plans are being overseen by communities with a direct interest in their continuation and success, enthusiasm and commitment appear high. An unexpected result of the extension program was the large number of villages deciding to establish community-owned Marine Protected Areas which have the potential of forming a network of fish refuges around the entire country. Although hard evidence on the benefits of Marine Protected Areas in increasing inshore fish production is lacking (Roberts and Polunin 1991), intuitively, the network may maximize linking of larval sources and suitable settlement areas, and provide the means by which adjacent fishing areas are eventually replenished with marine species through reproduction and larval migration (King and Faasili, 1998)."*

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=E0000000055>

**Kulbicki, M., S. Sarramegna, Y. Letourneur, L. Wantiez, R. Galzin, G. Mou-Tham, C. Chauvet and P. Thollot. 2007. Opening of an MPA to fishing: natural variations in the structure of a coral reef fish assemblage obscure changes due to fishing. *Journal of Experimental Marine Biology and Ecology* 353 (2): 145-163.**

Marine Protected Areas (MPAs) are known to enhance diversity, density and biomass of coral reef fishes and to modify the size and trophic structures of these fish assemblages. Opening to fishing has the opposite effects, but on a much shorter time scale. The present study compares the evolution of the fish assemblages of two adjacent reef zones, both initially MPAs, one of them being afterwards opened to fishing. The study was conducted on Aore Reef, a New Caledonian barrier reef (SW Pacific) which constituted a 148 km<sup>2</sup> marine protected area, of which 69 km<sup>2</sup> are within the lagoon. Two surveys of a coral reef fish assemblage, using underwater visual censuses, were performed, the first one was conducted in July 1993 following 5 years of protection from fishing, the second one was conducted in July 1995; part of the reef having been opened to fishing activity in September 1993. This study examined the effects of two factors on these fish communities: time (1993 vs. 1995) and zone (reefs protected from fishing vs. unprotected reefs); the interaction of these two factors indicating an effect of either protection or opening to fishing. Diversity (species/transect), density and biomass were tested for all species together (377 species), then according to diet, size and commercial use. There was a significant decrease over time of most values in both fished and unfished areas, the decrease being greater in the zone opened to fishing. The magnitude of decrease over time was within the range of known time variations from other studies in New Caledonia and other Pacific locations. However, this decrease was so large that it prevented the detection of effects linked to protection. Only some minor effects could be detected for 16 species with no specific pattern according to diet, size or use. The density and biomass of species of low commercial value were also affected by opening to fishing. Relative changes in diversity could be better detected than relative changes in density or biomass. This study demonstrates that on a short-term basis (2 years), natural variations can be of larger magnitude than changes that may be induced by management options, especially when fishing pressure is not very high.

**Leisher, C., P. Beukering and L.M. Scherl. 2007. Nature's investment bank: how marine protected areas contribute to poverty reduction. *The Nature Conservancy*. 52 pp.**

This study is one of the first to empirically analyze the link between biodiversity conservation initiatives and poverty reduction. From November 2006 to May 2007, 68 people in four countries helped conduct more than 950 household interviews and more than 50 focus group discussions and key informant interviews. In total, approximately 1,100 local people were consulted to determine whether four particular marine protected areas have contributed to poverty reduction, and if so, why. The four study sites do not represent a random sample but were deliberately chosen because local experts believe they have contributed to poverty reduction. The four marine protected areas are in Fiji (Navakavu), the Solomon Islands (Arnavon Islands), Indonesia (Bunaken) and the Philippines (Apo Island). This portfolio of sites is roughly representative of small, one-community local marine protected areas (Fiji), medium-sized, multi-community local marine protected areas (Solomons), big collaboratively managed national marine protected areas with lots of people (Indonesia), and small, co-managed national marine protected areas with few people (Philippines). In terms of area, 95% of marine protected areas globally fall between the largest marine protected area in the study (Bunaken) and the smallest (Apo Island). The four sites also have a good mix of population size and age of the marine protected area. The findings show that marine protected areas can effectively contribute to poverty reduction. "People in the community are now better off and this is because of the marine protected area," as one local person explained. For the residents of Navakavu and Apo Island, their marine protected area contributed to poverty reduction in very substantial ways (though both sites have fewer than 700 people). In the Arnavons and Bunaken, with populations of 2,200 and 30,000 respectively, the marine protected area has also clearly contributed to poverty reduction, though by no means eliminated it. Across all the study sites, over 95% of local people support the continuation of their marine protected area.

[http://www.nature.org/initiatives/protectedareas/files/mpa\\_report.pdf](http://www.nature.org/initiatives/protectedareas/files/mpa_report.pdf)

**Lincoln-Smith, M.P., J. Bell, P. Ramohia and K.A. Pitt. 2001. Testing the use of marine protected areas to restore and manage tropical multispecies invertebrate fisheries at the Arnavon Islands, Solomon Islands: termination report. *Great Barrier Reef Marine Park Authority Townsville, Queensland*. 72 pp.**

*The aim of this project was to "determine if the number and size of commercially important invertebrates (e.g. trochus, sea cucumbers and giant clams) increases as the result of the declaration of the Arnavon Islands Marine Conservation Area (MCA) relative to fished areas." Changes in the number and size of species observed were variable; however, it was reported that "overall, the declaration of the MCA has led to success in restoring abundance and size of some invertebrates at the Arnavon Islands. The findings of the study, however, demonstrate that more time is necessary to identify the period needed for recovery of several species".*



**Lincoln-Smith, M.P., K.A. Pitt, J.D. Bell, and B.D. Mapstone. 2006. Using impact assessment methods to determine the effects of a marine reserve on abundances and sizes of valuable tropical invertebrates. *63(6): 1251-1266.***

Procedures for impact assessment, including “beyond-BACI” (before-after control-impact) and proportional differences (ratios between impact and control treatments) were used to test population replenishment of marine invertebrates at a marine conservation area (MCA) and three fished (control) areas in the Solomon Islands of the southwestern tropical Pacific. Within shallow reef terrace habitat, the MCA caused abundance and size of the topshell *Trochus niloticus* to increase but did not affect holothurians (sea cucumbers) or the giant clam *Tridacna maxima*. Abundance of the nonexploited topshell *Tectus pyramis* was unchanged at the MCA but increased at the controls, possibly because of changes in abundance of *T. niloticus*. Within deep slope habitat, the MCA caused increased abundance of the sea cucumber *Holothuria fuscogilva* and prevented possible declines in abundances of *Thelanota anax* and all holothurians combined but had no effect on abundances of *Holothuria atra* or *Holothuria fuscopunctata*. Power analysis comparing the MCA with controls indicated that further, relatively modest increases in abundance or size of some species would have a good chance of being detected statistically. The beyond-BACI procedure holds promise for enabling rigorous evaluation of marine reserves as management tools at different spatial scales; the use of proportional differences is simpler but has limited management value.

**Lison de Loma, T., C.W. Osenberg, J.S. Shima,, Y. Chancerelle, N. Davies, A.J. Brooks and R. Galzin. 2008. A framework for assessing impacts of marine protected areas in Moorea (French Polynesia). *Pacific Science 62(3): 431-441.***

Marine Protected Areas (MPAs) have been promoted as effective management tools to protect biodiversity at local and global scales, but there remains considerable scientific uncertainty about effects of MPAs on species abundances and biodiversity. Commonly used assessment designs typically fail to provide irrefutable evidence of positive effects. In contrast, Before-After-Control-Impact (BACI) designs potentially remedy many of these problems by explicitly dealing with both spatial and temporal variation. Here, we document the historical context of implementation and the scientific assessment of MPAs recently established at eight sites around the island of Moorea, French Polynesia. In 2004, we designed and implemented a monitoring plan that uses a BACI-Paired Series (BACIPS) design to quantify the effect of the MPAs. Twice per year, we monitor fish, corals, and other benthic invertebrates at 13 sites (eight within MPAs and five outside MPAs) around Moorea, in three distinct reef habitats (fringing, barrier reef, and outer slope). We present statistical analyses of data collected during five surveys (July 2004 to July 2006), before the initiation of enforcement. We also assessed the potential of our program to detect future responses to the established MPA network. Our estimates of biomass for five categories of fishes (Acanthuridae, Chaetodontidae, Serranidae, Scaridae, and fisheries target species) within MPA sites generally track estimates in paired Control sites through time. Estimated statistical power to detect MPA effects (a 192% biomass increase within the MPA) was high at the MPA network scale but varied among taxonomic categories and reef habitats: power was high on the reef outer slope and lower in the lagoon, and generally high for acanthurids and chaetodontids. It did not vary significantly between sites. We discuss limitations of our approach (shared by all MPA assessments to date) and describe solutions and unique opportunities to redress these limitations in French Polynesia.

**MacKay, K. 2003. Community managed marine protected areas in the Pacific Islands: case studies from four small island states of the Pacific. *Second International Tropical Marine Ecosystem Management Symposium, Philippines. 42 pp.***

*This report gives an overview of the Pacific region in terms of inshore resource biodiversity, fishery status and management. Summaries are provided of the administration, formation, location, assessment, lessons learned and suggested modifications for future approaches of community managed marine protected areas in four Pacific countries: Samoa, Fiji, Vanuatu and Solomon Islands. “The community-managed reserves have in all cases been perceived to have been successful and are expanding (the approach to other species in that area and other communities in that country). In all cases local communities have implemented their own fish reserves, decided on the location, established their own rules and management approaches.” Specific examples of biological and social monitoring results are presented in each case study to illustrate the effectiveness of the community managed marine protected areas.*

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=A0000003731>

**Mackay, K.T. 2001. Managing fisheries for biodiversity: case studies of community approaches to fish reserves among the small island states of the Pacific. Blue Millennium: Managing Global Fisheries for Biodiversity Thematic Workshop, Victoria, BC, Canada. June 2001. 45 pp.**

The small island states of the tropical Pacific Ocean have limited land area yet considerable ocean resources. The population relies on the inshore fisheries for food and income. This fishery is complex, multi-species, and multi-gear, pursued by large numbers of fishers. Data, relevant research and enforcement are severely limited. Anecdotal evidence suggests overfishing on a number of stocks and many of the most valuable and vulnerable species are already extinct. Conventional fisheries management has not been effective. Elsewhere, ecosystem approaches involving closed areas such as fish reserves have assisted in sustaining fisheries and conserving biodiversity. In the Pacific this ecosystem approach has been combined with traditional systems. This paper describes the ra'ui system from Rarotonga, Cook Islands, a Marine Protected Area from Ono, Fiji and village reserves in Samoa. The fish reserves have been effective in increasing biomass and biodiversity. Local communities have implemented them, decided the location, the rules and management. Traditional leaders have played critical roles, while NGOs and fisheries departments have facilitated. The reserves allow harvest flexibility to match socio-cultural concerns and are evolving from short-term food banks to longer term closed areas. The village reserves are small but the network of reserves is significant and increasing. Compliance is high. Traditional sanctions appear to allow enforcement of compliance on community members but outside legitimisation is needed for compliance by outsiders. Village by-laws are used in Samoa, a simple legal instrument is being developed in Fiji while in the Cook Islands traditional respect is sufficient. These cases are but a few of the systems in the Pacific that are combining traditional and scientific management. There is a need to continue to document and share these success stories.

<http://www.unep.org/bpsp/Fisheries/Fisheries%20Case%20Studies/MACKAY.pdf>

**Manele, B. 2002. Island's struggle for sustainability: challenges in establishing marine protected areas in Gizo, Solomon Islands. PICCC Projects: project reports from the 2002 Pacific Island community-based conservation course. Institute of Applied Sciences, Faculty of Science and Technology, University of the South Pacific, Suva, Fiji. 30 pp.**

Gizo Marine Conservation Area (GMCA) Project is a proposed conservation scheme, aiming at protecting 4 reef sites within Gizo lagoon. While there is a need to maintain and restore the health of the marine environment and the abundance of the resources, current situations encompassing nearly all aspects of livelihood within Gizo have prevented the progress of this initiative. Current circumstances that are seen as the major stumbling blocks for the establishment of marine protected areas in and around Gizo includes the social lifestyle of the residents and resource users, their economic dependency on marine resources, current protected areas legislation and the breakdown of law and order in the country. These issues have been shaped by the islands' environmental setting, the historical events and the impacts of the current ethnic unrest. In trying to overcome these issues, counteracting methods have been strategically designed and implemented.

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=C000000077>

**McClanahan, T.R., M.J. Marnane, J.E. Cinner and W.E. Kiene. 2006. A comparison of marine protected areas and alternative approaches to coral reef management. Current Biology 16(14): 1408–1413.**

Marine protected areas (MPAs) have been widely adopted as the leading tool for coral-reef conservation, but resource users seldom accept them and many have failed to produce tangible conservation benefits. Few studies have objectively and simultaneously examined the types of MPAs that are most effective in conserving reef resources and the socioeconomic factors responsible for effective conservation. We simultaneously explored measures of reef and socioeconomic conservation success at four national parks, four comanaged reserves, and three traditionally managed areas in Indonesia and Papua New Guinea. Underwater visual censuses of key ecological indicators revealed that the average size and biomass of fishes were higher in all areas under traditional management and at one comanaged reserve when compared to nearby unmanaged areas. Socio-economic assessments revealed that this "effective conservation" was positively related to compliance, visibility of the reserve, and length of time the management had been in place but negatively related to market integration, wealth, and village population size. We suggest that in cases where the resources for enforcement are lacking, management regimes that are designed to meet community goals can achieve greater compliance and subsequent conservation success than regimes designed primarily for biodiversity conservation.

**McDonald, J. 2006. Marine resource management and conservation in Solomon Islands: roles, responsibilities and opportunities. Secretariat of the Pacific Regional Environment Programme, Honiara, Solomon Islands. 24 pp.**

This report is provided to the Solomon Islands International Waters Project as part of its work in supporting the establishment of community-based marine protected areas and the development of a national Beche-de-mer management plan. Part Two briefly considers the role of law in the management of resources on customary land and the limitations of law in the special context of customary land tenure in Solomon Islands. It then reviews the current legal framework that exists at a national level and the scope of provincial governments to take a greater role. Part three identifies the key requirements of a legal regime for both the establishment and management of MPAs and the implementation of a BDM management plan. For each requirement, it evaluates the extent to which each province meets the requirement. Part four presents the conclusions of the review. A "model ordinance" - that attempts to address each of the desirable features discussed in part three, is contained in the Appendix. This draft Isabel Province Resource Management and Environmental Protection Ordinance 2006 was endorsed by the Isabel Provincial Executive on 24 February 2005.

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=A0000003536>

**Miller, S.L., J.S. Shima and N.E. Phillips. 2006. Does substrate matter? A novel approach to assess the influence of substrate heterogeneity on abundance of the reef fish, maito (*Ctenochaetus striatus*), in relation to the ra'ui in the lagoon of Rarotonga: implications for marine protected area assessment. In J. Collen and L. Bukarau (eds.) Science, Technology and Resources Network (STAR), 23–28 September 2006, Honiara, Solomon Islands. Session 621: p 33.**

Managers often wish to know the effects of marine protected areas (MPAs) on metrics such as fish abundance, size, and diversity, and much of the published work to date suggests that MPAs often lead to increases in these metrics. However, many putative 'reserve effects' may be confounded by factors such as substrate type and habitat complexity; reserves are often sited in unique or comparatively pristine locations. Consequently, much of the empirical evidence that demonstrates effects of marine reserves may be equivocal. Authors explore spatial patterns of abundance of the Maito or Striped Bristletooth (*Ctenochaetus striatus*, Family Acanthuridae) within the lagoon of Rarotonga, Cook Islands. Patterns of abundance are quantified in relation to ra'ui (traditional marine managed areas) and associated environmental features that may vary systematically among ra'ui and/or between ra'ui and non-ra'ui areas. Fish abundance, substrate availability, and patterns of substrate use by Maito, both inside and outside areas protected by ra'ui were recorded. Response ratios were used to evaluate putative effects of ra'ui, calculated from both raw densities of Maito, and from "substrate-adjusted" densities. The results suggest that adjusting for substrate effects significantly alters authors' perceptions of the effects of ra'ui on Maito populations. It is concluded that substrate effects (or more generally, environmental heterogeneity) should be incorporated into future assessments of MPA effectiveness.

**Mulipola, A. 1999. Community-based marine protected areas in Samoa. Fisheries Division, Ministry of Agriculture, Forests, Fisheries and Meteorology, Apia, Samoa. 8 pp.**

Despite concerns of declining stocks, government actions and national laws (i.e. Fisheries Act 1988, Fisheries Regulations 1998, etc.) to remedy the problem has never been successful. However, Fisheries Division and AUSAID support initiated a Fisheries Village Extension Programme in 1995 in an effort to further address the major problem of fisheries reduction. The programme is a community-based fisheries approach whereby each village accepting the extension program was encourage to analyse its fishing practices and develop a community owned plan with undertakings to introduce appropriate village laws and pursue other conservation measures. Reciprocally, the FD supported the development of optional sources of seafood. Through the supported programme, village communities decided on many different undertakings, ranging from enforcing laws banning destructive fishing methods to protecting part and critical part of their fishing ground (MPA). This report details the community extension process and current conservation and management strategies as well as benefits and constraints of MPAs.

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=E0000000058>

**Munro, J.L. and S.T. Fakahau. 1992. Management of coastal fisheries resources. Forum Fisheries Agency, Honiara, Solomon Islands. 15 pp.**

*This paper reviews the basic coastal fisheries management methods applied in different parts of the world as described in Munro and Williams (1985). Marine reserves are one of many management measures discussed here. "Permanent reserves are recommended for island states. Current evidence suggests that, depending upon the configuration of the coastline or reef systems, a significant proportion of juvenile fishes or invertebrates resulting from local-spawning will tend to settle relatively close to where they were spawned and that the preservation of dense fish stocks in selected areas might therefore have beneficial effects on the fisheries. Such areas would also be of much interest and value to tourists and could be combined with general marine conservation areas such as marine parks and reserves. Areas which have been identified as important nursery areas should also be protected."*

*This paper also explores the problems of implementation and options for island nations. It presents management methods in the context of Pacific Island countries, particularly traditional resource tenure and customary rights. "The major feature of customary rights is that controls are exerted at a local level and not from outside. This promotes self-confidence amongst members of the community and can create a good working relationship between the government and the community. If the system works effectively the costs of enforcement of management measures are minimized, as are social and political conflicts between the government and the community. However, the main advantage is that the fishing community is likely to have a better understanding and appreciation of management principles if they are discussed at a local level." It is concluded that only community-based limited entry systems will prevent overharvesting in most Pacific fisheries in the long term.*

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=B0000000126>

**Nair, M. 2005. Stock enhancement programs in the United States Affiliated Pacific Islands for economic development and food security. Journal of Shellfish Research 24(1): 330–331.**

There is a strong desire by many of the Pacific Island governments to develop income-generating local industry based on available natural resources, and to restock reefs where natural marine populations have declined. Some nations in the United States Affiliated Pacific Islands, such as the Republic of the Marshall Islands (RMI), Federated States of Micronesia (FSM) and the Republic of Palau also face increasing economic pressure as funding from their respective Compacts of Free Association with the USA diminishes. Farming marine and freshwater aquaculture organisms has the potential to provide export products, alleviate social pressure on threatened food species, and provide import substitutes for the US Affiliated Pacific Islands. The economy mainly relies on foreign aid. Presently, there is emphasis on the development of marine resources, mainly marine aquaculture or mariculture, to meet future economic needs, become self-sufficient, and develop food security for its fast-growing population. Pollution-free water and biodiverse fauna of finfish and shellfish, of which several are endemic to the region, blesses all the US Affiliated Pacific Islands. Because the land area is minute compared to the vast ocean exclusive economic zones, it means that in all these nations the natural resources are primarily marine. The nation's abundant and extremely biodiverse coral reefs provide habitat for robust fish populations and other marine life that support subsistence and commercial fisheries. However due to over fishing and bad and destructive fishing practices, several species have become overexploited and need conservation. There is also a strong desire by the national governments to develop revenue-producing local industries based on available natural resources and to restock reefs where natural marine populations have declined. The national and local governments have also initiated marine protected areas (MPA) to revive the fisheries. In addition to this, there are several stock enhancement programs especially in shellfish like ornamental shellfish like trochus, black pearls, and giant clams being undertaken successfully to restock the depleted reefs and in the MPA. Preliminary results have shown that these stock enhancement programs have been successful mainly due to the community participation in these activities. The success and popularity of such measures have prompted the governments to look into the stock enhancement programs through sea ranching of hatchery-produced fish fingerlings of food finfishes like groupers, snapper, and other food fishes and several rare and endemic ornamental fish and shellfish species for food security, stock replenishment, and enhancement thus paving the way for future economic benefits and community self-sufficiency and self-reliance.

**Nash, W., T. Adams, P. Tuara, O. Terekia, D. Munro, M. Amos, J. Leqata, N. Mataiti, M. Teopenga and J. Whitford. 1994. The Aitutaki Trochus Fishery: a case study. Secretariat of the Pacific Community. Noumea, New Caledonia. 52pp.**

*Trochus niloticus* is a gastropod mollusc of economic significance in the mother-of-pearl trade. It is not endemic to the Cook Islands, and was introduced to Aitutaki from Fiji in 1958 under the auspices of the South Pacific Commission. The population expanded rapidly and in 1980 became the basis for significant external trade from Aitutaki. Thirty-five years after the initial introduction, the South Pacific Commission surveyed the status of the stock.

Three methods of estimating the size of a population of benthic invertebrates - strip transect, Petersen mark-recapture and simple change-in-ratio (for different size-classes) - were tested in conjunction with the 1992 Aitutaki trochus harvest, in order to assess relative precision of these methods for an approximately equivalent, and realistic, level of survey effort. The mark-recapture method was found to be far more accurate than the strip-transect method for this fishery, and more useful and robust than the change-in-ratio method. The number of adult trochus shells in the Aitutaki lagoon, before and after the harvest, was estimated.

The report describes how the Aitutaki trochus harvest is carried out and its method of regulation by quota. It also makes some recommendations for fine-tuning the management of the fishery, of interest to other trochus-producing countries.

[http://www.spc.int/coastfish/sections/reef/PROCFish\\_Web/Modules/Library/GetDocument.aspx?File=pdf/Reports/Nash\\_95\\_IFRP9.pdf&Hit=4&ID=938831de-0659-4a69-8aac-b725e1e1dbce](http://www.spc.int/coastfish/sections/reef/PROCFish_Web/Modules/Library/GetDocument.aspx?File=pdf/Reports/Nash_95_IFRP9.pdf&Hit=4&ID=938831de-0659-4a69-8aac-b725e1e1dbce)

**Obura, D. and S. Mangubhai. 2003. Marine biological survey report of the Fiji Great and North Astrolabe Reef, Ono, Kadavu. WWF South Pacific Programme, Suva, Fiji. 92 pp.**

Marine biological surveys of coral reefs of the Great Astrolabe Reef (GAR) and North Astrolabe Reefs (NAR) were conducted from the 29 April - 3 May, 2001. The GAR and NAR are found on the northeast and northern end of the Kadavu island group, within the Ono ikina, or customary fishing area, situated approximately 70 km south of Viti Levu, the main island of Fiji. The surveys were conducted for the World Wide Fund for Nature's (WWF) South Pacific Programme, as a component of the development of community-based management of the reefs. A separate study commissioned by WWF, on the first marine protected area in Kadavu, the Yavusa Ulunikoro Marine Conservation Area, run by Waisomo village on Ono Island, was conducted immediately preceding this study, and the results are incorporated here.

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=A0000003053>

**O'Garra, T. 2006. Estimating the total economic value (TEV) of the Navakavu locally managed marine area (LMMA) in Viti Levu Island, Fiji. CRISP, Noumea, New Caledonia. 138 pp.**

This report presents results from the Economic Valuation of the Navakavu LMMA study, supported by the Research Institute for Development (IRD), the Coral Reef Initiative for the South Pacific (CRISP) and the Institute of Applied Sciences (IAS) at the University of the South Pacific. The aim of this study was to estimate the total economic value (TEV) of the coastal ecosystems within the Navakavu Locally Managed Marine Area. In addition, the study aimed to estimate the economic value of the LMMA management intervention, in order to assess the economic impact of establishing a protected area.

The Navakavu LMMA is the fishing ground for four villages (Nabaka, Namakala, Muaivuso and Waiqanake), which are located on the Muaivuso Peninsula, 13 km to the West of Suva. The local communities have exclusive rights to extract fish and other resources from their fishing grounds. In January 2002, in response to concerns about declining fish catches, the community set up a "no-take zone" and implemented a number of resource use regulations, with the assistance of the Fiji LMMA network and USP. Using several valuation methodologies - a contingent valuation questionnaire, a catch survey and benefits transfer from secondary data - this study has produced estimates of the economic value of key goods and services provided by the marine ecosystems within the Navakavu LMMA. These are: fisheries, coastal protection, waste assimilation, research and education benefits and bequest values. Results show that the TEV of the coastal ecosystems within the Navakavu LMMA ranges between FJ\$3,034,460 - \$3,073,442 (US\$1,764,221 - \$1,786,885) per year, and the present value of the coastal ecosystems, over a 20-year period, ranges between FJ\$28,793,197 - 29,164,050 (US\$16,740,231 - \$16,955,843) using a 10% discount rate. Fisheries associated with these coastal ecosystems makes up about 45% of this value. The next most important service provided is coastal protection which accounts for 33% of the TEV. A simple analysis of changes in finfish catches over time suggests that there has been an average increase of 3% in finfish catch between mid-2002 and

late-2006. It is suggested that this increase is attributable to the establishment of the LMMA in January 2002. The value of these changes to the local community comes to about FJ\$63,000. It is expected that the economic benefit to local villages from the LMMA will continue to increase, as finfish and invertebrate catches continue to increase for several years.

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=A0000003660>

**Sabetian, A. and S. Foale. 2006. Evolution of the artisanal fisher: case studies from Solomon Islands and PNG. SPC Traditional Marine Resource Management and Knowledge Information Bulletin 20: 3–10.**

This paper describes the rapid uptake of technology that increases fishing efficiency in two parts of western Melanesia: Ghizo Island in Western Province, Solomon Islands, and Milne Bay Province in Papua New Guinea. We present evidence that demonstrates a disturbing lack of awareness among fishers of the finite nature of the stocks they are exploiting, and we argue that without corresponding systematic management interventions, the technological transformations we are now witnessing will accelerate the present pattern of sequential overfishing of commercially valuable species.

*The article notes that in the Solomon Islands "several informants suggested that non-indigenous Gilbertese fishers were the most brazen at targeting customary owned fishing grounds as far as inner VonaVona Lagoon and even marine protected sites". Across in Milne Bay, it notes that one of the main reasons there are still fishable stocks of white teatfish is its "great depth range, down to 40 m, which has afforded it a significant refuge from fishing pressure, along with the government-enforced six-month closed season".*

<http://www.spc.int/coastfish/News/Trad/20/Traditional20.pdf>

**Salm, R.V., J. Clark and E. Siirila. 2000. Marine and coastal protected areas. A guideline for planners and managers. Third Edition. International Union for Conservation of Nature, Washington DC, USA. xxi + 371 pp.**

This book is addressed mainly to conservation of the natural resources of tropical coasts and seas. To facilitate its use as a sourcebook, the volume is arranged in three parts. Part I introduces Marine Protected Areas (MPAs) as an important approach to managing coastal and marine resources, discussing in its six sections: roles of MPAs, site planning, community involvement, systematic selection of MPAs, strategies and tools for planning and managing MPAs, and the legal basis of MPAs. Part II considers principles and mechanisms for planning and managing protected areas in four different environments: coral reefs, estuaries and lagoons, small islands, and beaches. Emphasis is on technical knowledge about particular habitats and how this knowledge is used to meet management objectives. We recognize that many MPAs are composed of two or more of these environments but the guidance for each can be combined in the MPA plan. Part III presents case histories covering a wide variety of MPA experience around the world to help protected area planners and managers carry out their tasks. The emphasis in each case history is on lessons learned that are of wide application. E-mail addresses of the authors are given to assist the reader in following up on case details. A "Guide to the Cases" is presented to enhance the reader's search for relevant items.

*The report notes that spawning aggregations are often targeted by fisheries and that some aggregations have been completely exploited for the live reef fish trade and received increased fishing pressure due to increasing populations and export markets. Spawning aggregations have received little attention from fisheries managers in the Indo-Pacific. Although it is acknowledged that MPA site selection should take into account sites of spawning aggregations, they have in fact rarely been considered by MPA planners in the tropical Indo-Pacific. In 1976, a law was passed in Palau to prohibit fishing during spawning season in the Ngerumekaol Channel. This measure, although insufficient, probably prevented the complete loss of those spawning aggregations. The Ngerumekaol Protected Area has now been extended to also include a substantial buffer zone around it and efforts are being undertaken to raise awareness of Palauans with regard to this law. A complete year round closure of the area is being considered. It is concluded that "under the circumstances, precautionary protection of reef fish spawning aggregations, via MPAs or other approaches, is not merely appropriate; it is vital."*

**Samoa Fisheries Division. 2006. Fisheries socio-economic report. Fisheries Division, Ministry of Agriculture, Forests, Fisheries and Meteorology, Apia, Samoa. 39 pp.**

*This survey was conducted to assess the socioeconomic status of rural villages of Samoa with regard to fishing practices. Some 939 households in 49 villages nationwide were surveyed on their household makeup, income and expenses, seafood consumption, fishing practices, whether they sell fish or not, and perceptions of trends in fisheries and reef health. This paper provides a comparison of results of the current study with past studies conducted in Samoa. The study aimed to assist in directing future studies, analysis and management decisions. Comparisons were made between villages on geographical characteristics, as well as between villages with management plans developed under the Community-based Fisheries Management Program and nonparticipating villages. Note that a common feature of management plans under this program is the application of closed areas (reported elsewhere). However limited comparison is provided here of results between villages with management plans and those without, it appeared that certain fish were sold at higher prices when obtained from areas with management plans. Three respondents perceived that their environment had improved since their village banned destructive fishing methods or created a MPA. Other survey results are presented and discussed in more detail.*

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=A0000003415>

**Sulu R., C. Hay, P. Ramohia and M. Lam. (Unpublished report). The coral reefs of Solomon Islands. (Unpublished report).**

There is little reliable information about coral reefs and coral reef ecology of the Solomon Islands. Although many coral reef species are being exploited directly for sustenance and for cash, there is little information on their sustainability and on the ecological consequences of reef fisheries. There is also little information on the long-term ecological effects of industries like logging and mining on lagoons and coral reefs. Reliable baseline studies are fundamental to assessing changes to the reefs; but few of studies have been done in the Solomon Islands, and there is little expertise and material resources to undertake them. This is a country with a rapidly increasing population that is predominantly rural, coastal and where the annual per capita income is considerably less than \$US1,000. Coupled with new opportunities for converting reef resources to cash, and increased logging, mining and plantation development, activities that inevitably increase erosion and the turbidity of coastal waters, the situation in Solomon Islands does not bode well for the health and vigour of coastal marine life. In this report, we describe coral reef fisheries, current and potential threats to reef ecology, and problems for conservation. We conclude that overfishing, continued logging and new land developments, such as oil palm plantations, are detrimental to coral reefs and lagoons. Of concern is the likelihood that most fishers are probably unaware of the likely ecological consequences of over-fishing. Weak enforcement of fisheries regulations and the difficulties of creating marine protected areas (MPAs) are also problems.

*The report notes that the "problem faced by governments attempting to introduce MPAs is that all reef areas are 'owned' by various Solomon Islanders who claim traditional fishing rights. Persuading owners to relinquish fishing rights for common benefit is not easy. A variation could be to allow certain reefs to lie fallow for several years and to rotate such areas around the islands so that all coastal villages are involved in the process i.e. amplifying the indigenous serial prohibition. While closures would be accepted for months, they would probably be unacceptable if applied for years. The major concern in rural communities is obtaining food for that day".*

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=A0000002413>

**Sykes, H. 2006. Reef Mapping and Resource Assessment Project for Wainikeli and Bouma Qoliqoli and Lavena Qoliqoli, Taveuni, Fiji: brief report on the first stage, April 2004–April 2006. Marine Ecology Consulting, Suva, Fiji. 13 pp.**

*This study aimed to map and measure marine resources within the Qoliqolis (traditional fishing grounds) of Lavena, Wainikeli and Bouma in Fiji. Resource use was also measured through questionnaires and was mapped to assess fishing pressures in the study areas. The results were to aid in the formation of marine resource management plans for the indigenous communities of the area and provided here are several recommendations regarding monitoring approaches and closed area design. Results are presented and discussed from surveys of two tabu areas (closed areas) and three adjacent open fished grounds. Impacts are determined from observations of habitat cover, algae growth due to sedimentation, coral health, rubbish present and fishing pressure. A positive improvement of the reef populations inside its boundaries of the Korovou tabu was observed. It was suggested that the area of reef between this tabu area and the Waitabu tabu area was however so small that fishing pressures in the remaining fishing grounds are very high. Catches of fish and octopus had increased on reefs at the edges of the closed areas. However, there were no observed improvements in the permanent populations within the fishing grounds. It was suggested that fish are moving from tabu areas into fishing grounds. It was seen as probable that the two tabu areas were too close to each other to be effective.*

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=A0000003056>

**Sykes, H. 2007. Waitabu Marine Park: biological and economic report 2005–2007. Marine Ecology Consulting, Suva, Fiji. 44 pp.**

This report outlines the results of several years of surveys of the community-managed Marine Protected Area (MPA) managed by Waitabu Village in Taveuni, a no-take zone since April 1998. Originally an over-fished and severely depleted reef top, this area now has a breeding community of *Tridachna* Giant Clams, *Trochus* shells, and other socially and economically significant invertebrate and fish populations. Recent fish census in the area suggests that the fish life has reached a steady balance which is presumed to be the optimal biodiversity for this environment. As well as improved fishing on the boundaries of the MPA, the community has benefited from running a small community-managed snorkeling tourism operation. This survey included a socio-economic and Catch per Unit Effort aspect following Fiji Locally Managed Marine Areas (FLMMA) survey protocols for the village. The overall result of the socio-economic survey indicates a positive attitude towards the MPA, with a definite long term commitment towards keeping the MPA for future food security and a natural resource reserve. Much experience has been gained during the forming and running of this MPA and it is hoped that the record of this pioneering Fijian "Tabu" area will provide both a measure of success and a record of lessons learned during that progression.

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=A0000003060>

**Tabo, S., H. Tafea, J. Leqata and J. Kinch. 2004. Community workshops in the Marau Sound, Guadalcanal, the Solomon Islands. Marine Aquarium Council and Foundation of the Peoples of the South Pacific, Suva, Fiji. 15 pp.**

Communities in the Marau Sound are seeking solutions to the problems affecting their marine resources. This is partly due to the influence of awareness raising meetings by the Foundation of the Peoples of the South Pacific International's (FSPI) Coral Gardens-Solomon Islands (CGSI) and Gardening Good Governance (GGG) projects. To address this, a series of workshops over the last two years have assisted communities to have the capacity to implement overall resources management plans and monitor their marine resources. These workshops have also created an understanding of how Marine Protected Areas (MPAs) fit into community livelihood strategies. The objectives of CGSI program seeks to alleviate poverty in coastal communities and to halt or reverse environmental degradation. Capacity building in coastal communities is therefore one of the primary goals of the project. In doing so, CGSI provides support and expertise to assist community's conserve, manage and rehabilitate their coral reef resources through the establishment of MPAs and appropriate mariculture initiatives. The Marine Aquarium Council (MAC) has also worked as a partner, as the aquarium trade has and still is active in the Marau Sound and other areas that the CGSI works. To this end MAC and FSPI have tried to coordinate activities dealing with community marine resource management plans and MAC Collection Area Management Plans (CAMPs). This report details follow-up activities from a training workshop that was conducted earlier with the Komukomu Group in the Marau Sound. During this workshop, issues of concerns with regards to MPAs were raised and worked through for the development of appropriate management strategies. The next steps were also considered, which included biological monitoring and training of community members and community meetings with the Maraiapa and Hatare communities.

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=A0000003006>



**Tafea, H. and T. Bebeu. 2007. Abundance of commercially important species of invertebrates, fish and the status of coral health in community based marine protected areas in Gela, Central Province, Solomon Islands. Honiara, Solomon Islands. 28 pp.**

The sites at Sandfly in Gela, Central Province were established over a three year period (three sites in 2004, two sites in 2005 and one site in 2007) after a series of workshops on good governance and marine resource awareness raising under the coral gardens project which was implemented by SIDT, ECANSI and Fisheries Division of the Solomon Islands government with funding from SPREP through FSPI. The awareness raising programmes were conducted from the year 2000 onwards and the impact it had, led the communities to realize the need to conserve their most depended upon marine resources, which were declining at a pace they were unable to control, if no immediate steps were taken. They also realized that as a result of this, more time would be spent to fish, for the family's daily protein and subsistence needs, as they would be going out to distant fishing grounds. With insufficient land area to do gardening to meet their ever-increasing daily subsistence needs especially in the form of cash for school fees and household items etc, the only option was to resort to marine resources to meet these particular needs. The shortage in marine resources therefore is due mainly to "fish for cash " which is also stimulated by the closeness of the Gela fishing grounds to the markets in Honiara as compared to other island provinces in Solomon Islands. The latter has also created an even greater problem as it attracts fishermen from neighboring provinces, mainly Malaita who use destructive fishing practices such as dynamite fishing and gillnetting as a means to increase their catch, thus giving a good return at the end of the day.

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=A0000003686>

**Tawake, A. and W.G.L. Aalbersberg. 2002. Community-based refugia management in Fiji. Institute of Applied Science, Faculty of Science and Technology, University of the South Pacific, Suva, Fiji. 12 pp.**

Many coastal communities in Fiji depend on the sea particularly on mangrove, seagrass and reef ecosystems, for their livelihood and the use of "tabu" or refuge areas are increasingly being revitalized by resource owners as a tool to sustain local fisheries. One of the main challenges is the limitation in the scientific or appropriate skills to judge their effectiveness, which is traditionally based upon beliefs and casual observations. Through a Biodiversity Conservation Network (BCN) project, people in the Verata district in Fiji have developed skills to help address marine issues. Using participatory techniques, communities determined threats to marine resources and developed a marine resource management plan. Community members were also trained to perform simple biological monitoring techniques to assess the effectiveness of the use of refuge areas. Two target species; mud lobsters (*Thalassina anomala*) and clams (*Anadara* sp.) have been monitored. Since the baseline surveys in 1997, there has been a 13-fold increase in clam abundance in the refuge area and a 5-fold increase in the harvest area indicating the success of these interventions. Mud lobster numbers have also increased. Consequently, new refuge areas involving five target species have been set up and monitored by the communities. In collaboration with the government and other NGOs, efforts are also underway to replicate this "Veratavou model" in other parts of Fiji and to create a learning network of community-managed refuge areas. This will help determine conditions under which the declaration and monitoring of community-managed fishery refugia can be an effective tool in sustaining local fisheries in Fiji.

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=C0000000081>

**Tawake, A., J. Parks, P. Radikedike, W. Aalbersberg, V. Vuki and N. Salafsky. 2001. Harvesting clams and data: involving local communities in monitoring: a case in Fiji. Conservation Biology In Practice 2(4): 32-35.**

*This paper reports the outcomes of the Ucuivanua Project in Fiji. This project involved researchers from the University of the South Pacific and from the Biodiversity Conservation Network, and the residents of Ucuivanua village – all successfully engaged with the monitoring and management of marine resources in the Ucuivanua area. A tabu area (a traditional management practice where regions of fishing grounds are temporarily closed to fishing) was established as a measure to rehabilitate dwindling stocks of marine resources, in particular, the kaikoso clam. Data collected over the 3-year tabu period by the Ucuivanua monitoring team indicated that numbers and sizes of the clams increased. Increases were observed in occurrence and numbers of other marine animals in the area. The authors believed that the most significant results were the successful involvement of the entire community, and the promotion of conservation awareness and action, involving communities, in Fiji and across the Pacific region.*

<http://immanetwork.org/pdfs/HarvestingClamsandData.pdf>

**Tawake, A., L. Naitetika, J. Ravula, M. Crabbe, H. Dugmore, G. Hill, K. Pickering and R. Tamanivalu. 2005. Kadavu Yaubula Management Support Team: a report on the effectiveness and site suitability of five tabu areas (MPAs) in Kadavu. Institute of Applied Science, Faculty of Science and Technology, University of the South Pacific, Suva, Fiji. 32 pp.**

*Presented here are the survey results of community-based management initiatives, mainly tabu (closed) areas, at five sites in the Kadavu area, Fiji. Observations are presented of the densities and compositions of fish, invertebrates and substrates, inside and outside closed areas, and compared to previous observations, where available. Results are used to determine the "effectiveness to provide sustainable resource use within each qoliqoli (marine managed area)", mainly the use of area closure and the suitability of the location of the area location. Discussions indicated that three of five sites were effective, and that two sites required more extensive survey to extend the time series of observations. The comparison of all five closed areas concludes with "some degree of clarity" that "four of the five tabu areas are located in beneficial environments for their purpose of creating sustainable 'breeding grounds' for overspill into the Tara (open) areas." The report also explains the establishment of a management support team, its role to sustain environment management and its success in extending marine conservation and the establishment of closed areas in the Kadavu area.*

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=C0000000036>

**Tiraa, A. 2006. Ra'ui in the Cook Islands – today's context in Rarotonga. SPC Traditional Marine Resource Management and Knowledge Information Bulletin 19: 11-15.**

Traditional pre-contact societies of the Cook Islands had a complex system of marine and land tenure that allowed delineated and enforceable control over the use of land and sea. The customary prohibition known as a ra'ui was one example of such control. A ra'ui was imposed by the chief of the tribe or the head of the landowning lineage to control the use of resources or facilities. These included land areas, lagoons, rivers, freshwater ponds, lakes, swamps, fruit trees, coconuts, birds, and other wildlife such as turtles and coconut crabs for conservation management (Utanga 1989). The system bans the harvest of food resources for a set period to enable stocks to increase. Traditionally, when a ra'ui was lifted, it could be moved to another area or reestablished at a later time in the same area, sometimes after a very brief harvest period.

*The article discusses several socio-economic benefits of ra'ui. It adds though that 'dedicated, continuous, and focused commitment to awareness and education activities' is needed to maintain support of the traditional protected areas.*

[http://www.spc.int/coastfish/Sections/reef/PROCFish\\_Web/Modules/Library/GetDocument.aspx?File=pdf/InfoBull/TRAD/19/TRAD19\\_11\\_Tiraa.pdf&Hit=2&ID=a6dabb80-567b-4be4-8633-98aca10f5d79](http://www.spc.int/coastfish/Sections/reef/PROCFish_Web/Modules/Library/GetDocument.aspx?File=pdf/InfoBull/TRAD/19/TRAD19_11_Tiraa.pdf&Hit=2&ID=a6dabb80-567b-4be4-8633-98aca10f5d79)

**UNEP. 2004. People and reefs: successes and challenges in the management of coral reef marine protected areas. United Nations Environment Programme-Regional Seas Programme, Nairobi, Kenya. 103 pp.**

This report documents 13 coastal coral reef management initiatives, operated under the ICRAN framework. Before describing these case studies, this report introduces some of the key issues in coral reef conservation and the role of ICRAN and the UNEP Regional Seas Programme. First, it gives a brief introduction to the natural resources and economic opportunities that coral reef ecosystems provide. The report then highlights marine protected areas (MPAs) as one of the most applicable, useful and comprehensive management strategies available to local communities and local, national and international institutions (e.g., government, academic, scientific, non-governmental and donor organizations) to mitigate the threats faced by reef ecosystems and foster sustainable use of marine and coastal resources worldwide. A description of ICRAN and UNEP's Regional Seas programmes follows, noting their geographic coverage, how these two institutions came about and developed, their modus operandi, and some of the priority issues being addressed by both. This report includes seven case studies from the Wider Caribbean Region, two from the Eastern African Region, two for the East Asian Seas Region and two case studies from the South Pacific Region. Although they present a variety of issues, contexts and responses, and were implemented in four regions characterized by very diverse socio-economic and political situations, all sites highlighted common features:

- Threats to coral reefs - overfishing and associated declines in fish catches; use of destructive fishing practices; pollution (marine- and land-based); increasing population pressure; as well as poor development and land use practices;

- Management challenges - resource use conflicts; unsustainable development; and lack of education and public awareness, adequate management of resources, enforcement, monitoring, financial stability and human capacity
- Lessons learned - the need for: greater community empowerment and involvement; sustained and extensive consultation between stakeholders; proactive and innovative education and public awareness campaigns; improved communication and transparency between all involved members; strong management partnerships to secure long term financial stability; development of management plans based on ecological as well as socio-economic data and linked to regular monitoring programmes; implementation of clearly defined zoning regulations to reduce conflicts between stakeholders; and enhanced enforcement efforts.

*This report provides an overview of the South Pacific Region, and particularly the activities in conservation and sustainable development. The report states that most MPAs in the region are ineffective due to "insufficient funding, lack of capacity, insufficient data, and lack of information exchange". Listed are some examples of successful approaches in the region. Two detailed case studies are provided: "Multiple-use management plan for whole of atoll management: Jaluit Atoll marine conservation area management plan" (J. Bungitak, M. Power and M. Philip) and "Coral transplantation and restocking to accelerate the recovery of coral reef habitats and fisheries resources within no-take marine protected areas: hands-on approaches to support community-based coral reef management" (A. Bowden-Kerby).*

<http://www.unep.org/regionalseas/Publications/itmems2reportfinal.pdf>

**Veitayaki, J. 2004. Building bridges: the incorporation of traditional knowledge into ecosystem management and practices in Fiji. Bridging Scales and Epistemologies Conference, 17–20 March 2004, Alexandria, Egypt. 27 pp.**

*The report highlights the value of incorporating traditional knowledge into science-based contemporary resource use strategies. Discussed are methods for incorporating traditional knowledge to achieve sustainable development of habitats and ecosystems occupied by traditional communities. Possibilities for the incorporation into sustainable development practices of some traditional knowledge and experiences from Fijian communities are presented. Of particular interest here is the concept of sacred ground and the application of restrictions in access and activities in fishing grounds of Fiji. The traditional mechanisms that result in compliance with these restrictions are explained. Reverting to traditional systems for management of customary fisheries resources is reported to be achieving encouraging results in Samoa and Fiji (documented elsewhere).*

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=A0000003577>

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

*This paper considers elements of the Fijian traditional culture and traditional resource use practice in the context of current fishery resource use. It highlighted the appropriateness and effectiveness of resource use systems of traditional communities and how these have contributed to the "general maintenance of stock and the protection of the marine environment" although, "they have been quickly eroded and replaced by modern systems". Current experience though is showing that traditional resource use systems, like customary marine tenure, have useful elements that can be considered in, and applied to, current situations. Many fishery projects have been ineffective because they failed to accommodate the socio-cultural aspect of Fijian communities. The paper also mentions the increasing actions throughout Fiji in the declaration and development of marine reserves and protected areas. The "development of protected marine areas and reserves in Fiji will be easy, as the ownership of the customary fishing areas is already held by the people, who only need to agree as a group to have a portion of their fishing ground declared a marine reserve or protected area."*

[http://epress.anu.edu.au/culture\\_sustainable/ch09.pdf](http://epress.anu.edu.au/culture_sustainable/ch09.pdf)

**Veitayaki, J., A. Tawake, A. Bogiva, S. Meo, N. Ravula, R. Vave, P. Radikedike and P.S. Fong. Addressing human factors in fisheries development and regulatory processes in Fiji: the Mositi Vanuaso experience. Ocean Yearbook 21: 289–306.**

*The Mositi Vanuaso Project on Gau Island is part of the Fiji Locally Managed Marine Areas (FLMMA) network of community-based resource management initiatives being undertaken in Fiji. After about 3 years of observing the traditional resource management arrangements in their marine environment, whereby prohibitions were placed on fishing grounds and on destructive resource use practices, the people of Vanuaso Tikina (district) were beginning to ask when these arrangements would be relaxed. In an attempt to engage the people over the long term, it was decided to work on convincing the people of the value of environmental resources and their interrelationships by seeing if they could incorporate resource management into their rural development activities. Resource management is about managing human activities, and so this paper attempts to explain how human factors have been addressed to ensure the effectiveness of the whole initiative.*

**Veitayaki, J., A. Tawake, A. Bogiva, S. Meo, N. Ravula, R. Vave, P. Radikedike and P.S. Fong. 2005. Partnerships and the quest for effective community-based resource management: the Mositi Vanuaso Project, Gau, Fiji. The Journal of Pacific Studies 28(2): 328–349.**

The Mositi Vanuaso Project in Gau is a Fiji Locally Managed Marine Areas Network (FLMMA) site undertaking activities that intend to articulate sustainable development. With partnerships and collaboration, the communities and their outside partners have brought about changes that offer useful lessons in the quest for effective community based resource management.

*Mositi* denotes attachment to something that is cherished and deeply valued. Thus the name evokes a commitment of the district to protecting and managing the use of the resources of the area, which are intimately linked to people's welfare and livelihood. Wanting the environment they pass to their children and future generations to be their most significant legacy, the people have made Mositi Vanuaso initiatives forward-looking, innovative and relevant.

In the collaborative experience in the district (tikina) of Vanuaso, the partnerships at various levels have contributed to marine resource conservation work undertaken over the last five years. Using self-determined and -implemented management plans they formulated during participatory learning and action workshops, the people have collaborated to establish their community-based resource management areas and determine the management activities. The experience has been fulfilling and enriching for participants, and can be a useful source of information for the nation, the region and the world, wherever similar initiatives are promoted and tried.

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=C0000000189>

**Veitayaki, J., A. Tawake, S. Fong, I. Korovulavula and S. Meo. 2005. Partnerships, collaboration and cooperation for effective marine resources management: the Fiji Locally Managed Marine Areas (FLMMA) network. Institute of Applied Science, Faculty of Science and Technology, University of the South Pacific, Suva, Fiji. 21 pp.**

Over the last four years, the Fiji Locally Managed Marine Areas (FLMMA) network, in promoting community-based marine management areas in Fiji, has demonstrated a great deal about partnerships, collaboration and cooperation that provide useful lessons that need to be taken into consideration. The FLMMA network consists of a number of organisations in Fiji that are working with local communities in the management of their inshore marine resources. The network is based on the principle that people in coastal communities want to make marine resources management more effective and beneficial to their communities and contribute to the improvement of their living conditions. FLMMA members are committed to work with the community groups and with each other and to share their experiences because the sum of their collective effort is far greater than the sum of their individual contribution. Guided by a social contract that emphasises respect for each other, trust and good conservation practices, FLMMA has fostered working relations with the local government departments, international donor organisations, international and national organisations and the local communities. For the very first time, government departments are working with national and international and non government organisations as partners that are united to bring about positive change to how marine resources are utilised in coastal communities. The partnership, collaboration, and cooperation are resulting in good conservation practices and the increasing commitment of local communities to self determined development that reflect globally prescribed principles of precautionary, sustainable and integrated development. These interventions led to the recognition of FLMMA as one of the six winners of the United Nations Development Programme's Equator Initiative for outstanding contribution to poverty alleviation and conservation at 2002 World Summit on Sustainable Development. The network emphasises effective conservation while upholding the integrity of local communities to determine developments that improve their lives.

<http://www.reefbase.org/pacific/database.aspx?searchdata=1&refid=A0000003601>

**Veitayaki, J., B. Aalbersberg, A. Tawake, E. Rupeni and K. Tabunakawai. 2003. Mainstreaming resource conservation: the Fiji Locally Managed Marine Area Network and its influence on national policy development. Resource Management in Asia-Pacific Working Paper No. 42 Resource Management in Asia-Pacific Program, Research School of Pacific and Asian Studies, Australian National University, Canberra, Australia. 13 pp.**

The experience of the Fiji Locally Managed Marine Areas (FLMMA) network provides an illustration of how to mainstream community-based resource management practices that began with local communities, and were in turn supported by a Government which has witnessed the success of community-based intervention. To improve the success of conservation in the communities and attract attention to its approach, FLMMA formed a learning portfolio. This is a network of projects that use a common strategy to achieve a common end and agree to work together to collect, test and communicate information about the conditions under which the strategy works, to enable the partners to exchange ideas and experiences. The learning portfolio enhances collaboration and also ensures that lessons learnt are shared widely with people in the network. FLMMA is working to increase the effectiveness of conservation and to ensure that the involvement of people in the management of their marine resources is both satisfying and meaningful.

Modern science is an important part of the FLMMA approach because it is used to demonstrate the effects of the use of traditional resource management practices. Using simple biological, social, and economic monitoring methods, the villagers are collecting impressive results on resources and habitat recovery and the associated social and economic improvements in living conditions. The objectives of improving conservation to protect biodiversity and improve people's living conditions are important features of the kind of community-based resource conservation that is now being undertaken in the Pacific and Asia region. The objectives are also consistent with national policies for inshore fisheries development and global concerns about poverty alleviation.

The success of community-based conservation in different parts of Fiji has resulted in long-term support from the communities. It has also facilitated the articulation of Government fisheries development policies. The Government has set up a new conservation unit and has formalised its support, and adopted the FLMMA method of involving local community units in the sustainable use of their marine resources.

[http://rspas.anu.edu.au/papers/rmap/Wpapers/rmap\\_wp42.pdf](http://rspas.anu.edu.au/papers/rmap/Wpapers/rmap_wp42.pdf)

**Walker, B.L.E. 2001. Mapping Moorea's Lagoon: conflicts over marine protected areas in French Polynesia. Proceedings of the Inaugural Pacific Regional Meeting of the International Association for the Study of Common Property, 2-4 September 2001, Brisbane, Australia. 23 pp.**

This article examines the process of establishing a series of marine protected areas (MPAs) in the lagoon around Moorea, French Polynesia from 1998 to 2001. This case study is set within the context of tourism development resulting from the end of French nuclear testing and its concomitant incomes and social subsidies. Theoretically, I engage the approach of political ecology to explore the relationships between capitalist economic restructuring; environmental decision-making, and politics over lagoon knowledge and resources. My analysis raises questions about the objectivity of Geographic Information Systems and MPA science, as well as assumptions that local control and public participation are always effective in environmental decision-making.

<http://dlc.dlib.indiana.edu/archive/00001047/00/walker.pdf>

**Wantiez, L., P. Thollot and M. Kulbicki. 1997. Effects of marine reserves on coral reef fish communities from five islands in New Caledonia. Coral Reefs 16(4): 215-224.**

The effect of marine reserve protection on coral reef fish communities was studied on five islands located in the southwest lagoon of New Caledonia. Commercial fish communities and Chaetodontidae, sampled before fishing prohibition and after five years of protection, were compared. Reference stations were also sampled to assess variability in unprotected communities on the same time scale. The hypothesis that marine reserves protect and develop fish stocks was confirmed. Species richness, density and biomass of fish on the protected reefs increased respectively by 67%, 160% and 246%. This increase was statistically significant, whereas the reference stations showed only a small increase in density. There were significant increases in the species richness, density and biomass of the major exploited fish families (Serranidae, Lutjanidae, Lethrinidae, Mullidae, Labridae, Scaridae, Siganidae and Acanthuridae) and also of the Chaetodontidae. No significant increase in the mean lengths of fishes was noted among the main species, with the exception of one species of Siganid. Size structure changed for most of the main species, as the proportion of small individuals increased after five years of protection. Detrended correspondence analysis indicated that marine reserve protection was the most important determinant of the fish community structure. The second determinant was the position along an inshore-offshore gradient. Marine reserve protection resulted in an increase in the relative abundance and species richness of large edible species within the assemblages.

**Weiant, P. and S. Aswani. 2006. Early effects of a community-based marine protected area on the food security of participating households. SPC Traditional Marine Resource Management and Knowledge Information Bulletin 19: 16-32.**

There is general agreement among conservation practitioners that community-based marine protected areas (CB-MPAs) can improve food security in coastal communities. However, little attention has been given to how communities respond to CB-MPAs, particularly how households try to meet their livelihood needs following the establishment of a restrictive management regime. In this paper, we explore the early effects of a CB-MPA geared toward the management of marine resources harvested by women, as measured by perceived income and food availability. We strive to better understand: (1) the contribution of women's fishing activities to livelihood needs, particularly the harvest of blood cockles (*Anadara granosa*) and mud clams (*Polymesoda* spp.) (the species under management); (2) differences in how households respond to a CB-MPA; and (3) the relationship between food security and certain aspects of reef health. To illustrate our case, we draw upon our research experience with social and biological impact assessments and our experience in establishing marine protection in the Western Solomon Islands.

<http://www.spc.int/Coastfish/News/Trad/19/Weiant-Aswani.pdf>

**World Bank. 2000. Voices from the village: a comparative study of coastal resource management in the Pacific Islands - Final Report. Pacific Islands Discussion Paper Series No. 9. East Asia and the Pacific Region, Papua New Guinea and Pacific Island Country Management Unit. World Bank, Washington DC, USA. 85 pp.**

*"In 1998–99, the World Bank sponsored a survey of coastal communities in five Pacific Island Countries - Fiji, Palau, Samoa, Solomon Islands and Tonga. The purpose of the study was to strengthen the understanding, among the region's coastal managers, of the factors that contribute to the successful management of coastal resources."... "The study relied primarily on community perception of trends in the condition of coastal resources and factors affecting resource management at the village level."... "To assess the impact of coastal management, small focus groups were asked about their perception of trends in four major indicators: catch per unit of effort; habitat condition; threats to coastal resources, and compliance with resource management rules."*

*Results indicated that open-access areas, when compared with areas where there were restrictions on access by outsiders, generally lacked local management rules, were less effective in the local management of threats, threats were perceived to be rising at a greater rate than the average, and there was generally a lower level of awareness at these sites about the benefits of resource management.*

*"Community perceptions of the impact of sanctuaries were generally favorable. The abundance of key species inside sanctuaries was perceived to be increasing. Negative trends were mentioned in only two relatively older sanctuaries in Palau. There was also considerable optimism about the sustainability of sanctuaries. At 10 of the 14 sites (71 percent), community members believed the sanctuaries would continue to exist after five years. Compliance with these closed areas was also perceived to be significantly better than compliance with rules like size limits or bans on catching certain species."*

*Villagers perceived increases in resource abundance inside sanctuaries that were larger than would seem biologically possible. The report suggests that "sanctuaries provide a benefit that transcends their ecological impact. The presence of a sanctuary in a community seems to act as a catalyst for increasing interest, knowledge and awareness of coastal resource management.*

[http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2001/06/23/000094946\\_01061304010664/Rendered/PDF/multi0page.pdf](http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2001/06/23/000094946_01061304010664/Rendered/PDF/multi0page.pdf)

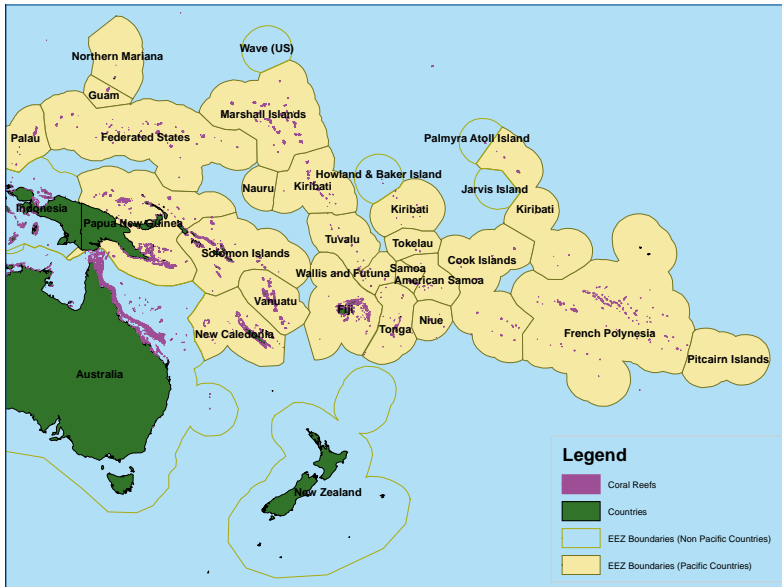
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This collection contributes to the work of the ReefBase Pacific project ([pacific.reefbase.org](http://pacific.reefbase.org)) which is Component 2D of the Coral Reef Initiatives for the Pacific, CRISP ([www.criponline.net](http://www.criponline.net)), executed by The WorldFish Center ([www.worldfishcenter.org](http://www.worldfishcenter.org)). The aim of the ReefBase Pacific project is to improve accessibility and availability of information to support effective management of reef resources in the Pacific. Impacts of marine protected areas that extend beyond biodiversity and habitat conservation tend to receive less popular attention despite their importance. The aim here is to highlight, in particular, impacts on fisheries and livelihoods attributed to coral reef marine protected areas in Pacific Island countries and territories. The document you are now reading includes the collection of references as of June 2008; however, the collection continues to grow and is regularly updated on the Internet at [pacific.reefbase.org](http://pacific.reefbase.org). Authors of relevant studies are encouraged to submit them for inclusion in the online collection.

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