EMERGENCE, EVOLUTION AND OUTCOMES OF MARINE PROTECTED AREAS IN VANUATU

IMPLICATIONS FOR SOCIAL-ECOLOGICAL GOVERNANCE

Dissertation submitted by

CHRISTOPHER YEOMAN BARTLETT

December 2009

for the degree of

Doctor of Philosophy

School of Earth and Environmental Sciences

James Cook University

Townsville

Australia

STATEMENT OF ACCESS

I, the undersigned author of this work, understand that James Cook University will make this dissertation available for use within the University Library and, via Australian Digital Theses network, for use elsewhere. All users consulting this thesis must agree to the following statement:

> "In consulting this dissertation I agree not to copy or closely paraphrase it in whole or in part without consent of the author and to make proper written acknowledgement for any assistance which I have obtained from it."

I understand that, as an unpublished work, this dissertation has significant protection under the Copyright Act and I do not wish to place any further restriction on access to this work.

	31/12/2009
……	……
Christopher Y. Bartlett	Date

STATEMENT OF SOURCES DECLARATION

I declare that this thesis is my own work. Information derived from the published and unpublished work of others has been acknowledged in the text and a list of references is given. All photography is my own unless otherwise specified.

	31/12/2009
……	……
Christopher Y. Bartlett	Date

STATEMENT ON THE CONTRIBUTION OF OTHERS

This research has been funded primarily by a Postgraduate Research Scholarship from the School of Earth and Environmental Sciences and the Graduate Research School of James Cook University. Much of the fieldwork undertaken as part of this dissertation was supported by a stipend from the US Peace Corps and funding from the National Oceanic and Atmospheric Administration International Coral Reef Conservation Grant Program. Logistical support was provided by the Nguna-Pele Marine Protected Area Network, and many of its member communities.

Associate Professor Peter Valentine, Dr. Joshua Cinner, Dr. Stephen Sutton, Dr. Robin South and Dr. Alison Cottrell undertook the supervision of this project. These supervisors have been included on several publications resulting from this research in order to acknowledge their various and diverse contributions. Their contributions have primarily been advisory and consultative in nature, particularly in improving the empirical design and analytical tools used herein. They have also provided some guidance on diction and writing style. Editorial support was provided by Karen Bartlett, Jim Bartlett and the above mentioned supervisory committee.

Data were collected with the assistance of Charley Manua, Willie Kenneth, Sam Kenneth, Jessica Nilsson and a team of over thirty volunteers from the islands of Nguna and Pele in Vanuatu.

	31/12/2009
……	……
Christopher Y. Bartlett	Date

ACKNOWLEDGEMENTS

I extend my deepest gratitude to the individuals on my dissertation supervisory committee: Associate Professor Peter Valentine, Dr. Joshua Cinner, Dr. Stephen Sutton, Dr. Robin South and Dr. Alison Cottrell. From the beginning of this dissertation journey they have attentively listened to my ideas, frustrations and concerns about multidisciplinary community-based research. It was in large part their open-mindedness and intellectual empowerment that enabled me to work through the rigors of academic research while maintaining the projects and relationships formed in the islands.

Thanks are also due to my parents, Karen and James Bartlett who reviewed several versions of this dissertation during the final months of writing. I owe my stylistic flair to them both from years spent observing and reading their own writings.

I owe a debt of gratitude to the US Peace Corps for accommodating my work in Vanuatu. Specifically I thank to former Vanuatu country director Kevin George, and project managers Ron Savage, Robert Moler and Mark Kalotap for their advice and support during my time as a volunteer.

Most importantly, I acknowledge the support of my ni-Vanuatu counterparts, without whom completion of this work would have been impossible. While I have worked directly with hundreds of individuals in Port Vila, several deserve special mention. The Directors of the Vanuatu Environment Unit: Ernest Bani and Trinison Tari, the Director of the Fisheries Department: Robert Jimmy and the Director General of Lands: Russel Nari have been outstandingly supportive. Touasi Tiwok, Tevi Obed, George Petro, Jason Raubani, Sompert Gereva, June Norman, Primrose Malosu, Leah Nimoho, Dorah Wilson and Donna Kalfatak each contributed their expertise generously.

Finally, I must convey enduring gratitude to my colleagues, family and friends on Nguna and Pele Islands. Charley Manua introduced me to the marine environment of Vanuatu and was a colleague and sounding board for this research. Dore Tamara, Nicholas Michael, Kalmet Willie and Tauratungoro Taimatua, Mark Song, Tavakalo George, Willie Kenneth, Morris Louis, Sam Kenneth, Tasaruru Whitely, Kenneth Talang, and Kalpat Tarip contributed to this work by my side for years, always with professionalism, even during the most tempestuous of sea and social storms!

To my island families: Leiman and Matuel Taura, Lily and Watson Kalo, Kalo and Margaret Kailes and Marie and Eddie Ng, you are the reason Vanuatu is so special to me. Thank you from the bottom of my heart.

ABSTRACT

General scope

For much of human history the oceans have been considered incomprehensibly vast; an inexhaustible source of goods and services. Over the last century however, that paradigm has proved largely inaccurate. The ocean is in a state of crisis, caused primarily by human overexploitation. A rational reaction to the crisis is to limit fishing, often by designating swaths of the ocean as marine protected areas (MPAs). To be effective, it has been suggested that marine protected areas must cover between ten and thirty percent of the world's oceans, ideally linked into MPA networks. Protection targets on this scale, however, present critical implementation and governance challenges. While some nations can effectively implement and enforce MPA rules, many are impoverished, and lack the capacity to centrally govern marine protected areas. Experience shows that centrally mandating MPAs and marine use regulations in these contexts is not realistic, and will often lead to management failure.

A weak central government does not always imply that a nation's marine resources are unmanaged. To the contrary, thousands of community-based organizations in developing countries, ranging from fishermen's cooperatives to entire villages, have implemented localized marine management institutions. The vast majority of vulnerable coastal marine habitats (e.g. coral reefs, sea grass, mangroves) are found in tropical developing countries with local governance contexts, and so investigating how collectively implemented institutions, including MPAs, function there is vital for improving global outcomes. Broadly, this dissertation addresses questions about how locally managed MPAs influence and are influenced by the complex interactions between marine ecosystems and human governance systems.

Specific Objectives

This dissertation sets out to accomplish the following objectives:

1. Place the study of marine protected areas within a theoretical framework that enables a comprehensive and simultaneous analysis of social and ecological factors
2. Utilize a linked social-ecological theoretical framework to better understand the emergence, evolution and outcomes of marine protected areas in Vanuatu; specifically to understand:
    a. Historical factors and trends that preceded and shaped the current marine resource governance regimes found in Vanuatu
    b. Motivations and expectations of ni-Vanuatu people regarding spatial marine closures
    c. Situational factors that may enable the selection and implementation of diverse marine closure regimes
    d. Ecological outcomes of diverse marine closure regimes

e. Ways and means by which positive outcomes of marine closures may be fostered and enhanced into the future

Refining MPA social-ecological theory

Understanding why and how user groups manage natural resources instead of overexploiting them has underpinned the development of theories on Commons and Collective Action. But because these kinds of questions typically focus on people, resulting theories tend to be firmly embedded in the social sciences. Marine protected area concepts, on the other hand, are generally encapsulated within the natural sciences. New paradigms are emerging that link social and ecological systems, and MPA investigators now routinely consider both social and ecological variables in their research. However, the social variables they investigate are often selected in an *ad hoc* fashion; they are rarely rooted in robust social-ecological theoretical frameworks. Elinor Ostrom has recently forwarded a framework to theoretically link social and ecological components of resource management systems; but, it has not yet been utilized to guide the empirical investigation of marine protected areas.

This dissertation adapts Ostrom's theoretical framework, and operationalizes it to suit marine protected area social-ecological investigations. The framework theoretically situates MPAs within complex social-ecological systems and highlights links among systemic components including the users (e.g. fishermen), resource system (e.g. coral reefs), resource units (e.g. fish), governance systems (e.g. community decision making), outcomes (e.g. increased abundance), interactions (e.g. fisher conflicts), related ecosystems (e.g. climate), social settings (e.g. demographics) and historical trajectories (e.g. resource declines). If MPA case studies are designed and interpreted in the context of the framework, findings will be cumulative and more easily comparable with results from other case studies, and even from unrelated social-ecological systems.

Using the framework to fill specific gaps in MPA knowledge and understanding

Much of the marine protected area literature focuses on permanently protected marine reserves that prohibit all forms of extraction. In contrast, only a handful of empirical studies have investigated the social and ecological outcomes of closures that are periodically harvested. Situating each type of MPA in the framework as a guide to empirical research facilitates a theoretically-based comparison of permanent and periodically harvested MPA types. Empirical data collected at the finest resolution can be 'scaled up' via the framework and compared to patterns emerging from other MPA case studies.

The empirical foundation of this thesis derives from the Indo-Pacific region, specifically the Republic of Vanuatu, where marine protected areas are commonly implemented, managed and enforced by island communities. In Vanuatu it is now common to find some villages implementing permanent no-take reserves, and others non-permanent closures (locally called *taboos*). On the islands of Nguna and Pele, different MPA rules are selected even among villages that are geographically adjacent, ecologically similar

and share a cultural and linguistic heritage. The variability in MPA rules here has created a unique 'natural experiment' by which it is possible to tease out the theoretically based social and ecological factors that have influenced the differential emergence, evolution and outcomes of marine protected areas. Accordingly, much of this dissertation is based on carefully constructed case study comparisons among communities on Nguna and Pele Islands with different MPA rules.

Of foremost concern to fisheries managers, conservationists and community stakeholders are the direct fisheries outcomes of different MPA rule types. Utilizing the comparative case study approach, the ecological conditions of periodically harvested *taboos*, permanent reserves and openly fished (control) sites were contrasted. Periodically harvested *taboos* were found to be suboptimal conservation strategies for some targeted organisms, for example giant clams and trochus snails because they are particularly vulnerable to harvest. Targeted fish species were found to have significantly higher biomass inside periodically harvested *taboos* than in adjacent openly fished areas, suggesting that in some contexts, periodic harvest may hold conservation and ecological value. This finding is directly relevant for the thousands of communities in the Pacific and beyond that implement periodically harvested *taboos* in order to boost stocks.

It is widely assumed that MPA establishment in the Pacific islands will be constrained by food security concerns. Many quite rightly ask why an island community would choose to permanently lock up its limited coral reefs under a no-take marine reserve regime. This research on Nguna and Pele suggests that the primary motivation for establishing MPAs (of both types) is, in fact, to improve food security by stemming the rapid decline in health and quantity of target marine resources. Additionally, non-ecological motivations for community-based MPA establishment were widely held, including the potential to gain indirect benefits from tourism and foreign aid. Further, perceived MPA outcomes did not always coincide with ecological findings, suggesting that communities may be selecting MPA rules based on a combination of contextual, political and ideological factors.

To date, no studies have empirically investigated how contextual factors enable the selection of MPA operational rules. Fuzzy-set qualitative comparative analysis enabled a qualitative-quantitative investigation into the combination of factors that potentially enable the differential selection of MPA rules on Nguna and Pele. Communities with no-take marine reserve rules were found to possess high levels of some conditions (for example the capacity to enforce closures). In contrast, communities that select periodically harvested MPA rules are characterized by low levels of these and other conditions. This finding suggests that there may be non-linear thresholds above and below which certain MPAs rules become inappropriate. Additionally, periodic harvest rules may represent an 'easier' management regime for some communities to implement. To avoid MPA failure, donors and conservation organizations seeking to implement specific MPA rules (e.g. no-take reserves) will need to consider 1) adapting the rules to suit specific community contexts, or 2) building capacity and capital in order to create the conditions necessary for obtaining desirable rules. Marine protected area panaceas or

blue-print approaches to MPA rules are inappropriate here as they are not effectively linked to community conditions.

Today however, an unlikely MPA panacea is being actively promoted throughout Vanuatu: customary *taboos*. Cultural elites argue that Pacific Island MPAs should imitate *taboos* that they claim were developed in the ancient past, assumedly over millennia. But the communities on Nguna and Pele have no collective memory of coral reef *taboos* being employed on their islands before present times. To investigate the historical longevity of *taboos* and marine management in Vanuatu, archaeological findings, existing custom stories, oral histories and the first-hand accounts of early explorers, missionaries and anthropologists were comprehensively reviewed. In sharp contrast to the prevailing ancient management paradigms, little evidence was found to support claims that ancient marine management existed on Nguna and Pele. Rather, the evidence indicates that marine resources have been systematically overexploited throughout the recent and ancient past. In essence, customary *taboo* panaceas are likely being promoted because they maintain the political authority (and often economic livelihoods) of urban-located cultural elites or *kastom* gatekeepers. In reality however, it is dynamism and diversity that have defined ni-Vanuatu custom over the millennia; an historical legacy of adaptive capacity.

Diverse MPA rhetoric and conflicting historical accounts have led to confusion within Vanuatu's small marine resource management community. Island communities often don't know whether to call their closures MPAs, protected areas, conservation areas, or *taboos*. Likewise, government agencies are unable to give accurate MPA status reports in fulfillment of international convention and treaty obligations. To overcome this challenge, a series of specific policy measures is proposed which would alleviate the discursive confusion surrounding MPAs in Vanuatu, while at the same time embracing and enabling the rich diversity of local management strategies. Building consensus on MPAs in Vanuatu is critical if island communities are to deal with the environmental, social and climactic changes that are predicted for the future.

Moving Forward

Because the world is changing faster now that ever before, communities on Nguna and Pele are constantly facing new and unique marine resource governance challenges. Accordingly, important questions remain: Can institutional adaptation match the speed and scope of the global changes? What social-ecological factors influence the speed of adaptation/institutional change across different contexts? Why have some ni-Vanuatu communities been able to collectively organize and adapt their management institutions (to varying degrees of success) while others have not?

This dissertation provides strong evidence that communities in Vanuatu have long been using and making decisions about marine resources. Institutions developed in the past and more recently guide the actions and strategies adopted by ni-Vanuatu people. These in turn are adaptive and responsive to local and supra local contextual factors. Having identified these patterns on Nguna and Pele and coded them into a decomposable

theoretical framework, it becomes possible to formulate and test hypotheses about MPAs, both in the marine science discipline and across natural resource fields.

Answering broader questions will require a more comprehensive research agenda; specifically a large-N theory-building empirical focus that crosses national boundaries, disciplinary confines and levels of organization and analysis. As this type of expansive research is beyond the capacity of most individual researchers, scientists will need to develop and make better use of theoretical ontologies that enable the standardization and translatability of existing case study research. Ostrom's proposed social-ecological conceptual framework will need to be expanded if it is to serve its purpose as a foundation for building cross disciplinary systemic models, testing hypotheses and translating case study data. In time this type of framework may provide a common language to scholars working across disciplines, at multiple scales and in geographically disparate locations.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

PROLOGUE

Forgive me, but to tell this story I must begin in the middle, for the beginning rests on the shoulders of Vanuatu's Lapita people who settled the island archipelago over 3000 years before I arrived…

It is June of 2002. I have just arrived in Vanuatu, am learning to speak Bislama[1], developing my taste for laplap[2], and relishing the fact that one of the world's most stunning coral reefs lies at my doorstep. Each day I feel less concerned about my decision to delay my graduate studies to become a US Peace Corps volunteer.

The journey that eventually became this dissertation research began in Paunangisu Village[3], a large community on the North Coast of Efate Island.[4] Paunangisu was hosting the cross-cultural training program for the newly arrived volunteers. I had already earned something of a reputation for skipping out on colonial history class in order to go for extended snorkels or bush hikes. On one hot and sticky island afternoon, after my daily swim, my host father[5] presented me with an envelope, the contents of which would fundamentally alter the next seven years of my life. Inside was a letter from a man I had never met, from an island which I had never visited. Charley Manua's request both intrigued and terrified me: "Chris, please come to Pele Island and help us set up a marine protected area[6]."

From my Peace Corps training hut I could easily see Pele, a gorgeous, sparsely populated volcanic island, single hilled and surrounded by fringing reefs. This unexpected request dominated my thoughts for days: Why does Pele need or want a marine protected area? If they close this reef, where will Charley's family get their fish? Aren't there more traditional options? How will it be managed, monitored and enforced? Is there something special about this Charley or his village, or do most communities want to set up protected areas?

---

[1] One of Vanuatu's three official languages, a form pidgin English

[2] Laplap is Vanuatu's traditional signature dish, made commonly of grated tubers blended with coconut milk. The mixture, wrapped in leaves, is cooked over hot stones and served with meat or fish (Bolton, 2001 pp 260; Lebot, 2006). It is notoriously slimly and tasteless to the uninitiated, though with habituation becomes quite desirable and delicious.

[3] Paunangisu's population of ~1000 people is dispersed over a large area, organized into residential stations. I lived in the home of Kaloran Kailes of the Marius Station. Paunangisu village proper is located on the coast of Undine Bay. From the beach one can see the nearby islands of Nguna, Pele, Kakula and Emao, all future sites of this research.

[4] Efate island is arbitrarily divided into three sections: 1) North Efate, including the villages from Epau through to Mangaliliu and the islands of Lelepa, Moso, Nguna, Pele, and Emao 2) South Efate, including the villages from Teuma through to Ekipe and 3) the Town district from Mele-maat to Erakor. North Efate's people, or '*man taleva'*, are characterized as robust, intelligent and free-thinking. Being close to Port Vila, Vanuatu's administrative and economic powerhouse, North Efate residents are often the first in Vanuatu to be exposed to the latest ideas, marketed products and social problems. They are widely envied, because they continue to live in villages, yet have easy access to the spoils of the capital city. Residents of North Efate are culturally connected, and part of the Nakanamanga language group.

[5] Each volunteer in training is assigned a host family that provides accommodation and looks after the general well-being of their 'child'

[6] marine protected area and its acronym, MPA, are interchanged throughout this dissertation

Soon however, with an overwhelming portion of the Vanuatu culture and the Bislama language yet to learn, I let Charley's request slip into the back of my mind. I reluctantly told myself I would probably never have a chance to make it to Pele Island anyway. Anyway, I was hoping to be assigned to a much more remote and exotic location in Vanuatu…far away from North Efate and its perplexing requests for marine protected areas.

At the end of our three months of cross-cultural and language training, Peace Corps staff revealed to each volunteer the specifics of our upcoming 2-year assignment[7]. One volunteer after another stood in front of the group to publicly learn the tantalizing details of work that had been requested of them by a ni-Vanuatu[8] community. Some were posted on the remote and beautiful Banks Islands to the extreme North; others to the wild, volcano-dominated island of Tanna to the South. When my name was called, I expected an equally exotic location…

Rather than give me a place name, the training coordinator simply pointed; pointed out over the white sand of Paunangisu beach and across a small spit of azure water to the islands of Nguna and Pele, not 20 minutes dinghy ride from where I stood. I admit I was disappointed, no land-diving, no ceremonial toka dances, nothing but…well… a beautiful Pacific Island where the only non-ni-Vanuatu person to have lived permanently was a Scottish missionary 100 years before me.

It is only now that I can fully recognize, by all that this dissertation represents, the serendipity of Peace Corps' decision to send me to Nguna and Pele Islands. I had unwittingly been placed onto the cutting edge of the marine management phenomenon now rippling throughout the nation and the wider Indo-Pacific region. The focus of my Peace Corps assignment could, in fact, now be dedicated to Charley's marine protected area. Notwithstanding the wide-ranging roles and responsibilities I would fulfill and interests I would pursue during my years in Vanuatu, the marine protected area motif that Charley introduced was, and has remained, a defining theme of my professional life.

Marine protected areas however, were certainly not the only enterprises to which I lent my time and attention in Vanuatu. Most importantly, I became a member of the communities in which I lived[9]. Literally adopted by Melanesian families[10], I was invited and culturally enabled to engage in even the most intimate familial and community junctures. I became fluent in the Nakanamanga language[11], with it gaining the nuances and cultural subtleties on which the

[7] Peace Corps volunteers are requested for specific jobs by communities, NGOs or government departments. During Pre-service training, volunteer skills and personality are matched with job request applications to ensure the most effective assignment.
[8] Ni-Vanuatu is the correct way to refer to a person or community from/in the Republic of Vanuatu
[9] I lived in Paunangisu Village (Efate) for three months in 2002. Most of my time in Vanuatu was spent in Taloa Village (Nguna) from 2002-2005. A final year (2006-2007) was spent based in Piliura Village (Pele).
[10] In Paunangisu during training I lived with Margaret and Kalo Kailes. My true mother and father in Vanuatu however were Leiman and Matuele of Taloa Village. They adopted me as a veritable son, and I became a godfather to their grandchildren. On Pele during my final year of research, I was lovingly adopted by Lilly and Watson of Piliura Village.
[11] Indigenous Austronesian labguage spoken by roughly 5000 people in central Vanuatu.

authority of this research rests. My bamboo hut, immediately adjacent to the village nakamal[12], became an extension of the social and political center of the village, always filled with friends and family. At times I was encouraged to be an active participant in village affairs. At other, more intimate and sacred times, I was allowed to be a cultural observer. My exposure and integration into the North Efate way of life was complete and profound.

As a development volunteer, I was involved in projects ranging from strengthening women's cooperatives to initiating novel renewable energy programs. However, the news of my qualifications as a marine biologist spread quickly throughout the adjacent villages and islands. Requests from villages to advise on the establishment of MPAs would be repeated over and over during my four years as a Peace Corps volunteer, originating from many communities and islands throughout the archipelago. And each time, I again would ask myself those most basic of questions: why and how?

At times the answers were simple, yet at other times they were steeped in lingering complexity. One thing is certain however: Charley's desire to set up an MPA was based on a tacit yet proactive acknowledgement of the fisheries crisis that continues to be affirmed by communities and researchers around the world. Charley and his village wanted answers, answers they believed a marine biologist should immediately have on hand: "How long do we have to keep the MPA closed before we can re-open it? Where is the best place to put our reserves? How big should they be? Can we still fish for food inside our marine protected area? Why do some people criticize us for setting up MPAs? Why do only some of the villages on the islands declare no-take areas while others allow some fishing? "

In the absence of the information they sought, local communities on Nguna and Pele adopted a trial-and-error approach to marine closures. During my initial years as a volunteer, Charley and the dozens of other community marine managers on North Efate began to physically try out some of the management approaches and techniques they had heard about from sources within and external to Vanuatu. These included growing and transplanting coral fragments, experimenting with gear-prohibition, collecting and cleaning reefs of algae, Drupella snails and Crown of Thorns starfish, artificially spawning clams and trochus and establishing no-take areas over portions of reef.

Some of these experiments seemed to work well, while others definitely did not[13]. This period represented a phase of active and data-less experimentation among the communities of Nguna and Pele. After six years of trial and error, a marine management protocol has begun to emerge.

[12] The Nakamal is the village meeting place. Most communities in central Vanuatu have a nakamal or varea (Nakamanga language), which serves as the center of community social activity (Van Trease, 1987 pp 8).
13 One of the most spectacular, cringe-inducing failures of those early years was a giant clam tank-based mariculture trial. Clams were painstakingly wild-collected and successfully spawned in land-based tanks. Within days of larval settlement, the seawater pump failed, killing all the juvenile clams, and rendering the $5,000 hatchery inoperative.

The tool of choice, employed by nearly every community on Nguna and Pele, is a small-scale spatial marine closure. Two closure regimes are preferred among Nguna and Pele communities: some villages elect to establish areas that are indefinitely closed to harvest, while others prefer to allow periodic harvests in generally-closed areas. Since the first indefinite spatial closure was established in 1998, colloquial opinion is that that each of these reserve strategies is effective.

That is, many believe that the set of rules operating in their own village is ideal. But in order to help fulfill the goals ni-Vanuatu people have set for their MPAs it is critical to evaluate them, look for commonalities with other resource management regimes, and ultimately enable them to adapt. This dissertation research derives from my own desire to contribute to that learning process, valuable not only for the MPAs of Vanuatu, but ideally for resource management strategies throughout the world.

Most important to the scholarly development of this work has been the ongoing collaboration I continue to enjoy with the people of Vanuatu. We were an unlikely group: a lone foreigner alongside fishermen, chiefs, mothers, council members, boat captains, gardeners, politicians, youth, elders, bungalow owners and civil servants. Together however, we were able to step into the metaphorical shoes of a large multidisciplinary academic research team.

While the intellectual property of this thesis is my own, the fuel and passion for the ideas contained within come from the people of Nguna and Pele Islands, people who I consider to be life-time friends and colleagues. For each of us, 2002 marked the beginning of a journey of solutions, a journey that far-transcended academic or theoretical pursuits. This dissertation represents only a small part of the larger contribution I hope I have made (and pledge to continue to make) to the people of Vanuatu. The following words make up my contribution to academia; a contribution which I hope will enable and encourage other scholars to directly or indirectly improve the livelihoods of the ni-Vanuatu to whom I owe so much.

CHAPTER 1 - INTRODUCTION

1.1 Theoretically based MPA investigations

Marine protected areas (MPAs) are one of the most widely used tools for the management and conservation of coral reef fisheries and ecosystems (Mora et al. 2006; Wood et al. 2008). Ecological theory has been the primary contributor to contemporary MPA science to date, specifically by designing and investigating closures that meet ecologically validated criteria: size, spacing, representativeness, larval connectivity, and networking (Airame et al. 2003; Almany et al. 2007; Ballantine 1997; Baskett et al. 2007; Jones & Carpenter 2009). Although new breakthroughs in ecological marine science are continuously made (Almany et al. 2009; Cudney-Bueno et al. 2009; Planes et al. 2009), many MPAs (particularly those in developing countries) have failed to meet their management objectives (Alder 1996; Kelleher et al. 1995; McClanahan 1999). While there exist substantial gaps in the marine science pertinent to MPAs (Sale et al. 2005), it is now widely recognized that MPA failures are equally due to social, economic and cultural factors (Christie et al. 2009; Cinner 2007; Mascia 2003).

In theory, MPAs prevent or minimize human extractive pressure on resources and associated human-caused ecosystem damage (Roberts & Polunin 1991). Marine protected areas therefore have as much to do with managing people as with managing fish (Laffoley 1995; Maguire et al. 1995). In consequence, a 'successor science' has been called for which explicitly acknowledges that natural resources are part of complex social-ecological systems, in which there are inextricable links between individual components (Berkes et al. 1998; Cinner et al. 2009; Folke & Rockström 2009; Goldman 1997; Paavola et al. 2009). Until very recently, there existed a critical gap between acknowledging the importance of cross-disciplinary variables and actually placing them within social-ecological theoretical frameworks.

This dissertation aims to bridge that gap by contextualizing marine protected areas as linked components of social-ecological systems. Focusing on a set of coral reef marine protected areas in the Republic of Vanuatu gave me the opportunity to explore, in comprehensive detail, the contextual social and ecological factors which influence and are influenced by them. Specifically, this dissertation sets out to investigate how broader ecological, social, cultural and political contexts influence the selection and outcomes of different MPA operational rules. To achieve these aims, the dissertation is divided into twelve chapters each addressing gaps in present MPA theory and understanding.

1.2 Addressing critical gaps with the Vanuatu case study

To date, much of the empirical research on the integrated social and ecological components of MPAs has been focused on single case studies (Aswani 2002; Cinner et al. 2007; Crawford et al. 2006; Pomeroy & Douvere 2008). However, single case study investigations run the risk of suffering from endogeneity, foregoing general applicability

because unique local contexts (with an unlimited number of potential causal conditions) may underlay correlations and conclusions (Agrawal 2003). To overcome this problem Agrawal suggests that purposive sampling be utilized in structured comparative case analyses to select cases for the variation they represent in theoretically significant variables (2003 pp 255). Accordingly, robust empirical comparative case studies of MPAs should control or minimize variation that is not theoretically significant.

Additionally, investigations about MPA success should focus on those regimes that have been maintained over time. Although many MPAs in the Caribbean, and South East Asia have experienced high failure rates (Burke et al. 2002; Burke & Maidens 2004; Kelleher et al. 1995), those in the Pacific Islands have, in many cases, achieved moderate levels of success (Alcala & Russ 2006; Gilman 1997; King & Faasili 1999; Pomeroy et al. 1997) (although there are examples of Pacific failures (Cinner et al. 2009) and South East Asia successes (Pollnac & Seara 2010; Pollnac et al 2001; Christie and White 2007). The Pacific Islands region has been identified as a "major priority" for new protected area expansion (Rodrigues et al. 2004), and is experiencing a renaissance of locally-based marine management initiatives (Johannes 2002b). The Republic of Vanuatu in particular has received considerable attention for the success of its community-based marine closures (Johannes & Hickey 2001; Johannes 1998b).

Chapter two establishes the suitability of MPAs in the Nguna-Pele area of Vanuatu to serve in this type of structured case study comparison: half of these MPAs have strict no-take operational rules, while half allow periodic harvest. Building theoretically structured case study analyses around successful MPAs in Vanuatu (and the contexts in which they operate) may provide information that is broadly relevant to marine management elsewhere.

Commons pool resource scholars are now refining frameworks which enable practitioners from different disciplines and working with different theories to investigate complex social-ecological system interactions and outcomes (Anderies et al. 2004; Ostrom 2007; Ostrom et al. 1994). Although applied widely to natural resource management scenarios including forestry, fisheries and agriculture (Gibson et al. 2000; Meinzen-Dick 2007; Rudd 2004), these social-ecological frameworks have not yet been applied to MPA investigations. Chapter three establishes the theoretical underpinning for this dissertation. It reviews the applicability of commons theory for investigating Vanuatu's MPAs and presents alternatives that explicitly situate MPAs within complex social-ecological system frameworks.

1.3 Moving beyond site-based understanding

In the Pacific one finds an array of marine use and management initiatives (Aswani et al. 2007; Aswani & Lauer 2006; Carrier 1987; Cooke et al. 2000; Hviding 1996; Jennings & Polunin 1996b; Johannes 1978; King & Faasili 1999; Polunin 1984; Wright 1985). These practices are often labeled 'customary' and considered integral components of Pacific Island culture (Foster & Poggie 1993; Lam 1998; Ruddle et al. 1992; Veitayaki 1997). It is often argued that these strategies have been in place for centuries (Johannes 1998a;

Ruddle 1989) or even millennia (Hickey 2001). Although rarely visible to those outside the Pacific, there is strong internal pressure for communities to conform to and emphasize an indigenous identity, even though the historical factuality of these practices is unknown (Foale et al. 2005; Redford & Richter 1999).

In order to move beyond suppositions and assumptions about the historical existence and contemporary relevance of customary marine management in the region as a whole, robust historical research is required. Various studies have sought to validate the historical longevity of customary management in the Pacific Islands, although they tend to be housed within a single discipline like archaeology (Dalzell 1998) or anthropology (Foale 2008). Multidisciplinary assessments have examined the historical management of Pacific forests (Bayliss-Smith et al. 2003), but this approach has not yet been applied to investigate MPAs or customary marine closures. Chapters five through seven address this gap by investigating the longevity of 'customary' marine resource management on Nguna and Pele using diverse disciplines including ecology, oral traditions, ethnography and archaeology.

1.4 Answering locally relevent and posed questions

As highlighted in the prologue, this dissertation developed alongside questions posed by local residents about their community coral reef marine protected areas. Answering questions for and alongside indigenous communities was facilitated by participatory tools that are commonly underpinned by decolonizing research epistemologies. Chapter four describes the philosophical orientation of this dissertation and details the specific approaches used to ensure that knowledge was equitably generated and that local people's specific questions were addressed. In many cases, locally-posed questions probed obvious gaps in the existing scientific knowledge about MPAs. For example, local village coumcils wanted to know which of the two MPA regimes employed on Nguna and Pele was more biologically effective: no-take reserves or closures that allowed periodic harvests.

Much of the marine-reserve literature focuses on the outcomes of permanent protection (e.g. Lester & Halpern 2008; Russ & Alcala 2004), whereas periodically harvested marine closures have received little attention. In many developing countries, including those in the Pacific Islands, socioeconomic realities, utilitarian mental models, and high dependence on resources inhibit the use of permanently closed marine reserves (Crawford et al. 2006; Foale & Manele 2004; McClanahan 1999). Closures that allow periodic harvest may be more appealing to subsistence users and enjoy higher compliance of rules and restrictions (Aswani et al. 2007; Cinner et al. 2005a). However, only a handful of studies have contrasted the ecological outcomes of permanent and periodically harvested reserves (Aswani & Weiant 2004; McClanahan et al. 2006; Williams et al. 2006). Furthermore, these studies have been confounded by sampling designs that lack robustness (Aswani & Weiant 2004), harvest scenarios which do not match those of most Pacific Island communities (Williams et al. 2006) or case studies with variable reserve size, habitat structure and cultural contexts (McClanahan et al. 2006). Chapter eight

addresses this critical gap, by empirically investigating the outcomes of MPA strategies that contrast with the dominant no-take paradigm.

Island residents also asked why some communities establish strict no-take reserve rules while others do not. Despite their widespread contemporary implementation, the suitability of marine protected areas in the Pacific Island region has been called into question, principally for an assumed incongruence with local ideologies (Foale & Manele 2004; Ruddle & Hickey 2008). Recent reviews suggest that the motivation for Pacific Island marine management expansion is grounded in food security concerns (Bell et al. 2009) and not in abstract biodiversity conservation concepts (Adams & Dalzell 1994) nor due to a conservation ethic (Foale 2001). However, studies of MPA motivations in the Pacific Islands have not been based in robust empirical research, as they have elsewhere (Brown et al. 2001; Dixon et al. 1993; Oracion et al. 2005). Chapter nine addresses this gap by investigating why communities on Nguna and Pele are motivated to establish different types of MPAs and whether or not they perceive each to be successful in meeting local objectives.

In addition to potentially producing different ecological outcomes, different MPA strategies can have very different impacts on stakeholders depending on the socioeconomic context in which they operate (Cinner 2007; Foale & Manele 2004). The resource management literature has focused heavily on the contextual conditions that are associated with successful management regimes including MPAs (Mascia 2004; Ostrom 1990; Pomeroy et al. 2001; Pomeroy et al. 1997). Most recently however, investigators have begun examining the conditions that enable regimes to emerge or be selected by collective action groups (McCay 2002), although these studies have yet to examine the emergence of different MPA strategies. Expanding on the local query about why different MPAs regimes are variously selected, Chapter ten investigates the socio-economic and contextual conditions which may enable the emergence and selection of divergent MPA operational rules.

Confounding both MPA policy and investigation, communities in the Pacific Islands are diversely labeling their marine closures as protected areas, reserves, sanctuaries, conservation areas, managed areas and taboos (Caillaud et al. 2004; Keen & Mahanty 2006; Veitayaki 2003). Thus conflicts are arising in the Pacific similar to those that erupted internationally over what was meant by the phrase ‘marine protected area’ (Agardy et al. 2003). The MPA terminological dispute was subsequently abandoned (Gaines et al. 2001) particularly when all acknowledged the ideological nature of the debate. Chapter eleven seeks to investigate the contemporary discourse surrounding community closures in Vanuatu, highlight emerging patterns and provide practical opportunities for concensus to move past ideological constraints to MPA development.

Chapter twelve holistically combines the findings from each of the preceding chapters into the theoretical framework presented in Chapter three. It serves as a platform to 1) contextualize the social and ecological variables found to be important to the MPAs on Nguna and Pele and 2) highlight broader lessons about MPAs that can be learned from

this Vanuatu case study. This final chapter summarizes the contribution the dissertation makes to Commons theory and MPA science; particularly through its challenge to widely held paradigms, theoretical frameworks and disciplinary methodologies.

1.5 Structure of the dissertation

The governance of marine resources in Vanuatu is, like most real-world problems, a complex puzzle. The dissertation begins with a comprehensive review of the existing archaeological and historical information on marine resource use in central Vanuatu. The historical archives provided the basis of a critique of exsiting paradigms of customary marine management including the taboo institution. Next I examine the political nature of *kastom*, and relate it to the prevalence of and implications for current marine management rhetoric. Then I, alongside a dedicated team of Nguna-Pele colleagues, set out to investigate the ecological effectiveness of different coral reef closure strategies. In addition we examine the motivations for establishing contemporary closures as well as the socio-economic factors which may enable reserve selection.

The reader will detect a common thread running throughout the dissertation based on the theoretical framework presented in Chapter three. Empirical findings are continuously reconsidered and recontextualized as they relate to MPAs and other components of linked social-ecological systems. The last chapter formally presents these diverse findings as a set of interrelated variables that define a future research agenda on marine governance institutions.

CHAPTER 2 - THE VANUATU CASE STUDY

2.1 Vanuatu case study context

The Republic of Vanuatu is a Y-shaped archipelago located in the Southwest Pacific Ocean (13°-20°S, 166°-172°E). There is a distance of roughly 850km from the northernmost island to the southernmost. The country is comprised of more than 80 islands, many of which are of volcanic origin formed in the Miocene (>5 million years BP) (Amos 2007; Quantin 1975). The total land area of Vanuatu is 12,336km^2 (NACCC 2007), set within a 200-mile exclusive economic zone (EEZ) of approximately 680,000km^2 (King 2007).

Vanuatu's coastline extends for 2,500km, much of which is vegetated by coconut plantations (UNDP 2005), and fringed with ~620km^2 of coral reefs (King 2007). The area of accessible inner reefs and lagoons is approximately 448 km^2 (Amos 2007). The National Biodiversity Action Strategy lists 34 endemic, endangered or threatened species in Vanuatu, including 7 fish and 2 mollusc species (Vanuatu Environment Unit 1999). Due to its high endemic biodiversity, Vanuatu has been included in Conservation International's Eastern Melanesian hotspot (Conservation International 2005; Myers 2003).

The national GDP is approximately $1,500USD (although it has remained constant over last twenty five years) ranking Vanuatu of 207th out of 233 countries (Henckel 2006). On the United Nations Human Development Index, Vanuatu ranks 118th of 177 countries (Henckel 2006). Absolute poverty levels are high, with twenty six percent of the population subsisting on less than $1 US dollar per day (King 2007). More critically, around forty percent of the population do not have access to clean water (Henckel 2006) and less than 0.1 percent of the population are enrolled in secondary school (Hughes & Sodhi 2008). Accordingly, Vanuatu is currently ranked as a Least Developed Country (LDC). However, due to recent improvements in human indicators like health and literacy, the UN has begun to review its status. The national government hopes to avoid the status "graduation", and maintain current levels of aid and trade assistance, by making the case that it remains extremely environmentally and economically vulnerable.

Population in Vanuatu has risen by 2.5 percent since 1975, giving it one of the highest population growth rates in the region (after Nauru 5.4 percent and the Solomon Islands 2.9 percent) (Hughes & Sodhi 2008). Today Vanuatu's population stands at just over 220,000 (Bakeo et al. 2000). Roughly eighty percent of the population reside on the coastal plains which encircle the rugged interiors of many islands (Mourgues 2005), although small interior villages can be found on the islands of Tanna, Malekula and Santo. Population density is relatively high, with sixteen people per square kilometer (King 2007). The most densely populated areas are in and around the two major urban centers of Port Vila (Efate Island) and Luganville (Santo Island). Vanuatu's population is

one of the most linguistically and culturally diverse in the world (Crowley 2007; Lynch & Crowley 2001).

Eighty percent of the population engage in artisanal agriculture and seventy seven percent in small-scale fisheries (Bakeo et al. 2000), infrequently using cash currency in daily interactions (Bazeley 2006). Tourism is rapidly emerging as a major contributor to the economy, particularly in urban areas, with international arrivals increasing by sixty percent from 2003 to 2008 (Duncan 2008). However, much of the country is cut off from tourism, living without electrification or major infrastructure (Johnston 2005). With the relatively recent but widespread use of small generators and solar panels, even remote islanders are now frequently using small appliances like televisions and mobile phones (Pacific Institute of Public Policy 2008).

2.1.1 Resource management responsibilities; national and local

As a signatory to international biodiversity conventions and treaties[1], the central government of Vanuatu has a responsibility to implement and manage protected areas. To meet these obligations, Vanuatu's parliament has passed several pieces of legislation that deal broadly with natural resource management and conservation[2]. The constitution gives all land to ni-Vanuatu customary owners and their descendents[3] along with the duty to protect and safeguard national resources and the environment (Government of Vanuatu 1988). Several pieces of auxiliary legislation specifically enable the creation of MPAs, including the National Parks Act (national parks), the Forestry Act (conservation areas), the Environmental Management and Conservation Act (community conservation areas), the Protection of Sites and Artifacts Act (protected sites), the Decentralization and Local Government Regions Act (protection zones) and the Fisheries Act (marine reserves).

The Fisheries Act (Cap 158, 1982) governs the use of "Vanuatu waters". It defines these as "waters of the exclusive economic zone, territorial sea, archipelagic waters, and internal waters…and any other waters over which Vanuatu claims fisheries jurisdiction." It specifically curtails the harvesting activities of foreigners and ni-Vanuatu (i.e. licensing, gear restriction, and species protection) although these restrictions are notoriously difficult to enforce and often go unheeded in rural areas.

Section 20 of the Fisheries Act provides for the establishment of marine reserves. Specifically, "the Minister may, after consultation with owners of adjoining land and with the appropriate local government council, declare any area of Vanuatu waters and the seabed underlying such waters to be a marine reserve." As signaled by the minister's direct intervention, this type of designation is for areas of high social or ecological relevance and is generally not appropriate for the small-scale community closure.

1 CITES (1989), Convention on Biological Diversity (1993), World Heritage Convention (2002).
2 The Wild Bird Protection Act (1965), International Trade (Flora and Fauna) Act (1989), National Parks Act (1993), Forestry Act (2001), Water Resources Management Act (2002), Environmental Management and Conservation Act (2002), Fisheries Act (2005).
3 The definition of customary land owner is the source of much conflict and debate in Vanuatu. In general, land was never historically owned by individuals, but rather by clans, tribes and family groups.

The Department of Environment and Conservation, on the other hand, has recently begun to implement the Environmental Management and Conservation Act of 2002. It is specifically designed to recognize and enable small scale community conservation closures. Part (4) of the EMAC Act provides for the recognition and registration of permanent Community Conservation Areas (CCAs). Registration is subject to four community requirements: the area must have 1) ecologically sound management objectives; 2) clear and undisputed boundaries; 3) consent and approval from interested parties; and 4) an appropriate management plan.

Confounding the issue of responsibility for protected areas however, Vanuatu's ministries and government departments often hold overlapping mandates, and intra-organizational coordination is minimal and fraught with gaps (King 2007; Lane 2006; Tom'Tavala & Hakwa 2004). "In terms of institutional consciousness and preparedness [for protected areas] the situation in Vanuatu is arguably depressing…much remains to be done in the area of intergovernmental and inter-institutional coordination." (Lane 2006 pp 6). To improve governmental cooperation in support of village-based resource management, the Vanuatu Village Based Resource Managed Areas Network (VBRMA) was established in 2009.

In the Pacific Islands in general, and in Vanuatu in particular, governance and decision-making institutions most commonly operate at the community level (Berkes 2009). Despite national-level responsibilities, the actual management of natural resources in Vanuatu is typically undertaken by villages or communities with little direct intervention by the central government (Johannes 1998b; Low & Davenport 2002). This may be due in part to the government's limited capacity to centrally implement or enforce management across the archipelago (Huffer & Molisa 1999; Lane 2006), as is also the case in other Pacific Island countries (Foale & Manele 2004; Rose 2008). Additionally, bureaucratic and procedural processes operating at national scales may not fully provide adequate support to communities (Rose 2008).

Non-centralized governance and ownership pose significant implementation challenges for effective and well-coordinated marine reserve networks in the Pacific Islands (Lam 1998). Conversely, decentralization affords each community an important degree of flexibility to design and implement an MPA that suits its own contexts and purposes. Ultimately, community-based resource governance, alongside national-level advice and coordination, is Vanuatu's de facto coastal resource management policy position.

2.2 Case study of MPAs on Nguna and Pele islands

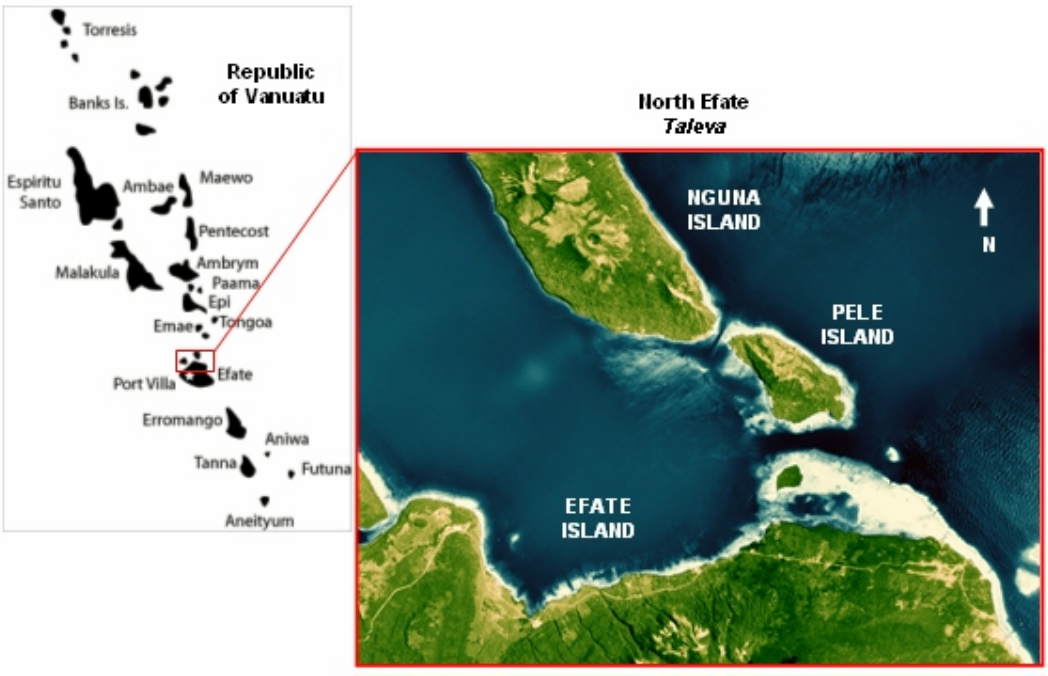


Figure 1 Map of the North Efate, Taleva region in Vanuatu

Nguna and Pele Islands are located in the central part of the Republic of Vanuatu, in Shefa province (17ºS 168ºE). These islands were formed by volcanic eruptions in the Late Pleistocene (~10,000 years BP) and make up the lower rim of a major submerged caldera to the north (Greene et al. 1988). The fertile soils of Nguna and Pele reflect the continuous volcanic activity occurring until very recently. Nguna's highest point is, in fact, a dormant volcanic cone. A recent archaeological dig on Nguna found more than two meters of basaltic topsoil, likely originating from the Kuwae eruption in AD 1425 (Bedford 2004; Monzier et al. 1994)

The North Efate region is colloquially known as "*Taleva" or "the other side"*, and is circumscribed geographically. The Taleva region, covering roughly 95km^2, includes the Northern quarter of Efate as well as the satellite islands of Nguna, Pele, Moso, Lelepa and Emao. These satellite islands are situated between one and seven kilometers off the north coast of Efate (Figure 1). More than forty villages with a combined population of 10,000 identify themselves as belonging to the Taleva region, each speaking the same *Nakanamanga* language (Lynch 2000).

Each of the islands in the Taleva region, including Nguna and Pele, is surrounded by fringing reefs (Dickinson 2001). These reefs are generally no more than 100 m wide and in many places begin directly on the shoreline. Coral reefs constitute the nation's most biologically diverse coastal system (Amos 2007). Efate's 8,100 hectares of fringing coral reef make up roughly eighteen percent of the national total, the largest portion of any one island (ibid).

Like the rest of rural Vanuatu, the people of Nguna and Pele subsist on the products of agricultural and fisheries activities. However, small-holdings agriculture is undoubtedly

the most socially and economically important subsistence activity practiced by local residents (Lini 1980). Income on Nguna and Pele is largely generated by supplying root crops, fish and handicrafts to the national market in nearby Port Vila (the capital city of Vanuatu). Other forms of income also support the local economy including small trade stores, tourism bungalows, boat and truck transport, small-scale construction and family remittance. The largest expenses for families on Nguna and Pele include school fees, store bought-food (like rice, tinned fish, sugar and kerosene), clothing, community fundraising obligations and church tithes/offerings.

Figure 2 Women in the North Efate area preparing the traditional dish of laplap for sale in the Port Vila market

2.2.1 Population and organization

The combined population of Nguna and Pele Islands was just over eleven hundred people at the time of the last national census (Bakeo et al. 2000). It is spread unevenly among sixteen communities or villages, ten of which are located directly on the coast. No village is more than a three-hour walk from any other. Villages on Nguna and Pele range in population size from under 100 to over 500 people.

A hereditary paramount chief presides over each village, assisted in governance duties by one or more lower chiefs. The function of the paramount chief largely deals with preservation and promotion of custom (Bolton 1998). Day-to-day affairs and community administration however, fall to the democratically elected village council as is common in other parts of the country (Huffer & Molisa 1999). The council apparatus is a direct artifact of the influence of the Christian Church, and is often made up of several specialized committees and working bodies[4]

2.2.2 Terrestrial resource use and ownership

In Vanuatu, all land belongs to customary owners by decree of the national constitution. However, the definition of customary ownership remains undefined and has partly led to the current legitimization crisis facing the nation (Nari 2000). In Vanuatu, customary

4 Planning committee, conservation committee, kindergarten committee, water committee, project committee, etc.

land owners are not always (or even usually) individuals, a trait that existing statutory land policy does not appropriately capture (Regenvanu 2008). Group rights of access to natural resources is the norm in Pacific Island societies, and is especially relevant and commonplace in the marine context (Ruddle 1998).

Encouraged by regional economic policies and exacerbated by investor-driven land acquisition (Hassall 2005; Regenvanu 2008), there is a trend away from group and toward private land ownership in Vanuatu. Today land stewardship rights are transferred patrilineally, yet decisions about extraordinary use and major developments must be made at the communal level (Arutangi 1971). On Nguna and Pele, land areas and garden plots currently have relatively clear boundaries, though ownership lies with extended families rather than individuals. However, in recent years some individuals have sought to acquire legal deeds over their land. Official land deeds are a source of much dispute and controversy on Nguna and Pele, often causing the breakup of family and community groups. According to public knowledge, no land on Nguna and Pele has (as yet) been leased to foreign investors.

Village boundaries on Nguna and Pele are different from the boundaries that demarcate family land parcels. A family/individual can hold land in several different villages, but a strong sense of village-ism and community patriotism exists on these two islands. Identifying with and belonging to a particular community or village affords a critical safety net, ensuring continuous access to resources, even for those without hereditary entitlements (Jowitt 2008). Thus, the geographical boundaries of a community hold utilitarian importance on Nguna and Pele, even though most families have access rights to land outside their own community. Village boundaries on Nguna and Pele commonly originate from the top of a hill and follow a well defined physical feature, such as a creek or stone wall, to the coast.

Due to the uncodified and heterogeneous nature of a 'community,' village boundaries are typically unclear and commonly under dispute. Most villages have areas of overlapping boundaries with adjacent communities. An unremarkable fact of life for most residents, these boundary disputes have occasionally flared up into hostilities when benefits of tourism or infrastructural development were at stake.

Despite infrequent tensions between communities, the Nguna-Pele area is locally renowned for its area-wide historical collaboration. Villages on the two islands share a unique dialect as well as similar cultural and customary practices. Intermarriage among island villages ensures that social connections remain strong. A legacy of the Christian Church's presence on Nguna and Pele (see Chapter seven) is the existence of robust, dual-island networks like the Nguna-Pele Presbyterian Session and the Nguna-Pele Council of Chiefs (NAPE).

2.2.3 Marine resource use and ownership

Few individuals or households on Nguna and Pele make an exclusive living from the sea, though most are involved in opportunistic fishing and reef gleaning. Some coastline

villages, those on Pele for example, have a more frequent interface with sea resources than their inland counterparts. Household diets of sea resources is variable on both islands and is dependent on the capacity and time allocated to fishing by family members.

Figure 3 Men from Nguna and Pele fishing and collecting octopus

In general, no single individual in Vanuatu can legally claim an area of reef as his own private property, even if his land sits adjacent to the sea. The Land Leases Act (Cap 163) stipulates that legal land tenure extends only to the mean high water mark. While land can be titled and leased under Vanuatu law, the sea remains the exclusive domain of the state and customary owners (Johannes 1998b). Although reefs legally belong to the state, local communities are considered the *de facto* owners of adjacent reefs. But, in stark contrast to land ownership, areas of reef on Nguna and Pele are not partitioned off for use by particular families or groups. A myriad of perceptions about marine boundaries on Nguna and Pele make them inherently difficult to identify. Many consider the sea tenure boundary to extend well into deep water, with some even citing the horizon.

Reefs are openly used by all members of a given community, with residents rarely excluding their fellow community members. Full time residency is the most common, but not exclusive, determinant of community membership and reef usage rights. Regular access to marine resources may be an important motivation for seeking clear and well-recognized community boundaries. Community access to marine resources is generally allowed if it fulfills subsistence or small-scale commercial needs. Major developments however, such as shoreline construction or large-scale commercial harvest, require permission of the chief and the village council. It is not uncommon for a village member to make a monetary contribution to the council when undertaking a larger-than-usual harvest from village sea tenure area.

Exclusion of non-community members from using village resources is a *de facto* practice on Nguna and Pele. While the reef is considered public domain *within* the community, individuals from neighboring villages are actively excluded. It is generally not tolerated for an outsider to fish on a village's reefs, even if those reefs are located hundreds of meters off the coast.

2.2.4 Marine resource governance

Although respect for the chiefly institution has eroded throughout the region, it remains robust in most parts of the Vanuatu archipelago (Forsyth 2004; Lindstrom 2008). One role of the chief is to grant or revoke permission for outsiders to use a community's reef resources, although this right does not imply his ownership over those resources (Taurakoto 1984). Permission must always be sought from the chief before reefs can be used by an outsider. In practice, however, the village council holds daily responsibility to define the uses, developments and restrictions within the community's sea tenure area.

The Nguna-Pele area may be one of the most advanced in Vanuatu in terms of its general consciousness of natural resource management issues. Each community's village council has established a conservation committee, whose primary responsibility is the maintenance and regulation of terrestrial and marine resources. Conservation committees propose and adapt the specific rules for use of the reef. These committees report to and follow the mandates of the village council, who in turn work under the guidance of the paramount chief.

It is considered everyone's responsibility, including residents, the conservation committee, village council and chiefs, to comply with village marine regulations and report trespassers. Enforcement and surveillance is not difficult in most cases, as reef areas are visible from the village. In cases where the reef is located away from the settlement area, trespassing events are reportedly more frequent.

Infraction of the rules by community members generally incurs a fine payable to the chief, which he divides among the council and conservation committee[5]. Infractions that involve non-community members are dealt with directly by the chief or village council of each respective community. Fines for non-community members are generally higher as these offenses are viewed as more severe[6].

In general, tension and ambiguity characterize the relationship between village, provincial and national-level marine policies. Higher levels of government do recognize local governance institutions via official Island Courts and Land Tribunals, but village councils do not yet receive formal endorsement or authority in national legislation[7].

2.3 Fisheries closures, coral reef reserves and diverse MPA operational rules

Two types of marine closures are common in the Nguna and Pele area: those that are permanently protected and those that are periodically harvested. Permanent reserves are those in which the community indefinitely closes all harvest activities. As in other places in Vanuatu, these are often called protected areas, conservation areas or MPAs. In

5 Fines are typically on the order of 500vatu ($5USD) for a first offense and a pig for repeated offenses
6 These fines may start at 10,000vatu ($100USD) and include pigs and woven mats
7 The Environmental Management and Conservation Act is currently being amended to formally recognize the marine regulations set by village councils, however it will not provide for rule enforcement or penalization.

contrast, periodically harvested closures do not permit harvest during their term but are designed to be re-opened in the not-too-distant future. These are often called 'taboos' on Nguna and Pele. Periodically harvested reserves may allow infrequent and well-controlled harvest at any time, but generally not more than one or two times per year.

Closures of all types generally restrict all species enclosed within them, although reserve openings and harvests may target specific organisms. For example, a harvest event may allow the capture of fish, but forbid the collection of trochus or giant clams. In some communities, the harvest of important species like trochus, biche-de-mer and giant clams are always prohibited, inside and outside of closures.

The decision to implement a marine reserve is nearly always taken democratically. The village conservation committee commonly makes the suggestion in a village meeting, followed by public debate among residents. If approved, residents discuss potential locations and the closure rules to be implemented. Final approval by residents to declare an MPA can take up to a year of detailed planning by the conservation committee. When a declaration date is fixed, notices are sent to adjacent villages informing them of the impending closure.

Each closure declaration is attended by particular rites and formalities, therefore ceremonial preparations for the closure are usually made well in advance. The village chief, acting as the symbolic resource steward, proclaims the area off limits following the terms agreed by the community. The paramount chief, or one of his assistants, will generally evoke ancestral and magical protection over the area, deterring potential rule-breakers and trespassers. Often, several pigs are killed at the site. Boundaries of the closed area are demarcated with recognizable custom objects. On Nguna and Pele, a *namele* palm leaf tied to a stake is the most commonly-employed marker, though large white stones, pig jaws and painted signs are also used.

Figure 4 Paramount Chief with the *namele* palm MPA marker

2.3.1 Networking of community MPAs

In 2002, four paramount chiefs established the Nguna-Pele Marine Protected Area Network in order to better coordinate the management of their village marine closures. They felt that village strategies were ineffective in isolation; resources were declining at an unprecedented rate. With the technical and ideological assistance of the Fisheries

Department, the Vanuatu Environment Unit and international volunteer organizations, the network's membership has since expanded to include fourteen communities on Nguna and Pele[8].

The Nguna-Pele MPA network is managed by representatives from each member community. Membership is open to all communities on the two islands. A full-time local manager, several part-time local staff and local village volunteers carry out the day-to-day activities of the network. These activities include cleanup campaigns, awareness talks, sea turtle tagging, eco-tourism, tree planting, social-ecological monitoring, and management evaluation.

The Nguna-Pele MPA network itself does not hold ownership, decision-making or enforcement rights over the sea-tenured areas of any of its village members, nor does it dictate the type of closure and associated rules to be implemented. Rather, the network brings together representatives from each community to discuss, coordinate, and collaborate on relevant marine and terrestrial resource issues. Networking has enhanced the political bargaining power of area communities with the national and provincial government, resulting in better support for marine management.

The benefits of networking are widely recognized, with villages often willing to adopt management strategies that may be most directly valuable to neighboring 'downstream' communities. For example, a recent Crown of Thorns starfish outbreak was contained because dozens of area representatives planned and jointly implemented a clean-up strategy in the affected village. Discussions at Nguna-Pele MPA Network meetings have also influenced the positioning of new MPAs, particularly at boundaries with other communities, in order to create larger cross-tenure closures. This island-wide collaboration on Nguna and Pele represents Vanuatu's first attempt at ecosystem-level conservation planning.

2.4 Summary

This Nguna-Pele case study from Vanuatu presents, within a single geographic area, a natural comparative experiment for studying the emergence, evolution and outcomes of diverse types of marine resource management regimes. Although the communities of Nguna and Pele Islands all speak the same language, have experienced similar historical patterns and are faced with the same current social, economic and political pressures, two divergent types of marine management have emerged. This chapter identifies and describes these as permanent no-take marine reserves and periodically harvested taboos. Both types of contemporary closures are integrated within customary, chiefly and ceremonial practices, and are locally governed. Thus, there can be no suggestion that one is internal and the other external. Additonally, marine closures on Nguna and Pele are

8 Laonamoa, Worasiviu, Piliura, Worearu, Unakap, Nekapa, Woralaapa, Malaliu, Mere, Matoa, Rewoka, Fareavau, Farealaapa, and Utanlangi. *Taloa village was an original member, but pulled out of the network (and all other island organizations) due to land disputes and political infighting.

driven, managed and enforced by communities, suggesting that benefits of some kind are being locally obtained or perceived.

Community tenure is an important factor related to the establishment of marine closures in the area. The concern over tenure and community boundaries has been shown to both limit and enable marine management on Nguna and Pele. Despite strong community tenure claims and chiefly-vested power over marine resources, cross-boundary discussion and governance has been possible through the Nguna-Pele Marine Protected Area Network. Although likely not acting purely altruistically, communities have demonstrated that they are willing to compromise and collaborate to obtain collective benefits. Networking is likely enhanced on Nguna and Pele because of the shared language, geographical proximity, and shared historical trajectory. Additionally, the network emulates previously existing island-wide organizations and flexibly incorporates both types of MPAs. While not directly implementing or managing reserves, the Nguna-Pele MPA network has a powerful indirect influence on the scope and connectivity of the area's marine management.

This area proved an advantageous opportunity for this study of marine reserves not only for the natural experiement of permanent and periodic closures, but also the existence of a forward-looking and supportive organization in the Nguna-Pele Marine Protected Area Network. The Network's existence demonstrates a concern for and receptiveness to marine resource management, something many other communities in the Pacific may yet lack.

Figure 5 Meeting of the Nguna-Pele MPA Network, collecting sea urchins, net fishing, and cleaning fish for market

CHAPTER 3 - MPAS; A THEORETICAL CRITIQUE AND SYNTHESIS

"A paradigm is the equivalent of a language or culture: it determines the questions that can be asked and those that can be excluded, the thinkable and the unthinkable" (Bourdieu & Nice 2004 p 15)

3.1 Orthodox paradigms of marine governance

Marine protected areas (MPA) and marine reserves are increasingly popular tools employed to manage marine resource stocks, protect species, and enhance seascapes (Mora et al. 2006), and today can be found in every coastal country on earth (Chape et al. 2008). However fisheries management in general and MPAs in particular often fail to meet their management objectives (Kelleher et al. 1995; McClanahan 1999; Mora et al. 2009). Although there are substantial gaps in the marine science pertinent to MPAs (Sale et al. 2005), many failures have occurred because local human dynamics and institutional constraints were poorly understood or ignored during MPA planning and implementation (Christie et al. 2009; Mascia 2003). In addition to ecological considerations mentioned in the previous chapter, the core element for successful marine protected area design is preventing human extractive pressure and associated ecosystem damage (Roberts & Polunin 1991), particularly as successful outcomes have less to do with managing fish than with managing people (Laffoley 1995; Maguire et al. 1995). Managing people focuses on strengthening, adapting or developing social institutions, which include norms, rules and shared strategies (Crawford & Ostrom 2000).

Over centuries, the dominant European tradition has defined natural resources as human property; either state owned, private or open access (Feder & Feeny 1991). In fact, property rights theory was one of the first in the social sciences to draw clear links between natural resources and human institutions (Feder & Feeny 1991; Hart & Moore 1990; North 1995). For most of European history, the seas and their resources were considered open-access due to technological and economic constraints (Grotius 1609). However, as sovereign navies in Europe became more powerful, and marine resources more valuable, many countries began enforcing the paradigm of *mare clausum* or private seas (Selden 1652). Due to the political structures of Europe at the time and the dominance of the European tradition on global affairs today, state-based solutions are ingrained within contemporary fisheries policy (McGoodwin 1990). In essence the state remains the "governing component" and the civil society is the "component to be governed" (Jentoft et al. 2007).

This dominant paradigm is evidenced today by the recent declaration of 200 nautical mile exclusive economic zones (EEZ) around each coastal state (Attard 1987). Even the worldwide MPA phenomenon of *mare reservarum* or protected seas (Russ & Zeller 2003), relies heavily on the actions of a coercive state and/or market pressures (Mangi et al. 2007; Oracion et al. 2005; Pérez-Ruzafa et al. 2008). *Mare reservarum* (like *mare clausem*) is possible in theory because national and international governing bodies are able to dictate the location and operational rules of MPAs and then utilize their navies, coast guards, police and legal systems to enforce those mandates (McGinley 2008; Perera & de Vos 2007).

In 1968, Garret Hardin's "tragedy of the commons" epitomized the prevailing paradigm about the value of state and market influences for natural resource management. He hypothesized that a resource not subject to use controls will be invariably exploited to tragic ruin, an ideal that remains at the heart of contemporary management and conservation ideologies (Hardin 1968; McCay 2002). Like Aristotle centuries before (Aristotle 1984 Politics II, ch 3), Hardin suggested that better care is taken of private property than that which is under common use. Controversially however, he suggested that resource over-utilization occurs because individuals operating in isolation within an open access scenario have little incentive to exercise restraint. He rationalized that this was because any ecological impacts of selfish behavior would be distributed among the entire population while the overexploiter would retain an economic advantage (Dietz et al. 2003; Ostrom 1990). Hardin further suggested that environmental degradation can only be overcome when property institutions are in place and are manifested through state control or privatization (Hardin 1968).

3.2 An alternative to state control or privatization; collective action

Hardin's seminal paper sparked an outpouring of scholarship on alternative property rights regimes and institutions that effectively control resource use (Ostrom et al. 1999). Subsequent empirical analysis of real-world situations demonstrated that while many cases lacking strong government enforcement or private property are associated with resource degradation as predicted by Hardin, there are also a vast number of exceptions (Bromley & Cernea 1989; Burger & Gochfeld 1998; Feeny et al. 1990; McCay & Acheson 1987; Ostrom 1990). Best known now as commons theory, this body of research was united in its opposition to Hardin's hypothesis and has been called "anti-tragedy" scholarship (Goldman 1997). Hardin's hypothesis was founded on a set of "extreme assumptions" (Ostrom 1990 pp 183), making predictions that hold in a potentially small set of cases. Similar simplistic assumptions are made by game theorists in the mathematical puzzles they devise to analyze specific scenarios where actors make independent decisions in interdependent situations (Dawes 1980; Rapoport & Chammah 1965).

In practice, resource users do not often operate in isolation, and instead make collective decisions about resource use and management (Sandler 1992). Self-organization for joint benefit was originally termed collective action by Mancur Olson (1965), a concept which, surprisingly, he systematically rejected throughout his lifetime, considering it improbable in all but the smallest user collectives (Olson 2002). Commons theory is based on the expectation that individuals who have the potential to interact with each other will do so, especially to "obtain continuing joint benefits even when all face temptations to free ride, shirk, or otherwise act opportunistically" (Ostrom 1990 pp 29). In the face of resource depletion, local, self-determined institutions for management often emerge, even in the face of selfish actors or free riders.

The digital library of the commons[9], a database of commons institutions, now has thousands of practical examples of successful resource governance regimes not based in state control or privatization (Castle 2009), with references hailing from agriculture, forestry, and even non

9 Digital Library of the Commons http://dlc.dlib.indiana.edu/

traditional commons like ideas and intellectual property (Hess & Ostrom 2003). The universe of commons scholarship is in a state of continuous expansion, now including the likes of email and the internet as manageable common-pool resources (Melville et al. 2006).

3.3 The 'fisheries crisis', marine commons, and MPAs paradigms

A common misconception is that all fishery resources are de facto open access and therefore especially prone to Hardin's tragedy (Clark 1980; Hardin 1968; Jentoft 2000). For that reason open-access resource dilemmas have long been referred to as the 'fisherman's problem' (McEvoy 1986). Today commercial and artisanal fisheries are involved in high stakes competition for global fisheries resources; a devastatingly complex scenario fueled by astronomical subsidies, technological advances and poverty (Clark et al. 2005; Newton et al. 2007; Pauly et al. 2002). It is rapidly becoming clear the fish are not open-access resources, particularly as governments act to curb unauthorized use (Mora et al. 2009). In addition to examples of government top down control, numerous empirical examples small scale fisheries collective management action have influenced the development of commons theory (Grafton 2005) (Basurto & Ostrom forthcoming; Berkes et al. 2006; Grafton 2005; Ostrom et al. 2007).

In many societies around the globe, fishers have developed complex collective action governance institutions to prevent overexploitation. Fishers in Turkey form fisher co-ops which partition prime fishing spots among its members to control site based competition (Berkes 1986). Chisasibi Cree fishermen in Canada divide fishing areas into family units and control harvest through seasonal and yearly rotational cycles (Feit 1973). The Seri people of Northwest Mexico have developed rules which dictate who can enter the fishery and how much each member can harvest (Basurto 2005). These case studies are not just isolated exceptions to an open-access or government control global fisheries norm. There are vast geographical regions where self-regulation and collectively managed marine use is commonplace.

Village-managed coastal fisheries in the Pacific Islands present a prime example of how communally held resources may be governed by institutions that are neither based in government control or private property (Larmour 1997; Wagner & Talakai 2007). The social and political institutions operating within many Pacific Island communities are themselves the very definition of collective action regimes; users form small village-level collectives and self-control marine use and restrict access to non-members (David & Cillaurren 1992; Hviding 1998; Hyndman 1993). For many villages, particularly in the archipelago nations of the Solomon Islands and Vanuatu, the central government is often little more than a far-removed entity; little respected if not out rightly rejected (Bonnemaison & Penot-Demetry 1994; Premdas & Steeves 1984). Commons theory may therefore be well placed to investigate the collectively determined institutions of marine governance in this region.

A key focus of commons scholarship has been to delineate the shared characteristics of successful commons institutions (Ostrom 1990), and the conditions which enable their emergence (Ostrom 2002). Commons theory may provide an insightful perspective about community-based marine reserves in Vanuatu because it considers the influence of contextual factors on governance, and does not assume exploitative human behavior and selfish "internal calculation processes" (Ostrom 1990 pp 193). Investigating and contrasting the contextual

factors associated with each diverse type of MPA established by ni-Vanuatu communities will enhance our understanding of how and why closures are designed, implemented and ultimately successful. However, before a commons theory framework is adopted here to organize and analyze research on MPAs in Vanuatu, it is critical to evaluate whether commons theory is, in fact, suitable to evaluate the collective action regimes in developing country contexts like Vanuatu. To evaluate commons applicability, relevant critiques of commons theory are reviewed and opportunities to improve current frameworks are explored.

3.4 Limitations of commons theory for MPA research in Vanuatu

3.4.1 Commons discourse

'Commons' and 'collective property' ideologies have recently been evoked by ni-Vanuatu people themselves in internal discussions about natural resource management. This fact suggests that a commons-derived framework may be an appropriate tool for investigating Vanuatu's community-based marine closures. At the Vanuatu Indigenous People's Forum held in 2007, the delegates approved the Lavatmagemu Declaration which in part read[10]:

"Natural resources include every "global commons" that are for us to share as a universal collective, including wind, air, stars, different planets, different worlds, the sun, the moon and our planet. Natural resources also include the collective property, which we strive to look after on behalf of the tribal generations from each area, including the sea, reef, land, and everything underneath, inside and above them."

Within this declaration one finds reference to common-pool goods, human management institutions, and links between social and ecological systems. However commons theory has been critiqued in its application to the South Pacific and other developing regions; critiques which must be acknowledged and mitigated before a theoretical framework is accepted here. These critiques include 1) the primacy of property rights, 2) use of powerful metaphors, 3) static systemic models, 4) inattention to social justice, 5) and apolitical analyses. In the next sections, each of these critiques is considered and addressed separately.

3.4.2 Primacy and complexity of property rights

Due to its origins in the private versus open access property debate, contemporary commons scholarship retains an innate connection to property ownership questions (Adams et al. 2002). But, the centrality of property rights in studies of common-pool goods represents a "misplaced analytic focus" (McCay & Jentoft 1998). 'Common' refers to the nature of the good, and not to the human institution of property rights (Ostrom et al 1994). While fallible property right regimes may be the cause of environmental degradation in some cases, power relationships, population growth or technological evolution may better explain outcomes in others (Frankel & Rose 2005; Goudie 2006; Urdal 2005). In the Pacific Islands for example, sea-level rise, cyclones, volcanic activity, population pressure, invasive species, tribal fighting, weak central

10 Najerel Risos emi inkludim evri 'global commons' we iblong iumi tuketa we iumi searem universe ia olsem win, air, ol sta, ol difren planet, ol difren wol, san, mun mo planet blong iumi. Najerel risos emi includim tu ol kolektiv propeti we ol traeb oli lukaotem long behalf blong ol traebol jeneresen long wanwan eria we oli stap olsem solwora, rif, kraon mo evri samting we igat andanit, insaed mo antap long kraon.

governments, and poor ecological and commercial monitoring have all been implicated in Pacific Island natural resource declines (Crosby et al. 2002; Hunt 1996; Wilkinson 1999; Wright & Hill 1993).

Global property ownership scenarios are too diverse and uniquely expressed to be classifiable into clearly defined categories like open access, common or private (McKean 1992), particularly in customary ownership contexts. In Australia, for example, aboriginal property ownership and land tenure regimes are based on spiritual affiliation, where "land is not measurable in mathematical terms, nor delineated through the mapping or textual mediums of a western society" (Brazenor et al. 1999 p 3). There also, songlines representing ancient ancestral journeys across the continent, bestow use and stewardship rights to places thousands of kilometers away from an individual's home area (Chatwin 1987). Among the lowland forest dwellers of Amazonia, property rights are communally held by the tribe. They perceive the extent of their land and resources to be "fluid and indeterminate" (Davis & Wali 1994). In Ghana, land rights are also held and defended by communal kinship-based groups (Gyasi 1994).

A diversity of tenure and property ownership regimes can also be found in the Pacific Islands. Carrier and Carrier (1983) observed highly complex and economically driven systems of tenure in Papua New Guinea and Aswani (1999) note several differing types of resource ownership regimes operating within a single region of the Solomon Islands. Wagner and Talakai (2007) argue that the complex historical and contemporary tenure regimes of the Pacific are not "captured by the overly neat categories of private, common or public property", but have "simultaneous, multilayered sets of rights, both communal and individual". Tanner (2007) argues that for Fiji, "common property concepts do not merely gloss over minor inconsistencies, they fundamentally misrepresent how the system works."

To conceptually move beyond this critique, it is important to explicitly define how the term commons will be used in this dissertation. In lieu of the more widely cited, but misinterpreted term 'common property resource', hereafter the term common-pool resource (CPR) will be applied to resource units independent of the property-rights regime which governs them (McCay 1996; Ostrom 1990). Recognition of this shifted discursive and analytical frame is required if commons theory is to be appropriately utilized in the Pacific Islands. To be considered common pool, resources must possess two characteristics:

> 1) the resource system produces a limited supply of resource units, and use by one individual will subtract from the quantity available to others and
>
> 2) there is a cost associated with excluding potential beneficiaries

In other words a common pool resource is intrinsically different from a public good because it is both nonexcludable and subtractive (Cornes & Sandler 1996; Ostrom & Ostrom 1977).

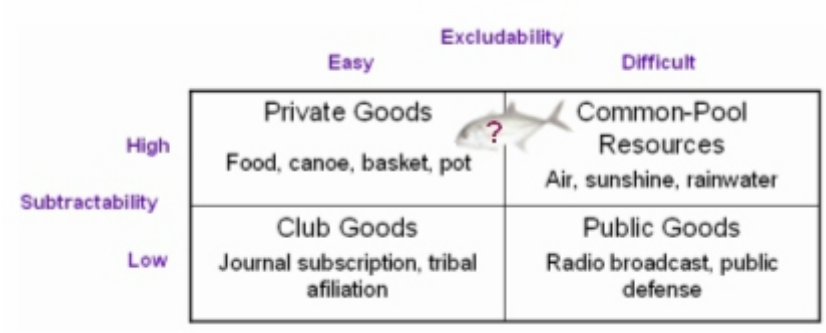


Figure 6 Conceptual model for classifying goods and common-pool resources. Adapted from (McKean 2000 pp29) and (Ostrom et al. 1994 pp7). The questionable fish highlights the complex nature of fisheries ownership rights and marine tenure regimes in the Pacific Islands.

3.4.3 Powerful metaphors and universal panaceas

While recent commons work highlights the diversity and complexity of collective choice governance regimes around the world (Dietz et al. 2003), much of the early literature indirectly (and often unintentionally) promotes a universal commons governance panacea[11]. Take for example the language utilized by Ostrom to describe the set of commonalities among institutions that sustain CPRs: design principles (1990). Because commons discourse has utilized powerful metaphors in the past, there exists the potential to misrepresent the complexity and diversity of local systems (McCay & Jentoft 1998). It has since been argued that developing lists of universally important conditions enabling successful management regimes is "flawed" and "costly, and there is likely little possibility for a universal theory of the commons (Agrawal 2001; Agrawal & Chhatre 2006). Although Ostrom explicitly refutes the suggestion that her design principles are necessary requirements for all successful CPRs (Ostrom 1990 pp 90), the implication remains that collective choice systems will be improved as more principles are met.

3.4.4 Systemic dynamism

Ostrom specifically states that her model is designed to examine systemic interactions and outcomes "achieved at a particular time and place" (Ostrom 2007 pp15182). However the framework is unable to consider insights from the system's historical trajectory over time. Understanding from whence a system has evolved will help predict where it is headed; vital for improving the future resilience of marine governance regimes (Hughes et al. 2005; Levin & Lubchenco 2008). A snapshot or ahistoric viewpoint may miss important aspects of contextual change that explain the existence of complex collective choice arrangements (Luzadis et al. 2002). Commons analyses tend to ignore or dismiss the dynamic shifts that institutions experience over time (Scoones 1999). Agrawal (2003) suggests that one of the most neglected aspects of commons research is "the changing relationship between the environment and human beings".

[11] A management panacea is a cure all solution for all problems. Some questiona remain as to whether marine protected areas are applied strategically or as cookie cutter type panaceas to complex problems (Kaiser, 2005).

In response to these criticisms, commons theory has been moving towards a more dynamic focus on collective choice institutions (Cleaver 2000; Ray 2006). It is not unusual for commons empirical practitioners to explicitly push further outward in space or backwards in time in their case studies (Vayda 1987). Post modern commons scholars, as they have been called, study governance institutions in "particular intersections of history, politics, culture, time and space" (McCay & Jentoft 1998), often describing the shift towards temporal dynamism using the terms "thin" and 'thick'. Thin commons frameworks are generalizing models, only cursorily recognizing historical continuity, while thick frameworks are more ethnographic, emphasizing a system's embeddedness within changing social and political contexts (Geertz 1994; McCay & Jentoft 1998). Although data generated from this kind of thick commons research will be more complex and difficult to analyze, results will undoubtedly be more authentic and explanatory. Taking a thicker perspective of social-ecological systems will help overcome these critiques.

3.4.5 Social justice

Until the lions have their historians, tales of hunting will always glorify the hunter.
-African proverb

A principal assumption of commons theory is that the rules or institutions governing resource systems can be manipulated to yield increasingly more effective alternatives (Hanna et al. 1996; McKean 1992). By highlighting commonalities among successful regimes, the commons remedy for failed management is often (albeit tacitly) to *change local institutions* (Ostrom 1990 pp 192). However, manipulating or prescribing changes to collectively determined local institutions strikes a dissonant chord among those who work towards a post-colonial and egalitarian world order (Loomba 1998; Smith 1999). Commons scholarship, and its potential links to social engineering, has been decried as an affront to the fundamental right to self-determination of local people, a 'disenfranchisement' as communities lose control over their own governance destiny (Giddens 1990). Goldman (1997) caustically suggests that "the commons debate is worth mining for explanations of new forms of social control…a hidden and not-so-hidden institution of domination and imperialism."

Bearing these criticisms in mind, commons theory may yet offer insights into collective choice marine management rules, so long as it maintains conscious concern about the social justice implications of knowledge acquisition and institutional recommendations. Social consciousness in commons research is particularly important when dealing with cultures like those in Vanuatu, which have been marginalized by two centuries of colonial policies (Firth 2000). Rather than practicing one-sided learning about or implementation of 'ideal' governance regimes, a participatory approach to exploring commons institutions could lead to more equitable and lasting solutions.

3.4.6 An apolitical and acultural theory

Commons theory has been criticized because its analytical assumptions are often "culture-free" (Tanner 2007) or apolitical (McCay & Jentoft 1998; Wagner & Talakai 2007) despite widespread acknowledgement that institutions are socially and politically embedded (Agrawal 2003; Campbell et al. 2001; Peters 1987). For example, the Ostrom diagnostic framework

(Ostrom 2007) only considers political settings as an externality to the focal social-ecological system. Accordingly, Agrawal suggests that commons theory will become more valuable if it "loosens" its assumptions about the apolitical nature of collective choice institutions (Agrawal 2003). Commons models could be improved by explicitly considering the contested meanings, definitions and politics of human actors within which institutions are situated (Peters 1987). In order to move beyond these critiques it may be possible to temper the traditional commons theory with an approach known today as political ecology.

3.5 Political ecology; deepening Commons research

The phrase 'political ecology' was first used by Eric Wolf in 1972 in an attempt to move away from "static analysis" of real-world systems, and instead offer a dynamic view of human-environment interactions (Wolf 1972). The contemporary field of political ecology however owes its methodological and ideological foundations to the work of Piers Blaikie and Harold Brookfield with their seminal publication, *Land Degradation and Society* (1987), in which they examine the human dimensions of environmental change in the context of developing country inequalities. Their analysis explicitly focuses on a combination of property ownership, historical legacies, economic disparity, and other social, ecological and political contextual factors.

Rather than representing a new theory, political ecology is an "historical outgrowth of the central questions…about the relations between human society and a significantly humanized nature" (Greenberg & Park 1994). As an approach that explicitly considers social and ecological influences on systems, political ecology can be a useful tool for expanding the number and breadth of factors commonly considered in traditional commons research (Cumming et al. 2006). Political ecological approaches fit well with the need to consider local and global knowledge and contexts because it explicitly examines "the influence of variables acting at a number of scales, each nested within another, with local decisions influenced by regional policies, which are in turn directed by global politics and economics" (Robbins 2004 pp. 11). Political ecological approaches actively scale up issues from the local level to the global in a process of 'progressive contextualization' (Vayda 1983).

Using political ecological approaches will help mollify the social justice critiques of existing commons theory, particularly because political ecology has often been explicitly used as a practical tool by which inequalities in the developing world are rectified at the policy level (Bryant 1998; Forsyth 2008). This is done by political ecological practitioners by consciously investigating the realities of marginalized populations, groups and individuals and by "giving voice" to an often silent demographic (Keys 2005). While not referring to any specific tool or theoretical framework, political ecology is an ethical commitment and practice (Jarosz 2004), intended to liberate knowledge generation and research from constraints of political or economic inequality (Peet & Watts 2004). The political ecological approach has been dubbed a postcolonial ideological "hatchet" (Robbins 2004) with which to "deconstruct" the colonial-esque researcher-subject paradigms of science (Nygren & Rikoon 2008).

Like recent attempts by commons theorists to integrate social and ecological components of complex systems, political ecology explicitly acknowledges the link between ecological

outcomes and human systems. The approach has historically lent itself to multidisciplinary methodologies which often enhance the "explanatory power" of the case studies it considers (Keys 2005). Political ecological approaches specifically require that ecological methodologies are considered alongside those of the social sciences, including the analysis of commons institutions (Neumann 2008). It is therefore a commons extension. Ultimately Brookfield and Blaikie (1987) sought to create an interdisciplinary academic space that acknowledges the "constantly shifting dialectic between society and resources."

However, one of the most significant criticisms of political ecology is its lack of a theoretical underpinning. It has been described as a 'part-theory' and 'discipline without an institutional home' (Wolford 2005). Alternatively considered, its "woolly incoherence" (Peet & Watts 2004), could in fact present the flexibility that is required to successfully integrate social-ecological investigations of MPAs. Without being bound by any one set of disciplinary approaches and methodologies, it may guide commons researchers towards minimizing the theoretical shortcomings of both marine ecology and commons theory. If used, it should not however privilege political factors over other social or ecological factors (Nygren & Rikoon 2008; Peterson 2000; Vayda & Walters 1999; Walker 2005). To do so may alienate natural scientists and further prevent interdisciplinary dialogue (Neumann 2008).

3.6 Connecting paradigms for commons-based MPA investigations

Investigations into marine protected areas are disproportionately influenced by ecological theory. Since Darwin published his *On the Origin of Species* in 1859, ecology has focused on what he called nature's "web of complex relations", or the processes of competition and interaction between biotic and abiotic elements of nature (Hagen 1992). In marine environments, the connectivity and interactions among these elements is particularly complex due to the open nature of marine populations (Cowen et al. 2000) and therefore the traditional role of marine scientists is to design MPAs that are best able to effectuate desirable ecological outcomes in these complex open systems (Roberts et al. 2003b). The contextual variables they consider include size, spacing, ecological representativeness, duration etc. and these often attempt to consider the vast scales of connectivity within marine systems (Palumbi 2003; Roberts et al. 2003a).

On the other hand, commons scholarship has largely been underpinned by social, economic and institutional theories. For example, in her seminal 1990 work, *Governing the Commons*, Ostrom proposed the existence of eight design principles for successful commons governance regimes including clearly defined boundaries, congruence with local conditions, collective choice arrangements, monitoring, graduated sanctions, conflict resolution mechanisms, legal support, and nested enterprises. The contextual variables the principles encompass do not include ecological factors, and each may operate on a very localized scale, much smaller than is often necessary to match marine connectivity. In Agrawal's review of the conditions suggested by commons theorists to enable successful regimes (2001), it is clear that the group of variables considered by commons practitioners is highly skewed towards the social sciences (see Table 1 below).

Table 1 Summary of the factors assumed to be critical to the successful governance of common-pool resources **(Agrawal 2001). RW-(Wade 1988) EO-(Ostrom 1990) B&P-(Baland & Platteau 1996)**

Resource System Characteristics	
	(i) small size (RW)
	(ii) well-defined boundaries (RW, EO)
Group Characteristics	
	(i) small size (RW, B&P)
	(ii) clearly defined boundaries (RW, EO)
	(iii) shared norms (B&P)
	(iv) past successful experiences - social capital (RW, B&P)
	(v) appropriate leadership (B&P)
	(vi) interdependence among group members (RW, B&P)
	(vii) heterogeneity of endowments, homogeneity of identities and interests (B&P)
Relationship between System and Group	
	(i) overlap between user location and resource location (RW, B&P)
	(ii) high dependence on resources (RW)
	(iii) fair allocation of benefits from resources (B&P)
Institutional Arrangements	
	(i) rules are simple and easy to understand (B&P)
	(ii) locally devised access and management rules (RW, EO, B&P)
	(iii) ease in enforcement of rules (RW, EO, B&P)
	(iv) graduated sanctions (RW, EO)
	(v) low cost adjudication
	(vi) accountability of monitors to users (EO, B&P)
Relationship between Resource System and Institutions	
	(i) match restrictions on harvest to regeneration rates (RW, EO)
External Environment	
	(i) low cost technology (RW)
	(ii) state
	(iii) local authority not undermined by state (RW, EO)
	(iv) supportive external sanctioning (B&P)
	(v) appropriate external aid for conservation (B&P)
	(vi) nested levels of appropriation, provision, enforcement, governance (EO)

Failure to consider both the social and ecological components of complex resources systems has been implicated in the widespread breakdown of environmental management regimes around the world (Berkes et al. 1998). Once acknowledged, a fundamentally different approach to resource management investigation was required; one that could integrate a holistic systems approach to ecosystem studies (Holling 1978; Walters 1986) as well as the people-oriented approach of institutional theory (McCay & Acheson 1987; Ostrom 1990). An approach was needed that could reverse the long acknowledged, pervasive and Western driven notion that humans are somehow separated from nature (Berkes et al. 2003; Nelson & Serafin 1992). It is only recently that the potentially valuable contributions of social science to investigations into

MPAs have become widely acknowledged (Mascia 2003, 2004). However the social science contributions to MPA investigations continue to be ad hoc and often not embedded within multi-disciplinary frameworks.

3.7 Integrated social-ecological frameworks

Improved understanding of the interactions between social and ecological components of complex systems is a critical priority for MPA research and ecosystem-based management more broadly. To date however, diagnostic analyses and cumulative learning have been hampered by the lack of a common theoretical framework to organize the large number of potential variables involved and their interactions. Frameworks are the broadest level of conceptual organization (Koontz 2003), and should provide "intellectual scaffolding" on which variables from multiple disciplines and theories can be placed and related to or contrasted with one another (Schlager 1999).

New diagnostic frameworks have recently emerged for investigating the interplay between key components of social-ecological systems (Anderies et al. 2004; Ostrom 2007). One of the most widely cited frameworks for examining commons institutions within social-ecological systems is the Institutional Analysis and Development (IAD) framework. It has been applied to frame specific questions about metropolitan organizations, public goods, infrastructure in developing countries, and common resource dilemmas (Ostrom et al. 1994). However, while the developers of the IAD framework include the physical world as a component of the system, they specifically state that the framework provides a common language that "any other social scientists" might want to use (Ostrom et al. 1994 pp 27).

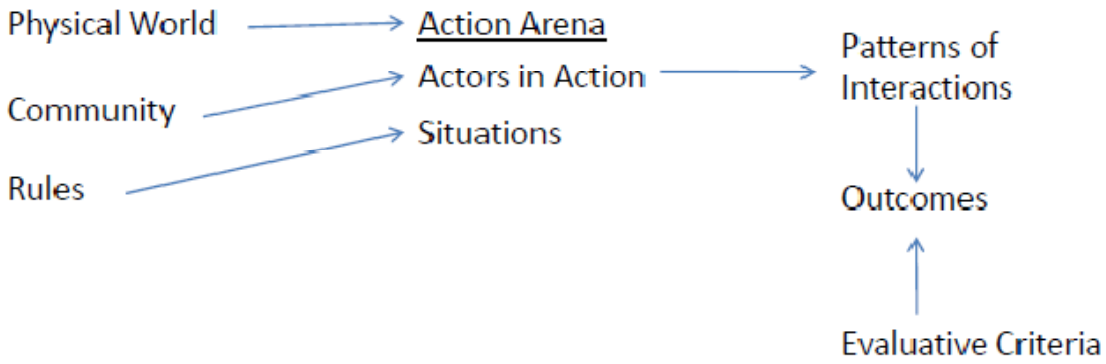


Figure 7 Schematic of the IAD framework from (Koontz 2003)

Acknowledging that the IAD framework is socially focused, and does not equally consider biophysical or ecological components of complex systems, Ostrom later published a multitier framework to better approximate the integrated nature of linked social-ecological systems (Ostrom 2007). She argues that in order to build on the field of sustainability science, it is critical to include work on "ecological systems, socioeconomic systems, and linked SES" (Ostrom 2007 pp 15181). In her model of a complex system, she suggests that elements of the resource system (e.g. pasture), the resource units (e.g. fodder), the users (e.g. farmers), and the governance system (e.g. harvest rules) jointly affect and are indirectly affected by the interactions among components (e.g. conflicts or cooperation) and the outcomes that result (e.g.

increased productivity). Like other recent attempts to place social-ecological systems within scaled contexts (Berkes 2008), she embeds the focal system within broader social, economic and political settings (e.g. state government policies) as well as within related ecosystems and processes (e.g. climactic patterns).

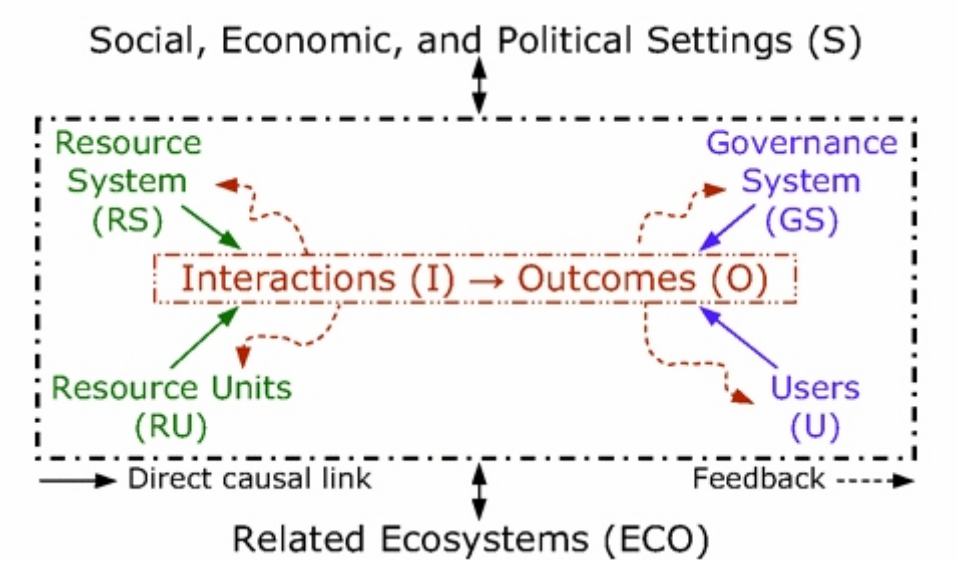


Figure 8 Simple model of a complex social-ecological system from (Ostrom 2007).

Recall the criticism that commons theory promotes policy panaceas. In response, Ostrom has recently forwarded a multitiered framework to enable researchers to build nested conceptual maps of key local variables (2007). Within the framework, locally relevant variables can be scaled-up and the interactions between them used to formulate hypotheses about other social-ecological systems. The factors included in the framework are hierarchal, allowing for the locally-relevant unpacking of variables important to the case at hand. The framework itself does not make value statements about the importance of any one contextual factor over any other. The structured nature of the framework is intended to allow studies conducted at different scales and in different geographical, social, cultural, environmental and political contexts to be theoretically contrasted. From this kind of commons framework, one does not "derive a precise prediction" or a policy panacea (Ostrom 1990 pp 192), but rather one is able to consider local specifics in determining appropriate management. Using a scaleable framework also helps avoid the analytical trap of considering each case as unique (Basurto & Ostrom forthcoming), within which cumulative theories cannot be developed from empirical results.

Figure 9 A hierarchal diagnostic framework for examining the theoretical and empirical relationships between components of complex social-ecological systems (SES) designed by Ostrom (2007). Particularly useful for "unpacking" theoretical concepts down to locally relevant scales and variables and vise versa.

Social-ecological frameworks like the IAD and SES diagnostic tool have been applied to examine water management, fisheries, and forestry systems, but have not yet been applied to MPAs (Gibson et al. 2000; Meinzen-Dick 2007; Rudd 2004). In this context, there is an urgent need to begin theoretically situating studies of MPAs within linked social-ecological systems frameworks. Situating MPAs within a social-ecological systems framework allows investigators to simultaneously and theoretically investigate the variables and interactions that are critical to marine ecology (e.g. size, connectivity, biomass, habitat complexity etc) as well as those variables critical to social science (user characteristics, institutional structures, government policies, poverty etc). It is expected that an adapted version of this commons theoretical framework will better organize MPA research and facilitate the development of novel research questions that bridge disciplines, theories and methodological approaches.

3.8 Moving beyond limitations; a hybridized multi-disciplinary approach

Despite the potential limitations of commons theory and political ecology highlighted above, each has been useful for challenging orthodox assumptions about the way complex social and ecological systems function and change over time. There is no single approach or an "everything pill" able to magically and successfully analyze all social-ecological scenarios (Robbins & Bishop 2008). Rather than reject outright existing frameworks because they have minor and nonfatal flaws (e.g. Greenberg & Park 1994), it may be possible to incorporate tenets of each to create a hybridized, yet theoretically grounded, approach to addressing questions about MPA in general and Vanuatu's contemporary closures in particular.

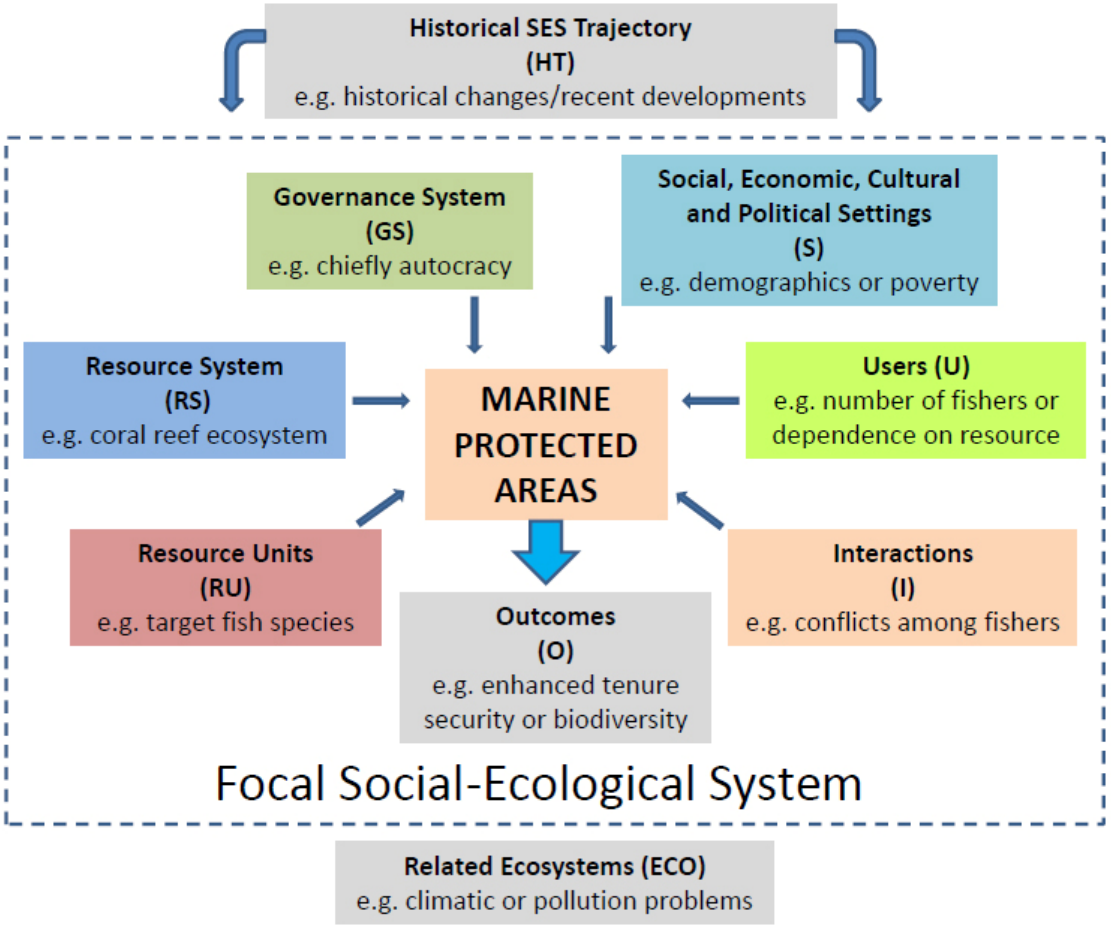


Figure 10. A proposed framework to investigate MPAs highlighting their place within complex social-ecological systems and the multiple relevant causal variables and SES components.

Presented above is a model of MPAs as a component of a linked social-ecological system, based on Ostrom's diagnostic framework (Ostrom 2007). This modified framework enables a structured analysis of how MPA outcomes are influenced by components of the linked social-ecological system, including the users themselves, the governance system, the social, economic, and political setting, characteristics of the resource system (e.g. coral reefs), characteristics of target resources (e.g. mobility of target fish species), the governance system (e.g. MPA operational rules) and interactions between components.

The framework presented above explicitly acknowledges the critiques and limitations of existing commons theoretical frameworks. Importantly this adapted framework internalizes social, economic and political settings by considering them as endogenous to the focal system, rather than considering them as externalities. Following a political ecological approach, the framework highlights the importance of cultural practices, customs, indigenous identities and social justice concerns to commons research in general and MPA research in particular. By explicitly acknowledging the complex nature of tenure and property ownership regimes, it may enable commons to finally break its reputation as a property-dominated discipline. Most importantly, the framework presented here will allow us to examine conditions relevant to Vanuatu's MPAs, but scale up findings so as to be theoretically comparable to and incrementally improve understanding of other social-ecological systems.

Utilizing this social-ecological system framework will help MPA studies focus on critical variables, and 'control for' others not deemed directly relevant (Ostrom 2007). This will be the case in MPA 'natural experiments' (Banana & Gombya-Ssembajjwe 2000), such as those on Nguna and Pele where communities either choose no-take MPAs or alternatives. Theoretically important variables, like different MPA operational rules, distance to market, and environmental conditions, can be 'held constant' to study the variability in other, more locally relevant, variables. Accordingly the framework enables the design of robust and structured case study comparisons, the lack of which Agrawal (2003) suggests is constraining Commons theoretical development.

Utilized as a guide alongside research methodologies that internalize social justice issues (Low & Gleeson 1998), the framework allows an integrated and multi-disciplinary approach to investigate complex multi-scalar problems (Cohen & Harel 2007; Esbjorn-hargens & Zimmerman 2009; Hughes et al. 2005). In essence, this theoretical orientation aspires towards Goldman's calls for a "successor science" (1997), able to examine collective action dilemmas within complex and contested hegemonic cultures.

3.9 Summary

This Chapter begins by considering the orthodox paradigms of marine governance (e.g. state led and controlled limits over common ownership etc), and then contrasts these with the much more common alternative to state control or strict privatization: collective tenure. The chapter examins in detail how throughout the world, small groups like families and communities have been collectively utilizing and managing coastal marine resources. Of course, not all of this management has been geared towards sustainable outcomes. Much marine utilization has been for short-term gain, leading to what is now globally recognized as a 'fisheries crises'. Overexploited and collapsed stocks have led many communities, governments and individuals to declare marine protected areas over all or part of their tenure area. The issue of marine protected areas establishment and enforcement is essentially a commons problem, how to manage a resource that is difficult or impossible to 'fence off' and one person's use subtracts from that which is available for others. This Chapter also makes a case for why Commons Theory may hold only limited traction for answering questions related to Pacific Island MPAs where communities can effectively exclude others from their reef tenure areas through physical and cultural enforcement. Other theoretical approaches are considered, including Political Ecology which can add depth to the analysis of MPAs by incorporating factors like historical trajectories and political contexts. Finally this Chapter describes an integrated and theoretical approach, based on Elinor Ostrom's diagnostic framework for linked social-ecological systems, but that more fully incorporates elements of culture, politics, social justice and historical context.

In each of the following chapters of this dissertation, several variables important to Vanuatu's MPAs are highlighted and the relationships between those variables are explored. At the end of each chapter I will place findings into the adapted framework to 1) theoretically situate critical variables within a model of complex MPA systems and 2) promote broader scale learning and comparison with other linked social-ecological systems.

CHAPTER 4 - EPISTEMOLOGICAL AND METHODOLOGICAL APPROACHES

"The rules of scientific method as set out by logicians do not correspond to the reality of scientists' practices. As in other professions, scientists take for granted that the existing theories and methods are valid…they work not to discover new theories but to solve concrete problems." (Bourdieu & Nice 2004 p 15)

4.1 Indigenous knowledge and ways of knowing

"To successfully build new epistemic foundations, accounts of innovation and experimentation must bridge the indigenous/Western divide" (Agrawal 1995 p 4)

The grounded theory approach recommends an examination of problems in terms of local realities; not just from *a priori* scientific hypotheses (Charmez 2006; Strauss & J. 1998). The political ecology additions to the commons theoretical frameworks discussed in the previous chapter helps to epistemologically ground this investigation by explicitly examining the generation and evaluation of knowledge. A "traditional" versus "Western" knowledge dialectic is widely promulgated within Vanuatu today, where communities establishimg marine protected areas are accused of "ignoring much of the richness and usefulness of the traditional ecological knowledge held by the First Nations regarding their resources." (Hickey 2001 pp 135). Thus, before the empirical methodologies and results of this dissertation can be appropriately presented, I briefly review the meaning and use of the phrase 'traditional ecological knowledge'.

Traditional ecological knowledge (TEK) is a phrase that has been largely championed by Fikret Berkes and others since the 1980's (Berkes 1989; Berkes 1993), and defined (in 1999 pp 8) as:

> *"a cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment".*

This definition is necessarily broad; it covers knowledge that potentially originates from any corner of the globe. Importantly however, the definition does not specify the specific content of the knowledge, practices or beliefs that are handed down through generations. Nor does the definition presented above argue that TEK is accurate, valuable, ecologically relevant or socially beneficial. The early noble savage debate has done much to coat discussions about indigenous environmental relationships and TEK with a veneer of ecological balance and harmony (Redford 1991), despite empirical evidence in many cases to the contrary (see Brush 1993; Diamond 1993; Vitousek et al. 1997) (also see Chapter five). Commons researchers have long struggled with the assumed conservation-enhancing nature of TEK, for example when Baland and Platteau (1996) concluded that rural communities are not "inherently conservationists" despite colloquial claims to the contrary.

The late Robert Johannes repeatedly found a disinclination among Pacific elites to acknowledge that there are "traditional maladaptations" among non-Western cultures. He also observed a propensity among many groups to "maintain the fiction that all cultural practices are beyond censure except Western cultural practices, which often seem to rank well beneath the rest" (Johannes 2003). This is particularly true in Vanuatu where academics risk being denied travel visas and research permits for not explicitly investigating 'traditional' practices (Johannes 2003 pp 121). However, the word traditional excludes much of the knowledge used and generated by ni-Vanuatu island people today. To them, knowledge is more a tool for every day life and survival, and is not divided into that which is traditional and that which is not.

Avoiding the ambiguity and unrealistic meanings surrounding the word *traditional,* some have replaced it with the term *indigenous* (e.g. Chambers et al. 1989b; Warren 1995). However, this terminology creates an artificial distinction between indigenous and 'Western' ways of knowing (Cochran et al. 2008). Agrawal (1995) makes a case against such a dichotomy as belittling and disempowering to all parties. He suggests that a Western/indigenous-traditional dichotomy forces us to ignore the possibility that indigenous ways of knowing change, adapt and blend with 'other' knowledge. Knowledge is neither ancient nor static, but actively reincarnated and rejuvenated with each generation, even if it may have deep historical roots (Houde 2007). Others suggest using the phrase *local knowledge*. Ignoring local knowledge has been shown to result in failure of business ventures, development and even research (Brokensha et al. 1980; Johannes et al. 2000). But even the phrase local knowledge is subject to the same critiques as above. The phrase local knowledge suggests that a body of knowledge originates from a single, limited geographic area (e.g. Ruddle 1994).

In order to avoid discursive confusion, here I propose the phrase 'contextual social-ecological knowledge' to describe the diverse values, beliefs and practices people hold regarding living and non-living things within variable contexts. The scope of the definition can be narrowed to the context of a single clan on a single island, or broadened to encompass the entire human race. The phrase does not discriminate on historical, ethnic or geographical origin of knowledge but incorporates each under its theoretical umbrella. One may further employ qualifying words such as *localized* (pertaining to a certain geographical area), *emic/etic* (within/external to a group), or *indigenous* (characteristic of or originating in a particular cultural system) to explicitly describe the context of the knowledge system. Inherent in this phrase is a call to valorize knowledge within the specific context it is being discussed.

In essence, this dissertation seeks to acquire specific contextual social-ecological knowledge about marine protected areas in Vanuatu. It values knowledge that originates from the islands of Nguna and Pele, but also that which has arrived from other islands in the archipelago or even overseas. It considers knowledge that has many generations of historical roots in Nakanamanga culture as well as that which is recent and has little time depth. Most importantly, this dissertation seeks to acquire knowledge from both an emic Melanesian point of view and an etic external perspective. Contextual social-ecological knowledge is likely what directly drives individuals and communities to act, and even implement marine protected areas. This is the type of contemporary, every-day, real-life knowledge I sought to obtain during the course of this research. In order to collect and convey this type of knowledge about MPAs in Vanuatu I was forced to critically consider and adapt the available methods of enquiry.

4.2 Social justice, decolonizing research and participatory approaches

Johannes observed in the Pacific that although "colonial bodies are being replaced, scientific colonialism lingers" (Johannes 2003). This critique is underscored by a large body of literature on the colonial style domination of knowledge acquisition and transfer prevalent in Western science (e.g. Bishop 1998). In a typology of research paradigms, colonial research has been defined as "reflecting and reinforcing domination and exploitation through the attitudes and differential power embodied in its research relationships with others" (Howitt & Stevens 2005 pp 32). In general this relationship plays out as an expert (usually Western) researcher extracting knowledge from or teaching a powerless (usually non-Western) layman. Often from the indigenous perspective, research is "so deeply embedded in colonization that it has been regarded as a tool only of colonization and not as a potential tool for self-determination and development" (Smith 2005 pp 87).

In response, many socially conscious academics have started to practice what has been labeled 'post-colonial research'. Howitt (2005) defines post colonial research as a "reaction to and rejection of colonial research" that will in turn contribute to self determination. He suggests that the research process itself can be utilized to break down the "asymmetrical power relationships and representations…through which colonial ideas are constructed and maintained." A practical challenge of this dissertation research therefore was to design and implement a methodological protocol that made tangible inroads into decolonizing the researcher-subject academic tradition, but that also allowed for the possibility that my own knowledge system could enhance and influence the process.

In Vanuatu this goal is particularly important because the country has been the scene of centuries of unjust relations between 'masters' and islanders (see Chapter seven). To guide my own research, I relied upon several outstanding examples of balanced and decolonizing research conducted with communities in Vanuatu including Joel Bonnemaison's work with the Tannese (Bonnemaison & Penot-Demetry 1994), Margaret Jolly's work with the communities on South Pentecost (Jolly 1984), and Bob Tonkinson with the people of Ambrym (Tonkinson 1985). Interestingly each of these mentors worked in the fields of anthropology and cultural studies, none in marine ecology.

In general, post-colonial investigators seek to engage in research that adresses real world problems for real word people (Brown & Tandon 1983); in other words the process begins not with a literature review, development of hypothesis and selection of a subject group, but in reverse. On that account, at least, this current dissertation is based on a project where questions were locally-relevant and indeed, locally asked from the very outset. Inclusion of stakeholders in the research process is another step towards decolonizing research, a methodological option covered by entire disciplines of participation in research including 'participatory research' (Cornwall & Jewkes 1995; Hall 1981; Stoecker & Bonacich 1992), 'participatory action research' (Fals-Borda & Rahman 1991; Kemmis & McTaggart 2000; Selener 1997), 'participatory rural appraisal' (Chambers 1994; Mosse 1995; Mukherjee 1993) 'action research' (Brown & Tandon 1983; Cunningham 1976; Lewin 1946) and most recently 'feminist research' (Acker et al. 1996; Hesse-Biber et al. 2006; Lather 1991). Although there are fine scale

differences among each of these approaches (Reason 1994; Reason & Bradbury 2007), each centers around research methodologies that benefit and enhance the condition of participants.

While undeniably difficult to put into practice, participatory research is theoretically valuable not only to the group not experiencing scientific colonialism, but also to the researcher, who has the opportunity to generate a new form collaborative knowledge (Israel et al. 1998). The presence of an outside researcher will undoubtedly influence (positively or negatively) the knowledge generation process (Gaventa 1993; Rahman 1991), but mutual influence is often a stated goal of action research. Researchers value participatory processes because they believe in the capacity of subjects to assess their own needs (Minkler & Wallerstein 2003) and articulate local realities (Gadamer 1989). Guided by those most connected to the issues, researchers have an opportunity to learn diverse points of view (see Berkes 1999) and unique ways of thinking about pre-existing problems (Fear & Edwards 1995). Participatory research has the potential to yield greater insight than 'expert command' colonial research, specifically by avoiding externally developed criteria to validate knowledge (see Agrawal 1995), or using 'expensive'[12] and inappropriate methods and typologies (Stoecker 1999).

There are, of course, degrees of participation in research. The cooperative management literature provides interesting examples of the continuum of shared power and responsibility (Borrini-Feyerabend et al. 2004) that could apply to levels of participation in research (see Figure 11). This dissertation could never have been achieved through a 'purely indigenous' research process, where all authority and responsibility was devolved to people on Nguna and Pele. What made this project so exciting to me, the NPMPA Network and my supervisors at James Cook University was its goal to cross not only disciplinary but also cultural boundaries of collaborative sharing and knowledge generation. Unsurprisingly, this approach runs against the grain of the modern scientific establishment, which is geared towards individualism and where success is measured by the number of sole-authored high impact-factor journal articles publish in a lifetime (Seipel 2003). Most investigators would feel comfortable with the "seek-consensus" level of research collaboration, but many would not recognize participants as co-authors. In this context, participatory approaches are typically only applicable to field research. Analysis, interpretation and publication often remain the exclusive domain of the expert researcher.

Figure 11 Diagrammatic representation of the various levels of co management and participation from Borrini-Feyerabend et al. 2004

However an important question is whether research can empower a marginalized group if an individual researcher instigates the research and undertakes the majority of data collection and

[12] Expensive is the term given by ni-Vanuatu to that which is showy, flash or not of the lay person. Government employees will commonly be criticized for using 'expensive Bislama' or a pidgin filled with foreign words.

analysis (Gaventa 1993). If an explicit goal of post-colonial research is to empower participants, then adjustments to orthodox roles in research are required. Explicitly defining the roles of those involved in the research process (such as animator, community organizer, popular educator, participatory researcher etc) will likely help readers interpret the validity research results contained within this work. Of course it is important to keep in mind that participants will often fill multiple roles (Stoecker 1999).

To define my role in the process, I first analyzed my own skills in interpersonal communication and facilitation as a proxy for the role I would eventually play in the participatory research (Stoecker 1999). Based on this self-analysis and my past work on Nguna and Pele project, my ni-Vanuatu colleagues and I saw my role in the research process as that of a facilitator and less like a disciplinary expert. My role was to mobilize multidisciplinary knowledge and expertise to facilitate productive outcomes (Whyte et al. 1989). Having defined my role thus, it became easier to navigate the collection of contextual social-ecological knowledge from village fishermen, elders, women, youth and village leaders. Throughout however, I explicitly sought to dismantle the opposing concepts of "subject-researcher" as found in traditional research designs (Sandelowski 1986), and replace them with the concept of "speaker-listener".

While my participation was central to the completion of this process, it was equally buoyed by technical skills and motivation of a core group of Nguna and Pele researchers and the willingness of village residents to engage with us day after day, year after year. In that sense I was no more in control of the project than any of the other participants. This role fit well with my previous one on Nguna and Pele as a development volunteer and facilitator[13]. Further, I explicitly sought to expand on spheres of participation traditionally occupied by researchers and participants. For example, ni-Vanuatu scholars argue that in order to avoid Johannes' 'scientific colonialism' in Vanuatu, knowledge generated by research should be compiled, interpreted and shared by ni-Vanuatu themselves (Regenvanu 1999). They should be active in all phases of research including initial design to the analysis, interpretation and presentation of results (Whyte et al. 1989). Of course not every resident in each village would become fully engaged in all aspects of research design and "cogenerative dialogue" (Fear & Edwards 1995). However I sought to maintain a moral value vis-à-vis with every participant well before field data collection began and long after it had ended (Ornelas 1997).

As will be discussed in more detail in the next section, the specific research methodologies and questions on which this dissertation is based were developed in Vanuatu, alongside a representative group of residents from Nguna and Pele. Field data were collected together with a large team of Nguna and Pele researchers. Analysis and interpretation was conducted in the field by this team. Intentional nudging may best describe how my research counterparts and I related to one another during our analysis and interpretive sessions in the field (Smith et al. 1997). Together we contributed to evolving co-learning by suggesting or nudging each other in different conceptual directions. Results were presented back to communities before leaving each community.

[13] In contrast to many development organizations in Vanuatu, the US Peace Corps does not provide financial resources to volunteers or communities.

Ni-Vanuatu colleagues travelled to Australia on three occasions to present seminars and work on co-authored peer-reviewed papers. During the course of 'writing up' I traveled back to Vanuatu twice to re-present results to communities and get feedback from colleagues. To date I have published/submitted five articles to peer-reviewed journals and all have been written with ni-Vanuatu colleagues.

Cultivating the relationships necessary for effective research and action was not a simple or straightforward task. It is highly unlikely that a project with these epistemological groundings could have been undertaken on Nguna and Pele by anyone without long-enduring relationships and trust. In Vanuatu, as elsewhere, it takes extensive time and understanding before this type of relationship is achieved (Rahman 1991; Smith et al. 1997). Time was required well before the dissertation officially began by living, working and doing with those who would eventually become participants in this study (Sullivan et al. 2001). In the case of this dissertation, participatory research was enabled by a long-standing 'insider' relationship I and the research team have enjoyed with the communities considered here. Although the official period of dissertation field research only lasted 18 months, I would consider the entire process to have begun the day in June of 2002 when I first arrived as a Peace Corps volunteer.

"In the human sciences, any genuine research based on fieldwork has an emotional, and therefore subjective, component. Researchers are more likely to perceive the truth of others when that truth is closer to their own or when it touches them personally." (Bonnemaison & Penot-Demetry 1994 pp xvi).

4.3 Invitation to undertake research

In late 2004, the Nguna-Pele MPA Network committee submitted a funding application to the US National Oceanic and Atmospheric Administration's (NOAA) International Coral Reef Program for support to conduct a major social and ecological assessment on the effectiveness of local marine management strategies. With funding secured, the Network requested my help to devise the assessment protocol. Nearing the end of my tenure as a Peace Corps volunteer however, I was looking for opportunities to continue my formal education. Coupling the MPA's local effectiveness assessment with my postgraduate studies was viewed by all as an ideal compromise.

My long history with the people and Nguna and Pele was a critical factor in my decision to become a researcher and undertake a PhD centered on the NOAA assessment. It was through repeated local requests for new knowledge on marine-related topics that led me back into academia. Invited to undertake this research by individuals, chiefs, local councils and the Nguna-Pele MPA Network, the research was guided by a locally-expressed need. The critical distinction between being explicitly invited to undertake research (this case) versus approaching a group that presents an interesting case study (most research in Vanuatu) should be emphasized to the reader. The locally-devised nature of the project was also an important factor in garnering support from my academic supervisors.

The communities on Nguna and Pele approached Peace Corps Vanuatu to request that I be re-instated as a volunteer in order to continue the environmental works in progress on the islands

and embark on the proposed collaborative research project. Together, the communities and the Peace Corps negotiated an arrangement whereby I could be reinstated as a volunteer, albeit with a different research-focused assignment. Because the research was to be undertaken by and for local communities and involved a significant capacity building component, Peace Corps was satisfied that it fell under the umbrella of their mandate outlined in the MOU they have with the Government of Vanuatu. Therefore I was to return to Vanuatu as a Peace Corps volunteer tasked with facilitating a locally-driven assessment of marine resource use and management on Nguna and Pele. The Environment Unit agreed to be my government sponsor and was fully engaged in the research process on Nguna and Pele.

4.4 Planning for research, defining protocol

Once the decision had been made collaboratively to transform our relationship from one based on community development to one focused on knowledge generation, there was a need to develop clear ground rules for research. This was accomplished through a series of meetings, both formal and informal, held with communities and NPMPA staff towards the end of my term as a Peace Corps volunteer from May-August 2005. Several guiding objectives were articulated during this preparation and consultation process:

1. Research should answer questions that hold direct relevance to Nguna and Pele residents
2. Research questions should be developed and approved through local consensus
3. Research processes and protocols should include training and capacity building for local residents
4. Data should be collected and analyzed, wherever possible, by Nguna and Pele residents
5. Participation in research by any individual or community should be voluntary
6. A community (chief and council) must officially invite (via written communication) the research term to undertake data collection in their village
7. Results should be returned to the community immediately, and in a form that is locally understandable and accessible
8. Data generated must not be shared with any third party without explicit permission from the community
9. Results must be kept anonymous, with village and individual names suppressed unless specifically agreed
10. Results must not be used to generate income or make a profit for any party
11. Resultant publications and presentations should be co-produced with Nguna and Pele residents, with appropriate acknowledgement of local intellectual property

This set of locally-developed guidelines demonstrates that the level and form of community participation was not decided a priori but emerged from the planning process. With this set of research guidelines, a specific assignment as a Peace Corps volunteer and three years of experiential knowledge about marine use and management on Nguna and Pele, I left Vanuatu in August 2005 to take up temporary residence at James Cook University in order to formalize my candidature as a PhD student.

From August 2005 thru April 2006, I dedicated myself to reviewing the literature on the norms, rules and strategies employed in Melanesia to manage and utilize marine resources. During this time I also formally engaged with the epistemologies, methodologies and approaches of the social sciences. I was required to deconstruct my natural science-based perspective and construct a novel objectivity which included frameworks from anthropology, ethnography, sociology, psychology, linguistics and history.

With three of five JCU supervisors grounded explicitly in the social sciences, I was able to learn techniques for developing indicators and survey questions, running focus groups, analyzing qualitative and quantitative social data, recording informal observations and negotiating the complexities of participatory research designs.

While my time at JCU was extremely productive, detail on the direction research would soon take in Vanuatu could not be specified. Based on the research priorities set out by local communities, research questions and methodologies were to be developed in full collaboration with local residents. Thus, I presented a very broad and generalized research agenda to my supervisors and peers at James Cook University in order to confirm my candidature, and in April 2006 returned to Vanuatu to further solidify the goals and methods of this research.

4.5 The Nguna-Pele MPA Network summit

In June of 2006 the Nguna-Pele MPA Network held a major, week-long summit for all member communities in order to produce a future strategic area plan as well as discuss the specifics of the upcoming research process. Each of the sixteen communities on Nguna and Pele were invited to send 2-5 representatives to the summit held in Unakap Village on Nguna Island. In planning for this dissertation I asked each selected representatives to meet with his/her community in advance of the summit. Specifically each representative was asked to qualitatively and broadly gauge and report on village-specific marine management problems, objectives and expectations.

Figure 12 Research planning workshops and summit in 2006

The staff of the NPMPA Network, village representatives and I all facilitated various sessions. The first three days were dedicated to general discussion and organizational and technical capacity building. The final two days saw a collective area management strategy emerge along with the set of overarching research questions to which this dissertation attempts to provide partial answers:

1. Are the marine management strategies in use on Nguna and Pele working?
2. What are the specific impacts of each strategy on target resources, the general ecosystem, local incomes, community livelihoods and social capital?
3. How do political, environmental, historical, social and economic factors influence the practical use of research results on Nguna and Pele?

This representative group reconfirmed their agreement with the research guidelines compiled in 2005, and specified further protocols. They determined that research would be best conducted if the research team visited and lived in each village for an extended period, and conducted the research in the local Nakanamanga language. It was agreed that each participating community would host a research team for a minimum of two weeks, during which time all social research for that village would be carried out. Ecological research would be completed opportunistically (based on tides, weather, fuel and distance to the SCUBA refilling station) after social research was completed. They requested that the social research team be made up of one to two local NPMPA staff who would in turn train five to eight volunteers in each village on data collection and analysis protocols. Finally, summit representatives requested that the research protocol be flexible enough to accommodate village-specific goals and objectives. For example, several villages requested that while research was underway, detailed maps be made of their marine and terrestrial closures.

In order to ensure that specific research methods could be appropriately designed, summit representatives nominated a team of core researchers, who would meet regularly over the coming weeks to devise the final methodology. The core research team included myself and four local NPMPA Network staff[14].

On the final day of the summit, paramount chiefs and village council chairpersons from all area villages were brought to the venue to discuss, adapt and approve the management and research plans devised by their representatives. At this time, several chiefs formally and in writing invited the research team into their communities. In the course of the next few weeks, the NPMPA Network would receive formal letters of invitation to conduct research from a total of six communities on Nguna and Pele.

4.6 Defining specific methodologies and creating indicators

After the summit, the nominated core research team met each day for two weeks to refine the empirical direction the research would take. My local colleague's superior knowledge of the local context ensured that the research protocol was intimately tied to local conditions and would be achievable in the field. We began by devising one or more indicators which would appropriately measure aspects of local MPAs identified at the summit. To assist in indicator development, we used a set of guidebooks developed specifically for marine management evaluation (Bunce et al. 2000; Hockings & IUCN World Commission on Protected Areas. 2006; Locally-Managed Marine Area Network 2003; Pomeroy et al. 2004; Wongbusarakum & Pomeroy 2008).

[14] Core research team members: Charley Manua, Sam Kenneth, Willie Kenneth and Kalpat Tarip.

Some indicators were straightforward and easily measured their intended variable (i.e. total sea area measured with a GPS), but many of the indicators were conceptually vague (i.e. conservation ethic) and required a multifaceted assessment of several quantitative and qualitative variables. Because no single instrument (i.e. household survey) was able to capture the depth of information required, the research team devised an integrated research protocol. In many cases, multiple techniques were used to triangulate results about a single empirical variable. Triangulation has been described as a methodology which allows "the simultaneous display of multiple, refracted realities" (Smith 2005 pp 6), and has been theoretically validated (Flick 2007).

After weeks of discussion and planning, the core research team finalized a draft field methodology to be piloted. Final social science research measurement tools included: individual questionnaires/surveys, key informant interviews, group interviews/discussion, community mapping/transect walks and participant observation. Ecological methods included line-intercept transects, belt-transects, and underwater visual census (UVC).

All research was to be conducted by a village research unit (myself + core research team + village volunteers). Therefore during the first two days of residence in each community, the core research team trained five to eight village volunteers on the theory and practice of conducting social science research. Because each village would be conducting the same methodologies, albeit with a different set of researchers, care was expended to ensure that the research was standardized to the greatest extent possible. For example, the core research team took pains to ensure that village volunteers would deliver individual interviews word for word in exactly the same manner for each interviewee. The core team led extensive training on each methodology regarding appropriate data collection and recording.

4.7 Community-based participatory methodologies

4.7.1 Individual questionnaires/surveys

Central to this study was the use of the individual questionnaire/interview to gauge individual perceptions on the effectiveness of community marine management (Fowler & Cosenza 2009). The final individual questionnaire/interview included 55 questions, both quantitative and open ended, and took approximately 20 minutes to complete. As village populations are typically composed of less than 100 adults, the survey was implemented census-style and aimed to cover at least 85% of the total adult population (Henry 2009). Selective sampling was not undertaken, and the results can be considered as those of the whole population. Only adults over the age of 18 were interviewed for the research. Verbal permission and informed consent was sought prior to the interview (See also Chapter nine).

Qualitative responses from open ended questions were thematically coded through the process of content organization (Cinner & Pollnac 2004). Eight questions in the interview were open ended. Open ended questions often required the interviewee to list responses (i.e. what are the 5 most common…?). Other questions asked for a response to a given scenario (i.e. what would you do if…?).

For quantitative questions, we utilized a modified Likert response scale (Likert 1932). Because we sought a gradient of local perception, an agree/disagree framework was deemed inappropriate (Bachman & O'Malley 1984). The research team also predicted that Likert's standard 1-5 response categories would be confusing to a largely illiterate population (Lee et al. 2002) and may be a culturally-biased technique (Flaskerud 1988). To deal with these issues, the research team devised a Gradient Response Board tool. With it, interviewees moved a bead along a fishing string superimposed over a rainbow spectrum to indicate the strength and direction of their perception.

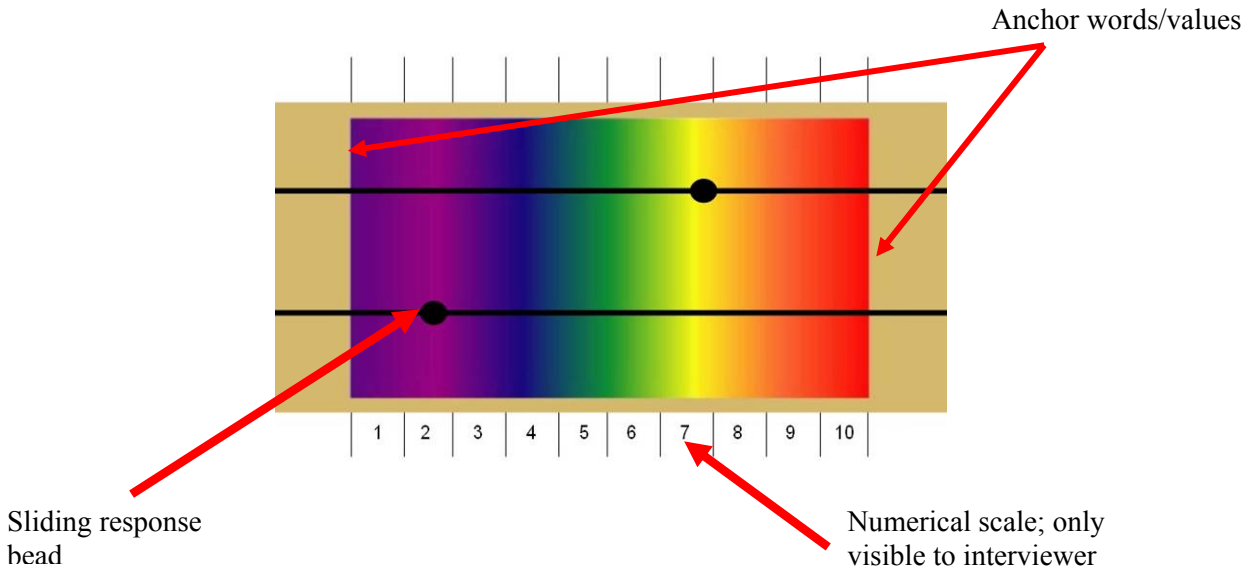


Figure 13 A tool developed to gauge Likert-style quantitative responses to individual questionnaires/surveys.

This technique is novel, although it is related in premise to a Cantril's self-anchoring ladder (1966) and McClanahan's string-based technique (McClanahan et al. 2005b). Questions using this tool were posed with two opposing statements as scale anchors and reference points for the interviewees (Reynolds & Jolly 1980). The question and anchor words were repeated exactly in the same way in each interview. Before the question was asked, the bead was moved off the

scale. The place of the bead on the board was converted by the interviewer into a 10 point a Likert-style category. A total of 47 questions yielded quantitative data from the gradient response board tool.

Perceived changes were also measurable using the gradient response board. Respondents were asked the current status of a certain variable on one bead slider, and the status of the variable 10 years in the past on the second bead slider. A trend in the perceived variable could be calculated using the equation: T (trend) = Vp (past variable) – Vc (current variable).

4.7.2 Key informant interviews

The research team conducted key informant interviews in each community to obtain general community-level information (Fetterman 2009). In general, they were asked to comment widely and informally on six topics:

- **local village governance**; hierarchy, structure and processes
- **marine resource management;** written/non-written regulations, rules, norms and strategies
- **community socio-economic status**; total population, economic activity, infrastructure, gear ownership, etc.
- **critical community/social issues**; affecting men, women and youth
- **environmental issues**; affecting men, women and youth
- **current disputes**; over land/sea resources, boundaries, crimes or governance

Key informants were selected based on their knowledge of the area and their willingness to share information (Marshall 1996). Each informant recommended several other potential key informants in a snowball-esque sampling technique (Goodman 1961). Key informant interviewing continued until the information obtained became redundant. Known as saturation sampling, this technique is widely used in social capital research (Lin 2001). In each community, between 3 and 6 key informants were interviewed, once verbal permission had been obtained. The interviews did not last for more than sixty minutes. Responses were recorded, transcribed and later thematically coded for analysis. These interviews provided useful quotes to illustrate, explain, and clarify quantitative results. As Arratia asserts (1997), we also found that more than any other medium of knowledge, people's stories have the potential give a sense of "texture, meaning and reality." Local stories and anecdotes would play a major role in interpreting motivations for establishing MPAs.

Figure 14 Research team member conducting a key informant interview

4.7.3 Focus groups

We used gender-segregated focus groups to tease out the major themes that emerged during key informant and individual interviews. Focus groups have been called a targeted tool used to identify "the salient dimensions of complex social stimuli as a precursor to further quantitative tests" (Kamberelis & Dimitriadis 2005 pp 899). For example, nearly all of interviewees told us that their primary expectation of village marine closures is to augment the number of valuable fish. But what are these valuable fish? In focus groups, we were able to collectively rank the fish men and women collected and thereby build our ecological effectiveness surveys.

Focus groups were co-facilitated by a member of the core research team and myself. They included between 8-14 participants (Morgan 1997). Discussion was moderated to enable equitable contributions from all participants (Kitzinger 1994). In each community, focus groups informally discussed 8 principal themes:

- Resources
- Threats
- Lifestyle
- Marine rules, norms and strategies
- Customary marine tenure
- Conservation and management ethic
- Disputes
- Supra-village marine governance and the NPMPA Network

Figure 15 Focus group meetings held with village fishermen and church deacons

4.7.4 Community mapping

The village research unit in each community mapped the full boundaries of community marine and terrestrial areas, as well as marine reserves and taboos using a Garmin global positioning system (GPS). Geospatial data was analyzed used ArcView G.I.S version 3.3.

During mapping exercises, the local research team was able to enter into practical dialogue with community members about their natural environment in the field. It was assumed that by conversing while walking through the physical environment, specific ideologies and mental models would more easily be assessed (Borrini-Feyerabend et al. 2000). The community mapping exercise allowed for verification and corroboration of issues and statements made during the individual, key informant and group interview sessions.

Figure 16 Village boundary mapping exercises

4.7.5 Direct participant observation

Malinowski (1922) asserted that researchers are able to approximate "native's point of view" by living and interacting with them. Owing its origins to him and others like Boas, Stevenson and Cushing, participatory research assumes that cultural understanding is acquired through intimate participation with the culture being studied (Tedlock 1991). Although now situated within a radically different worldview to that held by these early ethnographers, contemporary participant observation approaches are often characterized by the willingness of the researcher to develop "membership identities in the communities they study" (Angrosino 2005). Active participation in community life decreases the chances that research will record contrived information, as depicted in the Far Side cartoon below.

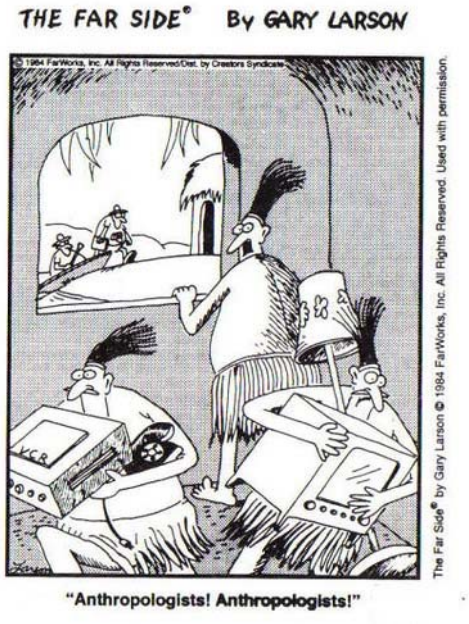


Figure 17 Far side cartoon published by Gary Larson, Chronicle Features, San Francisco

Today observer-as-participant methods in research have been much refined and theoretically strengthened. Widely-used, participant observation methodologies are based in the tradition of grounded theory, enabling knowledge to be gained without experimentation (Haglund & Olsson 2008). Natural, everyday interaction releases the researcher and subject from the constraints of formal interview settings (Kearns 2005). Observation may range from passive to active integration (Baker 2006), while the more assiduous approaches have been dubbed "intensive dwelling" (Clifford 1997), "deep hanging out", "deep chilling" and "deep grooving" (Wittbecker 1986).

Together we (myself + core research team + village volunteers) assumed the role of participant observers. Strong pre-established relationships with individuals and communities ensured that our participant observer status was much farther towards the "intensive dwelling" side of the participant observation spectrum. The entire research team was composed of Nguna and Pele locals, born in the very villages where the research was conducted (I, of course being the only exception). It is clear therefore that our research was far from the 'outsider looking in' paradigm of much early anthropological research. The team's intimate, deep, and life-long knowledge of the social-ecological system eliminated the very real risk faced by foreign researchers that that they will be told what locals think they want to hear (Edmonds 1995). As participant observers in the study communities, we attended village meetings, ceremonial events, fishing excursions and garden trips, all the while critically reflecting on what we saw and heard. At the end of each day, the village research unit would meet to enter data in to the computer, transcribe interviews, download maps, interpret what had been observed and discuss how it related to our research questions.

4.7.6 Ecological surveys

Detailed ecological methodologies are presented in Chapter eight. For all underwater research, local collaborators were fully included in the design, data collection and interpretation of

results. At the summit, local representatives identified key marine species that are protected and locally utilized. In village focus groups, key informant and individual interviews lists of critical marine species and knowledge were also compiled. Underwater research was therefore designed to measure parameters about these key organisms, as well as those identified as ecological indicator species in the literature. Accordingly ecological surveys were conducted after community social surveys had been completed.

A core team of researchers was selected for underwater surveys, in which each member is SCUBA certified[15]. A two-week training session was conducted for the three ni-Vanuatu divers and overseas volunteer. In the training, surveyors learned how to conduct standard ecological surveys, utilize scientific taxonomic classification systems, record data underwater, test for visual measurement accuracy, and practice safe scientific diving. Several aspects of the surveys were adapted to suit local conditions, for example using leaded ropes as transect markers in lieu of lightweight fiberglass tape measures. Multiple pilot surveys were run, validated and re-run with the trainee team. Divers were selected for their tasks during the actual survey based on their performance during training. For actual data collection, one person surveyed fish, one surveyed invertebrates, one surveyed substratum and one acted as a safety buddy and logistical diver.

Figure 18 Team of Nguna-Pele divers on a reef survey

Ecological research was conducted during the summer months when wind and waves were at a minimum. The research team set out each morning from the NPMPA Network base on Pele island with a set of SCUBA tanks to spend the day on the water. The first group to descend would be the fish surveyor and dive buddy. Once the 100m transect had been surveyed for fish, the invertebrate and substratum divers would simultaneously work along the transect while the first group would circle back behind and pick up the transect line. Deep transects were surveyed first in each site. Each person dove three times per day, usually only to a maximum depth of 8m. In this way, it was possible to complete three full sites (1 site=2 x 50m at 7m and 2 x 50m at crest) per day.

4.8 Data analysis, interpretation and dissemination of results

At the end of each day the village research unit would meet to discuss the day's events and jointly interpret them in the context of the research. I took detailed notes of the collaborative

[15] Charley Manua, Willie Kenneth, Sam Kenneth, Jessica Nilsson, Christopher Bartlett.

reflections. Particularly important in these sessions was the chance to triangulate results from the different methodologies employed during the day (Campbell 1959). Data sheets from interviews and focus groups were collected from surveyors and volunteers and entered into the computer by the core team. Key informant interviews were transcribed and thematically coded on they day they were conducted. For ecological surveys, each surveyor would enter his/her own data to be double checked by the dive buddy. Often the team would work late into the night to be ready for the next day.

Before leaving the community, the core research team produced a summary of descriptive results. Requiring sufficient word processing and data analytical skills to comply with this protocol, I spent time in developing this capacity among the NPMPA staff and local village volunteers. Several copies of the raw data, analyzed results, boundary and tenure are maps, photographs, meeting minutes and additional documents were both printed and put on CD-ROM and handed over to the village chief, council and conservation committee.

Back at James Cook University in April 2007, I further compiled and began exploring the data. At that time I also began evaluating novel tools for analysis, and began writing up results for peer reviewed publication. Communication and collaboration with my ni-Vanuatu colleagues did not cease when I left Vanuatu's. I remained in weekly and often daily contact with the core research team, principally to discuss progress on the analysis and raise concerns and questions over counterintuitive patterns in the data. Accordingly each of the papers currently published include ni-Vanuatu colleagues as co-authors. Credit is given where credit is due, and acknowledgement always is given to the entire population of Nguna and Pele.

This dissertation is not intended for the Nguna and Pele audience. Using scientific terminology and 'expensive' English, it does not meet the criteria set by local communities that research be returned in a form locally understandable and accessible. For this reason, I, and several members of the original research team have drafted a book-length version of the research results. Written in the Bislama and Nakanamanga it will present findings of this research in the most useful and relevant way to Nguna and Pele's communities. Copies of this dissertation (and all other resultant publications) have been provided to the communities concerned as well as to the relevant national departments, cultural organizations and NGOs.

Ultimately it is my hope that other communities, researchers, academic institutions and governments will see the value in collaborative and participatory production of knowledge. By this approach science can move forward as an institution for human advancement that is equitable, respectful and cognizant of our inherent diversity.

CHAPTER 5 - HISTORY OF MARINE RESOURCE EXPLOITATION

So that the reader may more fully understand the contemporary context of marine protected areas in Vanuatu, this chapter reviews the patterns of marine resource exploitation on Nguna and Pele Islands since the time of human colonization. Reconstructing historical marine exploitation in Vanuatu is a difficult task because unlike in many parts of the developed world, in Vanuatu the written historical record only began when European explorers passed through the islands in the 17th century. Even since that time, written observations are spotty and inconsistent. Bedford and Spriggs (2008) lament that Vanuatu's written records are

> *"varied in terms of their focus, coverage and detail. Prior to the 1840's they are few and far between".*

This dearth of accurate historical records has allowed a degree of creative freedom to the commentators on marine use in Vanuatu. Much of the current discussion on ancient life in the islands is considered by some to be nothing more than "conjectural history without academic merit" (Kirch 1996 pp 57). In order to escape these critiques, this chapter sets out to comprehensively review evidence for historical Vanuatu marine exploitation from the fields of archaeology, oral history, anthropology, and ecology. According to Munro (1995), "Theory is no real substitute for leg-work in the archives and in the field. There is a difference between being informed by theory and allowing theory to drive the argument."

5.1 Marine exploitation over the last 3,000 years

5.1.1 Earliest ni-Vanuatu inhabitants

> *"Towards the end of the second half of the second millennium BC, a pottery-making and Austronesian-speaking people, thought to be biologically of Island Southeast Asian origin, appeared in the Bismark Archipelago immediately to the East of the island of New Guinea. The Lapita expansion was rapid and involved the settlement of Remote Oceania including Vanuatu, New Caledonia, Fiji and on to Tonga and Samoa in western Polynesia within two to three hundred years."* (Buckley et al. 2008)

Originating from Taiwan, the Lapita group of Austronesian peoples led the colonization of the entire Indian-Pacific Ocean regions extending from Madagascar in the West to Polynesia and Micronesia in the East (though see Cox (2008 pp 51) and Donohue & Denham (2008) for contrasting settlement models). The first island in Vanuatu to be colonized is still a matter of debate (Buckley et al. 2008; Cox 2008) though most agree that particular islands may have acted as colonization focal points or metropolis' (Bedford et al. 1999). Efate Island was likely one of these Lapita focal areas (Bedford 2006). There is also evidence that post-settlement, Vanuatu became an important launch point for the human colonization of the rest of Remote Oceania (Bedford & Spriggs 2008).

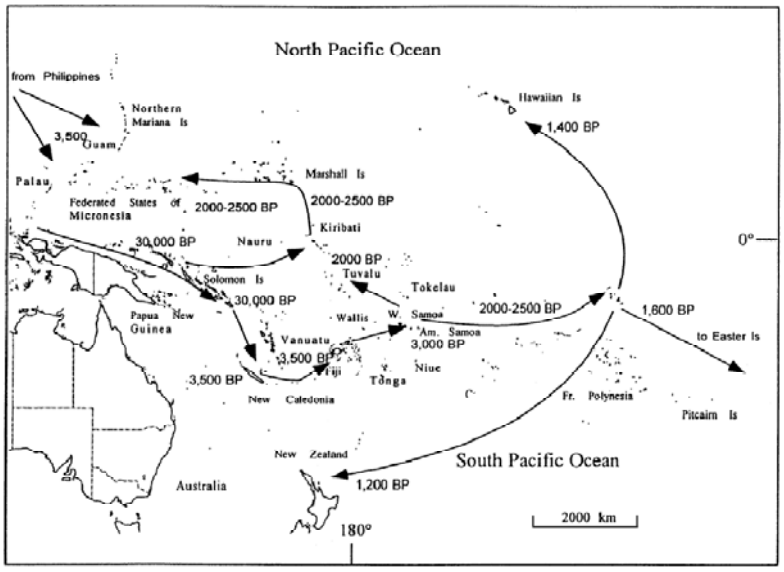


Figure 19 Map showing the dispersal of the Lapita cultural complex throughout the Pacific Islands, reaching Vanuatu sometime after 3500BP. From Dalzell 1998 page 240

Research into recently discovered Lapita burial sites in Vanuatu puts human colonization on Efate island at 3200-3000 years BP (Bedford & Spriggs 2000; Bedford et al. 2006). Estimates put the potential prehistoric population of Vanuatu at 1.5 million (Spriggs 1997), nearly 8 times that of the most recent census (Bakeo et al. 2000). The structure and location of ancient settlements suggest that the earliest Lapita inhabitants lived within structured social groupings (Green 2003; Kirch & Green 2001). These were larger than, but with distinct similarities, to contemporary communities and villages. The location of existing Lapita finds in Vanuatu, suggest that original settlers would look for homesites with an abundance of marine resources. Bedford writes (2006 pp 262) that in Vanuatu

> *"the zones targeted for settlement were overwhelmingly coastal, with a preference for areas which included easy canoe access, fringing reefs and/or lagoonal environments and easily accessible freshwater source… these factors enabled maximum utilization of marine and other faunal resources... occupation may have been short-lived due to changing environmental factors"*

Analysis of Lapita human remains in Vanuatu have found that the earliest human residents in Vanuatu were

> *"well adapted to the island environment, but lived a physically active life while coping with a significant disease burden" (Buckley et al. 2008 pp 110).*

Very little archaeological work has been undertaken on the islands of Nguna and Pele. However a dig on Nguna in 2003 revealed human discards and pottery of the Erueti period originating from at least 2700-2500 years BP (Bedford 2004). The Nguna Dalparu settlement was located within 100 meters of the coast, adjacent to a small fringing reef.

5.1.2 Lapita marine resource use

The first archaeological record of Lapita people's use of marine resources in the published literature is Gifford's analysis of mollusk remains from sites in New Caledonia (1956). Since that time, nearly all Lapita archaeological finds in the Pacific have included at least some marine resource remains. Vanuatu's Lapita inhabitants appeared to have attached some cultural significance to nearshore marine resources (Spriggs 1997), commonly using bivalve and turtle shells as decoration and as part of burial rites (Bedford et al. 2006). Further, results from isotopic analysis on Vanuatu Lapita tooth enamel and wear suggest an early diet which included marine organisms (Bentley et al. 2007; Buckley et al. 2008). Tooth condition of the earliest known Lapita settlement site (Teouma) suggests a mixed diet of "soft carbohydrate foods" and "rougher foods (e.g. shellfish)" (Buckley et al. 2008 pp 108). A mixed marine diet matches other studies conducted on Fijian Lapita remains (Nunn et al. 2007 pp 125), although some Fijian sites yield only the remains of marine resources (Thomas et al. 2004).

Based on these findings it is likely that marine resources were used by ni-Vanuatu people from the time of first settlement throughout the history of human habitation. In an archaeological analysis of fish and shellfish remains at the Mangaasi site on Efate island, Bedford (2006) found that sea resources were utilized throughout the first 1500 years of settlement. Remains most represented shellfish harvested from the sandy intertidal zones. Shellfish in this zone are typically easily harvested, not requiring a great deal of skill (Schmidt 2000). In most Vanuatu Lapita sites, there existed a fairly "unsystematic collection of shells from nearby sand areas" (Green & Anson 2000; Sand et al. 2002 pp 143). This evidence suggests that early inhabitants may have been unspecialized intertidal foragers (Bedford 2006).

Figure 20 Drawing representing the oft- presented paradigm of prehistoric coastal resource use in Vanuatu (Lucas Kukler; permission from the Vanuatu Cultural Center)

Bedford suggests that fish were also a "consistent component of the Lapita diet" (Bedford 2006 p 232). As can be seen from the summary table of the fish remains found at Lapita sites in Vanuatu (Bedford 2006 p 236), almost all targeted fish are reef-based species. Oceanic marine species are much less frequently found in Lapita archaeological deposits, probably due to limited technological capacity (Fraser 2001).

Table 2 Archaeological findings of fish families from a 3000 year old settlement on Efate island. Adapted from (Bedford 2006 pp 236)

Family	Common Name	% remains
Scaridae	Parrotfish	30.4
Diodontidae	Porcupine fish	17.3
Epinephelidae	Grouper	10.1
Coridea	Wrasse	9.8
Acanthuridae	Surgeon fish	6.5
Balistidae	Trigger fish	4.1
Holocentridae	Squirrel fish	4.1
Elasmobranchii	Shark/ray	3.8
Lethrinidae	Emperor	3.3
Teleostomi	other	2.3
Nemipteridae	Bream	1.4
Carangidae	Jack	1.4
Mullidae	Goatfish	1.1
Lutjanidae	Snapper	0.9
Muraenidae	Moray eels	0.9
Ostraciidae	Boxfish	0.9
Belonidae	Needlefish	0.6
Scorpaenidae	Scorpion fish	0.6
Myliobatiformes	Rays	0.3

In some Pacific Lapita archaeological sites, the recovery of relatively advanced fishhook technology is quite common (O'Connor & Veth 2005). Kirch believes that the Pacific Lapita used several marine resource harvest techniques including angling (hooks), netting, spearing, and plant poisons (1997 pp 201).This is not the case for Vanuatu however. After eight years of digs throughout the Vanuatu archipelago, Bedford (2006 pp 213) found a "complete absence" of fishhooks[16]. Kirch notes that sea resources were just one source of sustenance for early island settlers, explaining that

> *"as important as the sea was to Lapita life, it by no means provided their sole basis for existence." (1997 pp 203)*

He lists 28 Lapita food plants thought to make up the basis of the Pacific prehistoric economy (pp 206-207). Bedford also confirms that horticultural produce would have been the "major supplier of sustenance" in Vanuatu (Bedford 2006 pp 262). After examining the remains from dozens of sites across the Pacific, Butler also argues that

> *"a careful reading of the archaeological evidence of Lapita fish remains would indicate that fish were not a significant component of subsistence at all" (Butler 1988 pp 115).*

In essence, the Lapita cultural complex in Vanuatu was decidedly agrarian but used sea resources opportunistically (Spriggs 1997pp 84). The development of intensive agriculture however, may have been a belated development in Vanuatu. Permanent settlements and strong dependence on agricultural systems, likely did not occur until the post-Lapita period or ~1000 years BP (Bedford 2006 pp 263). Archeological evidence from the post-Lapita period suggest

[16] Many of the fish species remains found in Vanuatu digs would have best been captured with baited hooks.

large settlements, rapid population growth, the presence of domestic animals, the abandonment of previous settlements and refined terrace cropping (Harris 1996 pp 530).

5.1.3 Early (mis?) management

Throughout much of the world, there exists a widely held perception that prehistoric peoples lived in harmony with their natural environment. Even today, the concept of an 'ecologically noble savage' (Redford 1991) holds considerable traction among indigenous and conservation activists. It is not uncommon to read and hear assertions like

> *"Most island people of the Pacific have been successfully managing the limited fragile resources of small tropical islands for thousands of years. Their conservation methods have proven themselves through the test of time" (Hickey 2001 pp136)*

But does the empirical evidence corroborate these claims? Most Pacific prehistoric archaeologists have reached consensus that early Pacific inhabitants had considerable impact on the environment (Anderson 2002; Kenneth et al. 2006; Kirch & Rallu 2007). Spriggs (1997) hypothesizes that many Lapita settlements in Vanuatu were completely abandoned due to human overuse and degradation. Steadman (1989) notes the sudden absence of endemic bird and reptile remains evidence soon after the period of initial human settlement in the Pacific Islands, and cites hunting, competition with domesticated animals, and habitat degradation as direct causes. In reference to Vanuatu, Bedford (2006 pp262) writes that:

> *"Extinct birds were identified in only the lowest layers of a number of sites on all islands. The remains of an extinct land crocodile have also been identified at the Arapus site…There are even indications that certain species may have been extirpated from particular areas on different islands."*

To explain the species extinctions, Bedford argues that early Lapita resource use in Vanuatu likely followed a Blitzkrieg-like scenario (2006 pp261-262). That is, resources were harvested to maximum capacity, and once depleted, settlers moved on to more pristine locations. The Blitzkrieg scenario closely matches "prey choice frameworks" from foraging theory, which suggest that harvesters initially focused on the most valuable resources and then shifted to less valuable ones as target populations declined (Butler 2001). The prey choice foraging model may explain why Lapita peoples chose settlement sites close to wide fringing reefs (Nunn et al. 2007), so as to have access to a large pool of easily harvested resources. As optimal scavengers, it is likely that early settlers preferred to harvest in shallow, sandy, easy to reach marine environments (Bedford 2006 pp 243).

Prehistoric anthropogenic depletion of nearshore marine resources is well documented in archeological record of the Pacific Islands (Amesbury 2007; Fitzpatrick & Donaldson 2007). Localized overuse and depression of marine resources has even been implicated as a potential driver of Pacific prehistoric human dispersal (Mannino & Thomas 2002). According to foraging theorists, resource depression by Lapita peoples has been demonstrable in several ways (Morrison & Addison 2008): 1) decreasing amount of large bodied prey relative to smaller prey; 2) increasing use of less profitable habitats; 3) use of increasing taxonomic diversity; 4)

decreasing average age and size of exploited taxa[17]. The following Table 3 lists some of the key evidence for human impact on nearshore marine resources in Vanuatu and the wider Pacific.

Table 3 Summary of results of analysis of fish bone and mollusc shell assemblages in Pacific Island archaeological sites reproduced/appended from (Dalzell & Adams 1997)

Location	Time period	Comments	Source
Tongatapu (Tonga)	3,500-2,000 BP	Initial heavy of exploitation of bivalve molluscs *(Anadara* spp & *Gafrarium* spp) by early colonisers, followed by decline in *Anadara* spp due to a combination of fishing pressure and environmental effects. Mortality curves for *Gafrarium* reflect increasing fishing pressure on population with decrease in average size (and age) in population.	Spennenman (1987)
Mangaia (Cook Islands)	980-330 BP	Significant increase in frequency of molluscan remains at about 500 yrs BP. Average size of gastropod *Turbo setosus* decreased by 50 per cent between the earliest layers in the sequence and those in later years.	Kirch et al 1995 Butler (1993)
Tikopia (Solomon Islands)	2,900 -200 BP	Ark shells and other gastropods major source of animal protein during initial period of colonisation. Mollusc populations reduced through fishing and environmental change, followed by diversification of food base through agriculture.	Kirch & Yen (1982)
Pari (south east Papua New Guinea)	2,000 BP-Present	Gastropod and bivalve molluscs in shell middens reflect exploitation pressure with shift through time, with decrease in average size (and age) in population	Swadling (1977)
Mussau (northern Papua New Guinea)	3,500-350 BP	Composition of fish bone assemblages with time remains relatively constant, with landings dominated chiefly by lethrinids, scarids and serranids	Kirch et al (1991)
Santa Cruz Islands (Solomon Islands)	3,200-2,600BP	Gastropod and bivalve molluscs in shell middens reflect exploitation pressure with shift through time, with decrease in average size (and age) in population	Swadling (1986)

[17] Fish abundance estimates are potentially confounded by mesh screen recovery techniques. Some fish families possess bones which are more robust over time, and therefore more easily recoverable than others (Nagaoka, 2005).

Niutoputapu (Tonga)	2,800-200 BP	Fish bone assemblages from excavations show long term exploitation of reef & lagoon species, similar to contemporary fishing patterns.	Kirch & Dye (1979), Kirch (1988)
Kapingamarangi & Nukuoro, (Caroline Islands)	1,050-500 BP	Fish bone assemblages reflect importance of reef and lagoon fish as staple animal protein, despite cultural importance of pelagic fish such as rainbow runner (*Elegatis bipinnulatis*)	Leach & Davidson (1988)
Aitutaki (Cook Islands)	2,000-1,000 BP	Change in shell hook manufacture from pearl oyster shell (*Pinctada margaritifera*) to turban shell (*Turbo setosus*) with time due to breakdown in inter-island communication and trade. Reliance on more fragile *Turbo* hooks reflected in greater exploitation of smaller lagoon fishes	Allen (1992)
Palau	1,300-100 BP	Fish bone assemblages suggest continuity in reef fish composition and fishing practices during pre-contact period	Masse (1986)
Mussau (Papua New Guinea) Main reef Is & Tikopia, (Solomon Islands) Lakeba (Fiji) Niutoputapu (Tonga)	3,500-350 BP	Comparison of fish bone assemblages suggests greater reliance on line fishing for reef carnivores in west Pacific compared to net and spear fishing for reef herbivores/omnivores in east. Differences may possibly reflect greater fishing pressure in east with reduction of reef carnivore populations	Butler (1994)
Vanuatu (Mangaasi, Efate)	2,900-400 BP	Average size of gastropod *Trochus niloticus* decreased by 50 per cent between the earliest layers at Arapus and subsequent layers found at Mangaasi.	Schmidt (2000) Bedford (2006)
Moturiki Island (Fiji)	2720-2350 BP	Average size of Trochus declines by 20mm. Decline in total shell weight in pits over time.	Nunn (2007)
Mangai (Cook Islands)	700BP	Average size and abundance of Serranidae decrease with human pressure.	Butler (2001)
Vanuabalavu (Fiji)	1100 BP	Decrease in average size of bivalve Anadara sp.	Thomas et al (2004)
Northern Rock	1700 BP	Significant declines in abundance of	Fitzpatrick

islands (Palau)	sea bream, Parrotfish, wrasse, and leatherjackets. Decreasing species richness through time.	and Kataoka (2005)

In Vanuatu, both fish and shellfish were subject to Lapita and post-Lapita human pressures. The archaeological record gives evidence of declines in resource abundance and size (Butler 2001). On Efate Island, the basal widths of trochus remains (*Trochus niloticus*) found in pits in Arapus (earlier settlement) were compared to those in Mangaasi (later settlement)(Bedford 2006). Shells found in Arapus were 50% larger than those found at Mangaasi (Schmidt 2000). Reduced size is a commonly-cited outcome of high invertebrate fishing pressure (Ashworth et al. 2004). A similar consequence of early human exploitation on trochus size was found in the Reef/Santa Cruz group of the Solomon islands (Swadling 1986).

Figure 21 Child on Nguna holds a trochus shell, trochus shells awaiting sale to urban-based button makers.

There are alternative hypotheses about why resources consistently declined in size and abundance after Lapita settlement in the Pacific. These generally disagree that humans could have directly caused environmental degradation to the degree evidenced in the archaeological record (Brookfield & Overton 1988; Grant 1994; Nunn & Britton 2001). Geoarcheological evidence points to a major climactic event in the Pacific region approximately 700 years BP (Allen 2006; Nunn 2000). Contemporary evidence clearly demonstrates the potential scale and breadth of climactic impacts on marine resources, including declines in abundance, biomass, and diversity (Walther et al. 2002).

Climactic factors alone however, cannot adequately explain the patterns of marine resource decline found in the Pacific Island archaeological record (Butler 2001). More likely is that climate and human harvest pressures working together may have facilitated the marine resource declines in early Lapita sites (Morrison & Addison 2008). Ultimately however, we know that the Lapita cultural complex died out in Vanuatu, and according to Spriggs, principally due to environmental degradation (1997). Even if ni-Vanuatu did not directly overharvest natural resources, Spriggs (1997) argues that the Lapita peoples aided environmental instability through the advent of large-scale and unsustainable agricultural practices.

This review of the literature gives several clues about prehistoric Lapita marine resource use, management and subsistence lifestyle. Primarily, there is strong consensus that early ni-Vanuatu settlers utilized reef-based marine resources for subsistence, though may have focused

more heavily on terrestrial activities. Another critical point made by multiple authors is that early Lapita people had a severe deleterious impact on reef resources, most likely caused by excessive targeted harvest. The evidence clearly demonstrates that at no point since human colonization of Vanuatu have marine resources increased in average size or become more abundant. In fact, these reverse is true. This fact suggests that either 1) marine management is only a very recent phenomenon, or 2) prehistoric management existed but was ineffective.

5.2 Marine exploitation over the last 300 years

5.2.1 Custom stories

As discussed, culture and customary practices are not readily preserved in the archaeological record. There is a distinct gap in availability of physical evidence on prehistoric marine use. Much must therefore be pieced together circumstantially. In other long enduring cultures where the written or physical record is lacking, relatively accurate histories may be constructed from oral histories and stories (Bailey & Israel Oriental 1980; Vansina 2006). Vanuatu has a strongly developed tradition of oral history (Bonnemaison 1996), with custom stories describing many aspects of ni-Vanuatu life. It may therefore be possible to uncover important aspects of pre-contact marine use and management on Nguna and Pele through a detailed examination of oral history.

Recent evidence suggests that oral histories in Vanuatu however can be remarkably accurate. A huge volcanic eruption occurring several hundred years ago forms the centerpiece of many widely-told legends in Vanuatu. These stories are corroborated by geological evidence suggesting that the Kuwae volcano erupted in AD 1452 (Witter & Self 2007). In another example Nunn et al. (2006) recorded oral histories about existence and disappearance of several islands in Vanuatu. Subsequent geological analysis revealed that the custom stories were remarkably accurate in terms of volcanic and tectonic activity.

While there are limitations to using oral histories to reconstructing accurate historical timelines and practices *(Nunn et al. 2006 pp48; Tonkin 1992),* custom stories may be used to triangulate other evidence regarding the past use and management of marine resources on Nguna and Pele.

5.2.2 Local stories from on Nguna and Pele about marine use

The first records of oral history from Nguna and Pele began in 1870 with the arrival of the Reverend Peter Milne. He was succeeded by his son William Veitch Milne until 1937. Subsequent missionaries to Nguna, Ken and Chris Crump (1938-1956), also recorded some local stories. Later in 1963, a team of French anthropologists including J.J. Espirat and J. Guiart vistited the central islands of the then New Hebrides to detail the system of hereditary titles and record associated stories. Soon afterwards a University of Hawaii researcher, Albert Schutz, spent several months on Nguna in 1966 to record texts and stories. Canadian researcher, Ellen Facey lived on Nguna island intermittently between 1978 to 1980 to serve as what she has called a "scribe of kastom", eventually producing a volume entitled Nguna Voices (1989).

Of all that has been recorded from Nguna and Pele, only a handful of the stories make mention of marine resources or habitats. A few of the older stories mention the use of shellfish (Schütz

1969b pp 12) and fish (Facey 1989 pp 132; Schütz 1969b pp 283). Some stories describe resource biology (Facey 1989 pp 260-263) or the origins of marine spirits. In precontact times, spirits were believed to have resided in every village on Nguna, often living in caves (Schütz 1969b pp 102) and taking the form of marine animals including, snakes, crabs, sharks or even whales (Facey 1981 pp 305). For example, the principal spirit of Piliura village on Pele was a gigantic shark called Peseruru, who was widely believed to have the power to protect the village from its enemies (by tipping over canoes) as well as the ability to transport the Chief across the water on its back (Espirat et al. 1973 pp 335).

5.2.3 Early written records on marine use and exploitation in Vanuatu.

The preceding sections demonstrate, with evidence from archaeology and oral history, that ancient marine management may not have been a reality on Nguna and Pele. Additionally, there evidence to suggest that today's taboo institutions were not originally intended as conservation strategies or to ensure the long-term maintenance of important stocks. However, another source of information may yet help to explain the contemporary preoccupation with marine reserves and taboos on Nguna and Pele; the eye witness observations of early European visitors to Vanuatu. The earliest and most comprehensive written sources of information about marine use in early Vanuatu come from the journals, diaries and shipboard logs of explorers, traders and missionaries. What follows is a brief synopsis of how ni-Vanuatu people have been observed to utilize marine resources over last four hundred years.

By most accounts, the first European to reach what is now the Republic of Vanuatu was the Portuguese navigator Pedro Fernandez de Quiros sailing under the Spanish flag in 1606. He and his crew made the first written observations of pre-contact Vanuatu, including some notes on marine resource usage by locals. Stopping in Big Bay on Santo Island, Quiros noted that

> *"they make much use of mother of pearl shells, which they turn into wood chisels, fish hooks, and many types of neckwear" (Kelly 1966)*

During a raid on huts abandoned by terrified locals, his crew found

> *"several kinds of fish, roasted and wrapped in plantain leaves, and a quantity of raw mussel-shells" (Quiros 1904a pp 257-258).*

He also noted that island residents

> *"use shells also for musical instruments" (Quiros 1904a pp 265).*

Of fishing practices, Quiros observed that residents

> *"fish with a three-pronged dart, with thread of a fibrous plant, with nets in a bow shape, and at night with a light" (Quiros 1904a pp 267).*

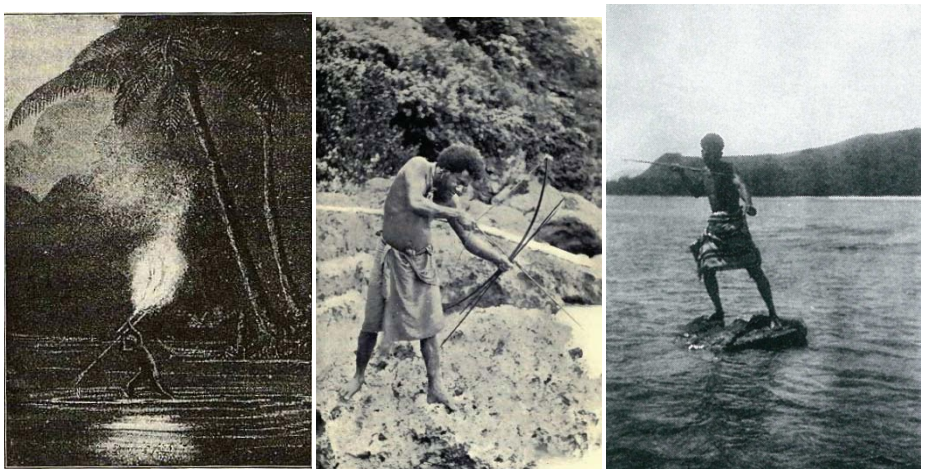


Figure 22 Drawing of a ni-Vanuatu night fisherman by Wawn in 1893 (Wawn 1893), a bow and arrow fisherman on Futuna Island in 1914 (Gunn 1914), a Nguna Island spear fisherman in 1947 (Crump & McKenzie 2000).

Quiros' journals provide clear evidence that marine resources were exploited by ni-Vanuatu at the time of first European contact. Additionally, his observations reveal that exploitation strategies had evolved significantly since the optimal foraging period of the first Lapita peoples, 3500 years before. Most importantly, we see that marine resources during this period were used for food, but also formed a part of musical culture.

Though preceded to the islands of Vanuatu by Quiros in 1606 and Bougainville in 1768, Captain James Cook was the first European to sight central and southern Vanuatu in 1774, giving the archipelago its former name: The New Hebrides. Captain Cook passed Nguna, Emao and Efate Islands on Tuesday, 26th of July 1774. He called them "Hinchinbrook" (Emao), "Montague" (Nguna) and "Sandwich" (Efate) Islands. This designation was widely used until the early 20th century in other early writing on the area (Goodenough 1876 pp 288; Ray 1887 pp 409; Schütz 1969a app 6). One gains an environmental appreciation of the Nguna-Pele area two hundred years ago from the following passages describing Cook's impressions:

> *"At noon we were in the Channel which divides the easternmost from the large island (Emao from Efate)… The sides of this isle opposed to us (Nguna) exhibited a most delightful view, its shores are low, the land rises with a gentle ascent to the hills, which are of moderate height, it is everywhere spotted with woods and lawns and has the appearance of great fertility but there is no approaching the coast in this part, on account of rocks and breakers, but on the west side of the small isles there seemed to run a bay (Undine), which if examined may be found to afford good anchorage… It ought to be remarked that we have not yet seen an isle on which we have not either seen people or signs of people (pp 473)…In short so far as may be judged from what we have seen from the ship this is one of the most beautiful and desirable islands we have yet seen in the South Seas (Cook et al. 1955pp 510)."*

Figure 23 Map made by James Cook during his 1774 expedition through the then New Hebrides, focus showing Hinchinbrook (Emao), Montague (Nguna) and Sandwich (Efate) Islands.

While Captain Cook did not weigh anchor on Nguna or Pele, his observations from other islands illuminate the then ni-Vanuatu agricultural way of life.

> *"When night fell the country was alight with fires from the shore to the hill tops as the people burnt off the growth for their plantations" (pp 409). "Plantations were everywhere seen, laid out by line and fenced around." (Cook et al. 1955pp 481).*

In general, as his journal entries indicate, he felt that marine resources were not a significant part of ni-Vanuatu livelihoods:

> *"I believe these people live chiefly on the produce of the land and that the Sea contributes but little towards their subsistence. Whether it is because the coast does not abound with fish or that they are bad fishers I know not, perhaps both, I never saw any sort of fishing tackle amongst them or any one out fishing except it was on the shoals or along the shores of the harbour" (Cook et al. 1955pp 503).*

In Sandwich Bay, Malekula however, he witnessed people collecting shellfish on the reef at low tide (Cook et al. 1955). One is able to deduce that ni-Vanuatu placed some non-subsistence value on marine resources from his description of ni-Vanuatu's appearance:

> *"The men were naked, with a belt round the middle so tight is almost gave them two bellies, attached to this a penis case made of cloth or a leaf, they wore bracelets of shell-studded cord and hogs tusks, curved cylindrical pieces of shell stuck through the nose, ear-rings of tortoise shell." (Cook et al. 1955pp 397).*

After Captain Cook's passage near Nguna and Pele in 1774, very little else was recorded on the area until the mid 19th century. Sandalwood was discovered in the New Hebrides in 1828, and due to a fear that trade secrets be used by the competition, there was a "habit of secrecy with respect to all their transactions on the part of the traders" (Erskine 1853pp 15). These traders therefore leave very few records of value to ethnographers. By 1849 Sandalwood was already scarce on Efate (Erskine 1853 pp 335), likely due to the incredibly large numbers of traders operating in the New Hebrides (Erskine 1853pp 487). While the Sandalwood trade was undoubtedly carried out on Efate, it is not known whether it was harvested on Nguna or Pele.

Facey (1981 pp 302) suggests that Nguna and Pele were likely too small to have received much attention from these early traders. No wild Sandalwood can be found on Nguna today.

After Cook, the most comprehensive writing on the islands of Efate and it satellites was published by Captain John Erskine after a cruise in 1849. He provides the following detailed early description of the people of North Efate:

> *"They were of large stature and regular features, some having straight or almost aquiline noses, good foreheads, and beards of a moderate size.... their dress... consisting of a broad belt of matting, seven or eight inches wide, very neatly worked in a diamond pattern of red, white, and black colors, with a species of maro suspended in front. Many of them had their skins tattooed, or rather covered with raised figures, the arms and chest being the parts generally operated upon; the cartilage of the nose was frequently pierced, and filled with a circular piece of stone, and the lobes of the ears always so, large ornaments of white shells, or of tortoise shell, being hung from them, so as often to extend the orifice to a great size. Round the arms, and, in some cases, round their ankles, they were handsome bracelets, made of small rings ground out of shells, exactly resembling chain armor, and so neatly strung together in alternate black and white rows or figures that the inside resembled a coarse woven cloth. Garters of a green leaf were often tied tight round the leg, under the knee; and, in one or two instances, the crisp hair, which was in general of a moderate length, was gathered up into a large topknot, colored yellow by lime, and a neat plume of cocks' feathers, attached to the scratching pain, inserted in it…. The women would were generally tall and thin, their hair cropped close to the head, and the skin occasionally marked with figures… Their dress... consisted of a somewhat broader waist belt, and a square map in front, resembling an enlarged maro. To this must be added however the singular appendage of a tail, made of grass or matting, the end is being a loose fringe of a foot and a half long, and the whole suspended from the waist belt, and reaching nearly to the calf of the leg." (Erskine 1853 pp 324-3332)*

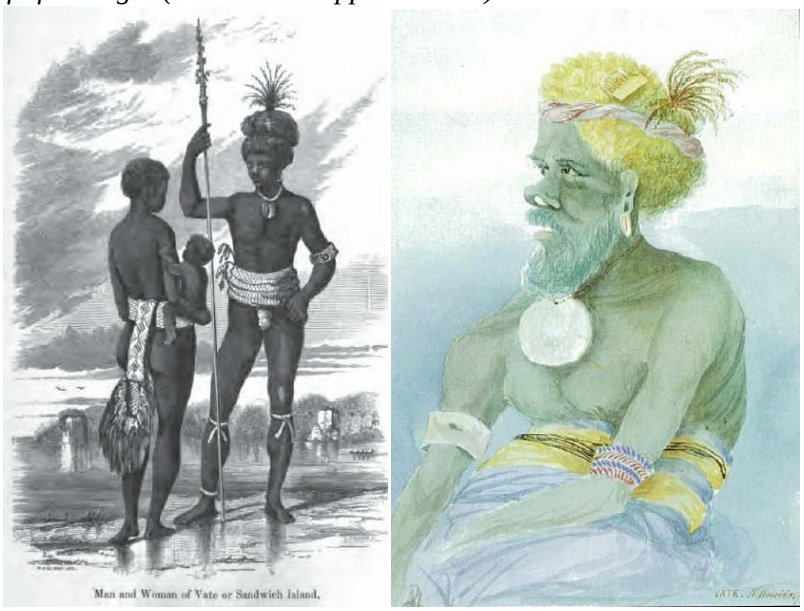


Figure 24 Drawing from Efate island (Erskine 1853 pp 333). Drawing from Bonnemaison (Bonnemaison 1996 pp 282): A portrait of a chief on Efate. Watercolor by B.M. in 1875. Alexander Turnbull Library, Wellington.

Arriving on Nguna in 1870, Mary Milne, the wife of Reverend Peter Milne described the traditional adornment characteristics of the Ngunese:

> *"The men…have a bracelet…made of white and amber shell beads, which are worn above the elbow and which are highly prized. A large pearl-shell is suspended by a chord around the neck- I have seen some with the center of a common blue plate. The women…wear very little in their ears, only a small ring of tortoise shell." (Don 1977pp 15).*

In 1875 Commodore Goodenough describes that among the Ngunese:

> *"they all paint the face black and red, and have an ornament round the neck a pearl shell…Their noses are pierced, and they carry in it a ground down piece of shell"* (Goodenough 1876 pp 293)

Visiting in 1880, missionary Robert Steel also confirmed that the Ngunese wore shell decorations (Steel 1880 pp 220), and further described their appearance as:

> *"well-built and strong, but fierce and painted savages. They wear little clothing; the men are almost naked, but wear many ornaments of shells and beads, and frequently have cock's tail feathers stuck in their hair"* (Steel 1880 pp 242).

In 1845, the Reverend George Turner described another cultural practice which was reliant on marine resources. He noted that traditional houses were decorated, often copiously, with the bones of fish and land animals (Turner 1861 pp 393). In 1849 Erskine noted that the North Efate village common houses were filled with:

> *"every conceivable bone of birds and fishes, mingled with lobster shells and sharks' fins" (Erskine 1853 pp 332)*

In 1849 Erskine noted that the habit of collecting these bone and shell ornaments was so passionately followed that trade in these items created a veritable market among tribes on Efate and other islands *(Erskine 1853 pp 332).* Canadian anthropologist Ellen Facey asserts that many of these bones belonged to enemies whose trophied heads were

> *"consumed and the skull and jaws hung up in the rafters of the chief's varea" (Facey 1981 pp 300).*

On a visit to Utanlangi Village (Nguna) in 1875, Goodenough also observed a hut that was decorated with

> *"no end of bones of turtle and pigs and fish hung from long strings"* (Goodenough 1876 pp 292).

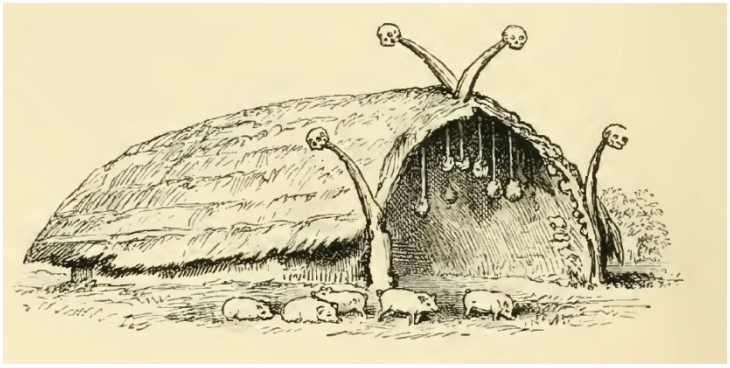


Figure 25 1875 Drawing of house on Nguna from (Goodenough 1876 pp 292)

These early descriptions from the Nguna and Pele area provide irrefutable evidence that the people of North Efate did utilize marine resources. Most commonly highlighted however is the non-consumptive use of these resources, including personal and home decoration with shells and bones. The importance of marine resources to subsistence, and the fishing abilities of Nguna and Pele residents is not clear. Captain Cook felt that the ni-Vanuatu of the period were a far cry from the sea people he had observed in the rest of the Pacific. In his diaries he wondered to himself whether the islanders of the 18th century were either bad fishers or suffering from a lack of fish *(Cook et al. 1955pp 503).*

Certainly coral reef resources were plentiful around Nguna and Pele. Commodore Goodenough's ship logs confirm that reef locations around Nguna and Pele in 1875 were identical to those of the present day, and that they were comprised of

> *"fine terraces of coral very clear all round the North end of Vate (Efate)" (Goodenough 1876 pp 318),*

In 1890 the reefs in the straights between Efate and Pele were described in flowing prose:

> *"take a look now into these depths. Mark the varying shades of the gay coral. Notice the forms into which it is built. There are sprays, and branches, and trunks of trees. They arc of every lovely tint. The tiny polypi have erected a forest. They have laid out gardens, rolled out plateaus, built arched passage ways, done their sweet will in everything. Wonderful zoophytes! In an out amid all the beauty glide an infinity of creatures in shell, and skin, and scale. You observe that the beach far away looks like a mere rim of white sand." (Adams 1890 pp 52)*

Cooks assessment of the fishing abilities of 18th century ni-Vanuatu is corroborated by more recent ethnographers (but contrast with Quiros above) who assert that:

> *"the natives cannot be said to be very skilled, and fishing on the open sea is never practiced…the fishhook was unknown in the New Hebrides"* (Speiser & Stephenson 1990 pp 141-143)

Much to the delight of early European mariners and traders, they were able to trade property and other valuables with the natives

"for a few hatchets, fish hooks, and other things" (Steel 1880 pp 132).

Observations on fishing correspond well with the archaeological evidence that suggested that Lapita settlers were highly terrestrially focused, and suffered from complete absence of fishhook remains. One piece of maritime technology that was undoubtedly widely used in Vanuatu, however, was the dugout canoe. The earliest Lapita immigrants must have traveled to Vanuatu in large ocean-going canoes Figure 26.

More recently, the letters and diaries of early European settlers often contain stories of canoe use. For example the reverend John Patton recorded that on Tanna island, locals took regular night fishing trips in canoes (Paton 1894 pp 265). In comparison to other Pacific Island countries, the quality of the contemporary canoes in Vanuatu have been both praised (Erskine 1853pp 334) and derided as substandard (Gunn 1914 pp198; Haddon et al. 1975 pp 14). Along with many other aspects of material culture, canoes are also unfortunately not preserved in the archaeological record. Thus the continuity and distribution of use as well as design sophistication in Vanuatu is difficult to assess.

Figure 26 Drawing of a canoe from on page 186 (Bonnemaison 1996). Most common type canoe found in Vanuatu today; small and roughly carved (Hermann & Bonnemaison 1975)

Vanuatu is an incredibly diverse nation, and it is to be expected that some groups used marine resources more than others. Steel was surprised by the local knowledge of reef diversity, commenting that in some groups:

> *"there are native names for ninety-five salt-water and for sixteen fresh-water fish" (Steel 1880 pp 208)*

The following description by missionary William Gunn vividly describes the fishing practices of Futuna Island in 1914 and provides contrast to the view that ni-Vanuatu people as a whole were incapable seamen:

> *"The most assiduous fishers are in the southern islands. Their methods are very numerous, some of them almost ingenious; by hook and line; by net and basket; large fish and turtles speared; the smaller fish sometimes killed with bow and arrow. Shell-fish are caught on the reef by day, or, with the aid of torch-light, by night."* (Gunn 1914 pp 197-198)

Obviously, this description was written nearly 80 years after the first white visitors landed on these islands with some permanence, describing some practices developed after the addition of critical equipment like fish hooks and diving masks. He also describes potentially more endemic forms of fishing on the adjacent island of Anytium;

> *"Below high-water mark a line of stones is laid in a semi-circle, and the fish, brought in at full tide, are entrapped as it ebbs, and killed in the shallow pools. Or coconut leaves, kept in position by heavy stones, when swayed by the moving sea, deter the fish from going out and they are caught at low tide. In some islands the juice of a certain plant, thrown into the water at low tide, kills the fish, without injuring them for eating."* (Gunn 1914 pp 197-198):

However, records from Efate do not detail the same indigenous maritime focus as found on other islands. Amassing a series of reports of net and spear use for fishing from throughout the archipelago, Speiser received none from Efate or its offshore islands (Speiser & Stephenson 1990). The lack of fishing technology on Efate contrasts sharply with many other pre-contact Oceanic societies which had finely developed fishing knowledge and practices (Johannes 1989; Kirch 1985). It is likely that the people of North Efate focused instead on terrestrial resources, and were clearly "bush" people (see Roe 2000 for a description). On Erskine's visit to North Efate in 1849, Erskine records the local use of terrestrial resources like yams and pigs but does not mention fish or other marine resources (Erskine 1853). Specifically referring to the people of Nguna, Peter Milne commented that

> *"The people are all tillers of the soil, whether bushmen or shoremen. The latter do some fishing from their canoes, but their staple articles of diet are the fruits of the soil" (Don 1977pp 20).*

5.3 Summary & Conclusion

This Chapter presents archaeological evidence suggesting that 3500-3000 years before present, early Vanuatu settlers selected homesteads near sources of marine resources, which had important subsistence and cultural values. Interestingly however, no advanced harvest technology, like fishhooks, has ever been recovered from early ni-Vanuatu settlement sites. This, and the prominence of agricultural remains in archaeological excavations, leads paleoecologists to conclude that Lapita livelihoods were overwhelmingly terrestrially focused and only harvested marine resources in shallow areas. The Chapter points to the archaeological record to suggest that these shallow nearshore marine resources were subjected to Blitzkrieg style harvest, leading to rapid local depleations and continuous declines in the abundance and size of target organisms. Ultimately the evidence provided in this chapter strongly suggests that ancient marine use in central Vanuatu was either unrestricted or else customary management regimes were ineffective.

The second part of the Chapter presents area-specific pritings and observations over the last 300 years to provide a lens to examine the extent of early marine uses, processes and marine governance institutions on Nguna and Pele. Considered as a whole, these sources strongly suggest that the islands of Nguna and Pele did not have a well-developed maritime culture. Residents primarily engaged in terrestrial subsistence activities, even in the presence of one of the most extensive reefs and intertidal seagrass areas in the archipelago (Chambers et al. 1989a). In line with Efate's archaeological evidence, the oral and written evidence suggests that people of North Efate during the 18th and 19th centuries did utilize sea resources, but primarily and most commonly in non-consumptive ways (e.g. for personal or home decoration). The perceptions, by a multitude of first hand observers, that early residents on Nguna and Pele were not expert seamen indicate the likelihood that few marine institutions had been developed to manage resource exploitation. Thus this chapter concludes by rejecting the widely-held presumption that all early Vanuatu inhabitants had developed complex systems of customary marine resource management.

CHAPTER 6 - TABOOS AND MPAS: 'CUSTOMARY' MARINE MANAGEMENT PARADIGMS

> ***"Revision is the lifeblood of historical scholarship. Interpretations of the past are subject to change in response to new questions asked of the evidence. There is no single, eternal, and immutable "truth" about past events and their meaning. "***
> **(McPherson 2003)**

6.1 Introduction

This chapter explores and critiques the prevailing paradigms that ancient or customary marine conservation practices were ubiquitous in the islands of Vanuatu. At the outset, I describe the institutions and practices widely held to represent ancient marine management in the Pacific, including the oft cited marine taboo. I then explore local factors which may have prevented or restricted the uptake of customary marine management on the islands of Nguna and Pele. Finally, this chapter presents background information about the contemporary MPA phenomenon in Vanuatu. It examines the ways in which communities are legislatively enabled to establish MPAs, and gives an historical account of their recent popularity in Vanuatu.

6.2 Ancient marine management paradigms

Many contemporary ni-Vanuatu communities are actively implementing management regimes purportedly to curb anthropogenic impacts on marine resources and ensure resource continuity and longevity. Due to the widespread nature of marine management initiatives throughout the archipelago, there is a widely-held view that conservation-focused marine management is endemic to all islands of Vanuatu and the Pacific. This view contends that Pacific Island people have, over thousands of years, conscientiously and systematically employed techniques to directly enhance stocks of nearshore marine resources (Hickey 2006; Johannes 1978).

The prevailing paradigm in Vanuatu's marine management sector holds that islanders have been successfully and sustainably managing marine resources for millennia *(eg. Hickey 2001 pp136)*.

> *"If management means regulating who may fish, when and where they may fish, what methods they use, and/or what they may catch, then fisheries management by villagers themselves has been widespread in Oceania for centuries." (Johannes 1998b)*

Kenneth Ruddle summarizes the commonly held perception that spatial closures, called taboos, are the ubiquitous customary form of MPAs in the Pacific.

> *"Marine resource conservation measures were traditionally employed by Oceanian communities to ensure sustained yields. Among these were the live storage or freeing of surplus fish caught during spawning migrations; use of closed season; the placing of taboos on fishing areas; the reservation of particular areas for fishing during bad weather; size restrictions; and, in recent times, gear restrictions."* (1989 pp 81)

Widespread throughout the Pacific today, the institution of taboo was recently the subject of a paper by several key environmental leaders from the Pacific region (Caillaud et al. 2004). In the opening paragraph, these authors assert that the taboo is a marine conservation strategy that was

> *"developed over many centuries and transmitted from generation to generation."*

The ancient management paradigm exists also at the highest levels of government in Pacific Island countries. At the Ministerial Conference on Environment and Development in Asia and the Pacific (2000), the ministers jointly declared that:

"Protected areas for nature conservation have been an integral part of Pacific Island countries for thousands of years. Pacific Island reserves were established by taboos to prevent anyone from entering the area, with the express purpose of allowing the wildlife to recover."

In the above mentioned papers however, as is the case in many studies arguing that effective pre-contact marine management existed in Oceania, little to no evidence is given to back up the assertions of ancient conservation. A close reading of the references and literature cited in these writings shows the heavy use of secondary sources, many of which contain no citations themselves. For example, in a paper entitled "Traditional marine resource management in the Pacific", Gary Klee writes about the extensive system of effective marine resource taboos (Klee 1985 pp 193) and cites page 27 in Meller and Horwitz as a reference (1971). Without providing a reference of their own, Meller and Horwitz wrote that

> *"an elaborate taboo system reinforced the essential principles of conservation and preserved the islands' natural resources". (1971 pp 27)*

A reliance on secondary or anecdotal sources may have led, in part, to the current assumptions regarding the longevity, distribution of conservation focus of the Pacific marine taboo. Rather than accepting these assertions without question, it is critical to ask what exactly is (and was) the Pacific Island taboo? Is it, as claimed above, a prehistoric and pre-contact Pacific institution developed to directly and sustainably manage natural resources? Although currently used by island communities throughout the Pacific today, does the taboo represent the most or only appropriate mechanism for resource management? Unfortunately these questions are difficult to answer because, like so much of culture, these institutions are not preserved in the archeological record. However, the archaeological record can provide important insight into the question of ancient marine resource use and management in Vanuatu.

6.3 The taboo as a tool for resource conservation?

The taboo is the most oft cited example of ancient marine management in the Pacific (Caillaud et al. 2004). However in light of the above mentioned archaeological evidence, it becomes necessary to examine the equally likely possibilities that 1) the taboo was not an effective management regime or 2) that it was used primarily for a non-conservation purpose.

6.3.1 Taboo as a system of social prohibitions

Colding and Folke reviewed the literature on contemporary informal taboo institutions around the world that contribute to natural resource management. They acknowledge the difficulty in distinguishing "among ecological, social, or religious origins and functions of resource and habitat taboos" but suggest that they are essentially informal socially-focused institutions of prohibitions (Colding & Folke 2001). Although thoroughly reviewing the contemporary literature, Colding and Folke do not review primary observations from sources before 1912. But what were taboos like centuries ago?

The first published reference to taboo was made by Captain James Cook in diaries from his voyages through the Pacific Islands in the late 17th century. In an account from the Hawaiian islands, Cook writes

> *"the priests, to prevent the intrusion of the natives, immediately consecrated the place, by fixing their wands round the wall by which it was enclosed. This sort of religious interdiction they call taboo' a word which we heard often repeated during our stay amongst these islanders, and found to be of very powerful and extensive operation" (Cook & King 1793 pp 157)*

The next formal description of the Pacific Island taboo comes from David Darling in 1835. He recounts that

> *"in all the Marquesan islands almost every thing has a tapu attached to it less or more. The Tapu is making of a thing or person sacred, or separating them from another thing or person, a prohibition. Sometimes they are only for a time and then removed, other Tapus are continual, such as sacred places" (quoted in Thomas 2000 pp 236)*

In his view, the taboo is implemented for the benefit of particular individuals and

> *"was bewilderingly various in its application: some things and people were tapu, others were always tapu….tapu might be applied to places, activities, times, people and objects" (Thomas 2000 pp 234).*

Codrington, speaking for the entirety of Melanesia, also perceived taboos as prohibitions which would benefit certain individuals. He noted that taboos could be placed over locations and objects to separate them from common use including

> *"a path, trees, part of the sea-beach, a canoe, a fishing-net" (1891 pp 216)*

Beale however suggests that rather than serving as an individual prohibition, the taboo institution was the foundation of human law and order in early Pacific society.

> *"As if to compensate for the absence of a moral code, they had raised the custom of tapu to a higher place in their social life than the provisions of the Decalogue have attained in ours" (Beale pp 125).*

In the Philippines too taboo was perceived to be a form of early legal institution, and

> *"entirely a creation of superstition, and its 'thou shalt not' often touched matters of deep import (Stephens & Bolton 1917 pp 164).*

More than any other function, the taboo institution likely served as a form of social control, and reinforcement for local power hierarchies.

> *"the motivation for such systems has been the preservation of social order and local power structures. Since fishing has been to Pacific Islanders their main source of food and employment, control of access to fishing ground is tantamount to political and social control. This may explain why many of the traditional systems are now in the process of disintegration, even though the need for conservation is as great as ever." (Panayotou 1989).*

Similarly Beale asserts that the taboo was likely

> *"exercised mostly by the chiefs, used to maintain their power and dignity" (Beale pp 125).*

Found throughout the Pacific region, the use of taboo may, according to some early observers, have been more prevalent in Polynesia than in Melanesia.

> *"The tapu or tambu of Melanesia is not so conspicuous in native life as the tapu of Polynesia; and it differs also perhaps in this, that it never signifies any inherent holiness or awfulness, but always a sacred and unapproachable character which is imposed. Some thing, action or place is made tambu or tapu by one who has the power to do it, any one whose standing among the people gives him confidence to lay his character upon it." (Codrington 1891 pp 215)*

Regardless of its original distribution, by the end of the 18th century the taboo institution had gained widespread recognition in Europe. Captain cooks travels were well known, along with his descriptions of the exotic institution of taboo. As the word became commonplace in households across Europe, it was soon adopted as a formal part of the English language in reference to social prohibitions (Horwitz 2002). In 1890, the taboo was the subject of a lighthearted romance novel entitled The Great Taboo (Allen 1890), and soon after played an important role in Herman Melville's adventure story of the Marquesas Islands (Melville 1900). The most famous European evocation of the taboo was Sigmund Freud's treatment of the concept in his book Totem and Taboo (Freud 1950). In an example of what he called 'avoidance behavior', Freud cites a customary taboo in Vanuatu which instructs young males to avoid contact with their mothers and sisters (Freud 1950 pp 9).

Most travelers to Oceania in the 19th and 20th centuries had read Cook's accounts of the taboo and perhaps even used the word in their home country before ever setting foot in the Pacific. Considering the linguistic and cultural diversity found throughout the Pacific, it is of

considerable interest that a single word was used so prevalently. Cook makes reference to other words which were used to indicate taboo in other locations. Thus, one may wonder whether this word became a tool for shared communication between early European settlers and the ni-Vanuatu, a proxy for the critical word 'no'. Would the word taboo have become so frequently used throughout the Pacific had it not been for the presence of foreigners who did not speak indigenous languages? Also worthy of discussion is whether or not taboos were declared more frequently and more widely in response to the dominating presence of foreigners. For example, perhaps chiefs used the taboo as an attempt to curtail the encroachment of the 'whiteman' on their land. In summary, it is quite possible that European visitors assisted in the 'taboo-ification' of the region, having arrived already pre-prepared to evoke and fully utilize the taboo to their advantage.

Beale confirms that the word and institution of taboo was a very useful instrument for the Pacific Island missionaries, giving them "not a bad substitute for government" (Beale pp 125). Prohibitions were valuable, and much required in Christian doctrines. Noting the value of the taboo to Europeans in the Pacific, Codrington argues that

> *"The tambu is too convenient an institution to drop when the original sanction of it has ceased to operate; a Christian teacher therefore does not hesitate, as a man of position in society, to set a tambu" (1891 pp 216)*

Using a word that was assumed to resonate with local residents, missionaries felt they could adopt and incorporate it into their own Christian teachings.

> *"Both Polynesia and Melanesia has strong systems of taboo and a new religion without some taboo would have been no religion at all…the Sabbath was itself a functional substitute and the islanders accepted it because they valued the taboo system and felt it met a social need." (Tippett 1987)*

6.3.2 Taboo as a resource management institution

It is clear that taboos were used for a variety of purposes by Europeans and indigenous Pacific Islanders. Were taboos also used to sustainably manage natural resources? Williams first noted a natural resources taboo in Fiji in the 1840's. He described how preparing for a feast months in advance,

> *"a tabu is put upon pigs and nuts" (1859 pp 115)*

Williams also observed that after the death of a king in Fiji,

> *"the coast for four miles was made tabu, so that no one might fish there; and the nuts, for at least six miles, were made sacred " (1859 pp 155)*

In 1861, Turner described eight distinct forms of natural resource taboo used in Polynesia, all of which were enacted over trees and land (1861 pp 294-296). In the Solomon Islands, certain sections of the beach were permanently taboo to keep uninitiated people and women away

(Codrington 1891 pp 94). There too, prohibitions existed over the use of sea resources, specifically the required abstinence from sea food consumption by a new father (Codrington 1891 pp 229). Rather than being a collective prohibition however, this taboo was practiced by a single individual for an unspecified length of time.

In the early 20th century, Malowinski describes the taboos associated with canoes and seafaring, and rules of behavior in the village during the absence of men on voyages in the Trobriand islands (Malinowski 1922 pp 230,484). He also mentions natural resource taboos, or prohibitions, on coconuts and betel nuts. These taboos were established to allow them time to mature and ripen, but also to protect those which were located

> *"too far away from the village to be watched." (Malinowski 1922 pp 425-426)*

Margaret Meade wrote about hereditary titles in Samoa which conveyed

> *"power over the sea to tabu certain fish or shellfish so that many would accumulate" for distribution (Mead 1937 pp 290)*

In the last two decades, much has been written about the taboo as a marine management institution. It is widespread throughout the world today, and often has a distinctive natural resource management aspect. Colding and Folke (2001) identify several types of taboos and highlight their conservation application:

Table 4 Typology of taboos and a description of their potential ecological benefits from Colding & Folke (2001)

Taboo Category	Conservation functions
Segment taboos	Reduce hunting and harvesting pressures on wildlife and plants, e.g. conserve local populations of species
Temporal taboos	Same as segment taboos. Promote stock recruitment of species, protect spawning grounds of fish
Method taboos	Same as segment taboos. Protect fish stocks.
Life history taboos	Maintain stock recruitment of species by protecting vulnerable stages in a species' life history, based on the individual's age, size, sex, or reproductive status
Species-specific taboos	Offer total protection to threatened, endemic, and keystone species. Preserve local and global biodiversity
Habitat taboos	Maintenance of biodiversity and ecological services.

In a relatively recent ethnographic account of the people of Marovo lagoon in the Solomon Islands, Hviding describes two contrasting taboos on fishing practices. The most common was a general taboo which was rotated among reefs and

"covering all types of fishing in an area of reef marked by raised sticks, and would be imposed by a chief in preparation for a large feast, or simply as a response to localized overfishing" (Hviding 1996 pp 268)

Another marine taboo of the Marovo was

"applied to the entire tuna-fishing grounds extending into the open sea." (1996 pp 269)

Thus marine taboos in the Pacific have been diversely applied, even within the same geographical area, and often without a conservation focus. There is no single standard or otherwise definitive customary marine taboo institution in the Pacific region.

6.3.3 Taboo in Vanuatu

The earliest mention of taboo in Vanuatu comes from the diaries of Captain Belcher in 1843. Then, the word was used by the Europeans to describe the no-go boundary they had designated around their camp which locals were not to enter. He describes how he was

"frequently annoyed by the natives intruding too closely on our tabu lines" (Belcher 1843 pp 59)

In the diaries of Captain Erskine from 1853, a story is recounted in which a young ni-Vanuatu man was so terrified by the demonstration of a quill-tube musket explosion that he

"fell ..as if shot, and begged that no experiment of the kind be repeated, exclaiming tabu, tabu if anyone approached the lock of either a gun or musket" (Erskine 1853pp 324)

Further, Erskine's diaries record that when locals on Efate island were offered tobacco, they respond in the negative saying it was "taboo" to smoke (1853pp 325). Land and objects were also tabooed in Vanuatu. In his diaries, missionary Paton describes how the chiefs of Aniwa had placed a taboo on construction of his mission station until it was paid off (Paton 1892 pp 76). Sandalwood traders forcibly took coconuts that were under local taboo prohibitions as an insult to the villagers (Erskine 1853pp 326). Christian missionaries would also ignore local taboos so as to undermine the authority of island chiefs (Gunn 1914 pp 23). Missionary Gunn himself, along with many other early white settlers became frequent users of the word taboo. For example, Gunn relayed to one young man that

"It is tapu for you to work at the house of God when you are bringing back heathenism. If you cut your hair you may work" (Gunn 1914 pp 104)

In his 20th century Ethnography of Vanuatu, Spesier, dedicates an entire section to the institution of taboo (1990 pp 316-317). He suggests that the taboo is

"encountered throughout the group, and means nothing more than a prohibition whose infringement is visited with magic penalties" .

and distinguishes between

> *"taboos of ordinary people which are respected to a variable degree and those which have to be reinforced with the help of a powerful man who gives the taboo added efficacy with his more potent mana"* .

Spesier also observed that taboos were publicized by making

> *"marks on objects which are known to everyone and which have roughly the same significance as prohibition notices in Europe."*

Steel was the first, in the late 19th century, to describe the specific beliefs and 'magic penalties' associated with breaking a taboo in Vanuatu. He noted that sacred men

> *"lay tabus upon certain places, trees, and food, when it is a forbidden thing to go to these places, touch or eat of these fruits, for so many moons. These tabus are very oppressive, for it is believed that if they are broken, disease or death will follow." (Steel 1880 pp 25)*

Local people were under no illusions about the strength of chiefly taboos, and missionary Patton confirmed that

> *"the Natives had an extraordinary dread of violating the taboo, and believed that it meant death to the offender or to some one of his family." (Paton 1892 pp 357)*

and Inglis recorded that

> *"death is the penalty of touching the forbidden fruit." (Inglis 1854 pp 62).*

Written records from Vanuatu also confirm that taboos were, at times, placed on natural resources. In 1850, writing about Tanna island, Inglis recounts witnessing a large dance

> *"to celebrate the ripening of the breadfruit, and removal of the tapu from the tree." (1854 pp58-59)* and noted that *"the tabu is employed in all the islands to preserve persons and objects. The cocoa-nuts are laid under a tabu till all the other crops are planted, or till some feast is celebrated" (pp 62).*

In 1890, he further clarified the use of natural resource taboos, describing how closures were placed by sacred men to stockpile natural resources in preparation for great feasts in which

> *"every kind of common food was tapu, not only for days but for weeks, and even for months, till the bones of their back and shoulders were far more prominent than the muscles" (Inglis 1890 pp 152)*

In the Southern islands of Vanuatu in the early 20th century, Gunn commented that

"The institution of ' tapu ' exists in great force. The sea has been tapu, the roads and even the water." (Gunn 1914 pp 19)

In his view, chiefs would declare taboos so as to claim the best resources for themselves, including

"good fishing places, good water springs, etc." (Gunn 1914 pp 213).

Speiser found that in 1915, most of the taboos in Vanuatu placed prohibitions over human behaviour, sacred sites, and fruits and trees resources. However without specifying the reason, duration or geographical location he mentions one instance of a taboo that was declared by very high ranking men over a

"stretch of the coast"

It is not clear whether this single instance of a marine taboo prohibited or controlled the use of resources or was simply marking a coastal sacred site. Also noteworthy is Speiser's single mention of rules and access controls over the sea. In describing mortuary rites in the Southern island, he notes in passing that

"in Tanna and Futuna people would bathe after a burial but kept away from the sea afterwards for several days" (Speiser & Stephenson 1990 pp 286)

6.3.4 Taboo on Nguna and Pele

The ethnographic evidence from Nguna and Pele is noticably silent on the existence of marine resource taboos. In only one instance have the stories recorded on Nguna and Pele (including the diaries of Milne, transcribed stories of Schütz or anthropological notes of Facey) made mention of any kind of prehistoric limitation or restriction placed on a marine resource, and then only indirectly and associated with a single cave. In his diary, Peter Milne records this story:

"In a small cave on Pele…was found a large shell called Paiga [18]…greatly feared by the natives. They believe that if a man has ill-will toward another man and wishes him to be out of the way…some remains of food left by the doomed man are put into the shell. The spirit of the cave eats the food, the man takes some disease and dies. No heathen would dare to enter the cave, far less to touch the shell" (Don 1977pp 27).

Recently Johannes made note of several contemporary taboos employed for marine management on the central islands of Vanuatu (Johannes 1998b), and we know from previous chapters that they exist on Nguna and Pele. But what of the taboo institution on Nguna and Pele? While certainly in use today, was it used in the past? If so was it ever applied to control

[18] Paiga is the contemporary local language name for the Triton shell *Charonia tritonis*, indicating that this pre-contact ecological nomenclature has remained constant. However, no contemporary local informants were able to confirm or recognize the elements of this story.

or manage sea and coastal resources? Peter Milne arguably produced the most comprehensive written account of Nguna and Pele in the last 200 years. During his nearly half-century of tenure on Nguna, he produced 12 diaries about daily life and local people, each containing over 1000 pages. The 12 original volumes of Peter Milne's diaries are housed in the archives of Otago's Hocken Library and have never been published. Contemporary scholar Gordon Parsonson however has read the diaries in their entirety several times and is in the process of transcribing Milne's complete writings. In response to specific questions about the institution of taboo on Nguna and Pele, Parsonson writes

> *"I have so far found nothing in the diaries, which suggests the laying of taboo on reefs or particular fishing spots... I very much doubt whether taboo existed on any major scale". (personal communication 2009)*

Donald Crump was the son of missionary Ken Crump on Nguna. He was born on Nguna in 1940 and lived there until he was nine years old. He recalls that fishing was a major activity on Nguna and most people owned a dugout canoe for daily reef fishing. Never during his tenure on Nguna however did he hear of any village declaring a taboo over the sea, reef or coast. In contrast, fishing was practiced day and night, and he recalls several villagers beginning to experiment with new and more efficient ways to catch fish, including the production of goggles and the use of dynamite.

Anthropologists and linguists visiting Nguna and Pele in the mid 20th century did find reference to taboos but not over marine or coastal resources. Guiart recorded the existence of a strong taboo on Efate prohibiting the marriage between a man a women of the same 'namatarao' totemic clan (Guiart 1964 pp 99). Later Schutz recorded stories on Nguna which tell of the dangerous taboo sacred powers that surround newly ordained chiefs (Schütz 1969b pp 265).

Today, of course, chiefs frequently establish taboos over the reef, although local informants claim these are the first in living memory (Johannes 1998b). By the late 1970's however, a visiting anthropologist recorded the local opinion that early Ngunese chiefs had always practiced direct resource management. Her informant suggested that this was accomplished by

> *"putting tabus on certain crops or areas to ensure a sufficiency, especially for feasts to propitiate the spirits" (Facey 1981 pp 301)*

Apart from Facey's single informant, there is no other evidence suggesting that taboos were established on Nguna in order to conserve or otherwise maintain natural resources over the long term.

Figure 27 Chief on Emao Island declares a taboo over the reef. The mark used on Nguna to inform visitors about the marine protected area

6.4 Historical diversity of cultural expression

This review provides evidence that the marine taboo is a relatively new phenomenon on the islands of Nguna and Pele. But other groups in Vanuatu obviously did possess significant knowledge of the sea and marine resources, so why was this expertise not homogenously distributed throughout the archipelago?

6.4.1 Inter island cultural isolation and marine use knowledge

The first European visitors to Vanuatu observed distinct differences in the appearance of residents among the islands. Considering mobility of the first Lapita colonizers three millennia ago, one would expect to find a relatively homogenous people, unless events and circumstances led to a decrease in inter-island mobility and genetic/cultural mixing. Archaeological evidence suggests that prehistoric trade networks for customary artifacts did exist between the islands in Vanuatu. Evidence of early inter-island exchange also hails from Vanuatu's nearest neighbors (Aswani & Sheppard 2003; Davenport 1962). These trading networks may explain the acquisition of marine artifacts (like decorative shells and bones), but why didn't the people of Nguna and Pele also adopt fishing practices or a sea-focused lifestyle?

Darrell Tyron describes what he calls a "network society" where trade connections between islands existed but where each locale sought to "preserve its autonomy in a dialectic between linguistic intelligibility and unintelligibility". In other words, islands and the communities there engaged in trade, but maintained an intentional degree of isolation, linguistic and cultural. Bedford and Spriggs (2008) present substantial archaeological evidence that a homogeneous ni-Vanuatu material identity was never maintained throughout the archipelago, but rather the islands were characterized by "regional diversification in traditions after Lapita". They identify several cultural 'boundaries' where archaeological finds show a change in substance and composition. These permeable boundaries are also well aligned with contemporary cultural governance and political practices (Bonnemaison 1996 pp 201)

> *"There are a number of specialized cultural practices noted by early [Vanuatu] ethnographers (Speiser 1996) that are unlikely to have developed independently, but rather are likely indicators of some form of interaction" (Bedford & Spriggs 2008)*

It is interesting that in 1776, when Captain Cook posed gestured questions to residents of Malakula island, he sensed that their geographic knowledge did not "exceed the limits of their horizon" (Beaglehole 1961 pp 504). Practical outcomes of the cultural isolation are made obvious when one considers the incredible linguistic diversity within the archipelago Figure 39, where even neighboring communities speak distinct languages.

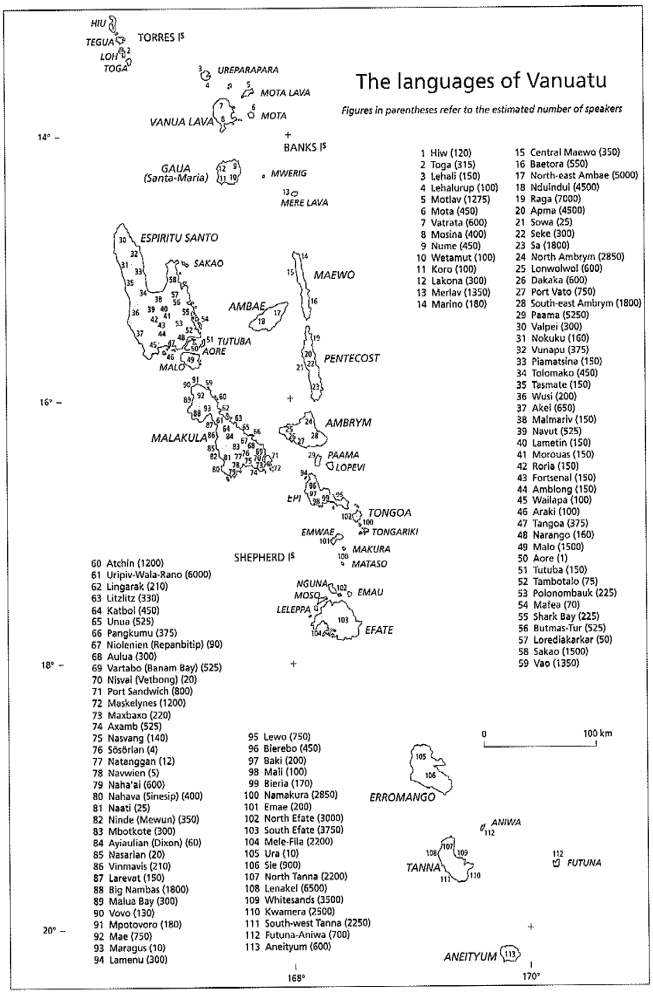


Figure 28 Linguistic diversity and geographic distribution of contemporary languages in Vanuatu (Bonnemaison 1996) page 171.

But how did an ocean going vicarious people suddenly adopt an isolative attitude? Spriggs asserts that at some point towards the end of the Lapita period, the early residents of Vanuatu became 'inward looking', reduced their mobility and contracted preexisting inter-island trade networks (Spriggs 1997). He makes a case that inter-island migration has remained negligible throughout much of prehistory (Spriggs 1997 pp 136). Genetic studies confirm that there are several distinct generic groups with today's Vanuatu (Cox 2008), strongly suggesting that indiscriminate mixing and cultural homogenization did not occur in the archipelago's ancient history. In the 19th century, social commentators noted that

> *"the principal permanent difficulties to be encountered in prosecuting missions in New Hebrides are, the small number and smallness of the tribes and the diversity of languages or dialects" (Inglis 1854 pp 69).*

The pervasive inward looking mentality of the diverse ni-Vanuatu island groups helps to explain why maritime focused activities, knowledge and institutions did not develop on Nguna and Pele to they extent that are assumed to have done in other parts of the archipelago. The flexibility of the network society, where trade was permitted also helps to explain how the people of Nguna and Pele were able to decorate themselves and their homes with marine shells and bones to the extent that they did.

6.4.2 Nguna and Pele's connections with the external

Despite limited interaction with distant islands within the archipelago, there have likely always been strong links between Nguna and Pele Islands and the Island of Efate, separated at the most distant point by only 6 kilometers. All of today's North Efate residents share the Nakanamanga[19] language (Ray 1887 pp 409), as well as similar customary practices and social organization (Espirat et al. 1973), and mythical stories (Capell 1938). North Efate and its satellite islands comprise an obviously distinct socio-cultural area within central Vanuatu (Facey 1981 pp 5). Residents of North Efate are described by several different early observers as lighter skinned, taller and closer in appearance to Polynesian people than the inhabitants of other islands in the New Hebrides. Several early observers hypothesize that the people of Efate have significant infusions of Polynesian blood and culture through regular Samoan and Tongan in migration events (Gunn 1914 pp 190-191; Speiser & Stephenson 1990 pp 52; Turner 1861 pp 392). Linguists also assert that the languages and beliefs of central Vanuatu are heavily influenced by Polynesian links (Capell 1938 pp 68).

In addition to links with other parts of the Pacific, North Efate has critical historical links with other areas in central Vanuatu, for example the shared Nakanamanga language with the island of Tongoa to the North. Existing Ngunese stories describe how Nguna's language came to be understood on Northern islands (Taman Onesmas, personal communication), and others suggest some cultural continuity with these islands through familial networks (Schütz 1969b pp 176-178). For example, one popular story recounting the origin of human settlement suggests that Nguna was originally peopled by a chief from Siviri on North Efate (Schütz 1969bpp116-117). Another custom story tells of regular canoe travel from Nguna to Emau, Mataso and even Erromango island some 160km to the Southeast (Schütz 1969b pp 21, 58-59). Surprisingly, many of these travel stories tell of inter-island travel on rafts of coconut trunks lashed together! This in the context of a people whose ancestors once made long oceanic voyages in sophisticated canoes! These stories suggest that not only did the ocean going-nature of the people on Nguna and Pele diminish throughout history, but also that knowledge associated with the sea was not continuous.

Even the people of Nguna and Pele themselves did not represent a single homogenous population throughout history. Contemporary Ngunese leaders assert that at one time over 12 distinct languages existed on Nguna alone (personal communication Kenneth Tarisu- secretary of the Nguna Duruaki council of chiefs). The development of distinct languages at the island level suggests a significant degree of cultural isolation, particularly in the absence of major geographic barriers (Boas 1982). The hypothesis that villages on Nguna were isolated from

[19] Also referred to as the Namakurana language (Schütz, 1969 pp 176), Ngunese, Nguna language or more colloquially Nafsana (literally "talk").

one another is corroborated by recent molecular evidence. Hagelberg and her colleagues found three major mitochondrial DNA lineages in existence on contemporary Nguna (Hagelberg et al. 2000; Hagelberg et al. 1999), a surprising result considering the small size of the island. But what could possibly have maintained village isolation on an island that only takes 8 hours to circumnavigate?

6.4.3 War, a major limitation on social relations and cultural transmission

Few other social institutions can limit the transmission of language and culture more effectively than can war. European cruises of discovery and trade throughout the archipelago during the 17th and 18th centuries provided eye-witness evidence that Vanuatu's population was fractured by a widespread prevalence of tribal hostilities. In the very first European record of the archipelago, Quiros in 1606 observed that

> *"a strict territorial division seemed to prevail. Each group occupied a cove or part of a beach, but could not go beyond an invisible boundary." (Bonnemaison & Penot-Demetry 1994 pp 10).* And *"No person of one tribe dared to go into the property or district of another (Quiros 1904b pp 368).*

After a cruise throughout the islands in 1850, Inglis observed that

> *"war appears to be universal, The Missionaries in the New Hebrides have ascertained that the natives are occupied fighting for ten months in the year: we found more or less of it almost everywhere." (Inglis 1854 pp 57)*

He further emphasizes the isolated nature of local populations by declaring that

> *"no intercourse could have taken place among inhabitants of the different islands, since they posses no canoes that could sail from one island to another, or only very rarely.(Inglis 1854 pp 66)"* and found *"recently, since foreigners have been visiting them, a trade in canoes and other articles" (Inglis 1854 pp 66).*

War was still prevalent throughout the archipelago decades later as Steel found that

> *"the men are almost always fighting, and the women, as on other islands, have all the work to do." (Steel 1880 pp 207)*

War on Efate was also prevalent. One of Vanuatu's most heralded custom stories recount the attempts of a great Efate chief called Roimata to create a lasting peace in his war-torn kingdom. He was motivated to act because

> *"he saw war all around him, and every day men were dying" (Espirat et al. 1973 pp 290).*

As late as 1849, Captain Erskine (1853 pp 17) noted that Efate island was broken up into separate communities "being constantly at war" with each other. War on Nguna and Pele was

no less frequent or severe. An old chief recounted to Reverend Milne that before Christianity had come

"we knew nothing- nothing but war war war" (Don 1977pp 22-23).

Milne noted in his diaries that conflicts were rampant throughout the islands of Nguna and Pele, tribe against tribe village against village. Even travel between the villages was a perilous undertaking, attacks could come at any moment. In order to permit at least some degree of inter-tribal communication, large stone walls called *nausaia* were constructed. These walls were patrolled on either side by warriors, and were used as a means of travel to other dominions for peaceful purposes like passing crucial information or to enable a marriage exchange (Facey 1981 p 299).

There is little doubt that for some time before Peter Milne arrived on Nguna until well into the 20th century, the tribes and villages on Nguna and Pele knew much hostility, conflict and isolation. Under these conditions, the diffusion of cultural knowledge would have been exceedingly difficult. The use of marine resources would have been a hazardous affair for locals, leaving them vulnerable to attack during trips to the reef and open sea. Harvest would have been opportunistic, carried out quickly, likely leaving little room for conservation strategies or stock enhancing taboos. What ancient marine management practices that may have developed before the period of hostilities in Vanuatu were almost undoubtedly disused over many generations.

6.5 Europeans, cultural change and marine resources on Nguna and Pele

With the somewhat fluid hindsight of history, it is possible to imagine that the effects of war paled in comparison to the changes that would begin in the late 19th century. The sustained influx of European traders, missionaries and colonists sparked an incredible, and often devastating, period of change in Vanuatu's history (White & Lindstrom 1997). It is doubtful that any existing marine management institutions or practices were able to survive intact during this period when so much that was integral to early ways of life did not. It is important to assess the nature of these impacts in the context of our goal; understanding contemporary marine use and management practices on Nguna and Pele.

This section examines how European contact impacted local livelihoods in our attempt to understand the contemporary push to manage the reefs of Nguna and Pele. To do so, it synthesizes the existing information relating to Nguna and Pele's social change over the last 140 years since Europeans first significantly interacted with the two islands. Written accounts are patchy, but they have been pieced together as comprehensively as possible in order to examine social and cultural changes. In contrast to other parts of the archipelago, anthropologists have paid scant attention to Nguna and Pele. However these two islands represent a fascinating case study for cultural change because according to Guiart, on Nguna and Pele,

"the influence of culture contact has been exceptionally strong" (Guiart 1964 pp 74).

6.5.1 Forced change begins

On July 19th 1870 Reverend Peter Milne of Aberdeen Scotland was the first European[20] to establish residence as a Presbyterian missionary on Nguna Island (Don 1918pp 1). The Milne's were sold a parcel of land by the late chief Mariwota of Tukilasoa on which now sits the Taloa Presbyterian Church[21]. Ironically the land was considered sacred and mortally dangerous, potentially indicating the local's expectations of a short residence by the Christian missionaries (Facey 1981 pp 303). Contrary to the islander's expectations however, Milne's tenure on Nguna lasted for the next 54 years until 1924. He was succeeded in his post on Nguna by other missionaries, including his son Willie Veitch Milne, until 1956. There were other Europeans living on Nguna and Pele during the 20th century including a white shopkeeper, Jenny McCoy (Schütz 1969b pp vii) and the Pouillets, a French copra plantation family (Crump & McKenzie 2000 pp 21-22)

6.5.2 Beche-de-mer and Sandalwood traders

By the time Peter Milne had first set foot on Nguna, international "trade" with Vanuatu was already in full swing. Mrs. Milne observed that on Nguna, many local residents already spoke what she called "Sandalwood-English" (Don 1977pp 88). While the trade in Sandalwood is well known to have occurred in Vanuatu, the specific exploits of the traders is little known. Due to the fortunes involved in trading (particularly in Sandalwood), the precise location of harvested resources was be kept very much out of the public domain. Erskine observed that

> *"secrecy is preserved on all subjects by the traders". (1853 pp 814)*

Ship logs indicate that the first beche-de-mer trading ships had arrived in Vanuatu by the end of the 18th century (Conand 1990 pp14). It is likely that these early traders discovered Sandalwood and bartered for all valuable items including pearls, pearl shell and turtle shell. The shallow seagrass beds and reefs around Nguna and Pele would likely have been an attractive harvesting site for early beche-de-mer traders. There was Sandalwood on Efate and possibly even on Nguna, however captain Erskine (1853 pp 814) records most Sandalwood activity on the southern islands of Tanna, Erromango and Anytieum. While the heyday of the industry was in the 19th century, it is nearly impossible to gauge the impact on Nguna and Pele, because, as Conand laments, "virtually no hard information exists" (Conand 1990 pp 15). What is clear however, is that the Sandalwood and beche-de-mer traders eventually focused their efforts on the trade in labour for Australia's sugar industry. When Inglis traveled through the archipelago in 1850, he noted that

> *"for some years, the sandal-wood trade has been the principal traffic. Though many of the natives have gone on board trading vessels" (Inglis 1854 pp 60).*

[20] Along with 20-year-old wife Mary Jane Milne
[21] The Church land is currently disputed by the chiefs of Taloa and Unakap

6.5.3 Blackbirding

The labour trade, or "blackbirding" began in earnest 1863 when the Don Juan sailed to Vanuatu to recruit labour for Australia's sugar and cotton plantations (Scarr & Davidson 1970pp 225). From that date until 1904, the Melanesian islands provided up to 62,000 workers to Queensland's plantations. While 30,400 were officially registered from Vanuatu (Mortensen 2000) the total may have been closer to 40,000 (Hayes 2001 pp 11; Siegel 1998). In 1867 alone, over eighteen trading vessels visited the island of Efate to recruit labor (Parnaby 1972). North Efate labour trading was in its heyday between 1868 and 1880. During that time a major labour trading station was operating in Undine bay adjacent to Nguna and Pele (Bonnemaison & Penot-Demetry 1994 pp 45; Giles & Scarr 1968 pp 50). The trade was so pervasive that on his arrival to Nguna in 1870, Peter Milne observed

> *"all the men in this village have been away at Sydney, Brisbane and other places working for the white men…and all can speak a little broken-English"* (Don 1977pp 84).

While it may be a slight exaggeration to suggest that that all Ngunese men had been overseas, within the first 12 months of Milne's tenure on Nguna, he records the landings of ten labour-recruiting vessels (Don 1977pp 92). The North Efate area was well known as a popular recruiting ground, with ships often passing between the islands of Kakula and Pele to look for laborers along North Efate's coast (Wawn 1893 pp 126). Other trader diary entries confirm that on Efate Island:

> *"fully one half of the men belonging to tribes residing within three miles of the coasts have fulfilled a term of service in one or other of our colonies"* (Wawn 1893 pp 41). And that Efate men"*have been in Queensland before. In fact it is not a month since they returned from there and are anxious to get back again as soon as possible"* (Farquhar 1980pp 23). In his opinion, working in the Queensland sugar fields must have been *"agreeable kind of slavery afterall"* (Farquhar 1980pp 23).

Figure 29 Blackbirders at work on Malekula Island in 1890 from (Bonnemaison 1996) page 187 and on Santo in (Scarr & Davidson 1970)

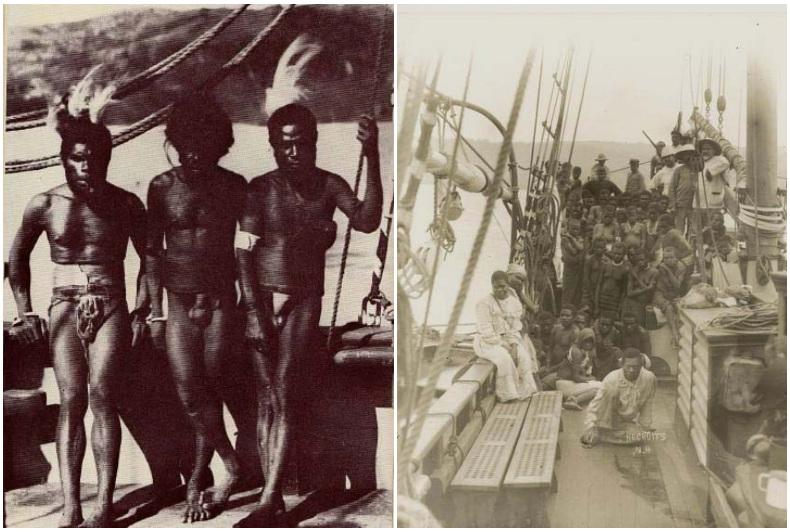


Figure 30 Labour recruits from Vanuatu in 1890s (Giles & Scarr 1968).

With such a significant proportion of the population involved in the Queensland sugar cane labor trade, it is feasible to assume that there were important sociocultural impacts. Far from the 'agreeable slavery' proposed by Farquhar, most accounts classify the blackbirding era in Vanuatu as one of the blackest in its history. Labour traders were often considered inhumane "man-stealers" (Hunt 2007), and eventually the atrocities committed by them aboard the ships (Saunders 1979) and on the Queensland plantations were brought to light and condemned by the Australian legal system (Corris 1973; Mortensen 2000). Because no ni-Vanuatu writings exist from the period, the impact of the experience can only be surmised by witnesses and assumptions.

The labour trade was particularly loathsome to Rev Milne of Nguna, and throughout his diaries he recalls the "stealing of natives" on Nguna and Pele by labour ships. It was likely under Milne's direction that one of the trading vessels came under attack off Nguna in February of 1871. First mate Bartlett and several of his crew were killed as they escorted two female 'recruits' to the ship (Docker 1970 pp 70). In an affidavit over the massacre, fellow missionaries Paton and Inglis wrote:

> *" But with such fearful effects, and these of such frequent occurrence, it is certainly high time that the British Government should step in and inquire — and that thoroughly — into the causes of these effects ; and if this traffic in labour, as it is called, cannot be carried on — as we feel certain it never will be— without more or less of these fearful results to those engaged in it, as well as its ruinous effects to the natives, by all means let it be wholly interdicted. The trade has nearly exhausted itself in the New Hebrides, and is now extending itself to the Solomon group. Most devoutly do we pray with the psalmist, "Oh, let the wickedness of the wicked come to an end; but establish the just !" (Steel 1880 pp 249)*

There were material impacts associated with the labour trade as well, particularly the introduction of alcohol and tobacco. Erskine noted that smoking was introduced to the island of Erromango only a year or so before he traveled there (Erskine 1853pp 312). The presence of

tobacco and alcohol was widespread on Nguna by the late 18th century. Reverend Milne noted that in Tikilasoa village, there was not to be found a

> *"a man, nor a boy, who does not smoke constantly" (Don 1977pp 84).*

But could there have been any benefits at all to ni-Vanuatu laborers? One direct outcome was the widespread uptake and stabilization of Melanesian Pidgin language. Keesing argues that by the 1860's the Bislama[22] language was

> *"quite grammatically developed"* with *"a substantial number of Islanders learning this pidgin as fluent childhood speakers" (Keesing 1988 pp 14,25).*

Before the time of the labour trade, as we have seen, the linguistic diversity in the country would have made inter-island communication very difficult. Speaking Bislama, ni-Vanuatu would have begun to have the chance to share and exchange ideas from other groups more easily. Spending years in Queensland in mixed-island groups may have for the first time enabled members from isolated groups to hear about, copy and adapt marine use and management ideas that would later be brought back to Vanuatu.

Travel for labour was not always overseas. There was a large domestic demand on foreign-owned plantations within the archipelago. By 1894, there were over thirty European plantations on Efate, all requiring substantial labour (Bonnemaison & Penot-Demetry 1994 pp 49). One coffee plantation was located directly across from Nguna island at Undine Bay Efate (Scarr 1967 pp 181). In the period from 1908-1941, over 54,000 people moved from their home islands to Efate and Santo to fully participate in colonial plantations (Jolly 2000; Siegel 1998). By the early 20th century, Speiser remarks that the people and culture of Efate had been irrevocably influenced by the plantation workers brought from other islands (Speiser & Stephenson 1990 pp 56). Could that influence have been positive? Perhaps including the importation of marine use knowledge? Inter-island mixing that occurred on Efate at that time facilitated unprecedented cultural sharing and learning, potentially bringing non-local marine management ideas to Efate, Nguna and Pele.

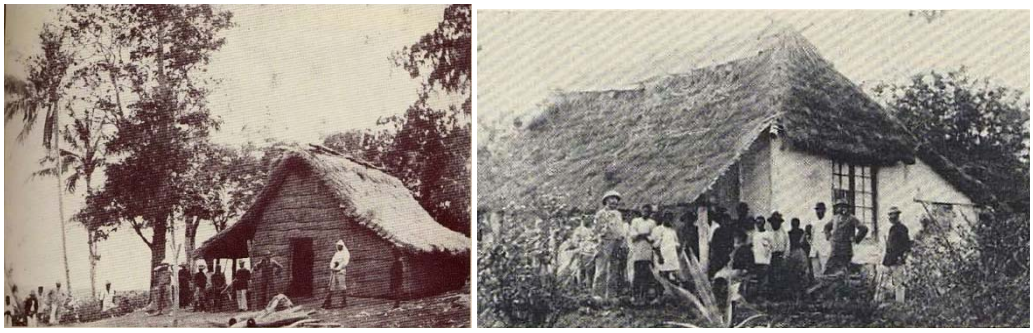


Figure 31 European plantation owner Robert Glissan at his Efate residence in the 1880s (visible over the water from Nguna and Pele) (Scarr & Davidson 1970) and (Giles & Scarr 1968)

[22] Bislama comes from the Portuguese "bico do mar" (Thomas) meaning sea cucumber, and likely called thus due to the original trade in *trepang* from Vanuatu destined for Asian markets.

Wawn, the prominent labour trader, also believed there were benefits to ni-Vanuatu related to the overseas travel. In his view, after three years on the plantations, the returned laborer

> *"is still a young man, in the prime of his life, strengthened and set up by his late labour, possessed of knowledge and experience of the world which has raised him above his stay-at-home fellows." And that the trade therefore "works as much for their benefit as ours" (Wawn 1893 pp 17)*

He also believed that many villagers wanted to leave Vanuatu to get away from the tyranny of the local missionaries. Naumeta was a houseboy who was allegedly mistreated and overworked by the Rev. Milne of Nguna. According to Wawn, Naumata wanted nothing more than to get off the island and away from Milne, and the labour trade provided that opportunity (Wawn 1893 pp 102). Wawn believed that real world experience in Queensland was beneficially enlightening to Naumata and other young islanders, who upon return would be less of a "pliable article" in the hands of the evangelists (Wawn 1893 pp 17). In his view, "the returned islander is a very different personage for the missionary to operate on" (Wawn 1893 pp 18). Like many other labour traders of the time, Wawn found the missionaries especially difficult to deal with, describing his impression that

> *"these holy men – of the Presbyterian denomination especially – are rather disposed to exaggerate, to use a mild term, when recounting the details of incidents" (Wawn 1893 pp 102)*

6.5.4 Depopulation

A significant impact of the labour trade on the ni-Vanuatu way of life was depopulation. The physical removal of ni-Vanuatu men, and subsequent drop in fertility rates likely contributed to island population declines (Bayliss-Smith 2006). Indirect consequences of the labour trade were much more severe: the introduction and spread of disease for which local people had little immunity. Ivens (1930) suggests that three main phases characterized the depopulation of Melanesia: 1) blackbirders physically removing people from the islands from the 1860s-1890s; 2) the increase in mortal tribal warfare with imported guns from the 1870's-1890s; and 3) a period of severe disease and epidemic from the 1880s-1920s. In Vanuatu, the third stage would prove to be a mortal blow to island society. Measles , cholera and dysentery were rampant throughout the islands in the 19th century (Bayliss-Smith 2006 pp 21). However at the time, witnesses considered the rapidly declining populations a mystery. Reverend Mackenzie, in a letter dated 1879 from Efate Island, wrote

> *"It is very sad to see how the natives are dying off at this village. I cannot account for it" (Miller 1978 vol.1987 pp 8).*

Neither Nguna, Pele, nor North Efate escaped the fatal epidemics gripping the islands. Visiting North Efate in 1845, Turner noticed that there were many old people about, and was told that men there lived "until the beards of their sons turned gray" (Turner 1861 pp 394)[23]. Longevity

[23] In 1845, Turner estimated that the population of Efate island including North Efate was approximately 12,000 people (1861 pp 393).

of that kind was not to last. When the Reverend Peter Milne arrived on Nguna in 1870, his seven island district (including Nguna, Pele, North Efate and other offshore islands) had a combined population of 4,000 people (Don 1977). By 1884, Milne's district population had declined to roughly 3,000 (pp 11)[24]. In 1908 the district population had reached a low of 1,361 people (Don pp 264) representing a 66% decline in the span of less than 50 years. In describing the experience, Milne wrote that

> *"there was a great mortality of both church members and children throughout the whole of the district which considerably reduced the population…the number who died of consumption was greater than usual; some died also of dysentery; but the greatest number died of influenza and pneumonia. Many children and several old people died of whooping cough. There was also an epidemic of measles which took its toll. From these causes, the population of most places became reduced…" (Don 1977 pp 256).*

The likely trauma to ni-Vanuatu lifestyle is even more pronounced when one considers the impact on each individual island. The population of Emao Island, immediately adjacent to Nguna and Pele, was reduced from 500 people in 1884 to 242 in 1917 (Guiart 1964 pp 105). The population trends on Nguna Island were more severe; in 1870 Milne recorded 1200 people residing in eighteen villages (Don 1977). By 1875 however, Nguna had only 500 residents (Goodenough 1876 pp 350). In 1908 the population on Nguna was 503 people (Don 1977pp 264). These reduced population levels remained constant for the next 50 years or so, because in 1951 Guiart (1964) estimated the population on Nguna to be 694. In 1966, the Australian Government officially estimated the Nguna population to be just under 800 (Schütz 1969a pp 6). Nguna's population has since recovered slightly from the lowest levels in the 1870's; the most current census estimating the islands population at 954 people (Bakeo et al. 2000). But the island has not fully recovered its highest levels. In summary, from 1870 to 1908 Nguna Island lost 58% and Pele lost 47% of the population.

The extent of the depopulation in Vanuatu is almost incomprehensible. One estimate puts the population of Vanuatu at over 1,000,000 people immediately precontact, reduced to 600,000 in 1852 and down to an astoundingly low 45,000 in 1935 (Harrison 1937 pp 261). One can only imagine the social consequences in the face of such momentous loss of life. Realistically there would be ecological consequences as well, primarily due to the reduced pressure on nearshore marine resources. Even if subsistence use was light on Nguna and Pele, the loss of half the population would certainly reduce marine resource use. In our attempt to examine the historical drivers of contemporary marine management on North Efate, we must consider that cultural processes and institutions were likely lost or fundamentally altered during this time of widespread human depletion. Strict rules and norms on marine use and management would be nearly impossible to maintain in a situation where human mortality rates are over fifty percent, as they were on Nguna and Pele. Certainly there would be more pressing concerns and institutional arrangements.

[24] Steel however estimates that the district population in 1880 was approximately 1000 people (Steel, 1880 pp 242), considerably less than Milne's estimates.

6.5.5 The cultural taboos of the missionaries

There is little doubt that during this period, Melanesian society was "in a state of deep trauma" (Bonnemaison & Penot-Demetry 1994pp 50). But in many ways, change had just begun for the ni-Vanuatu people. Depending on the informant, the next period in the islands' history is thought to have brought either eternal salvation or damnation. From the late 19th century, the next 50 years were to be dominated by the Christian missionaries. But who were these men and women that so changed the ni-Vanuatu way of life? Bonnemainson contends that

> *"most of these missionaries, of middle-class or modest origin, were from small towns in Scotland…These men were courageous and sincere, but with little schooling beyond their theological studies. They were often narrow-minded and enclosed their missions within the inflexible limits which they had imposed upon themselves. Further, their sectarian views meant that they were not inclined to take tolerant views of the society and the culture they would find" (Bonnemaison & Penot-Demetry 1994 pp 53).*

This description well suits Reverend Peter Milne, the Presbyterian missionary who arrived on Nguna and Pele in 1870. Not boding well for cultural survival of the already vulnerable population on Nguna and Pele, Rev. Milne was described as

> *"self-righteously puritanical, a fearless, dogged pursuer of heathenism, and an inflexible perfectionist."(Facey 1981pp 303)*

and

> *" the strictest of all the Presbyterians. He was against the recruiters and the casual traders, against the settlers at Havannah Hourbour, against the Anglicans in the islands to the north, against even his own younger colleague on Efate mainland" (Docker 1970 pp 74)*[25].

Figure 32 Photograph of the Reverend Peter Milne of taken in 1913 after nearly 45 years on Nguna (Don 1977) and Mrs. Milne (Don 1918)

One of Milne's greatest desires was eradicate what he considered to be savage paganism (Espirat et al. 1973 pp 338; Schütz 1969b pp ix). He sought by any means, along with other missionaries working in the archipelago, to ensure that "heathen join the Christian party" (Miller 1978 pp250). Collectively, the missionaries liberally adopted the indigenous word

[25] The missionaries who arrived later than Milne, often from different denominations and with more education, had more liberal and progressive ideas about local culture (Bonnemaison, 1994 pp 61).

'taboo' and used it in their teachings and cultural restrictions on local people. The taboos placed by the missionaries ranged from tobacco use (Paton 1894 pp 121) to wearing flowers behind the ears, and included a near complete prohibition of cultural ceremonies (Scarr 1967 pp245).

A drive to physically destroy pagan culture and custom was a widespread cornerstone of the early missionary philosophy. Erasing existing cultural beliefs was a way for missionaries to cement their spiritual authority over local populations. Tippitt found that

> *"most Missionary churches of Melanesia…were power encounter situations in which the old animistic divinities or their shrines were formally rejected by means of an ocular demonstration. The mode of destruction (skull houses, ceremonial skulls, fetishes, idols, monoliths, sacred groves or taboo totems) was by burning, burial, drowning or devouring." (Tippett 1987 pp 273)*

However, of all the missionaries working near Efate, only Rev. Peter Milne of Nguna made the most "serious efforts to interfere with native custom" (Guiart 1964 pp 98). In Milne's own words, he describes his war on the indigenous lifestyle:

> *"I forbade the betrothing of children when young; the selling of their girls to husbands; the making of feasts at funerals; the putting of superfluous calico and other things into the grave…the making of a feast at the birth of a child… I spoke about kava, grog and tobacco" (Miller 1978vol 1986 pp 159).*

He lamented that congregation continued to engage in cultural norms, for example taking

> *"a cargo of pigs to sell to the heathen who want them for…natemate (death rituals)" (Don 1977pp 281)*

and participating in group

> *"singsings…which are regarded by us…as the backbone of heathenism." (Don 1977pp 74).*

Figure 33 Pig killing ceremony on Tanna Island in 1975 (Hermann & Bonnemaison) and a pig killed on Nguna in 2007 in preparation for a village celebration.

Milne needed the support of local chiefs and leaders to spread his message, but was simultaneously desirous of eliminating their control over local people. As a means to minimize their customary authority, he was particularly insistent on replacing the system of matrilineal chiefly inheritance with a more familiar progenetorial system (Espirat et al. 1973 pp 338; Schütz 1969b pp ix). Before Milne arrived, chiefly titles and dowry land were inherited maternally[26] (Guiart 1964 pp 102). Figure 45 demonstrates the system of chiefly inheritance on Nguna and Pele before Milne's arrival. In this system, females pass the chiefly title to the next generation, and in the case of their husband's death, hold the title until the children are ordained (Ray 1887 pp 410; Schütz 1969b pp 249).

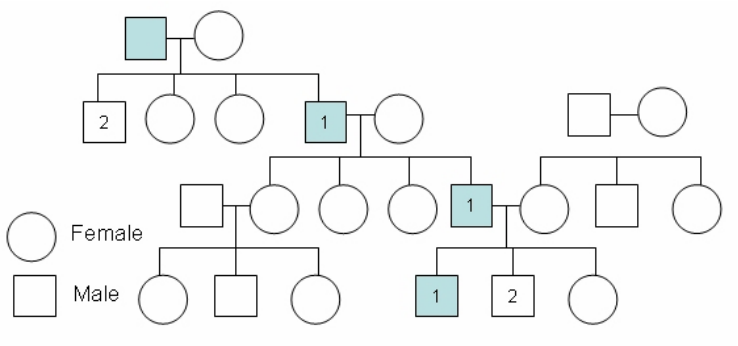


Figure 34 Traditional matrilineal transmission of chiefly titles. Dark blue signifies a title holder. Hatched blue signifies an individual who is able to transmit the title to the next generation. Numbers indicate the order of birth for males and females.

There is anecdotal evidence that, in terms of the ordination of paramount chiefs there was some democratic choice in pre-contact times. The word *pusumaki* in the Nakanamanga language literally means, to "discuss the selection of the chief at length" (Schütz 1969b pp 250-251). In ideal situations, the chieftainship would pass from chief to maternal nephew (Espirat et al. 1973 pp 274), but this was not always the case. In cases of many nephews, it is possible that the most revered would be selected (Facey 1981 pp 307). That is to say, chiefly titles, although maintained in matrilineal clan lines, would be bestowed in a discretionary manner on individuals who demonstrated the requisite governance characteristics (Facey 1981 pp 299). In the case of "weakness or unpopularity, the hereditary claimant was rejected in favor of another" (Don 1977 pp 20). Reverend Peter Milne's introduced first-born-son doctrine led to the creation of linear royal families more akin to the European aristocracy Figure 46. He created a system which unnaturally amassed power in particular families in order to be able to focus on converting them without worrying about their dethronement by popular democracy.

Pre-contact weddings would almost always be between a local man and a woman from another island. One of the principal benefits of this practice was its ability to connect people from across the archipelago and ensure permanent security and hospitality when traveling (Espirat et al. 1973 pp 275). The intentional function of maternally-inherited totemic systems (known on Nguna and Pele as namatarao) was to provide a safety net for any person on any island in the archipelago (Guiart 1964 pp 74), as any given village would have members of many totems (Guiart 1964 pp 100). Milne's progenitorial system of inheritance facilitated the formation of self enclosed groups or kingdoms, culturally cut off from neighboring villages and islands. This

[26] Although land stewardship responsibilities were often passed from father to son on Nguna and (a practice known as namavisi)

social exclusion practices may partially account for the intensity and longevity of modern disputes between communities. While the pre-Milne clan namatarao still exist, they have become significantly less important to social organization.

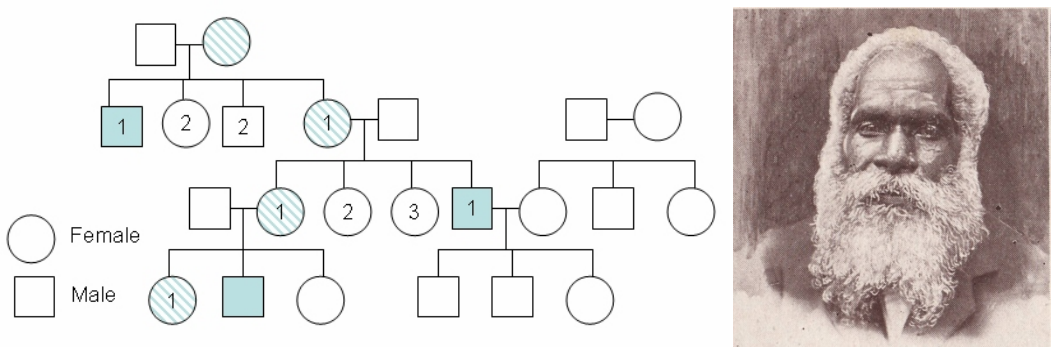


Figure 35 Milne's contemporary patrilineal progenitorial transmission of chiefly titles. Dark blue signifies a title holder. Numbers indicate the order of birth for males and females. Drawing of chief Matuele of Nguna, the first local teacher Milne sent out to convert the island of Emao to Christianity (Don 1918).

Land tenure was also severely impacted by Milne's forced disengagement from the matrilineal system. Before Milne's arrival, land was inherited from the father, but also from the mother (from others islands). Thus children would be culturally obliged to retain contact with and travel beyond their home community and island. In the case of land shortage in one village, islanders had land in others (Espirat et al. 1973 pp 275; Guiart 1964 pp 100). Today however, the land stewarded by the father's family must be divided and redivided with each subsequent generation. Families on Nguna and Pele strongly feel land availability pressures; there is simply not enough to be equitably shared among offspring. With the loss of the matrilineal land tenure system, there is no longer a mechanism for inter-community and inter-island land redistribution.

Problems related to Milne's changes to political and social hierarchy are surfacing in contemporary times. In one community on Nguna, the only son of the paramount chief has, throughout his life, proven himself generally unfit to lead the community. Though his father still holds the title, there is some discussion about reinstating the practice of electing the paramount chief rather than allow the office to be desecrated by an unworthy individual.

6.5.6 Language homogenization

Today the residents of Nguna and Pele all speak the Nakanamanga language, though as previously mentioned, many believe that there were once up to 12 separate dialects on Nguna. Peter Milne adopted the language he first encountered in Taloa on Nguna and began, for the first time, to codify, record, and disseminate it. During his lifetime he translated and published the entirety of the Old and New Testaments in Nakanamanga (Tusi Tapu). He also translated and published the Presbyterian Hymnal (Nalengaana maga ni Nalotuana) (Miller 1978 bk 5 pp 150). In all there may be as many as 40 works attributed to Peter Milne in the Nakanamanga language. While his dedication to these language projects shows that he valued local language for the spread of Christianity, there exists the strong possibility that he and other missionaries facilitated a homogenization of indigenous languages in central Vanuatu (Thieberger & Ballard 2008).

6.5.7 Physical displacement and a new marine identity

Social and cultural changes due to missionary influence, while severe, are often difficult to quantify. However the physical displacement of island communities is a prominent example of the profound changes wrought on ni-Vanuatu communities during this period. Housing and village settlement patterns in Vanuatu have been unceasingly adapted since European contact (Rodman 1985a; Rodman 1985b), often through physical displacement. Guiart credits the modern village on North Efate to the conscious intervention of the early missionaries (Guiart 1964 pp 99-100), arguing that the missions preferred settlements in lieu of the more common precontact aggregation of households around men's clubhouses. According to some, physical displacement was implemented by the missionaries to amass power, obtained via

> *"the colonial practices of forcing inland populations to move down to coastal areas where they could be more easily controlled and amalgamating small hamlet groups into larger villages" (Spriggs 1997 pp 263)*

Physically moving villages is a socially traumatic exercise in its own right. However moving upland communities down to coastal areas brings about special identity issues in Vanuatu. Here, as in much of island Melanesia, there exists a bush-sea dichotomy among communities (Roe 2000). Bush villages are stereotypically associated with agricultural production systems while sea villages are associated with fishing and reef scavenging. Via regular trade and barter, each group was able to obtain necessary resources, while specializing in the production and refinement of locally available products. Each group, the bush people and sea people, developed geographically-specific production and resource enhancement practices, able to provide "specialist services" (Roe 2000). Moving created a cultural vacuum. Connections with sacred places, dancing areas and stones were forgotten. The skills associated with place-based resource husbandry were lost or made irrelevant. Bush people were forced to begin using sea resources, ecosystems about which they previously may have had little practical knowledge. Roe confirms the disparity in expert local knowledge by acknowledging that

> *"not only the resources themselves, but also the knowledge of them are similarly assigned to different communities".* (2000)

Critically the mass amalgamations to large coastal settlements have increased human pressure on sea resources. Father Walter Lini laments the

> *"general movement of people away from the interior or 'bush' to the coastal plains and this has led to pressure on land" (Lini 1980pp 44).*

Displacement brought people to land that they previously had little customary right to use or husband, leading to much current confusion over land ownership. Contemporary oral histories suggest that few villages on North Efate were located directly on the sea shore. In fact, many residents can easily still identify the location of the previous "suman-tava" (hill house) settlement sites. Mass displacements can largely be attributed to Reverend Peter Milne who often told locals that moves were necessary to distance people from the epicenters of disease outbreaks. Regardless of the cause for the moves, Miller writes that

> *"In the closing years of the 1890's bush villages on Nguna ceased to exist. The remnants of bush villages appear to have merged with the coastal villages which were under Missionary supervision" (1978 pp 113).*

Not all communities on Nguna and Pele were in fact moved, and several villages are still considered 'bush'. In general, the bush-sea divisions "are sometimes somewhat fluid" (Roe 2000), as residents in bush villages would have had some interaction with the sea. In practice, no contemporary bush village on Nguna is more than an hour's hike to the coast. However, the number of 'new' coastal communities is of particular interest to the analysis of historical marine resource use. Culture and custom emerging from the post-contact period would, in theory, be most related to 'bush village' economic modes of production. Based on this argument, little collective indigenous knowledge about marine stewardship should exist in most North Efate communities. David, writing about contemporary fishing in general notes that

> *"The burden of history still plays a significant role in the importance of fishing among village activities. Many of the present residents of the foreshore areas came originally from inland villages which they abandoned in the first half of the 20th century, or later still, in order to congregate around the missions, which were all located in the waterfront. Faced with a totally alien environment (the sea) these bush people had to invent, in the space of a few decades, a whole new culture adapted for this environment. Very often, the new lore was developed in relationship to the old land oriented knowledge and is fragmentary at best" (David 1994)*

In the context of these often permanent physical relocations, it would be exceedingly difficult for a ni-Vanuatu community to actively maintain any preexisting marine management practices. Recent village displacements also likely intensified of pressure on localized marine resources, particularly on the coastal areas of Efate and its offshore islands. In general, it is instructive to recognize that the ni-Vanuatu relationship with the sea and its resources has undergone fundamental changes since the time of European contact. Accepting that geographical displacement (and associated social change) is a historical reality which refocuses and strengthens our analyses of contemporary marine identity and practices on Nguna and Pele.

6.6 Ancient customary taboos; drawing conclusions

Recent ethnographic and observational evidence, while patchy and often anecdotal, does suggest that resource prohibitions were used in Melanesia before European contact, but most commonly as a form of social restriction employed to cement the authority of village leaders. What Cook first observed as the taboo in Polynesia may have only reached archipelagos like Vanuatu in the last 200-300 years, introduced and popularized by early traders, missionaries and other visitors. Missionaries in particular were quick to use the term taboo widely to impose their will on indigenous congregations. Contemporary authors emphasize the ecological benefits of the taboo, though very few early observations support that these were the intentions of indigenous residents. The first suggestion that taboos were used to prohibit the use of sea resources only occurred in the mid 19th century, well after Europeans had been actively promoting and writing about the term in Europe and throughout the islands.

In Vanuatu, the earliest descriptions of the taboo institution depicted a system of social prohibitions, through some later observations note they were used to restrict the use of fruit and nuts. By and large these restrictions seemed to be utilitarian rather than conservationist; that is resources were taboo until such time as they could be most effectively harvested or consumed. There is little direct evidence that taboos were frequently declared over sea resources in Vanuatu. Of the scant evidence for this practice, observations suggest that marine taboos were evoked to restrict access by outsiders rather than actively manage stocks. The lack of marine management regimes over the last several centuries substantiates many early observations ni-Vanuatu were poor seamen in comparison to the archipelagos to the East. There were exceptions to the rule, for example Futuna Island in southern Vanuatu, which was observed to have a keenly developed maritime tradition.

As for Nguna and Pele, there is no evidence that marine taboos were employed at all. Despite thousands of pages of detailed descriptions by the first missionary of other cultural practices, marine taboos are not mentioned. Neither do surviving custom stories from Nguna and Pele include references to marine management. Rather, these stories tend to demonstrate only a basic level of maritime knowledge or skills. It is an unresolved mystery regarding why these islands did not appear to have developed a strong maritime culture despite the large area of available reef and sea grass flats nearby.

There is substantial evidence that the islands of Vanuatu were culturally isolated from one another, potentially limiting the spread of marine management regimes that may have been developed elsewhere. Soon after Lapita settlement, island populations became more settled and inward looking. Each group developed specialist services which could be bartered with neighbors, but in a way so as to maintain some linguistic and cultural unintelligibility. More than one hundred distinct languages evolved and cultural boundaries were strengthened. While the people of Nguna and Pele islands likely traded with their neighbors, they probably did so infrequently. The islands of Nguna and Pele certainly did not represent a homogenous cultural unit when Europeans first visited. Up to 12 languages are alleged to have been spoken on an island just a few kilometers across. Obviously, in such a fragmented society it is possible that if marine management taboos had been developed on one island or one village, they might never reach others. Warfare seems to have been the driver of cultural isolation. It was particularly intense on Nguna just prior to European contact, when settlements contracted into themselves for protection from neighboring groups. Reef use and management would have been an extremely hazardous activity on Nguna, exposing users to attack. Ongoing warfare convincingly explains why marine management was not practiced on Nguna and Pele, at least over the last several centuries.

Pre-contact cultural practices that were maintained through indeterminate periods of warfare in Vanuatu would soon be subjected to a greater threat: European culture contact. Exposed to new ideologies from the beche-de-mer and sandalwood traders, colonial explorers and missionaries, pre-contact customary and traditional practices were especially targeted for eradication. The labour trade physically removed entire generations of potential fishermen, often never returning them or their knowledge of marine resources. Back in the islands, the missionaries were actively seeking to eradicate the “paganism of the savages”. Disease and depopulation were

resolutely aiding these goals. Everything about the island way of life was undergoing change, from the language to the ownership of land and sea resources. Human settlements which were most commonly located in the bush were dismantled in favor of mega-villages by the sea. Thousands of island people with little coastal experience now had to create a new maritime identity for themselves.

Thus it is clear that for centuries, ni-Vanuatu communities have employed the prohibitive institution called taboo over areas, dwellings, substances, food, trees, the sea and the coast. However, there is no evidence to suggest that taboos in Vanuatu were established for conservation purposes or to prevent long-term resource overexploitation. Rather, the motivation for establishing taboos in Vanuatu can be categorized as follows: 1) the avoidance of some undesirable behavior/activity; 2) the reverence of a sacred place; or 3) a temporary means to stockpile resources for more efficient use at a later date. One of the leading advocates of the ancient marine conservation paradigm has recently acceded that the taboo of the past may not have been established for conservation purposes:

> *"many taboos imposed today, however, are more contemporary expressions of earlier ones that have integrated modern ideas and concerns" (Hickey 2006 pp 20).*

6.7 Marine Protected Areas: customary management?

Ambitious calls have been made to establish marine protected areas (Wood et al. 2008), (Mora et al. 2006) and reserve networks (Hughes et al. 2005) in order to meet global biodiversity targets (Brooks et al. 2006). According to scientific consensus (Gaines et al. 2001), a **marine protected area (MPA)** is "an area designated to enhance the conservation of marine resources" while a **marine reserve** is "an area of the sea completely protected from all extractive activities". These definitions include areas large and small, and areas designated by national governments and private individuals. In much of the developing world, communities also establish MPAs.

The number of community-established protected areas is increasing at an unprecedented rate (Chape et al. 2008) and there are calls to further recognize and facilitate these local-level initiatives as part of multi-scale responses to a changing world (Berkes 2007a; Berkes 2009). The Pacific Islands region has been identified as a major priority for new protected area expansion (Rodrigues et al. 2004), which is already experiencing a renaissance of locally-based marine management initiatives (Johannes 2002b). Closures defined and managed by island communities, often called community conserved areas, are being promoted as a sustainable and locally appropriate management option (Berkes 2008). While the region's rich heritage of marine use and management has long been recognized (Hviding 1996; Johannes 1978), the scale of the contemporary reserve implementation phenomenon in Pacific Island communities is historically unprecedented.

6.7.1 Recent history of protected area establishment

Today, community-based closures abound in Vanuatu. Most closures are specifically established for resource-enhancement and conservation, though spiritual and ceremonial closures also exist (Regenvanu 1997). In the early 1990's, the Vanuatu Environment Unit launched a program to establish community-based forest conservation areas (Techera 2005). As a result, the Vatthe Conservation Area was established in 1994 on the island of Espiritu Santo over 3,700 sparsely populated hectares of alluvial forest (Read 2002). Co-implemented by the Vanuatu Environment Unit and local communities, Vatthe was promoted as a demonstration project for the nation. It was this project that enabled the phrase 'conservation area' to become widely recognized. In 1995, the Vanuatu Forestry Department, in consultation with communities on Erromango Island, established the 3,200 hectare Kauri Protected Area (Tacconi 2000).

Several individually-owned or private closures also were established in the 1990s. In 1991, with support from the Fisheries Department, a 100-hectare coral reef closure was established by a family group in the Maskelyne islands. The small, permanently closed area has been known variously as a sanctuary, marine conservation reserve, and *ringi te suh*, which in the vernacular language means 'to allow to multiply and to leave something alone' (Masang 2000). Also in 1991, the Uri community on Malekula Island established the 25-hectare conservation-focused Narong Marine Park (Tari 2002). The Loru Rainforest Protected Area was established in 1995 on Santo Island as a 220-hectare privately owned permanent forest closure with the assistance of an NGO called the Vanuatu Protected Areas Initiative (VPAI) (Hills 2008).

Community establishment of protected areas took hold in earnest in 1995 through the work of the Wan Smolbag (WSB) Theatre Company. In response to the South Pacific Regional Environment Program's (SPREP) Year of the Turtle, WSB produced an educational play entitled '*I'm a Turtle*.' Presented to villages across the island of Efate, it sought to create sense of empathy and responsibility for the protection of sea turtles (Petro et al. 2007). One of the first practical outcomes of WSB's turtle play was a ten-year ban on turtle harvesting, enacted by the chiefs of Nguna and Pele islands. A network of villagers, initially called Turtle Monitors, was established to directly link community representatives to WSB. Now known as the Vanua-Tai network, this organization serves as a major conduit of conservation information and discourse to remote communities. Community-established conservation areas associated with Vanua-Tai members are now thought to number over two hundred and thirty throughout the archipelago.

Johannes (1998b) documents a case of community-initiated conservation closures resulting from a trochus awareness program on North Efate in the 1990's. Encouraged by a government Fisheries extension officer, villages began to establish three-year marine closures for the explicit purpose of trochus management. Expanding to include other important organisms like fish, beche-de-mer, and giant clams, these closures soon spread to surrounding villages. A follow-up survey in 2001 found that the number of village conservation measures had doubled (Hickey & Johannes 2002). This number included a never-before-recorded type of marine closure in Vanuatu: the marine protected area, or MPA.

MPA has now become the management regime of choice on Efate and the small satellite islands of Nguna, Pele and Emao. From 1998-2008, eighteen new small-scale MPA and taboo closures were established by communities on these three islands, initially with the support of US Peace Corps volunteers. These communities are part of the Nguna-Pele Marine Protected Area Network. Communities on the nearby islands of Lelepa and Moso also have declared marine protected areas with the encouragement of the Vanuatu Cultural Center and Fisheries Department (Tarisesei & Novaczek 2005).

The protected area phenomenon has now expanded to other parts of the archipelago. As part of the Global Environment Fund's International Waters Project (IWP), the national government assisted a struggling network of chiefly taboos on Malekula Island to establish the Amal Bay closure, known variously as a taboo area (IWP 2006), community conserved area (James 2006) and marine protected area (Vanuatu Environment Unit 2007). In 2005, the local NGO Wan Tok Environment Center (WTEC) began helping communities to establish marine protected areas and forest conservation areas on the islands of Santo and Malekula. Communities working with FSP Vanuatu, another local NGO, also have established taboo areas and marine protected areas. Recently, a group of communities and chiefs working in partnership with the national government created the Efate Reserve Park in interior Efate (now known as the Efate Land Management Area), which covers more than twenty percent of the island's surface area. Ultimately, the recent push by local communities to establish taboos and marine protected areas lilely far outstrips any previous regime of marine resource management in the history of the islands. Historically traditional or not, the contemporary MPAs are very much a part of todays's ni-Vanuatu culture, potentially serving both social and ecological needs.

6.8 Summary & Conclusions

Following on the previous Chapters, this Chapter delves further into the widely-held belief that ancient Vanuatu inhabitants had developed complex and sustainable systems of marine resource management. The Chapter examines the conceptualization of the "taboo" by contemporary anthropologists, historians, early missionaries and early Pacific peoples, and poses questions on the original intent of taboos and their efficacy for natural resource sustainability. The early part of the Chapter concludes that the ancient taboo was most likely a form of social institution which concentrated and maintained power for the leadership over the masses.

The Chapter then reviews the evidence for marine resource taboos on Nguna and Pele, drawing heavily from the over 12,000 pages of diaries left by the late Rev. Peter Milne. He and more recent missionaries of the 19th century suggest that marine closures did not form a part of the post-contact culture on Nguna and Pele Islands. Thus the existence of dozens of community closures in the area today is a very recent phenomenon.

To understand why these management regimes were not a part of life on Nguna and Pele over the last several hundred years, the Chapter examines potentially limiting factors, such as cultural isolation among the islands (geographical, linguistic, sea/bush divides etc), warfare (and the impossibility of controlling extra and intra village affairs), and the major upheavals brought by European contact (blackbirding, trade in trochus and beche-de-mer, disease and depopulation,

the cultural taboos of the missionaries, changes to chiefly heredity, language homogenization and physical displacement).

The Chapter concludes with a description of the current state of marine closure establishment throughout the archipelago. Community conservation areas, including MPAs and taboos, represent an increasingly popular approach to managing biodiversity around the world (Berkes 2009), and have proved extremely popular in Vanuatu over the last two decades. Communities in Vanuatu enjoy legislative support for marine protected areas and taboos, and although financial support is often lacking, MPAs continue to flourish because the costs to implement, maintain and enforce coral reef closures are shouldered by individual villages. The following chapter will focus on the political nature of marine management in order to understand the current broad-scale centralized support for MPAs in Vanuatu.

CHAPTER 7 - ROCKING THE CANOE- EXPLORING THE POLITICAL FOUNDATIONS OF 'KASTOM' MARINE MANAGEMENT

> *"History is more likely to be born on beaches, marginal spaces in between land and sea…where everything is relativised a little, turned around, where tradition is as much invented as handed down, where otherness is both a new discovery and a reflection of something old" (Dening 1992 pp 177)*

7.1 Introduction

In Vanuatu, indigenous Kastom[27] is central to national identity. Custom served as a rallying point during the struggle for independence and is even the policy platform for some major political parties[28]. Custom also plays an important role in natural resource management in Vanuatu. At present, strong messages are being sent to communities to embrace, revitalize and re-implement customary marine management practices (Hickey 2001; Ruddle & Hickey 2008). In Vanuatu, this translates into a push to establish customary taboos. Examples of other customary revivals across the globe are widespread, and range from re-learning mat weaving techniques in Samoa, language reacquisition in the Solomon Islands to reinstating natural resource production and management systems in Siberia (Crate 2008; Schischka et al. 2008). But even as the concept of *kastom* remains powerful to most ni-Vanuatu, its meaning is ambiguous and widely interpreted.

The possibility exists that customary revitalization may represent a process of customary homogenization or imposition. If island communities are scorned because they move outside the sphere of what is considered *customary*, then there is cause for concern. However, it is often difficult to identify when *custom* is imposed from positions of power onto those who are disempowered, because the preservation of indigenous identity is a globally appealing and worthy cause. Indigenous custom revitalization is a stated goal of many international bodies (eg. UN, IPACC[29], Cultural Survival) and financially supported by many influential grant-making groups (e.g. Firebird Foundation, Christensen Foundation, Ford Foundation to name a few).

The validity of some indigenous customs has, however, been subjected to rigorous scrutiny, especially when they contradict internationally accepted norms like democracy or women's rights. For example, consider the cases where the rights of women are curtailed due to references (often by men) to *custom* and their traditional place in society as subservient to fathers and husbands (Douglas 2002; Jolly 1996). Today many women's groups in Vanuatu have been empowered to reinterpret customs and traditions in the context of global norms. In 2001, Hilda Taleo, former director of the Women's Affairs department in Vanuatu remarked that

> *"Kastom should not be clung to for its own sake, if Vanuatu is to develop, some of its traditions will have to go; after all, we used to have a tradition of eating people." (Moldofsky 2001)*

[27] Kastom is the Bislama language spelling of the English word Custom
[28] Namangi-Aute Party, Shepherd Alliance Party, Vanuatu Republican Party and the Nagriamel Custom Movement
[29] Indigenous Peoples of Africa Coordinating Committee

But the promoted custom practices which do not contradict international norms often escape scrutiny. The academic task is particularly difficult for non-indigenous observers due to perceptions of neocolonialism and exploitation of traditional knowledge. Attempts to bring about academic dialogue on the validity of custom (Kuper 2003) have been criticized as discriminatory and impeding progress on indigenous rights (e.g. Asch et al. 2004). Being such a polarized topic, most prefer to ignore the issue of custom completely, putting it into the proverbial "too hard to deal with" basket. This has been the case among many contemporary researchers in Vanuatu; not willing to risk a renewed research visa. There, as elsewhere, it is easier to broadly promote 'custom' resource management than it is to define or question it.

Complicating an investigation into the political foundations of customary marine management paradigms is the paucity of written records, particularly on sensitive political issues. Much of the debate on custom takes place in unrecorded meetings, over the radio and in village nakamals. Thus this chapter explores the foundations of prevailing *kastom* resource management paradigms by probing the past and contemporary political contexts. I examine how *kastom* ideological frameworks are used by islanders and by city-based elites in the context of community resource management in Vanuatu. I conclude with a description of how custom has been dynamically adapted since since European contact in the 17th century. I review the social upheavals and pressures that have likely impacted the maintenance of *custom* management through time. The diaries of the first missionary to Nguna, the Rev Peter Milne, are used to illuminate how pre-contact culture and *custom* fared in their transition to modernity.

7.2 What is kastom?

Bolton defines K*astom* as

> *"anything understood to be derived from pre-colonial knowledge and practice" (1999)*

Since the end of the World War, emerging local political leaders have been searching for an element of ni-Vanuatu identity that was antagonistic to 'the whiteman' (Bashkow 2006), and that could put an end to the joint British and French colonial rule that had been in operation since 1906 (Bresnihan & Woodward 2002). Father Walter Lini wrote that he was searching for a symbol to represent how the ni-Vanuatu people had

> *"consistently struggled and spoken unceasingly against any form of colonialism" (Lini 1980pp 27).*

What emerged was Kastom, the flagship platform of the indigenous Vanuaku Pati. It was a symbol crafted by party leaders to politically unify a culturally and geographically diverse people under a single national identity (Keesing & Tonkinson 1982). However, in a context as culturally diverse as Vanuatu, there existed a serious problem with the kastom movement: no single kastom could possibly account for inherent uniqueness of each of Vanuatu's islands and communities. Many argue that rather than representing some coherent set of practices, kastom is the

"adoption of ethnic strategies… merely an instrumentality employed at a particular political level" (Linnekin & Poyer 1990pp 5):

Figure 36 Fathers of Vanuatu independence and kastom movements (Walter Lini, Barak Sope and Ati George Sokomanu) in the late 1970's in (Lini 1980)

A disconnect between authentic practice and kastom has been emphasized by a wide body of evidence (Foale et al. 2005; Potter & Majid Cooke 2004; Ward & Kingdon 1995). The kastom movement in Vanuatu was

"defined in context of international politics rather than with 'kastom' as it was employed prior to independence." (Larcom 1990pp 175)

Nevertheless, many ni-Vanuatu people have been led to believe that the kastom movement accurately promotes a "relatively fixed, unchanging and known set of practices" (Wagner & Talakai 2007). As we have seen, the social and cultural upheavals of the 19th and 20th centuries largely precluded the continuity of ancient or long-enduring customary practices, particularly on Nguna and Pele. Multiple generations had passed since Milne arrived on Nguna with his inflexible doctrines, and there was a notable absence of custom stories, written records or physical artifacts. Thus, there was a strong practical disparity between the historically vindicated

"pre-1800 reality, and the contemporary 'ethnographic present'" (Facey 1981 pp 296)

If Kastom was to be used to fight for independence, it would have to be reinvented (Hobsbawm & Ranger 1992), even though the kastom movement sought to promote the ideal that what existed before European contact had always existed. Therefore when kastom is evoked, it is necessarily vaguely contextualized (Fingleton et al. 2008 pp 28). On Nguna, Schultz gave the name "semihistorical traditions" to those 'kastom' practices and stories which were presumably ancient, but historically only recently adopted (Schütz 1969b pp 128). Many widely practiced 'traditions' are actually of

"varied development, form, fluid nature, and in some cases very recent appearance" and *"a whole series of cultural snapshots which may or may not be associated with any great time depth, and which have been heavily transformed by European contact" (Bedford & Spriggs 2008)*

Unsurprisingly, a disconnect between rhetoric and reality often creates confusion and anxiety among contemporary ni-Vanuatu attempting to rectify kastom discourse with the desire to adapt to global modernities.

> *"The discourse about kastom opposes modernity and development, presenting each as alternative models of present practice. Although clearly people understand that in the past things were different, this opposition, which is central to much thinking in the country, does not allow for history." (Bolton 1999)*

7.3 Gatekeepers of Vanuatu kastom

Well past the struggle for independence, a new fight is emerging against globalization, a threat many ni-Vanuatu perceive as neo-colonialism (Miles 1998). In response to pressures to join the market economy, adopt international policies and standards and adapt a Western ideological outlook, many within Vanuatu feel their identity is being usurped. The national government, while recognizing the benefits of international integration, has acknowledged a desire to retain an indigenous identity by promoting research and documentation of indigenous language and culture through the Vanuatu Cultural Center. In 2007, the national government declared the year of the "Kastom Ekonomi" which promoted the value of barter systems, payments in traditional currency and rural modes of production and distribution (Bazeley 2006).

In contrast to the moderate ideologies of the national government, which embrace change but emphasize local identity, an extreme version of anti-globalization has emerged in Vanuatu. The movement is led by a group who I call the 'gate-keepers of kastom'. Rather than an organized group, I use the term loosely to refer to individuals or organizations which impede evolution, change or adaptation in Vanuatu communities because of violations to the code of 'kastom'.

The Melanesian Institute of Philosophy[30] and the Vanuatu Cultural Center (both funded by the Vanuatu national government) have missions to promote 'customary' resource management strategies throughout the islands. Rather than allowing communities to freely design initiatives that best suit their particular needs, particular customary practices (including the taboo) are heavily pushed. To overcome the inherent diversity of custom and tradition in Vanuatu, kastom gate-keepers in the capital of Port Vila have organized 'custom classes' for unemployed youth, advertised as

> *"an exciting opportunity that will offer the Vanuatu young people a chance to learn their own Kastom and make good use of them." Vanuatu Daily Post (2008)*

[30] http://www.dailypost.vu/ArticleArchives/tabid/56/articleType/ArticleView/articleId/2022/categoryId/7/Turaga-celebrates-10year-anniversary.aspx

Figure 37 Graduates of the Port Vila customary revitalization Kastom Skul (Custom School)(Photo VKS), Youth on Nguna dress up in 'custom attire' to dance for visiting tourists.

But as we have seen in previous chapters, the custom of one island does not correspond to that on other islands, or even in other villages on the same island (Klinsko 2007). One might legitimately question the scope of custom classes in a country made up of over 84 islands and 113 indigenous cultural-linguistic groups.

Gate-keepers in contemporary Vanuatu reject the notion that non-indigenous ideas may be adaptive or beneficial, and rather promote the idea that what comes from outside is always detrimental to local people. Gate-keepers are commonly chiefs and other members of island governance systems, but they can also be politicians or even expatriate consultants who have lived in Vanuatu for decades. Often there is a personal benefit associated with being a gate-keeper: retaining 'kastom' authority or making a living from donor-funded cultural promotion projects or custom schools. Used as a political or economic tool, custom is open to manipulation by kastom elites (Johannes 2003; Rodman 1987). With an unqualified reference to kastom by the gate-keepers,

> *"divergent and contesting claims can be made at any particular time, all justified to some extent by reference to historical precedents" (Wagner & Talakai 2007)*

One example of the manipulation of kastom has been the artificial expansion of the chief as purveyor and incontrovertible head of local governance over the last century in Melanesia (White & Lindstrom 1997). As *kastom* became increasingly revered in the independence movement, so grew the authority of the *kastom* leader, or in Vanuatu's case, the village chief. Chiefs in Vanuatu have readily accepted the increased power of this newly relegated and often inherited role (Huffer & Molisa 1999; Weisbrot 1989). However, in pre-contact society the chief was often required to earn his authority through beneficial acts to his supporters (Bolton 1999). Today, Kastom gatekeepers lament the declining role of the symbolic head of their movement (Hickey 2001pp 133) as more effectual governance solutions to social problems arise (ie democratically elected councils and committees).

The kastom debate is often conducted by ni-Vanuatu or Western elite through the newspapers and on the radio (Regenvanu 1999pp 99). Those at the grass roots often find themselves marginalized when discussing desirable change in their own communities. The kastom rhetoric

tends to present Pacific Islanders as "ineffectual" or disengaged in ongoing cultural transformation processes (Linnekin 1997), suggesting that local indigenous peoples passively stood by as they were dealt the "fatal" blows of colonialism (Howe 1977) and now globalization. Via the discourse of elite kastom gate-keepers, local communities are presented as little more than a disengaged

> *"subject of historical forces, their cause lost from the start" (Philibert 1992)*

Kastom gate-keeping is particularly active in the resource management sector. Writing about the contemporary phenomenon in ni-Vanuatu communities to establish marine reserves and taboos Hickey states

> *"Of concern however is that an increasing number of these taboos no longer have much or any kastom association or ritualization to anchor them in the deeply rooted traditions of the past. In fact, this trend has more recently taken yet another step away from the protection of resources with the inclusion of kastom as its cornerstone. A large regional environmental organization now sponsors workshops in Melanesia… to promote MPAs as if they are oblivious to the context of thousands of years of marine resource management in the Pacific. Truly, from the sacred to the profane" (Hickey 2001pp 133).*

It is clear that the political agenda and social inequities associated with kastom discourse make it an inappropriate framework for an objective evaluation or discussion of long-enduring indigenous processes and institutions. Promoting political concepts such as '*kastom'* and 'whiteman' within resource management discourse potentially detracts from the adaptability and flexibility within Melanesian cultural processes and institutions (Hviding 1998). An uncritical acceptance of resource use and management regime on the basis of a traditional or customary label might hinder a sound understanding of dynamic cultural adaptation (Johannes 2003).

7.4 Dynamic Kastom

7.4.1 Christianity and Kastom

Many villages still speak of the time before missionization as "the darkness" and recall it as filled with intolerable hardship and war. While missionaries (like Peter Milne of Nguna) certainly forced social change in their districts, contemporary sentiment suggests that the changes were, at some level, eventually embraced by local people. Christianity's influence on ni-Vanuatu social organization, the change into the "light", was swift and widespread. Bonnemaison noted that

> *"the diffusion of Christianity, had indeed been incredibly fast, casting away, nearly everywhere, the systems of political hierarchy" (1994 pp 65).*

Today religion is the pillar of ni-Vanuatu society. On Nguna and Pele, the Presbyterian church and its leaders hold the most influential authority (Curtis 1999; Douglas 2002; Wittersheim 1998). Custom chiefs are now ordained inside churches by Presbyterian pastors.

Figure 38 Ordination of a new chief held on Nguna in the Taloa Presbyterian Church in October of 2003 and a Christian wedding on Nguna in 2004

In his writings, Walter Lini, father of Vanuatu's independence, captures the prevailing ni-Vanuatu commitment to the teachings of the church.

> *"I believe with my whole heart that the church must play its role in politics" (1980).*

But why were these new ideas and livelihood rules adopted so quickly and profoundly, particularly if they had such transformative impacts on the local ways of being? Understanding how and why a foreign ideology like Christianity took such deep root on Nguna and Pele may inform our search for the origins of Vanuatu's contemporary conservation ethic and discourse.

Change did not come without resistance. During a cruise throughout the islands in a missionary vessel, Steel noted that the residents of Nguna were originally very opposed to the acceptance of Christianity:

> *"the young men seem more opposed to it than the chiefs are; their periodical feasts or dancings, which, being connected with the worship of natemate, must also be given up by those who would worship Jehovah. But these feats are regarded by them as the source of their highest enjoyment…the perception of bliss, that they have become so much opposed to, and even enraged against it [Christianity].* (1880 pp 253)

The missionaries were well aware of the local disinterest in Jesus Christ. Father Jean-Baptiste Jamond wrote in his diary that

> *"the people do not want to be converted…They are just not interested. You have only to live with them for a week to realize that. (1992 pp 34,35).*

Facey speculates that if the colonial navies[31] had not been protecting the missionaries and their families, Milne may have

[31] The New Hebrides were jointly governed in a French and English condominium from 1906 until national independence in 1980.

> *"ended up shot in the back as he stood in the middle of a dancing-ground forbidding the dancing, kava-drinking and feasting that were raging about him."* (1981pp 303)

However the disinterest in Christianity was soon overcome throughout much of the archipelago. Rather than driven by spiritual fulfillment, the rapid uptake of Christianity in Vanuatu was likely spurred by the desire for material well-being. Bonnemaison writes that the general

> *"indifference towards European gods vanished when Melanesians realized they could benefit from having scissors, knives, axes, saws and fishhooks (1994 pp 40). It drove a wedge "between the group remaining faithful to the traditional social organization and those stepping into the new 'modernity' (1994 pp 45)*

The prestige and material prowess of mission-controlled coastal groups would have made them almost unconquerable in preexisting conflicts by their less fortunate 'bush' neighbors. Missions also provided the first formal Western education to the archipelago, skills that enabled ni-Vanuatu to hold their own during negotiations with traders. The acceptance of Christianity by ni-Vanuatu was therefore often made for "tactical reasons" (Bonnemaison & Penot-Demetry 1994 pp 215). The village of Ipai on Tanna Island illustrates the local perspective on the benefits associated with Christianity. There, local leaders would only submit to baptism if the Catholic Church agreed to three stringent conditions

1. the mission station could occupy only a small parcel of land
2. children would be schooled to become proficient in European weights and measures (for copra trading)
3. the mission must open a store that would continuously supply tobacco

The desire to possess foreign cargo was a salient attribute of much of ni-Vanuatu society during the period. During a visit throughout the archipelago in 1910, Speiser noted that among local residents it was

> *"among the highest ambition to be like the whites, which explains his passion for wearing clothes and so forth. Only a few elderly men, chiefly men…cleave strictly to the old tradition…partly because the European culture undermines the system to which they owe their status (1990 pp 77).*

Bedford and Spriggs suggest that rather than explain cultural and ideological shifts with arguments of cultural domination, many could have been brought about by the act of imitation.

> *"neither conquest nor major migratory events need be invoked necessarily to explain conscious or unconscious processes of imitation, adaptation or inclusion of exotic cultural practices and material culture" (2008)*

However there is little doubt that the people of Nguna and Pele had no alternative than to live with Milne's Christianity and its associated cultural realities for over half a century. Many considered them to be "quite cut off" from any pre-existing ceremonial world views or practices (Tippett 1987 pp 273). In 1895, twelve customary chiefs on Nguna renounced paganism and

were reordained as Christian chiefs, replete with name changes and burning of their traditional nakpeas (idol drums) (Don 1977pp 204) Figure 48. In 1896, Milne himself rejoiced that

> *"every village in the Nguna district has renounced heathenism" (Don 1977pp 267).*

Here Milne uses the word 'renounced', suggesting that islanders themselves made the decision to convert. In his view locals had consciously forgone pagan customs and culture. Somewhat surprisingly, this is a view is shared by many current residents of Nguna and Pele. A local story of Milne's reign that is told to children across the two islands today ends with the line

> *"when he came to Nguna there were no Christians, when he died there were no heathens" (Schütz 1969b p 299)*

This line was inscribed on the memorial headstone placed by local residents on Milne's grave in Taloa cemetery on Nguna. Because Christianity is so central to contemporary ni-Vanuatu identity, Tippett waves away criticisms of one-sided acculturation by the missionaries (Sillitoe 1998; Trompf 1989). He argues that societal innovation

> *"has to be accepted before it becomes a feature of the culture" (Tippett 1987)*

While this argument bears the unsavory flavor of justification for the cultural atrocities committed by the early missionaries, it does highlight the important fact that Christianity has been wholeheartedly accepted in the contemporary Pacific. The first converts to Christianity were often radically devout, living under a

> *"genuine messianic spell…and spent their days waiting for prayers…or any sign that could be interpreted in religious terms. Their aversion and contempt for everything related to their own ancestral beliefs and customs went beyond the wishes of the missionaries themselves" (Bonnemaison & Penot-Demetry 1994 pp 63).*

Today, nothing more important exists in most communities than the church and its teachings. All ceremonies, meetings and events are opened by prayer and the blessings of a Christian leader. On current-day Pele there is a strong movement to abolish customary chieftainship and its associated rites, and instead ordain only Christian chiefs who govern according to biblical rules and piety. Bonnemaison notes that in the local worldview

> *"paganism had been conquered and a 'biblical nation' was being shaped. Kastom as a whole was relegated to the sphere of Satan" (1994 pp 55).*

Custom and culture on Nguna and Pele was being reshaped, undoubtedly assisted by Christian missionaries, but also by islanders. Locals seemed to be adapting and integrating beneficial elements of Western ideology and rejecting those that were inappropriate. In essence, this period saw the death of one transitional indigenous identity and the collectively supported birth of another.

7.4.2 Kastom retention and reinvention

The labour trade, access to Western material goods, widespread epidemics and death, the cultural taboos of the missionaries, redistribution of land and authority, language homogenization and physical displacement each contributed to fundamentally alter the ni-Vanuatu way of being. On Nguna and Pele specifically, it seems there had been a complete "distortion of the local social structure" (Espirat et al. 1973 p 338). Island world views had been irreversibly altered. And according to Bonnemaison, indigenous identity

> *"was in disarray and, with it, the basic tenets of traditional life" (Bonnemaison & Penot-Demetry 1994 pp 44),*

In 1966, linguist Albert Schutz visited Nguna to record customary stories from pre-contact times. To his surprise, local informants were only able to recall stories from after the coming of the missionary in 1870! He comments that

> *"whatever tradition of storytelling there might have been a hundred years ago has been submerged by the present culture" (Schütz 1969b pp ix).*

One of the most fascinating and powerfully symbolic stories he recorded was a tale recounting the death of the last sacred custom man on Nguna. This *mau* (magic man) had worked many miracles until the Rev. Milne arrived and shook hands with him, whereupon the *mau* promptly died (Schütz 1969b pp 221-223). As symbolized by the story, pre-contact identity, custom and practice on Nguna and Pele were in a moribund state middle of the 20th century. Nguna and Pele islands existed in a "cultural vacuum" (Schütz 1969b pp ix), but despite the near complete loss of culture, custom and traditions, Allen asserts that

> *"important elements have survived in the new context of Presbyterian orthodoxy and market participation". (Facey 1981 pp 5)*

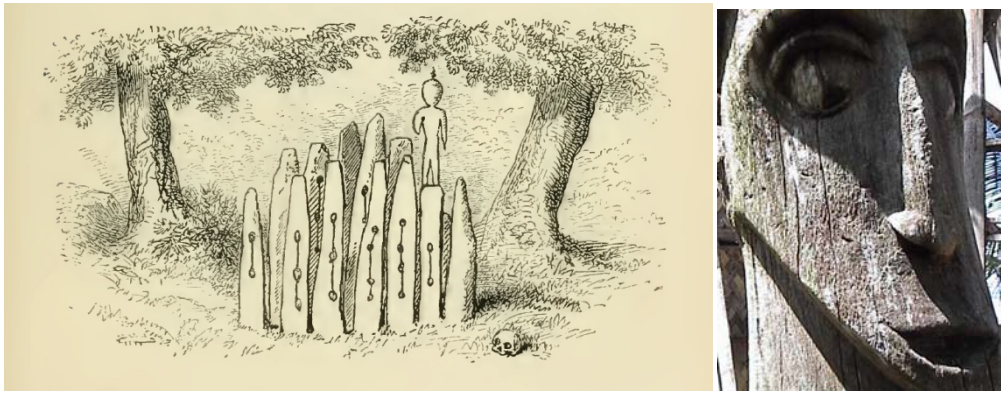


Figure 39 Drawing of carved idol drums on Nguna in 1875 (Goodenough 1876) and a photograph of a remaining drums on Nguna today

Some physical elements of culture were directly and often covertly retained. For example, Milne actively prohibited the carving of wooden idol drums and required them to be burnt (Don 1977pp 204-205). Contemporary residents of Pele however, tell of how their great-grandparents

kept a pit prepared in the bush behind the village so that when Milne visited, they could fool him by quickly burying the contraband, only to be exhumed once he left the island. Other than these rare instances of subversion, the funeral of pre-Milne identity was one at which no one on Nguna or Pele had mourned, that is until recently. In the last few decades, a desire to understand pre-contact identity has emerged after the previous 200 years of tumultuous change. Visiting Nguna in 1958, Espirat

> *"had the impression of a society already strongly acculturated, but on track to restore its traditional structures, or attempting to maintain its cultural memory, but yet searching for inner coherence." (Espirat et al. 1973)*

But how and why did the search for coherence and non-European identity begin on Nguna and Pele? Missionaries were still physically present on the island well past the middle of the 20th century.

It may have been the Second World War that reawakened the possibility of a renewed indigenous identity in the minds of many ni-Vanuatu people (Coulter 1946). From May of 1942 until the end of the war, up to 20,000 US troops manned the bases on Efate, directly across from the islands of Nguna and Pele. To fulfill major labour shortages, the US Army hired thousands of ni-Vanuatu people to build infrastructure, clear forest, undertake pest control, cook and provide fresh produce and meat (White & Lindstrom 1990 pp 32). According to local recollections, the ni-Vanuatu laborers were treated as human beings by their employers, often for the first time in their lives. Their work was critical to the success of the campaign against the Japanese, and locals were encouraged to take pride in the success of the initiative. Perhaps more importantly, the US Army at the time was fully integrated, and African-American soldiers served in equal capacity alongside their white colleagues. Such an equitable relationship between black and white had as yet been unheard of in Vanuatu. An elder from Nguna island recalled that one soldier, ready to depart Efate, told him

> *"Don't feel bad. Sometime we'll come again in peace. We'll be brothers; we'll have good times" (Schütz 1969b pp 312)*

If African-Americans could be soldiers and brothers with their white colleagues, then why couldn't the ni-Vanuatu be on equal footing with their once masters?

> *"The war created in South Sea people desires that can be fulfilled only partly or not at all. Drives that had been gradually entering their old culture have received great impetus; or, where contacts with the outside world were negligible, new drives have been created." (Coulter 1946 pp 419)*

The collective drive to realize these desires for equality sparked a quest to reconnect with something stable, endemic and uniquely Vanuatu: kastom.

7.5 Kastom; a continuous process of adaptation

Ni-Vanuatu people are (and likely have always been) active participants in constructing social institutions, continuously developing adaptive strategies to deal with social, political and environmental realities. Authentic custom is not a rigid, static or unchanging institution. Adaptation often involves cultural evolution and "selective modernization" (Philibert 1981), the process by which novel cultural elements become an enduring part of custom and the prevailing local "intellectual armory" (Geertz 1994). This process of cultural evolution and hybridization is not new to ni-Vanuatu society (Jolly & Thomas 1992; Keesing & Tonkinson 1982; Norton 1993).

> *"Even before the first contacts with Europeans, Melanesian custom was evolving. Custom is not a legal system which was set once and for all, but a system of attitudes and beliefs which are expressed in different islands at different times" (Bonnemaison 1984).*

The evolving state of customary identity has actually enabled islanders to cope with and survive environmental and socioeconomic stressors (Reenberg et al. 2008). Cox sums up the scholastic consensus on the evolution of custom by observing that

> *"the modern anthropological community embraces a more fluid view of human society, in which communities change through time and space, experience internal developments, and interact with surrounding groups."(Cox 2008)*

Throughout the 3000 year history of human habitation on Nguna and Pele, local culture and custom have undergone a continuous process of hybridization driven by

> *"innovation…and acquisition through interaction, contact-induced change, or direct migration" (Bedford & Spriggs 2008)*

Though the Christian institutions out rightly banned many cultural practices, contemporary equivalents have been re-assembled, sometimes even with distinctly colonial undertones (Thomas 1992). For example, contemporary weddings on Nguna and Pele are officiated by a pastor, conducted in a church and bedecked with white lace and shiny shoes. Just as in the past however, today's weddings place much emphasis on the pre-Milne rituals of property distribution and familial exchange. In another example, contemporary marine reserves are commonly established after long and involved democratic discussions among community stakeholders, but the paramount chief still ceremonially kills a pig to declare the closure.

Therefore, in order to move beyond the political construct of Kastom to derive a historically valid framework for understanding contemporary practices including marine use and management, Philibert argues that analysts take a middle ground by

> *"knowing the terms in which [ni-Vanuatu] recount their collective experience" (1992)*

Similarly Foster encourages those interested in traditional practices to assess how they are

"imbued with meaning, appropriated, and used by local communities" (1995)

Facey recommends that we must consider

> *"how the images and narratives…that are generated by nationwide political processes are interpreted and used by local communities" (1995pp 207)*

In essence these authors represent the moderate consensus that custom is largely an individual and community affair, an institution not to be codified, interpreted or mandated at a national level. Rather, a robust understanding custom should entail an examination of the meanings that have been locally attributed to it. The evolving nature of ni-Vanuatu custom is a natural process by which novel elements and ideologies can be flexibly incorporated or rejected as appropriate. In contrast to the views of the national Kastom gatekeepers, authentic indigenous identity is just that, an identity that belongs wholly to local people to define and adapt.

7.6 Conclusion

In the search to uncover the foundations of prevailing marine management paradigms, the political nature of kastom rhetoric has been uncovered. In essence this review rocks the canoe of popular thought about marine management in Vanuatu and the wider Pacific.

This chapter finds overwhelming evidence to suggest that contemporary Kastom is strongly influenced by contemporary political contexts. Created to serve as a rallying point in a pre-independence war against colonial domination, it is maintained today in Vanuatu by a group of influential cultural gatekeepers who have, over the nearly 30 years since independence, gained much from its promotion. Their authority is locally unquestionable because it too is proscribed within the ambiguous premise of kastom. Many of these elites make their livelihoods on promoting or revitalizing kastom identity, despite its historical inaccuracy. Until the United Nations required member nations to protect the rights of women and children, kastom ensured that men received continuous servitude from these groups. Because marine management issues do not constitute blatant human right violations, promoting kastom as the guide to managing natural resources allows gatekeepers to maintain at least some unfettered authority. Island communities that are showing signs of innovation and self-determination are dangerous for the kastom gatekeepers, threatening to rock the canoe of their status and prestige. A fight for power likely explains why island communities are persecuted for establishing marine reserves, MPAs or any other initiative that diminishes the authority of kastom elites.

Continuing to overcome challenges to their self determination, the people of Nguna and Pele have developed ways to circumvent the cultural impositions of others and have demonstrated a remarkable capacity to adapt to changing conditions. External elements that are beneficial are adopted, those detrimental are rejected. Some external elements, like Christianity, have been locally adapted to suit the Nguna-Pele way of life. Custom is constantly being reshaped, but actively, and driven by the people of Nguna and Pele. The historical proclivity for cultural innovation suggests that what exists on Nguna and Pele today in terms of marine management is

new. But contemporary practices are absolutely indigenous, and like Christianity, have been adopted and adapted from many sources, despite having no enduring historical roots.

Ultimately, this review suggests that contemporary marine management in Vanuatu is not defined solely by history, culture, socio-economics or environment, but represents a blending of processes, institutions and actors. Here, community initiatives to manage marine resources are "unlikely to conform to universal prescriptions given the unique context" (Lane 2006 pp4). No community should be criticized for innovation, particularly if that innovation is created by necessity to deal with a rapidly changing world. MPAs, marine reserves, taboos are all valid expressions of a contemporary ni-Vanuatu culture, one that is clearly not statically tied to ancient idylls. Selected, adapted and implemented by island communities, these regimes cannot be considered in contextual isolation nor expressed in exclusive binary categories: local vs. foreign.

The path of discovery has been cleared; our understanding of contemporary MPAs and taboos is no-longer curtailed by politically motivated paradigms. Freed from these constraints, we are able to begin making finer and finer distinctions among the diversity of marine management regimes found within Vanuatu today. Research should focus on answering questions that are relevant to island communities like what regimes produce successful outcomes, what social contexts enable different regimes to be selected, and how national consensus on marine management can be reached in such a sensitive and multi-level political context.

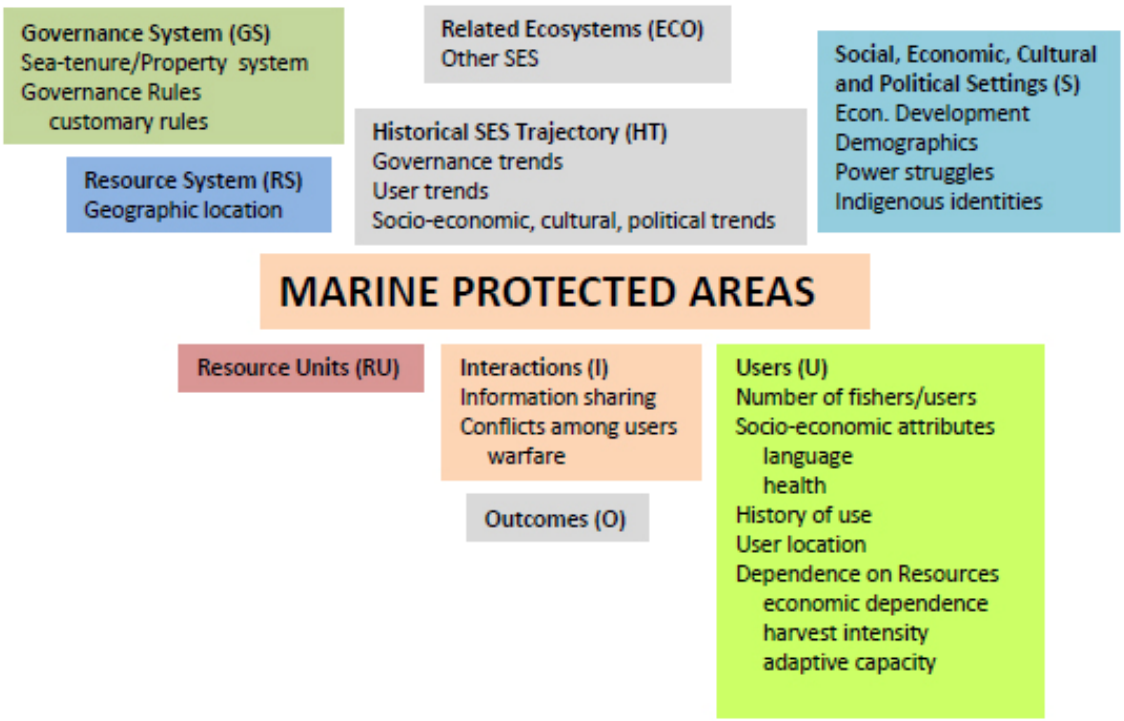


Figure 40 Reconsidering the critical variables identified in this Chapter in terms of the social-ecological analytical framework developed for MPA investigations (see Fig. 10)

CHAPTER 8 - ECOLOGICAL OUTCOMES & MPA RULES

8.1 Introduction

Marine reserves are among the most widely used tools for the management and conservation of coral reef fisheries and ecosystems (Wood et al. 2008). There is a strong consensus in the literature that reserves permanently closed to harvest provide biological and ecosystem benefits (Lester & Halpern 2008). In many developing countries however, socioeconomic realities, utilitarian mental models, and dependence on resources inhibits the use of permanently closed marine reserves (Crawford et al. 2006; Foale & Manele 2004; McClanahan 1999). In some countries, there has been an expansion of locally-implemented community conserved areas (CCAs) that often accommodate periodic harvest (See Chapter two and (Berkes 2009).

With usage rules devised to suit the local context, periodically harvested closures may be more appealing to subsistence users and consequently restrictions are more likely to have good compliance (Aswani et al. 2007; Cinner et al. 2005a). Many communities in the Pacific Islands design and implement marine closures to meet social, cultural, or conservation needs. For example, fishing closures in the Pacific Islands, commonly termed *taboo*, may last weeks, years, or indefinitely and endure infrequent and short-term harvests dictated by social, economic, and cultural processes (Johannes 1998b).

Much of the empirical MPA literature focuses on the outcomes of permanent protection (e.g. Russ & Alcala 2004), whereas periodically harvested marine closures receive little attention, despite their widespread implementation. Accordingly, there exists a clear need to better understand the ecological and conservation potential of periodically harvested closures.

8.1.1 Ecological outcomes of periodically harvested closures

Modeling suggests that rotation of marine closures or periodic harvest may still enable increased biomass or abundance of target species (Gerber et al. 2003; Valderrama & Anderson 2007). Empirical evidence from the Pacific also suggests that nonpermanent closures produce ecological benefits. For example, closures harvested under cultural controls in Papua New Guinea have higher biomass of target fishes than adjacent fishing areas (McClanahan et al. 2006). Likewise, significantly more trochus occur in long-lasting periodically harvested closures than in control areas in the Solomon Islands (Foale 1998).

MPAs opened to periodic, temporary, or rotational harvest often experience an immediate postharvest depletion of resources (Ferraris et al. 2005; Russ & Alcala 1998b) and a slow return to preharvest levels (McClanahan et al. 2007). Rotational strategies in a Hawaiian MPA have been ineffective because during rotations fish stocks were harvested to a degree that prevented long-term improvements (Williams et al. 2006). Likewise, harvests of trochus did not improve after several years of periodic restrictions in Indonesia (Ruttan 1998). However, in the preceding two examples the marine closures were open to significant or long-term harvest in an open-access context. The preceding examples do not reflect the taboo systems in place

throughout much of the Pacific. These taboo closures often allow infrequent, short-term harvest events in a common-property context.

This chapter examines the ecological implications of permanent and periodically harvested MPAs within a single, contiguous biophysical and cultural area in the Republic of Vanuatu. Specifically, the chapter investigates whether periodically harvested closures produce measurable ecological benefits compared with unfished zones and permanently closed reserves within the same biophysical area.

8.2 Methods

Eight community-based marine closures were empirically investigated (four periodically harvested and four permanent) from December 2006-March 2007 (Figure 23) as part of a larger assessment of marine management. Confidentiality agreements with local villages prevent the association of results with specific communities. Study sites were selected for similar resource use, harvest, reserve management, and enforcement practices Table 6. At the time of fieldwork, all closures had been established for at least 4 years, but none for more than 6 years. Two communities had, in addition to marine reserves, well-enforced complete tenure-area bans on the harvest of giant clams (tridacnids). In areas open to fishing, the most frequent and intense harvest activity focused on fishes, although invertebrates were taken opportunistically.

The periodically harvested closures studied had been harvested no more than twice in the preceding 12 months in single-day harvest events. Periodic harvest events generally focused on fishes (which were speared, hooked, or routed into nets), but, depending on village regulations, invertebrates were also collected. Resources harvested from periodic openings were generally used for village subsistence or celebration rather than commercial enterprise. However, not all villagers participated in the day-long harvest associated with the periodic closure opening (average: 15 people; range: 5-30).

Quantitative interviews with 85% of the study-area population were conducted to determine the number of regular fishers in each village and to gauge dependence on marine resources as a proxy for harvest intensity and catch data (not measurable within fieldwork timeframes). To measure dependence, a series of questions was asked regarding marine consumption patterns, harvest frequency, sea skills, and economic benefit (Cinner et al. 2007). Responses were analyzed with principal component analysis to yield a standardized factor score of marine-resource dependence for each community. The most locally important fishes and invertebrate taxa were identified through interviews and focus groups. Of the important taxa, six reef fish families described as vulnerable to fishing in the literature were considered, and five families described as less vulnerable were considered. Vulnerability to fishing is a function of life history, size, growth rate, harvest value, and consumption popularity (Jennings et al. 1999; Russ & Alcala 1998a). Vulnerable families included Labridae, Scaridae, Haemulidae, Lethrinidae, Lutjanidae, and Serranidae (epinephaline). Less-vulnerable families included Acanthuridae, Balistidae, Mullidae, Nemipteridae, and Siganidae. Based on interview responses, four species of locally targeted tridacnid clams and the topshell (*Trochus niloticus*) were surveyed.

8.2.1 Experimental design

The experimental design included a multiple-reserve, nested-site, control-impact comparison between reserve types and adjacent control fishing areas. Six closures were included in the comparative analysis (three permanently closed and three periodically harvested) and two closures for supplementary analyses. Survey sites were selected by dividing the reef front into ~150-m sections from aerial photographs and randomly selecting six in each village; three inside the reserve boundary and three outside. Control sites were geographically proximate and contiguous to reserve sites. Within each site, four independent 50-m replicate transects were surveyed, two each at the reef crest and 7-m depth Figure 21. Therefore overall analytical design was balanced with 36 replicate transects within each management zone: permanent, periodically harvested, adjacent control permanent, and adjacent control periodically harvested Figure 20.

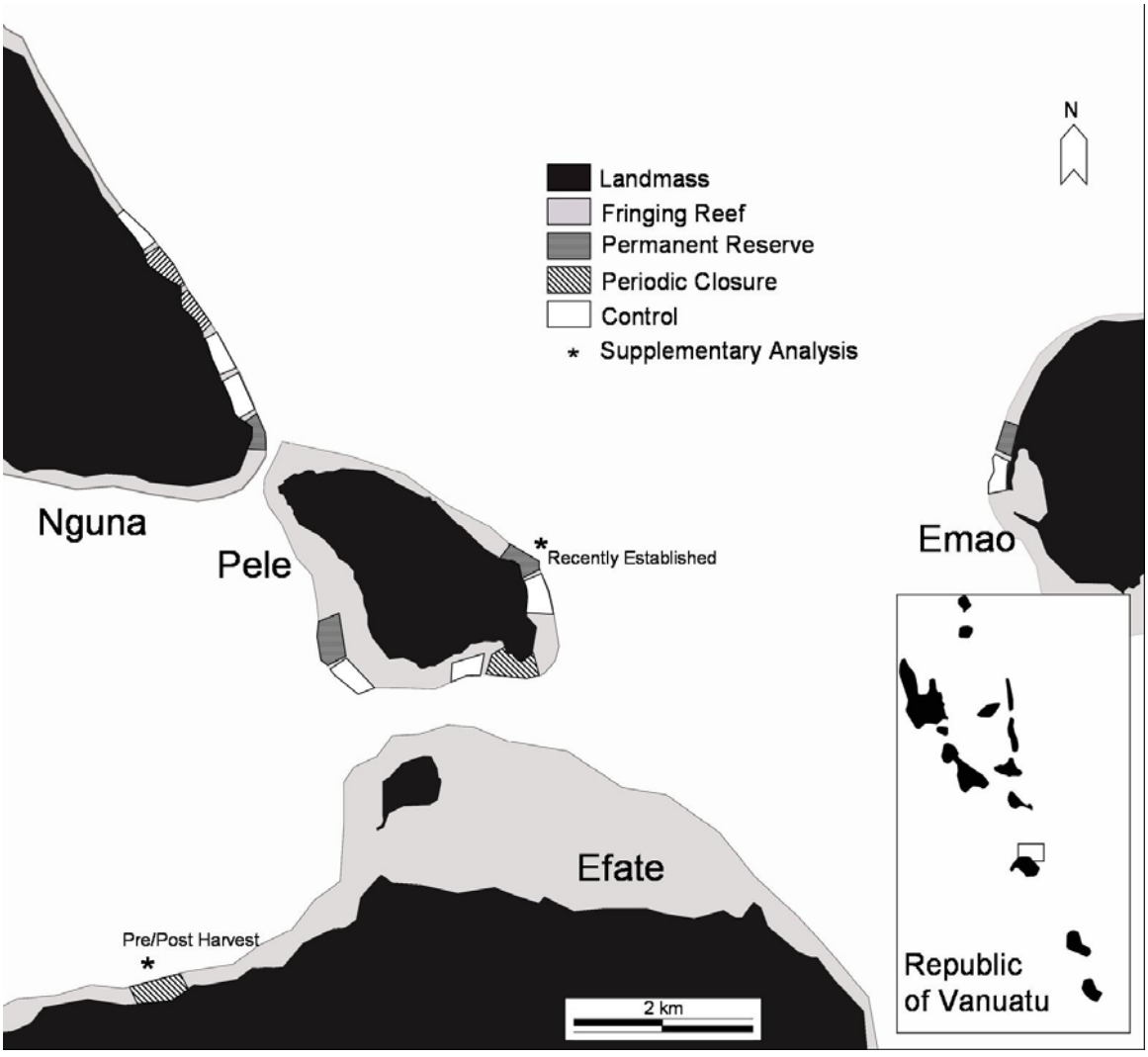


Figure 41 Locations of permanent reserves and periodic closures for principal analysis and of the two supplementary analysis reserves, one recently established and one opened to a single-day periodic harvest, and control areas.

To understand the direct impacts of periodic harvest and validate methodological efficacy to detect impacts, a periodically harvested closure opened for a one-day fishing event was

surveyed. Surveys were conducted both three days before and three days after the harvest event. To control for baseline prereserve condition, a single recently established permanent reserve (<6 months) and its adjacent fishing area were also separately considered. These supplementary analyses were also balanced with 12 transects within each zone: closed versus open and before versus after.

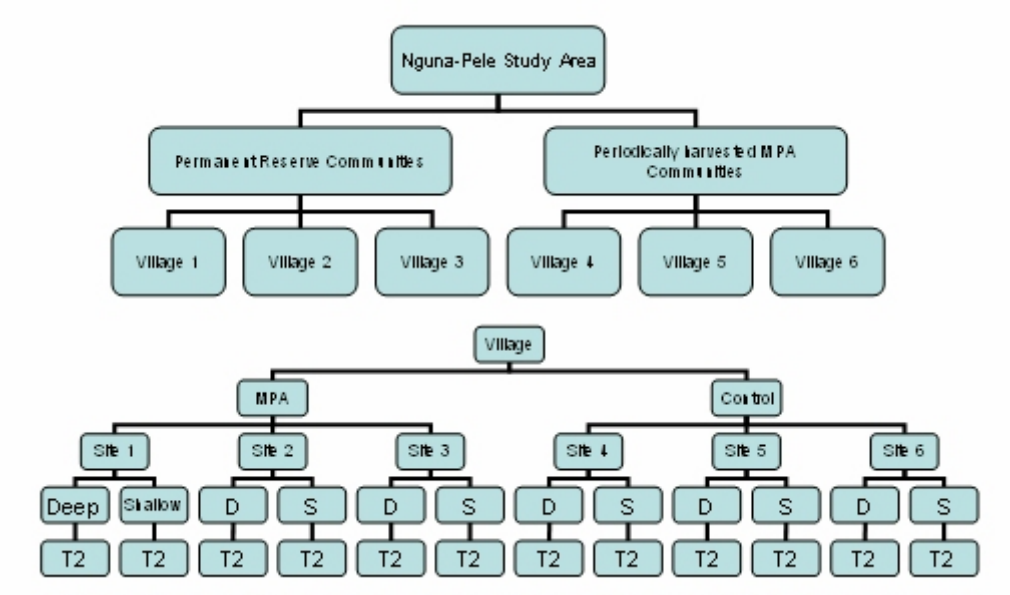


Figure 42 Balanced, control impact survey design in-built with replicates at the village, site and depth levels

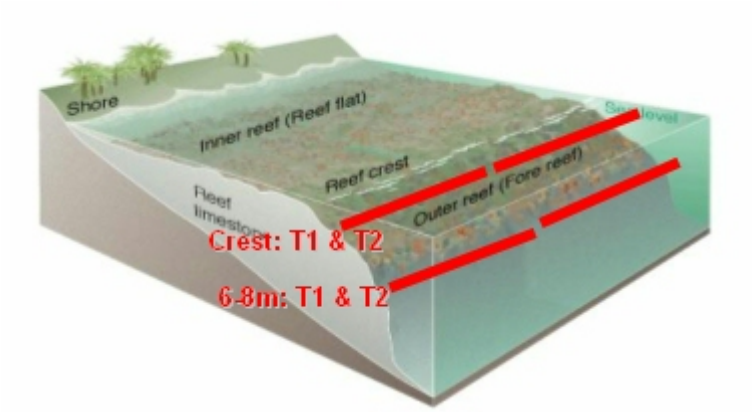


Figure 43 Schematic representation of transects at each site, 2X50m at the crest and 2X50m at 7m depth.

8.2.2 Ecological assessment

Underwater visual census (UVC) techniques were used to assess ecological parameters (English et al. 1997). On each transect, reef fish abundance and size, invertebrate abundance, and substratum composition were assessed. Potential bias between observers was eliminated by having one person observe fishes, a second observe invertebrates, and a third determine substratum composition throughout the research period. Discrete group sampling was used to minimize behavior biases, surveying large fishes (>15 cm) first on a 5-m belt and subsequently small fishes (3-15cm) on a 2-m belt (Greene & Alevizon 1989). To minimize recruitment

effects, only fishes > 3 cm total length (TL) were recorded. The TL of each fish was visually estimated, maintaining accuracy (<4% error at a distance of 3 m) by frequently practicing on known lengths of tubing (1993). Each fish sighted was classified by family and into 5-cm size categories. Length of fishes > 40 cm was recorded to the nearest 1 cm to allow for more precise biomass conversions.

Target giant clams and trochus were surveyed within a 50 x 2 m belt transect, identifying individuals to species. Substratum composition was estimated by classifying substratum under each of 100 randomly marked points on the transect line into 25 growth form-ecological categories (English et al. 1997), and then condensing them into live coral, dead coral, fleshy algae, turf algae, encrusting algae, smooth surface, coral rubble, sand, mud, deep crevice, and other substratum.

Table 5 Substratum under each transect intercept was recorded as one of the following categories and condensed into the bold headings for analysis (English et al. 1997):

Dead Coral Composite	**Other Composite**
Dead Coral	Sponge
Dead Coral w/ algae	Zoanthids
Live Coral Composite	Other
Acropora branching	**Algal Composite**
Acropora encrusting	Algal assemblage
Acropora submassive	Halimeda
Acropora digitate	Macroalgae
Acropora tabulate	Turf algae
Non-Acropora branching	**Bare Substrate Composite**
Non-Acropora encrusting	Rock
Non-Acropora foliose	Coralline algae
Non-Acropora massive	**Loose Substrate Composite**
Non-Acropora submassive	Silt/mud
Non-Acropora mushroom	Rubble
Heliopora	Sand
Millepora	**Water**
Tubipora	Water
Soft coral	

Statistical analyses

Fish biomass was calculated with family-level length-weight coefficients assayed from Pacific Island reefs (Kulbicki et al. 2005). Post hoc analyses revealed that fish data pooled at the family level did not yield sufficient power to detect significant difference among management regimes. However, fish data pooled into vulnerability groups yielded high power (1-β err prob. > 0.95). Principal component analysis reduced substratum composition data into a single factor score that represented over 50% of variability for each transect. Due to low correlation between normalized ecological parameters and a complex, nested, and mixed-factor experimental design, a series of univariate analyses of variance was used with a Bonferroni correction for type I error. Special, main, and interaction effects of depth, village, and site were built into the nested ANOVA model. A Dunnett T3 multiple-comparison post hoc analysis for unequal variances revealed the significance of differences between reserves and adjacent fishing areas; permanent

and periodically harvested MPAs; and fishing areas adjacent to permanent and periodically harvested MPAs.

The root-mean standardized effect size (D) with a Hedges bias correction was calculated. Effect size measures the strength and direction of the relationship between two variables, complementing measures of statistical significance (Cohen 1988). Effect sizes > 0.8, between 0.5 and 0.8 and between 0.2 and 0.5 are respectively indicative of substantial, moderate, and minimal relationships(Vaske 2002). Standardized confidence intervals were graphed to assess the practical differences between management regimes (Harlow et al. 1997). Principal-component analysis of Likert responses to resource-dependence questions gave a single, standardized factor score that represented 79% of the data's variability Table 6. A Kruskal-Wallis test was used to compare village-level socioeconomic characteristics of periodically harvested closure and permanent reserve communities.

8.3 Results

No significant differences were found between the group of communities with permanent reserves and those with periodically harvested closures in potentially confounding factors. These factors included reserve size (χ^2=0.0, p=1.0), percentage of tenured reefs closed (χ^2=0.333, p=0.564), period of closure regime (χ^2=1.175, p=0.278), number of rule violations in the preceding year (χ^2=0.467, p=0.495), and number of dedicated fishers (χ^2=0.333, p=0.564). Communities with periodically harvested closures had a significantly higher mean dependence on marine resources (χ^2=5.333, p=0.021) Table 6.

Periodically harvested closures had significantly higher abundance and biomass of fishes than openly fished areas Table 8 and Figure 44. Fishes with vulnerable life histories had higher abundance and biomass in periodically harvested closures than in adjacent controls Table 4, whereas no significant differences in fishes with less-vulnerable life histories were detected. Abundance and biomass of fishes did not differ significantly between permanent reserves and control fishing areas Table 8. Abundance and biomass of fishes also did not differ significantly between permanent reserves and periodically harvested closures Table 8 and Figure 44. Likewise, target fishes abundance and biomass did not differ significantly between fishing areas adjacent to permanent reserves and those adjacent to periodically harvested closures.

Target giant clams were significantly and substantially more abundant in periodically harvested closures than in adjacent fishing areas Table 7and Table 8 but there was no significant difference in giant clam abundance between permanent reserves and their adjacent fishing areas or between permanent and periodically harvested reserves. However, there were significantly more giant clams in open areas adjacent to permanent reserves than in areas adjacent to periodically harvested closures Table 7 and Table 8. The abundance of trochus among management regimes did not differ significantly Table 8 and Figure 45. Substratum factor scores did not differ significantly among management regimes Table 8.

Despite a lower sample size, the supplementary analysis of the closure opened for harvest provided sufficient power (1-β err prob. > 0.79) to detect impacts from fishing. A significantly higher abundance of trochus and a nonsignificantly higher biomass of target fishes and

abundance of giant clams was found in the closure before harvest Table 8, Figure 44 and Figure 45. The recently established reserve had significantly higher abundance and biomass of less vulnerable fishes than the adjacent fishing area Table 8 and Figure 45. Biomass of vulnerable fishes between the newly established reserve and control fishing area did not differ significantly. Giant clam abundance between the reserve and adjacent fishing area differed significantly Table 8 and Figure 45. Substratum was composed of significantly less live coral in the newly established reserve than the adjacent fishing area.

Table 6 Size, compliance, and duration of village marine protected areas. * a proxy measure of harvest intensity, standardized factor score based on marine consumption patterns, harvest frequency, sea skills, and marine economic benefit

	1	2	3	4	5	6	Recently established	Pre/post harvest
Closure type	permanent	permanent	permanent	periodic	periodic	periodic	permanent	periodic
Reserve size (km^2)	0.21	0.1	0.07	0.13	0.08	0.21	0.21	0.14
Village reefs closed (%)	34.2	25.4	48	30	41.2	35	33.1	38.6
Years since establishment	5	4	4	4	6	4	0.4	5
Form of enforcement	customary	customary	customary	customary	customary	customary	customary	customary
Tenure-wide restrictions	limited giant clams	no giant clams, no trochus	limited giant clams	none	no giant clams	none	no trochus	none
No. of rule violations in preceding year	0	0	1	0	0	1	0	1
No. of regular fishers	20	13	23	11	9	18	17	25
Mean resource dependence*	-0.70	-1.29	-0.59	1.37	1.06	1.58	-0.45	0.90

Table 7 Fish, invertebrate, and substratum parameter estimates (mean, SE) in permanent reserves, periodically harvest closures and control areas in Vanuatu. * Principal component analysis score reducing 25 growth form-ecological categorical data

	Control permanent	Permanent	Periodic	Control periodic	Recently established permanent reserve	Control recent	Pre-harvest periodic	Post-harvest periodic
Vulnerable fish abundance (no./ha)	2609(210)	3381(294)	3448(375)	2253(179)	2922(326)	3453(705)	2705(641)	3650(478)
Less vulnerable fish abundance (no./ha)	2468(160)	2281(153)	2153(143)	2110(178)	4195(633)	2172(197)	2125(59)	2495(378)
Vulnerable fish biomass (kg/ha)	296(63)	508(93)	669(125)	175(30)	677(239)	707(272)	289(96)	191(34)
Less vulnerable fish biomass (kg/ha)	261(24)	307(31)	381(39)	302(31)	696(166)	358(83)	156(10)	95(12)
Tridacnid clam abundance (no./ha)	575(87)	428(82)	411(56)	181(37)	158(63)	167(33)	500(122)	75(48)
Trochus abundance (no./ha)	244(64)	81(18)	114(35)	231(64)	75(58)	100(41)	175(63)	0
Substratum composition*	0.12(0.15)	0.35(0.11)	-0.21(0.2)	-0.26(0.18)	-0.8(0.18)	0.8(0.16)	NA	NA

Table 8 Nested analysis of variance (ANOVA) and Dunnett's T3 post hoc significance (p) with Bonferroni correction to compare ecological parameters of Vanuatu marine closure regimes. * Significant at the p<0.05 level.

		Post hoc							
	Nested ANOVA, (df 32, error 72)	Permanent vs. control	Permanent vs. periodic	Periodic vs. control	Control (permanent) vs. control (periodic)	Nested ANOVA; (df 6, error 12)	Recently established reserve vs. control	Nested ANOVA; (df 6, (error 12)	Pre vs. post harvest
	F	*p*	*p*	*p*	*p*	*F*	*p*	*F*	*p*
Vulnerable fish abundance (no./ha)	4.867	0.2	1	0.03*	0.73	3.72	0.03*	0.59	0.52
Less vulnerable fish abundance (no./ha)	2.46	0.95	0.99	1	0.59	8.65	0.00*	0.58	0.53
Vulnerable fish biomass (kg/ha)	1.08	0.32	0.88	0.00*	0.42	1.65	0.22	0.77	0.47
Less vulnerable fish biomass (kg/ha)	1.98	0.79	0.6	0.53	0.87	14.12	0.00*	8.71	0.1
Tridancid clam abundance (no./ha)	1.56	0.77	1	0.01*	0.00*	7.32	0.00*	7.81	0.11
Trochus abundance (no./ha)	2.35	0.1	0.95	0.51	1	1.74	0.2	49	0.02*
Substratum composition	6.71	0.76	0.09	1	0.49	0.39	0.87	NA	NA

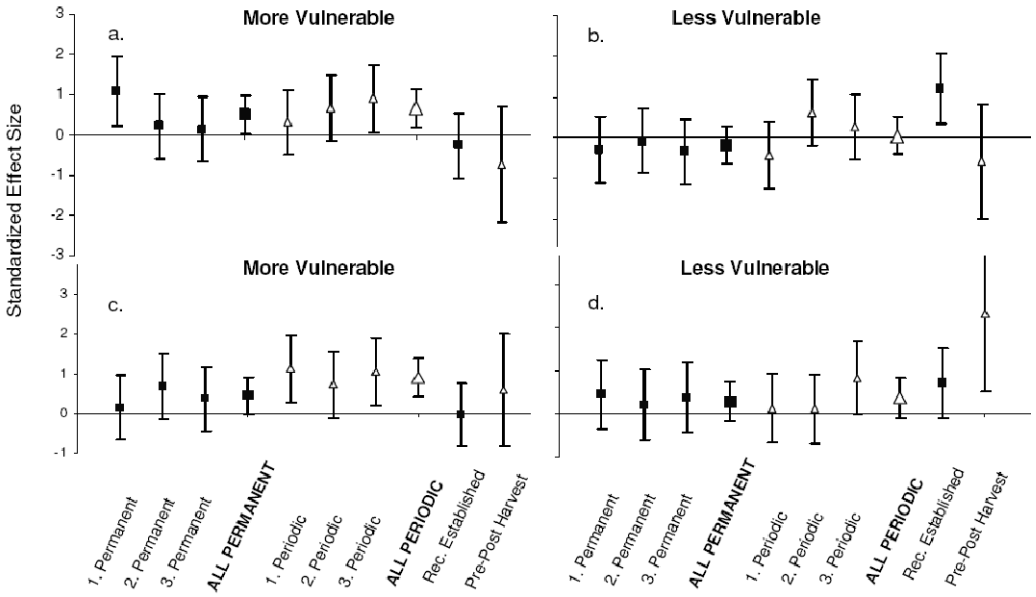
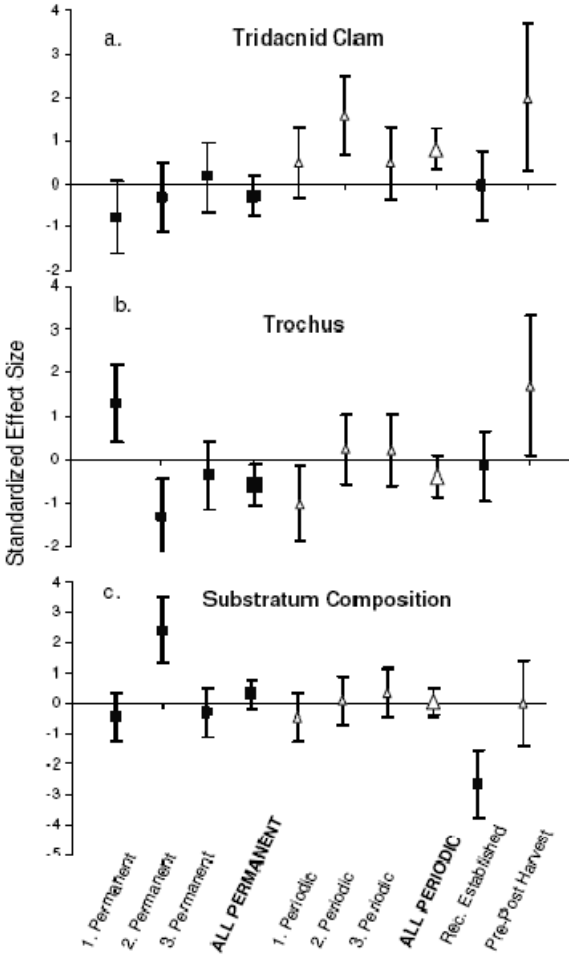


Figure 44 Standardized effect size (ES) with Hedges correction plotted with 95% CI in a comparative study of the ecological outcomes of marine closure regimes. Difference in fish abundance and biomass between reserves (periodic and permanent) and adjacent control areas (1-3), between a recently established reserve and a control, and in a reserve pre- and post-harvest. Graphs (a) (b) describe fish abundance, whereas (c) and (d) describe fish biomass

Figure 45 Standardized effect size (ES) with Hedges correction plotted with 95% CI in a comparative study of the ecological outcomes of marine closure regimes. Difference in (a) tridacnid clam abundance, (b) trochus abundance, and (c) substratum composition between reserves (periodic and permanent) and adjacent control areas (1-3),;between a recently established reserve and a control and in a reserve pre- and post-harvest.



8.4 Discussion

Evidence was found to suggest that small, periodically harvested marine closures on Nguna and Pele facilitated an increase in the abundance and biomass of targeted fishes and in taxa vulnerable to fishing. These results corroborate colloquial knowledge that nonpermanent closures may be effective fisheries management tools. Permanent marine reserves in the Asia-Pacific region commonly fail to meet their objectives due to a lack of compliance (McClanahan et al. 2006) or insurmountable social barriers (Cinner 2007; Foale & Manele 2004). Periodically harvested closures may represent a valid alternative to permanent marine closures in the community context because they are practical, locally appropriate, and as these results suggest, an ecologically adequate management solution in comparison with permanent reserves. Periodically harvested closures may ultimately result in high levels of community acceptance, compliance, and reserve success.

Of critical importance to the ecological effectiveness of periodically harvested closures is the human-controlled intensity and frequency of harvest events (Williams et al. 2006). Effective controls of this type require clear and intact systems of local governance, such as those found in parts of the tropical Pacific, where communities regularly manage the frequency, intensity, and scope of harvest activities (Aswani et al. 2007; Johannes 1998b). Through customary practices, the communities studied here regulate harvest intensity and frequency within and outside reserves so that ecological gains from protection are not completely lost with each harvest event. Local colloquial knowledge presumes that well-managed harvest events do not necessarily affect the long-term accumulation of stocks.

For example significantly lower biomass of vulnerable fishes was found in the closure after harvest (98 kg/ha). This decline may reflect an actual harvest impact or, alternatively, changes in fish behavior immediately after harvest (i.e., fishes are restive with divers and observers). Fish behavior, including response to human activity and flight distance, is variable and often taxon specific, and has the potential to influence visual census results (Edgar et al. 2004). Temporary behavioral disruption from the harvest event potentially masks a relatively stable stock. In fact, local knowledge asserts that closures make fish temporarily "quiet" or tame. Although survey results suggest an immediate reduction in biomass within this reserve, the larger comparative data set suggests that periodically harvested reserves have higher target fish abundance and biomass than controls. Infrequent, light, and well-controlled fishing may therefore have minimal long-term impact on the capacity of closures to maintain coral reef fish communities.

As expected, protection from fishing activity was observed to have the greatest impact on taxa targeted by fishers, and on families with vulnerable life histories. Family-specific response to protection is likely due to a complex interaction between life history, fishing intensity, and site conditions (Jennings et al. 1999; Russ & Alcala 1998a). Therefore, it is likely that the effectiveness of periodic harvest regimes is intrinsically tied to the life-

history attributes of target organisms (Myers et al. 2000), making it an inappropriate management strategy for some taxa. The timing of periodic harvest events is also critical, rendering them particularly destructive if they occur during spawning cycles or other vulnerable periods (Sadovy & Domeier 2005).

Results from surveys conducted before and after harvest events indicate targeted *Tridacnid* giant clams and trochus are particularly vulnerable. This is likely because of limited mobility and the effectiveness of Pacific Island invertebrate fishers. Accordingly, trochus abundance in reserves was not found to be significantly different from controls, which indicates annual periodic harvest may not be a suitable or effective strategy for trochus stock maintenance. This corroborates the findings of other studies of periodic harvest on trochus (Foale 1998; Ruttan 1998). As such, the Fisheries Department in Vanuatu currently advises communities to harvest trochus only when densities reach prescribed levels, rather than relying on arbitrary closure time periods. Periodically harvested marine closures may not always be sufficient on their own to achieve effective management of vulnerable invertebrate resources.

In contrast to the results for periodically harvested closures, significant differences in fish abundance and biomass or in giant clam abundance were not detected between permanently closed reserves and adjacent openly fished areas. Some communities regulate giant clams throughout the entire tenure area, potentially explaining the tridacnid survey results. Permanent reserve communities seem to implement these additional controls and regulations on specific organisms. Simultaneous and mutually supportive management rules, such as the invertebrate restrictions observed, may be effectively used in conjunction with periodically harvested and permanent MPAs to meet specific management objectives.

It is not clear why permanent reserves in the study area seemed to have no measurable impacts on fish parameters relative to control areas, whereas periodically harvested closures did. This result was unexpected. Permanent reserves should theoretically perform better than those allowing periodic harvest (Gerber et al. 2003). Other variables besides permanent or periodically harvested reserve status may be affecting ecological outcomes or the ability of our methods to identify reserve effects. Reef substratum is linked to fish population structure and can potentially confound evaluation of marine-reserve impacts (Kulbicki, 2007). However, substratum was not significantly different among management regimes. The short survey timeframe likely minimized the possibility that fish assemblage patterns shifted significantly during data collection.

Guidetti et al (2008) recommend that reserve effectiveness studies should, in addition to ecological parameters, examine local context including enforcement effectiveness and fishing intensity. Although no significant differences were found between permanent and periodically harvested reserves in potentially confounding factors such as reserve size, percent of area protected, period of protection, or enforcement, empirical data were unavailable on harvest intensity. Anecdotal evidence suggests that fishing is not the predominant subsistence or economic activity for most area residents, although

periodically harvested reserve communities did present higher factor scores for the composite marine-resource dependence variable.

It is plausible that differences among communities in fishing intensity drive the lack of differences between permanent reserves and fished control areas (Graham et al. 2005). The possibility that communities with periodically harvested closures fish open areas more intensely than communities with permanent reserves should be further explored. This hypothesis raises questions regarding the function of the reserves studied here: Have they allowed for biomass accumulation or simply protected against biomass loss? In either case, periodically harvested closures appear to provide some benefit to communities seeking tools to prevent the continued decline of marine resources. Lack of available data on fishing intensity and resource dependence continues to be a critical gap in the science of marine reserves in the Pacific Islands (Zeller et al. 2006).

Communities in the Pacific Islands and throughout much of the developing world may make resource management decisions to ensure food and livelihood security rather than for biodiversity conservation (Bell et al. 2009). However periodically harvested closures likely still provide a significant boost to international conservation targets. Community conserved areas may ultimately provide the balance between seemingly conflicting objectives, particularly in areas where marine management strategies are strongly influenced by cultural practices, economic necessity, and social capacity

It is expected that benefits will continue to accrue on the Nguna and Pele study reefs under both permanent and periodically harvested closure regimes. This is because coral reef fishes have high longevity and variable growth rates (Choat et al. 2006; Williams et al. 2007) and reserve benefits have been shown elsewhere to amass over decades (McClanahan et al. 2007; Russ & Alcala 2004). Thus, an important research goal for the future should be a comparative understanding of how small-scale periodically harvested and permanent reserves function over longer time periods. Furthermore, an empirically based understanding of the sociocultural conditions that enable or limit the types of locally implemented marine reserves is critical in order to promote effective community-based resource management.

8.5 Conclusion

Nearly two decades have passed since Hilborn and Walters (1992) suggested that fisheries management and conservation be optimized by active experimentation with alternative strategies. This investigation was a practical attempt to better understand the outcomes and effectiveness of reserve alternatives that are currently used by hundreds of communities throughout the tropical Pacific. In this region, sociocultural conditions may render permanent reserves locally unacceptable management strategies. Periodically harvested community conserved areas may better suit contemporary cultural context and may provide ecological benefits. Results from this research suggest that in some short-term contexts, controlled periodic harvest within reserves is, for some vulnerable taxa, an ecologically viable or even preferable alternative to permanent protection. At the same time, the theoretical and empirically demonstrated benefits of long-term permanent

protection are recognized and the author does not suggest that successful permanent reserves should be opened to periodic harvests. By examining alternative marine reserve designs, empirical breadth is added to the debate on locally appropriate and socially acceptable conservation practice.

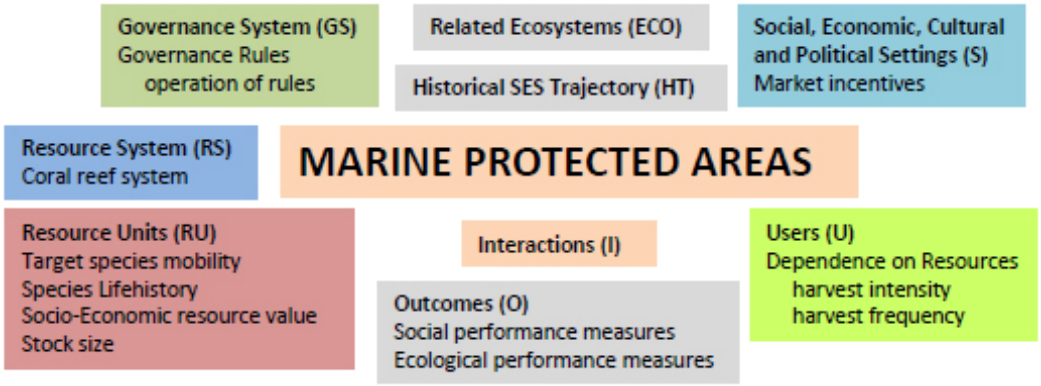


Figure 46 Reconsidering the critical variables identified in this Chapter in terms of the social-ecological analytical framework developed for MPA investigations (see Fig. 10)

CHAPTER 9 - MOTIVATIONS FOR AND PERCEPTIONS OF COMMUNITY-BASED MPAS

9.1 Introduction

Marine protected areas are rapidly expanding throughout the Pacific region, and throughout most of Vanuatu's islands (Govan et al. 2009 and Chapter six of this thesis). Despite the current expansion of Pacific Island marine reserve initiatives, their suitability in the region has been called into question, principally for an assumed incongruence with local ideologies (Ruddle & Hickey 2008, Foale & Manele 2004). To date however, few studies have specifically set out to empirically examine local people's motivations, expectations and ideological support for Pacific Island marine protected areas.

Recent reviews suggest that the motivation for Pacific Island marine management expansion is grounded in food security concerns (Bell et al. 2009) and not in abstract biodiversity conservation concepts (Adams & Dalzell 1994). That Pacific Islanders lacked an historical conservation ethic has been continuously argued (Spriggs 1997, Steadman et al. 2002), though authors examining contemporary contextual evidence counter that Pacific Islanders make management decisions based on a non-utilitarian concern for the environment (Regenvanu 1997, Johannes 2002a). It has also been argued that Pacific Island socioeconomic, food security or ideological contexts potentially limit the expansion of permanent no-take marine reserves (Ruddle & Hickey 2008), (Foale & Manele 2004) and (Cinner et al. 2006). Despite these hypothesized limitations, the Pacific region, and the country of Vanuatu is witnessing a proliferation of permanent and periodically-harvested community-based reserves. While historical and customary practices inform the present understanding of marine management, contemporary reserve motivations, expectations and support may have evolved beyond historical precedents (Dalzell 1998), (Berkes & Turner 2006) and may provide insight into the recent marine reserve phenomenon in the Pacific.

This chapter aims to understand why communities on Nguna and Pele are currently establishing marine protected areas. Specifically, this paper seeks to describe and contrast the expectations, motivations and ideological support behind the establishment of indefinitely closed no-take reserves, and of closures which allow periodic harvest. It also compares reserve benefits as perceived by local communities to outcomes of ecological quantitative surveys. Understanding how local reserve assessments and decisions are made in the context of data-poor (Johannes 1998a) Pacific Islands has important policy ramifications for the region. These research questions are answered utilizing a comparative research design examining three communities with indefinitely-closed reserves and three communities which allow periodic harvest within closures all located in the central islands of the Republic of Vanuatu.

9.2 Materials and Methods

9.2.1 Study sites and local context

This research was carried out within communities of Nguna, Pele and Emao Islands in the Republic of Vanuatu from 2006-2007. Communities on these adjacent islands speak the same language, share a historical trajectory, and undertake similar economic, cultural and social activities. As seen in Chapter two, community-based coral reef marine reserves in Vanuatu are commonly implemented and enforced by customary chiefs and village leaders, and can be less than 0.05km^2 (Johannes 1998b). Six communities were selected for this study, each with a village marine reserve in place and consistently enforced for 4-6 years. Three study communities had indefinite closures and three allowed periodic, controlled harvest in their closures. Communities that allowed periodic harvest did not harvest reserves more than twice per year, and the duration of harvest events was for no more than a single day.

9.2.2 Socio-cultural assessment

To understand local residents' motivations for marine reserve establishment and their perceptions on reserve outcomes, convenience sampling techniques were used in each community until 80% of village adults had participated in a quantitative social science survey. Eighty percent represents the minimum ratio of respondents for a survey to be considered a census. The survey included 55 questions asked in the Nakanamanga vernacular language by a trained local researcher. The questions attempted to gauge local resident's expectations, support, and perceived outcomes of village marine reserves. For most questions, respondents rated their response on a modified Likert-style scale, with 0 being the lowest with 10 being the highest possible response. Qualitative data was collected during these surveys and also via five key informant interviews in each community with leaders intimately involved in the marine reserve establishment process.

9.2.3 Ecological assessment

Ecological results and methodologies from Chapter eight were used to examine the validity of local resource perceptions. That chapter examined the biomass and abundance of reef fish, trochus, giant clams, and live coral substratum inside and outside community permanent and periodic reserves.

9.2.4 Statistical analysis

Quantitative and qualitative social data were grouped by community type, that is, associated with either a permanent (3) or periodically harvested reserve (3). Quantitative results from both reserve types were compared with multiple ANOVAs, building the interaction effect of village into nested models. Ecological data was analyzed by community reserve type, that is, at the level of permanent reserves (3) and closures that allowed periodic harvest (3). Grouping sites in this manner allowed high statistical power for analysis. For comparison, the interaction effects of depth, site and village were built

into nested ANOVA models. Target fish biomass was calculated with family-level length-weight coefficients assayed from Pacific Island reefs (Kulbicki et al. 2005). For quantitative social and ecological data, the standardized effect size (D) with a Hedges bias correction was calculated to examine the strength and direction differences (Cohen 1988). Effect sizes > 0.8 are indicative of substantial relationships (Vaske 2002). Qualitative interview data was transcribed, coded and thematically analyzed (Boyatzis 1998). Themes were categorized into a quantitative matrix for summative analysis.

9.3 Results

9.3.1 Motivations and expectations behind marine reserve establishment:

The most commonly cited motivation for establishing a periodically harvested marine reserve (57% of key informants) was found to be a response to perceived resource declines.

> *"Some things in the ocean are beginning to be lost now. Like the green snail. My son has never seen or eaten a green snail. When I was small, I could walk on the reef and I would find them. But I haven't seen any for a long time" - village housewife.*

> *"Today I see that around here, there isn't coral reef anymore. Its just dead reef, I see some bad coral that is growing, the brown stuff. I think that our sea environment is dying." - village church leader*

This was also the most commonly cited single motivation for establishing a permanent reserves, though uniquely, these respondents noted a dimension of human causality (56% of key informants).

> *"The main reason we have the reserve is that we are ruining the reef. When women go to the reef, they break the stones and ruin the reef." - village fisherman*

> *"The problem was that the mamas and papas and youth take shells that are too small. They take too many, too many that they can't eat so they just waste at the house." - village youth representative*

These results were confirmed by quantitative analysis with residents from communities with periodic reserves perceiving significantly stronger declines in marine resource levels ($p=0.000$, $F=7.44$, $df=5/168$, $D=0.3$), target fish stocks ($p=0.000$, $F=8.464$, $df=5/168$, $D=0.4$), and seafood consumption ($p=0.002$, $F=3.928$, $df=5/168$, $D=0.2$) than those from communities with permanent marine reserves Table 9. Harmful fishing practices were perceived to be significantly higher in communities with permanent reserves than those with periodic reserves ($p=0.000$, $F=5.924$, $df=5/168$, $D=0.5$).

Table 9 Mean values of perceived trends and current status of reserve related variables. Mean values can range from 0: lowest response, to 10: highest response.

Variable	Reserve Type	Likert Mean / 10 points	SD
Perceived decline in marine resources	Permanent	3.4	4.2
	Periodic	6.0	2.7
Perceived decline in target fish stocks	Permanent	3.2	3.6
	Periodic	6.0	2.9
Perceived decline in seafood consumption	Permanent	3.6	2.8
	Periodic	4.6	2.8
Perceived level of harmful fishing practices	Permanent	6.7	2.4
	Periodic	5.7	2.3
Perceived reserve efficacy	Permanent	8.7	1.7
	Periodic	7.8	1.6
Support for current reserve regime	Permanent	9.8	0.7
	Periodic	9.0	1.3

While some respondents from both community types mentioned specific utilitarian reasons for establishing reserves (e.g. current lack of food or target species) as a motivation for establishing marine reserves (39% of all respondents), most informants from both community types highlighted other, non-utilitarian incentives (88% of all respondents) such as

stewardship and environmental responsibility:

> *"Even before there was a marine reserve, I was always sorry for the little animals and the environment. I want my grandkids to see all the things that I like in the sea." – village fisherwoman*

improved tourism opportunity:

> *"In the marine reserve, the reef is colorful and there are big plate corals, and this is what tourists want, to scuba dive and take pictures of the reef. What we were hoping for is happening. – village council member*

strengthened village tenure:

> *"Well, the resources in the sea are enough for us to harvest, but other villages are ruining our resources without permission. We needed to make an arrangement to stop them from coming and spoiling our environment". – village fisherwoman*

local NGO promotion:

> *"We got the idea to start a marine reserve at an NGO and government meeting in Port Vila. We thought that every community should have a conservation area. So that's when we started it. Our community agreed with this idea and we set up a reserve inside the village boundary." – member of village reserve committee*

and village competition and rivalries:

"I saw that we needed to set it up. Village X was the first community to set one up, then village Y then village Z, so we were the last community on the island and I saw that we needed to set one up too." - village chief

9.3.2 Marine reserve effectiveness and outcomes

Residents of both community types perceive that reserves are working, though the mean was significantly higher in communities with permanent reserves (p=0.002, F=9.99, df=5/169, D=0.4).

"The reserve is working, I have seen a difference with my own eyes. In the reserve the fish are now everywhere and they are tame" - village fisherman (permanent reserve)

"Things that we hadn't seen for a long time, now they have increased a lot, and we see them again. They come out of the reserve. The reserve is giving it to us." – village chief (periodic reserve)

Residents of permanent reserve communities were found to perceive significantly higher live coral cover (p=0.000, F=11.321, df=5/168, D=.5) trochus abundance (p=0.000, F=8.115, df=5/168, D=0.4) and target fish biomass (p=0.017, F=2.837, df=5/168, D=0.4) than did residents of periodic reserve communities. No significant difference in people's perceptions regarding the average giant clam abundance (p=0.085, F=1.973, df=5/168, D=0.1) was found between community types. Comparing perceived ecological parameters to those measured in Chapter eight, ecological surveys confirmed that permanent reserves had significantly higher percent live coral cover (p=0.003, F=2.925, df=18/36, D=0.9) and giant clam abundance (p=0.006, F=2.657, df=18/36, D=0.04) than did periodic reserves. However, analysis found no significant differences in target fish biomass (p=0.188, F=10, df=18/36, D=0.4) or trochus abundance (p=0.378, F=1.115, df=18/36, D=0.2) inside permanent reserves and periodic reserves Figure 47.

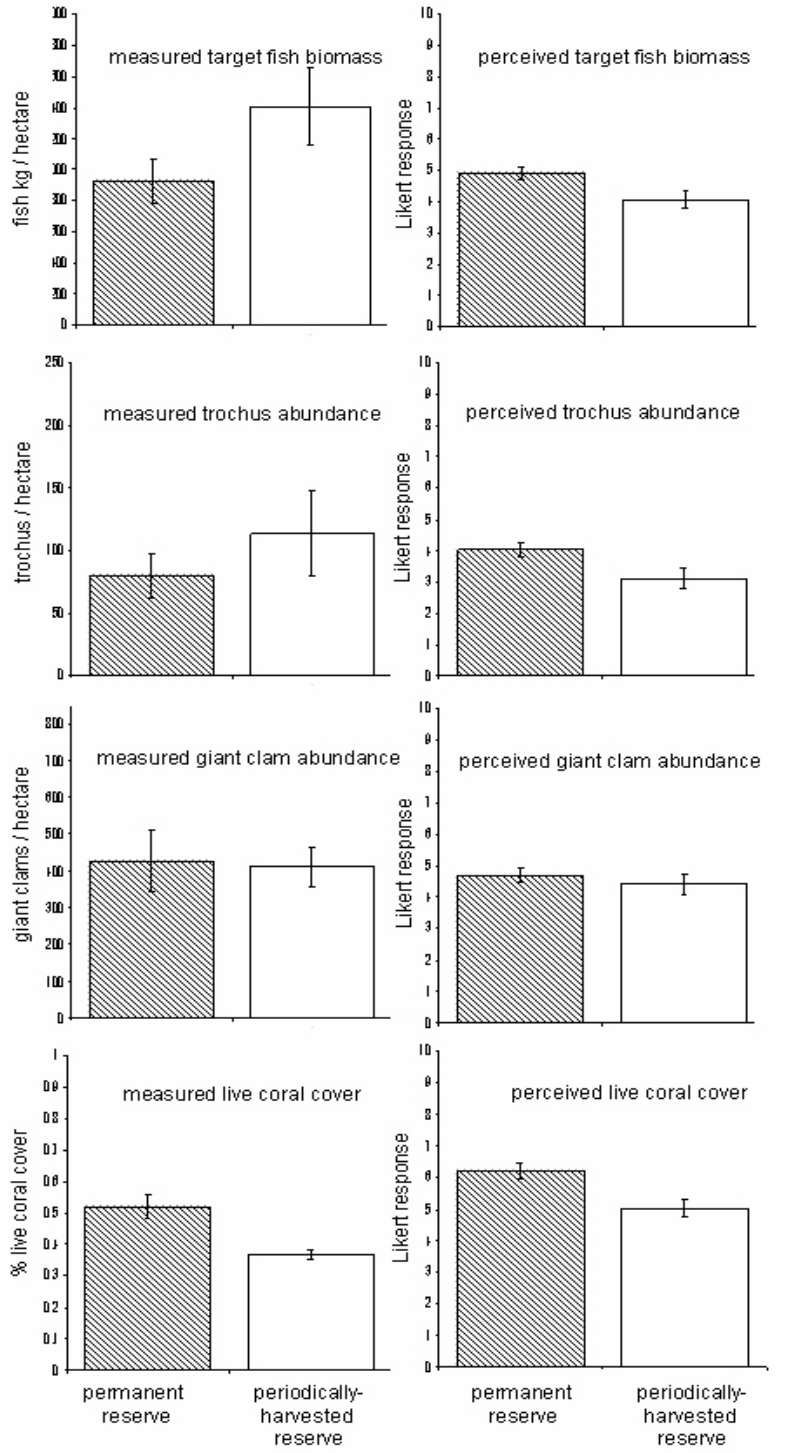


Figure 47 A comparison of the perceived and empirically measured target fish biomass and percent coral cover in permanent and periodically harvested marine reserves. Means +/- SE.

Asked about local assessments of reserve outcomes, 65.6 percent of respondents from permanent reserve communities noted they based their assessments on direct visual observations, compared to only 6 percent of respondents from periodic reserve communities. In contrast, 90.2 percent of residents from periodic reserve communities based their assessments solely on an assumption of reserve efficacy. Only 8.2 percent of residents from permanent reserve communities based their assessments on assumed reserve efficacy.

"We expect that in the conservation area, marine animals will grow and become plenty. When it's closed we get lots of resources, that's the way it works." – conservation committee member

9.3.3 Local support for MPAs

Though residents from both community types showed strong support for the continuation of their current marine closure regime, residents from permanent reserve communities showed significantly more support ($p=0.000$, $F=5.629$, $df=5/168$, $D=0.7$) than residents from communities with periodic reserves. When asked to explain why her community supported a permanent closure system over one allowing periodic harvest, one local woman responded:

"Well, when the chief opens a taboo [periodic closure] *and takes out the custom marker, we go catch fish, lots of fish. There are lots of resources when you first go in, but that is only for a short time. After we keep going in, then the numbers go down. So it is always up and down, up and down. But we want up and up." - member of village council*

9.4 Discussion

9.4.1 Reserve motivations are reactive and conservation focused

The most commonly cited factors motivating communities to establish marine reserves were found to be conservation-oriented and non-utilitarian. Community closures on Nguna and Pele were found to be a direct response to declining resources or to damaging human uses of the marine environment. These findings provide contrast to studies suggesting that ecological drivers may not be directly responsible for community marine use and management (Turner et al. 2007, Carrier 1987) or that they are established independently of an explicit conservation ethic (Ruttan 1998, Foale & Manele 2004). These motivating concerns may be well-founded, particularly as the fisheries crisis has been well described around the world (Pauly et al. 2005). While some evidence was found for utilitarian closure motivations, these were less commonly cited by local residents.

Importantly, the recently marine protected area phenomenon in Vanuatu appears to be a distinct departure from the assumed pre-contact system of temporary and utilitarian-focused marine taboos (Caillaud et al. 2004). This shift is likely due to changing ecological and social contexts, and local perceptions about complex social-ecological systems. However, while many of these novel conservation closures have not been harvested for decades, communities may yet decide to reopen them at some point in the future should local perceptions of the social-ecological system change.

Different closure types on Nguna and Pele were established following slightly different motivating factors. Human impacts on marine resources were commonly mentioned as a motivation for establishing an indefinite closure. This motivation may demonstrate an

elevated sense of human agency; increasing the likelihood that management measures will be reactive and potentially stricter. In contrast, communities which are responding to resource declines may not acknowledge human agency. If an acknowledgment of human agency is found to be a key factor in a community's decision to implement a permanent or non-permanent reserve, the finding would provide a clear strategic educational priority for governments and supporting organizations. The relationships between local perceptions and reserve establishment should be further explored.

Some qualitative evidence was found to support the widely-held view that conservation-focused NGOs have aided the push towards Pacific Island protected areas (Turnbull 2004, Cox & Elmqvist 1997, Hviding 2003b). It should be noted however that none of the major international conservation NGOs presently work in Vanuatu. Community marine management advice tends to originate from national government departments (Johannes 1998b), despite limited capacity (Rose 2008 and Chapter two of this thesis). Even with an absence of conservation NGOs and strong government initiative, Pacific Island communities seem to possess a 'double groundedness' (2003a) in terms of their knowledge about marine management activities in the region; they are directly influenced by issues and actors operating on supra-local scales. Colloquial awareness about regional protected area priorities and initiatives plays a role in the contemporary renaissance of community-based marine reserves. To avoid mismanagement in a regionalized context, coordinated efforts should be made to provide communities with accurate, empirically validated information about relevant marine reserve regimes on which to base local marine management decisions (Crosby et al. 2002).

9.4.2 Are MPAs working? Data-less assessments of reserve outcomes

Island residents perceive both closure types to be ecologically effective. However, conventional fisheries management theory suggests that reserves are most effective if they are "fully protected" or indefinitely closed (Roberts 2000). In fact, our empirical evidence suggests that local residents perceive indefinitely closed reserves to be significantly more effective than periodically harvested closures for enhancing target fish biomass, trochus abundance and live coral cover. Contrasting and validating these perceptions with ecological surveys was conducted with mixed results. Higher perceived coral cover inside permanent reserves was validated by underwater surveys. Neither local perceptions nor underwater surveys identified significant differences in the abundance of giant clams inside each MPA type. However, there was some incongruence between perceptions and empirical results for fish biomass and trochus abundance. In each of these cases, local people felt no-take reserves performed better while underwater surveys found periodically harvested areas to have higher resource stocks.

These results may be potentially explained by differences in resource mobility; fish and trochus have complex patterns of diurnal and seasonal mobility, whereas sedentary clams and coral remain site based and more continuously observable. It may be harder to accurately estimate the abundance of mobile resources than sedentary ones. Resource perceptions generally depend on observed trends and past states, without empirical records, the opportunity exists for misperceptions. Such a misperception has been well

documented in the case of the shifting baseline syndrome (Knowlton & Jackson 2008). Inhibiting the validation of colloquial marine resource perceptions is the lack of fine-scale time-series ecological data from Vanuatu and the Pacific Islands more generally (Wood et al. 2008, Clua et al. 2005).

Recognizing that marine management decisions in the Pacific are commonly made in the absence of empirical ecological or fisheries data (Johannes 1998a), the accuracy and validity of local perceptions may strongly influence the types of regimes implemented and by extension the outcomes of management. Recent studies on English Channel fishers found that fishermen there have high capacity to accurately detect changes in fish catches over time (Rochet et al. 2008). In contrast to the UK case, fishing is not typically a full-time commercial activity among Pacific Island residents (Turner et al. 2007), but represents one activity within an area of high occupational diversity (Chand 2005). Would non-fishing residents of Pacific-island communities hold equivalent experiential knowledge as professional fishers in a developed country? Dulvy and Polunin (2004) found that the capacity of Fijian fishers to detect declines in important species was relatively low, suggesting that decisions made on perceptions may not be reliable. However, even if perceptions are found to be incongruent with a measurable ecological reality (e.g. Gilchrist et al. 2005), there is consensus that they have a strong influence on environmental decision-making (Weber et al. 2004) and will undoubtedly dictate the future of MPAs in Vanuatu and other Pacific Islands

Despite the lack of scientific validation on the effectiveness of these small-scale Pacific Island reserves, the fact remains that hundreds of community reserves have been in place and locally supported for decades (Johannes 1998b), and the current trend of expansion continues. Hviding (2006) points out that Pacific Islanders often maintain an "empirical attitude" towards resource management and will employ and adapt strategies based on positive experience. This anecdotal evidence strongly suggests that communities are deriving important ecological or socio-economic benefits from closures. Periodic reserves, while arguably less ecologically effective may present communities with benefits in situations where socio-economic factors prohibit the establishment of a permanent reserve (Cinner et al. 2006). Few empirical ecological studies have examined the effectiveness of non-permanent Pacific Island reserves (Williams et al. 2006, McClanahan et al. 2006, and Chapter eight of this thesis) and this area of research should be expanded.

Whether or not MPAs performance is coinciding with local expectations, strong national and regional resource management policies remain important for filling the gaps and meeting marine resource use objectives (Pomeroy & Berkes 1997). Pacific Island governments enable the effectiveness of small-scale community reserves by facilitating large-scale reserve connectivity, regulating the trade and export of exploited species, arbitrating disputes over marine resource use, prioritizing education and extension activities, coordinating scientific research, and networking communities and other stakeholders. Well-planned government policy may assist communities overcome potential management weaknesses inherent in small community-based systems.

9.4.3 Local support for community-based marine reserves

Results from Nguna and Pele demonstrate that marine reserves of both types enjoy very strong local support. This finding is heartening as global experience finds communities willing to participate in protected area regimes only if the perceived benefits outweigh the costs (Gibson et al. 2007). An unbalanced cost-benefit equation may partly explain why the relationship between indigenous peoples and protected areas has been historically antagonistic (Adams & Hutton 2007, Berkes 2007b). Marine reserves in the Pacific Islands, as exemplified by those in Vanuatu, may therefore represent a model community-protected area relationship. A factor contributing to high levels of community support is the locally controlled nature of resource management in the country. With local tenure enshrined in Vanuatu's constitution (Johannes 1998b), and strongly enforced by communities themselves, marine management regimes are rarely controlled or directly managed by an external party. The region has witnessed a major paradigm shift away from the large, nationally managed protected area regimes recommended by the IUCN in the 1980's (Dahl 1987) and centralized co-management schemes suggested in the early part of the millennium (Crosby et al. 2002). Rather, enabled by new and adapted environmental legislation in some Pacific Island countries (Techera 2005), there is a trend towards the decentralization, legitimization and support of village-level marine closures, restrictions and governance (Muehlig-Hofmann 2007).

This Nguna-Pele case study indicates that some communities display a strong interest in marine conservation and management, actively seeking guidance and advice from colloquial and scientific sources as they deal with the threats impacting their environment. Strong local support for marine protected areas, both indefinitely closed and periodically harvested, is an indication that, at least in Vanuatu, these community-driven initiatives do not represent foreign ideologies forced upon an unwilling people (Ruddle & Hickey 2008, Gelcich et al. 2008). Rather, as in the Solomon Islands, many ni-Vanuatu communities have accepted the arrival of novel resource management ideas with "xenophilia", locally adapting and hybridizing them to become their own (Hviding 2006). In Vanuatu, community marine protected area motivations often stem from hybridized Western and indigenous ideologies. Official marine management policy should likewise accept and enable this contemporary hybridization.

9.5 Conclusion: the future of Pacific Island marine reserves

Locally-perceived as the most effective type of closure regime, permanent or indefinite reserves established by communities will likely continue to spread throughout the Pacific Islands. Ultimately however, the future expansion of community-based marine reserves will depend on a continuous and data-less cost-benefit analysis performed by communities. In a region living in a globalized information age, community decision-making may take into account advice from governments, NGOs and scientists, and temper that advice with experiential knowledge, local perceptions and official policy. This process resembles much of Pacific Island history, where its cultures and practices are continually evolving and often involve a self-determined symbiosis (Lindstrom 2008), integration (Spriggs 1997) or hybridization (Cinner & Aswani 2007) between internal and

external ways of knowing. The diversity of the region presents many opportunities for resource management collaboration and improvement (Hviding 2006), and for finding an ideological middle ground in the community conserved area debate (Berkes 2008) and (Jones 2001). The current community-led expansion of diverse marine reserve expressions in the Pacific Islands may represent a novel trend away from the command and control conservation regimes of the past (Holling & Meffe 1996), and towards an adaptive and collaborative approach to marine resource management (Folke et al. 2005).

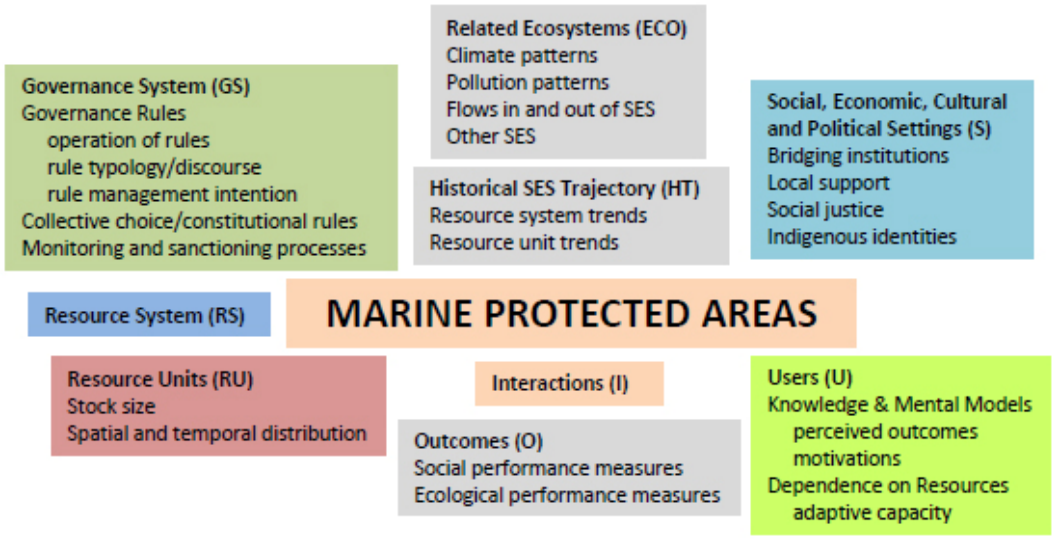


Figure 48 Reconsidering the critical variables identified in this Chapter in terms of the social-ecological analytical framework developed for MPA investigations (see Fig. 10)

CHAPTER 10 - ENABLING CONDITIONS FOR MPA RULES

10.1 Introduction

Global marine biodiversity and fishery resources are rapidly declining (Jackson 2008; Worm et al. 2006). Marine protected areas (MPAs), which limit or prohibit extractive activities such as fishing, are increasingly being implemented to help control human impacts and sustain the resilience of marine seascapes (Guarderas et al. 2008; Mora et al. 2006; Wood et al. 2008). But in some regions, up to 90% of MPAs fail to meet their management objectives (Kelleher et al. 1995). Failed MPAs can displace usage rights, increase conflicts over marine resources, and marginalize some stakeholder groups (e.g. fishers) in favor of others (e.g. tourism operators), sometimes ending up as 'paper parks' with poor compliance (Agardy et al. 2003; Mascia & Claus 2009).

Although there are substantial gaps in the marine science pertinent to MPAs (Sale et al. 2005), many failures have occurred because local human dynamics and institutional constraints were poorly understood or ignored during MPA planning, implementation and management (Christie et al. 2009; Mascia 2003). Sociocultural conditions profoundly influence how people use resources (Cinner et al. 2009) and how or whether they cooperate to manage them (Ostrom 1990). Increasingly, MPAs are being viewed as embedded within linked social-ecological systems and attempts are being made to integrate marine ecology with diverse social science disciplines such as anthropology and commons policy studies (Hughes et al. 2005). For example, interdisciplinary studies across Asia, East Africa, the Pacific, and the Caribbean have consistently found that MPA outcomes are influenced by broader demographic, economic, and institutional contexts, as well as by aspects of MPA design such as size and location (Christie et al. 2009; McClanahan et al. 2006; Pollnac et al. 2001). A key lesson from these studies is that there is no one-size-fits-all MPA strategy. Successful outcomes result, at least in part, from interactions among ecological processes, users, governance institutions, and the sociocultural contexts in which they operate.

Selecting MPA rules is a linked social-ecological issue for managers and conservation planners because different operational rules likely lead to different social and ecological outcomes. As demonstrated in Chapter eight, and in other published studies that have directly compared no-take and periodically harvested MPAs using standard ecological indicators and methods, both systems can show differences in fish biomass when compared to control fished areas (McClanahan et al. 2006). However, periodic harvests have the potential to stunt key ecosystem functions that have been observed over decadal scales in long-enduring no-take marine reserves (McClanahan et al. 2007; Russ & Alcala 2004). Thus there are undoubtedly critical longer-term ecological trade-offs between MPA rule types that policy makers should consider (Lester & Halpern 2008). Additionally, there are social trade-offs with different MPA types, particularly with rules that fully exclude local users (West & Brockington 2006). Periodically harvested MPAs have been shown to provide communities with direct benefits for culturally important events (e.g. wedding feasts) and consequently garner high levels of compliance (Cinner et

al. 2005a). Specific operational rules can have very different impacts on stakeholders depending on the sociocultural context in which they operate (Cinner 2007; Foale & Manele 2004).

A critical unanswered question constrains the implementation of successful marine management: do certain sociocultural conditions facilitate the selection of specific types of MPAs (i.e. their operational rules)? As the focal study to answer this question, sociocultural conditions that may enable communities on Nguna and Pele islands to select strict no-take reserve rules or alternative regimes were investigated. Nguna and Pele provide an interesting case for comparative investigation because, as discussed in Chapter two, the governance structure is highly decentralized, and communities are empowered to autonomously develop the rules that they find most appropriate.

10.2 Materials and methods

Critical variables highlighted by other commons case studies were compared and contrasted with contextual social-ecological knowledge about reserve rule selection in Vanuatu (Ostrom 2007). As described in Chapter four, contextual social-ecological knowledge on Nguna and Pele was generated from a series of participatory workshops. Thus variables from theory and contextual local knowledge were investigated Table 6. To investigate the necessary preconditions for selecting no-take marine reserve rules, variables were empirically compared in three Nguna-Pele communities with no-take marine reserves and three with periodically harvested closures. Communities were purposively selected for structured empirical comparison based on their sociocultural similarities (e.g. governance systems, cultural practices, and economic contexts). Structural similarities among communities enabled us to control the variability of several variables identified in the literature, and eliminate them from empirical analysis Table 8. Case study research may be subject to multiple confounding factors, particularly if it compares sites that are socio-economically distinct (eg. Cinner et al. 2007).

Table 10 Variables evaluated in the case study, originating from the wider marine protected area and marine management literature as well as from local expert knowledge. All variables were investigated. Variables in BOLD were used in the fsQCA analysis. Variables in ITALICS were removed from analysis due to minimal variation among cases. Variables with † were quantitatively evaluated, but removed from subsequent analysis due to minimal variation among cases (Cohen's D<0.2). Codes in parentheses relate to the variables identified in Ostrom (2007).

Governance System	**Resource Units**
Government organizations	*Target species mobility*
Non-government organizations	*Species replacement rate*
Sea-tenure/property system	*Reef ecological interactions*
Governance rules	**Economic value of the resource** †
customary management	*Species stock size (RU5)*
laws and regulations	*Spatial and temporal distribution*
effectiveness	**Resource System**
governance structure	*Coral reef system*
Collective choice/constitutional rules	*Clarity of tenure boundaries*

Monitoring and sanctioning processes	**Size of the resource system**
Users	**sea tenure area** †
Number of fishers/users	**% of area protected** †
Socio-economic attributes	*Coral reef productivity*
wealth †	*Reef system predictability*
income †	*Reef biomass storage*
formal education	**Social, Economic & Political Settings**
age	*Economic development*
Migration	*Demographic trends*
History of use	***Political stability***
User location	***Market incentives***
Norms/Social Capital	**Related Ecosystems**
public attitudes	*Climate patterns*
respect for authority	*Pollution patterns*
Ecological knowledge/TEK	*Flows into and out of focal SES*
perceived threats	**Interactions**
perceived human agency †	**Resource use patterns**
conservation ethic	**sea skills**
Dependence on resources	**gear density** †
alternative livelihoods	**Conflicts between users**
food security †	**cooperation**
economic dependence †	
Harvest technology	

Data were collected between June 2006 and January 2007. Most variables were measured via a census-type survey instrument administered in the local dialect to >80% of adult residents in the study communities. Some survey questions utilized a modified anchored Likert scale (Pollnac & Pomeroy 2005) to gauge the strength and direction of perceptions about local conditions, while other questions were left open-ended. Key informant interviews and focus groups provided information on demographic variables (estimates of compliance, target species and primary gears).

The number of variables used in the analysis was reduced by constructing composite indices to approximate complex latent indicators (Agrawal 2003). Indices were averages of between 2 and 7 variables, each passing Cronbach's alpha test of reliability (see Sutton 2007). Individual-level survey data was averaged at the community level. A finite population correction factor for high proportional sampling was applied to estimates of variance (Elzinga 2001). Cohen's Effect Size (D) was calculated as a measure of the strength of differences between no-take marine reserve and periodic harvest community conditions (Cohen 1988). Conditions which showed no variation (minimal relationships $D<0.2$) between regimes were eliminated from subsequent analyses.

Fuzzy set qualitative comparative analysis (fsQCA) was used to make inferences about the conditions necessary or sufficient to select particular marine closure operational rules (Ragin 2000). FsQCA accommodates real-world colinearity among predictor variables, it does not require large-N data sets, and it calibrates variables with expert contextual knowledge (see Ragin 2008). Calibration entails identifying variable values that constitute full membership, full non-membership, and crossover points. This process

contrasts with traditional crisp set analysis, which requires that each case be force fit into one of two diametrically opposed categories (membership versus non-membership). It allows for the possibility that variable thresholds exist which influence case outcomes: for example, the hypothesis that increasing population density may disable customary management regimes (Cinner et al. 2007).

Each of the 24 quantitative indicators was calibrated by defining the qualitative anchor points identified above Table 9. Qualitative anchor points enable investigators to distinguish between practically relevant and irrelevant variation within survey responses (Rihoux & Ragin 2009). Some of the data used in the analysis was pre-calibrated at the data collection stage through the use of modified anchored Likert scales with questions like "scale your perception of [*condition X*] from 0-10, with 5 being a cross-over point." r conditional variables were calibrated for fsQCA based on the research team's substantive, local, experiential and contextual knowledge.

The computer software fsQCA (v2.0) was used to generate a truth table, demonstrating the set membership of each case based on the calibration process described above. Because fsQCA may be confounded by limited diversity, conditions showing no variability across cases were eliminated from further analysis (Ragin 2008). Conditions showing no variation included conservation ethic, custom strength, threat trends, declining respect, tourism benefit, cooperation, food availability and wealth. Also, conditions which presented comparative effect sizes of less than 0.2 were eliminated from further analysis Table 8. Conditions showing minimal effect sizes included income, responsibility, wealth, percentage of protected tenure, gear density, seafood availability, sea tenure area and food availability.

Set theoretic analysis allows for the reality that a given outcome may result from several divergent combinations of conditions. Each combination represents an alternative path to reach the same outcome. At times the conditions within each combination are sufficient, but not individually necessary to achieve a given outcome. In some cases, particular combinations always result in a given outcome. These combinations of specific conditions are therefore necessary to achieve a given outcome. An important first step in fuzzy set qualitative analysis is analyzing the necessary conditions, and removing them from subsequent analysis. These will meet the condition of consistency above 0.75 and coverage above 0.5. According to Ragin (2006) "Consistency gauges the degree to which cases sharing a given combination of conditions agree in the outcome." Consistency is analogous to significance, and signals whether an empirical connection merits close attention. If the fsQCA results are not consistent, the researcher's hypothesis is not supported. Ragin (2006) defines coverage as the "degree to which a causal combination 'accounts for' instances of an outcome." When there are several paths to the same outcome, coverage may be small. Coverage is analogous to effect size, indicating the strength of relationships. Therefore, using the remaining indicators, the software fsQCA (v2.0) was used to examine the necessary and sufficient conditions for no-take and periodically harvested reserves Table 15, Table 16, Table 17 and Table 18.

10.3 Results

Communities which selected no-take reserves rules were found to have substantially higher (i.e. Cohen's D effect sizes >0.8) ecological resource knowledge, governance efficacy, population sizes, conservation ethic, enforcement capacity and strength of customary identity than communities which selected periodic harvest rules.

A fuzzy set qualitative comparative analysis (fsQCA) grouped sociocultural conditions into two distinct categories: 1) a set of 'enabling' conditions which were necessary to select a specific rule; and 2) a set of influential conditions which increased the likelihood a specific rule being selected. The enabling conditions for communities to collectively choose no-take marine reserve rules were: the presence of effective local governance, a minimum population size (mean 56 adults), and a minimum proportion of residents willing to personally enforce management rules (mean 31%) Table 17. Consistency and coverage for each of the enabling conditions for no-take reserves were high (>0.8 and >0.57 respectively). Without the presence of one or all of these enabling conditions, no-take reserve rules will not likely be selected by a community. In a separate fsQCA analysis, no enabling conditions were identified for the selection of periodic harvest rules.

Subsequent fsQCA analysis showed that in addition to the enabling conditions, communities may be more likely to establish no-take marine reserve rules in the presence of other influential conditions, namely the simultaneous presence of a high number of community organizations and a high mean age of residents Table 18. Consistency and coverage for this solution were only considered moderate (0.65 and 0.49 respectively). In contrast, periodic harvest rules are more likely to be selected when communities present with the following influential conditions: a low level ecological knowledge about target resources and have a relatively low proportion of local residents willing to personally enforce management rules. Consistency and coverage for this combination of variables were adequate (0.82 and 0.57 respectively).

Table 11 Explicitly considering the similarities among study sites on Nguna and Pele islands.

	1	2	3	4	5	6
MPA Type	**Permanent**	**Permanent**	**Permanent**	**Periodic**	**Periodic**	**Periodic**
MPA harvest frequency/ duration	NA	NA	NA	annually, 12 hours	annually, 1 day	annually, 3-4 hours
Closure duration (at time of study): years	4	5	4	6	4	4
Marine property rights	customary marine tenure	customary marine tenure	customary marine tenure	customary marine tenure	customary marine tenure	customary marine tenure
MPA size: (km2)	0.21	0.07	0.23	0.08	0.21	0.13
Closure management	customary	customary	customary	customary	customary	customary
Main marine habitat used	coral reef	coral reef	coral reef	coral reef	coral reef	coral reef
Principle marine targets	fish, invertebrates	fish, invertebrates	fish, invertebrates	fish, invertebrates, algae	fish, invertebrates	fish, invertebrates
Stock status	overfished, declining	overfished, declining	overfished, declining	overfished, declining	overfished, declining	overfished, declining
Language	Nakanamanga	Nakanamanga	Nakanamanga	Nakanamanga	Nakanamanga	Nakanamanga
Majority religion	Presbyterian	Presbyterian	Presbyterian	Presbyterian	Presbyterian	Presbyterian
Population size:	small	small	small	small	small	small
Demographic trends	slightly increasing	slightly increasing	slightly increasing	slightly increasing	slightly increasing	slightly increasing
Primary subsistence occupation	agriculture	agriculture	agriculture	agriculture	agriculture	agriculture
Collective choice rules	chief & representative council	chief & representative council	chief & representative council	chief & representative council	chief & representative council	chief & representative council
Income generating activities	capital city market, village stores, tourism, family remittance, sea transport	capital city market, village stores, tourism, family remittance, sea transport	capital city market, village stores, tourism, family remittance, sea transport	capital city market, village stores, tourism, family remittance, land transport	capital city market, village stores, tourism, family remittance, sea transport	capital city market, village stores, tourism, family remittance, sea transport
Location	Central Vanuatu, South West Pacific	Central Vanuatu, South West Pacific	Central Vanuatu, South West Pacific	Central Vanuatu, South West Pacific	Central Vanuatu, South West Pacific	Central Vanuatu, South West Pacific
Distance to the capital city, Port Vila	10 minute walk, 25 minute ferry, 2 hour truck	20 minute ferry, 2 hour truck	15 minute walk, 30 minute ferry, 2 hour truck	30 minute walk, 30 minute ferry, 2 hour truck	25 minute ferry, 2 hour truck	15 minute walk, 30 minute ferry, 2 hour truck
Migration	minimal and short-term outmigration to Capital City	minimal and short-term outmigration to Capital City	minimal and short-term outmigration to Capital City	minimal and short-term out migration to Capital City	minimal and short-term outmigration to Capital City	minimal and short-term outmigration to Capital City
History of marine use	artisanal, limited beche-de-mer/trochus harvest	artisanal , limited beche-de-mer harvest	artisanal , limited beche-de-mer/trochus/ornamental harvest	artisanal only	artisanal , limited beche-de-mer/trochus harvest	artisanal , limited beche-de-mer/trochus harvest
Pollution issues	limited village rubbish waste	limited village rubbish waste	limited village rubbish waste	limited village rubbish waste	limited village rubbish waste	limited village rubbish waste

		PERMANENT NO-TAKE RESERVE					PERIODICALLY HARVESTED MPA				
	D	1	2	3	MEAN	SD	4	5	6	MEAN	SD
resource knowledge	**1.20**	2.80	3.68	5.50	3.99	1.38	1.61	1.91	3.25	2.26	0.87
local governance efficacy	**1.03**	6.59	6.98	7.45	7.01	0.43	7.08	4.73	5.80	5.87	1.18
resident adult population	**1.01**	70	22	75	56	29	40	25	17	27	12
conservation ethic	**0.92**	7.83	8.03	9.39	8.42	0.85	7.13	7.09	8.33	7.52	0.71
% likely to personally enforce reserve	**0.84**	33%	47%	14%	31%	17%	31%	6%	7%	15%	14%
custom strength	**0.75**	3.70	4.47	3.78	3.98	0.42	2.31	3.91	3.79	3.34	0.89
marine focus- sea skills	**0.70**	5.71	5.85	5.56	5.71	0.14	3.41	5.49	5.79	4.90	1.29
years of formal education	**0.67**	6.58	6.47	7.93	7.00	0.81	6.97	5.94	6.36	6.42	0.52
threat trends	**0.63**	1.24	1.35	0.78	1.13	0.30	0.82	0.94	1.07	0.94	0.13
# community organizations	**0.49**	7.00	7.00	8.00	7.33	0.58	9.00	6.00	3.00	6.00	3.00
severity of declining respect	**0.44**	-3.40	-1.35	-2.24	-2.33	1.02	-2.36	-4.56	-2.07	-3.00	1.36
tourism benefits	**0.42**	6.10	8.32	7.53	7.32	1.12	6.13	7.81	6.39	6.78	0.91
% with marine primary occupation	**-0.42**	10%	6%	0%	5%	5%	0%	13%	14%	9%	8%
% using hook and line	**0.35**	73%	88%	68%	76%	10%	80%	38%	86%	68%	26%
age	**0.30**	37.4	41.7	41.0	40.0	2.3	37.4	38.2	41.9	39.1	2.4
external cooperation	**0.22**	5.58	6.94	6.26	6.26	0.68	5.56	6.16	6.57	6.09	0.51
food availability	**0.18**	5.86	6.79	6.07	6.24	0.49	6.17	5.44	6.73	6.11	0.65
total sea tenure km2	**0.12**	0.63	1.50	0.46	0.86	0.56	0.17	0.60	1.53	0.77	0.69
% selling seafood in market	**-0.11**	73%	88%	5%	55%	45%	6%	100%	79%	61%	49%
gear density	**-0.10**	0.25	0.57	0.10	0.30	0.24	0.04	0.40	0.57	0.34	0.27
% protected tenure	**-0.07**	30%	10%	50%	33%	18%	50%	40%	20%	34%	12%
wealth	**0.02**	5.98	6.37	6.45	6.27	0.25	5.85	5.94	6.96	6.25	0.62
% believing in local responsibility	**-0.02**	94%	76%	11%	61%	43%	86%	100%	0%	62%	54%
weekly income (vatu)	**0.01**	4311	3356	5892	4520	1281	2734	3675	7107	4505	2302

Table 12 Variable means at the village and MPA type levels. Strength of differences in socio-cultural variables between MPA types; ordered by Cohen's effect size D. Effect sizes > 0.8 indicate substantial relationships, 0.5-0.8 moderate relationships, and 0.2-0.5 minimal relationships.

Table 13Calibrating variables for fsQCA; anchor points and selection rationale

Condition	Full membership	Non-Membership	Cross Over	Local knowledge rationale
resource knowledge	7.5	2.5	5	collected as 0-10 pre-calibrated and anchored Likert scale
local governance efficacy	7.5	2.5	5	collected as 0-10 pre-calibrated and anchored Likert scale
resident adult population	65	10	20	large villages that are made up of 7 or more 'fareas' (= 3-5 households) ~50 adults , small villages only have 1 farea= <5 households, 10 adults. cross over is 2 fareas=10 households, 20 adults
conservation ethic	7.5	2.5	5	collected as 0-10 pre-calibrated and anchored Likert scale
% likely to personally enforce reserve	0.3	0	0.15	enforcement is typically a village leader's responsibility, leaders make up ~15% of adults, anyone else enforcing demonstrates a high enforcement capacity
custom strength	7.5	2.5	5	collected as 0-10 pre-calibrated and anchored Likert scale
marine focus-sea skills	7.5	2.5	5	collected as 0-10 pre-calibrated and anchored Likert scale
years of formal education	13	1	6	primary school on island ends after year 6, 13 is the highest public schooling available in Vanuatu
threat trends	2.5	-2.5	0	trends, past state 0-10 minus current state 0-10.
# community organizations	9	4	6.5	all communities have at least 4 organizations: council, men's fellowship, women's PWMU and youth group, full membership are communities with 5 others potentially including conservation committee, council of chiefs, tourism committee, planning and development group, water council, solar committee, council of churches, Sunday school group, or kindergarten.
severity of declining respect	2.5	-2.5	0	trends, past state 0-10 minus current state 0-10.
tourism benefits	7.5	2.5	5	collected as 0-10 pre-calibrated and anchored Likert scale
% with marine primary occupation	0.1	0	0.05	because we are agricultural people, only 10% would have a full time marine focus
% using hook and line	1	0.5	0.75	hook and line is a widely available fishing method, roughly half of all residents would fish regularly with this gear. Any more than 3/4 and this is beginning to be a high proportion. In some sea villages it is not uncommon for all adults to fish with hook and line.
age	70	18	40	childhood ends at 18, the youth period continues throughout marriage and childbearing until the individual can become an ordained leader at ~40 years
external cooperation	7.5	2.5	5	collected as 0-10 pre-calibrated and anchored Likert scale
food availability	7.5	2.5	5	collected as 0-10 pre-calibrated and anchored Likert scale

total sea tenure km2	1.53	0	1	village sea tenure is generally quite small, only extending a 50-100meters from the shore in most cases, a large area would considered any >1km2.
% selling seafood in market	1	0	0.05	half of the population selling seafood in the market would be a cross over point.
gear density	1	0	0.5	in bush villages, no residents posses marine gear, and in sea villages, every person owns at least one gear type, 0.5 represents every other person owning significant piece of gear i.e. snorkel, canoe, musket
% protected tenure	0.4	0.1	0.25	international standards call for between 20-30% of an area to be protected. A small percentage of protection would be less that 10%, a large proportion more than 40%.
wealth	7.5	2.5	5	collected as 0-10 pre-calibrated and anchored Likert scale
% believing in local responsibility	0.75	0.25	0.5	0.75 represents 3 in4 people feeling they are directly responsible for management, 0.25 is only 1 in 4 feeling this way
weekly income (vatu)	20000	0	5000	20,000 vatu is an excellent take for a weekly session at the market, 5000 vatu is enough to cover expenses and earn a small profit.

Table 14 Truth table output from fsQCA showing variable variation among cases. Logical remainders have been eliminated for ease of interpretation. The presentation of the truth table is a prerequisite for fsQCA replicability but does not, in itself, convey readily interpretable results.

resource knowledge	governance efficacy	population	enforcement capacity	marine focus	mean education	community organizations	marine occupation	hook and line	mean age	CASES	NO-TAKE	consist	pre	product
1	1	1	0	1	1	1	0	0	1	1	1	0.9458	0.946	0.8946
0	1	1	1	1	1	1	1	1	1	1	1	0.9314	0.931	0.8676
0	1	1	1	1	1	1	1	0	0	1	1	0.7874	0.787	0.6201
0	1	1	1	0	1	1	0	1	0	1	0	0.5025	0.502	0.2525
0	0	1	0	1	0	0	1	0	0	1	0	0.0904	0.09	0.0082
0	1	0	0	1	1	0	1	1	1	1	0	0.0832	0.083	0.0069

Table 15Analysis of Necessary Conditions for no-take rules. The presentation of the Necessary condition analysis is a prerequisite for fsQCA replicability but does not, in itself, convey readily interpretable results.

Condition	Consistency	Coverage
Ecological knowledge	0.294165	0.854837
Governance effectiveness	0.911854	0.569642
Population	0.824638	0.598008
Enforcement capacity	0.801334	0.651845
Marine focus	0.699303	0.584256
Formal education	0.602588	0.525556
Committees and organizations	0.716487	0.619236
Maritime occupations	0.546482	0.446461
Hook and line prevalence	0.524780	0.522273
Mean age	0.492831	0.514125

*Once necessary conditions have been identified, these must be removed form the analysis so as not to mask important combinations sufficient conditions. The program fsQCA (version 2), uses a Quine-McCluskey algorithms to produce parsimonious solutions for the outcome specified and input case study variables. In each analysis we have placed each of the 6 cases, as reined in the truth table.

Table 16Analysis of Necessary Conditions for periodic harvest rules. The presentation of the Necessary condition analysis is a prerequisite for fsQCA replicability but does not, in itself, convey readily interpretable results.

Condition	Consistency	Coverage
Ecological knowledge	0.049953	0.145163
Governance effectiveness	0.688895	0.430358
Population	0.554337	0.401992
Enforcement capacity	0.427999	0.348155
Marine focus	0.497608	0.415744
Formal education	0.543984	0.474444
Committees and organizations	0.440564	0.380764
Maritime occupations	0.677549	0.553539
Hook and line prevalence	0.480021	0.477727
Mean age	0.465751	0.485875

Table 17 Analysis of Sufficient conditions for No-Take Rules. The presentation of the Sufficient condition analysis is a prerequisite for fsQCA replicability but does not, in itself, convey readily interpretable results.

Model: NO TAKE = f(ECOLOGICAL KNOWLEDGE, MARINE FOCUS, EDUCATION, COMMUNITY ORGANIZATIONS, MARINE OCCUPATION, HOOK & LINE, AGE)
Cases: 6
Algorithm: Quine-McCluskey
True: 1-L

--- PARSIMONIOUS SOLUTION ---
frequency cutoff: 1.000000
consistency cutoff: 0.931943

	raw coverage	unique coverage	consistency
COMMUNITY ORGANIZATIONS*AGE	0.492831	0.492831	0.654232

solution coverage: 0.492831
solution consistency: 0.654232

This solution suggests that the simultaneous presence of multiple community organizations and a high mean age of residents will be sufficient to, or increase the likelihood of, no-take rule adoption.

Table 18 Analysis of Sufficient conditions for Periodic Harvest Rules. The presentation of the Sufficient condition analysis is a prerequisite for fsQCA replicability but does not, in itself, convey readily interpretable results.

Model: PERIODIC CLOSURE = f(ECOLOGICAL KNOWLEDGE, GOVERNANCE, POPULATION, ENFORCEMENT, MARINE FOCUS, FORMAL EDUCATION, COMMUNITY ORGANIZATIONS, MARINE OCCUPATION, HOOK & LINE, AGE)
Cases: 6
Algorithm: Quine-McCluskey
True: 1-L

--- PARSIMONIOUS SOLUTION ---
frequency cutoff: 1.000000
consistency cutoff: 0.909636

	raw coverage	unique coverage	consistency
ecological knowledge*enforcement	0.572001	0.572001	0.817696

solution coverage: 0.572001
solution consistency: 0.817696

This solution suggests that the simultaneous absence sound ecological knowledge and enforcement capacity will be sufficient to, or increase the likelihood of, periodic harvest rule adoption.

10.4 Discussion

10.4.1 Enabling conditions for selecting strict no-take marine reserve rules

Once a community has decided to implement spatial marine management, specific sociocultural conditions must exist before it can select no-take marine reserve operational rules. On Nguna and Pele, the selection of strict no-take rules was found to necessarily depend on the combination of local governance effectiveness, enforcement capacity and population size. Effective local governance and high enforcement capacity have been repeatedly highlighted as important for marine protected area management success in other contexts (Christie et al. 2009; Muehlig-Hofmann 2007; Young et al. 2007). Case studies from other social-ecological systems including management regimes in Ugandan forests, European river basins, and South Asian agricultural systems, also have found that the operational rules for resource use are influenced by enforcement capacity, social capital, and population pressure respectively (Ali 2007; Banana & Gombya-Ssembajjwe 2000; Pahl-Wostl et al. 2007).

Unexpectedly, a minimum population size also was found to be a necessary condition for selecting no-take permanent reserve rules. This finding seemingly contradicts studies which show a breakdown of collective action regimes with increasing population. According to collective action theory, there are thresholds above which collective management regimes cannot function (Olson 1965). Certain variables, like the number of users, may affect different types of MPAs in non-linear and sometimes even opposite ways. Population can have profound influences on how people organize (Gladwell 2000), particularly on aspects of social capital, which can be critical to the collective management of resources (Pretty 2003). For example, in the inter city neighborhoods of the U.S. city of Chicago, population loss was found to weaken interpersonal ties and lower social capital (Sampson et al. 1999). In Vanuatu, very low populations (mean <56 adults) may not support the levels of social capital needed to successfully implement strict no-take reserve rules. In contrast, higher populations were found to enable the selection of no-take marine reserve rules in Nguna-Pele sites. This result is an interesting complement to other studies from Melanesia that find populations of more than 600-1,000 people are associated with the breakdown of periodically harvested MPAs. This breakdown likely occurs because rules that allow intermittent exceptions (such as periodic harvests) may be increasingly difficult to manage in higher population contexts (Cinner et al. 2007). Therefore, there may be different population thresholds associated with the selection and breakdown of different MPA operational rules.

While not necessary, the selection of no-take rules was further influenced by the number of community social organizations and the mean age of residents. The number of community organizations is often a proxy indicator of social capital, strengthening the general argument that the local selection no-take reserve rules requires a minimum of human connectivity and interaction. In an example from an unrelated social-ecological system, higher mean age among hunters from the African nation of Gabon, is related to the extent that resource declines are perceived over time (Papworth et al. 2009). Older

stakeholders may be less likely to suffer from a shifting baseline syndrome (Pauly 1995) and be more likely to reactively establish no-take reserve rules.

10.4.2 Enabling conditions for periodic harvest rules

Although many communities implement periodically harvested closures, fsQCA results suggest that the selection of this rule type is not enabled by any particular necessary conditions on Nguna and Pele. However, the simultaneous absence of enforcement capacity and ecological knowledge increases the likelihood that periodic harvest rules will be selected. Periodic closures likely require less enforcement capacity (and enjoy higher compliance) than no-take reserves because users are not permanently excluded from the resource (Cinner et al. 2005b). Ecological knowledge plays a role in the selection of marine management strategies, particularly in island communities in the Indo-Pacific where there is often a lack of broad-scale, consistent, and locally-relevant environmental education (Foale & Manele 2004).

With few sociocultural constraints, periodic harvest may represent the 'easiest' set of rules for local communities to implement. Indeed, non-permanent spatial management is often preferred by fishers globally (McClanahan et al. 2005a; McClanahan et al. 2009). A possible explanation for the popularity of non-permanent closure regimes in some contexts are the similarities in usage rules that they share with cultural taboos (Lam 1998). Periodic harvest rules are also often most compatible with local fishing norms. In The Nguna and Pele cases, periodically harvested closures either do not require extraordinary preconditions or have yet to cross disabling socio-economic thresholds (like population or market pressure) (Cinner et al. 2007).

10.4.3 MPA policy choices: adapting the rules or building capacity

Selecting from different MPA operational rules will often require making tradeoffs between ecological outcomes and human use requirements. No-take marine reserves can have long-term benefits to marine ecosystems and are often advocated by marine scientists and conservation organizations (Agardy et al. 2003). However, in places like the Pacific Islands, periodically harvested closures may best meet local needs (i.e. to provide fish for a feast), have better ecological outcomes (as discussed in Chapter eight), and be preferred by subsistence and artisanal fishers. Consequently, periodically harvested closures enjoy higher compliance than no-take reserves. Compliance is critical in social contexts where enforcement capacity is often lacking (Cinner et al. 2005a).

Based on an improved understanding of MPA-enabling conditions, decision makers are presented with options when developing appropriate MPA rules: 1) choose the rules that best suit local contexts; or 2) build local capacity and capital until desired rules better suit local stakeholders (Jentoft 2005). Building capacity is an expensive and long-term solution, and may require donors and conservation organizations to move beyond traditional participatory conservation approaches (McClanahan et al. 2008). This is not to say that well-functioning no-take marine reserves should be scrapped in favor of periodically harvested closures, but rather that alternative rules may be appropriate

intermediaries in contexts where no-take reserves are not immediately viable or while capacity for no-take rule selection is being developed. A targeted social-ecological approach to selecting MPA rules will help avoid potentially unsuccessful management panaceas (Basurto & Ostrom forthcoming; Meinzen-Dick 2007).

While this study improves understanding of how sociocultural conditions can enable MPA rule selection in communities that have pre-existing aspirations for marine management, these results do not provide insights into how those aspirations develop. Without strong enforcement mechanisms, the implementation of an MPA where it is not locally desired can lead to failure, even if the community possesses the combination of enabling conditions highlighted here. Similarly, the presence of the enabling conditions discussed here is no guarantee for successful MPA ecological outcomes. Thus, there exists a strong imperative for further investigation into enabling conditions for MPA aspiration, selection and success.

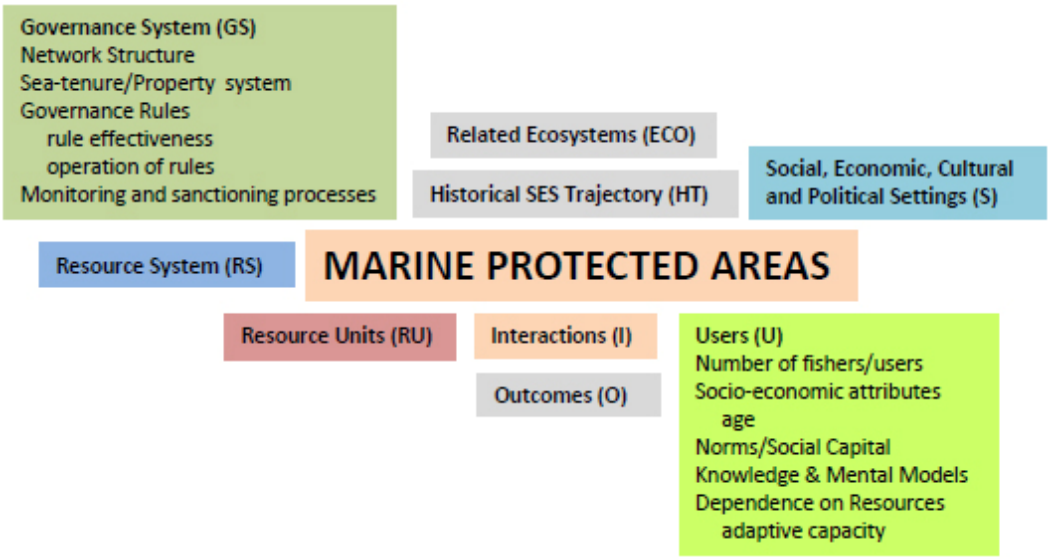


Figure 49 Reconsidering the critical variables identified in this Chapter in terms of the social-ecological analytical framework developed for MPA investigations (see Fig. 10)

CHAPTER 11 - MPA DISCOURSE; SEEKING CONSENSUS

11.1 Introduction

The number of community-established protected areas is increasing at an unprecedented rate (Chape et al. 2008) and there are calls to further recognize and facilitate these local-level initiatives as part of multi-scale responses to a changing world (Berkes 2007a; Berkes 2009). As the protected area phenomenon continues to sweep through the Pacific Islands (Johannes 2002b), communities are diversely labeling their closures as protected areas, reserves, sanctuaries, conservation areas, managed areas and taboos (Chapter two and (Caillaud et al. 2004; Keen & Mahanty 2006; Veitayaki 2003).

This multifarious application of protected area terminology raises critical questions for policy makers. Does the diverse typology reflect differences in MPA operational rules such as permanent versus periodically harvested closures? And critically, do the community-established closures of Nguna and Pele (and the rest of the Pacific) meet the IUCN definition of a protected area[32]?

To improve and clarify the protected area policy arena in the Pacific Islands, this chapter examines the typology of community-based closures in the Republic of Vanuatu. Here particularly there are tangible concerns and confusion caused by the multiplicity of protected area terminology. Questions from confused ni-Vanuatu village resource managers from different parts of the country have dominated several recent national summits. This paper seeks to demonstrate the practical need to resolve the discrepancies surrounding existing protected area discourse, and consider solutions for a region with diverse local management strategies. To ensure that a local point of view is considered in policy planning (Regenvanu 1997) and inform high-level policy makers of on-the-ground realities in the region, this chapter presents protected area discourse from a village stakeholder's perspective.

11.2 Multiplicity of protected area terminology

As described in Chapter two, the constitution gives all land to ni-Vanuatu customary owners and their descendents along with the duty to "protect and safeguard" national resources and the environment (Government of Vanuatu 1988). Diverse protected area rhetoric has since officially appeared in subsidiary legislation beginning in 1993 with the passage of the National Parks Act, which allows for the creation of "national parks" and the protection of areas that have "outstanding value from the point of view of science and conservation". The Forestry Act of 2001 allows custom owners to declare "conservation

[32] The IUCN (2008) defines a protected area as: "A clearly defined geographical space, recognized, dedicated and managed, through legal or other means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values."

areas". "Community conservation areas" are enabled under the Environmental Management and Conservation Act of 2002. Official terminology for closed areas is further confounded by the Protection of Sites and Artifacts Act (1965) recognizing "protected sites", the Decentralization and Local Government Regions Act (1994) "protection zones" and the Fisheries Act (2005) "marine reserves".

Regardless of the official terminology, many island communities use the word "taboo" (spelled *tabu* or *tapu* by ni-Vanuatu people) to refer to spatio-temporal closures (Caillaud et al. 2004). Endemic to the Pacific Islands and first recorded in English in the diaries and journals of Captain Cook (Cook et al. 1784), taboo is now pan-oceanic spatial closure terminology (Hviding 1996). It is not however, the only word employed by communities to describe resource closures. As we have seen in Chapter two, the terms "Conservation Area", "Protected Area", "Marine Protected Area" and "MPA", have recently become part of the colloquial closure vocabulary in even in the most remote corners of the archipelago.

11.3 Closure rhetoric in Vanuatu

11.3.1 Taboos

Taboo is arguably the most commonly employed resource closure term in Vanuatu. The word taboo eludes succinct definition, being diversely applied to a range of situations and scenarios. Speiser (1990) notes that the taboo is "encountered throughout the group, and means nothing more than a prohibition." In Bislama, the lingua franca of Vanuatu, the word taboo is commonly spoken to misbehaving children, signifying "don't touch" or "don't do that". In that scenario, the indicated activity is not appropriate, usually in any instance. A taboo can signify that practically anything is off limits to use, discussion, harvest, entrance or negotiation. An endemic part of some of Vanuatu's indigenous local languages, the word taboo has clearly been introduced into others[33].

On Nguna and Pele, and throughout Vanuatu, taboos are now commonly applied to marine or terrestrial resources. A taboo in the contemporary Vanuatu context typically indicates that the resource or area is temporarily off limits. A taboo closure is enacted with the expectation that the resource will be re-opened for use in the short to medium term. In the minds of most ni-Vanuatu, a taboo is a non-permanent tool to stockpile a resource for use at later date (such as provisioning wedding feasts). While sacred site taboos may be permanently off-limits, these generally do not have a resource use or management objective. In the past, breaking a taboo was avoided for fear of spiritual or supernatural retribution (Colding & Folke 1999; Johannes 1998b), though Christian and colonial influence have much eroded the contemporary belief in these consequences (Foale 2006).

11.3.2 Conservation areas

33 On Nguna and Pele, the indigenous Nakanamanga language name for a resource closure or prohibition is Natungoroana

'Konsevesen eria' is now a well-established Bislama phrase. Vanuatu's conservation areas are established in both marine and terrestrial environments, and are principally supported by the Environment Unit and Forestry Department, though several local and international NGOs have also supported their creation. Unlike in English, the Bislama word 'konsevesen' is nearly always used in reference to natural resources. In contrast to the taboo, there is often little expectation by village residents that a conservation area will be opened for harvest in the short or medium-term. Conservation areas are seen as a tool for the long-term enhancement of resources and habitats. Permanent or indefinite conservation areas likely represent a distinct departure from historical practices. Conservation areas are declared and revoked by a village chief, locally enforced, managed through customary governance, and offenses are punishable by village-level authorities.

11.3.3 Protected areas and MPAs

The phrase 'marine protected area' and its acronym 'MPA' are the most recent additions to the national spatial closure vocabulary. Two national-scale projects launched in 2008 by the Environment Unit and Forestry Department utilize this terminology in reference to village-based closures[34]. The term 'MPA' is most commonly used to refer to a geographically-bounded closure, although this is not always the case[35]. The Bislama word 'protek' is equivalent to its English counterpart, indicating the protection of a variety of objects and themes. Many village residents would argue that they are 'protecting' resources inside a taboo, even though the duration of the closure may only three months. In contrast, when communities establish a "protected area", it is, like a conservation area, considered to be indefinitely closed. There may be however, attenuating circumstances when marine protected areas are opened by the village chief to meet community resource needs (religious events etc.)(Tarisesei & Novaczek 2005). As seen in Chapter two, protected areas, marine protected areas and MPAs are fully grounded in local governance institutions, and are declared, legitimized and enforced by the village chief or council.

11.3.4 Others terms

Other terms are used in Vanuatu to describe spatial closures, albeit less frequently. Hideaway Island Marine Sanctuary is a 2.5 hectare permanent closure managed by a tourist resort to maintain coral reef condition for visitors as well as physically protect reefs from nearby village subsistence fishers. In 1983, 100 hectares covering the wreck of the US navy's SS President Coolidge on Santo Island were set aside as a marine reserve by the Fisheries Act (Government of Vanuatu 1983). Recently, two international donors, Seacology and the Force for Good Foundation, have been directly negotiating with communities to establish 'marine reserves' that are closed for at least 10 years. The

[34] PoWPA- UNDP initiative to implement the Convention on Biological Diversity's (CBD) Programme of Work on Protected Areas, VBRMA – Joint initiative funded by the US National Oceanic & Atmospheric Administration (NOAA) called the Village Based Resource Management Areas Network

[35] On Nguna and Pele people often use the name marine protected area or MPA to refer to the networking organization there, and not to any particular closure

newly negotiated Efate Land Management Area is indefinitely declared but accommodates ongoing sustainable use.

11.4 Protected area discourse; politics, symbolism and reality

Vanuatu's diverse conservation terminology has long been a source of confusion and contention among domestic and foreign scholars, developmentalists, conservationists, and village resource managers. While several factors limit collaboration within Vanuatu's small resource management community, protected area discourse seems to be a nucleus around which other divisive factors coalesce. History demonstrates that what appears to be a purely semantic debate can often be strongly ideological (Chapter seven). This was the case in the international dispute that erupted over the definition of the 'marine protected area' (Agardy et al. 2003). Protected area discourse in Vanuatu may present a similar scenario.

Fierce political and land-dominated ideological struggles characterized the lead up to Vanuatu's independence in 1980 (Van Trease & USP. 1987). As mentioned in Chapter seven, in response to pre-independence political struggles, "kastom" was developed as a political tool with which to solidify the local voice (Tonkinson 1982). The kastom construct is widely used to elevate and celebrate that which is endemic, exalting a pre-European way of being, free from external intervention. However it has also been used by the elite as an untouchable set of norms to amass power and authority (Douglas 2002). The distinction between what constitutes kastom and what does not is often based on, as discussed in Chapter seven, a politically convenient inauthenticity (Jolly 2000), more in symbolism than in historical reality (Lindstrom 2008).

In Vanuatu, the terms taboo and protected area have been unwittingly caught up in the post-colonial debate, politically appropriated to represent two sides of an ideological divide: local against foreign. Taboo, for example, has been dubbed sacred terminology, in contrast to the words "bans", "marine reserves" and "conservation areas" which have been called profane foreign introductions (Hickey 2001). (See Johannes (2003) for a discussion on the dangers of idealizing traditional Pacific Island practices in this way). Further confounding the kastom issue, ni-Vanuatu resource managers are often not fully aware of the practical aspects traditional management methods, likely because they have only developed in select areas. The Vanuatu Cultural Center promotes traditional marine management, but few villagers are able to give specific example, other than citing the declaration of a taboo.

It is critical to acknowledge that terms like "conservation" and "protected area" are also steeped in rhetorical symbolism. For example, some ni-Vanuatu people may associate these words with land alienation (Nari 2000; Ruddle & Hickey 2008; Techera 2005), a particularly sensitive topic in the current context of customary land leases to foreign investors (Regenvanu 2008). On the other hand, villages experiencing severe declines in natural resources may be actively seeking novel and more powerful regimes and terminologies (Chapter seven). Because a closure is called something else, it may be

perceived to be new. Situated within a globalized context, and with a long history of foreign 'xenophilia' (Hviding 2003b), ni-Vanuatu are often reaching out for a system that appears bigger, better and which the rest of the world has seemingly (and perhaps mistakenly) embraced as a resource management panacea (Berkes 2007a).

11.5 Discussion

11.5.1 Vanuatu protected areas: rhetoric or reality?

Ni-Vanuatu communities are implementing a range of endemic, novel and hybridized management regimes, each with different objectives, names and operational rules. While the current typology is by no means concretely fixed, a status quo has emerged. For example, what ni-Vanuatu villages today call a 'conservation area' is nearly always a fundamentally distinct management strategy from what is called a 'taboo'. Long-term biodiversity-focused closures are commonly given non-endemic names, while temporary, utilitarian, or cultural closures are often called taboo. Recognizing and building on the current status quo will greatly reduce the confusion experienced by most Vanuatu stakeholders. However, imposing a one-size-fits-all approach to naming or establishing closures in Vanuatu is clearly not appropriate.

While many of Vanuatu's closures have conservation objectives, as seen in Chapter seven, unstated secondary objectives also exist. In contemporary practice, closures may represent an important avenue for development materials and aid (Foale 2001; Hviding 2003b), strengthened ownership and territorial claims (Polunin 1984), access to tourism (Eagles et al. 2002), or political power (Foale & Manele 2004; Muehlig-Hofmann 2007). Depending on the objective, some closure terminologies may be more symbolically relevant or hold more political clout than alternatives. For example, if communities seek to gain from interaction with international parties (e.g. foreign tourists), employing globally recognized terms like marine sanctuary may yield the best outcomes. On the other hand, if the closure is established to strengthen customary governance, an indigenous language term may be preferable.

Ultimately, both rhetorical symbolism and functional reality influence the selection of protected area regimes and terminologies in Vanuatu. The complex tensions between post-colonial 'kastom' ideology and practical resource management goals make Vanuatu protected area discourse obscure and often ambiguous. To constructively bring the discussion forward, it is important to move beyond divisive dichotomies that artificially pit local against foreign. Intensifying global threats require the urgent use of a more inclusive and multi-scale approach to community resource management (Berkes 2007a). Pacific Islanders can most effectively build management regimes when they have access to multiple knowledge systems, customary and Western-scientific. The most successful examples of community resource management in the Pacific are those that employ hybridized regimes. However, until ideological debates are resolved and hybridized resource management is directly enabled by policy, protected area confusion will prevail.

11.5.2 Spread of hybrid protected area discourse

The expansion and evolution of protected area measures in Vanuatu is often spontaneous, assisted by what Johannes (1998b) calls a 'prodigious multiplier effect'. This phenomenon, whereby villages or individuals copy the actions of their neighbors, has been documented throughout the archipelago (Tacconi 1997). A similar concept known throughout the Pacific Islands, is that of 'copycat entrepreneurship' (Philip 2002). Copycat conservation may prove to be an extremely valuable process for facilitating rapid and widespread replication of effective MPA strategies. It has certainly played a role in Vanuatu's current protected area phenomenon.

There is a legitimate concern that externally imposed management approaches will be socially disruptive and/or locally inappropriate (Ruddle & Hickey 2008), alienate stakeholders from active management (West et al. 2006), not recognize the complexity of local knowledge (Hviding 2006; Johannes 2003) or derive from an incompatible world view (Igoe 2005; Jepson 2005). Conservation-focused NGOs in the Pacific and elsewhere are notorious (rightly or wrongly) for promoting eco-colonialist or environmental missionary-type agendas on local people (Cox & Elmqvist 1997; Dowie 2008; Roe 2008). In contrast to its Melanesian neighbors however, none of the major international environmental NGOs operate in Vanuatu. The civil society groups, local NGOs and overseas volunteer programs that work in ni-Vanuatu communities[36] must recognize the sovereignty of local communities to chart their own path of resource use and management (Aru 2004; Tacconi 1997). However, none should be ashamed to widely communicate outcomes of successful local and non-local strategies.

Just as other non-indigenous terminologies and ideologies are ubiquitous in Melanesia (e.g. Christianity see Chapter seven), protected area discourse and practice have become inseparable parts of the contemporary ni-Vanuatu world view. The local popularity of protected areas in Vanuatu suggests that communities perceive benefits from these management regimes, and are successfully responding to changing ecological, social and political contexts (Chapter seven). Supporting active local experimentation with closure practices, Vanuatu is continuously demonstrating its flexibility and adaptive capacity in the face of unprecedented change (Jolly 2000; Lindstrom 2008). More scholarly attention should focus on hotspots of protected area hybridization in the Indo-Pacific where management institutions embrace the overlapping concepts of past, present, local, foreign, colloquial and scientific.

11.5.3 Policy implications for Vanuatu's protected areas

While indisputably providing important ecological benefits, many of Vanuatu's closures are not managed specifically for biodiversity conservation, and therefore do not meet the IUCN's protected area definition. For example, most short and medium-term taboos are not "dedicated to achieve long-term conservation of nature" (Dudley 2008). That is not to say, however, that all of Vanuatu's taboos fall outside of IUCN's criteria. Taboos that

[36] Wan Smolbag Theatre (WSB), Foundation of the Peoples of the South Pacific-Vanuatu (FSPV), Wan Tok Environment Center (WTEC), Live and Learn, US Peace Corps, CUSO, VSO, AVI, JICA

are implemented with long-term conservation objectives could be appropriately be defined as IUCN category II[37] or VI[38] protected areas, provided that resource use within the area is sustainable.

Conservation areas, protected areas, and MPAs established primarily for increased aid, tourism or political power might qualify as IUCN protected areas if they are subsequently managed for biodiversity conservation outcomes. More research should examine the potential of the taboo in contemporary contexts to achieve objectives like sustainable use and long-term conservation. In particular, more empirical work is needed to document the ecological outcomes of non-permanent resource closures (see Chapter eight)

In order to avoid falsely inflating Vanuatu's protected area coverage to the international community (Locke & Dearden 2005), the national government must develop clear guidelines and definitions for the diverse MPA and protected area regimes occurring in Vanuatu. For example, as communities begin to register their community conservation areas (CCAs) under the Environmental Management and Conservation Act, screening should specifically consider a candidate closure's management strategies, terminology and biodiversity conservation potential. An ideal policy for CCA registration would embrace local closure typology, while standardizing nomenclature at a higher level for national clarity and international reporting. Communities employing taboos, protected areas, or other closures should equally be entitled to national recognition if management leads to conservation outcomes. In this way, the central government can avoid stifling local adaptive processes and continue to encourage communities which, due to socio-economic or cultural contexts, choose to establish alternative management strategies.

To deal with registration, analysis and reporting on contemporary protected areas in the Pacific Islands, national governments will require capacity-building support that extends beyond standard donor funding cycles (Jayaraman & Ward 2006). Long-term partnerships with international groups and academic institutions may be a particularly beneficial strategy in this regard. Continued alliance with locally-grown NGOs like Wan Smolbag Theatre and the Foundation for the Peoples of the South Pacific-Vanuatu will ensure a socially appropriate and beneficial transformation of protected area discourse in the region. Ultimately, regional protected area categorization should be undertaken in a way that is sensitive to and respectful of diverse local management regimes and knowledge systems.

11.6 Conclusion

This Chapter examines the discourse and symbolism attached to the various resource management terminologies currently employed in Vanuatu. With over six distinct terms for spatial closures embedded within Vanuatu legislation, there is little wonder that confusion abounds over exactly what constitutes a protected area or a marine reserve. The Chapter finds that despite the official multiplicity, a concensus has emerged in everyday

[37] combines ecosystem protection with recreation, subject to zoning (Dudley, 2008)
[38] natural areas where biodiversity conservation is linked with sustainable use of natural resources (Dudley, 2008)

usage. The word taboo is applied to a closure when there is an expectation of use in the future, or to temporary or periodically opened closures. Conservation Area and Protected Area are used interchangeably when the closure is designed for long-term or permanent resource protection.

In the context of this discursive concensus, the Chapter highlights the symbolism that remains attached to the use of taboo terminology. The Chapter describes the concept of kastom, developed in a pre-independence era as a tool to forward the self-governance agenda, and how the word 'taboo' has been swept into the extant political movement which continues to systematically reject the externally derived (conservation or protected area). This chapter also considers the symbolism attached to the words 'conservation' and 'protection', as it may be exploited by communities to obtain external support from those empathetic to conservation issues (e.g. tourists, the government or aid donors).

Irrespective of the terminologies employed, this Chapter highlights the incredible expansion of marine management initiatives throughout the archipelago. It describes how the protected area phenomenon has been aided by a 'prodigious multiplier effect', whereby communities rapidly emulate one another's resource management regimes. The Chapter provides strong support to the argument that these management tools are as indigenously implemented and owned as any historically traditional tool ever utilized in Vanuatu, and in no way forced on an unwilling people.

Finally the Chapter presents recommendations to improve the efficacy, monitoring and reporting of Vanuatu's spatial closures at national, regional and international levels. Flexibility must continue to be inherent within Vanuatu natural resource management (Lindstrom 2008), allowing a cross-scalar resilient symbiosis of internal and external resource governance typology and practice. Hybridization of protected area operational rules and rhetoric, combining Western scientific and traditional ecological knowledge, likely presents a valuable policy option for the Pacific region. Rather than overly codify or prescribe panaceas, protected area policy should embrace and enable local innovation and perspectives. It is ultimately through these dynamic adaptive processes that the "intellectual armory" (Geertz 1994) of the Pacific Island region will be strengthened in the face of change.

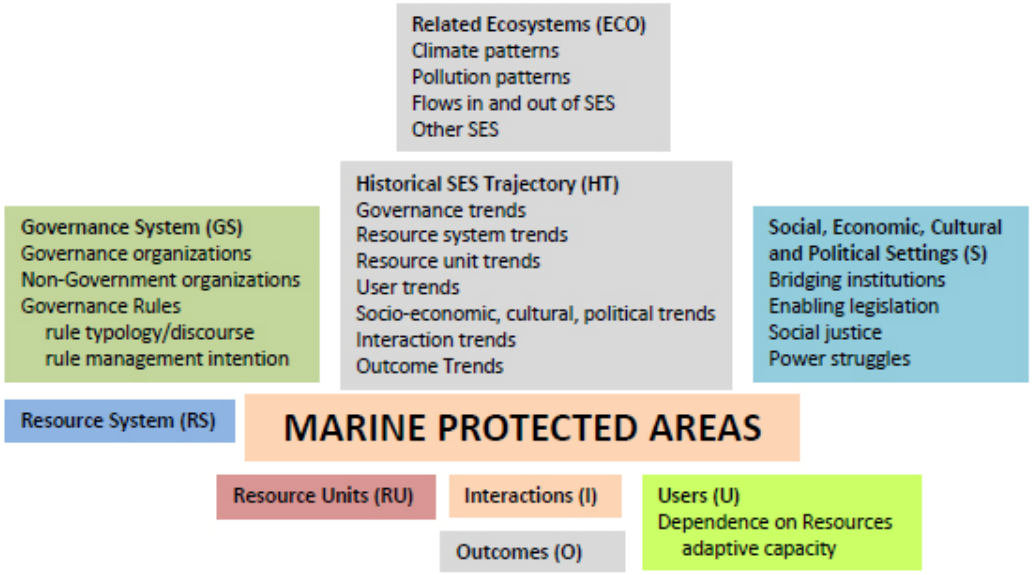


Figure 50 Reconsidering the critical variables identified in this Chapter in terms of the social-ecological analytical framework developed for MPA investigations (see Fig. 10)

CHAPTER 12 CONTEXTUALIZING COMMUNITY BASED MARINE PROTECTED AREAS IN VANUATU

11.7 Introduction

The large scale participatory research project in Vanuatu on which this dissertation is based set out to achieve a decidedly applied goal: fill gaps in marine protected area science that are of direct relevance to communities on Nguna and Pele islands. While this goal may be slightly too ambitious to accomplish in a single dissertation, the following specific objerctives were certainly achieved:

1. Place the study of marine protected areas within a theoretical framework that enables a comprehensive and simultaneous analysis of social and ecological factors
2. Utilize a linked social-ecological theoretical framework to better understand the emergence, evolution and outcomes of marine protected areas in Vanuatu; specifically to understand:
    a. Historical factors and trends that preceded and shaped the current marine resource governance regimes found in Vanuatu
    b. Motivations and expectations of ni-Vanuatu people regarding spatial marine closures
    c. Situational factors that may enable the selection and implementation of diverse marine closure regimes
    d. Ecological outcomes of diverse marine closure regimes
    e. Ways and means by which positive outcomes of marine closures may be fostered and enhanced into the future

This chapter summarizes the achievement of these objectives contained within the chapters of this dissertation, theoretically places Nguna-Pele MPAs within broader social-ecological contexts, discusses empirical limitations, and highlights priority areas for future research.

11.8 Recalling the theoretical framework

As discussed in Chapter three, MPA case study investigations are often hampered by their failure to make effective use of existing social-ecological theoretical frameworks. In that chapter, and those that followed, a strong case was made that community based marine protected areas cannot be understood, investigated or enhanced using a single theoretical approach or disciplinary set of tools. To overcome this constraint, Chapter three presented an adapted form of Ostrom's 2007 commons diagnostic framework. In the adapted framework, marine reserves and other types of MPAs are theoretically linked to other components of complex systems. By explicitly adding aspects of history, political analysis and cultural ethnography, the dissertation set out to avoid the widely used (but

often narrowly focused) snapshot approach to MPA research (Halpern et al. 2004; Kronen & Bender 2007; Kronen et al. 2002).

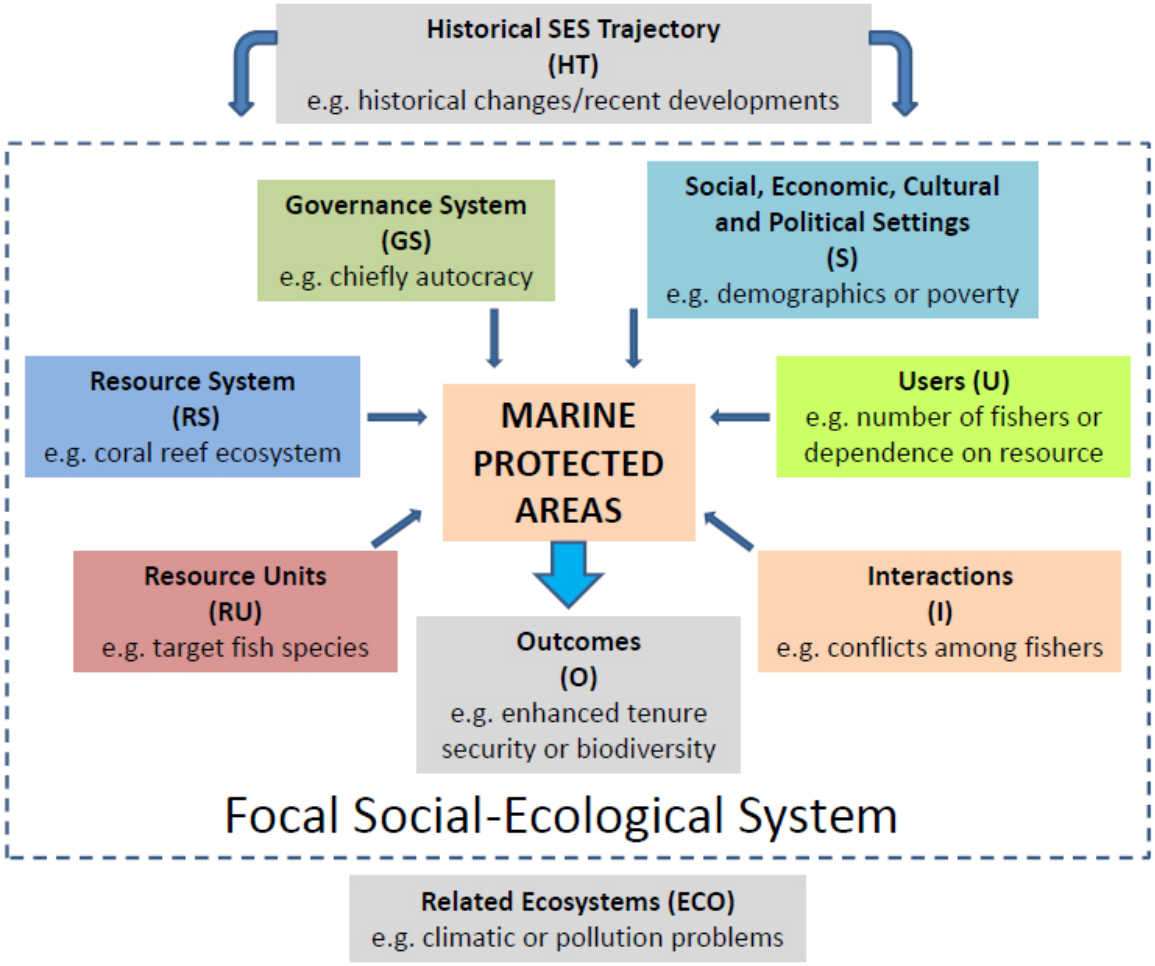


Figure 51 Framework presented in Chapter three to investigate MPAs in social-ecological systems

11.9 Returning Vanuatu results to the framework

Using a conceptually linked social-ecological framework will ensure that MPA case studies 1) contribute to broad, theoretical and cumulative learning about social-ecological systems and 2) guide the development of future research by highlighting valuable variables and relationships. In order to achieve these goals, empirical case study results should be identified within the general framework. Figure 52 below pulls together the critical variables and relationships identified in Chapters five through eleven, and codes them into the framework presented in Figure 51.

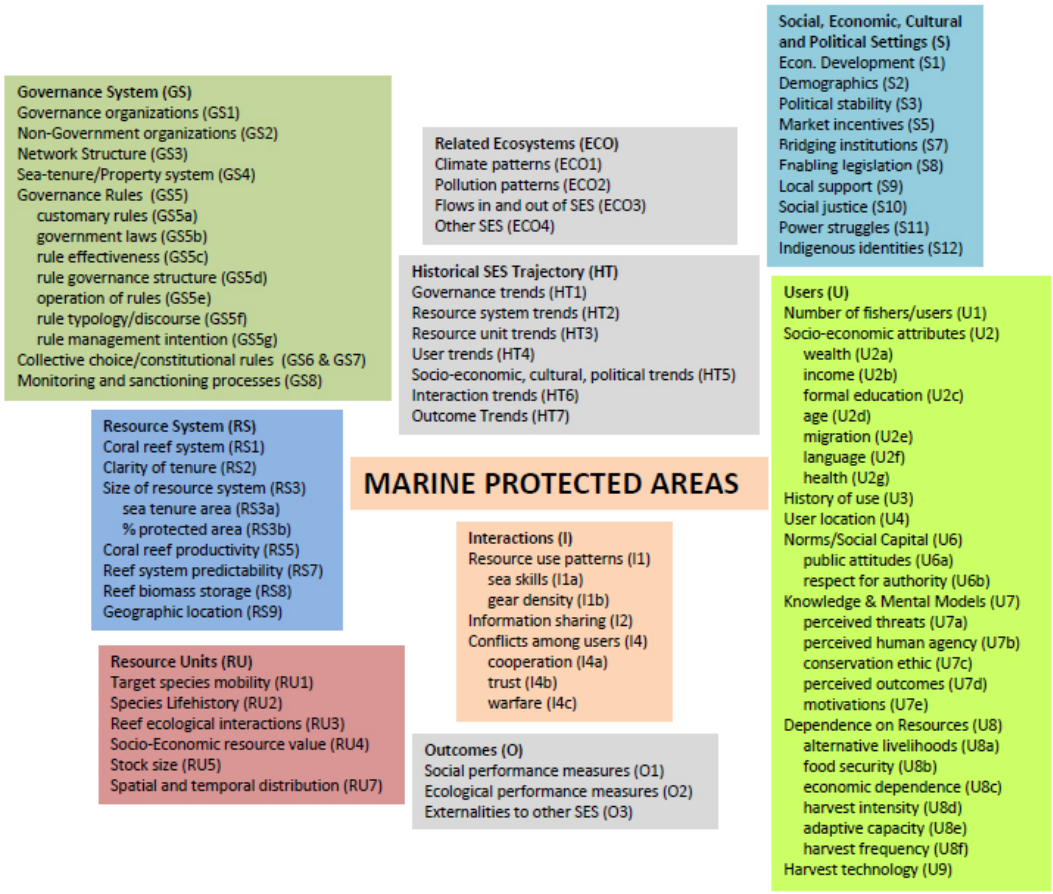


Figure 52 This figure codes important variables identified in each preceding chapter into the above framework presented in Chapter three. For consistency, numeric coding follows that in (Ostrom 2007). Missing numeric codes are those which Ostrom identified but that were not deemed relevant to this case study of MPAs in Vanuatu.

The following sections of this chapter review the variables and relationships identified in this dissertation and highlighted in Figure 52, and discuss them as they relate to broadly contextualizing community-based marine protected areas.

11.9.1 MPA phenomenon in Vanuatu

Chapter two described how contemporary coral reef closures on Nguna and Pele are diversely and locally implemented. There is a strong precedent for establishing protected areas in the North Efate area and in other parts of Vanuatu (ECO3; this and all subsequent codes in this Chapter refer to Figure 53), particularly over the last decade. Community-based MPAs are enabled by the constitution and other legislation (S8 & GS5b). This chapter also confirms that marine commons dilemmas in Vanuatu are often tackled at the village level; each community on Nguna and Pele establishes its own marine closure. MPA operational rules there often fall into two categories: permanent no-take reserves, and closures that are periodically harvested and then re-closed.

In terms of the framework, these operational rules are part of the governance system (GS), coded here as GS5e. Both types of village closures found on Nguna and Pele are integrated within customary, chiefly and ceremonial practices (GS5a) and appear to correspond with the characteristics of local users (U), resources (RU & RS) and social

settings (S). Closures seem to be supported by local residents (S9), likely because they themselves directly control rules, tenure, and resource access rights (GS6 & GS7). Governance at the village level presents considerable ecological challenges for marine managers and scientists, who tend to plan MPA strategies at larger ecosystem scales.

Evidence in Chapter two suggests that these challenges can be overcome despite strong village level marine tenure (GS4). Cross boundary cooperative decision-making and governance (I4a) is achieved through networking organizations and bridging institutions (S7). Networks of community MPAs help stakeholders manage both the ecological strengths and weaknesses of different closure operational rules. Although likely not acting completely altruistically, communities on Nguna and Pele have shown they are willing to compromise and collaborate to obtain benefits. Scaling-up collaborative marine governance may be a real possibility in other Pacific Island contexts, particularly if the resultant networks possess contexts similar to those that have enabled success on Nguna and Pele. These factors include:

1. the structure of the NPMPA organization (GS3) emulates previously existing island-wide organizations (GS2), thereby eliciting local trust (I4b)
2. individual villages maintain control of their own tenured closures (GS4); rights granted by legislation (S8) empower communities (S10)
3. there are minimal costs (S1) to impoverished central governments involved with networking because communities are still responsible for day to day management and enforcement (GS8)
4. networking effectively tackles issues that are too large in scope for individual villages to confront (RS3 & RU7)
5. networked villages are geographically proximate (RS9) speak the same language (U2f), share cultural norms (U6) and have similar historical trajectories (HT).

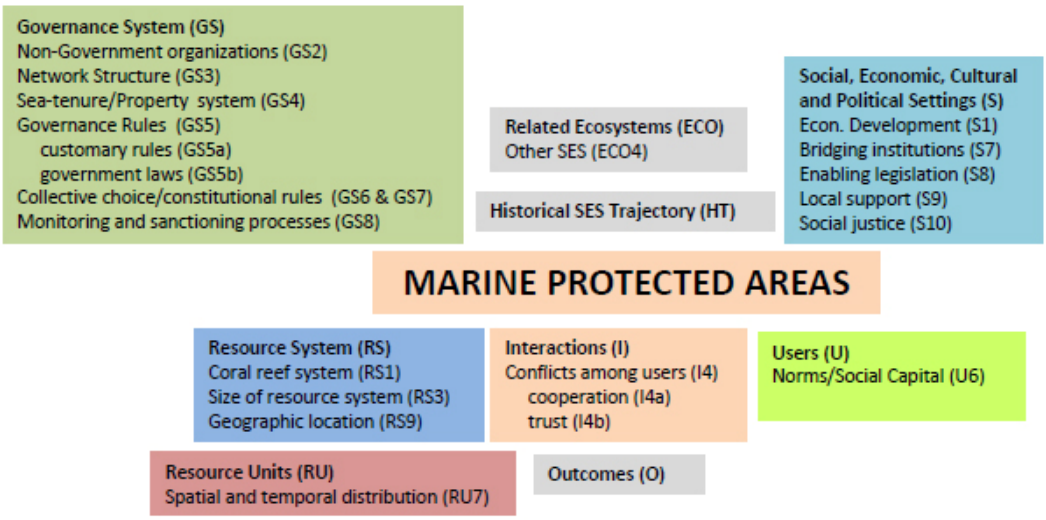


Figure 53 Schematic representation of the critical variables for MPAs and MPA Networks on Nguna and Pele as identified in Chapter two.

Chapter two suggests that if MPAs and MPA networks are flexibly designed to reflect local social, cultural, ecological, political and historical contexts, they may strengthen community marine tenure and associated management rights. The specific social-

ecological conditions which determine MPA outcomes or influence the selection of diverse MPA rules in Vanuatu were empirically investigated in Chapters eight thru ten and are summarized below.

11.9.2 Ecological outcomes

Chapter eight sought to quantify the ecological outcomes of diverse MPA rules on Nguna and Pele. It addressed a critical question asked by local stakeholders: do both types of closures (GS5e) have ecological value (O2)? Results from the comparative study suggest that periodically harvested closures do, in fact, influence the abundance and biomass of targeted fishes and in invertebrate taxa vulnerable to fishing (RU5 & O2). Although non-permanent MPAs are not popular among conservation biologists, they are widely implemented in the Indo-Pacific. These findings suggest that no-take MPA alternatives ($GS5e_{alternative}$) may represent a practical, locally appropriate and ecologically adequate management solution in certain social-ecological systems (O1 & O2).

Functionally, the ecological outcomes (O2) associated with periodically harvested closures ($GS5e_{periodic}$) are potentially explained by the intensity and frequency of harvesting within and outside reserves (U8d and U8f). Well-managed infrequent harvest events may not jeopardize the long-term accumulation of stocks inside reserves. Ecological gains from each protection-harvest cycle are not completely lost with each subsequent harvest event. The ecological outcomes of MPA closure rules (GS5e) are likely related to the target organism's life history and harvest vulnerability (RU2). Protection from fishing activity was observed to have the greatest impact on taxa with vulnerable life histories such as the *Tridacnid* giant clams and trochus. These organisms are vulnerable due to low mobility (RU1). But periodically harvested closures were especially effective for those taxa with high social and economic value, and those heavily targeted by fishers (RU4 & S5).

Interestingly, and somewhat counter intuitively, no-take marine reserves ($GS5e_{no\text{-}take}$) were not significantly different to adjacent openly fished areas (O2). This finding may be explained by the nature of the communities that implement no-take reserves. It is plausible that no-take operational rules are selected by communities that 1) also have other effective management regimes in place ($GS5e_x$), (e.g. permanent and tenure-wide bans on giant clams) or 2) exert less harvest pressure on reefs than other communities (US8d).

To be effective, MPA operational rules (GS5e) should be tailored to the specific ecological characteristics of the taxa to be managed (RU), the market incentives operating within the systems (S5), and the human dependence on and use of marine resource (U8). In this multidisciplinary planning context, it is clear MPAs are only a partial solution to effective and adaptive management.

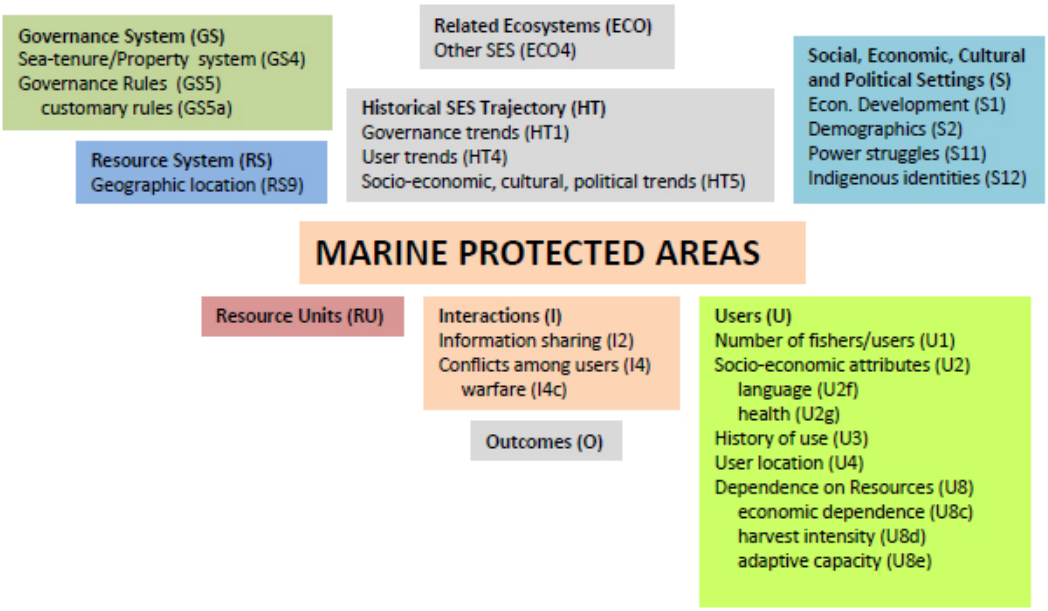


Figure 54 Schematic representation of the critical variables for MPA ecological outcomes on Nguna and Pele as identified in Chapter eight.

11.9.3 Motivations and perceptions

Chapter nine investigated the local motivations for establishing different MPA rules (GS5g). It also sought to ascertain the perceived ecological (O2) and social (O1 & GS5g) outcomes of different MPA types. Results suggest that both types of MPA operational rules (no-take and periodically harvested) (GS5e) are established on Nguna and Pele in reaction to severely declining resources (GS5f, HT2 & HT3). Both types are broadly expected to enhance the quality (RU5) and availability (RU7) of coral reef resources. Interestingly however, local perceptions about the ecological outcomes of their MPAs (O2) did not always correspond with results from underwater census surveys (RU5) (Chapter eight). This suggests that people's perceptions (U7d), and not just actual outcomes, are critically influential to establishing MPAs.

Marine protected areas of both types on Nguna and Pele are strongly supported by island residents (S9). Rather than being forced on them from external sources (S10), surveys reveal that island communities approach marine management with an attitude of xenophilia. That is to say, communities locally adapt and hybridize both foreign and indigenous forms of management (ECO3) to become their own (S12). The propensity to hybridize management regimes suggests a well-developed adaptive capacity and flexibility (U8e) to deal with an unpredictable and changing future. To enable continued adaptation, marine management policy must avoid rigid closure prescriptions and MPA panaceas. Effective policy will explicitly consider individual village motivations (U7e) and embrace management innovation (GS5e).

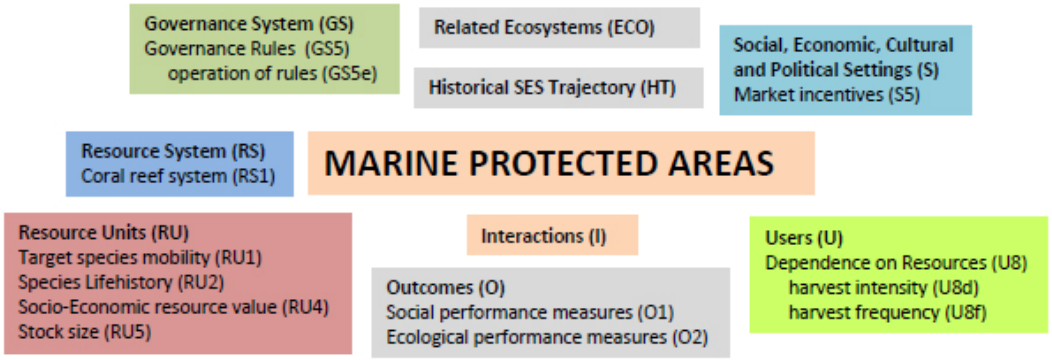


Figure 55 Schematic representation of the critical variables for MPA motivations on Nguna and Pele as identified in Chapter nine.

11.9.4 MPA enabling conditions

Delving deeper into the selection of MPA operational rules, Chapter ten investigated whether in addition to motivations, contextual variables also enable the selection of different MPA operational rules. For this investigation, the adapted theoretical framework proved particularly useful for selecting and refining study variables. It also helped to identify those variables which are effectively held constant due to structural similarities among Nguna-Pele communities.

Results of fuzzy set qualitative comparative analyses strongly suggest that some socio-economic variables must be necessarily present in order for a village to select no-take marine reserve rules ($GS5e_{no\text{-}take}$). These 'necessary conditions' included local governance effectiveness (GS5c), enforcement capacity (GS8) and population size (U1). While governance effectiveness and enforcement capacity corresponded well with other MPA studies, the finding that a minimum population size is necessary for no-take MPAs is somewhat counterintuitive. However, population likely exerts non-linear influence on MPA rule selection and maintenance. Lower and upper population thresholds may be associated with the selection and breakdown of different MPA operational rules (+U1→$GS5e_{no\text{-}take}$; +U1→ failed $GS5e_{alternative}$). No-take rule selection was found to be further influenced by the number of village social organizations (GS2) , social capital (U6) and the mean age of residents (U2d).

In contrast to no-take rules, no necessary enabling conditions were found for periodic harvest rules ($GS5e_{periodic}$). In practical terms, this finding suggests that periodically harvested closures may represent the 'easiest' set of MPA operational rules for ni-Vanuatu communities. The presence of some variables however did increase the likelihood of selecting a closure with periodic harvest rules. These included the simultaneous absence of enforcement capacity (GS8) and ecological knowledge (U7). In other words, communities that are not well informed about the environment or are unable to enforce management are more likely to select rules that allow periodic harvest.

Ultimately this improved understanding of MPA enabling conditions suggests that communities interested in developing MPAs should 1) choose the rules that best suit local contexts; or 2) build local capacity and capital until desirable MPA rules suit local

stakeholders. Communities can and do adapt to and within changing contexts (U8e) but may require support and capacity building along the way.

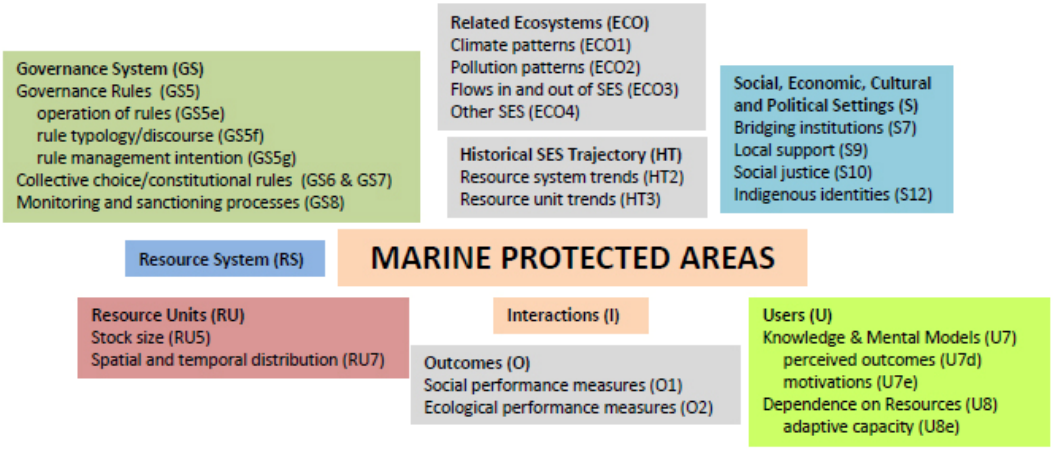


Figure 56 Schematic representation of the critical variables for enabling MPA rule selection on Nguna and Pele as identified in Chapter ten.

11.9.5 Historical reflections

Chapters five through seven sought to understand why MPAs in Vanuatu are criticized for violating or ignoring 'ancient customary' marine management practices. In order to fully contextualize the phenomenon of contemporary MPAs on Nguna and Pele these chapters investigated the historical longevity of coastal resource management in Vanuatu.

Archaeological, ethnographic, observational and oral evidence suggests that marine resources in the Nguna-Pele area have been fully exploited (and often overexploited U8d) since the time of Lapita colonization around 3000 BP (U3 & HT4). While ethnographic evidence confirms the existence of social prohibitions including taboos, it appears these were only recently applied to restrict marine resource use (HT1 & RS9), and even then in only a few locations within Vanuatu (ECO3). An exhaustive review of original sources failed to uncover evidence that marine taboos ever existed on Nguna and Pele. Although marine resources were used on these islands, most were probably acquired through trade arrangements (U8c) and not direct harvest (U8d).

Understanding why marine management did not develop on Nguna and Pele is complex. Extensive warfare throughout the archipelago caused widespread cultural isolation (I4c). Isolated communities were unable to share and transfer of marine management knowledge and innovation to other islands (I2). Although the arrival of Christianity brought a period of relative peace, local ideologies and practices were suppressed (S11). Disease (U2g) and depopulation (U1 & S2) also constrained the practice and transmission of maritime knowledge (U2). Over the last two hundred years, much of island life has undergone radical change (HT4 & HT5), change that further suppresses the maintenance and development of marine management. These changes included language (U2f), tenure systems (GS4) chiefly governance systems (GS5a), and even the geographical location of human settlements (RS9 & U4).

Chapter six disputes the claim that a single form of customary marine management exists (or ever existed) in Vanuatu. It also questions whether prehistoric people actively managed marine resources. Criticisms directed at MPAs and no-take marine reserves by cultural elites are likely motivated by considerations of political power, authority (S11) and indigenous identities (S12), rather than practical or historical concerns about village marine management. This review suggests that contemporary marine management in Vanuatu is not defined solely by historical, cultural, socio-economic or environmental variables, but represents a blending of processes, institutions and actors from all components of complex systems. Ultimately, this investigation of the historical trajectory of the Nguna-Pele system demonstrates that communities there have a remarkable capacity to adapt to changing conditions (U8e).

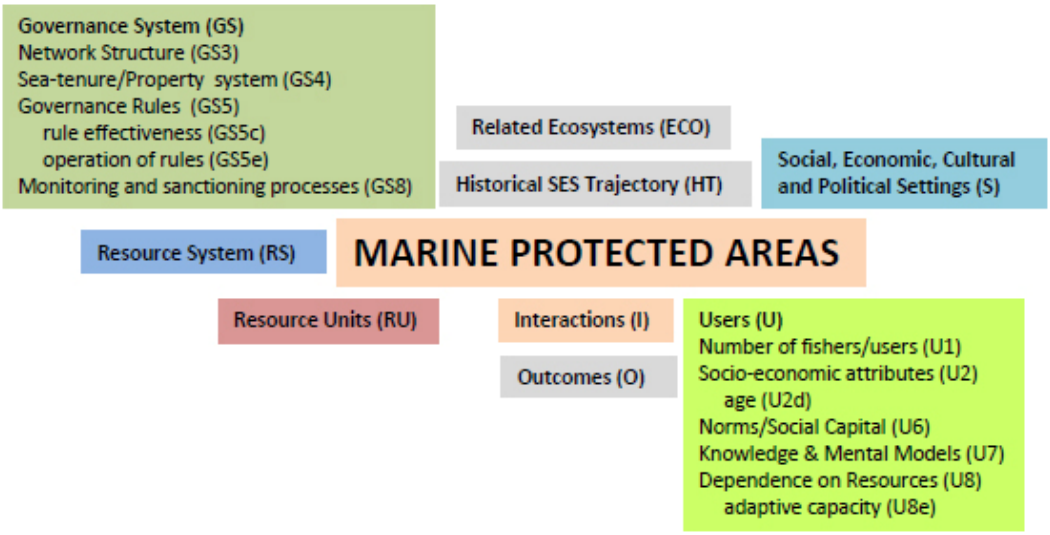


Figure 57 Schematic representation of the critical variables for understanding the historical longevity of marine management and MPAs on Nguna and Pele as identified in Chapters five through seven.

11.9.6 Contested meanings

Having ruled out a historical basis for promoting one set of MPA operational rules over another (Chapter six), Chapter eleven sought to identify practical solutions for enhancing the policies and governance of marine resources in Vanuatu. Opportunities for consensus were sought in order to minimize local and international misunderstandings. This chapter assessed the typology of MPAs from the perspective of local communities.

In general, Chapter eleven found that the MPA discourse used by ni-Vanuatu communities is converging into distinct and definable typological groups (GS5f): taboos are considered non-permanent closures while conservation areas and MPAs are considered indefinitely closed. Much of the remaining debate about MPAs and MPA discourse is promulgated by post-colonial elites who appear to be politically motivated. They dilute marine management efforts by emphasizing divisive and symbolic concepts like kastom. In contrast to suggestions that foreign elements and international NGOs (GS2) are imposing their will on unwilling communities, the evidence suggests that

contemporary MPAs are being established independently by communities and influenced by an indigenous multiplier effect (S7 & ECO3). Communities fully control marine management, and are assisted by national government departments (GS1), legislation (S8) and local networking institutions (S7). In essence, marine reserve and other MPA discourse are no longer foreign but have become ubiquitous within Vanuatu.

Due to their locally defined nature, many of Vanuatu's community closures do not meet the internationally accepted IUCN definition of 'protected area.' Primarily this is because they are not managed specifically for biodiversity conservation (GS5g). Critically however, even MPA rule types that do not meet the IUCN protected area definition do, in fact, produce valuable conservation and social outcomes (O1 & O2). An ideal MPA policy in Vanuatu would embrace local closure typology (GS5f), while standardizing nomenclature at higher levels for national clarity and international reporting (ECO3 & S7). In this way, local adaptive processes will not be stifled and the outcomes of the MPA phenomenon in Vanuatu can be accurately monitored. Policy makers and practitioners should acknowledge the emerging status quo of MPA typology in Vanuatu: taboo vs. conservation area/MPA. That said, if social justice is to be achieved (S10), island communities must remain free to elect marine management strategies that suit their local social, economic, political and ecological contexts (U8e).

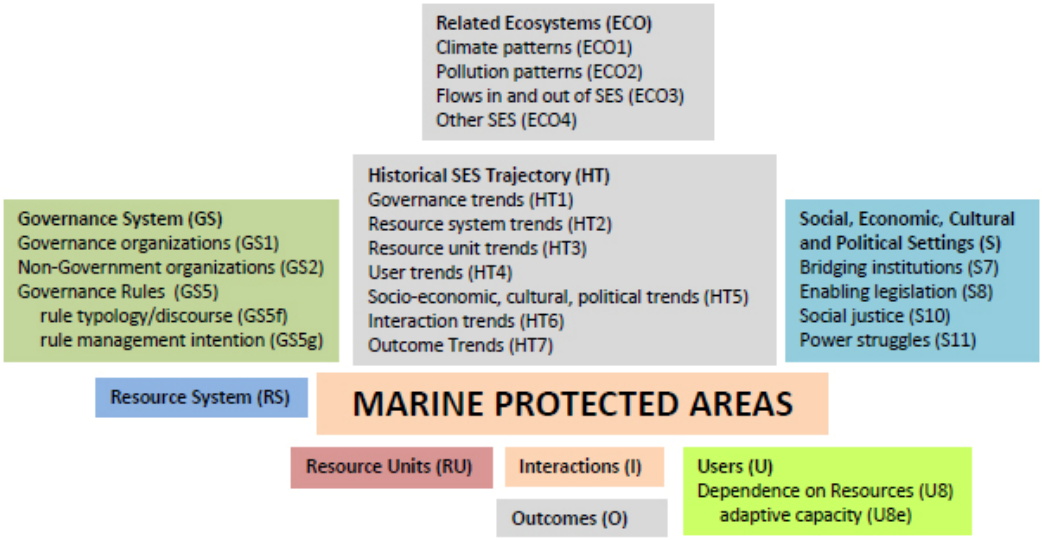


Figure 58 Schematic representation of the critical variables for understanding MPA discourse in Vanuatu as identified in Chapter eleven.

11.10 Value of linked social-ecological analytical frameworks

This study provides a novel contribution to the investigation of marine protected areas by demonstrating how 1) different operational rules may each produce valuable ecological and social outcomes; 2) certain operational rules may be more appropriate in specific social contexts; 3) historical, political and cultural contexts influence their expression; and 4) MPAs can be analyzed using a linked social-ecological system framework. In the absence of this type of hierarchical framework, MPA case studies have not yet easily lent themselves to cross-contextual comparison and often fall into 'my-case-is-unique'

analytical traps (Basurto & Ostrom forthcoming). Analytical traps of this nature assume that each research question, with each group of users, and in each resource system is unique. While each case IS arguably unique, this line of reasoning precludes the search for commonalities among systems. The process of finding patterns across cases, and identifying critical differences defines the process of knowledge generation, a process Ostrom (2007) calls building conceptual maps. The ability to make finer and finer distinctions among similar cases is the basis of diagnostic science, and improving MPA regimes requires that researchers can identify healthy and unhealthy systems.

However, as this dissertation demonstrates, there is also a strong rationale for explicitly considering multiple components of these complex systems. Unfortunately, the deeper one delves into a system, the more complex and unique the interactions become. Although fascinating, it is of little value to the cumulative power of science simply to describe a system to its most intimate detail. To avoid the 'my-case-is-unique' trap it is especially important to consider (at least initially) common variables that have been identified in other empirical studies and have been theoretically validated. For example, published research into both water management in India and coral reef management in Papua New Guinea each suggest that distance to market (RS9) can influence resource management operational rules (GS5e) (Cinner et al. 2007; Meinzen-Dick 2007). Therefore this Vanuatu case study also considered this variable. However, by taking advantage of the 'natural experiment' (Banana & Gombya-Ssembajjwe 2000) presented by communities with different MPA rules on Nguna and Pele, it was possible to 'control' for distance to market, environmental conditions, and several other key factors in the case study design. Carefully structured comparative case study designs of this nature offer a critical methodological workaround for overcoming 'my-case-is-unique' analytical traps, particularly when large-N comparative studies are prohibitively costly (Agrawal 2003).

Most importantly for the development of marine protected area science, this kind of linked social-ecological diagnostic framework also ensures that MPA practitioners, policy makers and researchers will avoid falling into the "panacea" analytical trap (Basurto & Ostrom forthcoming). Analytical traps of this nature assume that all resource systems act in similar and predictable ways, regardless of the characteristics of users, historical trajectories or political contexts. Policy makers falling into this trap may promote blue-print or cure-all type solutions to resource use problems. For example, the current global no-take marine reserve paradigm is likely a direct result of panacea trap thinking and analysis (Guenette et al. 1998; Kaiser 2005). This kind of policy making can be dangerous for local people (Agardy et al. 2003; West & Brockington 2006), especially when MPA rules are applied indiscriminately from one context (often a developed country) to another (often a developing country). Resource management panaceas are also more likely to fail in practice (Ostrom et al. 2007), costing taxpayers dearly (MacDonald & Mazany 1984; Meltzoff et al. 2002).

This dissertation demonstrates how a diagnostic framework can help to avoid MPA panacea traps. Specifically this was accomplished by guiding MPA analysis towards multiple components of the linked social-ecological system, including the users themselves, the governance system, the social, economic, and political settings,

characteristics of the resource system characteristics of target resources, and interactions between components. There will never be one-size fits all approach to resource management, and the impulse to find one can be tempered by a thorough examination of the variables identified here. Equally useful, and with strong social justice implications, the hierarchical and ontological nature of the framework ensures that variables identified *a priori* by theory and those identified *a posteriori* through contextual experience and local knowledge can be simultaneously considered. In other words, marginalized people can equally contribute to knowledge generation; a role that has traditionally been reserved for the expert researcher. Allowed to guide future marine reserve research, nested theoretical frameworks will encourage locally-relevant research, while enabling comparison and cumulative insight from diverse social-ecological systems.

11.11 Drawing conclusions

From a Commons theoretical perspective, this dissertation has systematically examined the contexts, outcomes and future directions of community-based MPAs in Vanuatu. Adapting an existing theoretical framework to include historical, political cultural and social justice concerns helped to conceptualize Nguna and Pele's marine protected areas within complex, real-world systems. In this case study the framework assisted in the formation and design of this empirical research, but also in interpreting findings in a way relevant to MPAs more generally. Broad conclusions that can be drawn from the framework results of the Vanuatu case study include;

1. MPAs are intrinsically tied to and embedded within both ecological and non-ecological components of complex real-world systems
2. Understanding the factors influencing and influenced by MPAs can be enhanced by embracing multidisciplinary approaches and diverse theoretical orientations
3. Epistemologies and processes of knowledge acquisition that incorporate local contextual knowledge add depth and breadth to MPA investigations
4. There are an infinite number of alternatives to no-take marine reserve rules, hundreds of which are employed by communities throughout the world, and some of which may hold important conservation or ecological value
5. MPAs are not the only marine management tool available, and should be considered alongside and in tandem with other strategies.
6. MPA rules may be designed to achieve ecological outcomes, but their implementation may be motivated by other factors
7. The selection of MPA operational rules may be a direct result of local conditions and contexts
8. Indiscriminately applying MPA policy panaceas (like no-take reserves or 'kastom taboos') is inappropriate
9. Debates over contemporary marine management strategies may be centered more in struggles for power, identity, and authority and less in practical marine governance
10. Embracing clarity and building consensus will improve MPA collaboration and partnerships across scales

There are also lessons derived from the framework results that are directly relevant to Vanuatu's MPAs;

1. Consensus is emerging among ni-Vanuatu communities that non-permanent periodically harvested closures are called taboos and indefinitely closed no-take closures are called conservation areas or MPAs.
2. Conservation-focused marine management is a relatively new phenomenon in Vanuatu; historical precedents for MPAs are limited
3. Ni-Vanuatu communities have the legal and moral right to self determination in marine management and governance
4. Communities in Vanuatu have historically demonstrated a high adaptive capacity; a quality that should be encouraged, supported and flexibly incorporated into future MPA policy
5. MPAs in Vanuatu cannot be accurately discussed, analyzed or interpreted in a single disciplinary context.

11.12 Limitations

This work represents an in-depth examination of marine protected areas on the islands of Nguna and Pele in the Republic of Vanuatu. Although political ecology approaches helped avoid the 'thin' and ahistorical limitations of snapshot research (McCay & Jentoft 1998), the generality of the results it is constrained by the small number of cases examined. Ideally, studies that attempt to quantify mean outcomes or general predictive conditions should be based on large-N samples (Agrawal 2003). Although desirable this was not possible in the limited time and financial contexts of this PhD dissertation. However, expanding the focus of the study to a larger number of community MPAs would have invalidated the 'natural experiment' inherent in Nguna-Pele communities with different MPA strategies.

Ecological assessment of different MPA operational rules was based on the contrasts between closed areas and adjacent control or open areas. In experimental biology this is known as a control-impact empirical design. However this form of design is often insufficient to evaluate the causal significance of a variable (for example MPA operational rules), because it does not incorporate a temporal component to the analysis (Stewart-Oaten et al. 1986). Without temporal controls, it is impossible to rule out the possibility that closed sites and control open sites perform differently due to some unknown variable unrelated to protection from harvest (Block et al. 2001). In order to accurately assess the effects of protection, this kind of study should ideally have utilized a Before-After-Control-Impact (BACI) empirical design (Underwood 1992; Underwood 1994). Unfortunately this was not possible because reserves in Vanuatu are commonly initiated by communities without detailed planning or prior baseline assessments.

Another factor which has constrained the breadth of this structured case study comparison was a failure to investigate the social-ecological contexts of communities with no MPAs

or management regimes. The original study design did, in fact, plan for the empirical investigation of three (3) communities with permanent reserves three (3) with periodically harvested closures and three (3) with no management regimes. However, at the Nguna-Pele Marine Protected Area summit where research priorities were finalized, the research team was only invited into communities with existing MPAs. It is plausible that the communities on Nguna and Pele without management regimes in place felt that this research could disadvantage them in respect to their neighbors. In any case, the field research component of this dissertation took over eighteen months, and adding additional study sites would have significantly extended the required research period. However, if no-management sites were contrasted with those with MPAs, it would enable a much clearer understanding of the enabling conditions for management emergence.

Unfortunately, several variables which have been identified in the literature as critically important to the outcomes of MPAs were not sufficiently investigated in this case study. For example, it is widely acknowledged that harvest intensity, both within and outside MPAs, will significantly determine ecological outcomes (Cote et al. 2001). While it may have been possible to collect detailed harvest intensity data, experience in other South Pacific communities shows this to be a time intensive and often unreliable exercise (Anderson & Mees 1999; Jennings & Polunin 1996a). To measure the real impact and value of MPAs to local residents, a study design incorporating catch per unit effort would have been ideal (Kaunda-Arara & Rose 2004).

Finally, when investigators possess extreme familiarity with their case studies, such as my own with Nguna and Pele, it may lead to overconfident generalization of results or even inaccurate assumptions about the system. This phenomenon has been well-demonstrated in the field of psychology, where practitioners begin to feel they 'know' their subject and even start to make unsupported predictions about his/her future behavior (Oskamp 1965). While some elements of this dissertation are based on my experience alone, I hope the reader is convinced that the majority of the findings and conclusions here presented are supported by robust empirical evidence. Unfortunately, empirical field research is the exception to the rule in MPA discourse, debate, and research in Vanuatu, a limitation I hope this dissertation can begin to overcome.

11.13 Future research

The concrete methodological limitations of this study suggest that there is scope for expanding the research questions set out at the beginning of this dissertation. In particular this chapter highlights the need to undertake ecological research on alternatives to no-take marine reserve rules, specifically by utilizing robust BACI survey methodologies in multiple sites around Vanuatu and the Indo-Pacific. There is also a critical need to examine how MPA alternatives create social benefits and work to reduce the present rates of marine reserve failure (Burke & Maidens 2004; Christie 2003; McClanahan 1999). Although historical and cultural analysis suggests that ancient marine management regimes did not evolve on Nguna and Pele, there may be other sites in Vanuatu in which they did. Understanding the nature of any long-existing management

systems will be useful to contemporary communities, and represents a neglected area of research in Vanuatu. A database project to document traditional ecological knowledge was started by the Vanuatu Cultural Center but has since been abandoned. There is also an urgent need to further investigate how new government legislation, like Vanuatu's Environmental Management and Conservation Act, can be implemented in a way that fosters discursive clarity but also embraces the country's inherent diversity.

More broadly, this case study of MPAs in Vanuatu contributes to the collective understanding about how and why resource users self-organize to collectively manage natural resources. Over the last twenty years, commons theory has enabled researchers to significantly contribute to and cumulatively learn about the conditions that enable governance success (Baland & Platteau 2000; Dietz & Henry 2008; Dietz et al. 2003; Ostrom 1990; Wade 1988). However the conditions that enable the emergence and evolution of collective action regimes require urgent empirical investigation (McCay 2002). Researchers have examined institutional emergence in forestry and watershed management systems (Anderson White & Ford Runge 1995; Lubell et al. 2002; Ostrom 2000), but like the use of social-ecological frameworks, they have been slow to examine emergence in studies of marine protected areas. In an era where fundamental change defines our existence and our future (Folke & Rockström 2009), there is a critical need to further investigate how collective action emerges and evolves.

The chapter of this dissertation examining the conditions that enable the variable selection of diverse MPA rules only scratched the surface of this exciting field of enquiry. Aided by emerging analytical tools like fuzzy set qualitative comparative analysis (Ragin 2008), the potential to derive broad-scale understanding from carefully designed comparative case studies has never been greater. Like this investigation into the conditions that enable the selection of MPA rules, future research should begin to tease out the conditions that foster the adoption of diverse institutional scenarios. There is a theoretical need to move beyond simply uncovering correlations among variables, but rather to design empirical studies to unearth underlying causality (Stern et al. 2002).

Beyond the scope of the present research is a concern that marine protected area networks may be rapidly turning into the next marine governance panacea. Today they are promoted by many marine scientists almost as a cure-all strategy to enhance marine processes and biodiversity (Almany et al. 2009; Wood et al. 2008). The institutional and governance difficulties of scaling up MPAs into effective networks have also been flagged (Lowry et al. 2009; Ruckelshaus et al. 2008), although robust research designs have yet been developed to address these issues. There is an incredible research opportunity in Vanuatu and other Pacific Islands to investigate cross-scalar MPA institutions and networks. Examples include the Nguna-Pele Marine Protected Area Network and the Vanua'Tai Resource Monitor Network discussed in Chapter six. Research into bridging institutions like these should focus on their governance structure, tensions between costs and benefits at various levels, sensitivities to local interests, outcomes, and of course, the factors that enable their emergence and evolution.

Once sets of general variables have been identified that may account for the emergence or adaptation of marine management institutions, it will necessary to begin constructing databases of multivariate analyses across other social-ecological systems (Chhatre & Agrawal 2008). With moderate-N samples, for example 20-30 sites each in the Solomon Islands, Papua New Guinea and Vanuatu, it will be possible to begin diagnosing the causal agents for institutional emergence, adaptation or degeneration. Acquiring this level of data is not difficult, and is achievable in the next 3-5 years. It will require robust research partnerships among individuals and groups working in these countries.

Strategic research partnerships like those developed in the Pacific (and potentially others with a wider geographic focus) will be necessary to answer critical questions for marine management more generally like 1) what factors influence the speed of marine management adaptation/institutional change?; 2) do rates of institutional change coincide with rates of social-ecological-climate change?; 3) how can groups that do not have adaptive capacity/fast rates of institutional change be transitioned to future scenarios?; and 4) how might improved understanding of marine institutional innovation and emergence be of value to solving broader poverty and development issues?

However, in the current era of rapid and often devastating global change (Barnett & Adger 2007; Folke & Rockström 2009), policymakers can't wait indefinitely for perfect science (Carter 2008). This dissertation represents the kind of active and frank dialogue between marine protected area science and policy that will hold practical relevance and value for MPAs around the world. It is a dialogue that bases its findings, action and recommendations on adaptive experimentation, much like the way that communities on Nguna and Pele began actively experimenting with management strategies before and alongside the development of scientific analysis.

The type of social-ecological applied policy research required to confront an unpredictable future must move beyond calls to incorporate social science into the investigation of marine protected areas (e.g. Mascia 2003). Future social-ecological systems research will need to examine the multidisciplinary and multiscalar nature of marine governance. It is also critical to understand how different scales interact horizontally and vertically (Armitage 2008; Berkes 2008; Reid et al. 2006), and (building on the work of this dissertation) how contextual factors influence the adaptation and evolution of those multiscalar institutions.

While it is desirable to maintain some aspects of complex systems (e.g. livelihoods, identities etc), long-term systemic sustainability requires that systems develop the capacity to adapt (Anderies et al. 2004; Berkes 2007c; Gunderson & Holling 2002). What are the critical factors that enable adaptation and how do they interact within social-ecological systems? Solving these dilemmas could mean the difference among collapse, persistence or transformation of many global societies.

BIBLIOGRAPHY

Acker, J., K. Barry, and J. Esseveld. 1996. Objectivity and truth: Problems in doing feminist research. Pages 135–153. Feminism and social change: Bridging theory and practice.

Adams, E. H. 1890. Two cannibal archipelagos: New Hebrides and Solomo groups. Pacific Press, Oakland California.

Adams, T., and P. Dalzell. 1994. Artisanal fishing in East-West Center, editor. Workshop on marine biodiversity issues in the Pacific Islands, Hawaii.

Adams, W. M., D. Brockington, J. Dyson, and B. Vira. 2002. Analytical framework for dialogue on Common Pool Resource Management. Common Pool Resource Paper **1**.

Adams, W. M., and J. Hutton. 2007. People, Parks and Poverty: Political Ecology and Biodiversity Conservation. Conservation and Society **5**:147.

Agardy, T., P. Bridgewater, M. P. Crosby, J. Day, P. K. Dayton, R. Kenchington, D. Laffoley, P. McConney, P. A. Murray, J. E. Parks, and L. Peau. 2003. Dangerous targets? Unresolved issues and ideological clashes around marine protected areas. Aquatic Conservation-Marine and Freshwater Ecosystems **13**:353-367.

Agrawal, A. 1995. Indigenous and scientific knowledge: some critical comments Indigenous Knowledge and Development Monitor **3**:1.

Agrawal, A. 2001. Common Property Institutions and Sustainable Governance of Resources. World Development **29**:1649-1672.

Agrawal, A. 2003. Sustainable governance of common-pool resources: Context, Methods, and Politics. Annual Reviews in Anthropology **32**:243-262.

Agrawal, A., and A. Chhatre. 2006. Explaining success on the commons: Community forest governance in the Indian Himalaya. World Development **34**:149-166.

Airame, S., J. E. Dugan, K. D. Lafferty, H. Leslie, D. A. McArdle, and R. R. Warner. 2003. Applying ecological criteria to marine reserve design: A case study from the California Channel Islands. Ecological Applications **13**:S170-S184.

Alcala, A. C., and G. R. Russ. 2006. No-take Marine Reserves and Reef Fisheries Management in the Philippines: A New People Power Revolution. AMBIO: A Journal of the Human Environment **35**:245-254.

Alder, J. 1996. Have tropical marine protected areas worked? An initial analysis of their success. Coastal Management **24**:97.

Ali, A. 2007. Population pressure, agricultural intensification and changes in rural systems in Bangladesh. Geoforum **38**:720-738.

Allen, G. 1890. The Great Taboo. Project Gutenberg Online.

Allen, MelindaÂ S. 2006. New Ideas about Late Holocene Climate Variability in the Central Pacific. Current Anthropology **47**:521-535.

Almany, G., S. Connolly, D. Heath, J. Hogan, G. Jones, L. McCook, M. Mills, R. Pressey, and D. Williamson. 2009. Connectivity, biodiversity conservation and the design of marine reserve networks for coral reefs. Coral Reefs **28**:339-351.

Almany, G. R., M. L. Berumen, S. R. Thorrold, S. Planes, and G. P. Jones. 2007. Local Replenishment of Coral Reef Fish Populations in a Marine Reserve. Science **316**:742-744.

Amesbury, J. 2007. Mollusk collecting and environmental change during the Prehistoric Period in the Mariana Islands. Coral Reefs **26**:947-958.

Amos, M. J. 2007. Vanuatu fishery resource profiles. Page 195. IWP- Technical Report. SPREP, Apia, Samoa.

Anderies, J., M. Janssen, and E. Ostrom. 2004. A framework to analyze the robustness of social-ecological systems from an institutional perspective. Ecology and Society **9**:18.

Anderson, A. 2002. Faunal collapse, landscape change and settlement history in Remote Oceania. World Archaeology **33**:375 - 390.

Anderson, J., and C. Mees. 1999. The performance of customary marine tenure- Vanuatu country report Marine Resources Assessment Group, London.

Anderson White, T., and C. Ford Runge. 1995. The emergence and evolution of collective action: Lessons from watershed management in Haiti. World Development **23**:1683-1698.
Angrosino, M. V. 2005. Recontextualizing observation. Pages xix, 1210 in N. K. Denzin, and Y. S. Lincoln, editors. The SAGE handbook of qualitative research. Sage Publications, Thousand Oaks.
Aristotle 1984. The complete works of Aristotle : the revised Oxford translation. Princeton University Press, Princeton, N.J.
Armitage, D. 2008. Governance and the commons in a multi-level world. International Journal of the Commons **2**:7-32.
Aru, C. 2004. Non-formal Education in Vanuatu. Pages 172-188 in K. Sanga, J. Niroa, K. Matai, and L. Crowl, editors. Re-thinking Vanuatu Education Together. University of the South Pacific, Suva, Fiji.
Arutangi, S. 1971. Vanuatu: overcoming the colonial legacy. Pages 261-302 in R. G. Crocombe, editor. Land tenure in the Pacific. Oxford University Press, Melbourne, New York,.
Asch, M., C. Samson, D. Heinen, J. Kenrick, J. Lewis, S. Saugestad, T. Turner, and A. Kuper. 2004. On the Return of the Native. Current Anthropology **45**:261-267.
Ashworth, J. S., R. F. G. Ormond, and H. T. Sturrock. 2004. Effects of reef-top gathering and fishing on invertebrate abundance across take and no-take zones. Journal of Experimental Marine Biology and Ecology **303**:221-242.
Aswani, S. 1999. Common property models of sea tenure: A case study from the Roviana and Vonavona Lagoons, New Georgia, Solomon Islands. Human Ecology **27**:417-453.
Aswani, S. 2002. Assessing the effects of changing demographic and consumption patterns on sea tenure regimes in the Roviana Lagoon, Solomon Islands. Ambio **31**:272-284.
Aswani, S., S. Albert, A. Sabetian, and T. Furusawa. 2007. Customary management as precautionary and adaptive principles for protecting coral reefs in Oceania. Coral Reefs **26**:1009-1021.
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**:81-102.
Aswani, S., and P. Sheppard. 2003. The Archaeology and Ethnohistory of Exchange in Precolonial and Colonial Roviana: Gifts, Commodities, and Inalienable Possessions. Current Anthropology **44**:S51-S78.
Aswani, S., and P. Weiant. 2004. Scientific evaluation in women's participatory management: Monitoring marine invertebrate refugia in the Solomon Islands. Human Organization **63**:301-319.
Attard, D. 1987. The exclusive economic zone in international law. Clarendon press.
Bachman, J. G., and P. M. O'Malley. 1984. Yea-saying, nay-saying, and going to extremes: Black-white differences in response styles. Public Opinion Quarterly **48**:491-509.
Bailey, C., and S. Israel Oriental 1980. The Negev in the nineteenth century: Reconstructing history from Bedouin oral traditions. Institute of Middle Eastern Studies, University of Haifa.
Bakeo, A. C., N. Wells, and S. Johnson. 2000. Vanuatu national population and housing census 1999: Main report in N. S. Office., editor. Republic of Vanuatu, Port Vila.
Baker, L. M. 2006. Observation: a complex research method. Library Trends **55**:171-189.
Baland, J.-M., and J. P. Platteau 1996. Halting degradation of natural resources : is there a role for rural communities? Oxford University Press, Rome.
Baland, J.-M., and J. P. Platteau 2000. Halting degradation of natural resources : is there a role for rural communities? Oxford University Press, Oxford.
Ballantine, W. J. 1997. Design principles for systems of 'no-take' marine reserves. Fisehries Centre Research Reports **5**:4-5.
Banana, A., and W. Gombya-Ssembajjwe. 2000. Successful Forest Management: The Importance of Security of Tenure and Rule Enforcement in Ugandan Forests. Pages 87-98 in C. C. Gibson, M. A. Mckean, and E. Ostrom, editors. People and forests: Communities, institutions, and governance. MIT press, Cambridge.

Barnett, J., and W. Adger. 2007. Climate change, human security and violent conflict. Political Geography **26**:639-655.
Bashkow, I. 2006. The meaning of whitemen : race and modernity in the Orokaiva cultural world. University of Chicago Press, Chicago.
Baskett, M. L., F. Micheli, and S. A. Levin. 2007. Designing marine reserves for interacting species: Insights from theory. Biological Conservation **137**:163-179.
Basurto, X. 2005. How Locally Designed Access and Use Controls Can Prevent the Tragedy of the Commons in a Mexican Small-Scale Fishing Community. Society & Natural Resources **18**:643-659.
Basurto, X., and E. Ostrom. forthcoming. Beyond the tragedy of the commons. Journal of Energy and Environmental Economics and Policy
Bayliss-Smith, T. 2006. Fertility and the depopulation of Melanesia: Childlessness, abortion and introduced disease in Simbo and Otong Java, Solomon Islands. Berghahn Books.
Bayliss-Smith, T., E. Hviding, and T. Whitmore. 2003. Rainforest composition and histories of human disturbance in Solomon Islands. AMBIO: A Journal of the Human Environment **32**:346-352.
Bazeley, P. 2006. Binding and not-so-binding constraints to economic growth from Vanuatu's productive sectors. Pacific Economic Bulletin **21**.
Beaglehole, J. C. 1961. The discovery of New Zealand. Oxford University Press, London.
Beale, W. H. 1914. A century in the Pacific. Methodist Book Room, Sydney.
Bedford, S. 2004. Ripot i ko long ol man Nguna long saed blong stadi blong Stuart Bedford mo Taman Willie long arkeologji blong Nguna, Julae 14 kasem 18 2003. Vanuatu Cultural Center Port Vila.
Bedford, S. 2006. Pieces of the Vanuatu puzzle : archaeology of the north, south and centre. Pandanus Books Research School of Pacific and Asian Studies Australian National University, Canberra.
Bedford, S., and M. Spriggs. 2000. Crossing the Pwanmwou : preliminary report on recent excavations adjacent to and south west of Mangaasi, Efate, Vanuatu. Archaeology in Oceania **35**:120-126.
Bedford, S., and M. Spriggs. 2008. Northern Vanuatu as a Pacific Crossroads: The Archaeology of Discovery, Interaction, and the Emergence of the``Ethnographic Present". Asian Perspectives **47**:95.
Bedford, S., M. Spriggs, and R. Regenvanu. 1999. The Australian National University-Vanuatu Cultural Centre Archaeology Project, 1994-97: Aims and results. Oceania **70**:16-24.
Bedford, S., M. Spriggs, and R. Regenvanu. 2006. The Teouma Lapita site and the early human settlement of the Pacific Islands. Antiquity **80**:812-828.
Belcher, S. E. 1843. Narrative of a voyage around the world. 2 vols. London: H. Colburn.
Bell, J. D., M. Kronen, A. Vunisea, W. J. Nash, G. Keeble, A. Demmke, S. Pontifex, and S. Andréfouët. 2009. Planning the use of fish for food security in the Pacific. Marine Policy **33**:64-76.
Bentley, R. A., H. R. Buckley, M. Spriggs, S. Bedford, C. J. Ottley, G. M. Nowell, C. G. Macpherson, and D. G. Pearson. 2007. Lapita migrants in the Pacific's oldest cemetery: Isotopic analysis at Teouma, Vanuatu. American Antiquity **72**:645-656.
Berkes, F. 1986. Marine Inshore Fishery Management in Turkey. Pages 63-83. Conference on Common Property Resource Management. National Academy Press, Washington, DC.
Berkes, F., editor. 1989. Common Property Resources: Ecology and Community-Based Sustainable Development. Belhaven Press, London.
Berkes, F. 1993. Traditional ecological knowledge in perspective. Traditional ecological knowledge: Concepts and cases:1-9.
Berkes, F. 1999. Sacred ecology : traditional ecological knowledge and resource management. Taylor & Francis, Philadelphia, PA.
Berkes, F. 2007a. Community-based conservation in a globalized world. Proceedings of the National Academy of Sciences **104**:15188.

Berkes, F. 2007b. Going Beyond Panaceas Special Feature: Community-based conservation in a globalized world. Proceedings of the National Academy of Sciences of the United States of America **104**:15188.
Berkes, F. 2007c. Understanding uncertainty and reducing vulnerability: lessons from resilience thinking. Natural Hazards **41**:283-295.
Berkes, F. 2008. Commons in a Multi-level World. International Journal of the Commons **2**:1-6.
Berkes, F. 2009. Community conserved areas: policy issues in historic and contemporary context. Conservation Letters **2**:20-25.
Berkes, F., J. Colding, and C. Folke 2003. Navigating Social-Ecological Systems: Building Resilience for Complexity and Change. Cambridge University Press.
Berkes, F., C. Folke, and J. Colding 1998. Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience. Cambridge University Press.
Berkes, F., T. P. Hughes, R. S. Steneck, J. A. Wilson, D. R. Bellwood, B. Crona, C. Folke, L. H. Gunderson, H. M. Leslie, J. Norberg, M. Nystrom, P. Olsson, H. Osterblom, M. Scheffer, and B. Worm. 2006. Globalization, Roving Bandits, and Marine Resources. Science **311**:1557-1558.
Berkes, F., and N. J. Turner. 2006. Knowledge, learning and the evolution of conservation practice for social-ecological system resilience. Human Ecology **34**:479-494.
Bishop, R. 1998. Freeing ourselves from neo-colonial domination in research: A Maori approach to creating knowledge. International Journal of Qualitative Studies in Education **11**:199-219.
Blaikie, P., and H. C. Brookfield 1987. Land degradation and society. Methuen, London/New York.
Block, W., A. Franklin, J. Ward, J. Ganey, and G. White. 2001. Design and implementation of monitoring studies to evaluate the success of ecological restoration on wildlife. Restoration Ecology **9**:293-303.
Boas, F. 1982. Race, language, and culture. University of Chicago Press, Chicago.
Bolton, L. 1998. Chief Willie Bongmatur Maldo and the role of Chiefs in Vanuatu. Journal of Pacific History **33**:179-195.
Bolton, L. 1999. Introduction. Oceania **70**:1.
Bolton, L. 2001. Classifying the Material: Food, Textiles and Status in North Vanuatu. Journal of Material Culture **6**:251.
Bonnemaison, J. 1984. Social and cultural aspects of land tenure. Page 76 in H. Alatoa, editor. Land Tenure in Vanuatu. Institute of Pacific Studies, USP Suva.
Bonnemaison, J. 1996. Arts of Vanuatu. Crawford House Publishing, Bathurst, N.S.W.
Bonnemaison, J., and J. Penot-Demetry 1994. The tree and the canoe : history and ethnogeography of Tanna. University of Hawaii Press, Honolulu.
Borrini-Feyerabend, G., M. T. Farvar, J. C. Nguinguiri, and V. Ndangang. 2000. Environmental Management Co-management of Natural Resources Organising. Negotiating and Learning-by-Doing, Eschborn, IUCN, GTZ.
Borrini-Feyerabend, G., A. Kothari, and G. Oviedo. 2004. Indigenous and Local Communities and Protected Areas: Towards equity and enhanced conservation. IUCN, Gland, Switzerland, and Cambridge, UK.
Bourdieu, P., and R. Nice 2004. Science of science and reflexivity. University of Chicago Press, Chicago.
Boyatzis, R. E. 1998. Transforming Qualitative Information: Thematic Analysis and Code Development. Sage, London.
Brazenor, C., C. Ogleby, and I. Williamson. 1999. The spatial simension of aboriginal land tenure 6th South East Asian Surveyors Congress, Fremantle.
Bresnihan, B. J., and K. Woodward 2002. Tufala Gavman : reminiscences from the Anglo-French Condominium of the New Hebrides. Institute of Pacific Studies, University of the South Pacific, Suva, Fiji.
Brokensha, D., D. M. Warren, and O. Werner 1980. Indigenous knowledge systems and development. University Press of America, Washington, D.C.
Bromley, D. W., and M. M. Cernea 1989. The Management of Common Property Natural Resources: Some Conceptual and Operational Fallacies. World Bank.

Brookfield, H. C., and J. Overton. 1988. How old is the deforestation of Oceania. Pages 89–99 in J. Dargavel, K. Dixon, and N. Semple, editors. Changing Tropical Forests. Australian National University, Canberra.

Brooks, T. M., R. A. Mittermeier, G. A. B. da Fonseca, J. Gerlach, M. Hoffmann, J. F. Lamoreux, C. G. Mittermeier, J. D. Pilgrim, and A. S. L. Rodrigues. 2006. Global Biodiversity Conservation Priorities. Science **313**:58-61.

Brown, K., W. N. Adger, E. Tompkins, P. Bacon, D. Shim, and K. Young. 2001. Trade-off analysis for marine protected area management. Ecological Economics **37**:417-434.

Brown, L. D., and R. Tandon. 1983. Ideology and Political Economy in Inquiry: Action Research and Participatory Research. The Journal of Applied Behavioral Science **19**:277.

Brush. 1993. Indigenous knowledge of biological resources and intellectual property rights. American Anthropologist **95**:65.

Bryant, R. L. 1998. Power, knowledge and political ecology in the third world: a review. Progress in Physical Geography **22**:79.

Buckley, H. R., N. G. Tayles, M. J. T. Spriggs, and S. Bedford. 2008. A Preliminary Report on Health and Disease in Early Lapita Skeletons, Vanuatu: Possible Biological Costs of Island Colonization. The Journal of Island and Coastal Archaeology **3**:87 - 114.

Bunce, L., P. Townsley, R. S. Pomeroy, and R. B. Pollnac 2000. Socioeconomic Manual for Coral Reef Management. Australian Institute of Marine Science, Townsville, Australia.

Burger, J., and M. Gochfeld. 1998. The tragedy of the commons: 30 years later. Environment **40**:4-27.

Burke, L., D. Bryant, J. McManus, and M. Spalding. 2002. Reefs at risk. World Resources Institute, Washington DC, USA.

Burke, L., and J. Maidens 2004. Reefs at Risk in the Caribbean. World Resources Institute.

Butler, V. L. 1988. Lapita fishing strateies: the faunal evidence Pages 99-115 in P. V. Kirch, and T. L. Hunt, editors. Archaeology of the Lapita cultural complex: a critical review. Washington State Burke Museum, Seattle.

Butler, V. L. 2001. Changing fish use on Mangaia, southern Cook Islands: resource depression and the prey choice model. International Journal of Osteoarchaeology **11**:88-100.

Caillaud, A., S. Boengkih, E. Evans-Illidge, J. Genolagani, P. Havemann, D. Henao, E. Kwa, D. Llewell, A. Ridep-Morris, and J. Rose. 2004. Tabus or not taboos? How to use traditional environmental knowledge to support sustainable development of marine resources in Melanesia. SPC Traditional Marine Resource Management and Knowledge Information Bulletin **17**:14-35.

Campbell, B., A. Mandondo, N. Nemarundwe, B. Sithole, W. De JonG, M. Luckert, and F. Matose. 2001. Challenges to Proponents of Common Property Recource Systems: Despairing Voices from the Social Forests of Zimbabwe. World Development **29**:589-600.

Campbell, D. 1959. Methodological suggestions from a comparative psychology of knowledge processes. Inquiry **2**:152-182.

Cantril, H. 1966. The pattern of human concerns. Rutgers University Press, New Brunswick, N.J.,.

Capell, A. 1938. The Stratification of Afterworld Beliefs in the New Hebrides. Folklore **49**:51-85.

Carrier, J. G. 1987. Marine Tenure and Conservation in Papua New Guinea. Pages 143-167 in B. McCay, and J. Acheson, editors. The Question of the Commons: The Culture and Ecology of Common Resources. The University of Arizona Press, Tucson.

Carrier, J. G., and A. H. Carrier. 1983. Profitless Property: Marine Ownership and Access to Wealth on Ponam Island, Manus Province. Ethnology **22**:133-151.

Carter, S. 2008. Research and Policy Implementation for More Equitable and Sustainable Use of Common-Pool Resources. Society and Natural Resources **21**:152-159.

Castle, E. 2009. Digital Library of the Commons Workshop on Political Theory and Policy Analysis, Indiana University

Chambers, M., E. Bani, and B. Barker-Hudson. 1989a. The status of dugong *(Dugong dugon*) in Vanuatu. Tropic Review No. 37. South Pacific Regional Environment Program South Pacific Commission, Noumea.

Chambers, R. 1994. The Origins and Practice of Participatory Rural Appraisal. World Development **22**:953-969.

Chambers, R., A. Pacey, and L. A. Thrupp 1989b. Farmer first : farmer innovation and agricultural research. Intermediate Technology Publications, London.

Chand, S. 2005. Labour mobility for sustainable livelihoods in Pacific Island states. Pacific Economic Bulletin **20**:63-76.

Chape, S., M. Spalding, and M. Jenkins 2008. The world's protected areas : status, values, and prospects in the 21st century. University of California Press, Berkeley.

Charmez, K. 2006. Constructing Grounded Theory: A Practical Guide through Qualitative Analysis. Sage, London.

Chatwin, B. 1987. The songlines. Cape, London.

Chhatre, A., and A. Agrawal. 2008. Forest commons and local enforcement. Proceedings of the National Academy of Sciences **105**:13286.

Choat, J. H., C. R. Davies, J. L. Ackerman, and B. D. Mapstone. 2006. Age structure and growth in a large teleost, Cheilinus undulatus, with a review of size distribution in labrid fishes. Marine Ecology Progress Series **318**:237-246.

Christie, P. 2003. Toward developing a complete understanding: A social science research agenda for marine protected areas. Fisheries **28**:22-26.

Christie, P., and A. White. 2007. Best practices for improved governance of coral reef marine protected areas. Coral Reefs. **26**:1047-1056.

Christie, P., R. Pollnac, E. Oracion, A. Sabonsolin, R. Diaz, and D. Pietri. 2009. Back to basics: An empirical study demonstrating the importance of local-level dynamics for the success of tropical marine ecosystem-based management. Coastal Management **37**:349-373.

Cinner, J. E. 2007. Designing marine reserves to reflect local socioeconomic conditions: lessons from long-enduring customary management systems. Coral Reefs **26**:1035-1045.

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

Cinner, J. E., M. J. Marnane, and T. R. McClanahan. 2005a. Conservation and Community Benefits from Traditional Coral Reef Management at Ahus Island, Papua New Guinea Conservation Biology **19**:1714-1723.

Cinner, J. E., 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**:34.

Cinner, J. E., M. J. Marnane, T. R. McClanahan, T. H. Clark, and J. Ben. 2005b. Trade, Tenure, and Tradition: Influence of Sociocultural Factors on Resource Use in Melanesia. Conservation Biology **19**:1469-1477.

Cinner, J. E., T. R. McClanahan, T. M. Daw, N. A. J. Graham, J. Maina, S. K. Wilson, and T. P. Hughes. 2009. Linking Social and Ecological Systems to Sustain Coral Reef Fisheries. Current Biology **19**:206-212.

Cinner, J. E., and R. B. Pollnac. 2004. Poverty, perceptions and planning: why socioeconomics matter in the management of Mexican reefs. Ocean and Coastal Management **47**:479-493.

Cinner, J. E., S. G. Sutton, and T. G. Bond. 2007. Socioeconomic thresholds that affect use of customary fisheries management tools. Conservation Biology **21**:1603-1611.

Clark, C., G. Munro, and U. Sumaila. 2005. Subsidies, buybacks, and sustainable fisheries. Journal of Environmental Economics and Management **50**:47-58.

Clark, C. W. 1980. Restricted access to common property fishery resources: a game-theoretic analysis. Pages 117-132 in P.-T. Liu, editor. Dynamic optimization and mathematical economics. Plenum Press, New York.

Cleaver, F. 2000. Moral Ecological Rationality, Institutions and the Management of Common Property Resources. Development and Change **31**:361-383.

Clifford, J. 1997. Spatial practices: Fieldwork, travel, and the disciplining ofanthropology. Pages viii, 275 p. in A. Gupta, and J. Ferguson, editors. Anthropological locations : boundaries and grounds of a field science. University of California Press, Berkeley.
Clua, E., B. Beliaeff, C. Chauvet, G. David, J. Ferraris, M. Kronen, M. Kulbicki, P. Labrosse, Y. Letourneur, D. Pelletier, O. Thebaud, and M. Leopold. 2005. Towards multidisciplinary indicator dashboards for coral reef fisheries management. Aquatic Living Resources **18**:199-213.
Cochran, P. A. L., C. A. Marshall, C. Garcia-Downing, E. Kendall, D. Cook, L. McCubbin, and R. M. S. Gover. 2008. Indigenous ways of knowing: implications for participatory research and community. American Journal of Public Health **98**:22.
Codrington, R. H. 1891. The Melanesians: studies in the anthropology and folklore. Clarendon Press, Oxford.
Cohen 1988. Statistical Power Analysis for Behavioral Sciences. Lawrence Erlbaum Associates, Hillsdale, New Jersey.
Cohen, I. R., and D. Harel. 2007. Explaining a complex living system: dynamics, multi-scaling and emergence. Journal of the Royal Society Interface **4**:175-182.
Colding, J., and C. Folke. 1999. Taboo System: Lessons about Informal Institutions for Nature Management, The. Georgetown International Environmental Law Review **12**:413.
Colding, J., and C. Folke. 2001. Social taboos "invisible" systems of local resource management and biological conservation. Ecological Applications **11**:584-600.
Conand, C. 1990. Holothurians. The fishery resources of Pacific Island countries. FAO, Rome.
Conference, M. 2000. Biodiversity Issues in the Pacific Islands. Ministerial Conference on Environment and Development in Asia and the Pacific, Kitakyushu, Japan.
Conservation International. 2005. Hotspots Revisited: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions. CI, New York.
Cook, J., J. C. Beaglehole, R. A. Skelton, and Hakluyt Society. 1955. The Journals of Captain James Cook on his voyages of discovery. Published for the Hakluyt Society at the University Press, Cambridge,.
Cook, J., and J. King 1793. Discoveries in the Northern Hemisphere: performed under the direction of Captains Cook, Clerke and Gore, in the years 1776-1780. Champante and Whitrow, London.
Cook, J., J. King, and G. B. Admiralty. 1784. A voyage to the Pacific Ocean. For making discoveries in the Northern hemisphere, to determine the position and extent of the west side of North America. G. Nicol, & T. Cadell, London.
Cooke, A. J., N. V. C. Polunin, and K. Moce. 2000. Comparative assessment of stakeholder management in traditional Fijian fishing-grounds. Environmental Conservation **27**:291-299.
Cornes, R., and T. Sandler 1996. The Theory of Externalities, Public Goods, and Club Goods. Cambridge University Press.
Cornwall, A., and R. Jewkes. 1995. What is participatory research? Social Science & Medicine **41**:1667-1676.
Corris, P. 1973. Passage, port and plantation : a history of Solomon Islands labour migration, 1870-1914. Melbourne University Press, Carlton, Vic.
Cote, I. M., I. Mosqueira, and J. D. Reynolds. 2001. Effects of marine reserve characteristics on the protection of fish populations: a meta-analysis. Journal of Fish Biology **59**:178-189.
Coulter, J. 1946. Impact of the War on South Sea Islands. Geographical Review:409-419.
Cowen, R. K., K. M. M. Lwiza, S. Sponagule, C. B. Paris, and D. B. Olson. 2000. Connectivity of marine populations: open or closed? Science **287**:857-859.
Cox, M. P. 2008. The genetic environment of melanesia: clines, clusters and contact. Nova Biomedical Books, New York.
Cox, P. A., and T. Elmqvist. 1997. Ecocolonialism and indigenous-controlled rainforest preserves in Samoa. Ambio **26**:84-89.
Crate, S. 2008. “Eating Hay”: The Ecology, Economy and Culture of Viliui Sakha Smallholders of Northeastern Siberia. Human Ecology **36**:161-174.

Crawford, B., M. Kasmidi, F. Korompis, and R. B. Pollnac. 2006. Factors Influencing Progress in Establishing Community-Based Marine Protected Areas in Indonesia. Coastal Management **34**:39 - 64.
Crawford, S., and E. Ostrom. 2000. A grammar of institutions. Page 114 in M. D. McGinnis, editor. Polycentric games and institutions. University of Michigan Press, Ann Arbor.
Crosby, M. P., G. Brighouse, and M. Pichon. 2002. Priorities and strategies for addressing natural and anthropogenic threats to coral reefs in Pacific Island Nations. Ocean and Coastal Management **45**:121-137.
Crowley, J. 2007. The Consequences of Vernacular (ll) literacy in the Pacific. Pages 164-184 in A. J. Liddicoat, editor. Language Planning and Policy: Issues in Language Planning and Literacy. Multilingual Matters, South Australia.
Crump, C., and D. McKenzie 2000. Christina's Story Realities of Family Life on an isolated Pacific Island 1938-1956. Ngaio Press, Wellington.
Cudney-Bueno, R., M. Lavín, S. Marinone, P. Raimondi, and W. Shaw. 2009. Rapid Effects of Marine Reserves via Larval Dispersal. PLoS ONE **4**.
Cumming, G. S., D. H. M. Cumming, and C. L. Redman. 2006. Scale mismatches in social-ecological systems: causes, consequences, and solutions. Ecology and Society **11**:14.
Cunningham, B. 1976. Action research: toward a procedural model. Human Relations **29**:215.
Curtis, T. H. 1999. Tom's Tambu House: Spacing, Status and Sacredness in South Malakula, Vanuatu. Oceania **70**.
Dahl, A. L. 1987. Review of the Protected Areas System in Oceania. IUCN Commission on National Parks and Protected Areas, Geneva.
Dalzell, P. 1998. The role of archaeological and cultural-historical records in long-range coastal fisheries resources management strategies and policies in the Pacific Islands. Ocean & Coastal Management **40**:237-252.
Dalzell, P., and T. J. H. Adams. 1997. Sustainability and management of reef fisheries in the Pacific Islands. Pages 2027-2032. 8th International Coral Reef Symposium Panama City.
Davenport, W. 1962. Red-feather money. Scientific American:94-104.
David, G. 1994. Traditional village fishing in fisheries development planning in Vanuatu. Institute of Pacific Studies, Suva, Fiji.
David, G., and E. Cillaurren. 1992. National fisheries development policy for coastal waters, small-scale village fishing, and food self-reliance in Vanuatu Man and Culture in Oceania **8**:35-58.
Davis, S. H., and A. Wali. 1994. Indigenous Land Tenure and Tropical Forest Management in Latin America. AMBIO **23**:485-485.
Dawes, R. M. 1980. Social Dilemmas. Annual Reviews in Psychology **31**:169-193.
Dening, G. 1992. Mr Bligh's bad language : passion, power, and theatre on the Bounty. Cambridge University Press, Cambridge, Eng.
Diamond, J. M. 1993. New Guineans and their natural world. Pages 251-271 in S. R. Kellert, and E. O. WIlson, editors. The Biophilia Hypothesis Island Press, Washington, DC.
Dickinson, W. 2001. Petrography and geologic provenance of sand tempers in prehistoric potsherds from Fiji and Vanuatu, South Pacific. Geoarchaeology **16**.
Dietz, T., and A. Henry. 2008. Context and the commons. Proceedings of the National Academy of Sciences **105**:13189.
Dietz, T., E. Ostrom, and P. C. Stern. 2003. The Struggle to Govern the Commons. Science **302**:1907.
Dixon, J. A., L. F. Scura, and T. van't Hof. 1993. Meeting ecological and economic goals: marine parks in the Caribbean. Ambio **22**:117-125.
Docker, E. W. 1970. The blackbirders : the recruiting of South Seas labour for Queensland, 1863-1907. Angus and Robertson, [Sydney].
Don, A. 1918. Light in dark isles : a jubilee record and study of the New Hebrides mission of the Presbyterian Church of New Zealand. Foreign Missions Committee P.C.N.Z., Dunedin.
Don, A. 1977. Peter Milne of Nguna (1834-1924). Maropa Bookshop, Port Vila.

Donohue, M., and T. Denham. 2008. The language of Lapita: Vanuatu and an early Papuan presence in the Pacific. Oceanic Linguistics **47**.
Douglas, B. 2002. Christian citizens: women and negotiations of modernity in Vanuatu. The Contemporary Pacific **14**:1(39).
Dowie, M. 2008. Wrong Path to Conservation in Papua New Guinea The Nation, New York, September 29, 2008.
Dudley, N. 2008. Guidelines for applying protected area management categories. Page 86p. IUCN, Gland.
Dulvy, N. K., and N. V. C. Polunin. 2004. Using informal knowledge to infer human-induced rarity of a conspicuous reef fish. Animal Conservation **7**:365-374.
Duncan, R. 2008. Solomon islands and Vanuatu: an economic survey Pacific Economic Bulletin **23**:1-17.
Eagles, P. F. J., S. F. McCool, and C. D. Haynes 2002. Sustainable Tourism in Protected Areas: Guidelines for Planning and Management. The World Conservation Union (IUCN).
Edgar, G. J., N. S. Barrett, and A. J. Morton. 2004. Biases associated with the use of underwater visual census techniques to quantify the density and size-structure of fish populations. Journal of Experimental Marine Biology and Ecology **308**:269-290.
Edmonds, M. 1995. Why won't we tell them what they want to hear? Native Title, politics, and the intransigence of ethnography. Native Title: Emerging Issues for Research, Policy and Practice. Research Monograph **10**:1–8.
Elzinga, C. L. 2001. Monitoring plant and animal populations. Blackwell Science, Malden, Massachusetts.
English, S. A., C. R. Wilkinson, V. J. Baker, Australian Institute of Marine Science, and ASEAN-Australia Marine Science Project 1997. Survey manual for tropical marine resources. Australian Institute of Marine Science, Townsville.
Erskine, J. 1853. A cruise among the islands of the Western Pacific including the feefees and others inhabited bu the Polynesian negro races, in her majesty's ship Havannah. John Murray, London.
Esbjorn-hargens, S., and M. E. Zimmerman 2009. Integral Ecology: Uniting Multiple Perspectives on the Natural World. Shambhala Pubns.
Espirat, J., J. Guiart, M. S. Lagrange, and M. Renaud 1973. Systeme des titres, electifs ou hereditaires : dans les Nouvelles-Hebrides centrales d'Efate aux iles Shepherd. Institut d'ethnologie, Paris.
Facey, E. 1981. Hereditary chiefship in Nguna. Pages 295-313 in M. R. Allen, editor. Vanuatu : politics, economics and ritual in Island Melanesia. Academic Press, Sydney.
Facey, E. 1995. Kastom and Nation Making: The Politicization of Tradition on Nguna, Vanuatu. Pages 207-226 in R. J. Foster, editor. Nation Making Emergent Identities in Postcolonial Melanesia. University of Michigan Press, Ann Arbor.
Facey, E. E. 1989. Nguna voices : text and culture from central Vanuatu University of Calgary Press, Calgary.
Fals-Borda, O., and M. Rahman. 1991. Action and knowledge: Breaking the monopoly with participatory action research. International congress from the local to the global; anthropological perspectives, Londres: Intermediate Technology.
Farquhar, W. G. 1980. Diary from 7th November 1861 to the 17th January 1872, Townsville.
Fear, K. L., and P. Edwards. 1995. Building a Democratic Learning Community Within a PDS. Teaching Education **7**:13 - 24.
Feder, G., and D. Feeny. 1991. Land tenure and property rights: Theory and implications for development policy. Pages 135-153. World Bank.
Feeny, D., F. Berkes, B. J. McCay, and J. M. Acheson. 1990. The Tragedy of the Commons: Twenty-two years later. Human Ecology **18**:1-19.
Feit, H. A. 1973. The ethno-ecology of the Waswanipi Cree; or how hunters can manage their resources. Cultural Ecology:115-125.
Ferraris, J., D. Pelletier, M. Kulbicki, and C. Chauvet. 2005. Assessing the impact of removing reserve status on the Abore Reef fish assemblage in New Caledonia. Marine Ecology Progress Series **292**:271-286.

Fetterman, D. 2009. Ethnography. Pages xviii, 661 in L. Bickman, and D. J. Rog, editors. The SAGE handbook of applied social research methods. Sage, Los Angeles.
Fingleton, J., A. Napua, and C. Ballard. 2008. Village land trusts in Vanuatu: 'one common basket'. Reconciling customary ownership and development
Firth, S. 2000. The Pacific Islands and the Globalization Agenda. CONTEMPORARY PACIFIC **12**:178-192.
Fitzpatrick, S., and T. Donaldson. 2007. Anthropogenic impacts to coral reefs in Palau, western Micronesia during the Late Holocene. Coral Reefs **26**:915-930.
Flaskerud, J. H. 1988. Is the Likert Scale Format Culturally Biased? Nursing Research **37**:185.
Flick, U. 2007. Designing qualitative research. Sage, London.
Foale, S. 1998. Assessment and management of the trochus fishery at West Nggela, Solomon Islands: An interdisciplinary approach. Ocean & Coastal Management **40**:187-205.
Foale, S. 2001. Where's our development? The Asia Pacific Journal of Anthropology **2**:44 - 67.
Foale, S. 2006. The intersection of scientific and indigenous ecological knowledge in coastal Melanesia: implications for contemporary marine resource management. International Social Science Journal **58**:129-137.
Foale, S. 2008. Conserving Melanesia's coral reef heritage in the face of climate change. Historic Environment **21**:30-36.
Foale, S., M. Macintyre, and S. Sontag. 2005. Green Fantasies: Photographic representations of biodiversity and ecotourism in the Western Pacific. Journal of Political Ecology **12**:1.
Foale, S., and B. Manele. 2004. Social and political barriers to the use of marine protected areas for conservation and fishery management in Melanesia. Asia Pacific Viewpoint **45**:373-386.
Folke, C., T. Hahn, P. Olsson, and J. Norberg. 2005. Adaptive Governance of Social-Ecological Systems. Annual Review of Environment and Resources **30**:441.
Folke, C., and J. Rockström. 2009. Turbulent times. Global Environmental Change **19**:1-3.
Forsyth, M. 2004. Beyond Case Law: Kastom and Courts in Vanuatu. Victoria University of Wellington Law Review **35**:427.
Forsyth, T. 2008. Political ecology and the epistemology of social justice. Geoforum **39**:756-764.
Foster, K., and J. Poggie. 1993. Customary marine tenure and mariculture management in outlying communities of Pohnpie States, Federated States of Micronesia. Ocean & Coastal Management **20**:1-22.
Foster, R. J. 1995. Nation making : emergent identities in postcolonial Melanesia. University of Michigan Press, Ann Arbor.
Fowler, F., and C. Cosenza. 2009. Design and evalutaion of survey questions. Pages xviii, 661 in L. Bickman, and D. J. Rog, editors. The SAGE handbook of applied social research methods. Sage, Los Angeles.
Frankel, J. A., and A. K. Rose. 2005. Is Trade Good or Bad for the Environment? Sorting Out the Causality. Review of Economics and Statistics **87**:85-91.
Fraser, K. L. 2001. Variation in Tuna Fish Catches in Pacific Prehistory. International Journal of Osteoarchaeology **11**:127-135.
Freud, S. 1950. Totem and taboo; some points of agreement between the mental lives of savages and neurotics. Routledge & Paul, London.
Gadamer, H. G. 1989. Truth and method. Crossroads, New York.
Gaines, S., J. Lubchenco, S. Palumbi, and M. Dethier. 2001. Scientific consensus statement on marine reserves and marine protected areas. American Association for the Advancement of Science University of California
Gaventa, J. 1993. The powerful, the powerless, and the experts: Knowledge struggles in an information age. in P. Park, B. Brydon-Miller, B. Hall, and T. Jackson, editors. Voices of change : participatory research in the United States and Canada. Bergin and Garvyy, Westport, CT.

Geertz, C. 1994. Thick description: toward an interpretive theory of culture. Page 213 in M. Martin, and L. C. McIntyre, editors. Readings in the philosophy of social science. MIT Press, Cambridge, Mass.

Gelcich, S., M. J. Kaiser, J. C. Castilla, and G. Edwards-Jones. 2008. Engagement in co-management of marine benthic resources influences environmental perceptions of artisanal fishers. Environmental Conservation **35**:36-45.

Gerber, L. R., L. W. Botsford, A. Hastings, H. P. Possingham, S. D. Gaines, S. R. Palumbi, and S. Andelman. 2003. Population models for marine reserve design: A retrospective and prospective synthesis. Ecological Applications **13**:S47-S64.

Gibson, C., M. McKean, and E. Ostrom 2000. People and forests: communities, institutions, and governance. MIT Press.

Gibson, C. C., D. Dodds, and P. Turner. 2007. Explaining Community-Level Forest Outcomes: Salience, Scarcity and Rules in Eastern Guatemala. Conservation and Society **5**:361.

Giddens, A. 1990. The consequences of modernity. Stanford University Press, Stanford, Calif.

Gifford, E. W., and D. Shutler. 1956. Archaeological Excavations in New Caledonia. University of California Anthropological Records **18**.

Gilchrist, G., M. Mallory, and F. Merkel. 2005. Can local ecological knowledge contribute to wildlife management? Case studies of migratory birds. Ecology and Society **10**:20.

Giles, W. E., and D. Scarr 1968. A cruize [sic] in a Queensland labour vessel to the South Seas. Australian National University Press, Canberra.

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.

Gladwell, M. 2000. The tipping point: How little things can make a big difference. Little, Brown and Company, New York.

Goldman, M. 1997. 'Customs in common': The epistemic world of the commons scholars. Theory and Society **26**:1-37.

Goodenough, J. G. 1876. Journal of Commodore Goodenough, during his last command as senior officer on the Australian station 1873-1875. H.S. King & Co., London.

Goodman, L. A. 1961. Snowball sampling. The Annals of Mathematical Statistics:148-170.

Goudie, A. 2006. The Human Impact on the Natural Environment: Past, Present, and Future. Blackwell Publishing.

Govan, H., A. Tawake, K. Tabunakawai, A. Jenkins, A. Lasgorceix, E. Techera, H. Tafea, J. Kinch, J. Feehely, P. Ifopo, R. Hills, S. Alefaio, S. Meo, S. Troniak, S. a. Malimali, S. George, T. Tauaefa, and T. Obed. 2009. Community Conserved Areas: A review of status & needs in Melanesia and Polynesia. ICCA regional reviews for GEF-SGP. IUCN, Samoa.

Government of Vanuatu. 1983. Subsidiary legislation: Declaration of marine reserve Fisheries Act: No 37 Gazette No. 40 Vanuatu

Government of Vanuatu 1988. The laws of the Republic of Vanuatu : containing the acts and certain subsidiary legislation in force on 30 June 1988 together with the Constitution. Chambers of the Attorney General Port Vila

Grafton, R. Q. 2005. Social capital and fisheries governance. Ocean & Coastal Management **48**:753-766.

Graham, N. A. J., N. K. Dulvy, S. Jennings, and N. V. C. Polunin. 2005. Size-spectra as indicators of the effects of fishing on coral reef fish assemblages. Coral Reefs **24**:118-124.

Graham, N. A. J., T. R. McClanahan, M. A. MacNeil, S. K. Wilson, N. V. C. Polunin, S. Jennings, P. Chabanet, S. Clark, M. D. Spalding, and Y. Letourneur. 2008. Climate warming, marine protected areas and the ocean-scale integrity of coral reef ecosystems. PLoS ONE **3**.

Grant, P. J. 1994. Late Holocene histories of climate, geomorphology and vegetation, and their effects on the first New Zealanders. Pages 164–194 in D. Sutton, editor. The Origins of the First New Zealanders. Auckland University Press, Auckland.

Green, R. C. 2003. Assessments and Anniversary of the First Lapita Excavation. Pages 95-120 in C. Sand, editor. Pacific Archaeology. Le Cahiers de l'Archeologie en Nouvelle-Caledonie, Noumea, New Caledonia.
Green, R. C., and D. Anson. 2000. Excavations at Kainapirina (SAC), Watom Island, Papua New Guinea. New Zealand Journal of Archaeology **20**:29-94.
Greenberg, J. B., and T. K. Park. 1994. Political ecology. Journal of Political Ecology **1**:1-12.
Greene, H. G., F. L. Wong, and Circum-Pacific Council for Energy and Mineral Resources 1988. Geology and offshore resources of Pacific Island arcs--Vanuatu region. Circum-Pacific Council for Energy and Mineral Resources, Houston, Tex., U.S.A.
Greene, L. E., and W. S. Alevizon. 1989. Comparative accuracies of visual assessment methods for coral-reef fishes. Bulletin of Marine Science **44**:899-912.
Grotius, H. 1609. The Freedom of the Seas. Oxford University Press, New York.
Guarderas, A. P., S. D. Hacker, and J. Lubchenco. 2008. Current Status of Marine Protected Areas in Latin America and the Caribbean. Conservation Biology **22**:1630-1640.
Guenette, S., T. Lauck, and C. Clark. 1998. Marine reserves: from Beverton and Holt to the present. Reviews in Fish Biology and Fisheries **8**:251-272.
Guiart, J. 1964. Marriage regulations and kinship in the South central New Hebrides. Ethnography **3**:96-106.
Guidetti, P., M. Milazzo, S. Bussotti, A. Molinari, M. Murenu, A. Pais, N. Spanò, R. Balzano, T. Agardy, and F. Boero. 2008. Italian marine reserve effectiveness: Does enforcement matter? Biological Conservation **141**:699-709.
Gunderson, L., and C. Holling 2002. Panarchy: understanding transformations in human and natural systems. Island Press.
Gunn, W. 1914. The gospel in Futuna. Hodder and Stoughton, London.
Gyasi, E. A. 1994. The adaptability of African communal land tenure to economic opportunity: the example of land acquisition for oil palm farming in Ghana. Africa **64**:391.
Haddon, A. C., J. Hornell, and Bernice Pauahi Bishop Museum 1975. Canoes of Oceania. Bishop Museum Pr., Honolulu, Hawaii.
Hagelberg, E., N. Goldman, P. Lio, S. Whelan, W. Schiefenhovel, J. B. Clegg, and D. K. Bowden. 2000. Evidence for mitochondrial DNA recombination in a human population of island Melanesia: correction. Proceedings of the Royal Society B: Biological Sciences **267**:1595–1596.
Hagelberg, E., N. Goldman, P. Lio, S. Whelan, W. Schiefenhövel, J. B. Clegg, and D. K. Bowden. 1999. Evidence for mitochondrial DNA recombination in a human population of island Melanesia. Proceedings of the Royal Society B: Biological Sciences **266**:485.
Hagen, J. B. 1992. An entangled bank : the origins of ecosystem ecology. Rutgers University Press, New Brunswick, N.J.
Haglund, L., and P. Olsson. 2008. The Impact on University Libraries of Changes in Information Behavior Among Academic Researchers: A Multiple Case Study. The Journal of Academic Librarianship **34**:52-59.
Hall, B. 1981. Participatory Research, Popular Knowledge and Power: A Personal Reflection. Convergence: An International Journal of Adult Education **14**:6-19.
Halpern, B., R. Warner, and S. Gaines. 2004. Feedback on Subject of Marine Reserve Science: Readers Respond With Variety of Views. MPA News Seattle.
Hanna, S., C. Folke, K.-G. Mäler, and Beijer International Institute of Ecological Economics. 1996. Rights to nature : ecological, economic, cultural, and political principles of institutions for the environment. Island Press, Washington, D.C.
Hardin, G. 1968. The Tragedy of the Commons. Science **162**:1243-1248.
Harlow, L. L., S. A. Mulaik, and J. H. Steiger 1997. What if there were no significance tests? Lawrence Erlbaum Associates Publishers, Mahwah, New Jersey.
Harris, D. R. 1996. The origins and spread of agriculture and pastoralism in Eurasia. UCL Press, London.
Harrison, T. 1937. Savage Civilization. Alfred A. Knopf, New York.

Hart, O., and J. Moore. 1990. Property Rights and the Nature of the Firm. Journal of political economy **98**:1119.
Hassall, G. 2005. Conflict in the Pacific: challenges for governance. Pacific Economic Bulletin **20**:192-199.
Hayes, L. 2001. On Plantation Creek : a community history of the Australian South Sea Islanders in the Burdekin Shire. Burdekin Shire Council, Burdekin, Qld.
Henckel, T. 2006. Vanuatu's economy: is the glass half empty or half full? Pacific economic bulletin **21**.
Henry, G. 2009. Practical sampling. Pages xviii, 661 in L. Bickman, and D. J. Rog, editors. The SAGE handbook of applied social research methods. Sage, Los Angeles.
Hermann, B., and J. Bonnemaison 1975. New Hebrides. Publications Elysees, papeete-tahiti.
Hess, C., and E. Ostrom. 2003. Ideas, Artifacts, and Facilities: Information as a Common-Pool Resource. Law and Contemporary Problems **66**:111.
Hesse-Biber, S., P. Leavy, and P. Leavy 2006. Feminist research practice: A primer. Sage Pubns.
Hickey, F. R. 2001. Traditional Marine Resource Management in Vanuatu - Sacred & Profane: World views in transformation Pages 117-137 in N. Haggan, C. Brignall, and L. Wood, editors. Putting Fishers' Knowledge to Work. University of British Colombia, Fisheries Center.
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.
Hickey, F. R., and R. E. Johannes. 2002. Recent evolution of village-based marine resource management in Vanuatu. SPC Traditional Marine Resource Management and Knowledge Information Bulletin **14**:8-21.
Hilborn, R., and C. J. Walters 1992. Quantitative fisheries stock assessment : choice, dynamics and uncertainty. Chapman and Hall, New York.
Hills, R. 2008. Loru Rainforest Protected Area.
Hobsbawm, E. J., and T. O. Ranger 1992. The Invention of tradition. Cambridge University Press, Cambridge ; New York.
Hockings, M., and IUCN World Commission on Protected Areas. 2006. Evaluating effectiveness : a framework for assessing management effectiveness of protected areas. IUCN, Gland, Switzerland.
Holling, C. 1978. Adaptive environmental assessment and management. New York.
Holling, C. S., and G. K. Meffe. 1996. Command and Control and the Pathology of Natural Resource Management. Conservation Biology **10**:328-337.
Horwitz, T. 2002. Into the blue : boldly going where Captain Cook has gone before. Bloomsbury, London.
Houde, N. 2007. The six faces of traditional ecological knowledge: Challenges and opportunities for Canadian co-management arrangements. Ecology and Society **12**:17.
Howe, K. R. 1977. The fate of the'savage'in Pacific historiography. New Zealand Journal of History **11**:137-154.
Howitt, R., and S. Stevens. 2005. Cross-cultural research: ethics, methods, and relationships. Pages xxvii, 339 in I. Hay, editor. Qualitative research methods in human geography. Oxford University Press, South Melbourne, Vic.
Huffer, E., and G. Molisa. 1999. Governance in Vanuatu: in search of the Nakamal way. Page 16. State, Society and Governance in Melanesia Project. Australian National University, Research School of Pacific and Asian Studies Canberra, Australia,.
Hughes, H., and G. Sodhi. 2008. The bipolar Pacific Issue Analysis. The Center for Independent Studies Canberra.
Hughes, T. P., D. R. Bellwood, C. Folke, R. S. Steneck, and J. Wilson. 2005. New paradigms for supporting the resilience of marine ecosystems. Trends in Ecology & Evolution **20**:380-386.
Hunt, C. 1996. Property rights and environmental management on Pacific atolls. Economics **23**:6.

Hunt, D. 2007. Hunting the blackbirder. The Journal of Pacific History **42**:37-53.
Hviding, E. 1996. Guardians of Marovo Lagoon: practice, place, and politics in maritime Melanesia. University of Hawaii Press, Honolulu.
Hviding, E. 1998. Contextual flexibility: present status and future of customary marine tenure in Solomon Islands. Ocean & Coastal Management **40**:253-269.
Hviding, E. 2003a. Both sides of the beach: knowledges of nature in Oceania. Pages 245-276 in H. Selin, and A. Kalland, editors. Nature Across Cultures: Views of Nature and the Environment in Non-Western Cultures. Springer.
Hviding, E. 2003b. Contested rainforests, NGOs, and projects of desire in Solomon Islands. International Social Science Journal **55**:539-554.
Hviding, E. 2006. Knowing and managing biodiversity in the Pacific Islands: challenges of environmentalism in Marovo Lagoon. International Social Science Journal **58**:69-85.
Hyndman, D. 1993. Sea Tenure and the Management of Living Marine Resources in Papua New Guinea. Pacific Studies **16**:99-114.
Igoe, J. 2005. Global indigenism and spaceship earth: Convergence, space, and re-entry friction. Globalizations **2**:377-390.
Inglis, J. 1854. Report of a Missionary Tour in the New Hebrides. Journal of the Ethnological Society of London **3**:53-85.
Inglis, J. 1890. Bible illustrations from the New Hebrides: with notices of the progress of the mission. T. Nelson, London.
Israel, B., A. Schulz, E. Parker, and A. Becker. 1998. Review of community-based research: Assessing partnership approaches to improve public health. Annual Review of Public Health **19**:173-202.
Ivens, W. G. 1930. The island builders of the Pacific. Seeley Service, London.
IWP. 2006. Chief Manoa Kaun, helping to strengthen the management of Vanuatu's precious coastal fisheries in I. W. Project, editor, Apia, Samoa.
Jackson, J. 2008. Ecological extinction and evolution in the brave new ocean. Proceedings of the National Academy of Sciences **105**:11458.
James, G. 2006. Crab Bay Community Conserved Area, Vanuatu, South West Pacific. ICRAN, Port Vila, Vanuatu.
Jamond, J.-B. 1992. Mes souvenirs. Maison mariste, Port Vila.
Jarosz, L. 2004. Political ecology as ethical practice. Political Geography **23**:917-927.
Jayaraman, T. K., and B. D. Ward. 2006. Economic growth in a vulnerable island nation: an empirical study of the aid-growth nexus in Vanuatu Asia-Pacific Development Journal **13**:93-112.
Jennings, S., and N. V. C. Polunin. 1996a. Effects of fishing effort and catch rate upon the structure and biomass of Fijian reef fish communities. Journal of Applied Ecology **33**:400-412.
Jennings, S., and N. V. C. Polunin. 1996b. Fishing strategies, fishery development and socioeconomics in traditionally managed Fijian fishing grounds. Fisheries Management and Ecology **3**:335-347.
Jennings, S., J. D. Reynolds, and N. V. C. Polunin. 1999. Predicting the vulnerability of tropical reef fishes to exploitation with phylogenies and life histories. Conservation Biology **13**:1466-1475.
Jentoft, S. 2000. The community: a missing link of fisheries management. Marine Policy **24**:53-60.
Jentoft, S. 2005. Fisheries co-management as empowerment. Marine Policy **29**:1-7.
Jentoft, S., T. C. van Son, and M. Bjørkan. 2007. Marine Protected Areas: A Governance System Analysis. Human Ecology **35**:611-622.
Jepson, P. 2005. Governance and accountability of environmental NGOs. Environmental Science & Policy **8**:515-524.
Johannes, R., and F. Hickey. 2001. Evolution of village-based marine resource management in Vanuatu between 1993 and 2001. Report to the Environment and Development in Coastal Regions and in Small Islands Bureau. UNESCO.
Johannes, R. E. 1978. Traditional marine conservation methods in Oceania and their demise. Annual Review of Ecology and Systematics **9**:349-364.
Johannes, R. E. 1989. Traditional ecological knowledge : a collection of essays. IUCN The World Conservation Union, Gland, Switzerland ; Cambridge, U.K.

Johannes, R. E. 1998a. The case for data-less marine resource management: examples from tropical nearshore finfisheries. Trends in Ecology & Evolution **13**:243-246.
Johannes, R. E. 1998b. Government-supported, village-based management of marine resources in Vanuatu. Ocean & Coastal Management **40**:165-186.
Johannes, R. E. 2002a. Did Indigenous Conservation Ethic Exist? SPC Traditional Marine Resource Management and Knowledge Information Bulletin **14**:3-7.
Johannes, R. E. 2002b. The renaissance of community-based marine resource management. Annual Review of Ecology and Systematics **33**:317-340.
Johannes, R. E. 2003. Use and misuse of traditional ecological knowledge and management practices. Pages 111-126 in D. Dallmeyer, editor. Values at Sea: Ethics for the Marine Environment. University of Georgia Press Athens.
Johannes, R. E., M. M. R. Freeman, and R. J. Hamilton. 2000. Ignore fishers' knowledge and miss the boat. Fish and Fisheries **1**:257-271.
Johnston, P. 2005. Pacific Regional Energy Assessment 2004 – Vanuatu National Report. SPREP, Apia Aamoa.
Jolly, M. 1984. The Anatomy of Pig Love: Substance, Spirit and Gender in South Pentecost, Vanuatu. Canberra Anthropology **7**:78-108.
Jolly, M. 1996. " Woman Ikat Raet Long Human Raet O No?" Women's Rights, Human Rights and Domestic Violence in Vanuatu. Feminist Review:169-190.
Jolly, M. 2000. Specters of Inauthenticity. Pages 274-297 in D. L. Hanlon, and G. M. White, editors. Voyaging Through the Contemporary Pacific. Rowman & Littlefield, Lanham, MD.
Jolly, M., and N. Thomas. 1992. The politics of tradition in the Pacific. Oceania **Special Issue 62**.
Jones, P., and A. Carpenter. 2009. Crossing the divide: The challenges of designing an ecologically coherent and representative network of MPAs for the UK. Marine Policy.
Jones, P. J. S. 2001. Marine protected area strategies: issues, divergences and the search for middle ground. Reviews in Fish Biology and Fisheries **11**:197-216.
Jowitt, A. 2008. Reconceptualising labour markets in the South Pacific. Journal of South Pacific Law **6**:2002.
Kaiser, M. J. 2005. Are marine protected areas a red herring or fisheries panacea? Canadian Journal of Fisheries and Aquatic Sciences **62**:1194-1199.
Kamberelis, G., and G. Dimitriadis. 2005. Focus groups: Strategis articulations of pedagogy, politics and inquiry Pages xix, 1210 in N. K. Denzin, and Y. S. Lincoln, editors. The SAGE handbook of qualitative research. Sage Publications, Thousand Oaks.
Kaunda-Arara, B., and G. Rose. 2004. Effects of marine reef National Parks on fishery CPUE in coastal Kenya. Biological Conservation **118**:1-13.
Kearns, R. 2005. Knowing seeing? Undertaking observational research Pages xxvii, 339 in I. Hay, editor. Qualitative research methods in human geography. Oxford University Press, South Melbourne, Vic.
Keen, M., and S. Mahanty. 2006. Learning in sustainable natural resource management: Challenges and opportunities in the Pacific. Society & Natural Resources **19**:497-513.
Keesing, R. M. 1988. Melanesian Pidgin and the Oceanic Substrate. Stanford University Press.
Keesing, R. M., and R. Tonkinson 1982. Reinventing Traditional Culture: The Politics of Kastom in Island Melanesia. Anthropological Society of New South Wales.
Kelleher, G., C. Bleakley, and S. Wells. 1995. A Global Representative System of Marine Protected Areas. Vol I–IV. The Great Barrier Reef Marine Park Authority, The World Bank. The World Conservation Union (IUCN).
Kelly, C., editor. 1966. La Austrialia del Espiritu Santo : the journal of Fray Martin de Munilla O.F.M. and other documents relating to the voyage of Pedro Fernandez de Quirós to the South Sea (1605-1606) and the Franciscan Missionary Plan (1617-1627). Hakluyt Society, Cambridge.
Kemmis, S., and R. McTaggart. 2000. Participatory action research. Pages 567-606 in N. K. Denzin, and Y. S. Lincoln, editors. Handbook of qualitative research. Sage Publications, London.

Kenneth, D., A. Anderson, M. Prebble, E. Conte, and J. Southon. 2006. Prehistoric human impacts on Rapa, French Polynesia. Antiquity **80**:340(315).
Keys, E. 2005. Book Review: Political Ecology: An Integrative Approach to Geography and Environment-Development Studies. Annals of the Association of American Geographers **95**:227-230.
King, M., and U. Faasili. 1999. Community-based management of subsistence fisheries in Samoa. Fisheries Management and Ecology **6**:133-144.
King, P. 2007. Country Environmental Analysis. Mainstreaming Environmental Considerations in Economic and Development Planning Processes in Selected Pacific Developing Member Countries. Asian Development Bank Port Vila
Kirch, P. V. 1985. Feathered gods and fishhooks : an introduction to Hawaiian archaeology and prehistory. University of Hawaii Press, Honolulu.
Kirch, P. V. 1996. Lapita and its aftermath: the Austronesian settlement of Oceania. Pages 57-70 in W. H. Goodenough, editor. Prehistoric settlement of the Pacific. American Philosophical Society, Philadelphia.
Kirch, P. V. 1997. The Lapita peoples : ancestors of the oceanic world. Blackwell, Cambridge, Mass.
Kirch, P. V., and R. C. Green 2001. Hawaiki : ancestral Polynesia : an essay in historical anthropology. Cambridge University Press, Cambridge.
Kirch, P. V., and J.-L. Rallu 2007. The growth and collapse of Pacific Island societies : archaeological and demographic perspectives. University of Hawaii Press, Honolulu.
Kitzinger, J. 1994. The methodology of focus groups: the importance of interaction between research participants. Sociology of Health & Illness **16**:103-121.
Klee, G. A. 1985. Traditional marine resource management in the Pacific. Pages 193-202 in J. A. McNeely, and D. C. Pitt, editors. Culture and conservation : the human dimension in environmental planning. Croom Helm, London.
Klinsko. 2007. No copy kastom blong nara island. Vanuatu Daily Post, Port Vila
Knowlton, N., and J. B. C. Jackson. 2008. Shifting Baselines, Local Impacts, and Global Change on Coral Reefs. PLoS Biology **6**:e54.
Koontz, T. 2003. An Introduction to the Institutional Analysis and Development (IAD) Framework for Forest Management Research. First Nations and Sustainable Forestry: Institutional Conditions for Success" Workshop, University of British Columbia Faculty of Forestry, Vancouver, Canada.
Kronen, M., and A. Bender. 2007. Assessing Marine Resource Exploitation in Lofanga, Tonga: One Case Study—Two Approaches. Human Ecology **35**:195-207.
Kronen, M., E. Clua, B. McArdle, P. Labrosse, and N. Auckland. 2002. Use and Status of Marine Resources–A Complex System of Dependencies Between Man and Nature Case Studies from Tonga and Fiji, South Pacific. South Pacific Comission Noumea.
Kulbicki, M., N. Guillemot, and M. Amand. 2005. A general approach to length-weight relationships for New Caledonian lagoon fishes. Cybium **29**:235-252.
Kuper, A. 2003. The Return of the Native. Current Anthropology **44**:389-402.
Laffoley, D. 1995. Techniques for managing marine protected areas: zoning. Marine protected areas: Principles and techniques for management:103–118.
Lam, M. 1998. Consideration of customary marine tenure system in the establishment of marine protected areas in the South Pacific. Ocean & Coastal Management **39**:97-104.
Lane, M. B. 2006. Evaluating the governance of coastal resources and environments in Vanuatu. Technical Report IWP-Pacific (International Waters Project). SPREP, Apia, Samoa
Larcom, J. 1990. Custom by Decree: Legitimization crisis in Vanuatu in J. Linnekin, and L. Poyer, editors. Cultural Identity and Ethnicity in the Pacific. University of Hawaii Press, Honolulu.
Larmour, P., editor. 1997. The Governance of Common Property in the Pacific Region. National Centre for Development Studies, Australian Nation University, Canberra.
Lather, P. 1991. Getting smart: Feminist research and pedagogy with/in the postmodern. Routledge.

Lebot, V., R. Malapa, T. Molisale, and J. L. Marchand. 2006. Physico-chemical characterisation of yam (Dioscorea alata L.) tubers from Vanuatu. Genetic Resources and Crop Evolution **53**:1199-1208.
Lee, J. W., P. S. Jones, Y. Mineyama, and X. E. Zhang. 2002. Cultural differences in responses to a Likert scale. Research in nursing & health **25**.
Lester, S. E., and B. S. Halpern. 2008. Biological responses in marine no-take reserves versus partially protected areas. Marine Ecology Progress Series **367**:49-56.
Levin, S. A., and J. Lubchenco. 2008. Resilience, Robustness, and Marine Ecosystem-based Management. Bioscience **58**:27-32.
Lewin, K. 1946. Action research and minority problems. Journal of social issues **2**:34-46.
Library, N. 189-? Recruits, New Hebrides. National library of Australia
Likert, R. 1932. A Technique for the Measurement of Attitudes. Archives of Psychology **22**.
Lin, N. 2001. Building a network theory of social capital. Social capital: Theory and research:3-29.
Lindstrom, L. 2008. Melanesian Kastom and Its Transformations. Anthropological Forum **18**:161-178.
Lini, W. 1980. Beyond pandemonium : from the New Hebrides to Vanuatu. Asia Pacific Books, Wellington.
Linnekin, J. 1997. Contending approaches. Cambridge University Press, Cambridge, U.K.
Linnekin, J., and L. Poyer 1990. Cultural identity and ethnicity in the Pacific. University of Hawaii Press, Honolulu.
Locally-Managed Marine Area Network. 2003. Learning Framework of the Locally-Managed Marine Area Network LMMA Network Suva, Fiji.
Locke, H., and P. Dearden. 2005. Rethinking protected area categories and the new paradigm. Environmental Conservation **32**:1-10.
Loomba, A. 1998. Colonialism-postcolonialism. Routledge.
Low, N., and B. Gleeson 1998. Justice, Society and Nature: An Exploration of Political Ecology. Routledge.
Low, W., and E. Davenport. 2002. NGO capacity building and sustainability in the Pacific. Asia Pacific Viewpoint **43**:367-379.
Lowry, G., A. White, and P. Christie. 2009. Scaling up to networks of marine protected areas in the Philippines: Biophysical, legal, institutional, and social considerations. Coastal Management **37**:274-290.
Lubell, M., M. Schneider, J. Scholz, and M. Mete. 2002. Watershed partnerships and the emergence of collective action institutions. American Journal of Political Science:148-163.
Luzadis, V. A., K. M. Goslee, E. J. Greenfield, and T. D. Schaeffer. 2002. Toward a More Integrated Ecosystem Model. Society & Natural Resources **15**:89-94.
Lynch, J. 2000. South Efate phonological history. Oceanic Linguistics:320-338.
Lynch, J., and T. Crowley 2001. Languages of Vanuatu: A new survey and bibliography. Pacific Linguistics (Australian National University), Canberra.
MacDonald, J., and R. Mazany. 1984. Quality Improvement: Panacea for the Atlantic Fishing Industry? Canadian Public Policy/Analyse de Politiques:278-286.
Maguire, J., B. Neis, and P. Sinclair. 1995. What Are We Managing Anyway: The Need for an Interdisciplinary Approach to Managing Fisheries Ecosystems. Dalhousie Law Journal **18**:141.
Malinowski, B. 1922. Argonauts of the Western Pacific. Routledge & Kegan Paul, London.
Mangi, S., C. Roberts, and L. Rodwell. 2007. Reef fisheries management in Kenya: Preliminary approach using the driver–pressure–state–impacts–response (DPSIR) scheme of indicators. Ocean and Coastal Management **50**:463-480.
Mannino, M. A., and K. D. Thomas. 2002. Depletion of a resource? The impact of prehistoric human foraging on intertidal mollusc communities and its significance for human settlement, mobility and dispersal. World Archaeology **33**:452 - 474.
Marshall, M. N. 1996. The key informant technique. Pages 92-97. Family Practice. Oxford Univ Press.

Masang, E. 2000. Vanuatu Giant Clam Sanctuaries. Ministerial Conference on Environment and Development in Asia and the Pacific Kitakyushu, Japan.
Mascia, M. B. 2003. The Human Dimension of Coral Reef Marine Protected Areas: Recent Social Science Research and Its Policy Implications. Conservation Biology **17**:630-632.
Mascia, M. B. 2004. Social dimensions of marine reserves. Pages 164-186 in J. Sobel, and C. Dahlgren, editors. Marine reserves: a guide to science, design and use. Island Press.
Mascia, M. B., and C. A. Claus. 2009. A Property Rights Approach to Understanding Human Displacement from Protected Areas: the Case of Marine Protected Areas. Conservation Biology **23**:16-23.
McCay, B. 2002. Emergence of institutions for the commons: contexts, situations, and events. The drama of the commons:361–402.
McCay, B., and S. Jentoft. 1998. Market or Community Failure - Critical Perspectives on Common Property Research. Human Organization **57**:21-29.
McCay, B. J. 1996. Common and private concerns. Pages 111-126 in S. Hanna, C. Folke, and K. Maler, editors. Rights to Nature: Ecological, Economic, Cultural and Political Principles of Institutions for the Environment. Island Press, Washington, DC.
McCay, B. J., and J. M. Acheson 1987. The Question of the commons : the culture and ecology of communal resources. University of Arizona Press, Tucson.
McClanahan, T., J. Cinner, J. Maina, N. Graham, T. Daw, S. Stead, A. Wamukota, K. Brown, M. Ateweberhan, and V. Venus. 2008. Conservation action in a changing climate. Conservation Letters **1**:53-59.
McClanahan, T., J. Davies, and J. Maina. 2005a. Factors influencing resource users and managers' perceptions towards marine protected area management in Kenya. Environmental Conservation **32**:42-49.
McClanahan, T. R. 1999. Is there a future for coral reef parks in poor tropical countries. Coral Reefs **18**:321-325.
McClanahan, T. R., C. Abunge, J. Cinner, A. T. Kamukuru, and J. Ndagala. 2009. Management preferences, perceived benefits and conflicts among resource users and managers in the Mafia Island Marine Park, Tanzania. Environmental Conservation **35**:340-350.
McClanahan, T. R., N. A. J. Graham, J. M. Calnan, and M. A. MacNeil. 2007. Towards pristine biomass: reef fish recovery in coral reef marine protected areas in Kenya. Ecological Applications **17**:1055-1067.
McClanahan, T. R., J. Maina, and J. Davies. 2005b. Perceptions of resource users and managers towards fisheries management options in Kenyan coral reefs. Fisheries Management &# 38; Ecology **12**:105-112.
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**:1408-1413.
McEvoy, A. F. 1986. The fisherman's problem: ecology and law in the California fisheries, 1850-1980. Cambridge University Press, Cambridge.
McGinley, M. 2008. Islands and Protected Areas of the Gulf of California, Mexico. Isla **358**:358,000.
McGoodwin, J. R. 1990. Crisis in the World's Fisheries: People, Problems, and Politics. Stanford University Press, Stanford, California.
McKean, M. 2000. Common property: what is it, what is it good for, and what makes it work. Pages 27-55. People and forests: Communities, institutions, and governance.
McKean, M. A. 1992. Success on the Commons: A Comparative Examination of Institutions for Common Property Resource Management. Journal of Theoretical Politics **4**:247.
McPherson, J. 2003. Revisionist Historians. Perspectives **41**.
Mead, M. 1937. Cooperation and competition among primitive peoples. McGraw-Hill Book Company, New York ; London.
Meinzen-Dick, R. 2007. Beyond panaceas in water institutions. Proceedings of the National Academy of Sciences **104**:15200.

Meller, N., and R. Horwitz. 1971. Hawaii themes in land monopoly. Pages 25-44 in R. Crocombe, editor. Land tenure in the Pacific. Oxford University Press, Melbourne ; New York.
Meltzoff, S. K., Y. G. Lichtensztajn, and W. Stotz. 2002. Competing Visions for Marine Tenure and Co-Management: Genesis of a Marine Management Area System in Chile. Coastal Management **30**:85-99.
Melville, H. 1900. Typee, a narative of the Marquesas Islands. London Dent, London.
Melville, N., A. Stevens, R. K. Plice, and O. V. Pavlov. 2006. Unsolicited Commercial E-Mail: Empirical Analysis of a Digital Commons. International Journal of Electronic Commerce **10**:143-170.
Miles, W. F. S. 1998. Bridging mental boundaries in a postcolonial microcosm : identity and development in Vanuatu. University of Hawai`i Press, Honolulu.
Miller, J. G. 1978. Live: A history of church planting in Vanuatu. Committees on Christian Education and Overseas Missions of the General Assembly of the Presbyterian Church of Australia, [Sydney].
Minkler, M., and N. Wallerstein 2003. Community-Based Participatory Research Josey-Bass, San Francisco.
Moldofsky, L. 2001. A place in the sun despite the lingering power of kastom, women in Vanuatu are recognizing their worth and taking strides toward equality. Time International Port Vila
Monzier, M., C. Robin, and J.-P. Eissen. 1994. Kuwae ([approximate] 1425 A.D.): the forgotten caldera. Journal of Volcanology and Geothermal Research **59**:207-218.
Mora, C., S. Andrefouet, M. J. Costello, C. Kranenburg, A. Rollo, J. Veron, K. J. Gaston, and R. A. Myers. 2006. Ecology: Enhanced: Coral Reefs and the Global Network of Marine Protected Areas. Science **312**:1750-1751.
Mora, C., R. A. Myers, M. Coll, S. Libralato, T. J. Pitcher, R. U. Sumaila, D. Zeller, R. Watson, K. J. Gaston, and B. Worm. 2009. Management Effectiveness of the World's Marine Fisheries. PLoS Biology **7**:e1000131.
Morgan, D. L. 1997. Focus groups as qualitative research. SAGE publications Inc, New York.
Morrison, A. E., and D. J. Addison. 2008. Assessing the role of climate change and human predation on marine resources at the Fatu-ma-Futi site, Tutuila Island, American Samoa: an agent based model. Archaeology in Oceania **43**:22-34.
Mortensen, R. 2000. Slaving in Australian courts: Blackbirding cases, 1869-1871. Journal of South Pacific Law **4**.
Mosse, D. 1995. Authority, gender and knowledge: Theoretical reflections on Participatory Rural Appraisal. Economic and Political Weekly:569-578.
Mourgues, A. 2005. Republic of Vanuatu Environment Profile 2004. European Union, Port Vila.
Muehlig-Hofmann, A. 2007. Traditional authority and community leadership: Key factors in community-based marine resource management and conservation. SPC Traditional Marine Resource Management and Knowledge Information Bulletin **21**:31-44.
Mukherjee, N. 1993. Participatory rural appraisal: methodology and applications. Ceocept Pub. Co.
Munro, D. 1995. Review article: Revisionism and its enemies: Debating the queensland labour trade. The Journal of Pacific History **30**:240-249.
Myers, N. 2003. Biodiversity Hotspots Revisited. Bioscience **53**:916-917.
Myers, R. A., S. D. Fuller, and D. G. Kehler. 2000. A fisheries management strategy robust to ignorance: rotational harvest in the presence of indirect fishing mortality. Canadian Journal of Fisheries and Aquatic Sciences **57**:2357-2362.
NACCC. 2007. National Adaptation Programme for Action. National Advisory Committee on Climate Change, Port Vila
Nagaoka, L. 2005. Differential recovery of Pacific Island fish remains. Journal of Archaeological Science **32**:941-955.
Nari, R. 2000. Land tenure and resource management: a major challenge in Vanuatu. Pacific Economic Bulletin **15**:170-174.
Nelson, J., and R. Serafin. 1992. Assessing biodiversity: a human ecological approach. Ambio:212-218.

Neumann, R. P. 2008. Probing the (in)compatibilities of social theory and policy relevance in Piers Blaikie's political ecology. Geoforum **39**:728-735.
Newton, K., I. Côté, G. Pilling, S. Jennings, and N. Dulvy. 2007. Current and future sustainability of island coral reef fisheries. Current Biology **17**:655.
North, D. 1995. The new institutional economics and third world development. The new institutional economics and third world development:17–26.
Norton, R. 1993. Culture and identity in the South Pacific - A comparative analysis Man **28**:741-759.
Nunn, P. D. 2000. Environmental catastrophe in the Pacific Islands around AD 1 300. Geoarchaeology: An International Journal **15**:715-740.
Nunn, P. D., M. Baniala, M. Harrison, and P. Geraghty. 2006. Vanished islands in Vanuatu: new research and a preliminary geohazard assessment. Journal of the Royal Society of New Zealand **36**:37-50.
Nunn, P. D., and J. M. R. Britton. 2001. Human-Environment Relationships in the Pacific Islands around AD 1300. Environment and History **7**:3-22.
Nunn, P. D., T. Ishimura, W. R. Dickinson, K. Katayama, F. Thomas, R. Kumar, S. Matararaba, J. Davidson, and T. Worthy. 2007. The Lapita Occupation at Naitabale, Moturiki Island, Central Fiji. Asian Perspectives **46**:96.
Nygren, A., and S. Rikoon. 2008. Political Ecology Revisited: Integration of Politics and Ecology Does Matter. Society and Natural Resources **21**:767-782.
O'Connor, S., and P. Veth. 2005. Early Holocene shell fish hooks from Lene Hara Cave, East Timor establish complex fishing technology was in use in Island South East Asia five thousand years before Austronesian settlement. antiquity **79**:249-256.
Olson, M. 1965. The logic of collective action; public goods and the theory of groups. Harvard University Press, Cambridge, Mass.,.
Olson, M. 2002. Dictatorship, Democracy, and Development. Pages 130-144 in B. Kaushik, editor. Readings in Political Economy. Blackwell Publishing.
Oracion, E. G., M. L. Miller, and P. Christie. 2005. Marine protected areas for whom? Fisheries, tourism, and solidarity in a Philippine community. Ocean & Coastal Management **48**:393-410.
Ornelas, A. 1997. Pasantias and social participation: Participtory action-research as a way of life Pages xxii, 281 in S. E. Smith, D. G. Willms, and N. A. Johnson, editors. Nurtured by knowledge : learning to do participatory action-research. The Apex Press, New York.
Oskamp, S. 1965. Overconfidence in case-study judgments. Journal of consulting psychology **29**:261-265.
Ostrom, E. 1990. Governing the Commons: The evolution of institutions for collective action. Cambridge University Press, Cambridge.
Ostrom, E. 2000. Collective action and the evolution of social norms. The Journal of Economic Perspectives:137-158.
Ostrom, E. 2002. The drama of the commons. National Academy Press, Washington, DC.
Ostrom, E. 2007. Going Beyond Panaceas Special Feature: A diagnostic approach for going beyond panaceas. Proceedings of the National Academy of Sciences **104**:15181-15187.
Ostrom, E., J. Burger, C. B. Field, R. B. Norgaard, and D. Policansky. 1999. Revisiting the Commons: Local Lessons, Global Challenges. Science **284**:278-282.
Ostrom, E., R. Gardner, and J. Walker 1994. Rules, games, and common-pool resources. University of Michigan Press, Ann Arbor.
Ostrom, E., M. A. Janssen, and J. M. Anderies. 2007. Going beyond panaceas special feature: perspectives. Proceedings of the National Academy of Sciences **104**:15176-15178.
Ostrom, V., and E. Ostrom. 1977. Public goods and public choices. Page 145 p. in E. S. Savas, and Diebold Institute for Public Policy Studies., editors. Alternatives for delivering public services : toward improved performance. Westview Press, Boulder, Co.
Paavola, J., A. Gouldson, and T. Kluvankova-Oravska. 2009. Interplay of actors, scales, frameworks and regimes in the governance of biodiversity. Environmental Policy and Governance **19**.

Pacific Institute of Public Policy. 2008 Social and economic impact of introducing telecommunications throughout Vanuatu. PiPP, Port Vila.
Pahl-Wostl, C., M. Craps, A. Dewulf, E. Mostert, D. Tabara, and T. Taillieu. 2007. Social learning and water resources management. Ecology and Society **12**:5.
Palumbi, S. R. 2003. Population genetics, demographic connectivity, and the design of marine reserves. Ecological Applications **13**:S146-S158.
Panayotou, T. 1989. Comments on Kenneth Ruddle's "the organization of traditional inshore fishery management systems in the Pacific. Kluwer Academic Publishers, Dordrecht ; Boston.
Papworth, S. K., J. Rist, L. Coad, and E. J. Milner-Gulland. 2009. Evidence for shifting baseline syndrome in conservation. Conservation Letters **2**:93-100.
Parnaby, O. W. 1972. The labour trade. Pages 124-144 in R. G. Ward, editor. Man in the Pacific Islands : essays on geographical change in the Pacific Islands. Clarendon Press, Oxford.
Paton, J. 1892. The Story of John G. Paton told for young folks or Thirty years among South Sea cannibals. A.L. Burt Company, Glasgow.
Paton, M. 1894. Letters and skethes from the New Hebrides. Hodder and Stoughton, London.
Pauly, D. 1995. Anecdotes and the shifting baseline syndrome of fisheries. Trends in Ecology & Evolution **10**:430.
Pauly, D., V. Christensen, S. Guenette, T. J. Pitcher, U. R. Sumaila, C. J. Walters, R. Watson, and D. Zeller. 2002. Towards sustainability in world fisheries. Nature **418**:689-695.
Pauly, D., R. Watson, and J. Alder. 2005. Global trends in world fisheries: impacts on marine ecosystems and food security. Philosophical Transactions of the Royal Society B: Biological Sciences **360**:5-12.
Peet, R., and M. Watts 2004. Liberation Ecologies: Environment, Development, Social Movements. Routledge.
Perera, N., and A. de Vos. 2007. Marine Protected Areas in Sri Lanka: A Review. Environmental Management **40**:727-738.
Pérez-Ruzafa, A., C. Marcos, J. García-Charton, and F. Salas. 2008. European marine protected areas (MPAs) as tools for fisheries management and conservation. Journal for Nature Conservation **16**:187-192.
Peters, P. 1987. Embedded systems and rooted models. Pages 171-194 in McCay, and J. M. Acheson, editors. The Question of the Commons: The Culture and Ecology of Communal Resources. University of Arizona Press, Tuscon.
Peterson, G. 2000. Political ecology and ecological resilience:: An integration of human and ecological dynamics. Ecological Economics **35**:323-336.
Petro, G., F. R. Hickey, and K. Mackay. 2007. Leatherback Turtles in Vanuatu. Chelonian Conservation and Biology **6**:135-137.
Philibert, J.-M. 1992. Social change in Vanuatu. Pages 98-133 in A. B. Robillard, editor. Social change in the Pacific Islands. Kegan Paul International Ltd. , London.
Philibert, J. M. 1981. Living under two flags: selective modernization in Erakor village, Efate. Pages 315-333 in M. Allen, editor. Vanuatu: Politics, Economics, and Ritual in Island Melanesia. Academic Press, Sydney.
Philip, K. 2002. The quest for rural enterprise support strategies that work-the case of Mineworkers' Development Agency. Small Enterprise Development **13**:13-25.
Planes, S., G. Jones, and S. Thorrold. 2009. Larval dispersal connects fish populations in a network of marine protected areas. Proceedings of the National Academy of Sciences **106**:5693.
Pollnac, R. B., B. R. Crawford, and M. L. G. Gorospe. 2001. Discovering factors that influence the success of community-based marine protected areas in the Visayas, Philippines. Ocean and Coastal Management **44**:683-710.
Pollnac, R. B., and R. S. Pomeroy. 2005. Factors influencing the sustainability of integrated coastal management projects in the Philippines and Indonesia. Ocean & Coastal Management **48**:233-251.
Pollnac, R.B., and T. Seara 2010 Factors influencing success of marine protected areas in the Visayas, Philippines as related to increasing protected area coverage. Environmental Management DOI 10.1007/s00267-010-9540-0

Polunin, N. V. C. 1984. Do Traditional Marine "Reserves" Conserve? A View of Indonesian and New Guinean Evidence. Pages 267-284 in K. Ruddle, and T. Akimichi, editors. Maritime Institutions in the Western Pacific. National Museum of Ethnology, Osaka.
Polunin, N. V. C., and C. M. Roberts. 1993. Greater biomass and value of target coral-reef fishes in two small Caribbean marine reserves. Marine Ecology Progress Series **100**:167-176.
Pomeroy, R., and F. Douvere. 2008. The engagement of stakeholders in the marine spatial planning process. Marine Policy **32**:816-822.
Pomeroy, R. S., and F. Berkes. 1997. Two to tango: The role of government in fisheries co-management. Marine Policy **21**:465-480.
Pomeroy, R. S., B. M. Katon, and I. Harkes. 2001. Conditions affecting the success of fisheries co-management: lessons from Asia. Marine Policy **25**:197-208.
Pomeroy, R. S., J. E. Parks, and L. M. Watson. 2004. How is your MPA doing? A Guidebook of Natural and Social Indicators for Evaluating Marine Protected Area Management Effectiveness Page xvi + 216 pp. IUCN, Gland, Switzerland and Cambridge, UK.
Pomeroy, R. S., R. B. Pollnac, B. M. Katon, and C. Predo. 1997. Evaluating Factors Contributing to the Success of Community-Based Coastal Resource Management: The Central Visayas Regional Project-1, Philippines. Ocean and Coastal Management **36**:97-120.
Potter, L., and F. Majid Cooke. 2004. Introduction: Negotiating modernity, themes and ideas. Asia Pacific Viewpoint **45**:305-309.
Premdas, R. R., and J. S. Steeves. 1984. Vanuatu: The evolution of the administrative and political context of decentralization. Public Administration and Development **4**:231-248.
Pretty, J. 2003. Social Capital and the Collective Management of Resources. Science **302**:1912-1914.
Quantin, P. 1975. Soils of the New Hebrides islands. Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences (1934-1990) **272**:287-292.
Quiros, P. F. d. 1904a. V1: The voyages of Pedro Fernandez de Quiros 1595-1606. Hakluyt Society, London.
Quiros, P. F. d. 1904b. V2: The voyages of Pedro Fernandez de Quiros 1595-1606. Hakluyt Society, London.
Ragin, C. 2006. Set relations in social research: Evaluating their consistency and coverage. Political Analysis **14**:291-310.
Ragin, C. C. 2000. Fuzzy-set social science. University of Chicago Press, Chicago.
Ragin, C. C. 2008. Redesigning social inquiry : fuzzy sets and beyond. University of Chicago Press, Chicago.
Rahman, M. A. 1991. The theoretical standpoint of PAR in O. Fals-Borda, and M. A. Rahman, editors. Action and knolwedge: Breaking the monopoly with participatory action-research. Apex, New York.
Rapoport, A., and A. M. Chammah 1965. Prisoner's Dilemma. University of Michigan Press.
Ray, I. 2006. Outcomes and Processes in Economics and Anthropology. Economic Development and Cultural Change **54**:677-694.
Ray, S. H. 1887. Sketch of Nguna Grammar. The Journal of the Anthropological Institute of Great Britain and Ireland **16**:409-418.
Read, T. 2002. Navigating a new course : stories in community-based conservation in the Pacific Islands. United Nations Development Programme, New York.
Reason, P. 1994. Participation in human inquiry. Sage Pubns.
Reason, P., and H. Bradbury 2007. The SAGE handbook of action research: Participative inquiry and practice. Sage Pubns Ltd.
Redford, K. H. 1991. The ecologically noble savage. Cultural Survival Quarterly **15**:46.
Redford, K. H., and B. D. Richter. 1999. Conservation of Biodiversity in a World of Use. Conservation Biology **13**:1246-1256.

Reenberg, A., T. Birch-Thomsen, O. Mertz, B. Fog, and S. Christiansen. 2008. Adaptation of Human Coping Strategies in a Small Island Society in the SW Pacific—50 Years of Change in the Coupled Human–Environment System on Bellona, Solomon Islands. Human Ecology.
Regenvanu, R. 1997. Changing forestry regimes in Vanuatu: is sustainable management possible? The Contemporary Pacific **9**:73-96.
Regenvanu, R. 1999. Afterword, Vanuatu perspectives on research. Oceania **70**:98-100.
Regenvanu, R. 2008. Issues with land reform in Vanuatu. Journal of South Pacific Law **12**:63-67.
Reid, W., M. Assessment, F. Berkes, T. Wilbanks, and D. Capistrano 2006. Bridging scales and knowledge systems: concepts and applications in ecosystem assessment. Island Pr.
Reynolds, T. J., and J. P. Jolly. 1980. Measuring personal values: an evaluation of alternative methods. Journal of Marketing Research:531-536.
Rihoux, B., and C. C. Ragin 2009. Configurational comparative methods : qualitative comparative analysis (QCA) and related techniques. Sage, Thousand Oaks.
Robbins, P. 2004. Political ecology : a critical introduction. Blackwell Publishing, Malden, Mass.
Robbins, P., and K. M. Bishop. 2008. There and back again: Epiphany, disillusionment, and rediscovery in political ecology. Geoforum **39**:747-755.
Roberts, C., G. Branch, R. Bustamante, J. Castilla, J. Dugan, B. Halpern, K. Lafferty, H. Leslie, J. Lubchenco, and D. McArdle. 2003a. Application of ecological criteria in selecting marine reserves and developing reserve networks. Ecological Applications **13**:215-228.
Roberts, C. M. 2000. Selecting marine reserve locations: optimality versus opportunism. Bulletin of Marine Science **66**:581-592.
Roberts, C. M., S. Andelman, G. Branch, R. H. Bustamante, J. C. Castilla, J. Dugan, B. S. Halpern, K. D. Lafferty, H. Leslie, J. Lubchenco, D. McArdle, H. P. Possingham, M. Ruckelshaus, and R. R. Warner. 2003b. Ecological criteria for evaluating candidate sites for marine reserves [Review]. Ecological Applications **13**:S199-S214.
Roberts, C. M., and N. V. C. Polunin. 1991. Are marine reserves effective in management of reef fisheries? Reviews in Fish Biology and Fisheries **1**:65-91.
Rochet, M.-J., M. Prigent, J. A. Bertrand, A. Carpentier, F. Coppin, J.-P. Delpech, G. Fontenelle, E. Foucher, K. Mahe, E. Rostiaux, and V. M. Trenkel. 2008. Ecosystem trends: evidence for agreement between fishers' perceptions and scientific information. ICES Journal of Marine Science **65**:1057-1068.
Rodman, M. 1985a. Contemporary Custom: Redefining Domestic Space in Longana, Vanuatu Ethnology **24**:269-279.
Rodman, M. 1987. Masters of tradition : consequences of customary land tenure in Longana, Vanuatu. University of British Columbia Press, Vancouver.
Rodman, M. C. 1985b. Moving Houses: Residential Mobility and the Mobility of Residences in Longana, Vanuatu American Anthropologist **87**:56-72.
Rodrigues, A., H. R. AkÇAkaya, S. J. Andelman, M. I. Bakarr, L. Boitani, T. M. Brooks, J. S. Chanson, L. D. C. Fishpool, G. A. B. Da Fonseca, and K. J. Gaston. 2004. Global Gap Analysis: Priority Regions for Expanding the Global Protected-Area Network. Bioscience **54**:1092-1100.
Roe, D. 2000. Maritime, coastal and inland societies in Island Melanesia: The bush-saltwater divide in Solomon Islands and Vanuatu Pages 197-222 in J. Pasveer, and K. Alpin, editors. East of Wallace's Line: Studies of Past and Present Maritime Cultures of the Indo-Pacific region. Modern Quaternary Research. SE Asia. A.A.Balkema, Rotterdam.
Roe, D. 2008. The origins and evolution of the conservation-poverty debate: a review of key literature, events and policy processes. Oryx **42**:491-503.
Rose, J. 2008. Community-Based Biodiversity Conservation in the Pacific: Cautionary Lessons in "Regionalizing" Environmental Governance Pages 193-226 in M. I. Jeffery, J. M. Firestone, and K. Bubna-Litic, editors. Biodiversity Conservation, Law, and Livelihoods: Bridging the North-South Divide. Cambridge University Press.

Ruckelshaus, M., T. Klinger, N. Knowlton, and D. P. DeMaster. 2008. Marine Ecosystem-based Management in Practice: Scientific and Governance Challenges. Bioscience **58**:53-63.
Rudd, M. A. 2004. An institutional framework for designing and monitoring ecosystem-based fisheries management policy experiments. Ecological Economics **48**:109-124.
Ruddle, K. 1989. The organization of traditional inshore fishery management systems in the Pacific. Kluwer Academic Publishers, Dordrecht ; Boston.
Ruddle, K. 1994. Local Knowledge in the Folk Management of Fisheries and Coastal Marine Environments. Pages 139-160 in C. L. Dyer, and J. R. McGoodwin, editors. Folk Management in the World's Fisheries: Lessons for Modern Fisheries Management. University Press of Colorado, Niwot.
Ruddle, K. 1998. The context of policy design for existing community-based fisheries management systems in the Pacific Islands. Ocean & Coastal Management **40**:105-126.
Ruddle, K., and F. Hickey. 2008. Accounting for the mismanagement of tropical nearshore fisheries. Environment, Development and Sustainability **10**:565-589.
Ruddle, K., E. Hviding, and R. E. Johannes. 1992. Marine Resource Management in the Context of Customary Marine Tenure. Marine Resource Economics **7**:249-273.
Russ, G. R., and A. C. Alcala. 1998a. Natural fishing experiments in marine reserves 1983-1993: Roles of life history and fishing intensity in family responses. Coral Reefs **17**:399-416.
Russ, G. R., and A. C. Alcala. 1998b. Natural fishing experiments in marine reserves 1983–1993: community and trophic responses. Coral Reefs **17**:383-397.
Russ, G. R., and A. C. Alcala. 2004. Marine reserves: long-term protection is required for full recovery of predatory fish populations. Oecologia **138**:622-627.
Russ, G. R., and D. C. Zeller. 2003. From Mare Liberum to Mare Reservarum. Marine Policy **27**:75-78.
Ruttan, L. M. 1998. Closing the commons: cooperation for gain or restraint? Human Ecology **26**:43-66.
Sadovy, Y., and M. Domeier. 2005. Are aggregation-fisheries sustainable? Reef fish fisheries as a case study. Coral Reefs **24**:254-262.
Sale, P. F., R. K. Cowen, B. S. Danilowicz, G. P. Jones, J. P. Kritzer, K. C. Lindeman, S. Planes, N. V. C. Polunin, G. R. Russ, Y. J. Sadovy, and R. S. Steneck. 2005. Critical science gaps impede use of no-take fishery reserves. Trends in Ecology & Evolution **20**:74-80.
Sampson, R., J. Morenoff, and F. Earls. 1999. Beyond social capital: Spatial dynamics of collective efficacy for children. American Sociological Review:633-660.
Sand, C., J. Bole, and A. Ouetcho. 2002. Site LPO023 of Kurin: Characteristics of a Lapita Settlement in the Loyalty Islands (New Caledonia). asian perspectives **41**:130.
Sandelowski, M. 1986. The problem of rigor in qualitative research. Advances in Nursing Science **8**:27-37.
Sandler, T. 1992. Collective action : theory and applications. University of Michigan Press, Ann Arbor.
Saunders, K. 1979. 'The middle passage?'conditions on the labour vessels from Queensland to Melanesia, 1863–1907. Journal of Australian Studies **3**:38-49.
Scarr, D. 1967. Fragments of empire : a history of the Western Pacific High Commission, 1877-1914. Australian University Press, Canberra.
Scarr, D., and J. W. Davidson 1970. Pacific Islands portraits. Australian National University Press, Canberra.
Schischka, J., P. Dalziel, and C. Saunders. 2008. Applying Sen's Capability Approach to Poverty Alleviation Programs: Two Case Studies. Journal of Human Development **9**:229-246.
Schlager, E. 1999. A comparison of frameworks, theories, and models of policy processes. Pages 233-260 in P. Sabatier, editor. Theories of the policy process. Westview Press, Boulder, CO.
Schmidt, L. 2000. Shellfish collection strategies in the Vanuatu islands in D. o. A. a. N. History, editor. Research School of Pacific and Asian Studies: ANU, Canberra.

Schütz, A. J. 1969a. Nguna grammar. University of Hawaii Press, [Honolulu].
Schütz, A. J. 1969b. Nguna texts: a collection of traditional and modern narratives from the central New Hebrides. University of Hawaii Press, [Honolulu].
Scoones, I. 1999. New ecology and the social sciences: What prospects for a fruitful engagement? Annual Review of Anthropology **28**:479-507.
Seipel, M. 2003. Assessing Publication for Tenure. Journal of Social Work Education **39**:79-89.
Selden, J. 1652. *Mare Clausum (On the Dominion of Ownership of the Sea)*. William Du-Gard, for Council of State, London.
Selener, D. 1997. Participatory action research and social change. Cornel university, Ithaca NY.
Siegel, J. 1998. Substrate reinforcement and dialectal differences in Melanesian Pidgin. Journal of Sociolinguistics **2**:347-373.
Sillitoe, P. 1998. An introduction to the anthropology of Melanesia : culture and tradition. Cambridge University Press, Cambridge ; New York.
Smith, L. T. 1999. Decolonizing methodologies: Research and indigenous peoples. Zed Books.
Smith, L. T. 2005. On tricky ground: researching the Native in the age of uncertainty Page 85 in N. K. Denzin, and Y. S. Lincoln, editors. The SAGE handbook of qualitative research. Sage Publications, Thousand Oaks.
Smith, S. E., D. G. Williams, and N. A. Johnson 1997. Nurtured by knowledge : learning to do participatory action-research. The Apex Press ; International Development Research Centre, New York.
Speak, Y. P. 2008. Vanuatu's new kastom school Vanuatu Daily Post Port Vila Wednesday 27 February 2008.
Speiser, F., and D. Q. Stephenson 1990. Ethnology of Vanuatu : an early twentieth century study. Crawford House Press, Bathurst, N.S.W.
Spriggs, M. 1997. The Island Melanesians. Blackwell, Oxford, UK.
Steadman, D. W. 1989. Extinction of birds in Eastern Polynesia: A review of the record, and comparisons with other Pacific Island groups. Journal of Archaeological Science **16**:177-205.
Steadman, D. W., A. Plourde, and D. V. Burley. 2002. Prehistoric butchery and consumption of birds in the Kingdom of Tonga, South Pacific. Journal of Archaeological Science **29**:571-584.
Steel, R. 1880. The New Hebrides and Christian Missions: Notes of a cruise through the group in the mission vessel. James Nisbet & Co., London.
Stephens, H. M., and H. E. Bolton. 1917. The Pacific Ocean in histroy. Panama-Pacific Historical Congress. The Macmillan Company, San Francisco.
Stern, P. C., T. Dietz, N. Dolsak, E. Ostrom, and S. Stonich. 2002. Knowledge and questions after 15 years of research. Pages 445-490 in E. Ostrom, editor. Drama of the Commons National Research Council New York.
Stewart-Oaten, A., W. Murdoch, and K. Parker. 1986. Environmental Impact Assessment:" Pseudoreplication" in Time? Ecology:929-940.
Stoecker, R. 1999. Are academics irrelevant? Roles for scholars in participatory research. The American behavioral scientist **42**:840.
Stoecker, R., and E. Bonacich. 1992. Why participatory research? Guest editors' introduction. The American Sociologist **23**:5-14.
Strauss, A., and C. J. 1998. Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory. Sage, London.
Sullivan, M., A. Kone, K. D. Senturia, N. J. Chrisman, S. J. Ciske, and J. W. Krieger. 2001. Researcher and researched-community perspectives: toward bridging the gap. Health Education & Behavior **28**:130.
Sutton, S. G. 2007. Constraints on recreational fishing participation in Queensland, Australia. Fisheries(Bethesda, Md.) **32**:73-83.
Swadling, P. 1986. Lapita shellfishing: evidence from sites in the Reef/Santa Cruz Group, Southeast Solomons. Pages 137-148 in A. Anderson, editor. Traditional fishing in the Pacific: ethnographical and archaeological papers from the 15th Pacific Science Congress. Bernice Pauahi Bishop Museum, Honolulu.

Tacconi, L. 1997. Property rights and participatory biodiversity conservation: lessons from Malekula Island, Vanuatu. Land Use Policy **14**:151-161.
Tacconi, L. 2000. Forest Resources Assessment Working Paper 051. Page 306 in FAO., editor. Data Collection for the Pacific Region Rone
Tanner, A. 2007. On Understanding Too Quickly: Colonial and Postcolonial Misrepresentation of Indigenous Fijian Land Tenure. Human Organization **66**:69-77.
Tari, T. 2002. Pacific Asia: Vanuatu in B. Bhandari, O. Abe, M. Takahashi, and A. Nakahata, editors. The Path to Success: "Some pioneering examples of Environmental Education". IGES, Japan.
Tarisesei, J., and I. Novaczek. 2005. Gender, Generational Perceptions And Community Fisheries Management In Lelepa, North Efate, Vanuatu in I. Novaczek, J. Mitchell, and J. Vietayaki, editors. Pacific Voices: Equity and Sustainability in Pacific Island Fisheries. University of the South Pacific; Institute of Pacific Studies Suva.
Taurakoto, P. 1984. Customary rights to reefs and landings. Pages 14-16 in H. Alatoa, editor. Land tenure in Vanuatu. University of the South Pacific, Suva, Fiji.
Techera, E. J. 2005. Protected Area Management in Vanuatu. Macquarie Journal of International and Comparative Environmental Law **2**:107-119.
Tedlock, B. 1991. From Participant Observation to the Observation of Participation: The Emergence of Narrative Ethnography. Journal of Anthropological Research **47**:69-94.
Thieberger, N., and C. Ballard. 2008. Daniel Macdonald and the “Compromise Literary Dialect” in Efate, Central Vanuatu. Oceanic Linguistics **47**:365-382.
Thomas, A. Language planning in Vanuatu Pages 234-258. Language planing and education in Australasia and the South Pacific. Multilingual Matters, 1990.
Thomas, F. R., P. D. Nunn, T. Osborne, R. Kumar, F. Areki, S. Matararaba, D. Steadman, and G. Hope. 2004. Recent Archaeological Findings at Qaranilaca Cave, Vanuabalavu Island, Fiji. Archaeology in Oceania **39**:42-50.
Thomas, N. 1992. The Inversion of Tradition. American Ethnologist **19**:213-232.
Thomas, N. 2000. David Darling: Tapu and Conceit in the Marquesas. Pages 233-243 in N. Thomas, V. Smith, and J. Lamb, editors. Exploration & exchange : a South Seas anthology, 1680-1900. University of Chicago Press, Chicago.
Tippett, A. R. 1987. Introduction to missiology. William Carey Library, Pasadena, CA.
Tom’Tavala, Y. D., and M. T. Hakwa 2004. Review of environmental legislation and policies in Vanuatu. South Pacific Regional Environment Program (SPREP) Apia, Samoa.
Tonkin, E. 1992. Narrating our pasts : the social construction of oral history. Cambridge University Press, Cambridge ; New York.
Tonkinson, R. 1982. National identity and the problem of kastom in Vanuatu. In The politics of kastom in Island Melanesia. Mankind **13**:306-315.
Tonkinson, R. 1985. Forever Ambrymese? Identity in a relocated community, Vanuatu. Pacific Viewpoint **26**:139-159.
Trompf, G. W. 1989. Macrohistory and Acculturation: Between Myth and History in Modern Melanesian Adjustments and Ancient Gnosticism. Comparative Studies in Society and History **31**:621-648.
Turnbull, J. 2004. Explaining complexities of environmental management in developing countries: lessons from the Fiji Islands. The Geographical Journal **170**:64-77.
Turner, G. 1861. Nineteen years in Polynesia: missionary life, travels, and researches in the islands of the Pacific. J. Snow, London.
Turner, R., A. Cakacaka, N. Graham, N. Polunin, M. Pratchett, S. Stead, and S. Wilson. 2007. Declining reliance on marine resources in remote South Pacific societies: ecological versus socio-economic drivers. Coral Reefs **26**:997-1008.
Underwood, A. 1992. Beyond BACI: The Detection of Environmental Impacts on Populations in the Real, but Variable, World. Journal of Experimental Marine Biology and Ecology **161**:145-178.
Underwood, A. 1994. On beyond BACI: sampling designs that might reliably detect environmental disturbances. Ecological Applications:4-15.

UNDP. 2005. Republic of Vanuatu – Millennium Development Goals Report. United Nations Development Programme, New York.
Urdal, H. 2005. People vs. Malthus: Population Pressure, Environmental Degradation, and Armed Conflict Revisited. Journal of Peace Research **42**:417.
Valderrama, D., and J. L. Anderson. 2007. Improving utilization of the Atlantic Sea Scallop resource: An analysis of rotational management of fishing grounds. Land Economics **83**:86-103.
Van Trease, H., and USP. 1987. The politics of land in Vanuatu : from colony to independence. Institute of Pacific Studies of the University of the South Pacific, [Suva, Fiji].
Vansina, J. 2006. Oral tradition : a study in historical methodology. Aldine Transaction, New Brunswick, N.J.
Vanuatu Environment Unit. 1999. National Biodiversity Conservation Strategy Port Vila
Vanuatu Environment Unit. 2007. Socioeconomic study of the Crab Bay villages of Central Malekula, Vanuatu in SPREP, editor. IWP- Pacific technical report 1818-5614. SPREP, Apia, Samoa.
Vaske, J. J. 2002. Communicating Judgments About Practical Significance: Effect Size, Confidence Intervals and Odds Ratios. Human Dimensions of Wildlife **7**:287 - 300.
Vayda, A. P. 1983. Progressive contextualization: Methods for research in human ecology. Human Ecology **11**:265-281.
Vayda, A. P. 1987. Reply to Harris. Human Ecology **15**:519-521.
Vayda, A. P., and B. B. Walters. 1999. Against Political Ecology. Human Ecology **27**:167-179.
Veitayaki, J. 1997. Traditional marine resource management practices used in the Pacific Islands: an agenda for change. Ocean & Coastal Management **37**:123-136.
Veitayaki, J. 2003. Mainstreaming Resource Conservation: The Fiji Locally Managed Marine Area Network and Its Influence on National Policy Development. Australian National University, Canberra.
Vitousek, P. M., H. A. Mooney, J. Lubchenco, and J. M. Melillo. 1997. Human Domination of Earth's Ecosystems. Science **277**:494-499.
Wade, R. 1988. Village republics : economic conditions for collective action in South India. Cambridge University Press, Cambridge [Cambridgeshire] ; New York.
Wagner, J., and M. Talakai. 2007. Customs, Commons, Property, and Ecology: Case Studies From Oceania. Human Organization **66**:1-10.
Walker, P. A. 2005. Political ecology: where is the ecology? Progress in Human Geography **29**:73-82.
Walters, C. J. 1986. Adaptive management of renewable resources. Collier Macmillan, New York.
Walther, G. R., E. Post, P. Convey, A. Menzel, C. Parmesan, T. J. C. Beebee, J. M. Fromentin, O. Hoegh-Guldberg, and F. Bairlein. 2002. Ecological responses to recent climate change. Nature **416**:389-395.
Ward, R. G., and E. Kingdon 1995. Land, Custom and Practice in the South Pacific. Cambridge University Press.
Warren, D. 1995. Comments on article by Arun Agrawal. Indigenous Knowledge and Development Monitor **4**:13.
Wawn, W. T. 1893. The South Sea Islanders and the Queensland Labour Trade: A Record of Voyages and Experiences in the western Pacific, from 1875 to 1891. S. Sonnenschein & Co., London.
Weber, J. M., S. Kopelman, and D. M. Messick. 2004. A Conceptual Review of Decision Making in Social Dilemmas: Applying a Logic of Appropriateness. Personality and Social Psychology Review **8**:281.
Weisbrot, D. 1989. Custom, pluralism and realism in Vanuatu: legal development and the role of customary law. Pacific Studies **13**:65-97.
West, P., and D. Brockington. 2006. An Anthropological Perspective on Some Unexpected Consequences of Protected Areas. Conservation Biology **20**:609.
West, P., J. Igoe, and D. Brockington. 2006. Parks and Peoples: The Social Impact of Protected Areas. Annual Review of Anthropology **35**:251.

White, G. M., and L. C. Lindstrom 1990. The Pacific theater : island representations of World War II. Melbourne University Press, Carlton, Vic.
White, G. M., and L. C. Lindstrom 1997. Chiefs today : traditional Pacific leadership and the postcolonial state. Stanford University Press, Stanford, Calif.
Whyte, F. W., D. J. Greenwood, and P. Lazes. 1989 Participatory Action Research: Through Practice to Science in Social Research. The American behavioral scientist **32**:513.
Wilkinson, C. R. 1999. Global and local threats to coral reef functioning and existence: review and predictions. Marine & Freshwater Research **50**:867-878.
Williams, A. J., B. D. Mapstone, and C. R. Davies. 2007. Spatial and interannual patterns in growth of an exploited coral-reef fish. Journal of Fish Biology **71**:970-992.
Williams, I. D., W. J. Walsh, A. Miyasaka, and A. M. Friedlander. 2006. Effects of rotational closure on coral reef fishes in Waikiki-Diamond Head Fishery Management Area, Oahu, Hawaii. Marine Ecology Progress Series **310**:139-149.
Williams, T., and J. Calvert 1859. Fiji and the Fijians. D. Appleton and Company, New York.
Wittbecker, A. E. 1986. Deep Anthropology: Ecology and Human Order. Environmental Ethics **8**:261-270.
Witter, J. B., and S. Self. 2007. The Kuwae (Vanuatu) eruption of AD 1452: potential magnitude and volatile release. Bulletin of Volcanology **69**:301-318.
Wittersheim, E. 1998. Melanesian élites and Modern Politics in New Caledonia and Vanuatu in R. S. o. P. a. A. Studies, editor. Australian National University, Canberra.
Wolf, E. 1972. Ownership and political ecology. Anthropological Quarterly **45**:201-205.
Wolford, W. 2005. Book Review: Political Ecology: A Critical Introduction. Annals of the Association of American Geographers **95**:717-719.
Wongbusarakum, S., and R. S. Pomeroy. 2008. SEM-Pasifika, Socioeconomic Monitoring Guidelines for Coastal Managers in Pacific Island Countries. NOAA/SPREP.
Wood, L. J., L. Fish, J. Laughren, and D. Pauly. 2008. Assessing progress towards global marine protection targets: shortfalls in information and action. Oryx **42**:340-351.
Worm, B., E. Barbier, N. Beaumont, J. Duffy, C. Folke, B. Halpern, J. Jackson, H. Lotze, F. Micheli, and S. Palumbi. 2006. Impacts of biodiversity loss on ocean ecosystem services. Science **314**:787-790.
Wright, A. 1985. Marine Resource Use in Papua New Guinea: Can Traditional Concepts and Contemporary Development be Integrated. Pages 53-77 in K. Ruddle, and R. E. Johannes, editors. The Traditional Knowledge and Management of Coastal Systems in Asia and the Pacific. UNESCO, Jakarta Pusat, Indonesia.
Wright, A., and L. Hill 1993. Nearshore Marine Resources of the South Pacific: Information for Fisheries Development and Management. University of the South Pacific.
Young, O., G. Osherenko, J. Ekstrom, L. Crowder, J. Ogden, J. Wilson, J. Day, F. Douvere, C. Ehler, and K. McLeod. 2007. Solving the crisis in ocean governance: Place-based management of marine ecosystems. Environment: Science and Policy for Sustainable Development **49**:20-32.
Zeller, D., S. Booth, P. Craig, and D. Pauly. 2006. Reconstruction of coral reef fisheries catches in American Samoa, 1950–2002. Coral Reefs **25**:144-152.