WAVES OF CHANGE: POLITICS, ONTOLOGIES, AND THE STRUGGLE FOR ACCEPTABLE MARINE MANAGEMENT IN MOOREA, FRENCH POLYNESIA

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Chelsea E. Hunter

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Waves of Change: Politics, Ontologies, and the Struggle for Acceptable Marine Management in Moorea, French Polynesia

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DEDICATION

This thesis is dedicated to the ocean, transcendent in space, time, and memory, a provider and an intimidator, and to all of the people who live along its shores and depend upon its existence.

"Conservation is getting nowhere because it is incompatible with our Abrahamic concept of land. We abuse the land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect. There is no other way for land to survive the impact of mechanized man."
- Aldo Leopold, *A Sand County Almanac*

"The family, a house, fishing, enough for everyone to eat, music and dancing; it is all that is necessary to live in Tahiti."
- Renée Roosevelt Denis, *To Live in Paradise*

ABSTRACT OF THE THESIS

Waves of Change: Politics, Ontologies, and the Struggle for
Acceptable Marine Management in Moorea, French Polynesia
by
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This thesis, through two distinct, yet interrelated and contingent main chapters (Chapters Four and Five), explores peoples' relationships to marine environments in Moorea and the implications of these relationships for marine management. Chapter Four combines household survey data with key informant interviews to suggest how adaptive co-management may be a more suitable and more widely accepted form of marine governance in Moorea. I argue that an already demonstrated interest by fisherfolk in managing marine resources creates a suitable climate for co-management arrangements to occur. However, the management regime should focus on shared goals in order to overcome and work with preexisting conflicts over management practices in Moorea. In Chapter Five, I use a mixed methods approach to explore how stakeholders on the island of Moorea, differentially and correspondingly 'value' specific ecosystem goods and services of the marine environment, focusing on 'cultural' values. I analyze the quantitative portion of these results using geometric data analysis (GDA), arguing that GDA provides a more suitable method for investigating the heterogeneity of social perceptions and attitudes. My interpretation of these results is supported by the qualitative data I collected. The main findings include, 1) that all stakeholders view education as a gateway to more environmentally responsible behavior, though definitions of education differ, 2) that all stakeholders view economic gain to be antithetical to environmental health, and 3) that there is a tension between Tahitians desire to continue fishing and their desire to conserve fisheries. I implement an ontological anthropological framework to understand how differences in marine stakeholder's valuations, reflect their multiple ways of existing in the world. I argue that, fundamentally, environmental management efforts need to take into consideration these ways of being in order to be effective. In sum, the arguments made in this thesis demonstrate the importance of acknowledging difference and harnessing multiple ways of being to create more effective marine management decisions, especially in highly threatened ecosystems such as the coral reefs of Moorea represent.

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Now that I have already rambled on too long, I of course have to acknowledge my cohort for their role in challenging me and providing healthy environments for discussion and critical thinking throughout our seminars together. Mark Strother and Ashley Bunnell who I worked in Moorea with were also of fundamental importance in aiding my analyses of certain topics and for teaching me all they had learned in Moorea prior to my first trip to the island. Finally, many thanks to my twin, Christine Hunter and dearest of friends Marissa Lampert for patiently hearing me out when I needed to talk out loud about my research regardless of whether they cared to listen or not. Also, many thanks to Robert Stewart, of the Coffee Method, for keeping me adequately caffeinated (and thus motivated) with the highest quality espresso while writing both my thesis proposal and the thesis itself. Finally, many many thanks to my mother and father for pushing me to go to college, for not haranguing me for choosing to study the most ‘impractical’ of disciplines, for encouraging me to go after what I am passionate about, and for providing a source of inspiration (and financial aid) for me to do so. Mic Drop.

CHAPTER 1

INTRODUCTION

It was a windy Saturday morning as I mounted my bike to ride the 16 km north to Papetoai from where my house was located in Vaianae, a community of southern Haapiti. I had arrived in Moorea the previous Thursday. I was happy to finally be going to see my research assistant, partner, translator, counterpart, and comrade, Pam, in order to review our research goals and the survey I designed for this years' field season. We were both ecstatic. To see each other and to have another summer together conducting research we are both passionate about. After thoroughly discussing our personal and professional activities over the last year and our plans for this summer, we went to her parent's house. We shared food. Her parents were simmering *pahua* (Pacific Giant Clam, *Tridacna gignas*) and *ma'oa taratoni* (Green Turban, *Turbo marmoratus*) in coconut milk – a favored Tahitian dish – in preparation for the special Sunday meals that bring together families and friends together over food. Many of these dishes are oriented around seafood; shellfish and lagoon fish representing important Sunday foods that are classed as Tahitian. Pam's parents asked me several times if I would like to take some *pahua* and *ma'oa* home with me before I finally accepted. After accepting, they offered me more *pahua* and *taioro*. Subsequently, they offered me fresh fruits from the trees surrounding their house. Their generosity was overwhelming. I finally escaped the offers for food as I had began preparing to leave for the 16 km bicycle ride ahead of me. Gray clouds were rolling in, signaling rain, forming dense layers that surround the high mountain peaks that constitute the island's interior. Pam and I joked about how a good friend is one who continues to offer more and more food to another. I left joyful. Happy at again having seen my friend and filled with the significance of how important the sharing of food is as a means to show caring and affection in Moorea.

In Moorea, the lagoons that surround the island are an important part of people's daily lives, as a 'refrigerator' that stores important foods classed as Tahitian, as a site of

recreation, and as an economic opportunity. The numerous values that coral reefs hold stems from both tangible and non-tangible goods and services (Moberg and Folke 1999). Coral reefs are noted for their high levels of biodiversity (Moberg and Folke 1999), being comparable to tropical forests on land as the most bio-diverse of marine environments (Castri 2002, 16). Reefs hold numerous values for local populations, serving as subsistence and economic fisheries (Fabinyi 2012; Hicks, Graham, and Cinner 2013; Laurans et al. 2013; Segi 2013, 2014; Walley 2004), as sites of cultural heritage (Castri 2002; Hicks, Graham, and Cinner 2013; Laurans et al. 2013; O'Garra 2009; Walley 2004), as sites for education (Hicks, Graham, and Cinner 2013; Hicks et al. 2015; Segi 2013), and as tourism attractions (Brander, Van Beukering, and Cesar 2007; Fabinyi 2012; Kahn 2011; Segi 2014). The connectivity of ocean ecosystems allows for their ecosystem goods and services to benefit both local and global populations aided through transnational markets (Moberg and Folke 1999). Undoubtedly, there is some tension present between the diverse interests in and uses of coral reefs, in the ways that people find reefs and their resources to be important. Value(s) are contested in diverse social contexts due to people's differing motivations (Eiss and Pedersen 2002). Brander, Van Beukering, and Cesar (2007), make the argument that the recreational and tourism values of coral reefs are their most valuable asset. While for island inhabitants throughout the South Pacific, coral reefs are a fundamental source of non-substitutable protein (Laurans et al. 2013). In Polynesia, especially, do coral reefs and their resources house special significance due to the historical relationship with ocean environments through the sea-faring and marine-centric culture of Polynesian peoples.

1.1 AVOIDING CRISES? THE SIGNIFICANCE OF THE STUDY

Coral reefs worldwide are facing increased chronic and acute stressors that, when combined, have detrimental effects on reef health, resulting in phase shifts from dominant coral reef cover to a macroalgae composition (Bellwood et al. 2004; Hughes et al. 2010; Trapon, Pratchett, and Penin 2011). Coral reefs face two types of stressors, slow and chronic stressors (such as pollution) and rapid/acute stressors (e.g. cyclones, bleaching events, and *A. planci* breakouts) (Hughes et al. 2010; Trapon, Pratchett, and Penin 2011). Anthropogenic stressors, include increased human populations living on shorelines, deforestation, and intensive agriculture and the increased nutrient and sediment loads reefs receive due to these

phenomena (Moberg and Folke 1999). Reefs have the capacity to adapt to and deal with chronic stressors through time, however, if they concomitantly experiences an acute stressor, it can have disastrous effects (Hughes et al. 2010; Trapon, Pratchett, and Penin 2011). The ability for reefs to adapt to chronic and acute drivers of change is relatively poorly understood. This understanding is complicated by regional variations in reef resilience that hinge on floral and faunal composition, reef structure, anthropogenic uses of reefs, and the historical and current stressors that a reef faces.

Natural disasters, such as cyclones, *Acanthaster Planci* outbreaks, bleaching events, and climate change can cause intense change in reefs when coupled with chronic anthropgenic stress, such as pollution (Bellwood et al. 2004; Hughes et al. 2010; Trapon, Pratchett, and Penin 2011). The increasing prevalence of phase-shifts in coral reefs globally has been termed the 'Coral Reef Crises'. Phase-shifts result in the loss of biodiversity and there associated economies where shifts occur (Bellwood et al. 2004). Disturbances resulting in an immediate loss of habitat have greater effects than disturbances that kill corals but do not immediately effect reef structure. Moreover, disturbances that create a decrease in coral taxa and reef diversity can support fewer fish due to the critical role of topographic complexity in moderating recruitment, competition, and predation (Trapon, Pratchett, and Penin 2011). Fish are critical in maintaining reef resilience through their functional roles as bioeroders, scrapers, and grazers. The presence of these groups in a coral reef is indicative of its capacity to resist phase shifts and retain critical function (Bellwood et al. 2004, 830-831). Changes in the structure of food webs, inputs of pollutants, and larval recruits plays an important role in preventing or reversing phase shifts (Hughes et al. 2010). After reefs have shifted to a macroalage composition, returning to a coral-dominated state is a formidable challenge for reefs. It is important to understand what factors contribute to both the health and degradation of reefs. The increasing frequency with which phase-shifts are occurring requires innovative research to understand how to manage coral reef resilience in the face of both anthropogenic and biological stressors (Bellwood et al. 2004).

While there are some successes in maintaining coral reef resilience, the global pattern of degradation indicates an overall failure in reef management (Bellwood et al. 2004; Hughes et al. 2010). More effective management entails an increased understanding of how human and naturally induced disturbances affect coral reefs (Bellwood et al. 2004, 827). In addition

to long-term knowledge of how reefs have reacted to disturbances in the past (Trapon, Pratchett, and Penin 2011, 3). Because coral reefs are 'passive receivers' of decisions made elsewhere, decision-making regarding reefs requires a more holistic and intimate perspective (Moberg and Folke 1999). Integrated approaches that use both social and ecological perspectives are beneficial to understanding how people and ecosystems have co-evolved (Balée 1998; Kittinger et al. 2011). Studying the cultural values that people hold for marine environments is one way through which to work towards more effective environmental governance (Hicks, Graham, and Cinner 2013; O'Garra 2009; Song, Chuenpagdee, and Jentoft 2013). Ultimately, the overall goal of coral reef management should be to sustain the level of ecosystem goods and services upon which people depend (Bellwood et al. 2004).

Moorea provides an interesting case for coral reef research for both its social and ecological characteristics. Current marine management efforts on the island are highly contentious. The conflicts surrounding marine management has led to wide resistance to fishing regulations around the island, marking Moorea's marine management as a social failure. The government bodies responsible for marine management have decided to revise the current management plan in conjunction with fishers, tourism operators, and other vested community members in order to create more socially-acceptable marine governance. Social-ecological research that can disentangle how peoples perceive and understand their relationship to the marine environment of Moorea could greatly benefit these management efforts. The research presented in this thesis seeks to understand the ways that Moorea's residents are interacting with the marine environment and how these interactions frame their values of the island's unique coral reef-lagoon ecosystem. The goal of this research is to understand how incorporating understandings of the social relationships within and surrounding the marine environment of Moorea can contribute to the design and implementation of more effective marine management.

1.2 LOCATION AND POPULATION

French Polynesia is an out-of-the-way location, located half-way between South America and Australia in the South Pacific Ocean. There is a mythic connotation to the name Tahiti. The tourism economy of the country of the region plays with this mythical imagery to draw in visitors from around the world to the turquoise waters and (relatively rare) white

sand beaches. However, the country of French Polynesia itself is often unknown, eliciting questions of whether or not it is a place in Europe (Kahn 2011). The country covers an area the size of Western Europe, although broken up among 118 islands. Only 76 are inhabited. The majority of the roughly 282,000 inhabitants are concentrated in the Society Islands Archipelago. The island of Tahiti is in this archipelago, where Papeete, the capital city of the country, is located, as is Moorea, the subject of this study (CIA 2016). The Society Islands are divided into the Leeward and Windward island groups. Moorea and Tahiti are both in the Windward group, which is a center of economic activity in the country. Moorea is home to twenty-two villages nestled within five districts (Paopao, Teavaro, Afareaitu, Haapiti, and Papetoai) which house the island's 16,889 residents (ISPF 2012).

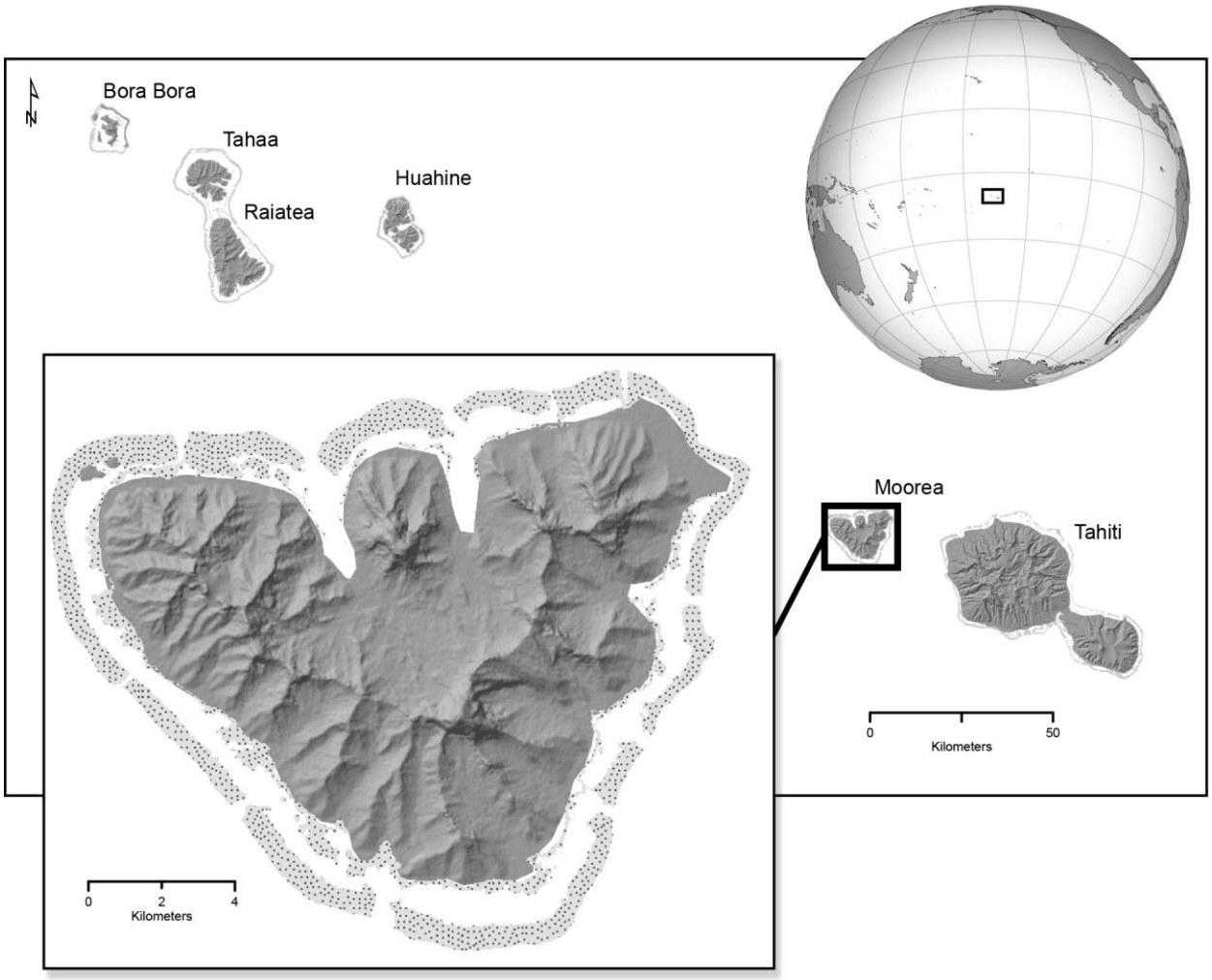

Figure 1.1 Map of Moorea's place in the world and in the Society Islands Archipelago.

There are two marine biology research centers located in Moorea. The French *Centre de Recherches Insulaires et Observatoire de l'Environnement* (CRIOBE) and the American *UC Berkeley Richard B. Gump station*. Due to the presence of these stations, the island is a primary location for coral reef research in the Pacific (Trapon, Pratchett, and Penin 2011). While extensive research has been conducted on the reefs and lagoons around the island, little has been done to document how people, and especially fishers, are impacting reef resilience through fishing efforts. Moorea's reefs have shown an unusual resilience to anthropogenic and biological stressors that have resulted in degradation in coral reefs worldwide (Trapon, Pratchett, and Penin 2011). Thus, the reefs on the island have become of particular interest to marine scientists. Numerous field schools and student research projects are carried out on the island every year.

Moorea's government has also taken interest in the island's reefs, creating eight marine protected areas (MPA) around the island in the mid-2000s. The creation of these MPAs will be discussed in more detail later (Chapter Four). My interests are in understanding how these MPAs affect fisherfolk on the island. I therefore situated my research in two different districts, each with a different relationship to Moorea's MPA's. The first district, Papetaoi, is directly adjacent to an MPA in the coastal area that lies in front of the community. The second study district, the southern portion of the Haapiti district, represents the longest stretch of coastline on the island that is absent of an MPA. The two districts also differ in that Papetoai is located on the North shore of the island, which serves as a hub for tourism activities, including the Intercontinental Hotel, one of the largest hotels on the island. Southern Haapiti, and specifically the communities of Atiha, Vaianae, and Haapiti, are in a more remote portion of the island that generally only draws in surf tourism to some smaller, independently owned hotels, bed and breakfasts, and pensions.

1.3 RESEARCH DESIGN

This research is based on 15 weeks of fieldwork carried out over the summers of 2015 and 2016. In 2015, I spent seven weeks between July and August conducting household surveys in the southern portion of the Haapiti district. These surveys were part of the larger Coastal SEES work funded through the National Science Foundation that sought to better understand how fishing practices played into the resilience of the Social-Ecological System

on the island. This research was not an explicit component of my thesis research. Although, it did help me familiarize myself with the community of and island of Moorea. The household surveys also helped me learn about local fishing and fish consumption practices, perceptions of marine environmental health, and perceptions of marine governance, both broadly across the Island and in Southern Haapiti, more specifically. In 2016, I returned to southern Haapiti to carry out my thesis research, which consisted of different research questions and methods than were carried out during the 2015 season. I conducted the 2016 research over two months, living in the same house I had resided in the summer before.

In the 2016 field season, I conducted 100 surveys (different from the household surveys carried out the summer prior), using an embedded mixed methods design (Creswell 2014). This research was guided by the following questions:

1. How can I use an Ecosystem Services Framework to identify and measure non-use values that surround coral reef ecosystems in Moorea?
2. How do values associated with the marine environment differ between resource user groups in Moorea (fishers, scientists, tourism operators, and the general public) and how does the governance of MPAs affect these values?
3. Do shifting values caused by marine governance impacrt the way people interact with the marine environment?

During the 2016 survey, qualitative questions surrounded a quantitative ranking exercise that used a contingent valuation approach to elicit what marine-oriented ecosystem goods and services participants found more important, or valued more, than others. Qualitative questions asked participants to talk about their relationship with the lagoon, in addition to enquiring whether their ‘values’ represented in the exercise had changed since they were young. The ecosystem goods and services we chose for valuation were informed by the household survey results that we had gathered the prior two years. Data from both of these projects will be analyzed in relation to crafting socially acceptable environmental governance and conservation efforts on the island of Moorea.

1.4 THE STRUCTURE OF THIS THESIS

This thesis is oriented around two distinct, but interrelated, chapters (Chapter Four and Chapter Five) that form the crux of my research analysis and arguments. Chapter Two provides a site background, from prehistory through colonial transformations and into the current ecological and social conditions of Moorea. Chapter Three switches modes by

reviewing relevant literature, which forms the theoretical basis I use to approach my analyses. The review covers a wide range of topics from MPAs, environmental governance, environmental subjectivities, and ecosystem goods and services. Chapter Four largely uses information gathered during our household surveys in order to write a history of and evaluation of the current marine management system on Moorea. I then provide specific recommendations for how to craft a more socially acceptable and equitable conservation system on the island, using ideas of adaptive governance to frame my argument. Chapter Five discusses the research conducted during the summer of 2016, using an ecosystem goods and services framework to understand the cultural values of the marine ecosystem of Moorea. This chapter couples an unused theory in ecosystem services literature with geometric data analysis techniques that provide an innovative approach to theoretically and methodologically interpreting our research results. The conclusion in chapter six synthesizes chapters four and five, discussing the key findings of this research and the main themes that permeate the thesis.

1.5 A NOTE ON TERMINOLOGY

In this thesis, the terms Tahitian and Moorean will be used interchangeably to refer to the population of Moorea. Maohi is a term that has been used to refer to Tahitians (*see* Oliver 1974), and which was re-popularized during the Polynesian cultural revitalization movement throughout the mid to late 20th century. However, this term is also viewed as offensive to some Tahitians due to its disputed history as an insulting term operationalized during colonialism (Saura 2009). I therefore choose to use the terms Tahitian and Moorean instead. At times, the wording ‘Tahiti and her islands’ will be used, which is a colloquial phrase for the Society Islands. In addition, I have chosen to write out the name of the island as ‘Moorea’ rather than ‘Mo’orea’ due to how the diacritic is commonly dropped in the scientific literature on the island. Finally, I also discuss eco-scapes, in order to reference both land and seascapes simultaneously.

CHAPTER 2

TE MITI, TE FENUA (THE SEA, THE LAND): PAST AND PRESENT RELATIONSHIPS WITH MOOREA'S ECOSYSTEMS

2.1 PREHISTORIC POLYNESIA

The Society Island archipelago came to be peopled by migrations out of Asia, through Melanesia, and finally into Polynesia. This can be traced through the Lapita cultural complex. Beginning around 3,000 BP or earlier there was a sudden and widespread appearance of the Lapita cultural complex throughout Melanesia (Sheppard, Chiu, and Walter 2015). Around 1,300 B.C., the Lapita complex started moving out of New Bismarck and into sites previously uninhabited by humans, such as Polynesia. Although, more recent evidence argues that Lapita is both a unique ceramic tradition, as well as a larger cultural complex with linguistic and genetic support. Polynesian culture is one development out of the spread of the Lapita complex. Prior to settlement, Pacific Island ecology was highly endemic, thus it was vulnerable to ecological disturbance and anthropogenically-induced change (Kirch 1984, 137). Floral and faunal extinctions consistently occurred shortly after Polynesians occupied new islands due to both intentional and unintentional land alterations and the introduction of new species (Balée 1998). Throughout the Pacific, Polynesian settlement is associated with large reductions in or extinctions of land bird species (Balée 1998), and over time, shrinking fish and shellfish size, indicating the intensification of marine resource harvesting (Kirch 1984). The initial migration into Polynesia required greater seafaring technology than other parts of Oceania, due to the increased distance between islands (Goodenough 1996).

The history of oceanic migrations and their ensuing close relationship with marine environments, has resulted in Pacific Islanders having an 'outwards looking' perspective (Hviding 2003). This perspective is complemented by the high degree of terrestrial and

marine ecological knowledge that Pacific islanders had to develop in order to thrive on the often small, and rather isolated, islands that they inhabit (Hviding 2003). This combined perspective has led to native inhabitants of Oceania as viewing the landscape and seascape as an extension of one another (Hviding 2003). Many Tahitians, for example, find a sense of place and identity in the land, illustrated in their practice of planting placentas in the ground (Kahn 2011). Yet, they also view the land and sea as a cohesive whole (Kahn 2011; Oliver 1974), thus grounding Tahitian identity in the entire eco-scape. Historically, the practice of placing pieces of coral on *marae* - constructed platforms where 'humans can receive the gods in a befitting manner' (Oliver 1974, 95) - reflects how the land and sea complement each other in Society Island cosmology (Kahn 2011, 69). Traditionally, and to some extent still today, for Tahitians 'nature' is composed of innumerable individual entities, some of which are intrinsically animate, and others intrinsically inanimate, but capable of animation (Oliver 1974, 55). Society Islanders view geographical locations as being inhabited by spirits and gods in addition to other natural phenomena, like the wind (Oliver 1974). Polynesian languages contain more names for coral reef habitats and marine flora and fauna than any other languages (Salvat and Pailhe 2002, 219).

Tahitians have numerous labels for aspects of their geographic environment (e.g. large or small mountain cliffs, streams, and beaches). In the past in the Society Islands, social groups inhabited an area of the island whose boundaries were defined relative to the highest mountain, principle cape, and largest freshwater stream (Oliver 1974, 176). Thus, the names of specific groups of people corresponded to a mountain, cape, or stream that they lived by. These watershed-level units of social organization became political units, through which environment decision-making was made. The maintenance of land relied on both spiritual and political considerations. Social action was managed through hierarchical social relations that were shown in the class composition of Tahitian society.

Throughout Oceania, traditional resource management was somewhat of a side effect of marine and land tenure that aimed to control both social relations and resource distribution (Foale et al. 2011). In many traditional societies, social and ecological factors are inseparable from religious and superstitious factors (Colding and Folke 2001, 584), and ritualistic actions often have ecological consequences (Johannes 1978, 352) that can meet conservation goals. Resource management in the Society Islands was influenced by social, political, and ritual

actions and beliefs. Areas could also be closed for ritual reasons (Johannes 1978, 353) and some species had closed seasons. Fishing gear restrictions - or method taboos (Colding and Folke 2001) - appear to be the rarest form of management in Oceania (Johannes 1978, 354). Although, archaeological and historical evidence in Hawai'i suggests that gear type changed through time as an adaptive response to changing environmental conditions (Kittinger et al. 2011, 5). Traditional natural resource management practices throughout Oceania are notable for their adaptive capacity (Johannes 1978).

Tahitian cosmology and spiritual-ecological practices developed over time and in conjunction with anthropogenic changes to both land and seascapes. Variations in management techniques throughout Polynesia correspond with the state of the chiefdom and the degree of stratification (Kirch 1984, 167). Three important economic factors that influence management decisions, include: 1) the chiefs role in directing and controlling production, 2) the means of appropriating surplus products, and 3) the uses of the surplus goods, mainly composed of agricultural products (Kirch 1984, 165). In less stratified societies, Polynesian chiefs tended to redistribute surplus back to producers through feasts and exchanges. However, as social stratification increases the degree to which goods are redistributed decreases. Nonetheless, chiefs were expected to invest in public works, and the failure to do so could result in warfare or rebellion (Kirch 1984, 167). Agricultural and other surplus goods were intensified under chiefdoms in order for communities to provide sacrifices to chiefs in honor of these deities as chiefs served as representatives of Polynesian deities (Kirch 1984).

Society Islander's customs and ceremonies in large part revolved around metaphors based on, and products made from, the plants and animals that comprised their subsistence system. The food economy of most households operated on principles of sharing and pooling resources, including sharing with one's tutelar spirits. Food sharing extended beyond household members and spirits to generous sharing with visitors, including friends, kin, or sometimes strangers. Food generosity was an important part of Society Islander social relations, though there is little evidence that food trade or barter ever existed as a formalized market system (Oliver 1974). Though there is some indication that it was customary to exchange portions of one's catch for labor or other products. The high levels of respect for *manahune* and the right they held to access fishing grounds through higher classes' land also

indicate the fundamental role that food access and sharing held in the Society Islands. Throughout the Pacific, food is a form of social communication, symbolically expressing people's relationships, concerns, and care for one another (Kahn 2011, 188). Denying food is a sign of disrespect and willful neglect (Kahn 2011, 188). Forms of food sharing are one of the ways that Tahitians have practiced adaptive flexibility in the face of ecological and social change. The social and religious practices of Tahitians created fairly complex societies with high levels of specialization. This specialization, and people's intricate religious and environmental knowledge of the land and seascapes they inhabited, contributed to their social complexity (Oliver 1974).

Tahitian society had three relatively well-understood classes. They were the *ari'i* (the chief and his family - the ruling class), the *ra'atira* (the middle class), and the *manahune* (the lowest, working class). There were numerous metaphorical ways for Tahitians to speak of class divisions, including through the use of directional markers, as well as the landward and seaward contrast (Oliver 1974, 793). The *manahune* were said to have lived inland, away from the coast, though they had rights to follow paths to the ocean to fish (Oliver 1974, 766-767). As the working class, *manahune* were agriculturalists, woodworkers and fisherfolk. Interestingly, there are some indications that those *manahune* who were fishers or boat makers held a level of respect generally designated for higher classes (Oliver 1974). This respect attests the importance of fishing and ocean travel in Society Islander society and cosmology.

Ocean voyages, like other land- and sea-based practices, were correlated with specific rites that ensured spirits would help them to reach their destinations in safety and speed (Oliver 1974). The role of sea voyaging and boats in Tahitian cosmology demonstrate their close relationship to the ocean. By the time of European contact, most ocean travel took place within the Society Islands. It is unclear, though, how far people may have regularly traveled prior to contact. Three types of boats were commonly used throughout Tahiti and her islands, each with their own purposes, strengths and weaknesses. Boat construction and initial launch were ceremonious occasions that brought together social groups in labor and ceremony. The organization of boat building, like other public works, was financed by a general levy of objects and services. Individual differences in the kinds and numbers of boats owned served to influence and symbolize differences in social status (Oliver 1974). Today,

the *va'a*, an outrigger canoe continues to serve as an important symbol of Tahitian cultural heritage and are used widely for recreation, cultural events, and fishing.

As with fishing and sea voyaging, important land-based foodstuffs, such as breadfruit and freshwater eels, play central roles in Tahitian folklore and myths (Oliver 1974, 285). It is possible that eels were sometimes domesticated and tame enough to eat out of their owners' hands (Oliver 1974, 286). Society Islander land subsistence revolved around the gathering of wild foods, supplemented by horticultural practices, and the rearing of some livestock (Oliver 1974). Agricultural crops are an important component of Tahitian diets and many have been with them since their ancestors settled Polynesia. Some of the foods that Polynesian settlers introduced to Pacific Islands include taro, yam, and tree crops, while livestock included dogs, pigs, and chickens (Goodenough 1996; Kirch 1984). Human migrations also attracted other guests who joined cross-sea journeys, including rats, snails, skinks, and geckos[1], thus resulting in changing ecologies (Balée 1998; Diamond 2004; Goodenough 1996; Kirch 1984). Many of the introduced crops that Tahitians brought with them to the Society Islands continue to play central roles in local diets. Ceremonies and religious action surrounded many subsistence activities, regarding both harvest and consumption. Sources on ancient Tahitian culture do not mention specific horticultural rites or practices enacted by individuals or households to ensure success of their gardens (Oliver 1974). Though, it is possible that *ti'i*- images of spirits that mingle in people's affairs and which were used for fishing - were placed in gardens to benefit plant growth (Oliver 1974, 259).

For Pacific Islanders, land and sea tenure regimes differed little from one another. In both cases people are viewed as integral parts of the natural system and serve a custodial role as opposed to a possessive relationship (Ruddle 1988, 355). Traditionally, reef and lagoon tenure was the most widespread management technique in the Pacific - where the right to fish is controlled by the clan, chief or family. Tenure rights usually extended from the beach to outer reef (Johannes 1978, 350) and resources are managed through a range of practices. Sea tenure – the way fisherman perceive, define, delimit, own, and defend rights to inshore fishing – throughout Oceania, reflects social organization, stratification, and local power dynamics (Ruddle 1988, 353–354) Out of all of the marine resources used by Tahitians, fish

[1] Interestingly, the name of the island of Moorea itself means 'yellow-belly lizard'.

were the most important in terms of both quantity and amount of species used (Oliver 1974, 283). Fishing areas may have unrestricted ownership or were governed by chiefs (Ruddle 1988, 355). Fishery rights were passed down through time through ancestors, families, spirits or gods and held varying degrees of exclusivity, being either primary or secondary (Ruddle 1988, 355). Primary rights were obtained via inheritance, whereas secondary were acquired through marriage, purchase or trade (Ruddle 1988, 356).

Out of all of the Tahitian subsistence activities fishing was probably the most technically developed (Oliver 1974, 281). Fishing went beyond subsistence and took on a form of pleasure and sport. Like other subsistence patterns, fishing was regulated by an intricate knowledge of environmental factors combined with religious practices that served to appease spirits and improve the success and safety of fisherfolk. Tahitians set up *puna i'a* - a type of *ti'i* - in specific locations and facing certain directions so the spirits could aid in controlling fish movements therefore influencing the success of the catch. Wind, rainfall, tides, and moon phase all affected the reproductive cycles of marine fauna and influenced the time, place, technique used, and size of the catch. Marine life is subject to variation depending on moon and annual cycles (Oliver 1974, 127). This variation is understood by many fisher folk who continue to use the *Tarena* (lunar calendar) to inform fishing, and sometimes agricultural, decision-making. Men and women in the past participated in fishing activities; though women tended to primarily do inshore fishing (Oliver 1974). This is a trend that continues today (Walker and Robinson 2009). Fishing took place both in the lagoons and open sea and was managed through *rahui* (Oliver 1974).

Chiefs were responsible for sanctioning areas of marine and terrestrial landscapes in order to preserve them from production for extended periods of time, a practice known, in some areas of Polynesia, as *Rahui* (Kirch 1984, 165). In the Society Islands, this practice was enforced by denying access to land for those who broke the *rahui* (Kirch 1984, 66). *Rahui* was generally implemented to benefit the chief as areas were sanctioned in order to prepare natural resources for upcoming festivals, feasts, or rituals (Kirch 1984, 166). Thus, *rahui* served as a way to maintain both social and environmental relationships, though the ecological benefits may not have been an explicit intention of Polynesian's ritual cycles. *Rahui* entails restrictions on hogs, fish, fruit, and other natural resources for management and ritual purposes (Oliver 1974). Usually, these restrictions were spirit sanctioned (Oliver 1974).

The ability to implement *rahui* was class bound. The *ra'atira* (middle class) had the right of *rahui* over the *manahune* (lowest class) and the *ari'i* (ruling class) over both groups (Oliver 1974, 779). In some cases, *rahui* only excluded outsiders. In other cases, with permission from the proprietor, an individual could gain rights to access resources. A general *rahui* could be imposed throughout entire districts on certain occasions or during specific periods during the year, for both political and religious reasons (Oliver 1974).

Through its ritual and social connotations, *rahui* was a form of accumulation and redistribution as chiefs allowed natural resources to accumulate through non-use and then redistributed these goods through festivals. *Rahui* thus benefited chiefs and the citizenry. Aside from serving the reproduction of chiefly power and status, subsistence surplus buffered Polynesians against the oscillating environmental hazards of drought and cyclones, and associated famine and social distress that could follow. Food storage technologies were vital to Polynesian resilience. This resilience is indicated in fermentation pits and in the drying of starches to create flours (Kirch 1984), though this was less common in the Society Island Archipelago. Turtles and seabirds were also considered in various social customs. In some cases entire small islands were left uninhabited in order for these populations to thrive (Johannes 1978, 354). A fundamental feature of traditional Oceania management systems was the adaptive flexibility of their system (Johannes 1978). This flexibility is exemplified through shifting management practices, such as the closure of seasons or areas or the sharing of fishing rights for those in need. Both *rahui* and food storage techniques were important mechanisms for Tahitians to deal with fluxes and flows in the environments they inhabited. Ultimately Tahitian cosmology and spirituality, informed these practices.

Traditional management techniques throughout Oceania have become less common, sometimes forcibly, due to colonial relationships and changing social conditions (Johannes 1978). Colonialism worldwide has disrupted autochthonous environmental practices, disengaging people from traditional practices and lifestyles, attempting to substitute them with capitalist market-based jobs. The weakening of traditional management systems is correlated with diminishing marine resources around islands (Johannes 1978, 356; Kittinger et al. 2011). Johannes (1978, 356) recognizes three interrelated causes that have contributed to the breakdown of traditional conservation methods throughout Oceania: the introduction of a monetary economy, the breakdown of traditional authority, and the imposition of new

laws and restrictions by colonial authorities(. The introduction of a monetary economy has altered the values associated with fishing. What was once an internally regulated subsistence economy is now a monetary system, whereby colonial leaders pressured the relaxation of conservation methods in the name of monetary profit. A profit-driven capitalist system does not allow a conservation ethic to thrive (Johannes 1978, 357).

2.2 CREATING FRENCH POLYNESIA: COLONIAL TRANSFORMATIONS

For the Society Islands, the lifestyle-transforming effects of colonization materialized later than in some other areas due to the isolated location of the islands, though, the effects of colonialism still fundamentally changed life on the islands. Because of their distance from markets and lack of natural resources, Tahiti and her islands did not become a settler colony until the mid-20th century, following the introduction of the French Nuclear Testing Program (Hemmingham 1992). In the early 19th century, Britain incorporated Tahitian's traditional social structure into an informal British colonial system. In 1842, the Society Islands Archipelago became a French Protectorate. The Society Islands never became a productive resource base, such as Africa may be viewed throughout colonial enterprises. Rather, the islands garnered an alternative image. Tahiti and her islands have come to be called the 'Islands of Love' and have garnered a mythic nature for being a romantic paradise, both peaceful and provocative (Hemmingham 1992; Kahn 2011). Indeed, "It is impossible to approach Tahiti free of its myth" (Levy 1973, 95). The myth of Tahiti began when Bougainville first encountered these islands and called them 'New Cytherea' after the Greek goddess of love. This image has persisted, adding to and playing off of Westerner's conceptions of 'paradise' through careful marketing and advertising techniques by the tourism economy that has developed in the region (Kahn 2011).

During early colonial phases before a monetary economy was widespread, the peoples of Tahiti and her islands primarily lived off of subsistence agriculture and fishing, while earning some cash from copra, vanilla, and other food crops (Hemmingham 1992). However, unlike British colonial policies that allowed somewhat for people's lifestyles and traditions to remain, the French used strict acculturationist policies in their colonial style (Hemmingham 1992). These policies have created widespread change throughout the French Pacific. Two major changes occurred in French Polynesia during the 20th century that have

fundamentally transformed life in the region, and shaping current lifestyles in the Society Islands. The first is the creation and spread of a monetary, capitalistic society spurred by the beginning of France's nuclear testing program. This program facilitated the growth of a tourism economy. The second component of this is the growing political autonomy that was in part developed out of the Polynesian cultural revitalization movement in addition to pro-autonomy movements that occurred throughout the French Pacific during the mid to late 20th century. Effectively, colonial enterprises in the South Pacific have recreated and re-imagined Tahiti, first through explorers' accounts and later through postcards, films, Gauguin's artwork, and through commodities (Kahn 2011, 31).

The 'naming' of the island of Tahiti itself demonstrates how it has become a creation of the western imagination as the name of one island (*Otaheite*, now Tahiti) has come to represent the entire Society Islands region and French Polynesia more broadly (Kahn 2011). As Kahn (2011) points out, and as I have often experienced, many people have heard of Tahiti and may have a vague notion of where it lay in the world. Yet, those same people have never heard of French Polynesia and are confused whether it is a place in Europe or not. Effectively, the name of Tahiti itself has been commodified (Kahn 2011). However, this widespread commodification and importance of Tahiti in the South Pacific was in part created and exacerbated by the movement of France's nuclear testing program from Algeria to the Tuamotus archipelago of French Polynesia in the early 1960s (Hemmingham 1992; Kahn 2011). This program resulted in unprecedented development in the region, as Papeete, Tahiti, became the administrative seat of the testing program, despite testing taking place in the Tuamotus. This development entailed the creation of new infrastructure including, perhaps most significantly, an international airport that opened in 1960. Testing and the airport fundamentally transformed life on the islands through creating and sustaining a cash economy (Hemmingham 1992; Kahn 2011; Levy 1973). Tahitians increased access to cash and a monetary economy allowed them to partake more in French customs, adopting French laws, language, and food (Kahn 2011). Tahitians growing reliance on a monetary, rather than subsistence, economy has created a dependence on French subsidies provided by the nuclear testing program. As of the early 1990s several years before testing ended, France was spending twice the amount of money in French Polynesia than in New Caledonia despite the population only being slightly larger. This has resulted in French Polynesia having a larger

GDP than New Zealand (Hemmingham 1992). This GDP, however, masks existing social inequalities and the inability of French Polynesia to cover the costs of its own services and infrastructure, or to maintain standards of living (Hemmingham 1992). Moreover, a high GDP does not translate to purchasing power parity (PPP) as the cost of living is much higher in French Polynesia than New Zealand (Poirine 2010).

Interestingly, the growing reliance on French customs and lifeways, which, in part, increased through the nuclear testing program in the 1960s, occurred concurrently with growing pro-autonomy and pro-independence movements throughout French Polynesia. Around the time of WWII, France transformed French Polynesia from a colony to a territory, resulting in the country's current status as a *Collectivitié d'outre-mer de la Republique Française* (French Overseas Collectivity). This transformation was in part due to the outpouring of pro-autonomy and pro-independence movements that began to transpire throughout the French Pacific during this time. During these movements, the French government tactfully granted some autonomy, while also ensuring that the territories could remain with France (Hemmingham 1992). Due to France's role throughout the Pacific, the country has the third largest exclusive economic zone in the world (Hemmingham 1992). It was not until the 1970s and 1980s, however, that French assimilationist policies finally began to be lifted. Pro-autonomy/pro-independence movements in French Polynesia ebbed and flowed in strength from the 1940s onwards. While many political parties and movements were formed in the name of pro-independence or pro-autonomy, and have been successful in numerous regards, the country also realizes its economic dependence on France and French subsidies, making full political autonomy, or independence, a difficult goal to actualize (Hemmingham 1992). Despite remaining a French territory, the empowerment and maintenance of cultural identity through revival movements has been more evident in Polynesia than in other locations in the world (Castri 2002, 270).

During the 1970s there was a renewed push for pro-independence movements through the formation of new political parties. In 1972, France expanded the municipal government of French Polynesia to the 118 islands that now encompass the country, rather than just including the capital city, Papeete. Each municipality was made responsible for their own budget, allowing for greater local participation in government. Though, this also resulted in a growing French presence. In 1977, due to pro-autonomy pressures, the territorial

government was granted even greater managerial responsibility. The territory was given jurisdiction over all areas that were not listed as state or municipal responsibilities, granting greater control over funding decisions. Gaston Flosse, an important political leader in the region to this day, came to support autonomy in the 1980s as it offered a compromise between complete domination and complete independence. In 1982, his party won 30% of the vote and thirteen seats in the assembly, cementing autonomy rather than independence in the country's politics (Hemmingham 1992).

Political autonomy and pro-independence movements throughout the French Pacific occurred concurrently with Polynesian cultural revitalization and indigenous rights movements. These movements gained a lot of traction from the mid 1970s onwards, reasserting Tahitian culture and identity as a valid way of being. Unlike in other colonial locations that had assimilationist policies, Tahitians were largely able to preserve their language through its use in church, specifically the *Maohi* Protestant Church. Though the speaking of Tahitian was forbidden at schools until the 1980s. A 'bi-culture' policy emerged in the late 1970s and was increasingly embodied as autonomy came to be instituted in 1983. During this phase, Tahitian became an official language and the dominant language for legislative discussion. Additionally, territories began to use Tahitian names rather than the French names they were given in the 1950s and 1960s. Aside from being incorporated into governmental affairs, the 1980s also included plans to incorporate the Tahitian language into classrooms and public media. Bi-cultural policies implemented during this time were intended to allow a distinctive Tahitian identity to exist in conjunction with a political commitment to France. Overall, this has been highly effective as pro-independence movements have failed to materialize and people generally regard Polynesian heritage as compatible with political affiliations with France (Hemmingham 1992).

Despite how fiercely cultural revitalization movements have fought for the validity of Tahitian identity, access to Polynesian identity in French Polynesia remains rather fluid. Since colonialism, there has been high ethnic mixing between Tahitian, European, and Chinese communities throughout the region, in addition to other immigrant groups. Yet, as Hemmingham (1992) points out, generally any person with Polynesian ancestry has access to Polynesian identity. Thus, there is very little differentiation between a *demi* (person with mixed ancestry) versus a Tahitian. Polynesians have been able to absorb and incorporate

elements of other cultures, while maintaining their own lifestyles and value systems (Castri 2002, 271). Because of the fluidity of identity in Tahiti, there has been little conflict between ethnic groups in the region. Although, there has been some distrust towards Chinese populations who were granted land adjacent to water during the colonial period (Hemmingham 1992). The granting of shoreline land to Chinese populations by colonial officials probably offended Tahitians who view the coastal strip as the most prized, as in the past it was retained for the higher classes. Today in Moorea, most homes are constructed along the shoreline (Salvat and Pailhe 2002), although some are located further inland in valleys that have flat enough elevations to allow for construction.

While Tahitian populations have accepted other ethnic groups coming to their lands and have adapted with resilience to colonialism (Hemmingham 1992), there have also been numerous instances of Tahitian resistance to colonial policies and practices (Hemmingham 1992; Kahn 2011; Walker 2001). Polynesians, generally, are deeply rooted and proud of their unique and impressive histories as navigators, allowing them to be resilient in the face of colonially –induced change (Castri 2002). Polynesians embody acts of resistance in their everyday behavior (Kahn 2011). At times, resistance is obvious through displaying anger or aggression. Other times, resistance is expressed through food, music, dance, language, and humor, subtle counter-discourses that escape hegemonic forces (Kahn 2011). The communication of political messages through bodily practices, like eating, singing, dancing, joking, and laughing, allow Tahitians to appropriate their own space, counteracting the ways that they have been excluded through colonial mechanisms of control (Kahn 2011).

Acts of resistance demonstrate the tension that exists between adopting French lifestyles and revitalizing Tahitian traditions, especially in the face of economic instability. French Polynesia's slum areas, poverty, prostitution, petty crime, high unemployment and wealth distribution inequalities all lead to social tension (Hemmingham 1992). These tensions are reflected in periods of unrest, such as occurred between 1983-1987, and which included armed guerilla warfare in opposition to French rule (Kahn 2011). Additionally, in both 1983 and 1987 hotel strike riots occurred (Hemmingham 1992). The 1987 riots resulted in political programs that provided extra jobs and more public housing in order to alleviate social ills, simultaneously encouraging migrants to return home and to be successful in jobs. These periods of protests and resistance exemplify the social distress that many

underdeveloped economies face. The Society Islands, alongside many other small-island countries often have fragile economies that are difficult to develop (Salvat and Pailhe 2002).

Again in the mid 1990s protests erupted in Papeete. The protests were in response to France's seizure and then recommencement of their nuclear testing program. While Tahitians had been peacefully protesting the nuclear testing program for numerous years, in September 1995, the protests turned violent after France conducted a series of nuclear tests on the Mururoa Atoll in the Tuamotus archipelago (Shenon 1995). Several shops and French government offices in Papeete were burned to the ground during the riots, while over twenty people were injured in conflicts between demonstrators and French riot police (Shenon 1995). Perhaps the most dramatic of the outcomes of the riots was the damage caused at the Faa'a Airport in Papeete. Cars and trucks at the airport were lit on fire, shops in the terminal were looted, and the restaurant burned. Moreover, a French jumbo jet had its engine turbines jammed with stones, while people also threw stones at the plane. An Air New Zealand jet parked near the French jet was left untouched. Tahitian action on this day, seemed to be clearly targeted at French colonialists, while also lacking regard for tourists inside of a plane and in the airport (Shenon 1995).

More recently, protests and resistance have occurred in Moorea in response to tourism development projects. Many fishers complain of fisher-hotel conflicts, as hoteliers try to prevent fishers from fishing in front of their hotels (Walker 2001). Exacerbating the hotel-fisher divide was a three-month protest that ensued in response to the Sheraton Moorea's Lagoon Resort and Spa development plan in 2000 (Kahn 2011; Walker 2001). The hotel desired to create an artificial beach and to build thirty-one overwater bungalows, requiring the lagoon in front of the hotel to be dredged. Locals were concerned about the ecological disturbances this would cause to the coral reef and associated fish populations in this area. Fishers occupied canoes encircling the dredge, alternating shifts with family members who picketed on the roadside in order to alert tourists to the environmental injustices occurring for tourism development (Kahn 2011; Walker 2001). The protesters consulted with a local NGO *Faatura Aimeo* (Respect Moorea), which was founded over twenty years ago to educate residents on throwing trash in the lagoons around Moorea. The NGO hired a lawyer, who directed people to gather signatures to petition dredging for the bungalows. The residents of the Piahena neighborhood adjacent to the Sheraton gathered

over 2500 signatures and then sent a delegation of more than fifty people to Papeete to present the petition. Their efforts were successful in stopping this tourism development from occurring (Kahn 2011; Walker 2011). During this movement, residents of Moorea organized and politicized for their own livelihoods and sovereignty. They protested government interference and foreign exploitation (Walker 2001, 15).

Certainly, Tahitian populations have reason to be skeptical of governments and foreign exploitation due to the fundamental ways in which the simultaneous (and relatively recent) developments of nuclear testing and tourism affected the region. Together, the two combined and built off of the juxtaposed qualities of paradise, dreams, and fantasies, as well as the destruction and nightmares of testing (Kahn 2011). Following the clear statements made in the protests to nuclear testing in fall of 1995, the French permanently halted their testing program in 1996. This halting, however, resulted in an economic hole as the subsidies provided by the testing program to French Polynesia would also come to an end (Poirine 2010; Walker and Robinson 2009). In 1993 *Le Pacte de Progrès* (The Progress Pact) was signed into legislation, attempting to replace the nuclear testing economy with an increased emphasis on tourism and export markets in French Polynesia (Poirine 2010; Walker and Robinson 2009). *Le Pacte* had a goal of increasing exports and tourism from 26% to 43% of the economy's external resources by 2005, however, the country managed to reach this goal by 1998 due to pearl exports and tourism increases (Poirine 2010, 30). However, tourism profits and pearl exports have been decreasing since 2000 due to protectionist policies that make competitive pricing difficult for the country (Poirine 2010, 30). Additionally, the post 9/11 tourism crash, which was felt around the world, negatively affected the economy of the region. Following September 11th, the *Club Méditerranée* (often referred to as Club Med) the largest, and first, hotel in French Polynesia on the island of Moorea closed (Castri 2002). Club Med was built in 1955. By 1966 the hotel had 488 rooms. This had grown to 3,021 units in 1998 (Salvat and Pailhe 2002). When the hotel closed in December of 2001, it had 300 overwater bungalows (Castri 2002).

2.3 THE INTERSECTION OF ECOLOGY, FISHING, AND TOURISM IN MODERN MOOREA

Moorea's lagoons are formed by barrier reefs that average a distance of about one kilometer from the shore, creating a 29 km coral reef-lagoon ecosystem. The reef ecosystem

itself is composed of a fringing reef that emerges at low tide, a sand channel that is up to seven meters deep, a barrier reef two to three meters deep, and a reef front upon which ocean waves break (Salvat and Pailhe 2002, 223-224). The outer slop of the barrier reef has experienced increasing fish density and species richness over the last thirty years (Lison de Loma et al. 2008). The outer slope is partially covered by soft and calcareous algae and corals. On the fringing reefs grow branching and massive corals (Salvat and Pailhe 2002). Branching corals, such as *Acorpora* and *Pocillipora*, have experienced shifts in species cover in relation to multiple disturbances that Moorea has experienced over the last thirty years (Trapon, Pratchett, and Penin 2011). Coral composition has notably changed from an abundance of *Acorpora* to *Pocillipora*, perhaps because the latter are more resilient to bleaching events and other disturbances, such as cyclones (Trapon, Pratchett, and Penin 2011). While maintaining coral cover is a positive sign of resilience in the face of disturbance, the change in coral composition and sometimes the ensuing decrease in topographical complexity can lead to less diversity in reef habitats (Trapon, Pratchett, and Penin 2011). While Moorea's outer reef drops have proven to be more resilient than other coral reefs worldwide (Leenhardt et al. 2016), they are relatively colorless in contrast to other reefs (Salvat and Pailhe 2002, 217).

Perhaps more important than the actual diversity of the reefs is the way in which people relate to them (Salvat and Pailhe 2002, 217). The marine environment in Moorea, viewed from high elevations or in planes, stuns the viewer as the navy blue of the open ocean, meets the turquoise lagoons, diminishing the more monotonous colors of coral reef diversity that sit below the waters' surface (Salvat and Pailhe 2002, 218). The coral reefs surrounding Moorea have come to represent two major economic opportunities: fishing and tourism (Leenhardt et al. 2016). Most reef and lagoon fisheries are characterized as subsistence fisheries, as they are not monetarily comparable to high seas fisheries (Labrosse, Ferrais, and Letourneur 2006). A recent valuation of Moorea's reefs showed that the reefs held recreational values of 27 million Euros, whereas fishing was valued at four million Euros, including 2.8 million Euros of which were fish that were consumed in households and not sold on the open market (Pascal and LePorte 2015). However, these figures fail to capture the enormous cultural values of reefs for local populations. Fishing in Moorea, and the consumption of fish, plays a large role in the cultural identity of the Moorean population,

perhaps as significant as speaking the Tahitian language (Leenhardt et al. 2016). Fish are consumed at church gatherings, birthdays, Sunday feasts, and other important events and play a dominant role in local diets (Leenhardt et al. 2016, 6). The consumption of foods classed as Tahitian is central to having a Tahitian identity (Levy 1973). Indeed, Moorean's annual consumption of fish is around 110 kilograms per inhabitant (Yonger 2002), ranging far above the average of 23 kilograms per annum for other Pacific Island regions (Labrosse, Ferrais, and Letourneur 2006).

Fishers, are generally categorized as commercial, subsistence, and recreational, with an approximate 70% of the fishers in Moorea categorized as recreational (Leenhardt, Moussa, and Galzin 2012; Leenhardt et al. 2016), according to the definitions of recreational used in this study[2]. The diverse array of times, locations, gear types, and fishing methods used around the entire island make it extremely difficult to track the fish yields being taken from the lagoons (Leenhardt, Moussa, and Galzin 2012; Leenhardt et al. 2016). Moreover, while three species, Soldierfish, Parrotfish, and Unicorn fish, dominate the fish species sold on roadside stands[3], there have been over 40 genera documented as for sale on these stands (Leenhardt et al. 2016). This heterogeneity in the fishery can complicate fishery management efforts, especially when considered in conjunction with the varied usages and pressures caused on the lagoons by tourism (Castri 2002; Leenhardt et al. 2016).

Due to its proximity to Tahiti and the Faa'a airport in Papeete, approximately 80% of tourists to French Polynesia journey to Moorea (Walker and Robinson 2009, 468-469). As a result, the economic programs started under *Le Pacte* in Moorea have primarily resulted in tourism development (Walker and Robinson 2009). One way in which tourism development was attempted was through the creation of Marine Protected Areas (MPAs) around the island. In 1995 the government began planning MPAs on Moorea, in response to a recommendation by the Pacific Asia Travel Association (Walker 2001). Many Tahitians feel that the MPAs were created as part of the larger tourism-development plan, rather than as a

[2] In this study, recreational fishers were defined as those who: fish one to four times a month, catch fish for home consumption, and who fish primarily as a recreational activity.

[3] Roadside stands are the most common place where lagoon fish species are sold. Numerous fish (and sometimes species) are grouped onto fiber strings, weighing approximately 3 kilos, called *tuis.* (Leenhardt, Moussa, and Galzin 2012; Leenhardt et al. 2016).

'true' conservation measure. Indeed, the recommendation of creating MPAs by PATA is indicative of the tourism development motivation behind the protected areas. The MPA system officially began in October of 2004 and is part of a lagoon wide management plan known as the PGEM (*Plan de Gestion d'Espace Maritime*). The PGEM encompasses the entire island and out to 70m in depth on the outer reef slope of the barrier reef that encompasses the island (Lison de Loma et al. 2008). Eight marine protected areas were designated around the island, most with varying regulations, from no-take zones to selective fishing practices. These MPAs were placed primarily on the north shore, where tourism activity is concentrated. This PGEM is the first management plan of its kind in French Polynesia (Leenhardt, Moussa, and Galzin 2012), though there are other MPAs and marine management plans now in the country[4]. Local community members were attempted to be incorporated into the planning process, especially in the placement of the MPAs (Lison de Loma et al. 2008), however, this had questionable success (Walker 2001).

The PGEM has four stated objectives, including: 1) rational use and development of resources and the area 2) managing conflicts regarding lagoon use 3) controlling pollution and damage to marine environments, and 4) protecting marine ecosystems and endangered species (Leenhardt, Moussa, and Galzin 2012). The only reef threat that was considered during the planning phase was fishing, despite significant land-based pollution (primarily from agriculture and hotel sewage effluent, according to locals) that can have detrimental effects on reef health (Walker 2001). This is particularly disconcerting as phase-shifts associated with dwindling fish stocks in the Caribbean were associated with increased nutrient loads through land-based runoff (Bellwood et al. 2004). However, the creation of the MPA system was also motivated by declining fish stocks, following severe cyclones that hit Moorea in the 1980s; there was concern that overfishing would prevent the reef and fish stocks from recovering, thus creating a need for MPAs (Lison de Loma et al. 2008).

Many Moorean residents viewed the motivations of the PGEM as questionable due to the PGEM's apparent link to tourism development. Therefore, the planning phase for the MPAs on the island was met with resistance. This resistance came to a head when GIS maps

[4] These include MPAs in the Tuamotus Archipelago, including an UNESCO Biosphere reserve, and an MPA in Tahiti at the infamous surf spot, Teahupoo.

– that were not intended for public dispersal - were produced and subsequently published in newspapers regarding MPA placement (Walker 2001). During the planning process, fisherfolk protested MPAs through non-participation in planning meetings, through forming fisher/environmental organizations, and by damaging the fishing gear of one fisher who was thought to be helping the planning process too much (Walker 2001). Rather, the act of blocking access to marine resources, especially for those who lack other resources, is viewed as offensive to Tahitians. The PGEM exacerbated existing conflicts among fishers, while also creating tensions between resource management paradigms and scientific versus traditional/local ecological knowledge (Walker 2001). It is difficult not to notice the irony in these conflicts given that one of the objectives of the PGEM is to diminish conflict over lagoon use rather than to increase it.

One area of contention arising out of the PGEM discussions was in the context of shark feeding practices that occur around the island (Walker 2001). Shark (primarily black-fin) and ray feeding are the most popular tourism attraction in Moorea (Jonathan Biarez, personal communication 2015). Tourism operators will throw fish carcasses into the water to attract sharks and rays, which will quickly appear and swim around tourists who are often in the water, watching them. In some cases, people will even pet the rays, which tourism operators will direct towards peoples, at times leading rays to rub up against guests' bodies. Prior to the PGEM, this practice had been encouraged as a unique experience unavailable elsewhere in the world. Since, it has since become a point of contention between tourism operators, hoteliers, and fisherfolk. Fishers especially complain of how brave the sharks are, coming dangerously close to fishers and others swimming in the lagoons (Walker 2001). Hotels also worry that sharks will swim into hotel swimming areas and attack their clients (Walker 2001). While the conversations regarding the dangers of shark feeding have been going on for over 15 years now, the practice has changed little, and if nothing else, has continued to draw tourists to Moorea's lagoons.

The creation of protected areas in the lagoons of French Polynesia has been promoted as a beneficial way to grow the economy, especially in the face of decreased French support (*see* Castri 2002; Poirine 2010; Salvat and Pailhe 2002). Part of the argument in favor of this is that "going to these South Sea Islands is like going to nature and paradise, with all of the myth of nature and inhabitant culture that they represent for Westerners" (Salvat and Pailhe

2002, 227). Indeed, the tourism bureau of French Polynesia cleverly plays off of these conceptions in their advertising, further romanticizing these island chains (Kahn 2011). Tourism bureaus essentially create an image of what the tourists wants to or expects to see (Kahn 2011; Salvat and Pailhe 2002). In a 2002 survey of tourism and tourists, Salvat and Pailhe found that of eight tourism guides in French Polynesia, all emphasize the islands as 'nature' destinations. Advertising focuses on the coconut trees, white sand beaches, coral reefs, and lifestyle of the inhabitants (Kahn 2011; Salvat and Pailhe 2002), "which make the destination heavenly" (Salvat and Pailhe 2002, 25). This advertising masks the persistent rain that occurs throughout the year in French Polynesia, the relative rarity of white sand beaches, and the social inequalities that are exacerbated by tourism (Kahn 2011). The Society Islands archipelago is the most affected by tourism as 95% of the hotels in French Polynesia are located in Tahiti, Moorea, Bora Bora, and Huahine (Salvat and Pailhe 2002). Americans form the majority of tourists to the islands (Kahn 2011). Thus, only those who have access to education and can speak English are likely to benefit from jobs in the tourism sector, which forms the staple of the economy. Moreover, those Polynesians who appear more 'traditional' are hired preferentially over others (Kahn 2011). This can include having tattoos or being a traditional dancer (Kahn 2011).

Tourism is largely marine-oriented in the islands. A survey of tourists found that their recreational budgets were distributed accordingly: 66% for snorkeling activities, 28-40% for boating or pirogue activities, 18% for scuba diving, and 8-9% of their budgets went towards ship cruises and excursions (Salvat and Pailhe 2002). Yet, the largest expense is the cost of hotel bills (Salvat and Pailhe 2002). This is exacerbated by Tahiti's status as 'high-end tourism' where many people stay in luxury resorts with vacations averaging $10,000 for a 4-person family (Kahn 2011). Smaller pensions, ran by local families rather than transnational businesses, are becoming more common throughout French Polynesia and are becoming more popular among tourists (Kahn 2011; Salvat and Pailhe 2002). Pensions are cheaper than large hotels. Tourists staying in these locations tend to stay two times longer than those staying in large hotels (Salvat and Pailhe 2002). French Polynesian authorities have demonstrated their desire to develop tourism and ecotourism (Salvat and Pailhe 2002), however, this has been met with resistance by Tahitians who seem to strengthen their own

culture through revitalization movements in the face of globalizing forces that tend towards cultural homogeneity.

While the myth of Tahiti plays a central role in the social imaginary of this place as a popular tourist destination, the impact of tourism has actually been less significant here than in other parts of the Pacific, in part due to the lack of an airport and economic development until the 1950s-1960s (Castri 2002, 261). Tourism and economic development have, however, contributed to reef degradation on the Society Islands. Tourism development needs to take into account both population density and growth and how these affect natural resource health and resource utilization (Salvat and Pailhe 2002). Prior to tourism, marine degradation existed due to agriculture and deforestation. Coral reef and fish resources are at present even more degraded than before (Castri 2002). Researchers have found that there is a correlation between reduced coral cover and frequency of beach use in Moorea, reducing especially the amounts of branching corals (Juhasz et al. 2010). Though, French Polynesia has not yet reached the level of degradation of other island environments such as the Philippines, Indonesia (Castri 2002), or in the Caribbean where phase-shifts in coral reefs have been common. The increasing local population size has also exacerbated stress on marine resources as more people are using them (Salvat and Pailhe 2002). Tourism also affects coral reefs, the impacts on which stem from related both the natural and built environments (Salvat and Pailhe 2002). In order to have a full understanding of how nature and culture interact with tourism we need to understand the diversity of components affecting these relationships (Salvat and Pailhe 2002).

In Moorea, the creation of MPAs has fundamentally altered Tahitians' relationships to the marine environment, further disengaging them from past ways of interacting with and using marine resources. Rather than weakening cultural identity in French Polynesia, economic development and international tourism have created an environment in which cultural revitalization has flourished (Castri 2002, 258). The islands of French Polynesia and the inhabitants of this region are highly influenced by the marine environment and associated activities (Salvat and Pailhe 2002, 218). Though historical transformations have changed many components of life for Tahitians, they have managed to maintain many components of their cultural heritage. The difference in the way that the government and others who created the MPAs and the local Tahitian populations value the marine environment is indicated in the

eruption of local protest and opposition that occurred in response to MPA planning on Moorea. In order to address the local lack of support in addition to the perceived and lived marginalization of fisherfolk by the MPAs, a restructuring of the marine conservation system is in the process of occurring. Undoubtedly, this restructuring needs to take into account the numerous ways that local peoples value marine resources. Additionally, we need to understand how these resources are contributing to local people's economic and socio-cultural wellbeing. Through this process, we can engage people with their local environment and garner support for conservation programs, rather than disengaging people from both the environment and government.

CHAPTER 3

A REVIEW OF RELEVANT LITERATURE

3.1 INTRODUCTION & DIRECTION

This chapter provides a review and synthesis of the literature used in Chapters Four and Five to support our arguments regarding how to improve conservation initiatives in Moorea (Chapter Four) and the applicability and usefulness of an ecosystem goods and services framework in understanding the cultural values of marine environments (Chapter Five). More specifically, Chapter Four, as a policy paper focused on marine management in Moorea, uses literature drawn from environmental governance. Ranging from critiques of protected areas, to the theoretical basis upholding adaptive governance regimes, including the idea of managing for resilience and devolved, community-based approaches to natural resource management. Chapter Five, alternatively, builds off of the idea of ecosystem goods and services in order to understand how the values associated with environments have been interpreted and measured. Importantly, this chapter also seeks to understand how stakeholder's varying valuations of environments are constructed through their ontological positions.

This chapter begins by examining an anthropological theory of value as discussed by David Graeber. This topic has been placed at the beginning of the chapter due to its centrality in framing the values research we conducted, as presented in Chapter Five. The concept of value is persistent throughout the conservation and environmental governance literature. It is argued that values of stakeholders need to be incorporated into management decision-making. Following the review of an anthropological theory of value, I will discuss environmental conservation and management literature to investigate how institutional decisions affect communities, especially in regards to often marginalized peoples who live close to the land or the sea as a predominant economic opportunity. This will lead into a review of the concept of ecosystem goods and services, which like the environmental

governance literature, attempts to use an integrated social-ecological systems perspective. Additionally, the ecosystem goods and services framework aims to measure the use and non-use values of environments, therefore providing an avenue through which we can explore integrating anthropological perspectives on ontology and value into environmental management perspectives. Following the section on ecosystem goods and services, I will discuss the 'ontological turn' within anthropology and the implications of ontology for both anthropological method and theory and how it relates to understanding the 'other'. This ontological perspective guides my analysis in Chapter Five, revealing the various understandings of existence and human-environment relationships uncovered in our value research. While I cover a wide variety of terrain through this chapter, my review coheres around understanding the ways in which people interact with or affect environments (and vice versa) and the ways in which these relationships are framed as legitimate or illegitimate, of substantial value or of an arbitrary nature.

3.2 UNDERSTANDING VALUE(S)

While most anthropologists find it difficult to speak of cross-cultural universals in human societies one place where we can perhaps comfortably presume such a phenomena exists is in the realm of 'value'. In David Graeber's text *Toward an Anthropological Theory of Value* he challenges theoretical dilemmas that the materialist/interpretivist divide and the substantivist/formalist debate through bringing together a wide range of social theories and theorists in order to disentangle how value(s) draw people to creative action. Value theory is necessary if we view social worlds as projects of mutual creation that are constantly made and remade (Graeber 2001). Using a theoretical approach that begins with questions of "value, creativity and an open-ended layering of real and imaginary social realties" may aid in our ability to understand the paradoxes between individuals and social forms (Graeber 2001, 257) that have plagued anthropological research for much of its history. A theory of value is able to analyze the relationship between individual desire and social structure in multiple arenas of life (e.g. economic, spiritual, cultural) (Graeber 2001, 76). Value is often found in dyadic distinctions in theoretical practice. For example, as measure or meaning, material or symbolic, secular or sacred, as being found in production and exchange or in structure and process; Analyses of value are interested in social relations or objects, the make

up of persons or policies, and systems of meaning or patterns of action (Eiss and Pederson 2002, 283).

In general, value and values are discussed as something around which people organize their lives, feelings, and desires (Graeber 2013, 219). The ways that values are expressed in human lives are through sociological 'values', indicating to us what is good, proper or desirable; economic 'value' measured by what someone is willing to give in order to get something; and linguistic 'value', as described by Ferdinand de Saussure in his argument of value as 'meaningful difference' (Graeber 2001, 1-2). The important part of Saussure's idea here is how it seeks to understand the value of a word within a totality of meaning that constitutes a language. Following Saussure, articulations of value are understood when placed within a larger system of meanings and can then be interpreted through their relation to other beings, objects, and ideas. Both social and monetary forms of value take on meaning within the larger socio-cultural framework that creates one's way of perceiving and understanding reality. The term 'Value' relates to economic price mechanisms whereas, the pluralized version - 'Values' – is indicative of conceptions of what is desirable, for example, behavior or specific ways of thinking about an issue (Graeber 2001).

Values stem from the dialectical relationship between interiority and externality – through which internally motivated desires, spurred by human creativity, come to have meaning and significance when conducted in the face of society. Graeber's understands society to be ". . . a potential audience, the totality of those whose opinions matter to a social actor." (Graeber 2001, 216-217). People's actions only take on value in a social arena, when they are viewed and then interpreted by others. Through viewing society as an audience in relation to an actor, the agency/structure or individualism/holism divides begins to fade away. We see that people's actions are intended to have social effects. Yet, because the actor also wants to effect society in certain ways, the social context leads them to act in certain ways. The individual and society act in similar capacities on one another. The desire to create meaning motivates people to act in certain ways. People act in creative ways, in a sense, performing for the audience that is society. Because meaning is realized through both action and creation, value(s) exist in both objects and actions. When we consider that it is value(s) that inform human behavior and which lead to us creating and assigning meaning to our

material lives, we can begin to see how multiple types of values (social and economic) are refractions of the same thing. Essentially, economic values are part and parcel of our social values and social values influence how we economically value things. Our ideas of objects, much like are perspectives on behavior, are informed by our conceptions of the desirable. Ideals are informed by the material reality that is created through everyday social reproduction. Commodities, or our material reality more broadly, can be understood as by-products of internal processes that are shaped and reshaped by processes of socialization that occur throughout one's lifetime. Material objects stem from utilitarian needs and creative action (Graeber 2001). When we understand values in this manner - as 1) an individual impetus that drives people to act in social settings and 2) as something that is represented through material mediums produced from human creativity and action – it is possible to extend this discussion to understand how people's relationships to the natural world come to have meaning and significance through both action and discourse. Through how people understand their relationships to natural spaces as evidenced in the way they discuss environments and through the material relationships they hold with ecosystems.

Marx and Mauss are notable in Graeber's analysis, for their roles in analyzing how commodities or objects of exchange take on value and the implications of these values in social settings. Marx's idea of social relations, bounded in his critique of capitalism, is essentially an existential questioning of how value is produced in social contexts (Graeber 2001, 2013); while Mauss' theoretical undertaking in *The Gift* illuminate how objects obtain aspects of the giver through forms of gift exchange in non-market societies. While Marx's analysis stopped at consumption, Mauss' inquiries into gift exchange tracked objects through their social histories to understand how they were interpreted after and through continuous exchanges. For Marx, value emerged from the amount of energy people were willing to put into producing and maintaining specific objects (Graeber 2001, 55). Whereas for Mauss, value emerged through gifts taking on components of the giver, acting as a social contract that binds the giver and receiver into a system of reciprocity (Mauss 1967). Ultimately, the two analysts complement each other in understanding how the production and consumption of objects affects the social realities of people, masked by social institutions that designate proper forms of action. Graeber pulls on the strengths of both theorists, while illuminating their weaknesses in order to craft a more well-rounded understanding of how material objects

take on meaning in public contexts. The ways in which values guide human behavior often remain under the surface, influencing action without the actor being cognizant of the underlying processes. In this way, values are motivating, they drive us to act.

Our values exist in this space between the individual and the social, they are reflection that leads to action and action that leads to reflection. Bourdieu's idea of 'objectification' is indicative of this issue of action and reflection. When a person is unsure how to act, they become self-conscious, causing them to think reflectively on themself. Similarly, Jacques Lacan's notion of the 'mirror phase' in child development argues that children's external images of themselves become the image around which they construct their sense of self (Graeber 2001, 96-97). Thus, social relations, from a young age, inform how we develop our individual personae. We reflect on how we conduct ourselves in social relations and adjust our behavior as we see fit – based on our values and the economic form of value that in one way or another influences our behavior. Graeber argues that the self moves back and forth between action and reflection, grounding in our conception of ourselves, while also being grounded in social relationships. The invisible aspects of the self (the soul) are viewed as the location that the capacity to act stems from through reflection. The concrete or visible self is seen and observed by other social actors through individual action and adornment. Adornment of the body, then, becomes a way for individuals to define and project our capacities to act (Graeber 2001). Graeber posits that the relationship between an invisible and visible self from which behavior, and understandings of it, may be intrinsic to how human thought and action functions (Graeber 2001, 96).

Our systems of categorization and our knowledge, are one side of a system of action, forming a dialectic that constructs our value systems and informs how we chose to use our creative energies to act (Graeber 2001, 254). Peoples actions become fetishized in how we understand our action to impact social institutions. We view social institutions as beyond our control and as something which we have to follow, when, in reality, one has the capacity to act in a range of manners whether or not they subscribe to social, state, or institutional standards (Graeber 2001, Chapter 7). Fetishization stems from the confusing of one's own desires for a power intrinsic in an object or institution itself (Graeber 2001, 115). Objects are created as a way to realize human desire. Objects stem from creative action. As does human behavior. Confusion in social theory surrounding the idea of creativity, Graeber argues,

comes from viewing creativity as an individual rather than social phenomenon (Graber 2001). Value theory grounds the individual in the social, and the social as a collective of individual actions. This perspective empowers the individual to affect the social, while acknowledging how the social shapes individual behaviors. This allows us to link a theory of value to political potential, which is ultimately Graeber's goal. Like Mauss and Marx before him, Graeber is using social theory in order to illuminate paths towards political engagement, largely against the totalizing forces of neoliberalism that have taken the world stage over the last thirty plus years.

The values that people hold have come to represent a gateway for designing socially-appropriate environmental management. Resource managers and conservation scientists have argued that understanding people's values can enable better management (Balint et al. 2011; Hicks, Graham, and Cinner 2013; Hicks et al. 2016; Poe, Norman, and Levin 2014; Song, Chuenpagdee, and Jentoft 2013). Too often, though, socio-economics discussed as 'value' becomes the focus of concern for conservation affected communities (Blount and Pitchon 2007). Moreover, adequate measures for the murky non-use values of ecosystems are difficult to come by (O'Garra 2009). From here forward, the literature review will begin by briefly discussing the influence of neoliberalism on conservation efforts, before discussing marine conservation through top-down protected area approaches. In the next section, I will shift our gaze towards alternative environmental governance approaches, rooted in the perspective of community-based approaches. In the final part of this chapter, I will examine how the concept of ecosystem goods and services has been crafted and used as a method and theory behind understanding both the use and non-use values of ecosystems and the ways that people perceive and understand these values.

3.3 MARINE CONSERVATION THROUGH PROTECTED AREAS

Neoliberal political philosophies have been charged with spreading specific ideologies regarding environmental conservation issues. From exacerbating marginalization through the creation of protected areas (Brockington, Duffy, and Igoe 2008; Fletcher 2010; Igoe and Brockington 2007; Levine 2007; Segi 2014) to decreasing government support to create more responsibilities for communities to manage natural resources (Davis and Ruddle 2012; Dressler et al. 2010; Evans 2012; Harvey 2007), to actually changing the

environmental subjectivities of conservation-affected communities (Evans 2012; Fletcher 2010; Segi 2013), neoliberalism has become a token word in critiques of a wide variety of conservation forms. By and large, neoliberalism results in the marketization of everything (Harvey 2007). Thus, conservation under neoliberal political-economic theories is often intricately linked to economic development projects, aiming to meet dual biodiversity conservation and social wellbeing goals. There are two main ways that neoliberalism is discussed as having infused its way into conservation efforts. First, I will discuss integrated conservation and development projects through the creation of protected areas. The second is in relation to how neoliberal philosophies have resulted in environmental governance, leading to collaborative approaches to natural resource management projects.

The world's ecological biodiversity is a global and local commons, providing services for both human wellbeing and economic needs (MEA 2003). The narrative of global ecological degradation has acted as a moral imperative, justifying conservation efforts that often use top-down approaches (Fairhead and Leach 1995; Brockington, Duffy, and Igoe 2008; Ostrom et al. 1999). This idea of global tragedy has resulted in economic gain for neoliberal governments, largely through the privatization of landscapes that were once treated as a commons (Graeber 2010; Harvey 2007). The concept of 'The Tragedy of the Commons' has contributed to the disempowerment of local resource users through the perception that they are not capable of responsibly and effectively managing natural resources for sustainability (Dietz, Ostrom, and Stern 2003; Feeny et al. 1990; Ostrom et al. 1999). This has justified the implementation of protected areas as an ecological conservation method that uses top-down management approaches. Top-down management that relies on centralized actions can disrupt cultural processes, especially when the styles originate in different social contexts from where they are implemented (Poe, Norman, and Levin 2014; West and Brockington 2006). Yet, protected areas have come to represent a 'blueprint' approach to conservation, (Berkes 2007; Brockington, Duffy, and Igoe 2008; West and Brockington 2006), failing to recognize the social contingencies that come with them. In effect, protected areas have become a form of government through the reproduction of their model throughout the world (West and Brockington 2006). Protected areas hold within them the assumption that those living in and around them will hold the same values (both monetary and non-monetary) as those that lead to their creation (Segi 2013, 336). These

endeavors assume that if people make money from nature-in-situ, this will reduce their ability to use natural resources in unsustainable, manners therefore representing more environmentally friendly livelihoods (Brockington, Duffy, and Igoe 2008; West 2006).

In tropical reef environments, the creation and implementation of MPAs is often viewed as the answer to meeting the dual goals of biodiversity conservation and environmentally sustainable livelihoods through benefiting both fisheries and alternative economic development efforts (Fabinyi 2012; Halpern 2003; Segi 2014; Walley 2004). Sustainable livelihoods are by and large thought to stem from the incorporation of MPAs as a tourist attraction (Fabinyi 2012; Segi 2014; Walley 2004). Despite their growing popularity, it is difficult to say that MPAs have been a success (Kareiva 2006, 533). Many integrated conservation and development projects (ICDPs) fail to meet both conservation and development goals, being pulled towards one component more than the other (Berkes 2007, 15189). Essentially, MPAs are viewed as answers to problems that, at times, they end up perpetuating or exaggerate through their social-ecological repercussions.

In 2010, the Convention on Biological Diversity set a goal to increase the level of MPA coverage to 10% of the world's oceans by 2020 (Secretariat of Convention on Biological Diversity 2010). MPAs began in the 1970s. As of 2015, 3.5% of the ocean is defined as protected when lumping together all forms of marine conservation and protection (Lubchenco and Grorud-Colvert 2015). Theoretically, MPAs are generally placed in spawning areas in order to protect juvenile fish as they develop (Fabinyi 2012), though this varies in practice. For promoters of MPAs, there is little doubt that protected areas will yield larger fish populations that will benefit fishers through the 'spillover effect' (Fabinyi 2012; Kareiva 2006). Essentially, the spillover effect results in fish moving in and out of protected areas so that they can be caught by local fisherfolk (Fabinyi 2012). Unfortunately, evidence that spillover has resulted in more sustainable fisheries is lacking (Kareiva 2006; Lison de Loma et al. 2008). There is a need for improved tools that can effectively measure both localized and regional effects of MPAs on marine ecosystems (Lison de Loma et al. 2008).

Jentoft, Chuenpagdee, and Pascual-Fernandez (2011) argue that assessments of marine protected areas need to be centered on goal formation processes and dynamics, in addition to the way that power dynamics are situated among stakeholders. Critical assessments should evaluate the stated goals against the actual outcomes of conservation

efforts (Halpern 2003; Jentoft, Chuenpagdee, and Pascual-Fernandez 2011). Jentoft, Chuenpagdee, and Pascual-Fernandez (2011) distinguish between the stated and operational goals of MPA systems, which may differ in practice. These differences can problematize the ability of resource management to achieve its desired goals. There is a positive relationship between the diversity of resource users and the amount of flexibility needed in MPA regulations and goals (Jentoft, Chuenpagdee, and Pascual-Fernandez 2011, 76). Goals of MPAs also need to account for the biological variation inherent in reserves (Halpern 2003, 128). There are two main ecological measures of MPA success. The most common method is a Control-Impact design, which contrasts areas inside and outside of the MPA, but which fails to account for other processes that affect spatial variation (Lison de Loma et al. 2008). The other, is a Before-After-Control-Impact design, which compares data in one or more MPA before and after the impact of interest. While these ecological measures may provide some indication of the MPA's effect on marine ecosystems, they do little to account for the social dimensions of MPAs and whether they have been successful or not. Whereas comparing the goals of MPAs to the outcomes may provide insight into both the ecological and social dimensions of MPAs.

In a comparative study, Halpern (2003) looked at 89 marine reserves classified as no-take zones in order to understand how reserves, specifically in terms of size of the reserves, affected the following biological indicators: biodiversity, fish density, fish size, and biomass. He found, that regardless of size, reserves tended to result in increases in the four indicators he was measuring. As larger reserves cover larger areas, their potential for improving fishery stocks is greater than that of smaller reserves. However, many MPAs fail in that they do not truly provide protection (Halpern 2014). Halpern (2003) reminds us that it is important to bear in mind the goals of creating marine reserves when assessing their effectiveness. Goals not only aid in assessment, but also are fundamental in the creation of reserves and facilitate assessments of the effectiveness of protected areas. However, the definition of success in marine protection remains tenuous as there are multiple characteristics, some of which may be met while others are not (Rossiter and Levine 2014).

McClanahan et al. (2006) used a comparative study of various marine management types to understand the impacts of conservation efforts on marine ecosystems. The authors examined three marine management regimes, including: national marine parks, co-managed

areas, and traditionally managed marine environments. The authors used a control-impact design, comparing underwater visual censuses of key resources and ecological parameters inside and outside of the managed areas to assess how management was impacting marine resources. They expected that the resources that are used by adjacent peoples would be the ones to respond to management most dramatically and that this would be evidenced through increased populations inside of managed areas. Surprisingly, they found little difference in coral cover, coral and fish diversity, and abundance of targeted fish species inside of reserves in comparison to areas outside of reserves. Aside from ecological indicators, the authors were also interested in understanding peoples level of compliance with the reserves. They found that traditional management regimes held greater acceptance and compliance by adjacent communities than co-managed areas or national parks. National parks were, at least in part, premised on tourism and biodiversity conservation, and yet were failing to meet the biodiversity component of their goals. Simultaneously, these parks failed to garner local support and compliance. They conclude, as other researches of the social dimensions of MPAs have, that conservation initiatives rooted in local contexts that encompass local values and traditions will be more successful than those that only answer to global science and development goals (Blount and Pitchon 2007; Berkes 2007; Brander, Van Beukering, and Cesar 2007; Davis and Ruddle 2012; Fabinyi 2012; Kareiva 2006; McClanahan et al. 2006; Segi 2013, 2014; Walley 2004).

3.4 ENVIRONMENTAL GOVERNANCE AND COLLABORATIVE APPROACHES TO CONSERVATION

The shift from government to governance is a byproduct of the global movement towards neoliberal policies. Neoliberalism is a distinct political-economic philosophy that has taken on various manifestations as it is adapted to specific locations and contexts (Harvey 2007). This movement has resulted in the cutting back of state resources, leaving space for community organizations to take up the role of providing social services (Evans 2012; Harvey 2007). Environmental governance is a byproduct of community involvement, resulting from series of partnerships that attempt to collaboratively work towards more desirable futures (Evans 2012; Stoker 1998). This requires a sharing of power through

acknowledging that many peoples from differing backgrounds hold a stake in environmental issues.

Conservation efforts by large transnational corporations and NGOs or BINGOs (Big International Non-Governmental Organizations) often portray local communities who rely on the environment they inhabit for their livelihoods as threats to that ecosystem, undermining local environmental relationships (Brockington, Duffy, and Igoe 2008; Fabinyi 2012; Igoe and Brockington 2007; Segi 2014; Walley 2004). Natural resource management is increasingly aware that it is necessary to include public perspectives and opinions into management decisions in order to be effective (Balint et al. 2011; Berkes 2007; Poe, Norman, and Levin 2014). Thus, governance approaches to conservation have led to a plethora of community-based or collaborative approaches to environmental management projects. Fisheries literature itself has shifted from a 'maximum sustainable yields' approach to discussing governance and social-ecological systems (SESs) (Berkes 2007, 2012).

Governance approaches to conservation often use integrated approaches that combine conservation and development projects, attempting to address economic and ecological components of environments (Brockington, Duffy, and Igoe 2008; Davis and Ruddle 2012; Igoe and Brockington 2007; Levine 2007; West 2006). Integrated projects have been critiqued as promulgating neoliberal philosophies through espousing the market as the solution to all social ills (Brockington, Duffy, and Igoe 2008). Both top-down management through protected areas and community-based co-management efforts have been critiqued as neoliberal conservation. This critique is important for examining how pre-existing power inequalities strengthen through pursuing economic and ecological goals simultaneously. Many integrated conservation and development projects fail to meet all of their objectives, generally becoming more concerned with either conservation or development (Berkes 2007).

Integrated approaches, though, are notable for their focus on understanding people and the environment as an integrated whole. Researchers are starting to recognize that the full complexity of social-ecological systems is not evident until using a coupled perspective (Berkes 2012). The idea of resilience drives social-ecological systems literature, acknowledging the uncertainty of ecosystems and how they, like human relationships to the environment, are constantly in flux (Folke 2006; Lebel et al. 2006; Olsson, Folke, and Berkes 2004). Understandings of resilience infuse Co-management approaches as they both

recognize that people and environments change through time, thus necessitating institutional flexibility that can be managed through open, honest, and trusting relationships between a wide range of actors (Evans 2012; Berkes 2010; Carlsson and Berkes 2005; Dietz, Ostrom, and Stern 2003; Ostrom et al. 1999; Stoker 1998).

For many individuals who lack appropriate resources, NGOs and GROs offer a political voice that can contribute to desired change (Evans 2012; Harvey 2007). The increasing role of NGOs and GROs in political movements, is characteristic of the shift from government to governance under neoliberal policies (Evans 2012; Harvey 2007). Under governance, private and public actors take up the role of providing services that governments once did (Evans 2012; Harvey 2007). At times, NGOs and GROs may be viewed as superior to elected governments and as more aligned with local people's needs (Harvey 2007, 179). Simultaneously NGOs, especially Big International Non-Governmental Organizations, (BINGOs), are critiqued for their promulgation of neoliberal policies that align with larger political-economic structures that may already ignore marginalized populations (Brockington, Duffy, and Igoe 2008). In effect, governance blurs the boundaries between private and public, relying on new forms of transnational collaborations in order to create functional programming (Biermann and Pattberg 2008; Evans 2012; Stoker 1998).

Decentralization requires a shared vision that make explicit management goals (Berkes 2010, 495). Accountability has to be constructed (Larson and Soto 2008) and communication made effective through careful coordination (Berkes 2010). Devolution through horizontal and vertical power sharing in governance frameworks leads to multilevel management, allowing for greater adaptability than traditional governments (Berkes 2010; Larson and Soto 2008). The goals of collaborative approaches need to mediate social inclusion, authority, and sustainability (Berkes 2010; Larson and Soto 2008; Lemos and Agrawal 2006). Community-based approaches need to focus on multi-level approaches if we want to move past the mistakes that have hindered the successful implementation of community-based natural resource management in the past (Dressler et al. 2010). Fundamentally, community-based conservation moves beyond communities to institutional linkages and is more likely to be successful if exclusivity and subtractability are factors in decision-making (Berkes 2007, 15191). Co-management is better able to deal with the complexity of biodiversity conservation because the plurality of perspectives can bring

innovative solutions and magnify complementary strengths (Berkes 2007; Carlsson and Berkes 2005; Dietz, Ostrom, and Stern 2003; Evans 2012; Lebel et al. 2006; Poe, Norman, and Levin 2014). Focusing on designing the functions of management, rather than creating power-sharing arrangements, can aid in facilitating co-management arrangements (Carlsson and Berkes 2005). This process requires the ability to adapt and change as people learn together and to adapt to changing social and environmental contexts (Berkes 2010; Carlsson and Berkes 2005; Lebel et al. 2006; Olsson, Folke, and Berkes 2004). The term adaptive co-management is used to emphasize the role of social learning, of learning-by-doing, and of flexibility throughout environmental and social fluctuations (Berkes 2009, 2012).

Iterative processes of social learning require patience and openness between collaborators. In the context of Hawaii, adaptive co-management arrangements emerged only after the public was motivated and mobilized enough to take political action in order to exact what they viewed as more equitable and just marine management policies (Ayers and Kittinger 2014). The failure of current marine management coupled with the past success of native Hawaiian's management efforts motivated native Hawaiians to fight for co-management arrangements due to their dissatisfaction with current regimes (Ayers and Kittinger 2014). Fundamentally, co-management is backed by the idea that people who are affected by environmental decisions should be involved in the decision-making process (Berkes 2009, 1692). Along with this comes the need to recognize how formal and informal institutions are arranged to entitle use or access to natural resources (Leach, Mearns, and Scoones 1999). In order to build social and ecological resilience, the protection of rights and the pursuit of justice for minorities are key (Lebel et al. 2006). Creating sustainable pathways will never be error free (Ostrom et al. 1999). Thus, adaptive management approaches that learn through time and are in touch with the needs and perspectives of resource users are necessary (Berkes 2009; Folke 2006; Lebel et al. 2006; Olsson, Folke, and Berkes 2004).

In order to create 'good governance', we must adequately address issues surrounding: participation, representation, deliberation, accountability, empowerment, social justice, and the organizational features of collaborative relationships (Lebel et al. 2006). Too often, community-based approaches to conservation do not adequately involve local people and have failed to meet the expectations of those involved (Berkes 2010; Larson and Soto 2008; Lemos and Agrawal 2006). This is not due to a problem in decentralization or devolution

theory, rather, it is a reflection of the challenges of creating effective programming that has to account for numerous variables, including differing perspectives and scientific uncertainty (Berkes 2010, 494). We cannot ignore the power dynamics that are inherent in the capacity to manage resources. The relationship of co-management forms to the marketing, processing, and selling of marine resources directly affects these power dynamics (Davis and Ruddle 2012, 252). The social relations surrounding small-scale fisheries can "protect against the dehumanizing external power forces" that governance can carry with it (Davis and Ruddle 2012, 251).

While the incorporation of multiple perspectives and value systems into resource management efforts has been applauded as a necessary component of equitable and successful management paradigms, it has also been critiqued as an opportunity for uncaring governments to release their own responsibilities onto community members. Fundamental political inequalities must be addressed or co-management can lead to class-based exploitation (Davis and Ruddle 2012). The devolution of power creates more responsibility for community members who already may be facing stress in their everyday responsibilities. It is symptomatic of governmental ills if co-management emerges out of people's frustrations with government's inability to effectively manage resources. We must be careful in community-based approaches to not place extra burden on those who are already marginalized (Dressler et al. 2010). As Ayers and Kittinger (2014) pointed out was the case in Hawaii, one of the paradoxes of neoliberalism is that it is a free-market ideology that emphasizes privatization and marketization. This emphasis on privatization and marketization disengages peoples from their lands (Graeber 2010). Simultaneously leading them towards social actions to rectify negative situations that they are experiencing. However, some co-management approaches to coral reef conservation have been more ecologically and socially successful than top-down protected area approaches (McClanahan et al. 2006). Thus, co-management may best be suited for locations where local peoples have already shown their vested interests in conservation efforts and have ideas and/or practices already established to manage natural resources. Co-management may then be an opportunity, rather than a burden placed on people by their government.

3.5 ECOSYSTEM GOODS AND SERVICES: A THEORY AND METHOD FOR VALUE?

Of late, the attempt to address environmental degradation occurring worldwide has come to use market-based approaches to promote more sustainable behavior. This, in part, is encouraged through the declining role of the state since the 1970s due to neoliberal policies, which tend to view the market as the answer to all social-ills (Harvey 2007). This has resulted in the usage of market and voluntary incentive based programs have become proprietors of environmental governance, addressing climate change and sustainable resource use (Lemos and Agrawal 2006; McGrath et al. 2015). Many consider markets to be one of the most effective levers with which to address climate change (Evans 2012). Similar to Adam Smith's idea of the 'invisible hand', market approaches assume that through an individual pursuing their own self-interest, they will also benefit public causes (Harvey 1996). For better or worse, many market-based approaches result in turning common property into private property (Harvey 1996). Other manifestations occur through green certifications or eco-labeling (Evans 2012). Market approaches also assume that people show their preferences through consumption choices (Brockington, Duffy, and Igoe 2008; Evans 2012). This assumption ignores the structural barriers that may exist for many people to purchase eco-certified or 'green' products. Often market approaches focus on a single resource-as-commodity, ignoring many of the other valuable ecosystem goods and services that come from environments (Thompson, Baruah, and Carr 2011). An example of this is the UN REDD+ program that compensates people living in forests to not cut down trees so that forests continue to act as carbon sinks. This program thus assumes that local peoples value trees, or can learn to value trees, the same way as transnational governmental organizations do – as a carbon sink (or non-use value) as opposed to another usage of a tree that may be deemed appropriate. Ultimately, most – if not all – market-based approaches result in commodifying components of an environment rather than treating them as an integrated whole. Effectively, ESs approaches transform ecosystems, or characteristics of them, into commodities – things for consumption. Market-based approaches to solving environmental and social issues is one attempt to use the 'common language' of money as a motivator of responsible social behavior.

In his 1996 book, *Justice, Nature, and the Geography of Difference*, David Harvey dedicates a chapter to the valuation of nature, addressing the arguments for and against monetary valuations of environments. Money serves as a powerful symbol in valuations as it is part of a daily practice of demonstrating value. Moreover, money is the only universal measure of value. Through this characteristic, money has the capacity to cross-culturally communicate wants, needs, desires, choices, and preferences. Thus, money serves as a powerful form of social power, possessing the ability to both liberate and suppress people's desires in a theoretically morally neutral manner. Because money has no inherent moral position, Harvey argues, it becomes a convenient mechanism through which to actualize human desires, while maximizing individual freedom and minimizing socio-political restraints. The world over, money serves as a tool for articulating values (Harvey 1996, 150-151). However, this also leads to the troubling notion that those with more money have more ability in demonstrating and exacting their values. Money valuations, with their inherent linkage to market-based approaches, continue to be viewed as valuable for their ability to demonstrate values cross-culturally and 'neutrally'. This neutrality stems from money's representation of the potential to act – when you have it, you can turn it into whatever you want it to be (Graeber 2001). The idea of ecosystem services is based around a similar assumption - that money motivates people to act in desirable ways. ESs valuations assign monetary figures to the various goods and services that ecosystems provide for humans. These studies presume that the presence of a monetary value on aspects of the environment will motivate people to develop more sustainable behaviors (Oliveira and Berkes 2014; Hicks et al. 2015). ESs approaches are a method of proxy commodification of nature through their role in compensating for 'missing markets' (Castree 2003).

The idea of ecosystem goods and services came about in the same political climate, which allowed the global neoliberal project to emerge, popularizing in the late 1980s and 1990s. The concept of ESs first appeared in the late 1960s and now is commonly understood to account for the tangible and intangible benefits we obtain from the natural world (MEA 2003). The 2003 Millennium Ecosystem Assessment (MEA) created a framework for implementing ESs approaches. The MEA used the concept of ecosystem goods and services (ESs) as a foundation for its assessment. This is unsurprising given that ecosystems and their services can be viewed as the basis upon which people's lives and actions are founded

(Lemos and Agrawal 2006, 317). The MEA concludes that the past half-century of human activity has altered ecosystems more than ever, leading to substantial net gains in economic development and wellbeing. Yet, because of this ecosystems are being degraded and the goods they produce are being used unsustainably (Lemos and Agrawal 2006, 317). The MEA considers a range of responses for addressing environmental degradation, such as market incentives, improving social contexts, promoting better technologies, and education efforts. These responses are all institutional (Lemos and Agrawal 2006), focusing on environmental governance as a thing of large power structures, ignoring localized, community-level or community-based responses to environmental issues.

Categorization of the goods and services that ecosystems provide allows us to unpack how ecosystems form the foundation for human (and other) lives on the planet, granting recognition to the numerous ways in which we benefit from well-functioning environments. While ESs stem from a motivation to steer human behavior towards environmental sustainability, their applications have largely come from ecological and/or economic science, lacking integration with broader social science studies about people's choice and behavior (Oliveira and Berkes 2014; Hicks et al. 2015). Surely, human behavior and preferences need to be understood in order to maintain ecologically sustainable behavior (Hicks et al. 2016). The material focus of ESs categories and valuations fail to properly capture people's subjective relationships to ecosystems (Oliveira and Berkes 2014). Moreover, the numerous and multiple values of ecosystem goods and services are often not included in land-use planning (Grêt-Regamey, Walz, and Bebi 2008). Or, if they are, they focus on the material relations of people with places (Oliveira and Berkes 2014), rather than preferences or perceptions. We need to discuss the benefits people gain from nature into conservation conversations (Hicks et al. 2015, 7). These benefits being both a product of and a contributor to people's value systems.

The MEA delineates four categories of ESs: regulating, provisioning, supporting, and cultural. Regulating services are benefits obtained from the regulation of ecosystem processes (e.g. climate regulation); provisioning are the products obtained from ecosystems (e.g. fuel or food); supporting services are those necessary for the production of other ecosystem services (e.g. nutrient cycling); while cultural services are defined as the nonmaterial benefits obtained from the ecosystem (e.g. educational values). Use values can

be thought of as the goods that ecosystems produce, such as timber or fish, while non-use values stem from the benefits derived through the functions of ecosystems. The concept of use-values corresponds with that of ecological goods. Goods are renewable resources. Alternatively ecological services are physical, biotic, biogeochemical, informational, and socio-cultural characteristics or functions of ecosystems (Moberg and Folke 1999). Examples of socio-cultural services include the emotional or spiritual values that the goods and services associated with ecosystems for local communities. ESs approaches have been more successful in measuring the 'use' values of ecosystems than the non-use values (Oliveira and Berkes 2014; Grêt-Regamey, Walz, and Bebi 2008; Hicks et al. 2015; O'Garra 2009). The lack of effective cultural service valuation methods is disconcerting given that these services may be more apparent to the daily reality of individuals in comparison to regulating or supporting services that affect daily life, but are not cognized as readily (Oliveira and Berkes 2014).

Contingent valuation (CV) is the only valuation method that has been proven capable of getting at the murky non-use values of ecosystems and their services (Brander, Van Beukering, and Cesar 2007). These valuations use two main approaches: stated preference and revealed preference methods (Grêt-Regamey, Walz, and Bebi 2008). Revealed preference methods observe consumer behavior in order to understand people's values, while stated preference methods present hypothetical situations to individuals and inquire how they would react (Grêt-Regamey, Walz, and Bebi 2008). Revealed preference methods may fail to acknowledge how markets through ignoring disjunction between held ideologies and material realties limit people's choices. Whereas, a downfall of hypothetical situations is that they may not reveal how people would truly act in a functioning market (Grêt-Regamey, Walz, and Bebi 2008). Generally, hypothetical situations elicit how much an individual is 'willing to pay' (WtP) in order to ameliorate a negative environmental situation. This approach presents difficulties in that people's various economic standings may affect the monetary amount they state. Moreover, eliciting a WtP has shortcomings in that in requires respondents to assign fractions of a total WtP to various motives that can be driven by numerous overlapping and inseparable motivations that are unavailable to the author (O'Garra 2009). Nonetheless, contingent valuation approaches still hold the most hope in

being able to understand the messier cultural values that are more difficult to monetarily measure.

We need valuation methods that can understand various aspects of ecosystems if we assume that people must make trade-offs about goods and services on a daily basis (Grêt-Regamey, Walz, and Bebi 2008). Considering that the non-use values have been less well considered in valuation studies (Grêt-Regamey, Walz, and Bebi 2008; Hicks et al. 2015; O'Garra 2009), it is imperative that we find innovative valuation methods (Grêt-Regamey, Walz, and Bebi 2008) that can address these forms of value (Oliveira and Berkes 2014). The following section will discuss ESs valuations specifically in the context of coral reef environments. This review will be grounded in an interest in the non-use and cultural values that ecosystems provide in order to understand how we can move forward with measuring the non-use values of coral reef ecosystems.

3.5.1 Coral Reef Valuations through Ecosystem Services

Coral reef ecosystem valuation studies (CRESVs) began in the late 1980s. Early papers wrote on the costs of coral reef degradation rather than their total economic value. The 1990s led to an expansion of the valuation literature. Over 100 studies have since appeared (Brander, Van Beukering, and Cesar 2007). Studies on the cultural values of reefs occur in much smaller numbers than papers examining ecological or total economic values of reefs. Throughout the Pacific, island communities have held long-term relationships with coral reefs leading to an interdependence with marine environments (Moberg and Folke 1999). These relationships are difficult to express in monetary terms (Laurans et al. 2013). For island communities, inherent variation exists in the relative importance of ecosystems and their goods and services, based on both individual and national scales (Smith et al. 2013, 639) as well on biogeographic regions, reef types, individual reefs, and among zones within reefs (Moberg and Folke 1999, 217). Thus, it is important to keep in mind that human life is dependent on seascapes as a whole (Moberg and Folke 1999, 217), rather than reducible components that valuation studies tend to delineate. Most ecosystem goods and services valuations, however, focus on direct use-values and overlook non-market goods that reefs provide, undermining the specific and important cultural histories that develop in conjunction with reefs (Laurans et al. 2013).

The South Pacific in particular presents a difficult area to conduct valuation studies given the long and intimate relationships that autochthonous peoples living in these locations have with marine ecosystems. In a review of five valuation studies occurring in the South Pacific, Laurans et al. (2013) acknowledge that most CRESVs have been categorized into three approaches: the economics of degradation, the economics of protection, and the economics of welfare. The economics of degradation concentrates on how people's activities impact coral reefs, comparing private benefits and social costs to illuminate negative human impacts. Studies focusing on the protection (and therefore management) are often framed within the perspective of biodiversity conservation and resource management. In general, these studies elicit reef services through measuring participants' willingness to pay for preservation or willingness to accept resource loss. Whereas an economics of welfare approach looks at how reefs contribute to coastal/national economies, acknowledging the dependence of people on coral reef provisioning services. The authors find that throughout these studies the values of reefs tend to increase with four factors, including: the economic development of the coastal zone; the concentration of the population; the per capita national GDP as a proxy for budget availability and the 'ability to pay'; and "the rate of highly valued activities, such as tourism, as opposed to agriculture and small-scale fisheries" (Laurans et al. 2013, 137). The lack of incorporation for many Pacific island communities into broader economic markets undermines our ability to adequately measure the values of the marine environment given the small or weak monetary economies of these places.

In comparing the value of reefs in the South Pacific to other regions, Laurans et al. (2013) found that South Pacific reefs have the lowest values per hectare of coral cover. Contributing to these low values are the difficulties in monetizing the value of non-commercial fisheries (i.e. subsistence and recreational fisheries) and associated factors such as people's dependence on fisheries for protein dependence, the non-substitutability of fishing activities, and the maintenance of a stable source of income through fisheries in otherwise uncertain markets. Another missing factor is the marine environment's role in facilitating social cohesion (Laurans et al. 2013, 140). Other cultural components of reefs that are generally not included in valuation studies, include: the level of familiarity that islanders hold with the reef, the role of the reef in the identity of the community, and the role of the reef in the social and political positioning of the community towards other island

communities (Laurans et al. 2013, 140-141). Common economic assumptions fail to capture the value that local communities assign to reef characteristics as they lack exchange equivalents. This is especially true in underdeveloped economies (Laurans et al. 2013). In Moorea, and French Polynesia more broadly, the relatively high GDP created through French subsidies fails to reflect the on-the-ground reality where there are relatively few economic opportunities. Those opportunities that do exist are largely within tourism. Tourisms' subjectivity to global processes and events marks it is a fickle and unreliable industry (Levine 2007).

Most CRESVs since the 2000s have tended to focus on the high-value activities of recreation and tourism (Brander, Van Beukering, and Cesar 2007). In a meta-analysis of coral reef valuation studies, Brander, Van Beukering, and Cesar (2007, 211) found that recreational values tended to produce the highest values for reefs. However, the mean and median values of coral reef recreation start as low as $17 USD per visit, with an average of $184 USD. These values depend considerably on location, recreation activity, and the valuation method used. The authors found that contingent valuation approaches tended to produce the lowest results out of all of the valuation methods they examined. They view the economic draws of reefs as the most important usages of coral environments, especially in the realm of tourism/recreation, which were found to provide the highest values for coral reefs. Similarly, Laurans et al. (2013) found that over 80% of the sum of estimated value in CRESVs was in tourism, coastal protection, and coral reef fisheries. They argue that the socio-cultural development and context of the tourism industry better explained the variation in values than the ecological characteristics of the reef (Laurans et al. 2013, 139). There is no doubt that coral reef ecosystems have the ability to draw in tourists from around the world who want to snorkel in their biodiverse habitats. However, the finding that tourism/recreation values trump other ecosystem goods and services of reefs is biased towards the easily monetizable values of tourism. This contrasts with other cultural and subsistence values that reef systems hold for local populations. The difficulty in measuring the cultural values of coral reef environments has lead to their under-privileging in CRESVs.

O'Garra (2009) took on the challenges of measuring cultural values through using a contingent valuation exercise to measure bequest values with Fijian fisherfolk. Bequest values have largely been left out of CRESVs, despite a focus on them in anthropological and

cultural geography research (Laurans et al. 2013). Bequest values are defined as the "value attached to preserving a good or service for use by future generations, independent of one's own use of the good/service" (O'Garra 2009, 179). This research took place in a Fijian community located near Suva, the capital of the country. Her research site was at the Navakavu fishing grounds in an indigenous subsistence community. She presented respondents with a questionnaire that first reminded them of the benefits that their fishing grounds provided followed by a hypothetical scenario. This scenario asked participants to imagine that there was a threat to their fishing ground that could potentially destroy it. In order to prevent this, the grounds would have to be closed to everyone. If current participants stopped using the fishing territory then it would be available future generations to use in all modes they desired. Participants were asked to imagine that they would have to contribute time or money in order to conserve the resources. She found that respondents felt a responsibility to protect their marine resources even if no one could currently use it, although, people mostly valued the marine environment so that they and future generations could use it. People were more willing to contribute time than money to conservation efforts, suggesting that there was a refusal to place a monetary value on the 'right' of future generations to use the fishing grounds (O'Garra 2009). O'Garra's findings also blur the distinction between use and non-use values, as bequest is generally conceptualized as a non-use value, though she was measuring bequest in relation to future usages of the ocean.

In another attempt to better understand socio-cultural values through ecosystem goods ands services, Hicks et al. (2015) interviewed coral reef stakeholders in four countries, completing twenty-eight valuation studies. Their research used human value theories derived from social psychology in order to understand people's motivations for specific ESs preferences. The theory of value was derived from the work of Schwartz, which splits human motivations/values into four domains (e.g. self-transcendence, openness to change, self-enhancement, and traditionalism). This theory assumes that these values are cross-cultural and thus applicable to all human societies. Their analysis sought to understand how the values fisherfolk held across the four countries converged or made trade-offs between researcher-designated value types and domains and ESs categories. They found that there was convergence between ESs and multiple human values, but the values any specific ecosystem service held all stemmed from the same value domain. They also found that

specific ESs were prioritized over others and there were consistent patterns among ESs priorities and associated human values. Because values influence people's behavior, their findings have implications for coral reef management on a transnational scale given the consistency in findings between sites. The authors argue that pro-environmental behavior needs to align with peoples motivations, which are informed by what they value. Though, the authors warn us that while there is some consistency apparent at a community or country scale, underlying this is considerable variation within a community (Hicks et al. 2015).

In another similar study, Hicks, Graham, and Cinner (2013) compared the ways that scientists, managers, and fisherfolk valued coral reef ecosystems in Tanzania, Kenya, and Madagascar, once again using an ecosystem goods and services model. The research team used photos to represent eight ecosystem goods and services categories whose definitions were refined through focus group interviews in each of the countries. They asked those interviewed to first rank the services and then rate them by distributing between them 100 'points'. However, fishers were allotted 80 points split up into four groups of twenty in order to rank the categories, whereas scientists and managers were given the entire 100 points at once. The authors were particularly interested in the synergies and trade-offs that occurred in the respondents' valuations. They found that fishers tended to prioritize fishery, habitat, and education. Scientists gave the most points to fishery, habitat, and coastal protection. Both groups rated 'culture' among the lowest priorities, while fisherfolk also valued recreation and scientists valued sanitation lowly. Managers ranked habitat, education, and bequest among the highest priorities and sanitation among the lowest. For all three groups, there were more trade-offs than synergies. While there was some variation between the three groups' priorities, they also found there was some remarkable similarities. These similarities can serve as a starting point for resource management discussions. The authors posit that variations in the groups' valuations are due to differences in social characteristics, experiences, and conceptual understandings (Hicks, Graham, and Cinner 2013, 1451).

The imposition of ecosystem goods and services' categories onto environments assumes that Western scientific ideas can describe peoples relationships with environments, largely ignoring other perceptions or understandings of nature (Oliveira and Berkes 2014). By and large this results in the propagation of people as apart from rather than belonging within 'nature' and the 'natural'. People's perceptions inform their values, and are

underprivileged in many ecosystem services research. This is disconcerting given that ESs are used to inform resource management decisions (Oliveira and Berkes 2014). Overall, the high degree of variability that numerous authors point out in valuation studies brings into question the legitimacy of this approach for producing credible understandings of the value of coral reef ecosystems and their associated goods and services for linked human populations. This lack of consistency is especially problematic given the current difficulties in measuring the non-use values of coral reef ecosystems. All ecosystem good and service studies make the presumption that the categories they are having people valuate are important to the people participating in the research. While the ESs approach attempts to be inclusive of all goods and services that ecosystems can provide, operationalizing them in research requires researchers to select various ESs to valuate, therefore not necessarily being inclusive of what on-the-ground participants may think or feel of the values that ecosystems have (Oliveira and Berkes 2014). This failure to incorporate people's own understanding of their experiences, requires us to move beyond current ESs research models to more adequately capture peoples relationships to environments. While contingent valuation approaches attempt to move away from creating monetary values for ESs, they still have the effect of categorizing the characteristics of environments and delineating these categories into western conceptions of the natural (Oliveira and Berkes 2014). ESs assume that scientists can escape their own values that are implicit in scientific enquiry (Harvey 1996, 162). Effectively, ecological economics attempts to overcome compartmentalizing nature through understanding how all components of an ecosystem (both the use values and non-use values) coalesce into a totality, yet, they fail to overcome their own institutional and ontological assumptions about the order of the world (Harvey 1996, 155).

Using monetary valuations of ecosystems creates a way to alienate people from ecosystems and then to re-incorporate them back in more 'sustainable' ways. Money acts as a 'neutral' medium through which to understand value (Harvey 1996, Chapter 7). This value is presumed to motivate people to act in more environmentally friendly ways, as if money was the greatest motivator of people. The ability for monetary valuations to be easily translatable across numerous cultural, economic, and environmental contexts certainly contributes to their desirability. However, there are many components of the human condition that money valuations may not be able to address. Many cultural aspects of human-environment

relationships are incommensurable or intangible, making monetary values irrelevant to them (Oliveria and Berkes 2014, 118). Money is essentially 'dead and inert' and only acquires meaning through social processes (Harvey 1996, 152). These social processes result in a consistent transformation of the value of money through time, as the credit and power of the state assign money its tangible value. Thus, to calculate the value of 'nature' through "the flow of environmental goods and services" poses significant problems, requiring one to carry out complicated calculations in order to account for constant rates of exchange and price deflators (Harvey 1996, 152). The rapid shifts in market prices and asset values leads to arbitrary assumptions when conducting monetary valuations. Moreover, monetary valuations inherently assume that multiple environmental goods or services are interchangeable, in that they can all be reduced to the same type of value, alienating specific components of ecosystems from their socio-political contexts and understandings. The idea that money can serve as an equivalent representation of the numerous functions, services, and goods that environments provide requires us to reduce ecosystems to discreet components. Monetary valuations compartmentalize, leading us to value fish independently of their habitat (Harvey 1996, 153). This runs counter to an ecological understanding of the world in which the environment is integrated and holistic (Harvey 1996, Chapter 7).

Monetary valuations are tied to specific understandings of time and space. They cannot account for changing values through time, especially in regards to natural fluctuations of environments. Monetary accounts remain static, while ecosystems fluctuate. For example a well-known total economic valuation of the world's ecosystems by (Costanza et al. 1997), came up with a value of between $16-54 billion USD for ecological services. The authors note numerous limitations to this valuation. With such a wide-ranging value, and with serious consideration of all of its limitations, it is hard to seriously incorporate these figures into management decisions. Through creating these economic valuations of ecosystems, we relegate environmental services to the status of an 'externality', failing to understand how internalized human understandings, which motivate behavior and action, may affect the value of the natural world (Harvey 1996, 155). At the same time, money valuations tend to benefit those who have money over those who do not. The domination of nature often goes hand-in-hand with social domination. There are many recorded instances of the most marginalized people living in the most polluted and degraded environments, creating a spiral-down effect

of social and environmental justice issues. Effectively, monetary valuations fail to capture the complexity of people's wants, desires, passions, and values (Oliveira and Berkes 2014; Harvey 1996). As Harvey notes, ". . . there is something morally or ethically questionable or downright objectionable to valuing human life in terms of discounted lifetime earnings and 'nature' in monetary terms" (1996, 155). Ultimately, valuation and the choice of values assigned to environments lies within people, and human creations, and not in nature (Harvey 1996, 163).

3.6 THE ONTOLOGICAL TURN: MOVING PAST CULTURE AND SCIENTIFIC PERSPECTIVES?

Ontology, neatly defined, is the study of being. In anthropology, ontological perspectives have been used increasingly since the 1990s (Scott 2013). The term 'ontology' is used to describe both a theoretical and methodological approach to anthropological, philosophical, and metaphysical inquiries, in addition to a word describing the way in which a person, being, or thing, understands its relation to other persons, beings, and things, in the world. The increasing popularity with which anthropologists use ontological perspectives has been labeled the 'ontological turn'. Essentially, this theoretical and methodological movement is interested in capturing how 'reality' is engaged in by people (Kohn 2015; West 2016). A person's ontological position can be understood as "a set of propositions about what *is* in the world" (West 2016, 126, *emphasis original*). The turn, debatably, has resulted in new ways to explore ethnographic inquiries (Pedersen 2012). Methodological and theoretical innovations have emerged out of ontological anthropology (Kohn 2015).

In large part, ontological anthropology has been motivated by the widespread ecological degradation the world has witnessed, jeopardizing the future of humans and the environment (Kohn 2015; Pedersen 2012). Ontological approaches are posthumanist as they no longer view people as the center of their inquiries, but seek to investigate how we can understand the world through humans' engagements with it (Kohn 2015). Some ontological studies are premised on acknowledging the agency of nonhuman beings and entities. Since many human societies rest on this ontological assumption, these studies assume that this acknowledgement will act as a motivation for more responsible and sustainable human behavior (Latour 2014). Essentially, an anthropology concerned with ontology is another step towards breaking down the nature/culture dichotomy perpetuated by

Western/Cartesian/Kantian thinking. It has been argued that we can essentially distill two ontological positions according to the ways in which anthropologists discuss ontology – a Western/Cartesian/Kantian ontological position and a relational one (Scott 2013).

An ontological anthropology is classified as a relational approach to understanding the world (Kohn 2015; Scott 2013). Ontological inquires are primarily concerned with relationships. This is due to how relational ontology emphasizes people's engagements with other beings and things. Therefore, the anthropologists' perspective shifts towards engagements rather than having people's thoughts, myths, or perceptions as the central focus of ethnographic inquires. The idea is to avoid the need to reduce other people's experiences into western understandings of being and experience (Ingold 2000).

A relational perspective can be extended from an anthropological approach to how people grasp their own place-in-space. For example, (Ingold 2000) concept of an 'organism-in-its-environment' exemplifies a relational ontology. He draws this understanding from his interactions with Cree Hunters, who understand their existence to be in relationship with and contingent upon Caribou (and the environment that houses both themselves and the Caribou). In the 'organism-in-its-environment' perspective, people and the environment are understood to exist in relation to one another, as an indivisible totality. Humans, their understanding of being, is constituted through relations with the beings and things that surround them in the world (West 2006). In this sort of experientially-focused, rather than abstracting (i.e. scientific/Cartesian), position of a person's being-in-place, knowledge that is embodied is given as equal an emphasis as knowledge that is cognized. For example, for Solomon Island fisherfolk, the practical activity of fishing, among other activities, leads to an embodied knowledge developed through the "sensitivities, orientations, and skills" that one engages with throughout their lifetime (Lauer and Aswani 2009, 318). Knowledge comes from a person's engagement with others and the world. Attributing human experience, and thus knowledge, as 'culture', and therefore apart from the environment or scientific knowledge, expresses a deeper ontological disengagement of people from the environment (Ingold 2000; Kohn 2015).

Anthropology, has the ability to perpetuate this disengagement of people from their histories, and perhaps more viciously and subtlety, the validity of the 'other's' own perspective. It does so through the idea of perceptual relativism, acting as an authoritative

account of what other people think, translating these understandings into western scientific language in order to give them validity (Ingold 2000). Science has a tendency to strip away historicity, through erasing the narrative of existing in the world due to its authoritative way of producing 'objective' facts and ideas (Latour 2014). The removal of people from understandings of nature leads to the assumption that science is 'objective' (Latour 2014). The erasure of scientists, humans, and history from scientific knowledge enables Science to claim a hegemonic space in which its authority and relevance displaces the validity and importance of 'cultural' or other 'social' aspects of existence (Latour 1993, 2014). This leads to the prioritization of scientific perspectives over local people's understandings of existence in conservation and natural resource management efforts (West 2006). The perpetuation and prioritization of western scientific ideas over others, has led to the dispossession of peoples from their histories and traditions (West 2016). This dispossession extends to the world itself, through erasing the agency of the earth and the nonhuman beings and things that inhabit it (Latour 2014). If there is truly a desire to improve environmental governance efforts to be more inclusive, and thus socially/environmentally just, we need to understand how ontological positions frame conservation efforts (Foale, Dyer, and Kinch 2016; West 2006).

Anthropologists using a relational ontological perspective have attempted to counteract the ways in which Western/Scientific/Kantian/Cartesian ontologies dominate and erase. For some anthropologists, the ethnography produced from ontological ethnographic research is considered to be a product of the anthropologist and those people with whom their work leads them to interact with, rather than a direct representation of the ontological position of the research participants (Scott 2013, West 2016). From this understanding, ethnography is seen as a byproduct of the relationship between the anthropologist, the people they work with, and the beings and things encountered 'in the field'. Moreover, interactions between different types of people affect their understandings of the world. Interactions cause ontologies to transform through time, partially due to interactions between people of different backgrounds, in addition to other social and environmental changes (West 2016).

Anthropologists employing an ontological perspective, view this theoretical and methodological framework as moving past the 'culture' concept for how it engages with human and nonhuman experience and shifts the focus of inquiry from people to the world. However, others have critiqued ontology as "just another word for culture" (Venkatesan et al.

2008). Within this debate, Carrithers (Venkatesan et al. 2008) has proposed that ontology is subsumed under the larger 'culture project'. The pursuit of understanding *what is*, as is undertaken in the ontological turn, is just one sub-project within the larger culture project that defines the discipline of anthropology (156-168). Many who employee an ontological perspective would agree that those employing this perspective are interested in the same or similar ethnographic questions as anthropology has been traditionally (Pedersen 2012). The ontological turn offers a "technology of description" for interpreting ethnographic data in experimental ways (Pedersen 2012). However, the term 'ontology' carries with it philosophical and metaphysical baggage that engages with questions about the world in ways beyond what the idea of 'culture' can convey (Pedersen 2012). Ontological perspectives move beyond relativistic understandings of culture and into questions of how the world and the beings and things within it engage and grasp each other, grounding people as interconnected and contingent upon all of the other phenomena that constitute our world.

3.7 CONCLUSION

Effective resource conservation must engage with the full complexity of social-ecological systems, especially in areas with a colonial history that has created marginalized communities and displaced traditional values and relationships with natural resources (Brockington, Duffy, and Igoe 2008, 121). If natural resource management needs local support to be successful, and it does, the primary consideration of marine conservation should be the social context (Kareiva 2006). Because communities affected by marine governance are heterogeneous, the value systems located within adjacent peoples will alter the way that they respond to management systems (Song, Chuenpagdee, and Jentoft 2013, 172). While clearly a multitude of opinions, perspectives, and values exist in any community, many small-scale fishing communities share similar values, attitudes, and behaviors as fishing is best understood as a way of life (Davis and Ruddle 2012, 250). Thus, finding methodological and theoretical innovations with which to understand these values could benefit resource management decision-making. An ontological approach to resource management issues may be one gateway to more inclusive and just environmental governance efforts (Foale, Dyer, and Kinch 2016).

It is important to acknowledge that resource management decisions are built on specific ontologies and contain within them varying levels of power, including how they are perceived of as 'legitimate' or not. Ultimately, the linking of conservation with development serves to mask the way that political dynamics and power relations are played out in conservation efforts (Brockington, Duffy, and Igoe 2008; Igoe and Brockington 2007; Segi 2014). Given the focus of protected areas on controlling human's relationships to ecosystems, success being marked by changing subjectivities of affected persons seems logical, though this can also have pernicious implications. We are left to wonder if people align with the values espoused by conservation because they find them important or because they are afraid of legal repercussions that resistance to protected areas entails. If we want management to be effective, or supported, rather than following an 'ideal' design, we must incorporate the everyday realities of those affected by conservation decisions into the decision-making process (Kareiva 2006; Segi 2013). This may require a truly devolved approach that views conflict and tension in perspective as a gateway for innovation rather than as a blockage to improvements.

CHAPTER 4

DYNAMIC ENVIRONMENTAL GOVERNANCE: MANAGING CONFLICTS ARISING FROM MARINE RESOURCE MANAGEMENT IN THE SOUTH PACIFIC

4.1 INTRODUCTION

The planet's biodiversity represents a global commons, providing a multitude of ecosystem goods and services that contribute to human wellbeing (MEA 2003). Sustaining these goods and services is a commons issue, requiring efforts from people at a multitude of institutional and structural levels to manage environmental resources responsibly (Dietz, Ostrom, and Stern 2003; Ostrom et al. 1999; Berkes 2007; Lebel et al. 2006). The global degradation of ecosystems around the world has contributed to a conservation narrative that acts as a moral imperative for politically-charged conservation efforts (Fairhead and Leach 1995). Protected Areas have become the mainstream form of conservation, serving as a 'blueprint' approach towards achieving more sustainable human-environment relationships (Berkes 2007; Brockington, Duffy, and Igoe 2008; West and Brockington 2006). The creation of protected areas has disengaged many peoples from their livelihoods and the social relations that encompass them (Benjaminsen and Bryceson 2012; Brockington, Duffy, and Igoe 2008; Igoe and Brockington 2007).

Protected areas, or parks, tend to focus on the ecological priorities of biodiversity conservation, ignoring how these locations are also sites of social interactions and social reproduction (Brockington, Duffy, and Igoe 2008; Jacoby 2014; Poe, Norman, and Levin 2014; West 2006; West and Brockington 2006). Parks require abstracting places from their contexts, aiming to restrict human behavior according to manners designated as appropriate by governments (Brockington, Duffy, and Igoe 2008; West 2006; West and Brockington 2006). The establishment of protected areas has fueled conflicts ignoring how the creation of

them has resulted in the destruction of livelihoods, negatively affecting peoples' wellbeing (Blount and Pitchon 2007; Jacoby 2014; Poe, Norman, and Levin 2014; West and Brockington 2006).

Despite the numerous failures surrounding, and conflicts caused by, protected areas, in 2010 the Convention on Biological Diversity set a goal of reserving 10% of global oceans as marine protected areas (MPAs) by 2020 (Secretariat of Convention on Biological Diversity 2010). The perception that MPAs can create ecological sustainability while simultaneously achieving economic development justifies and motivates their implementation (Fabinyi 2012; Halpern 2003; Jentoft, Chuenpagdee, and Pascual-Fernandez 2011; Levine 2007; Salvat and Pailhe 2002; Segi 2014; Walley 2004). However, there are numerous instances evidencing that MPAs are not achieving their goals (Fabinyi 2012; Kareiva 2006; Levine 2007; McClanahan et al. 2006; Segi 2014; Walley 2004). While MPAs are a popular marine management tool, community-based natural resource management efforts have also taken root and been successful throughout the Pacific (R. E. Johannes 2002). Pacific Islander's close relationships with marine resources have motivated islanders to address marine degradation through community-based natural resource management (CBNRM) (R. E. Johannes 2002)

Throughout the Pacific, coral reefs are crucial fishery habitats for small-island states (Laurans et al. 2013). Reefs are marked by their high levels of environmental uncertainty, being subject to various anthropogenic and biological disturbances that can lead to a shift from a coral-dominated state to a macroalgae state that is difficult to recover from (Bellwood et al. 2004; Hughes et al. 2010; Trapon, Pratchett, and Penin 2011). The global shift of coral reefs to macroalgae states has created the coral reef crises. The effects of the coral reef crises (Bellwood et al. 2004), combined with the global collapse/decline of fish stocks, and the effects of anthropogenic pollution (Bellwood et al. 2004; Blount and Pitchon 2007; Kittinger et al. 2011) has reinvigorated the drive to create effective marine conservation techniques. The environmental fluxes reefs face in response to both biological and anthropogenic stressors complicates management efforts.

Resource managers have realized it is imperative to incorporate the social dimensions of ecosystems for management to be effective (Poe, Norman, and Levin 2014). Socially and ecologically beneficial community-based or collaborative resource management frameworks

have largely not been successful, however (Chaffin, Gosnell, and Cosens 2014; Dressler et al. 2010). A major challenge facing marine conservation is that it focuses on managing fish, when it is really about influencing human behavior (Blount and Pitchon 2007; Gilden 2008). Addressing human motivations, values (Brander, Van Beukering, and Cesar 2007; Hicks, Graham, and Cinner 2013; Hicks et al. 2015; Song, Chuenpagdee, and Jentoft 2013) and perceptions (Oliveira and Berkes 2014), while also incorporating multiple ways of knowing into management decisions (Berkes 2008, 2009, 2012; Carlsson and Berkes 2005; Chaffin, Gosnell, and Cosens 2014; Gilden 2008; Poe, Norman, and Levin 2014) can greatly improve the chances for marine conservation to be ecologically beneficial and locally supported.

The global connectivity of the world's oceans and the difficulties of coordinating international rights in offshore fisheries also problematize marine management. Fisheries face ever-shifting drivers and technically irresolvable management problems, marking them as a wicked environmental problem (Berkes 2012). Wicked problems are defined by their lack of permanent solutions and their ecological uncertainty. Both characteristics require flexibility in management frameworks that protected areas have trouble providing. Institutional flexibility allows us to better account for the diverse interests, judgments, and worldviews that comprise the social contexts around wicked problems (Balint et al. 2011; Berkes 2012). The combined factors of environmental uncertainty and institutional flexibility require adaptive governance techniques that are able to transform alongside changing social and ecological conditions (Berkes 2009; Lebel et al. 2006; Olsson, Folke, and Berkes 2004). Community-based natural resource management is a method through which to achieve adaptive governance (Dressler et al. 2010).

Adaptive co-management is better able to deal with the complexity of biodiversity conservation because the plurality of perspectives it incorporates can lead to innovative solutions and magnify complementary strengths (Berkes 2007; Carlsson and Berkes 2005; Dietz, Ostrom, and Stern 2003; Evans 2012; Lebel et al. 2006; Poe, Norman, and Levin 2014) The term adaptive co-management is used to emphasize the role of social learning, of learning-by-doing, and of flexibility throughout environmental and social fluctuations (Berkes 2009, 2012). Devolution through horizontal and vertical power sharing in governance frameworks leads to multilevel management, allowing for greater adaptability than traditional governments (Berkes 2010; Larson and Soto 2008). Focusing on the

functions of management, rather than institutional arrangements, can aid in facilitating co-management arrangements (Carlsson and Berkes 2005). This process requires the ability to adapt and change as people learn together through time and adapt to shifting social and environmental contexts (Berkes 2010; Carlsson and Berkes 2005; Lebel et al. 2006; Olsson, Folke, and Berkes 2004). Conflict should be an expected variable that affects both social and ecological outcomes (Robbins et al. 2006). Beginning with identifying shared desired outcomes of management and then taking careful consideration of how these decisions are made can improve adaptive governance approaches

This paper provides an inquiry into what sort of environmental governance regime will be more socially supported and ecologically effective in the context of Moorea, French Polynesia where current marine management efforts are highly contested. I argue that in Moorea an adaptive co-management framework for conservation will be more effective than the current marine protected area network on the island. Because fishers on the island have self-organized to effect change in the marine management system, there exists an advantageous opportunity to implement devolved community-based management efforts. I emphasize the role of managing conflict, and the importance of finding shared goals and outcomes in creating collaborative management efforts, that effectively incorporate multi-level decision-making, and knowledge and power sharing.

4.2 SITE BACKGROUND

Moorea, French Polynesia is a small high-volcanic island located 25 km northwest of Tahiti in the South Pacific Ocean. Moorea belongs to the Society Island archipelago, one of five island archipelagos that form the country of French Polynesia. Turquoise lagoons surround Moorea. Barrier reefs emerge roughly one kilometer from the shore, resulting in a 29 km^2 reef-lagoon ecosystem that surrounds the island. This environment is composed of a fringing reef, a sand channel up to seven meters deep, a barrier reef two to three meters deep, and a reef front that meets the open ocean (Salvat and Pailhe 2002, 223-224). The outer slope of the barrier reef has experienced increasing fish density and species richness over the last thirty years (Lison de Loma et al. 2008). The outer slope is partially covered by soft and calcareous algae and corals, while the fringing reefs contain branching and massive corals (Salvat and Pailhe 2002). Moorea's reefs have maintained coral cover in the face of

numerous anthropogenic and biological disturbances, including cyclones, *Acanthastar planci* outbreaks, and anthropogenic pollution, demonstrating greater resilience than other reefs worldwide (Leenhardt et al. 2016; Trapon, Pratchett, and Penin 2011). While maintaining coral cover is a positive sign of resilience, changes in coral composition and decreases in topographical complexity can still lead to biodiversity loss in reefs (Trapon, Pratchett, and Penin 2011). The maintenance of coral reef health in Moorea is an issue of global relevance given the huge decrease in coral reef cover worldwide, and the high dependence of local peoples on Moorea's marine resources.

Marine resources have formed an important component of Polynesian diets since they settled the Pacific. In pre-colonial times, fishing served as both a source of pleasure and as an economic and subsistence endeavor (Oliver 1974). Of all marine resources in the past, fish were paramount. Technologically, fishing gear was more developed than for other subsistence endeavors (Oliver 1974). In Polynesian languages, there are more names for coral reef habitats, and marine flora and fauna than in any other languages in the world (Salvat and Pailhe 2002, 219). Arguably, Pacific Islanders have some of the highest amounts of ecological knowledge in the world (Hviding 2003). This knowledge is complimented by an 'outwards looking' perspective, viewing the land and sea as an extension of one another (Hviding 2003). Polynesians' traditional environmental governance systems reflect the viewpoint that the land and sea are a unified whole.

Prior to the imposition of colonial governments, Society Islander's ecosystem management units extended from the ridgeline to the reef crest and were governed by a chief. Land and sea tenure differed little from one another throughout the Pacific (Ruddle 1988). Sea tenure reflected social organization, stratification, and the power dynamics in these social structures (Ruddle 1988). Fishery rights tended to be passed down through time through families, spirits, or gods. All residents enjoyed some fishing rights, though they were not always equal (Oliver 1974). While families could hold marine tenure rights, fishing was also regulated by weather, seasons, moon phase, wind, and through *rahui*.

Rahui was implemented in order to preserve natural resources in marine and/or terrestrial eco-scapes so they could be used at a later point in time (Kirch 1984; Oliver 1974). *Rahui* could include restrictions on hogs, fish, fruit, or other resources. *Rahui* was often used to prepare for upcoming festivals, feasts, or rituals (Kirch 1984, 166). In the Society Islands,

rahui was enforced through the dispossession of land for anyone who broke the mandate (Kirch 1984, 66). Thus, *rahui* maintained both social and environmental relationships. The ability to implement *rahui* was class bound. The *ra'atira* (middle class) had the right of *rahui* over the *manahune* (lowest class) and the *ari'i* (ruling class) over both groups (Oliver 1974, 779). In some cases *rahui* only excluded outsiders. A general *rahui* could be imposed throughout entire districts on certain occasions or during specific periods during the year, for both political and religious reasons (Oliver 1974). Rahui is notable for its adaptive flexibility as with other traditional management systems in Oceania (Johannes 1978). This flexibility helped to buffer Polynesians against environmental uncertainty. The weakening of traditional management associated, with colonialism, has been correlated with diminished marine resources in the Pacific (Johannes 1978; Kittinger et al. 2011).

In 1842, the Society Islands were named as a French Protectorate. Under colonialism, but prior to the existence of a widespread cash economy, Society Islanders primarily lived off of subsistence agriculture and fishing (Hemmingham 1992). Though, some cash was earned through selling copra, vanilla, and other food crops (Hemmingham 1992). Economic and structural development really began to occur, after the French government decided to move their nuclear testing program from Algeria to the Tuamotus Archipelago of French Polynesia in the mid-20th century (Hemmingham 1992). Papeete, Tahiti became the economic and political capital as an airport and additional infrastructure was constructed to serve as the headquarters of the nuclear testing program. The construction of an airport during this time was fundamental in creating a tourism economy in the region (Hemmingham 1992; Walker and Robinson 2009).

Due to Moorea's proximity to Tahiti, the island has become like a suburb of Papeete and a major tourism destination of French Polynesia (Walker and Robinson 2009). Moorea's reefs currently represent two major economic opportunities: fishing and tourism (Leenhardt et al. 2016). In comparison to other island states the tourism economy in the Society Islands bloomed rather late (Castri 2002). Though, Tahiti and Moorea are still highly affected by tourism. Bora Bora and Huahine, which are also in the Society Islands archipelago, alongside Moorea and Tahiti house 95% of the hotels in French Polynesia (Salvat and Pailhe 2002). Polynesia is interesting in that cultural identity and cultural revitalization movements have strengthened rather than weakened alongside tourism development (Castri 2002, 258). A

recent valuation of Moorea's reefs demonstrated that the reefs held a recreational value of 27 million Euros. Conversely, fishing was valued at four million Euros. 2.8 million Euros of which were fish that were consumed in households and not sold on the open market (Pascal and LePorte 2015).

Moorea's residents tend to be subsistence and small-scale commercial fishers, although, there is also a sizable recreational component to Moorea's fisheries composed of visitors from other islands (Leenhardt, Moussa, and Galzin 2012). An estimated 70% of the fishery has been considered to be recreational (Leenhardt, Moussa, and Galzin 2012). Three species, Soldierfish, Parrotfish, and Unicorn fish, are sold most frequently on roadside stands. Though, there have been over 40 genera of fish documented for sale on these stands (Leenhardt et al. 2016). The recreational characteristic of Moorea's fishery, combined with the diverse array of times, locations, gear types, and fishing methods used around the entire island make it extremely difficult to track the fish yields being taken from the lagoons (Leenhardt, Moussa, and Galzin 2012; Leenhardt et al. 2016). While labeled recreational, the importance of Moorea's fishery as a site of cultural heritage and cultural pride is also a fundamental component of the fishery; the consumption of lagoon fish species perhaps being as important as speaking the Tahitian language to Polynesian residents (Leenhardt et al. 2016, 6). When considered in conjunction with the varied usages and pressures caused on the lagoons by tourism (Castri 2002; Leenhardt et al. 2016), management becomes increasingly complex.

The creation of marine protected areas of French Polynesia has been prsomoted as a beneficial way to grow the economy (Poirine 2010), while also addressing fishery management issues. French legislation enacted in 1993 paved the way for the creation of MPAs on the island. *Le Pacte de Progres* (The Progress Pact) was created in order to fill the economic hole to be left by the halting of French subsidies provided through the nuclear testing program (Poirine 2010; Walker and Robinson 2009). *Le Pacte* sought to do this through increasing both the export and tourism economies in the country (Hemmingham 1992; Poirine 2010; Walker and Robinson 2009). For the island of Moorea, policies enacted under *Le Pacte* have primarily resulted in the development of tourism (Walker and Robinson 2009). In 1995 the government began planning MPAs on Moorea, partially in response to a recommendation made by the Pacific Asia Travel Association (Walker 2001).

Following ten years of planning, Moorea's marine management plan began in October of 2004. The *Plan de Gestion d'Espace Maritime* (PGEM) primarily took into consideration threats to the reef stemming from fishing, failing to address significant agricultural pollution and sewage runoff (Walker 2001). Severe cyclones in the 1980s lead to decreased fish stocks in Moorea. Fear that overfishing would prevent the reef and fish from recovering contributed to the perceived need for MPAs (Lison de Loma et al. 2008). The plan is lagoon wide, extending from the shore to 70m in depth on the outer reef slope (Lison de Loma et al. 2008). Local community members were attempted to be incorporated into the planning process, especially in the placement of the MPAs (Lison de Loma et al. 2008), however, this was met with resistance (Walker 2001). Today, PGEM officials will state that fishers asked for the MPAs, while fishers feel that MPAs were imposed, were designed for tourists, and are undesirable.

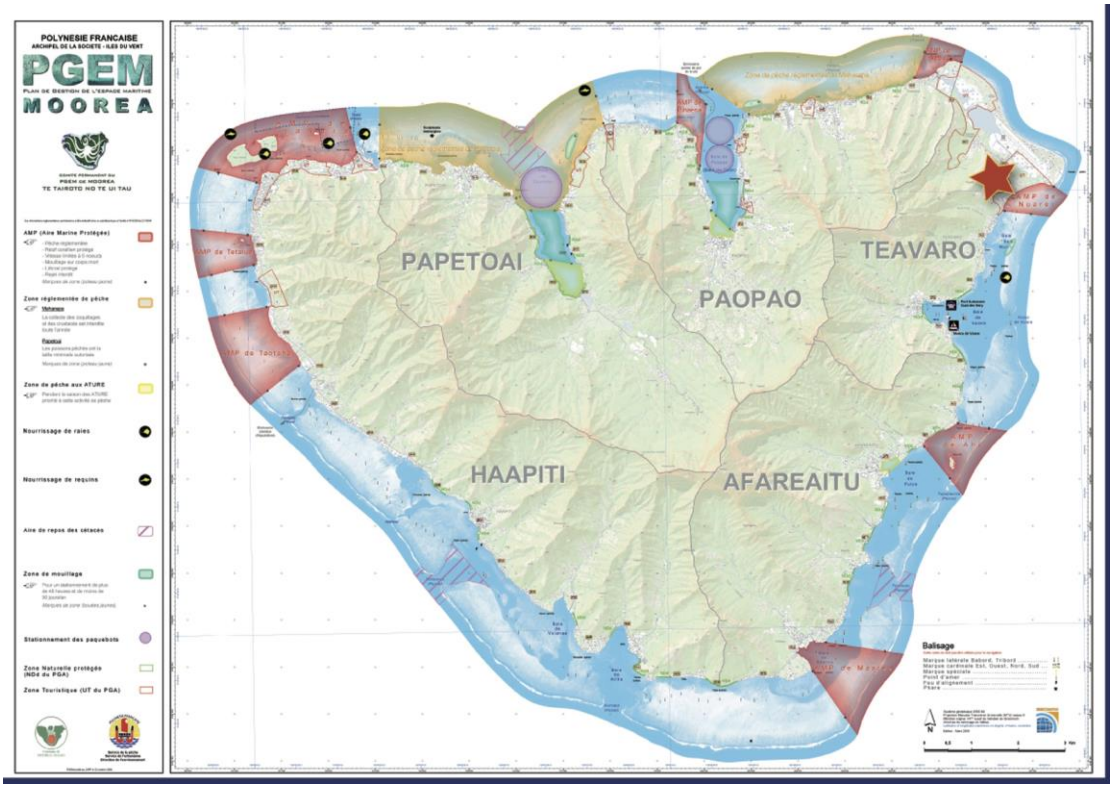

Figure 4.1 Map of current MPAs in Moorea with each color representing different sets of regulations (PGEM 2004).

Under the PGEM, eight marine protected areas were designated around the island, most with varying regulations, from no-take zones to selective fishing practices. The PGEM

functions in collaboration with fisheries laws made by the country's *Service de la Pêche* (Fishery Service). This marine management plan is the first of its kind in French Polynesia (Leenhardt, Moussa, and Galzin 2012), though there are now other MPAs in the country. The objectives of the PGEM are: 1) to rationally use and develop the resources and the area 2) to manage conflicts regarding lagoon use 3) to control pollution and damage to marine environments, and 4) to protect marine ecosystems and endangered species (Leenhardt, Moussa, and Galzin 2012). Rather than reducing conflict, the PGEM has heightened tensions between hoteliers, tourism operators, and fishers (Walker 2001).

For the 10-year anniversary of the management plan, the government has decided to restructure the PGEM. This restructuring is largely to redress the 'sense of injustice' that the PGEM has caused. The objectives of the consultation process include: addressing feelings of marginalization, better consulting the population, ensuring the best representation of actors on the PGEM committee, and responsiblizing different actors. Additionally, the restructuring seeks to improve the efficacy of the PGEM through correcting what does not work, through facing the problems of the PGEM, and through organizing activities accordingly. An outside consultant has been hired in order to assist with the process. Consultation began by meeting with the fishers of the five districts on the island, before bringing together fishers, tourism operators, and other concerned community members in island-wide planning meetings that are to last through 2016. The final planning and consultation steps will take place through the beginning of 2017, until the new plan is enacted in May or June of 2017.

One of the mechanisms through which the PGEM is hoping to achieve these goals is through creating a committee composed of public stakeholders. The committee is theorized to use consensus in the management decision-making process. The committee, known as CLEM, would be responsible for coordinating with the current permanent PGEM committee. The permanent committee is composed of ten government employees, a representative of culture, a representative of the hotels, a representative of tourism businesses, a representative of scientific research, and a representative of the fishers. Theoretically, this team is supposed to ensure that the PGEM represents the public interest adequately.

Marine management in Moorea can potentially be greatly benefited by the high amounts of marine-oriented scientific research that takes place on the island. There are two scientific research stations on Moorea, the French *Centre de Recherches Insulaires et*

Observatoire de l'*Environnement* (CRIOBE) and the American U.C. Berkeley Richard B. Gump Station (from here forward, Gump). CRIOBE was established on Moorea in 1971 and Gump in 1985. Together, the two stations host faculty and research associates from universities, post-doctoral researchers, PhD students, master's students, and marine biology/ecology-oriented field schools for undergraduate students. The presence of these stations has created the Moorea as a center of coral reef research in the Pacific (Trapon, Pratchett, and Penin 2011). Research produced by these stations has the potential to greatly contribute to the marine management plan when used in conjunction with knowledge held by other parties who want to contribute to maintaining marine health on the island.

4.3 METHODS

Between 2014 and 2016 nine months of social science field research were conducted. During this work, our team collected 14 semi-structured interviews with professional fishers and 351 household surveys. Household surveys were carried out in 3 of Moorea's five districts, including: Afarieatu, Papetoai, and the Southern portion of Haapiti. In 2014, we completed 121 household surveys in Afarieatu and 116 in Papetoai. In 2015, we finished 114 surveys in southern Haapiti. Survey topics included demographics, fishing practices, perceptions of environmental health, perceptions of marine management, and perceptions of fishery change through time. Afarieatu, located along the southern half of the eastern coast of the island, serves as the island's governmental center. Maatea – a community within Afarieatu, is a center of fishing activity on the island. Papetoai located on the western half of the north shore, is a hub of tourism activity, containing one of the largest hotels on the island. Additionally, the district of Papetoai houses Opunohu Bay, where cruise ships frequently make pit stops and allow guests on shore for pre-arranged outings. Haapiti is the largest district on the island. The northern portion used to house the first and largest hotel on the island, Club Med (Salvat and Pailhe 2002). The hotel has since shut down due to the global tourism decline post-9/11. The southern portion of Haapiti is the longest stretch of coastline where no MPAs are located.

During the 2016 field season, 100 surveys using a contingent valuation approach were conducted in order to better understand the cultural and ecological values of the marine environment. These surveys used an embedded mixed methods design (Creswell 2014) in

order to elicit both qualitative and quantitative data regarding how people perceive, understand, and relate to the lagoon environment. These surveys were conducted using both convenience and reputational sampling methods and some quotes collected during this research are included in this article. Finally, during the 2016 field season, I attended an island-wide all-day planning meeting for the PGEM consultation. This allowed for more insight into their approach for restructuring the marine management system and the discourses surrounding this project. Data collected during the 2016 research will be used to supplement household survey data throughout this analysis.

4.4 RESULTS AND DISCUSSION

4.4.1 Understanding Local Perceptions of Management and Marine Resource Health

Moorea's reef-lagoon system provides a dynamic resource for both inhabitants and visitors to the island. A site for business, food acquisition, relaxation, and recreation, the lagoon experiences a diversity of uses, entailing that people hold a variety of relationships with the marine environment. Human migration has resulted in short-term relationships with the marine environment standing next to long-term relationships that have accumulated generations of lived experience and knowledge. This diversity in experience is reflected in the ways that people value and perceive marine resources around Moorea. Though, some broad patterns occur in peoples' relationships with the lagoon. Of the 351 households we surveyed, 75.8% of households had at least one person who currently went fishing in them. Additionally, 83.2% of households desired that their children fish. Of those who answered that they wished for their children to fish, 78.1% of respondents desired this because fishing is a family tradition and 48.9% so that their children could eat fish. For Moorean's, fishing as a form of cultural heritage seems to trump the importance of fishing to eat fish, though, the consumption of fish is certainly a component of fishing as identity.

Table 4.1 Fishing as a Family Legacy in Moorea

	Afarieatu	**Papetoai**	**S. Haapiti**	***Avg.***
Respondents desire that children fish	77.7%	85.3%	86.8%	*83.2%*
Respondents desire that children fish because: it is a family tradition	70.2%	88.9%	74.7%	*78.1%*
Respondents desire that children fish	30.3%	56.6%	54.5%	*48.9%*

because: so their children can eat fish

In Moorea, fishing is a fundamental form of food acquisition and one that can be shared among friends and relatives, in addition to representing a way to make extra money when one is in need. A stigma exists against selling fish if one has other sufficient and reliable sources of income. When asked about the importance of fishing, respondents stated that fishing to sell fish was very important 33.3% of the time and somewhat important 22.5% of the time. However, 96.5% of people stated that fishing to eat fish was very important and 2.6% said it was somewhat important. Fishing to give to friends and relatives was very important for 72.7% of respondents and somewhat important 16.5% for others. Finally, fishing for pleasure was very important for 73.2% of people and somewhat important for 16.5% of them. Understanding what is important to people is another way of understanding what they value (Graeber 2001). While many fisherfolk are stigmatized for degrading marine resources in the pursuit of money, the fisherfolk of Moorea seem to value more the consumption of fish and the social relationships that surround fishing more than fishing as a pursuit of income. Throughout the Pacific, the sharing of food is a way to show you care and concern for one another. Denying food is a sign of disrespect and neglect (Kahn 2011, 188).

Table 4.2 Rankings of What Makes Fishing Important

	Very Important	Somewhat Important	Not Important
Fishing to sell the catch			
Afarieatu	30.3%	21.5%	48.1%
Papetoai	39.0%	26.8%	34.1%
S. Haapiti	30.0%	18.6%	51.4%
Average	*33.3%*	*22.5%*	*44.2%*
Fishing to eat fish			
Afarieatu	94.9%	1.3%	3.8%
Papetoai	93.9%	4.9%	1.2%
S. Haapiti	98.6%	1.4%	0.0%

Average	*96.5%*	*2.6%*	*0.9%*
Fishing to give to friends and family			
Afarieatu	94.9%	1.3%	3.8%
Papetoai	57.3%	24.4%	18.3%
S. Haapiti	65.7%	24.3%	10.0%
Average	*72.7%*	*16.5%*	*10.8%*
Fishing for Pleasure			
Afarieatu	86.1%	6.3%	7.6%
Papetoai	62.2%	22.0%	15.8%
S. Haapiti	71.4%	12.9%	15.7%
Average	*73.2%*	*16.5%*	*10.3%*
Because no other work is available			
Afarieatu	5.1%	10.1%	84.8%
Papetoai	19.5%	8.5%	72.0%
S. Haapiti	57.4%	7.3%	35.3%
Average	*25.8%*	*8.7%*	*65.5%*

By and large, marine protected areas in Moorea are viewed as blocking access to marine resources that provide an irreplaceable subsistence source. As one respondent told me: “The ocean is my second family, because it is a way of solving hunger” (Male, June 2016). On Moorea, people refer to the lagoon environment as their refrigerator. When one is hungry and has no money, one goes to the ocean to fish. From fishing, people can both feed themselves and their family. If one catches extra fish, one can sell them for spare cash. Fishing is important because it can meet multiple needs as both an economic and subsistence practice. The ocean is viewed as providing food, fish are described as ‘the resource’, and fishing is the ultimate fallback option for those who cannot access other work. The PGEM is offensive to local fisherfolk as it prevents access to marine resources that are viewed as a basic right and a method of survival.

While the PGEM is largely associated with blocking access to basic rights, there arevarying levels of support for the regulations and motives of the PGEM. Many people support the preservation of marine resources, though they do not necessarily view the PGEM as a desirable way to achieve conservation goals. During our household survey, participants were asked if they knew what 'PGEM' meant. Out of our respondents 91.2% knew what the 'PGEM" meant. Of those who knew, 90.6% of them were familiar with a specific PGEM regulation. Of the 536 total responses we gained to what specific PGEM regulations people were familiar with, 42.4% of these responses were for MPAs. Respondents were asked if they supported the specific regulations that they mentioned. They supported the regulations 56% of the time, sometimes supported them 14.4% of the time and did not support regulations 28.8% of the time.

Table 4.3 Knowledge of PGEM, PGEM Regulations, and Levels of Support for Regulations

	Afarieatu	**Papetoai**	**S. Haapiti**	***% of Total Responses***	**n =**
Percentage of Respondents who know of the PGEM	99.2%	89.7%	84.2%	*91.2%*	320
Percentage of Respondents who know of specific PGEM regulations	93.1%	86.6%	92.7%	*90.6%*	280
Frequency of MPAs mentioned as a specific PGEM regulation	46.0%	39.3%	40.9%	*42.2%*	226
Frequency of regulations mentioned being supported	53.7%	42.3%	65.9%	*56%*	214
Frequency of regulations mentioned being supported some of the time	24.8%	16.5%	5.5%	*14.4%*	55
Frequency of Regulations Mentioned not being supported	19.0%	41.2%	28.6%	*28.8%*	110
Support: because the PGEM preserves/protects marine resources	32.8%	54.0%	46.4%	*44.8%*	99

Support: because the PGEM allows species to reproduce and mature	60.7%	36.5%	23.7%	*37.6%*	83
Support: People should not fish small fish	0.0%	0.0%	20.6%	*9.0%*	20
Do not support: because the PGEM blocks access to food/income	7.1%	31.3%	48.3%	*31.3%*	53
Do not support: because there are too many regulations / regulations do not make sense	14.3%	44.8%	3.3%	*22.5%*	38
Do not support: MPAs should be more like rahui / they are not real rahui	38.1%	10.4%	8.3%	*16.6%*	28
Do not support: because the PGEM is for tourists	4.8%	8.9%	6.6%	*7.1%*	12

When asked why respondents supported a PGEM regulation, the most commonly listed reasons for supporting included: that the PGEM preserves and protects marine resources (44.8% of responses in support) and that the PGEM allows species to reproduce and mature (37.6% of responses). The diversity of responses given for why respondents did not support the PGEM was much greater. The most frequent answers, included: that the PGEM blocks access to food/income (31.3% of response not supporting) and that the regulations did not make any sense or there are too many of them (22.5% of responses). Additionally, respondents mentioned that the MPAs should be more like *rahui*/or that the PGEM is not real *rahui* (16.6% of responses) and that the PGEM is for tourists (7.1% of responses). Fishing acts as a basic right on Moorea, people should be able to participate in fishing in order to feed themselves and their family. They fish to sustain their lives. Fishing is of paramount importance for those families with the least resources. The way that the PGEM blocks access through permanent closed areas is understood to be an unacceptable way to achieve conservation efforts for many people in Moorea.

Because marine protected areas do not change locations, they place more duress on fishers and families who live adjacent to them and who use the lagoon as a subsistence and economic opportunity. If people live next to an MPA they may be unable to access fishing locations. Through criminalizing subsistence activities, protected areas create criminal landscapes (Jacoby 2014; Kull 2002). Poaching activities within the MPAs of Moorea indicate that community members prioritize subsistence over current fishing regulations.

Marine species are consumed at church gatherings, birthdays, Sunday feasts, and other important events and play a dominant role in local diets (Leenhardt et al. 2016, 6).

Table 4.4 Amount of population that consumes fish/marine species on a daily average per week

Consumption times per week:	1 to 2	3 to 5	6 to 7
Afarieatu	34.7%	38.8%	26.4%
Papetoai	25.9%	33.6%	33.6%
S. Haapiti	31.0%	23.0%	37.2%
Average	*30.6%*	*32%*	*34.6%*

As one respondent explained to me: "If I did not eat fish, I would not be alive" (Female, June 2016). During our household survey, we found that 30.6% of people ate fish, shellfish, or crustaceans one to two times a week, 32% ate fish, shellfish or crustaceans three to five times a week, and 34.6% of people ate these items six to seven times a week. Indeed, Moorean's annual consumption of fish is around 110 kilograms per inhabitant (Yonger 2002), ranging far above the average of 23 kilograms per annum for other Pacific Island regions (Labrosse, Ferrais, and Letourneur 2006). For many Pacific Islanders, fish represent a non-substitutable source of protein (Laurans et al. 2013). Tahitians are proud of their cultural heritage (Castri 2002). Consuming foods classed as Tahitian is central to having a Tahitian identity (Levy 1973). The importance role of marine species consumption to Moorean's sense-of-self needs to be recognized and incorporated into management practices.

The PGEM has caused Moorean's to feel that the lagoon is no longer meant to be their fridge. At the island-wide PGEM planning meeting, fishers brought up the irony of the PGEM slogan "*Le Lagon est à tout le monde, sachons le partager!*" (The lagoon is for everybody, let us share it!"). Mooreans feel that the government cares more about making money through tourism than taking care of their citizenry. Indeed, the placement of MPAs tends to correspond with popular tourist hang-outs, concentrated on the north shore. Also offensive to Mooreans is that tourists do not hold the same respect nor concern for marine resources as many Mooreans do. These sentiments are exacerbated through the role of hotels, smaller pensions, and tourism operators blocking access to lagoons.

During the household survey, we asked respondents what phenomena blocked access to fishing locations. These responses showed high variability between districts. Collectively, hotels (8.3%) were seen as an impediment to fishing. The most significant factor for Papetoai residents was people who live on the coast (35.2%). In Afarieatu, the lunar cycle was the most significant (57.1%). While in Southern Haapiti, sharks and shark feeding locations (21.4%) were mentioned. These results highlight how inter-district variation can complicate island-wide management efforts. For instance, differential tourism development has caused coastline access to become increasingly difficult in Papetoai. While in law, the totality of the coastline is public land, in practice, parts of Moorea's coastline become sites of contention, where tourism operators and local peoples fight for the right to access the marine environment. This can exacerbate pre-existing conflicts over who has the right to use the marine environment and in what ways they can do so.

Table 4.5 Factors listed as blocking access to fishing locations

	Afarieatu	**Papetoai**	**S. Haapiti**	***% of Total Responses***
CRIOBE/Gump/Community Assoc.	0.0%	12.5%	7.1%	*10.4%*
Hotels	0.0%	6.3%	14.3%	*8.3%*
Lunar Cycle	57.1%	0.0%	0.0%	*8.3%*
People who live on the coastline	0.0%	53.1%	0.0%	*35.2%*
Sharks / Shark feeding locations	0.0%	0.0%	21.4%	*6.3%*

Many Mooreans understand tourism activities to have negative impacts on local environments and peoples, yet still see tourism as being favored in management decisions. Jet skis, for example, are blamed for zooming around the lagoon without regard for people swimming or fishing, lacking respect for locals' recreational uses of the marine environment. Also problematic are tourists who do not understand that they should not touch or disturb coral. One day while at a popular beach with a fisher, we watched as teenage tourists repeatedly climbed on top of a coral head, pushing each other off of it and into the lagoon. They played this game for half an hour. One fisher exclaimed to me "Can you imagine someone stepping on your home? Your whole family is in there. The ocean is our fridge and

they are destroying it." (Male, July 2016). The destruction of coral by uneducated tourists does a disservice to both local people and the tourism economy.

Fundamentally, the tourism economy in Moorea relies on the cleanliness and beauty of the marine environment. We need to understand the impacts of reef-goers on the lagoon in order to maintain the reef as an economic asset (Juhasz et al. 2010). Beaches with higher levels of tourism impact are found to have less coral cover than less used sites on Moorea's north shore (Juhasz et al. 2010). Marine protected areas can serve as an attempt to prevent reef-degrading practices, yet, they fail to account for the increased concentration of tourism activities that take place within protected areas that can negatively impact marine environments. If locals view the establishment of MPAs as primarily for tourism and not as supporting their own livelihoods, they are less likely to be successful due to a lack of local support (Levine 2007, 574). In Moorea, the PGEM is not only viewed as blocking access to food and as prioritizing tourists, but as actually endangering community members through the role of the PGEM in managing shark-feeding.

Shark and ray feeding is one of the top tourism activities in Moorea. It is also one of the most contentious. Shark and Ray feeding came to be a divisive issue in the initial PGEM planning process, exacerbating conflicts between fishers, hoteliers, and tourism operators (Walker 2001). Tourism operators feed Rays and Black-Tip Sharks (Carcharhinus limbatus) who tend to be non-aggressive and smaller than other shark species that inhabit the waters around Moorea. Rays are often tame enough to be touched by guests, though sharks remain slightly more standoffish. During initial planning phases, hoteliers expressed concern about the safety of their guests due to sharks. Fishers too complained about the increase in shark numbers and the diminishing fear that sharks have of people. Fishers have noticed an increase in the amount of sharks trying to get their bait or their catch (Walker. 2001). These observations are still frequently discussed by fisherfolk who are concerned by the seemingly ever-increasing presence and boldness of sharks in the lagoon.

Changes in shark presence and behavior are not the only anthropogenically-induced changes happening in Moorea's lagoon. Significant amounts of pollution litter the coastline and drift into the marine environment. Though, it is not just pollution from trash that is of concern to locals, but also the role of erosion caused by building developments in combination with agricultural and sewage run-off that flows into the sea after it rains. Both

sources of pollution are understood to be negatively affecting the health of marine resources. During our household survey, when asked an open-ended question about what are the biggest problems for the local marine environment, pollution (agricultural or otherwise) was mentioned 41.4% of the time. Moorean's widespread concern over pollution traveling from hillsides and agricultural pollution and into the ocean evidences the perspective of the land and sea as an integrated whole. Agricultural pollution is particularly disconcerting given that phase shifts to macroalgae in the Caribbean were associated with increased nutrient loads that occurred through land-based runoff (Bellwood et al. 2004, 827). Local citizens concern over land-based pollution, combined with evidence that run-off can degrade lagoon resources, and with a traditional ridge-to-reef perspective, justifies incorporating a holistic resource management system that accounts for terrestrial impacts on marine environments. Combining the island's land management plan *Plan Général d'Aménagement* (PGA) with the PGEM may hold the potential to better achieve the PGEM's objective of reducing pollution, while also gaining local support through acknowledging peoples' legitimate concerns over land-based pollution on the marine environment.

Table 4.6 Frequency of problems named as largest issues for marine environment health

	Afarieatu	**Papetoai**	**S. Haapiti**	***% of Total Responses***
Problem: Agricultural and other forms of pollution	36.9%	47.6%	39.8%	*35.2%*
Problem: People/People lacking respect	21.7%	0.0%	13.1%	*8.9%*
Problem: Boats/water sports/tourism/hotels	5.1%	7.3%	15.5%	*6.3%*

Another issue listed as one of the largest problems for the marine environment was people/people-lacking respect (11.6% of responses). The central role of respect in human-marine relationships for Tahitians is expressed through how they talk about their relationships to marine resources in daily discourse and in current efforts towards transforming marine management. For Moorean's a lack of respect for the environment leads to environmental degradation. A lack of respect is evidenced in people fishing too small of fish or shellfish or people wasting fish. Multiple subtle social pressures exist in Moorea for people to fish responsibly (Walker 2001). One fisher who was caught fishing with a net one-

finger size below the required size by law was shocked when PGEM officials threw out his large catch of parrotfish in the deep part of the lagoon where he could not retrieve them. While telling this story, he hypothetically asked how the PGEM could say they care about preserving fish if they are willing to waste such an enormous resource. I responded that this was sad, I was corrected, 'no, this is not sad, this is serious.' Tensions certainly exist between the perspectives of fishers and the PGEM and *Service de la Pêche*. However, finding areas where ideas align can create a basis for co-management efforts.

Tahitians prefer to eat several species of fish when they are at younger, juvenile stages, such as with two popular species of parrotfish, *Pahoro* and *Paati* (*Scarus* sp.). Parrotfish, in particular, are a hermaphroditic species, becoming able to reproduce when mature. When parrotfish mature to larger sizes, the Tahitian name for the fish changes (i.e. *Pahoro* becomes *Moiri*). For Tahitians, some fish at larger stages, such as *Pahoro/Moiri* are no longer preferable to eat - the logic being that the older, larger fish can reproduce and lay many eggs so they should be left in the water. Under western scientific logic, if fish are caught when they are small they will not be able to make it to larger stages in order to reproduce. Thus, the fishery service has placed minimum size restrictions on many fish species. Both forms of knowledge have implemented strategies to achieve the same goal, successful species reproduction. Yet their modes of achieving these ends differ. Management needs to focus on outcomes rather than processes in order to first unearth and then to achieve shared goals.

Perhaps the largest challenge facing a truly devolved co-management approach in Moorea stems from the lack of trust between the local population and the territorial government. During the planning meeting it was stated that the new management plan could not move forward under the name of the PGEM as this entity represented too much injustice. The island-wide planning meeting demonstrated to fishers that the government already had a plan and a path laid out for how to get to where they wanted to be. It seemed to the fishers that they had no stake in deciding the process for incorporating their opinions and perspectives into management design. Rather, their role was pre-assigned by government officials. Their role was to participate in CLEM, thus becoming 'responsibilized' to care for the marine environment. The fishers rebutted this plan and refused CLEM. Gathering

amongst themselves during the lunch break of the all-day meeting, the fishers discussed how they wanted management efforts to move forward. The fishers demanded *rahui*.

While the meeting did not provide ample enough time for fishers to construct exact demands and methods for how *rahui* would work, there has since been a grass-roots level organization formed that seeks to create more concrete grounds on which *rahui* would function (Rey 2016). This organization is called 'Moorea Rahui et Toohitu'. Moorea Rahui seeks to create a management plan that is formed out of the concept of respect. While fishers are still figuring out what *rahui* would exactly entail they view it as an approach to marine management that more effectively incorporates their perspectives through devolved decision-making capacities (Rey 2016). *Rahui*, depending on how exactly it is carried out, has the potential to be the flexible and adaptive approach that adaptive governance in uncertain ecosystems necessitates.

4.4.2 Why Adaptive Co-Management in Moorea

For Moorea, like many other areas where CBNRM has been or is being attempted, the management of and capacity to deal with conflict is fundamental to the outcomes of the management of social-ecological systems (Chaffin, Gosnell, and Cosens 2014; Dressler et al. 2010). Resistance to protected areas around the world is common, requiring us to enquire why people resist conservation rather than immediately assuming that resistance is negative for biodiversity (Robbins et al. 2006). Given current levels of resistance against the PGEM, the lack of evidence that the PGEM is positively effecting ecological biodiversity, the importance of the marine environment in both economic and subsistence endeavors, and the prominent role of the lagoon in the cultural heritage of Moorea, it is imperative for community members to have a say in resource management decision-making.

The challenge lies in creating an adaptive framework that maintains flexibility while addressing social and ecological goals. Setting up an institutional structure that includes nesting and polycentricity is fundamental to the success of adaptive management regimes that incorporate diverse perspectives while simultaneously managing conflict (Chaffin, Gosnell, and Cosens 2014; Dietz, Ostrom, and Stern 2003; Dressler et al. 2010). With increasing amounts of stakeholders, comes the need for more flexible regulations in marine management issues (Jentoft, Chuenpagdee, and Pascual-Fernandez 2011). We must critically

evaluate what rules local resources users are actually willing to follow (Song, Chuenpagdee, and Jentoft 2013). Adaptive governance needs to use social organization to achieve agreed-upon ecological visions (Chaffin, Gosnell, and Cosens 2014). Leadership is fundamental to the success of community-based environmental management (Chaffin, Gosnell, and Cosens 2014; Gutiérrez, Hilborn, and Defeo 2011; R. E. Johannes 2002) Yet, the nesting and multi-level power-sharing that governance proposes, needs to avoid placing an overwhelming burden on those who are already poor or disempowered (Davis and Ruddle 2012; Dressler et al. 2010). Co-management should be a form of empowerment not an inconvenience.

In the following, I outline specific recommendations based out of the research that we conducted that can aid in facilitating the shift to and carrying-out of adaptive co-management in Moorea.

4.4.3 Recommendations for Implementing Adaptive Co-Management in Moorea

- Finding Shared Desired Outcomes: Co-management efforts should begin by examining the desired outcomes of management among all interested parties, including fishers, tourism operators, and scientists. These outcomes should cover both social and ecological goals. Planning meetings conducted on a management unit-by-unit basis (management units should be pre-defined and are discussed further below) should be conducted in order to examine what goals people hold in common for management and where contentions exist. When conducting these meetings, conflict and disagreement should be expected, not avoided. Focusing on outcomes of management, rather than the process can facilitate the emergence of co-management (Carlsson and Berkes 2005). Through discussing shared desired outcomes, rather than differences in ways that people use the lagoon, we shift the focus of the conversation towards group collaboration rather than division. When conflicts in priorities arise, we can look for innovative ways to address issues that facilitate multiple perspectives.
- Devolving Power to Appropriate Units: Devolving, marine management to community control on a district level in Moorea could greatly benefit the success of CBNRM efforts. These districts match traditional territories that were managed on a chief-by-chief basis. Returning to these sorts of traditional land-marine management units can benefit modern community-based management efforts in the Pacific (R. E. Johannes 2002). As the household survey demonstrates, there is inter-district variation in how people relate to the marine environment. Fundamentally, co-management regimes need to be formed to their specific contexts (Chaffin, Gosnell, and Cosens 2014; Dressler et al. 2010). If thought necessary, management could devolve further to the township level. Maintaining networks and communication between these management units would allow for management efforts to be compared, functioning as an experiment to understand what management techniques or regulations are beneficial. Learning-by-doing is an essential component of adaptive

co-management. One of the strengths of traditional management units in Polynesia and the Pacific is that they are divided into political-ecological units, already creating a context-specific scenario that can adapt to the various needs and customs that can exist on a town-by-town basis on a single island (R. E. Johannes 2002).

- Devolving Decision-Making Across Sectors: If power is devolved on a district or township level, this leaves space for the government (specifically, the Moorea-Maiao commune, the PGEM and *Service de la Pêche*) to act as a facilitator to co-management efforts. Maintaining flexibility within the rules (and reminding participants of the importance of flexibility throughout the rule-making process) allows for the decision-making process to become an iterative experiment that adapts to changing social and ecological needs of all involved. Given adequate resources, maintaining a consistent schedule of both island-wide and district-level management meetings, or knowledge and results sharing sessions, will aid the process of training leadership, of sharing lessons learned, and of building trust, ultimately increasing the capacity of peoples to manage for resilience. The government's role should not be in deciding who participates nor in teaching how to manage, but rather providing a space in which community members and leaders can come together in order to discuss and share with each other their perspectives and goals that exist in relation to marine management on Moorea. While smaller management units may have more luck in gaining consensus (as opposed to an island-wide homogenous plan), ultimately the lagoon-coral reef ecosystem is an integrated whole. Maintaining communication between management units will better ensure that the entire island is on a similar trajectory in regards to their management efforts.
- Addressing Inter-Island Social and Economic Heterogeneity: One of the ways in which districts and townships hold variation is through how tourism and fishing locations are distributed around the island. For instance, the North shore has high levels of large hotels and tourism operations in comparison to the southern portion of the island, which tend to house smaller, family-owned *pensions* for tourists to rent. District or township specific management could aid in accounting for this variability in uses of the lagoon. Some tourism operators already self-police MPA sites when they catch people fishing inside of the PGEM, which is also where their own tourism operations takes place. Others will block access to fishing grounds in front of their tourism operations and/or hotels, regardless of whether or not an area is a government designated MPA. Collaboration on local levels could negotiate these tradeoffs so that professional fishers, the general population (who fishes or uses the lagoon recreationally), and tourism all agree on when it is okay to block access to a lagoon area and when it is not. Negotiating the details of these rules within smaller management units may aid in reaching consensus across sectors.
- Addressing Island-Level Ecological Heterogeneity and Change: Further reason for devolvement on a district basis stems from how ecological dynamics vary around the island. For instance, a bleaching event that occurred early in 2016 predominately affected the northern portion of the island around the Papetoai district. Adaptive management arrangements should seek to change in accordance to changing ecological parameters caused by the bleaching. However, if little to no bleaching occurred in Southern Haapiti (as it did not), than management in this region does not

need to responds to the bleaching event. Environmental diversity within the coral reef-lagoon ecosystem results in areas responding differently to environmental stressors, requiring differential management techniques. These unique ecological characteristics also affect the ways in which people use the lagoons. For instance, Opunohu Bay (in Papetoai) and Atiha Bay (in southern Haapiti) both house productive *Ature* (*Selar crumenophthalmus*) fisheries. These fish are popularly targeted during their seasonal runs. Their presence in these areas requires different management techniques than in areas that do not have *Ature* runs.

- Incorporating Multiple Ways of Knowing: The role of Moorea as a center of coral reef monitoring and research, and as the site of an NSF designated long-term ecological research site is also a huge benefit to co-management efforts on the island. Ultimately, scientific knowledge alone is not enough to effectively manage natural resources (Berkes 2007; R. E. Johannes 2002). Though, scientific monitoring can be an invaluable tool used to provide feedback on the ecological responses to management efforts, especially when triangulated with the observations of fishers who spend high amounts of time in the lagoon. Fishers and tourism operators could also be incorporated into monitoring efforts. In the Philippines, fishers participated in transect surveys of MPAs. This participation strengthened fishers' confidence in management efforts (Segi 2013). Teaching fishers and tourism operators these scientific methods can improve peoples' perceptions of and trust in management efforts, while also allowing direct observations of how management efforts are affecting marine health. Many marine-oriented tourism operators and fishers already hold in-depth knowledge of marine resources in the areas they frequent. Their knowledge of Moorea's reefs could aid scientists in their own inquiry, again providing an avenue for iterative learning and trust building between stakeholders on the island. However, we must also be careful of how environmental knowledge is translated across domains, heeding warning to how environmental perspectives and knowledge can become stereotyped or misunderstood (West 2005).

- Moving Towards Social-Ecological Resilience through Environmental Governance: The final step in transforming management should be towards building resilience into governance efforts (Chaffin, Gosnell, and Cosens 2014). The emergent stages of co-management need to focus on crafting a shared vision, building trust, and improving capacities for collaboration. Governmental bodies involved in this process are fundamental in creating grounds upon which communities truly have authority in deciding how natural resources are managed. Governments should act as facilitators rather than decision-makers. Ecological resilience is more feasible when groups and communities trust one another and can learn from one another, thus maintaining a level of social resilience. Facilitating avenues for communication and trust building, which can take on both professional and recreational components, are fundamental to creating successful collaboration. In Moorea, the fundamental role of the fishery in cultural heritage, and the unique role of tourism as a way to maintain cultural heritage, has already benefited the social resilience of the island. Re-incorporating *rahui* as an adaptive technique that can shift as biological and anthropogenic environmental stressors occur has the potential to create the ecological resilience

necessary to maintain Moorea's unique coral reef-lagoon ecosystem that plays such a fundamental role in peoples' daily lives and the island's tourism economy.

To demonstrate how tourism, scientific knowledge, and local knowledge interact in Moorea, I relate a story told to us by a tourism operator who gives tours of Moorea, educating guests on the effects of climate change on coral reefs among other cultural and historical topics relating to the island. In 2006 Moorea began experiencing an infestation of crown-of-thorns sea stars (*Acanthaster planci*), locally known as *taramea*. The Moorea Long-Term-Ecological Research (LTER) Site had just been designated in 2004. Researchers, watching the reef be torn apart by *taramea* were concerned about the degradation and were considering injecting the sea stars with a mixture of vinegar and lemon juice in order to poison and kill them. The *taramea* had reduced coral cover up to 97% within a one-month period. Scientists decided to consult with Tahitian community members to understand their experiences and opinions on the infestation. An elderly woman, originally from the Tuamotus archipelago, who had never before seen *taramea* began to recount a chant she knew about the sea-stars. The chant celebrates the coming of *taramea*, calling their arrival a blessing. The scientists decided to do nothing and let the *taramea* run its course. After the *taramea* began dying off, they released nitrogen into the lagoon and re-stimulated coral growth. The *taramea* had burrowed into the sand and cleaned detritus and septic run-off out of the lagoons. While Moorea's reef-lagoon system has not completely returned to its level of coral cover prior to the invasion, its reefs have recovered substantially. Moorea's resilience is benefitted by the social relationships that contextualize the ecosystem, especially when people take the time to listen to one another.

4.5 CONCLUSION

Fundamentally, co-management is backed by the idea that people who are affected by environmental decisions should be involved in the decision-making process (Berkes 2009, 1692). For many complex systems, such as Moorea represents, simple rules of thumb can be more effective than complex government regulations (Berkes 2012). Each grouping of people that resource management decisions effect relies on different institutions to support their claims to environmental resources. Along with this recognition comes the need to acknowledge and manage how formal and informal institutions are arranged to entitle use or

access to natural resources (Leach, Mearns, and Scoones 1999). Fundamental political inequalities must be addressed or co-management can lead to class-based exploitation (Davis and Ruddle 2012). Too often community-based resource management efforts have simultaneously recognized the rights of people while disempowering them through prioritizing ecological conservation over social justice (Dressler et al. 2010).

In order to build social and ecological resilience, the protection of rights and the pursuit of justice for minorities are key (Lebel et al. 2006). Creating sustainable pathways will never be error free (Ostrom et al. 1999). Adaptive management approaches that learn through time and are in touch with the needs and perspectives of resource users can aid in creating socially beneficial resource management (Berkes 2009; Folke 2006; Lebel et al. 2006; Olsson, Folke, and Berkes 2004). Injustice and marginalization, whether one defines it as real or perceived, do not contribute to effective marine management. The broad-stroke brushing of good and bad environmental behaviors is too simplified to account for the real-life heterogeneity of understandings that exist in relation to any natural resource management decision.

Throughout the Pacific, community-based management has proven to be successful, emerging as indigenous peoples witness ecological degradation and find strength in their cultural heritage (R. E. Johannes 2002). Some co-management approaches to coral reef conservation have been more ecologically and socially successful than top-down protected area approaches (McClanahan et al. 2006). In order to avoid co-management as a burden, co-management arrangements may best be suited for locations where local peoples have already shown their vested interests in conservation efforts and have ideas and/or practices already established to manage natural resources, such as we witness in Moorea. Building management out of the passion that fuels resistance has the potential to be more effective than management that attempts to quell specific behaviors through punitive measures. It has been demonstrated that co-management has lessens the perception that environmental management has detrimental livelihood effects within a relatively short time-frame of six years (Cinner and McClanahan 2015). With increased social acceptance, environmental governance efforts are all the more likely to be successful.

CHAPTER 5

UNDERSTANDING THE VALUES OF HUMAN-MARINE RELATIONSHIPS IN MOOREA, FRENCH POLYNESIA

5.1 INTRODUCTION

There is an urgent need to assess the value of coral reef ecosystems. Given the decline of coral reef health globally, these ecosystems are a salient example of the need for more socially and ecologically effective natural resource management efforts. This is especially the case in the Pacific region where coral reefs meet economic and subsistence needs for many communities (Laurans et al. 2013). Pacific island peoples have held long-term relationships with coral reefs, leading to an interdependence of humans with marine environments (Moberg and Folke 1999).

The primary approach for assessing the value of ecosystems is the ecosystem goods and services (ESs) framework (MEA 2003). Essentially, the framework is interested in uncovering how environments enhance human wellbeing. Through uncovering the 'benefits' that ecosystems provide to people, ecosystem goods and services valuations seek to motivate more sustainable human behavior. Ecosystem goods and services is a coupled human-environment approach that can theoretically assist in providing more socially and ecologically sustainable pathways (MEA 2003). Coupled approaches focus their energy on investigating how people and the environment coexist, rather than viewing the environment as separate or uninfluenced by humans.

Ecosystem goods are understood as the products that environments provide for human communities. Ecosystem services, on the other hand, are the functions of environments that help sustain life (MEA 2003). For example, the fish that inhabit coral reefs are an ecosystem good for associated human communities, while the role of barrier reefs in providing coastal protection from large waves or tides is an ecosystem service. For island

communities, inherent variation exists in the relative importance of ecosystems and their goods and services, based on both individual and national scales (Smith et al. 2013) as well on biogeographic regions, reef types, individual reefs, and among zones within reefs (Moberg and Folke 1999, 217). A key assumption of ESs research is that placing monetary value on the environment will motivate people to develop more sustainable behaviors (Oliveira and Berkes 2014; Hicks et al. 2015). In general, ESs research has had difficulty assessing these cultural values, or what economist call 'non-use' values that people hold in conjunction with ecosystems (Grêt-Regamey, Walz, and Bebi 2008). This is especially the case in the Pacific, where Pacific Islanders have intimate relationships with marine environments and depend on them for subsistence as well as deeply engrained cultural reasons. Value in ESs studies is investigated primarily through monetary measures. Value, however, can also be conceptualized as *values* in the social or moral sense, as socially mediated conceptions of desirable behaviors and states of being (Graeber 2001).

Under the ecosystem goods and services framework, *values* are discussed under the category 'cultural'. In valuation studies, cultural values are often left unmeasured due to the difficulty in creating standardized measurements for them and due to the inability for monetary measures to adequately represent the depth of human experience. These difficulties have led to a need for new approaches to measuring values or the cultural values of ecosystems (Grêt-Regamey, Walz, and Bebi 2008). Contingent valuation methods have been described as the most promising method for measuring the non-use values of ecosystems (Brander, Van Beukering, and Cesar 2007). Contingent valuation approaches tend to be either a stated or revealed preference method often through eliciting an individual's 'willingness to pay' to ameliorate some situation (Grêt-Regamey, Walz, and Bebi 2008). However, extracting a 'wilingness to pay' alone fails to understand the underlying motivations, principles, and values that guide individual and group decision-making processes that transform peoples understandings of the world. We need valuation methods that can address the cultural forms of value that are often left out of goods and services valuations (Oliveira and Berkes 2014; Grêt-Regamey, Walz, and Bebi 2008) if we want to make resource management efforts based off of ESs successful.

In an attempt to expand beyond the limits of conventional ecosystem goods and services valuation methods, this paper focuses on explaining the cultural values associated

with the coral reef-lagoon ecosystem in Moorea, French Polynesia. I use mixed qualitative and quantitative methods to capture people's relationships to, and experiences of, the marine environment. Drawing from the ecosystem goods and services framework, I chose eleven ESs (seven 'cultural' and four 'ecological') to valuate.

To analyze my quantitative results, I use geometric data analysis (GDA) techniques. GDA is an approach of multivariate statistics that represents datasets as clouds of points, allowing the researcher to explore and interpret their data via visual statistical methods (Le Roux and Rouanet 2004, 1). Geometric data analysis is particularly suitable for social sciences because 1) it allows for data analysis at the individual level; 2) it allows for the examination of how demographic variables affect the patterning of the data set; and 3) social attribute data[1] can be compared against other variables to understand how they interrelate (Le Roux and Rouanet 2004). Additionally, GDA better facilitates the interpretation of datasets involving human perceptions and social attributes because it does not hold the same set of assumptions that standard statistical measures use, which often do not hold true for the complex realities of people. For instance, GDA does not require the normalization (and thus transformation) of data and is also capable of analyzing multiple data types (i.e. categorical and numerical) simultaneously.

Below I employ GDA methods to analyze the differences and similarities in the valuations of the main stakeholders on the island: fishers, the general Moorean population, scientists, and tourism operators[2]. I combine my GDA analysis with an assessment of stakeholder narratives to explore how differing ontological positions of marine environment stakeholders affects their varying valuations of the marine environment.

Exploring ontological positions is concerned with understanding how 'reality' is understood by people, how they understand their own being and its relation to other beings and things (Kohn 2015; West 2016). In anthropology, the 'ontological turn' has provided

[1] I define social attributes as the 'social attribute' variables we measured during our surveys. These are viewed as part of an individual's socio-economic background, influencing how they understand their role in larger social relations, such as their political and/or ontological positions.

[2] I would like to note that the term stakeholders has a utilitarian connotation to it that I do not view as fully representative of the relationships that different peoples hold to the marine environment in Moorea. However, I employ the term here as a way to acknowledge the multiple 'groups' of peoples with which we conducted our research.

scholars with new means of exploring ethnographic inquires (Pedersen 2012). Ontological inquires provide both methodological and theoretical means of understanding the world through the ways in which people engage in it (Kohn 2015). Framing this research in an ontological perspective is useful in that it aids us in understanding the 'values' that stakeholders have for the marine environment. It facilitates this understanding through grounding my descriptions of values in the multiple and distinct ways in which different stakeholders understand their own position within the world. Simultaneously, an ontological perspective aids in disentangling what people understand the significance of their behaviors to be for the beings, things, and essences that compose their realities.

5.2 SITE

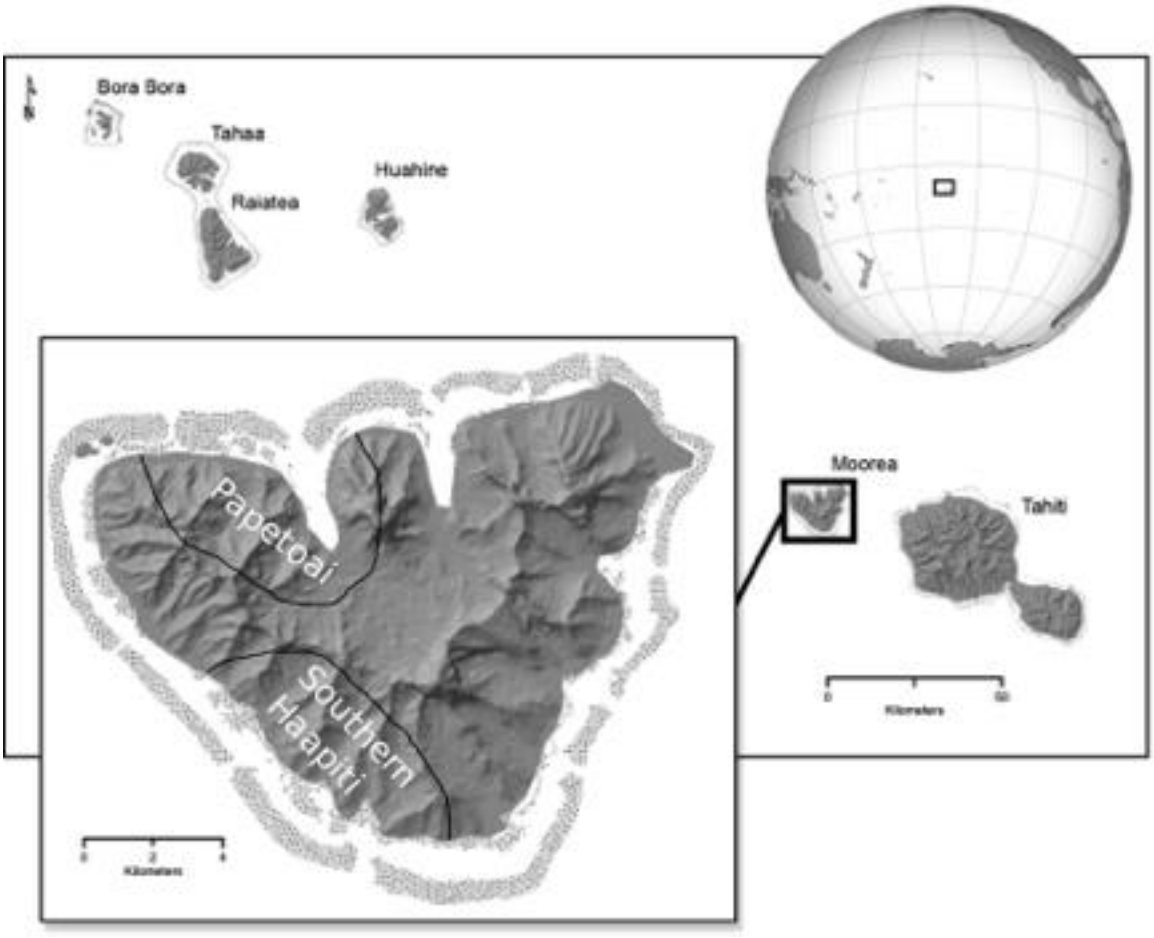

Figure 5.1 The Society Islands and Moorea

Moorea is a small high-volcanic island located approximately halfway between Australia and South America, 25 km northwest of Tahiti in the Society Islands archipelago.

The island is encompassed by a 49-km^2 coral reef-lagoon system, broken up by eleven passages in the barrier reef that allow for water to move in and out of the lagoon. The steep, green, and rugged peaks of the island interior causes the majority of the population to be concentrated around the coastal strip (Salvat and Pailhe 2002). The long-term relationships that Polynesians have held with island environments has led to them having an 'outwards' looking perspective, understanding the land and sea as an interconnected whole (Hviding 2003). The jagged dense interior of Moorea quite literally causes the population to be marine-oriented in both their practices and perspectives.

The coral reefs of Moorea support some of the highest levels of fish consumption that have been documented in the Pacific (Yonger 2002). Moorean residents consume on average 110 kg of fish a year (Yonger 2002), compared to an average of 23 kg in other regions of the Pacific (Labrosse, Ferrais, and Letourneur 2006). A recent valuation of Moorea's reefs demonstrated that the reefs held a recreational value of 27 million Euros. Conversely, fishing was valued at 4 million Euros. 2.8 million Euros of which were fish that were consumed in households and not sold on the open market (Pascal and LePorte 2015). While not necessarily reflected in these monetary figures when compared to recreational value, the consumption of fish by the Tahitian population in Moorea is fundamentally important to their livelihoods. The consumption of foods classed as Tahitian is central to having a Tahitian identity (Levy 1973). In Moorea, the consumption of lagoon fish may be as important to Tahitian identity as speaking the Tahitian language (Leenhardt et al. 2016).

Interestingly, Tahitians have used tourism as a way to strengthen their own cultural heritage and identity alongside a monetary economy (Castri 2002). French Polynesia is heavily dependent on tourism, building off of the 'myth of Tahiti' that originated when early colonial explorer Louis-Antoine Comte de Bougainville first named the area 'New Cythera' after the Greek goddess of Love (Kahn 2011). The turquoise lagoons that encapsulate the island also serve to draw in tourists, captivated by the warm iridescent waters and white sand beaches that are promoted through the marketing materials of the tourism bureau of the country (Salvat and Pailhe 2002; Kahn 2011). The proximity of Moorea to Papeete, Tahiti, the capital of French Polynesia and host of the country's major international airport, has essentially lead to Moorea being a suburb of Papeete and a top destination for the majority of tourists who visit the country (Walker and Robinson 2009).

Access to French Polynesia was enhanced through the construction of an international airport in the mid 20th century (Hemmingham 1992), which enabled an influx of tourists and scientists into the region. Moorea's unique lagoon system, and the unusual resilience that the island's outer reefs have demonstrated to biological and anthropogenic stressors, has led to Moorea being a top site for coral reef research in the South Pacific (Trapon, Pratchett, and Penin 2011). Two scientific research stations on Moorea host a range of environmental researchers. These stations are predominately populated by natural scientists studying the marine ecosystem of Moorea and French Polynesia. The French *Centre de Recherches Insulaires et Observatoire de l'Environnement* was implemented in 1971 and the American U.C. Berkeley Richard B. Gump station began in 1985. Both stations host students and faculty from a range of universities, in addition to other researchers, largely from the United States and Europe. These three usages of Moorea's reef (tourism expeditions, fishing, and scientific research) have resulted in competing interests, exacerbating conflicts over marine resource management efforts (Walker 2001). This research focused on dissecting how these 'stakeholder' groups differentially valued the marine environment in the interest of how I could use this understanding to create more equitable conservation efforts.

5.3 METHODS

5.3.1 Research Methods

I used an embedded mixed methods design (Creswell 2014) that combined quantitative value measures with two qualitative questions that asked participants to relate a story about their relationships to the lagoon surrounding Moorea. I was interested in exploring the ways in which peoples of different 'professions' (i.e. stakeholders) value ESs, though, I also want to move beyond solely descriptive quantitative data of *how* valuations differ to explain *why* they differ through the qualitative data. Like one's ontological position (West 2016), I view people's values as dynamic and processual, affected by changing social and environmental conditions through time (Graeber 2001). Thus, I argue that values of ecosystems cannot just be measured just in monetary terms, as many ESs do, but need to be understood as a social process. Moreover, if we we use valuation studies to inform resource management decision-making, this understanding implies that management should remain flexible through time to adapt to changing socio-environmental conditions.

I largely derived the quantitative portion of our methods from Hicks, Graham, and Cinner's (2013), who analyzed synergies and tradeoffs in coral reef ecosystem service valuations among scientists, resource managers, and fishers. In their research, respondents were shown eight photos, each representing an ecosystem good or service, and asked to 1) rank the ESs according to importance, and 2) to rate the ESs by distributing 100 points across the services in regards to where they would like to see improvements. In this research, I combined these stages, asking respondents to distribute 100 points, represented by small seashells, across eleven photos representing various ecosystem goods and services. These seashell points were used to demonstrate which photos held more 'importance' in a respondents' personal relationship to the lagoon environment. What people view as important is another way of understanding what they value (Graeber 2001). We asked our participants explicitly about their personal opinion of the importance of the ESs we presented to them, rather than what they may view as important to others or important in a general sense.

The ESs we chose to valuate were based on 351 household surveys our research team conducted over the summers of 2014 and 2015 in three of Moorea's five districts. The household surveys provided me with background information on which ESs may be salient to people's everyday realities. I chose eleven services to valuate, seven cultural values (bequest, cultural heritage, economic gain, education, sense of place, recreation, and tourism), two regulating services (coastal protection and sanitation), one supporting service (habitat), and one provisioning service (fishery). Most of the photos that were used to represent these values were taken during the 2015 research season, though an internet search provided the images for both 'education' (France Info 2013) and 'sense of place' (Viola Moorea 2016). Two Moorean research partners vetted the photos and the definitions of the ecosystem goods and services we selected. The name of each ecosystem good or service that a photo represented was written on the front, while definitions of the ESs were included on the back of the photos. Finally, after respondents distributed their set of 100 points across the eleven categories, we showed them a white card with the word 'Other' on it, asking them if there was any other category that they found important that was missing from the exercise that they would like to add.

Table 5.1 Photos and descriptions used in ecosystem goods and services exercise.

	**Bequest** Benefits we gain knowing we will have healthy reefs we can pass on to our children so they can use them benefit the same way we do (*as defined by* Hicks et al. 2013)		**Habitat** The role of the lagoon and coral reefs in providing a home for fish, shellfish, coral, and other creatures that live in the water around Moorea.
	**Coastal Protection** The role that the lagoon/coral reef provides in protecting the coastline from the ocean		**Recreation** The role of the lagoon/ocean in providing recreational opportunities for local people (as opposed to tourists/tourism)
	**Cultural Heritage** The role that the lagoon/ocean plays in the cultural heritage of Moorea. Cultural heritage being the traditions, foods, customs, and values, that are important to Mooreans.		**Sanitation** The importance of having clean and healthy oceans, lagoons, and marine resources.
	**Economic Gain** Any lagoon/marine resource that somebody sues to make money.		**Sense of Place** How the ocean and lagoon provides a way for you to feel connected to Moorea, how it represents'home' or makes you feel grounded.
	**Education** Benefits we gain from the knowledge we have from the time we and our elders have spent in in the marine environment (*as defined by* Hicks et al. 2013)		**Tourism** The importance of the lagoon/ocean in drawing in a tourism economy on the island.
	**Fishery** The fish and shellfish that people obtain from the lagoon and ocean.	Autre	**Other** Anything that the participant feels is missing or should be included as a category in the valuation exercise.

I viewed respondent's answers to the "other" question as aiding in addressing researcher bias in selecting important categories of human-marine relationships. Broad patterns in respondents suggestions about what was missing would inform us if the categories I selected were not entirely relevant or comprehensive of people's relationships with the marine environment in Moorea. Because I wanted to be sure that the ecosystem goods and services selected actually matched people's realities, I also had respondents evaluate our valuation exercise. To do this I asked three questions, which allowed participants to rank (using a Likert scale) their level of agreement to a statement on a scale of one (highly disagree) to five (strongly agree). Three qualitative questions followed the Likert scale questions in order to gain a greater depth of understanding on how people found the exercise to match their experiences of and relationships to the lagoon environment of Moorea.

Table 5.2 List of Questions used to evaluate valuation exercise.

Likert Scale Questions

- These categories accurately represent how I experience/feel about marine resources.
- It is worthwhile to say that some ecosystem services are more important than others.
- I think ecosystem services are a useful way to think about my relationship to the marine environment.

Qualitative Questions

- Do you think this exercise reflects how you experience/feel about the marine environment? Why or why not?
- Is there anything missing from this exercise in regards to how you think about the marine environment? If so, what?
- What would you change about this exercise to make it more meaningful?

In addition to data collected on the valuations of ESs, I also measured eleven 'social attributes' to explore their influence on the respondents' valuation responses. Social attributes (as seen in Table 3) consisted of personal information on the participant, including profession, ancestry, and age, for example. I conducted these surveys with 57 individuals from the general population, 13 professional fishers, 20 scientists from the French and

American research stations, and 10 tourism operators (owners of *pensions* [n=2], marine excursion companies [n=5], island tour guides [n=2], and a Traditional Tahitian Foods Restaurant [n=1]). The 57 survey participants from the fisher/general category were divided between the Southern Haapiti district in the southeast portion of the island and from the Papetoai district on the northeastern part of the island. I chose these two districts in order to assess if there was variation between the values of people who live in Southern Haapiti, where no marine protected areas (MPAs) exist, and Papetoai, which has multiple marine protected areas (MPAs) and a higher presence of tourism. Tourism operators were interviewed in the districts of Afarieatu, Pao Pao, Haapiti, and Papetoai.

Table 5.3 Social attribute variables collected during our survey about each respondent. All social attributes were coded categorically for our statistical analyses.

Variable	Definition
Ancestry	What island or country the participant is from
Age	Age of participant (*this variable was lumped into ranges (i.e. 18-29) and thus analyzed as categorical rather than continuous)*
District	District where participant lives, or in the case of scientists, where their research station is located.
Eats_fish	Whether or not the participant eats fish
Gender	The gender of the participant
Goes_fishing	Whether or not the participant goes fishing. If they fished in the past, but do not currently, this question was answered as no.
Level_of_school	The highest level of education the participant has achieved.
Lived_in_Moorea	The length of time that the participant has lived in Moorea
Profession	The profession of an individual respondent. Defined as the general population (any number of employment statuses), professional fisher (fishers who sell fish), a scientist (including Full Professors, PhD Students, Post-Doctoral Researchers, and Technicians), or a Tourism Operator.
Religion	The religion of the participant
Sells_fish	Whether or not the participant sells fish that they catch.

5.3.2 Data Analysis

Data from the photo evaluation exercise was analyzed using geometric data analysis (GDA) techniques. Through multi-dimensional scaling, GDA allows for dimension-reduction and visualization of one's dataset. I followed the design of Le Roux and Rouanet (2004). I began by transforming the data into multidimensional 'clouds of points' that are then dimensionally reduced through an iterative statistical procedure into two-dimensional biplots. Essentially, the NMDS biplots are a two-dimensional representation of an *n*-dimensional space that demonstrates relationships between the individuals who participated in our study, the variables we measured, and the individuals and the variables that create our dataset. The creation of these plots allows for the researcher to visually explore their data, drawing inferences into what causes the data to be clustered into specific spaces. Clustering of the data is used in order to search for broader patterns within the dataset. The object of this sort of multi-dimensional scaling is to first investigate the spatial proximity or distance of the variables measured, which can reveal underlying social trends that structure the data in the biplots (Unlukaplan 2011). The clouds of points represented in the biplots are interpreted by the attraction (similarities) and repulsion (differences) of variables, evidenced in the distances between data points; larger distances are interpreted as higher levels of repulsion or difference between variables and/or individuals. I was particularly interested in analyzing how one's 'profession' (professional fisher, general population, scientist, or tourism operator) influenced one's valuation of the ecosystem goods and services[3].

I conducted all statistical analyses in R, adapting scripts created by (Ullah 2014), that were developed specifically to operationalize a GDA approach to pattern analysis in social and economic data (Ullah, Kuijt, and Freeman 2015). I adopted this workflow to analyze how a participants' profession is related to their valuations of the ecosystem goods and services we selected for measurement. Using this method, I first grouped my data using a k-medoids clustering technique. I chose to use k-medoids, rather than the more commonly used

[3] It is important to note that many people in the 'general population' and 'tourism operator' categories crossed boundaries between these 'profession' categories as they may work at a hotel, in housekeeping for instance, or may also fish and occasionally sell fish. A person's 'profession' was largely based on their primary form of income. Though, most professional fishers rely on multiple sources of income in order to effectively provide a monetary income for themselves and their families.

k-means or k-medians procedures, because k-medoids accepts a wider range of data types. This was necessary due to the presence of social attribute data within our dataset that was coded categorically, while our ESs data was numerical. K-medoids in combination with a Manhattan distance matrix (rather than the standard Euclidean distance), gave me the capacity to analyze categorical data in combination with the numerical data. K-medoids clustering is also preferable from a sociological perspective as it forms clusters around representative individuals, rather than a hypothetical "central point". Because GDA does not require data normalization techniques or data transformations, as standard statistical methods do, I view it as a more appropriate statistical method to analyze my dataset as it was not necessary to alter the data to make it 'fit' a model.

Through GDA, I was able to analyze my data tables by both row (all data points from an individual) and column (i.e. ecosystem good/service or social attribute measured) as when it is viewed in an excel document. Therefore, both individual participants (rows) and the variables I measured (columns) that comprised the data were plotted onto the biplots created through GDA statistical procedures. This allowed me to view how individuals (data rows) were spatially patterned in relation to the data columns (ESs and social attributes), allowing inference into what factors lead to the underlying structure of the plots. In general, the underlying structure of the biplots reveal the relationships that exist between the variables and the individuals one's research investigates. The clusters produced through the k-medoids process are indicated in the biplots by polygonal convex hulls of various colors. In some of the biplots, individual participants are represented by various shapes (i.e. squares, circles, diamonds, etc), which represent the social attribute characteristic I highlight within each biplot.

The data analysis procedures I used require that I also address Galton's problem (Eff 2004; Eff and Dow 2008). Galton's problem is one of autocorrelation. This problem arises as multidimensional data that is reduced into a two-dimensional space may potentially have two variables in close proximity to each other within the biplots, though there may not be an actual correlation or causality between them. I sought to delineate what are truly spurious correlations (the random association of two points being plotted in close proximity in the two-dimensional biplot) from the hidden, structuring correlations that hold causality or relationships and are revealed through GDA techniques. Galton's problem is of less concern

when using GDA than with standard statistical procedures, as GDA explicitly looks for correlations within the dataset that can help explain social phenomena. However, it is still important to investigate whether the biplots I produced are reflecting actual relationships between variables. Or, whether two variables are in close spatial proximity, but are not actually correlated and therefore not useful in explaining the results of our analyses.

In order to test for Galton's problem, I analyzed parsed datasets that contain subsets of the full dataset using the same statistical procedures explained above. By analyzing subsets of the complete dataset I was able to test whether variables were consistently plotted in close proximity to one another or if their spatial patterning was a spurious association produced through the reduction of dimensions. It is important to note that while the close proximity of two or more variables within the biplots may not indicate an actual correlation or causality between these factors, large distances between variables within the biplots demonstrates that the variables are definitively repelled by one another. I also examine the social attribute and valuations of the representative individuals of each of our clusters, (these individuals having been determined through our k-medoids clustering procedure), in order to see how these individuals represent broader trends in the polygonal clusters that place our data into groups. In other words, I investigate how the characteristics of these representative individuals are representative of the individuals that comprise the polygonal clusters. I use this as another method of investigating whether autocorrelation is present or not. These combined lines of inquiry provide insight into why correlations exist within the biplots and help to substantiate my explanations of why the plots are spatially patterned as they are. Finally, there was no missing data in the complete dataset, so no steps were taken to ameliorate this potential source of error in these analyses.

5.4 RESULTS

5.4.1 General Description of Clustering Patterning

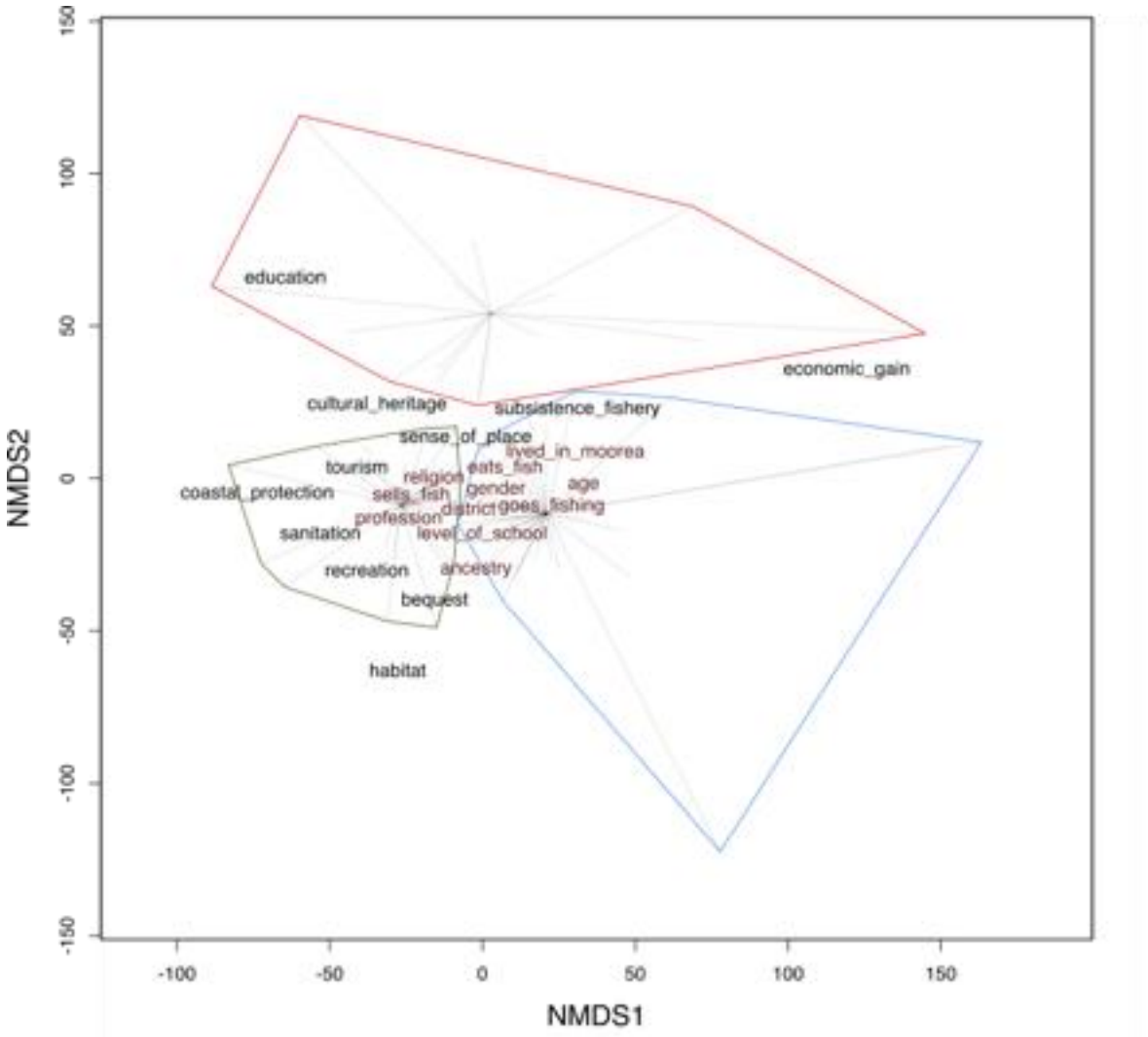

Figure 5.2 Three clusters, bounded by polygons, which were produced through k-medoids procedure. Social attributes are in red. Ecosystem services are in black. Note that the axis labels and scales are arbitrary.

To explore the underlying structure of the dataset, I employed an iterative k-medoids clustering procedure. I first grouped the data into six clusters and then into progressively fewer clusters. I found that when the dataset was grouped into three clusters there was a discernible clustering structure (Figure 5.2). The individuals who form the center of each cluster, as determined by the k-medoids procedure, were a PhD student from the American research station, (bottom left green cluster), a professional fisher who had moved to Moorea

ten years ago from another island (top red cluster), and a young, unemployed woman from the general population (bottom right blue cluster). These individuals were selected through the k-medoids process as typical of the other peoples who fell into the cluster, thus acting as model individuals for each grouping. Understanding these individual's characteristics, aids in bringing insight into why the individuals and variables are distributed in the spatial patterns visible in the biplots.

The social attributes (in red text) of the survey participants are clustered within the central portion of the biplot (Figure 5.2), whereas ecosystem goods and services (in black text) are positioned just outside and surrounding this central portion. Most notable are the ESs 'education' and 'economic gain', which are located apart from (and thus repelled from) the other ecosystem goods and services variables, suggesting that there are underlying factors that set 'education' and 'economic gain' apart from the other variables I measured. The reasons for the separation of 'education' and 'economic gain' from the other variables is explored further in the 'Analysis of Stakeholder Narratives' and 'Discussion' sections.

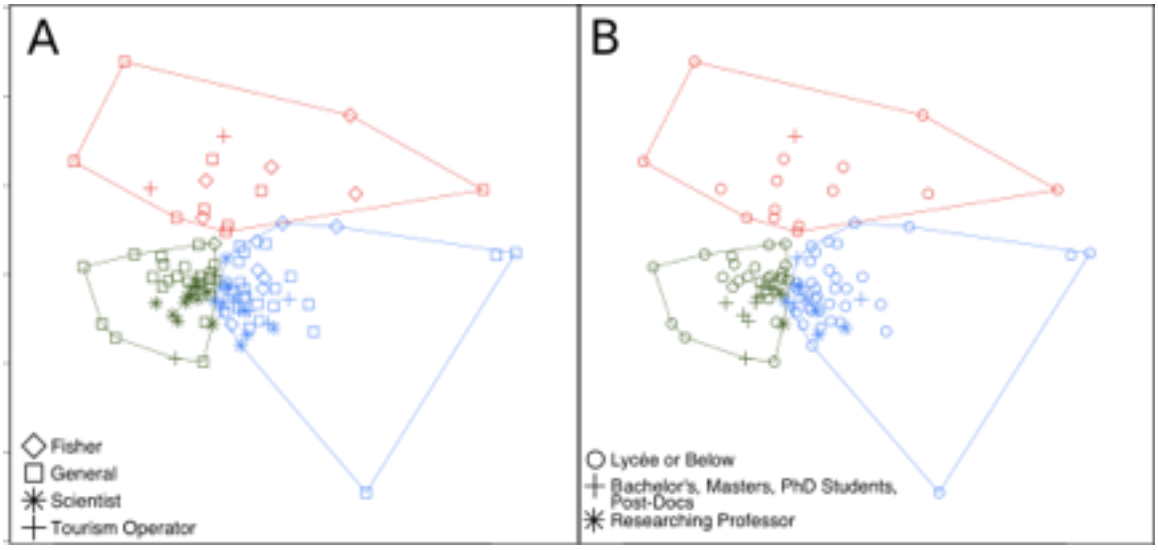

Figure 5.3 Two biplots with survey respondents represented by profession (A) and level of school (B)

To visually analyze how various social attributes relate to a survey participant's position within the three clusters, I generated two biplots (Figure 5.3), each of which used shapes to represent different social characteristics of the survey participants. I removed the ESs and social attribute labels to ease visual interpretation. I chose to feature profession (3a) and level of school (3b), due to the significance of these variables in structuring the data

within the biplots (discussed in more detail later). In Figure 5.3a, respondents from the fisher and general population stakeholder groups dominate the top cluster. Scientists are located more centrally in the densest area of the clusters, falling between the first and second clusters and taking up a distinct horizontal level in the plot. Most tourism operators are also found in this central area. The clustering of scientists and tourism operators along the central portion of the NMDS plots reflects their tendencies to distribute the 100 seashell points more evenly across the ecosystem goods and services categories. If we refer to Figure 5.2, we can see that these two stakeholder groups are grouped around the ecosystem services coastal protection, sanitation, tourism, recreation, bequest, and habitat[4]. While some Tahitians from the general population and the professional fisher stakeholder groups also are located in this central portion of the biplots, a number of survey respondents from these groups are also located around the perimeter of each of the three clusters. This spatial patterning suggests that there are high levels of variation in the valuation responses of Tahitian respondents from the general population and professional fisher stakeholder categories. Indeed, while the ESs 'education' and 'economic gain' are repelled from the majority of other variables measured, there are individuals, primarily Tahitian respondents with lower levels of education (as indicated in Figure 5.3b), who are attracted to these services, as indicated by their close proximity to these variables in the biplots.

As indicated in plot 3b, participants with higher levels of education tend to be grouped in the central portion of the clusters, despite the ecosystem service of education being repelled from this area. Respondent's level of education and profession are highly correlated, especially as the profession 'Scientist' is premised on having achieved high levels of education. The structuring influence of individuals' education level within our biplots demonstrates that ones' perceptions of the value/values of the marine environment are largely influenced by one's level of education.

[4] Coastal protection, sanitation, and habitat are also closely linked in our plot containing just ESs information as well (Figure 5), suggesting that these services are not in close proximity due to Galton's problem.

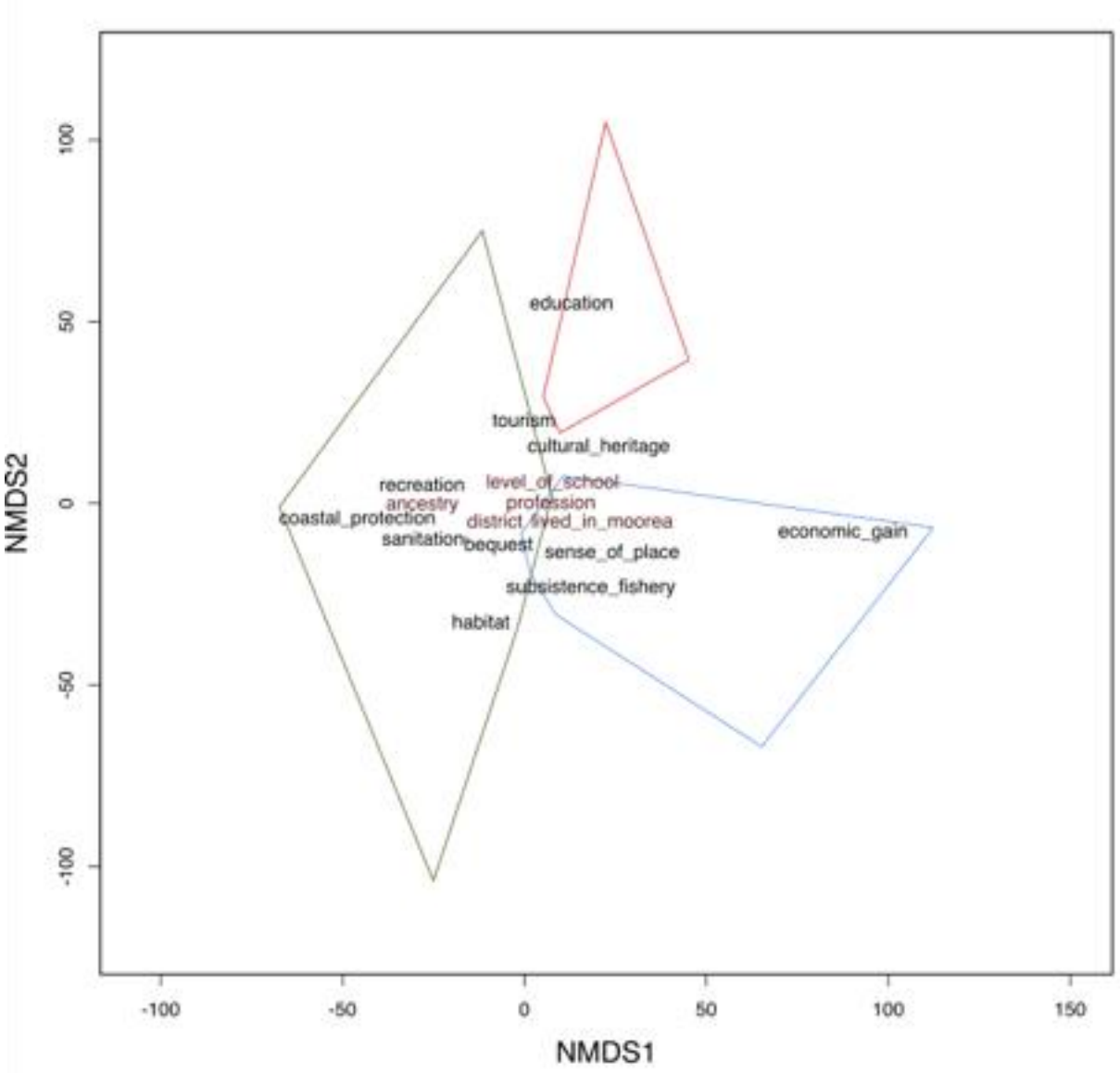

Figure 5.4 Biplot created using parsed data set containing all the ESs data (in black) with influential social attributes (in red): ancestry, lived in Moorea, level of school achieved, and profession. Social attributes not included in this analysis are age, eats fish, gender, goes fishing, religion, and sells fish.

To test for Galton's problem, I used parsed datasets to examine how the removal of specific variables affected the underlying structure of the biplots (Figure 5.4). I compared the structure of the parsed datasets (Figures 5.4, 5.5, and 5.6) to the complete dataset (Figure 5.2). Figures 5.4, 5.5, and 5.6, analyzed datasets containing all of the ESs we measured, but a limited number of (or none of) the social attribute variables we collected. Of particular interest to the researcher is not so much the position of the polygonal convex hulls, but that

of the spatial patterning of the ESs and social attribute variables (as represented by their text labels in the figures). Similar to the analysis of the complete dataset displayed in Figure 5.2, the social attribute data in Figures 5.4, 5.5, and 5.6, is clustered in the central portion of the biplot and the ESs form a ring round them. The notable differences in the location of the variables we measured are the ecosystem services 'sense of place' and 'subsistence fishery'. Both 'subsistence fishery' and 'sense of place' move away from the red polygonal cluster in Figure 5.4, which is analyzed with only limited social attribute data. The ESs 'sense of place' and 'subsistence fishery' come into close proximity with 'cultural heritage' when the social attributes of 'eats fish', 'goes fishing', and 'sells fish' are added to the data set (Figure 5.2). It is also interesting to note that the representative individual of the cluster delimited in red in Figure 5.2, is a Tahitian fisherman. I conclude from this change in the position of variables within the biplots that eating fish, going fishing, and selling fish are important 'Tahitian' social attributes that are intertwined with Tahitian's 'sense of place' and 'cultural heritage', reflecting the overall importance of the fishery in their daily lives. Also of note is that the ecosystem services 'sense of place' and 'subsistence fishery' are consistently linked throughout all of the biplots I produced.

Table 5.4 Percentage of respondents who eat fish, go fishing, and sell fish.

	Eats Fish	Goes Fishing	Sells Fish
General	100%	61.4%	0%
Professional Fisher	100%	100%	100%
Scientist	80%	35%	0%
Tourism Operator	100%	40%	10%

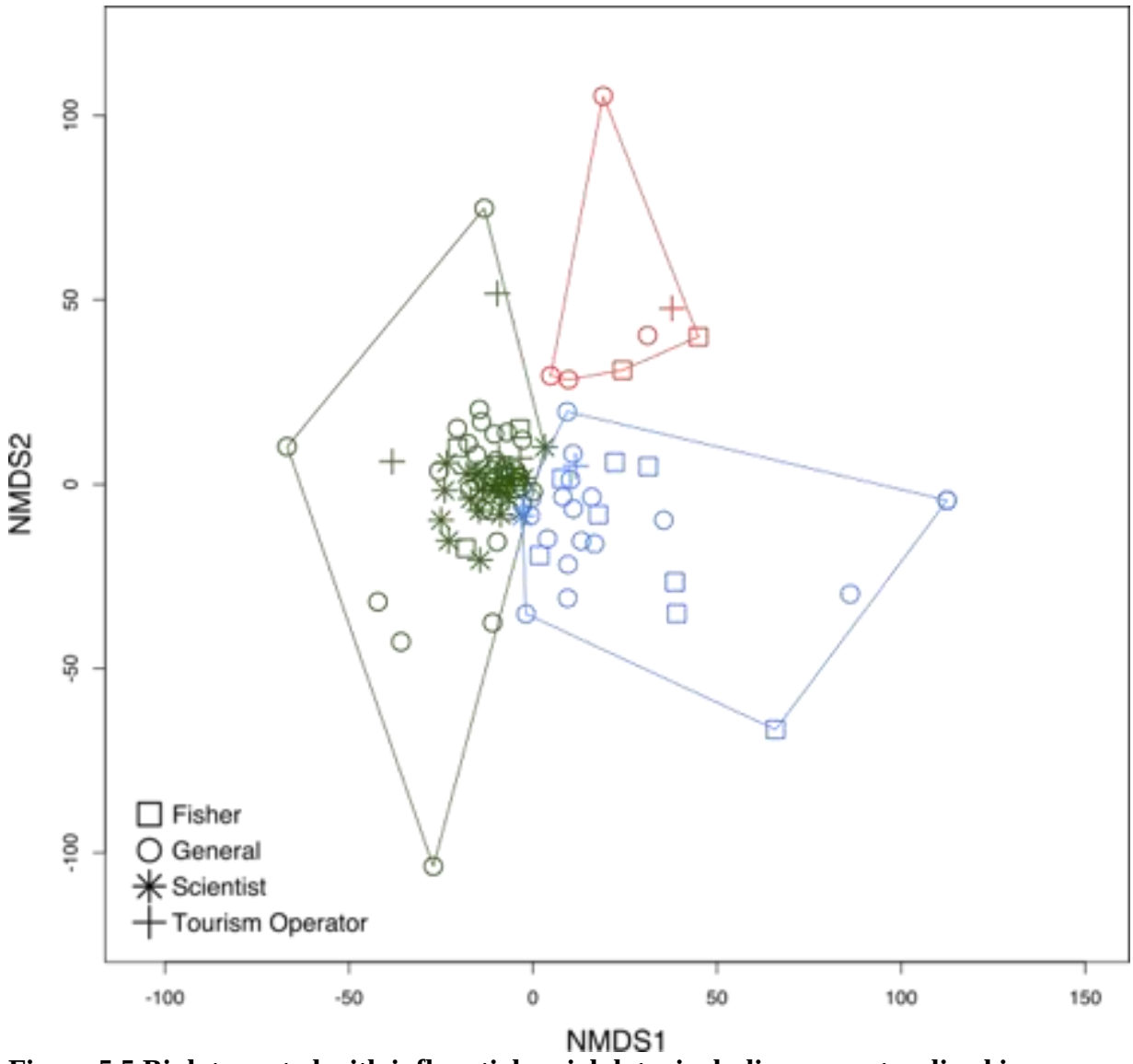

Figure 5.5 Biplot created with influential social data, including: ancestry, lived in Moorea, level of school achieved, and profession.

In addition to the parsed dataset in Figure 5.4, I also produced a biplot containing only the ESs that we measured in our survey (Figure 5.6). The biplot with just ESs has much the same structure as the biplots that display the complete dataset (Figures 5.2 and 5.3). Therefore, I have some certainty that the analysis reflects underlying trends and is not an artifact of the data analysis technique. Figure 5.6 also suggests that the ecosystem goods and services hold even greater influence in the structure of our dataset than do the social attribute data. This is demonstrated through the high levels of correspondence in the spatial distribution of the ecosystem good and services variables present in Figure 5.6 and Figures

5.2 and 5.4. This could perhaps be due to the high levels of homogeneity within the social attribute data that causes these variables to be centralized between the three clusters. For instance, the high levels of agreement in the social attribute data with the variables 'profession' and 'district' across stakeholder groups, 'level of education' among scientists, and the high levels of agreement in 'eating fish' and 'going fishing' among Tahitians.

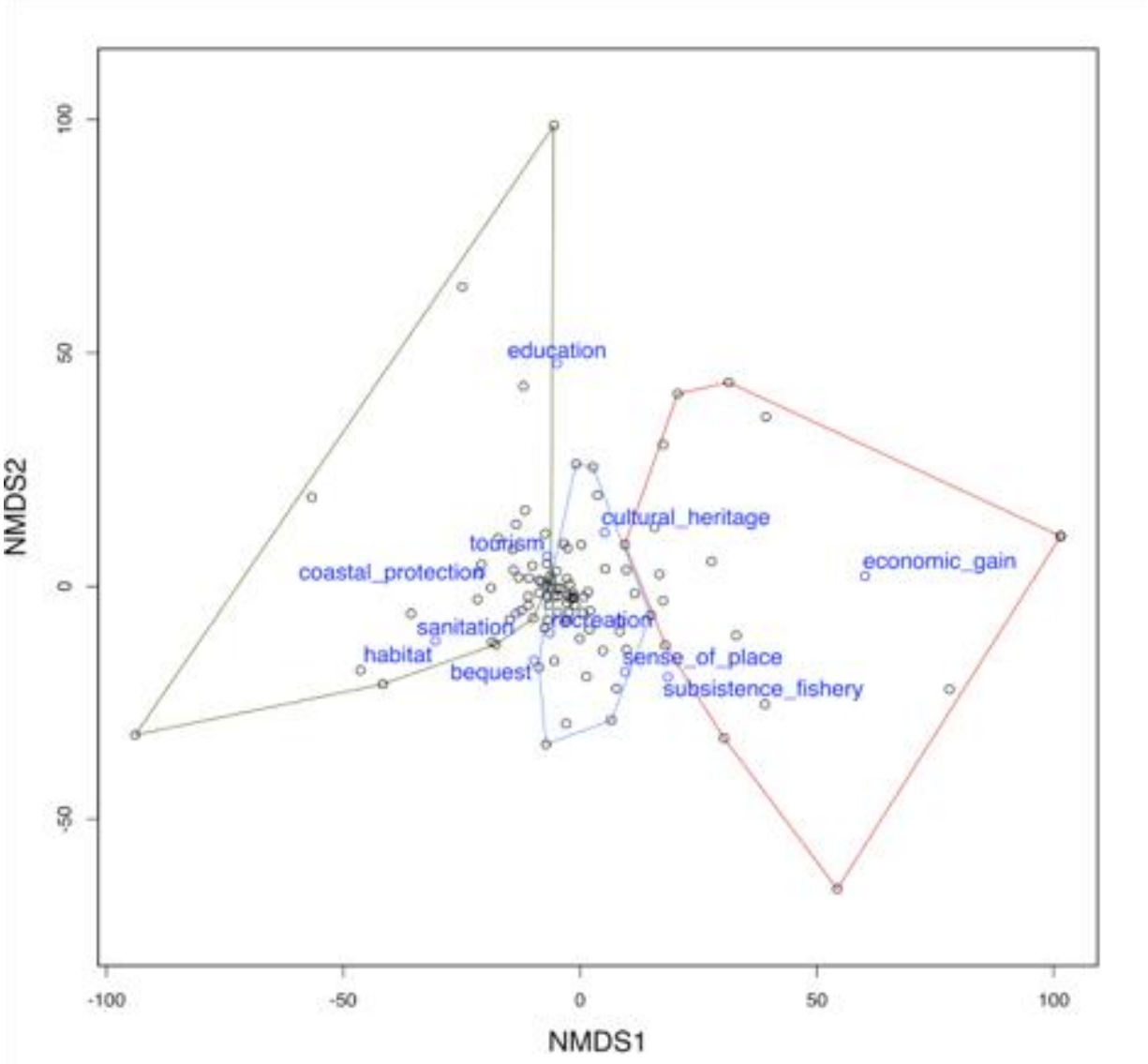

Figure 5.6 Biplot produced using k-medoids clustering analysis with only ecosystem goods and services valuations data.

5.4.2 Analysis of Stakeholder Narratives

5.4.2.1 Education and Ecological Sustainability

All stakeholders discussed education as a gateway to responsible and beneficial treatment of the marine environment. A lack of education was viewed as resulting in high levels of pollution in, and degradation to, the marine environment. The stakeholder groups, however, defined 'proper' education, differently. Tahitians discussed quality education in terms of teaching children respect for the marine environment, this respect being a component of Tahitian cultural heritage. "Education, teaching the children. When we [him and who I suppose is his wife sitting next to him] become parents it is important to teach them [children] about the sea, to respect the ocean for life." (Male, Age 38, June 2016). Respecting the ocean is viewed as leading to environmentally responsible behavior for Tahitian respondents and therefore as maintaining Tahitians' own lives and livelihoods. "It is always the same. Keep the sanitation and respect the lagoon. It all returns to the sanitation and to the respect of the lagoon" (Female, Age 52, General Population, July 2016). The increasing level of degradation that the lagoon has experienced is concerning and 'proper' education is thought to be one way in which to combat degradation. "Education has come to be important because fishing has changed due to ecological degradation." (Female, Age 24, General Population, June 2016). Tahitians see that they have to make a more concerted effort towards education due to the changing socio-ecological conditions that Moorea is experiencing.

Scientists, too, discussed education as leading to environmentally beneficial behavior but they described it differently. While Tahitians grounded education in culture, scientists tended to associate education with acquiring knowledge and to separate education from 'culture'.

> I'm an educator, so clearly the education to me is super important. And the habitat and all those sorts of things, but, yet, the cultural values are, and the economic values are, what are going to drive people to save the lagoons and the reefs. And I find those really important too (Female, Age 60, Scientist, July 2016).

Or as another scientist responded when asked if there was any ESs missing from the exercise: "Science, because with science you could manage the fisheries, manage the

protection, do education . . .” (Male, Age 40, Scientist, July 2016). For scientists, education was based in science and knowledge, separated from the cultural reality of everyday life.

Scientists emphasized a divide between empirical knowledge and their emotional experience of the lagoon. As one scientist indicated “. . . my interactions with the lagoon are divided into scientific experiences and personal experiences.” (Female, Age 26, Scientist, July 2016). While another scientist stated:

> I’ve been working in Moorea for 20 some years now. I’m still in awe when I get into the lagoon and look around and see the, sort of, the amazing coral reef and all it means as, you know, on a number of different levels. Obviously, there is the science level, which for the sorts of things I am interested in doing intellectually, it is a phenomenal model system. But far beyond that it [the lagoon] is just absolutely breathtaking (Male, Age 65, Scientist, July 2016).

Scientists’ conception of scientific knowledge as something independent of their emotional and aesthetic experience(s) is reflected in their understandings of what constitutes a ‘proper’ education. Education is achieved through science, through empirical studies that create knowledge, separate from their experience and their cultural values. In contrast, Tahitian understandings of education are linked to respect and cultural heritage. Despite these differences, both groups view education, however defined, as a gateway to more ecologically responsible behavior.

Tourism operators also discussed education as a way to achieve environmentally responsible behavior. Though, their perspectives on what leads to education were not consistent. Responses tended to vary based, at least in part, on the ancestry of the survey respondent. For example, an American tourism operator stated: “Education starts with a healthy functioning reef” (Male, Age 57, American, July 2016). Yet for a Tahitian tourism operator, education needed to be grounded in Tahitian cultural heritage in order to continue to mutually benefit Tahitians and the marine environment.

> All of the economic activities, need to start with education, when the students are young, in order to educate them on these topics. We need to give them this knowledge, of being Polynesian. Our cultural heritage is the lagoon, it is the reef, it is the fish, it is our language, our culture; for me this is important to be a witness to our patrimony. (Male, Age 44, Tahitian, July 2016)

Unlike other stakeholders, tourist operators also associated education with recreational or economic uses of the lagoon. For example, when speaking about his frequent boating excursions on the lagoon, one operator said: “When canoeing there is a good vision to

connect with the lagoon. I benefit from this. It is a mental education. I'm a teacher. For me, this is very important. (Male, Age 39, Tahitian, June 2016). For tourism operators, excursions or recreational activities that are grounded in Tahitian cultural heritage were also viewed as a gateway towards environmentally responsible behaviors.

5.4.2.2 ECONOMIC GAIN AND ECOLOGICAL DEGRADATION

In all of the interviews, stakeholders emphasized the importance of having a healthy marine environment. They linked ecological degradation to economic gain. I view the clustering of the 'ecological' variables 'coastal protection', 'sanitation', 'habitat' and the cultural value 'bequest' as indicative of stakeholder's desire for environmental sustainability. Especially of scientist's desire given the spatial proximity of these ESs near the cluster of scientists and tourism operators in the biplots. This 'ecological sustainability' index, so to speak, was spatially positioned apart from economic gain within the biplots. In participants' responses, there was a clear correlation between economic gain and ecological degradation. As one respondent blatantly stated: "Money is the cause of environmental degradation." (Female, Age 52, General Population, June 2016). Scientists, fishers, and the general population were concerned about how linking the lagoon to monetary gain may negatively impact marine health.

For Tahitians, monetary gain was linked to a lack of respect for the ocean - this respect being part of what comprises a 'proper' education. "Because people don't respect the lagoon, the sea is for sale. It is dead. It is destroyed" (Female, Age 60, General Population, June 2016). For scientists as well, the meshing of economic gain with the lagoon was viewed as leading to ecological degradation

> When I first got here [to Moorea] I would have said 'It's [the reef] trashed, it's over, too much [negative environmental impact] from the hotels, and too many tourists anchoring boats and riding jet-skis, and too many fishermen smacking the reef apart to get at *Tridacna* [*Tridacna gigas,* Pacific Giant Clam] and on and on and on (Male, Age 54, Scientist, July 2016).

However, for this American scientist, along with others who study in Moorea, the unusual resilience that Moorea's reefs have demonstrated gave them hope for the ability of the coral reef-lagoon ecosystem to bounce back from current levels of degradation induced by activities seeking economic gain.

The tourism industry's impact on marine-environmental health was a cause of concern for scientists, the general population, and professional fishers. "Who destroys the coral? Tourists. This is all for the money. This is not the way of our ancestors." (Male, Age 58, General Population, June 2016). Both money and tourists themselves are viewed as causing ecological degradation. Moreover, Tahitians are further offended by tourism due to how tourists appear to be prioritized over Tahitian livelihoods and wellbeing. "They [tourists] are prioritized over the fishers. They [tourists] don't know about the coral, the ocean. From hotel to hotel we cannot fish because they make the lagoon for the tourists" (Female, Age 32, June 2016). Both the prioritization of tourists, and the tourism economy's perceived contribution to ecological degradation, framed the industry in a negative light for fishers, the general population, and scientists.

The linking of ecological degradation and tourism was juxtaposed, however, with the recognition that Moorea's economy depends on tourism for certain respondents. "It is good to keep the lagoon clean, for the future, so the tourists keep coming." (Female, Age 29, General Population, June 2016). Scientists also noted that tourism could be one avenue for maintaining marine resource health. "I understand that tourism provides alternative dollars to fishing and other things that are actually more damaging to the lagoon." (Male, Age 54, July 2016). Thus, tourism, if practiced responsibly, could be a beneficial avenue for maintaining marine health through non-destructive recreational activities. Scientists and tourism operators alike tended to view recreational value as an important attraction and motivation for keeping the lagoon healthy. This was evidenced in the biplots (Figures 5.2 and 5.3) through the close proximity of the ESs 'tourism' and 'recreation' in the central portions of the plots where scientists and tourism operators are grouped, but away from many Tahitian respondents.

I observed during the surveys that fishers and the general population valued recreation and tourism less in comparison to scientists and tourism operators, during the valuation exercise. Upon revisiting the data, I found that 50% of professional fishers and 41% of the general population placed no points on tourism. This can be compared to 15% of scientists and 10% of tourism operators who did not add points to tourism. Similarly, 43% of fishers and 36% of the general population did not add points on recreation, whereas 10% of tourism operators, and no scientists added points to the ES 'recreation'. These responses aid in explaining why the ESs 'recreation' and 'tourism' were clustered by scientists and tourism

operators in the biplots. Rather than near Tahitian respondents, or the clusters that have Tahitians as their representative individuals.

5.4.2.3 THE FISHERY, AND ECOLOGICAL DEGRADATION

The tourism industry and the fishery are similar in how they are simultaneously viewed as a cause of ecological degradation and a motivation for environmentally responsible behavior. In part, the juxtaposition of degradation and sustainability reflects the difficulty in assigning an individual to one stakeholder group and, therefore, as having a concrete set of values unique to that 'profession' or 'stakeholder' category. Out of the ten tourism operators we interviewed, 40% currently go fishing (one of whom sells fish), while another 30% used to go fishing. For Tahitians, whether one works in tourism, is a professional fisher, or is in the 'general' stakeholder group and thus has a different occupation, fishing is understood to be an important way to sustain life when other economic opportunities falter or fail.

> [For] me, when we go to the lagoon, the ocean, it is a very good thing. Because the ocean has all of the gifts, it keeps our food. You can fish to sell [fish]; you can get food for the house for the family to eat. It is good. Sometimes when I don't need to do something at home, I go fish with my husband [who is a professional fisher] (Female, Age 40, June 2016).

Tourism and the fishery are both viewed as fundamental to the economic livelihoods of local people, yet, when carried to extremes are known to be potentially damaging. "Tourism is negative but it also gives economic life to people here, there is a limit to how much fish you can sell" (Female, Age 52, General Population, June 2016). When the marine environment cannot provide the amount of fish that people are demanding, they must turn to other economic opportunities like tourism.

All stakeholder groups discussed threats to the health of the lagoon and reef caused by irresponsible fishing practices, such as destructive uses of nets, fishing for too small of fish, or catching and keeping too many fish. For Tahitians, there exists a discord between their desire to keep fishing, as part of their cultural identity and as an important and enjoyable subsistence endeavor, and the potential damage fishing practices can cause to the lagoon and reef.

> In our culture, there are the fishers, there are no more fish. It is necessary in our culture to place importance on protecting the environment. The culture is how we can learn, [the culture is] for adapting. The culture is not disappearing, it is adapting. We are living (Male, Age 39, Tourism Operator, June 2016).

One of the fundamental ways in which Tahitians teach respect for the marine environment to their children is through their cultural heritage. Tahitians, including individuals from the fisher, general, and tourism operator stakeholder groups, linked environmentally responsible behavior to their cultural heritage, the importance of respect for the coral-reef lagoon ecosystem, and a sense of place. From these social values, responsible environmental behavior follows.

The proximity of 'sense of place', 'subsistence fishery', and 'cultural heritage' within Figure 5.2, containing the complete dataset, demonstrates how Tahitians link these three ecosystem services. The services 'sense of place' and 'subsistence fishery' are also positioned in close proximity throughout the biplots containing the parsed data sets (Figures 5.4 and 5.6). The ecosystem goods and services 'cultural heritage', 'sense of place', and 'subsistence fishery', could be viewed as underpinning Tahitian's relationships to the marine environment. As one professional fisher explained to me during the interview: "Sense of place is my grandfather, subsistence fishery is my grandmother – she feeds you, you should not sell your grandmother" (Male, Age 43, June 2016). While we labeled the fishery as a 'subsistence fishery' within our survey, this title is not adequate in capturing the relationship between Moorea's fishery and the island's Tahitian residents.

5.5 DISCUSSION

This research demonstrates several key findings that deserve closer inspection. These findings are about, on one hand, how different stakeholders value ecosystem goods and services and, on the other hand, what we can derive from these valuations in regards to stakeholder's understandings of their place in relation to the environment. Primarily, I want to focus on three points, 1) the ways in which different stakeholders discuss education as a gateway to environmentally-responsible behavior, but how definitions of education differ; 2) the antithesis for stakeholders between economic gain and environmental degradation; and, 3) the tension that exists for Tahitians between the desire to continue fishing and viewing some types of fishing as destructive to the coral reef-lagoon ecosystem. I ground the discussion of these findings in a theoretical inquiry into how our stakeholders view their

place in the world. More specifically, I am interested in how people's ontology – "a set of propositions about what *is* in the world" (West 2016, 126, *emphasis original*) – informs and explains particular valuations of ecosystem goods and services.

The ontological turn within anthropology is, in part, a reaction to a jeopardized future due to environmental degradation, putting at risk both people and the environment (Kohn 2015; Pedersen 2012). Environmental degradation has lead to a heightened need to understand nature and culture holistically, rather than attempting to delineate these entities. This process can be facilitated through acknowledging, rather than denying, the agency of nonhuman beings and entities (Latour 2014). Ontological approaches are posthumanist, in that they are interested in what we can learn about the world through the engagement of humans with the world (Kohn 2015). In our research, we view people's ontological positions as informing how people value things, or influencing what they find to be important in their engagements with the world. We understand ontologies to be transforming through time, in part through interactions between people of different backgrounds (West 2016). We extend our understanding of stakeholder's ontological positions to analyze the ability of ecosystem goods and services frameworks to capture people's understandings of their place in relation to the environment while simultaneously, examining the specific ontological underpinnings of the ecosystem goods and services framework itself.

5.5.1 Education and Environmentally Responsible Behavior

One area where the differences in the ontological positions of stakeholders are apparent is through the multiple definitions of 'proper' education that were given in this research. For example, Tahitians view their cultural heritage as a gateway to responsible environmental behavior. For many Tahitians, the lagoon is inseparable from human experience; it is part and parcel of life. The lagoon was said to be important for life. It was also said that everything linked back to the respect and sanitation of the lagoon. This understanding of the lagoon is something inculcated in Tahitians through their upbringing, through engaging with other people and things in the world around them. Tahitians' experience of the lagoon relates to Ingold's (2000) idea of an 'organism-in-its-environment'. Whereby an organism and the environment exist only in relation to one another, as an indivisible totality. People constitute themselves and their environments through these

relations (West 2006). These relations necessitate practical experience with environments in order to learn. As some fishers told me, ‘you can’t think about fishing in order to learn how to do it, you have to go out and do it’. For Tahitians, knowledge is embodied through the experience of practical activities, such as fishing, that occur throughout one’s life (Lauer and Aswani 2009, 318). Participating in these activities teaches one the ‘proper’ or desirable ways in which to act, thus being valued behaviors (Graeber 2001).

Tahitian’s conception of culture as a gateway to ‘proper’ education contrasts with scientists’ perspectives on ‘proper’ education. Scientists disassociated what they understood as cultural, personal, or emotional experiences, from the production and consumption of scientific knowledge that comprises the cornerstone of ‘education’ for them. During our survey, scientists spoke of a double experience in which they experience the lagoon in a poetic, aesthetic manner, while simultaneously holding scientific, and thus abstracting, relationships to the lagoon. Some scientists openly stated their ability to exist in relation to the marine environment in two different modes, choosing how to exist based on the context of what they were doing. Scientists’ academic pursuits require viewing the lagoon as an object, a thing to be measured and evaluated, or esteemed and preserved. Rather than understanding themselves to be in a contingent, organism-in-the-environment relationships with the lagoon, scientists viewed themselves as able to either be in a personal, emotional, or aesthetic experience with the lagoon or as able to abstract themselves into an objective position. It is from this ‘objective’ position that science is conducted and scientific knowledge is produced. The objectivity of science stems from the removal of people (Latour 2014), requiring scientists to mentally abstract themselves from the environment when conducting research. Due to this understanding of their place(s) in relation to the environment, scientists tended to be clustered more closely to the ‘ecological’ ESs ‘coastal protection’, ‘sanitation’, and ‘habitat’, and the cultural ecosystem service ‘bequest’ in our biplots, rather than, for example, the ESs ‘cultural heritage’ and ‘sense of place’.

The ecosystem service ‘bequest’ is, indeed, the major ‘cultural’ value taken into consideration in many western, scientifically driven conservation efforts that tend to separate people and nature into distinct categories. Attributing human experience as ‘culture’, and thus apart from the environment or from scientific knowledge, expresses a deeper ontological disengagement of people from the environment (Ingold 2000; Kohn 2015). Many western,

scientifically driven conservation efforts strive towards eliminating extractive human uses of the environment, instead promoting the 'park' model, of preserving nature *in-situ.* This ethic of *in-situ* preservation promotes the non-use values of environments. It is an underlying assumption of this type of western-scientific conservation that not holding extractive relationships with ecosystems will allow ecosystems to maintain their bequest values. However, the creation of parks or protected areas often have the effect of disengaging local peoples from their livelihoods and place-specific histories (Brockington, Duffy, and Igoe 2008; Fabinyi 2012; West 2006, 2016). Indeed, in Moorea, the perception that marine protected areas prioritize tourists over fishers has led to multiple conflicts over the marine environment.

5.5.2 The Relationship between Economic Gain and Ecological Degradation

During this research, multiple stakeholders discussed tourism as causing distress to the health of the coral reef. Indeed, ecological surveys in Moorea have shown that beaches with higher levels of tourism have less coral cover, and reduced amounts of the branching coral genus, *Acropora*, relative to other species (Juhasz et al. 2010). For all the stakeholders, reductions in coral cover and in fish populations are explicitly linked to a reduction in the value of the reefs. This reduction in value stems from the loss of biodiversity (a characteristic important to scientists), negatively impacting the fishery (important to the general population and professional fishers), simultaneously reducing the 'aesthetic' value of the coral reefs, which are used to draw in tourists (Castri 2002; Salvat and Pailhe 2002). These reductions in value, or the understood antithesis between these values of the marine environment, were demonstrated in the biplots through the plotting of 'economic gain' apart from other variables I measured.

Interestingly, throughout French Polynesia, cultural revitalization has strengthened alongside growing tourism economies, rather than weakened (Salvat and Pailhe 2002). Many Tahitian tourism operators use their businesses as a way to teach about the cultural-environmental heritage of French Polynesia, attempting to impart an understanding of respect of people and place to their guests. The country is largely known as a 'high-end' tourism destination, resulting in many large-scale, internationally owned resorts in the country (Kahn 2011), although this trend has been changing over the last several decades (Kahn 2011;

Salvat and Pailhe 2002). Tahitians' efforts to combine tourism excursions with education on cultural heritage can be understood as a way to combat the negative socio-environmental effects that stem from tourism. The placement of MPAs adjacent to the major large-scale, internationally run hotels that have overwater bungalows (understood to be damaging to the lagoon) exacerbates the perception that tourists are prioritized over Tahitians (*see* Walker 2001).

Most coral reef valuations since the 2000s have focused on the high economic value activities of recreation and tourism (Brander, Van Beukering, and Cesar 2007). Indeed, like the ecosystem goods and services framework itself, tourism and recreation values are thought to exist as motivations for the preservation of marine resources (Fabinyi 2012; Levine 2007; Walley 2004). The focus of valuation studies on the categories of recreation and tourism explicitly undermines how people *in-situ*, through their lived experiences, understand these pursuits to be affecting the health and vitality of marine resources. Pascal and LePorte's (2015) research valued the recreational values of Moorea's reefs well above that of the fishery (27 million Euros compared to 2.8 million Euros for local fish consumption). These figures undermine the ways in which Tahitians understand their relationship to the fishery. In part, prices of fish sold locally in Moorea are kept low because to do otherwise would be to deny a community member a right to life. Moreover, many people give fish away to friends and family rather than selling it. These practices make fisheries difficult to monetarily valuate.

In a comparative study of coral reef valuations in the South Pacific, 80% of the sum of estimated value in coral reef valuations was in tourism, coastal protection, and coral reef fisheries (Laurans et al. 2013). The value of coral reefs in the South Pacific were found to increase with four factors, including: 1) the economic development of the coastal zone; 2) the concentration of the population; 3) the per capita national GDP as a proxy for budget availability and the 'ability to pay'; and 4) "the rate of highly valued activities, such as tourism, as opposed to agriculture and small-scale fisheries" (Laurans et al. 2013, 137). Notably, all of these factors revolve around easily measurable monetary measures. The prioritization of recreation and tourism values is troubling given the high proportion of Tahitian respondents who by and large refused to 'value' the ecosystem services of 'recreation' and 'tourism' in our survey. The biasing of economic phenomena, due to the

ease in monetarily valuating them, undermines the historical relationships that people have with reefs throughout the Pacific (Laurans et al. 2013). The focus of coral reef ESs research on monetary measures conflates the way that money is valued with the values that people hold. However, the two are not interchangeable. Given that scientists and the local population of Moorea all voice that economic gain is antithetical to responsible environmental behavior, it seems that the creation of monetary measures to motivate conservation ethics is misplaced. Money is inert; it fails to account for how people's values change through time in response to changing social and environmental conditions (Harvey 1996). Rather, we should be discussing the ways in which societal norms and ways of making/interpreting meaning (i.e. values and ontologies) structure our understandings of and relationships to places in order to better interpret the entanglements between people and the world.

5.5.3 Tensions of the Fishery

For many Tahitians, the consumption of fish is as central to their cultural identity as is speaking the Tahitian language (Leenhardt et al. 2016). Within our biplots, the addition of the social attribute variables ‘eats fish’, ‘goes fishing’, and ‘sells fish’ causes the variables ‘cultural heritage’, ‘sense of place’, and ‘subsistence fishery’ to be located in close proximity to one another. This finding reflects the idea that for Tahitians consuming fish is crucial to having a Tahitian identity (Leenhardt et al. 2016; Levy 1973).

Because Tahitians view themselves as existing in a contingent, interdependent, and socio-environmentally produced and reproduced relationship with the coral reef-lagoon ecosystem, the fishery on the island is not adequately defined as either a recreational or subsistence fishery. While this research measured the ecosystem service ‘subsistence fishery’, this term was used to emphasize the differences between fishing for economic gain and fishing to eat. Moorea’s fishery has been labeled as “largely recreational” (Leenhardt et al. 2016), however, as demonstrated during our survey, many Tahitian’s deny that the marine environment holds much recreational value. Instead, they emphasize how the coral reef-lagoon ecosystem is a provider of food, an agent in itself. The marine environment is responsive to human agency, commanding respect in order to continue upholding the components of human-marine relationships that Tahitians desire to obtain from it. Tahitians are concerned that the fishery is not getting the proper respect it deserves. This lack of

respect is evidenced in pollution of the lagoon, in irresponsible fishing practices, and in the prioritization of monetary uses of the lagoon over Tahitian fishing practices. This again demonstrates the antithetical relationship between environmental behavior and economic gain observed in our biplots.

Tahitians' concern over the state of the fishery and lagoon, of the health of the coral reef, stems from their understanding of the lagoon as a life source. The lagoon stores relatively accessible food, providing homes to fish species that people cherish eating. Simultaneously, the lagoon provides income for those in great need of it who have no other economic opportunities. The fishery of Moorea may be better described as one of cultural heritage, rather than as a subsistence or recreational fishery. The coral reef-lagoon ecosystem is fundamental to Moorean's heritage. For Tahitian's, the prioritization of tourism and economic gain over the maintenance of healthy socio-environmental relationships does a disservice to both the lagoon and to Tahitian heritage.

5.6 ONTOLOGICAL POSITIONS AND THE ECOSYSTEM GOODS AND SERVICES FRAMEWORK

The interest in understanding the cultural values of ecosystems is informed by the need for more effective and socially just management efforts, especially for coral reefs, which are rapidly degrading around the world. It is argued that these 'meta-level' governance principles, such as values, images, principles (Song, Chuenpagdee, and Jentoft 2013) or perceptions (Oliveira and Berkes 2014) can improve environmental governance efforts. If we want to improve governance to be more socially just, we need to understand how ontological positions frame conservation efforts (Foale, Dyer, and Kinch 2016; West 2006). All too often, 'scientific' perspectives are treated as superior to local people's understandings of the environment, leading to the prioritization of scientists' opinions in conservation efforts (West 2006). Science strips away historicity and thus the narrative of existing in the world (Latour 2014). If ESs valuations are intended to motivate people to act sustainably (Hicks, Graham, and Cinner 2013), then we need to discuss how people of multiple backgrounds understand the everyday realities of their existence, embracing narrative and history rather than removing it.

Tahitians' understanding of their contingent relationship with the marine environment seems to break down the debates in conservation of whether environments hold value because of their goods or because of an inherent quality that they possess. Tahitians need the lagoon and the fishery to survive for both utilitarian and non-utilitarian reasons. The lagoon is both a food source and a fundamental factor in how Tahitians understand themselves and their larger social relations - the marine environment and its inhabitants themselves holding agency and therefore constituting social relations. The ontological assumptions of the ecosystem goods and services framework positions people as apart from rather than embedded within 'nature' and the 'natural'. This disregards Tahitians own understandings of themselves, as an organism-in-its-environment.

The concept of ecosystem goods and services ultimately abstracts people from place. It does this through assuming that Western scientific ideas can describe people's relationships with environments, largely ignoring other understandings of nature (Oliveira and Berkes 2014). Ecosystem goods and services divide components of environments into distinct categories, such as 'cultural' or 'provisioning' categories. This compartmentalizing limits our ability to understand how people value environments, given that not everybody holds the same ontological assumptions that ecosystem goods and services promote. The assumption that peoples from diverse backgrounds can use the same valuation exercises to demonstrate their understandings of the importance of human-environment relationships perpetuates the domination of western scientific ideas. This ultimately undermines other ontological positions. The perpetuation of western ideas results in dispossession, through discursively removing people from their histories and traditions (West 2016). This dispossession extends to the world itself, through failing to acknowledge or assign agency to the earth and the nonhuman beings that inhabit it (Latour 2014).

Under the Ecosystem goods and services framework, scientists are assumed to be able to escape their own subjective positions in order to objectively assign value to environments (Harvey 1996, 162). Scientists act as a blank, objective slate, a tool for measurement, ignoring how their own preconceptions, values, and personal experiences are influencing their actions and their interpretations of specific phenomena. Scientific discourse strives to achieve objectivity, ultimately abstracting place, and the environment, from lived, emotional, culturally laden experience (Latour 1993). Science is a discursive practice. Discursive

practices tend to disengage (Ingold 2000). Studies that frame people as rational, neutral, or as prioritizing monetary economic concerns, undermine the poetic, social, moral, and aesthetic relations humans have with environments (West 2005). Because of the framing of science as 'objective' and 'rational' all too often the perspectives, opinions, and values of scientists themselves are overlooked in ecosystem goods and services valuations. The erasure of scientists, and everyone/everything else, from scientific knowledge creates a hegemonic space in which scientific knowledge as a hard 'thing' is allowed to override the porous and fluid dynamics of the 'cultural' values of environments (Latour 1993, 2014). This erasure allows the continued undermining of people's relationships to environments within natural resource management and conservation efforts.

This study attempts to overcome the limitations of ecosystem goods and services approaches that solely place monetary values on the goods and services that environments provide. Through using mixed qualitative and quantitative methods to understand values, we are better able to reveal how various actors apprehend their place in the world. The ways that people understand what *is* in the world and the implications of this for how they should act is, in part, revealed through how they explain their experience and understanding of the world. The values that people hold inform how they interpret and subsequently explain their engagements with the world. These values are inculcated through lived experience, through education, and through the institutional structures that people are affected by and effect (Graeber 2001). Ontological understandings of the world form the basis of the ways that people value nonhuman things and entities.

CHAPTER 6

ENGAGING MARINE CONSERVATION'S PAST AND PRESENT IN MOOREA: PATHWAYS TO A MORE EQUITABLE AND SUSTAINABLE FUTURE

6.1 REVIEW OF FINDINGS

Given the global degradation of coral reefs, innovative approaches to marine management are necessary. Effective management necessitates that local peoples who are affected by management decisions, and who affect local environmental health, support the management paradigms that are put in place. In order for people to support management efforts, it is important that efforts are created by and with local people who experience the environments of concern on a day-to-day basis and who depend on these environments for their livelihoods. This thesis investigates how management decisions can more effectively incorporate affected peoples in Chapters Four and Five through two different theoretical and methodological frameworks.

In Chapter Four, this thesis uses household survey data to make specific recommendations on what sorts of regulations and management methods may hold more social support in Moorea and therefore be more socio-ecologically effective. I propose that using a coupled social-ecological systems perspective will improve capacity to manage reef resilience given the dynamic character of reef ecosystems that are subject to numerous anthropogenic and biological disturbances. I argue that Moorea may be a case where adaptive governance, or adaptive co-management, paradigms are more appropriate, given the public's demonstrated and vested interest in participating in management efforts. Adaptive co-management also has the potential to include the heterogeneity of perspectives that exist in relation to the marine environment in Moorea. The island's management structure could be greatly benefited by the high amounts of scientific research that take place there, the

inhabitants' strong desire for marine resources to last into the future, and the tourism business' reliance on a healthy marine environment. I emphasize the importance of using conflict to inform management, as an insight into what people view as important in environmental governance efforts, rather than viewing conflict as a hindrance to successful management.

While Chapter Four primarily focuses on our household survey and key informant data to inform its analysis, Chapter Five focuses almost exclusively on data gathered during the 2016 contingent valuation survey. I found that my value(s) research, as presented in Chapter Five, like the argument for adaptive governance in Chapter Four, was greatly benefited through the prior research we had done conducting household surveys and key informant interviews in Moorea. This research greatly informed my analysis of how people used and understood the marine environment and the implications of this for management efforts on the island. Additionally, the household surveys allowed key insights into how people use and perceive the marine environment, improving my ability to select socially relevant ecosystem goods and services to valuate for the values research. Of course, the knowledge I learned of how people experience their relationships to the lagoon-coral reef system of Moorea during my first year on the island conducting household surveys cannot be analytically separated from the following year's values research.

Chapter Five explores the values that diverse stakeholders hold in relation to the marine environment of Moorea, drawing comparisons between professional fishers, the general population, tourism operators, and scientists. Utilizing an ecosystem goods and services framework as a method for investigating environmental values, I attempt to measure, primarily, cultural values that exist in relation to Moorea's coral reef-lagoon ecosystem among these four stakeholder groups. I propose that using mixed qualitative and quantitative methods approaches to data collection and analysis, is necessary to unearth not only what people find important, but also to understand how people interpret their own experiences. My data analysis techniques were able to uncover how various stakeholder's positioning of their experience of the marine environment influenced their valuations of the ecosystem goods and services we presented to them. The interpretation of the quantitative results was bolstered through the collection and analysis of the qualitative data. Geometric Data Analysis techniques, which were employed in the analysis of the quantitative data, require inductive

interpretation of the results. The qualitative data was a useful guide in interpreting the results of the quantitative data analyzed using GDA methods.

I chose to use an ontological perspective in explaining the combined qualitative and quantitative results in Chapter Five, due to my interest in understanding how different stakeholders' value, and thus experience and stand in relation to, the marine environment of Moorea. While it is impossible to classify each respondents' perspectives as truly unique and confined to the perspectives of a 'stakeholder' category, broad patterns within the perspectives of stakeholder groups allowed me to compare and contrast the varying valuations of the marine environment that we collected. Particularly, the findings demonstrated that 1) tourism and recreation were valued differently among stakeholders 2) education and economic gain were viewed antithetically to other ecosystem goods and services measured and that 3) all stakeholders understood certain forms of fishing as being detrimental to marine health.

The finding that one's social attributes largely influenced their valuations was interesting in light of the ontological perspective I employed. An ontological anthropology suggests people are not an object to be studied apart from the world, instead, seeking to understand human engagements with other beings and things in the world. I find, however, that the coupled (i.e. socio-ecological) approach that both ecosystem goods and services and adaptive management frameworks propose are complimented by an ontological perspective as all deny that people are apart from, rather than within, nature and the natural. Nonetheless, I found that the 'social attribute' data that we collected and analyzed within Chapter 5, were influential in how people understand their place-in-space and how they explain their experience of the world. I view one's ontological position and the values they hold as interconnected wholes, both comprising a basis out of which individuals understand their being, their relation to other beings and things, and their ways of justifying their actions and ideas/ideals.

While Chapter Four and Chapter Five of this paper, by and large, use different data sets and literature to inform their analyses, both address how people engage with environmental management efforts on Moorea. Marine management thinking has shifted to a social-ecological systems perspective (Berkes 2012). This shift requires that I account for the social dimensions of environments. Yet, this is often done cursorily, as in Moorea, where

fishing practices were limited, while other reef-degrading activities are left unaccounted for within the management plan's regulations. This sort of approach inhibits successful management efforts, rather than facilitating sustainable human-environment relationships. People and the environment are an integrated whole. Anthropogenic pressures contribute to the degradation of coral reefs (Bellwood et al. 2004; Bellwood, Hoey, and Hughes 2012; Hughes et al. 2010; Juhasz et al. 2010; Trapon, Pratchett, and Penin 2011). Yet, anthropogenic actions also contribute to the health of coral reefs. For governance to be effective it is imperative that the public sees that their opinions and perspectives are truly being taken into consideration.

Devolved coral reef management efforts have been found in some cases to be more socially acceptable and ecologically effective than top-down efforts (McClanahan et al. 2006). Thus, co-management efforts can be a beneficial avenue through which to conduct management. Yet, we must also keep in mind the ways that institutions can blur individual agency and power (Graeber 2001). Governance efforts may be hindered by focusing on institutional structures rather than goals and outcomes (Carlsson and Berkes 2005). Rather than obscuring the role of individual agency in governance efforts through focusing on structural arrangements, collaborative management needs to focus on empowering the public to hold stake and to foster their authority in management efforts. Values research can benefit one's ability to create empowering co-management arrangements through illuminating the ways in which people frame their relationships to society and to the environment.

REFERENCES

Ayers, Adam L., and John N. Kittinger. 2014. “Emergence of Co-Management Governance for Hawai‘i Coral Reef Fisheries.” *Global Environmental Change* 28 (September): 251–62. doi:10.1016/j.gloenvcha.2014.07.006.

Balée, William. 1998. “Historical Ecology: Premises and Postulates.” In *Historical Ecology: Postulates and Premises. Advances in Historical Ecology*, 13–29. New York: Columbia University Press.

Balint, Peter J., Ronald E. Stewart, Anand Desai, and Lawrence C. Walters. 2011. *Wicked Environmental Problems: Managing Uncertainty and Conflict*. Washington DC: Island Press.

Bellwood, D. R., A. S. Hoey, and T. P. Hughes. 2012. “Human Activity Selectively Impacts the Ecosystem Roles of Parrotfishes on Coral Reefs.” *Proceedings of the Royal Society B: Biological Sciences* 279 (1733): 1621–29. doi:10.1098/rspb.2011.1906.

Bellwood, T. P. Hughes, D. R., C. Folke, and M. Nystrom. 2004. “Confronting the Coral Reef Crises.” *Nature* 429:827–33.

Benjaminsen, Tor A., and Ian Bryceson. 2012. “Conservation, Green/Blue Grabbing and Accumulation by Dispossession in Tanzania.” *Journal of Peasant Studies* 39 (2): 335–55.

Berkes, Fikret. 2007. “Community-Based Conservation in a Globalized World.” *Proceedings of the National Academy of Sciences* 104 (39): 15188–93.
———. 2008. *Sacred Ecology*. New York: Routledge.
———. 2009. “Evolution of Co-Management: Role of Knowledge Generation, Bridging Organizations and Social Learning.” *Journal of Environmental Management* 90 (5): 1692–702. doi:10.1016/j.jenvman.2008.12.001.
———. 2010. “Devolution of Environment and Resources Governance: Trends and Future.” *Environmental Conservation* 37 (4): 489–500. doi:10.1017/S037689291000072X.
———. 2012. “Implementing Ecosystem-Based Management: Evolution or Revolution?” *Fish and Fisheries* 13 (4): 465–76. doi:10.1111/j.1467-2979.2011.00452.x.

Biermann, Frank, and Philipp Pattberg. 2008. “Global Environmental Governance: Taking Stock, Moving Forward.” *Annual Review of Environment and Resources* 33 (1): 277–94. doi:10.1146/annurev.environ.33.050707.085733.

Blount, Ben, and Ariana Pitchon. 2007. “An Anthropological Research Protocol for Marine Protected Areas: Creating a Niche in a Multidisciplinary Cultural Hierarchy.” *Human Organization* 66 (2): 103–11.

Brander, Luke M., Pieter Van Beukering, and Herman S. J. Cesar. 2007. “The Recreational Value of Coral Reefs: A Meta-Analysis.” *Ecological Economics* 63 (1): 209–18. doi:10.1016/j.ecolecon.2006.11.002.

Brockington, Dan, Rosaleen Duffy, and Jim Igoe. 2008. *Nature Unbound: Conservation, Capitalism and the Future of Protected Areas*. London: Earthscan.

Carlsson, Lars, and Fikret Berkes. 2005. “Co-Management: Concepts and Methodological Implications.” *Journal of Environmental Management* 75 (1): 65–76. doi:10.1016/j.jenvman.2004.11.008.

Castree, Noel. 2003. “Commodifying What Nature?” *Progress in Human Geography* 27 (3): 273–97. doi:10.1191/0309132503ph428oa.

Castri, Francesco di. 2002. “Diversification, Connectivity and Local Empowerment for Tourism Sustainability in South Pacific Islands - A Network from French Polynesia to Easter Island.” In *Tourism, Biodiversity and Information*, edited by F. Castri and V. Balaji, 257-84. Leiden: Backhuys Publishers.

Chaffin, Brian C., Hannah Gosnell, and Barbara A. Cosens. 2014. “A Decade of Adaptive Governance Scholarship: Synthesis and Future Directions.” *Ecology and Society* 19 (3). doi:10.5751/ES-06824-190356.

CIA. 2016. “French Polynesia.” *The World Factbook*. Accessed February 22. https://www.cia.gov/library/publications/the-world-factbook/geos/fp.htmlaccessed.

Cinner, Joshua E., and Tim R. McClanahan. 2015. “A Sea Change on the African Coast? Preliminary Social and Ecological Outcomes of a Governance Transformation in Kenyan Fisheries.” *Global Environmental Change* 30 (January): 133–39. doi:10.1016/j.gloenvcha.2014.10.003.

Colding, Johan, and Carl Folke. 2001. “Social Taboos: ‘Invisible’ Systems of Local Resource Management and Biological Conservation.” *Ecological Applications* 11 (2): 584–600. doi:10.2307/3060911.

Costanza, Robert, Raphael d’Arge, Rudolf de Groot, Stephen Farber, Monica Grasso, Bruce Hannon, Karin Limburg, et al. 1997. “The Value of the World’s Ecosystem Services and Natural Capital.” http://mro.massey.ac.nz/handle/10179/5983.

Creswell, John W. 2014. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 4th ed. Thousand Oaks, CA: Sage Publications.

Davis, Anthony, and Kenneth Ruddle. 2012. “Massaging the Misery: Recent Approaches to Fisheries Governance and the Betrayal of Small-Scale Fisheries.” *Human Organization* 71 (3): 244–54.

Diamond, Jared. 2004. “Twilight at Easter.” *The New York Review of Books* 51 (March): 6–10.

Dietz, T., Elinor Ostrom, and Paul C. Stern. 2003. “The Struggle to Govern the Commons.” *Science* 302 (5652): 1907–12. doi:10.1126/science.1091015.

Dressler, Wolfram, Bram BüScher, Michael Schoon, Dan Brockington, Tanya Hayes, Christian A. Kull, James Mccarthy, and Krishna Shrestha. 2010. “From Hope to Crisis and Back Again? A Critical History of the Global CBNRM Narrative.” *Environmental Conservation* 37 (1): 5–15. doi:10.1017/S0376892910000044.

Eff, E. Anthon. 2004. “Does Mr. Galton Still Have a Problem? Autocorrelation in the Standard Cross-Cultural Sample.” *World Cultures* 15 (2): 153–70.

Eff, E. Anthon, and Malcolm M. Dow. 2008. “How to Deal with Missing Data and Galton’s Problem in Cross-Cultural Survey Research: A Primer for R. Structure and Dynamics.” *Structure and Dynamics: eJournal of Anthropological and Related Sciences* 3 (2, Article 1).

Eiss, Paul K., and David Pedersen. 2002. “Introduction: Values of Value.” *Cultural Anthropology* 17 (3): 283–90.

Evans, J. P. 2012. *Environmental Governance*. New York: Routledge.

Fabinyi, Michael. 2012. *Fishing for Fairness Poverty, Morality and Marine Resource Regulation in the Philippines*. Acton, Australia: ANU E Press. http://epress.anu.edu.au?p=167001.

Fairhead, James, and Melissa Leach. 1995. "False Forest History, Complicit Social Analysis: Rethinking Some West African Environmental Narratives." *World Development* 23 (6): 1023–35.

Feeny, David, Fikret Berkes, Bonnie J. McCay, and James M. Acheson. 1990. "The Tragedy of the Commons: Twenty-Two Years Later." *Human Ecology* 18 (1): 1–19.

Fletcher, Robert. 2010. "Neoliberal Environmentality: Towards a Poststructuralist Political Ecology of the Conservation Debate." *Conservation and Society* 8 (3): 171. doi:10.4103/0972-4923.73806.

Foale, Simon, Philippa Cohen, Stephanie Januchowski-Hartley, Amelia Wenger, and Martha Macintyre. 2011. "Tenure and Taboos: Origins and Implications for Fisheries in the Pacific: Tenure and Taboos in Pacific Fisheries." *Fish and Fisheries* 12 (4): 357–69. doi:10.1111/j.1467-2979.2010.00395.x.

Foale, Simon, Michelle Dyer, and Jeff Kinch. 2016. "The Value of Tropical Biodiversity in Rural Melanesia." *Valuation Studies* 4 (1): 11–39. doi:10.3384/VS.2001-5992.164111.

Folke, Carl. 2006. "Resilience: The Emergence of a Perspective for Social–ecological Systems Analyses." *Global Environmental Change* 16 (3): 253–67. doi:10.1016/j.gloenvcha.2006.04.002.

France Info. 2013. "L'école Maharepa.*"* http://la1ere.francetvinfo.fr/polynesie/2013/08/14/ce-ne-sera-pas-une-rentree-comme-les-autres-l-ecole-maharepa-de-moorea-55605.html.

Gilden, Jennifer. 2008. "Small Fish in a Big Pond: An Applied Anthropologist Working in Natural Resource Management." In *Careers in Applied Anthropology in the 21st Century: Perspectives from Academics and Practitioners*, edited by Carla María Guerrón-Montero, 41–55. NAPA Bulletin 29. Malden, MA: Blackwell Pub.

Goodenough, Ward H. 1996. "Introduction." In *Prehistoric Settlement in the Pacific*, edited by Ward H. Goodenough, 1-10. Vol. 86 pt. 5. Transaction Series. Philadelphia: American Philosophical Society.

Graeber, David. 2001. *Toward an Anthropological Theory of Value: The False Coin of Our Own Dreams*. New York: Palgrave.

———. 2010. "Neoliberalism, or the Bureaucratization of the World." In *Insecure American: How We Got Here and What We Should Do about It*, edited by Hugh Gusterson and Catherine Besteman, 79–96. Berkeley: University of California Press.

———. 2013. "Is It Value That Brings Universes into Being." *HAU: Journal of Ethnographic Theory* 3 (2): 219–43.

Grêt-Regamey, Adrienne, Ariane Walz, and Peter Bebi. 2008. "Valuing Ecosystem Services for Sustainable Landscape Planning in Alpine Regions." *Mountain Research and Development* 28 (2): 156–65. doi:10.1659/mrd.0951.

Gutiérrez, Nicolás L., Ray Hilborn, and Omar Defeo. 2011. "Leadership, Social Capital and Incentives Promote Successful Fisheries." *Nature* 470 (7334): 386–89. doi:10.1038/nature09689.

Halpern, Benjamin S. 2003. "The Impact of Marine Reserves: Do Reserves Work and Does Reserve Size Matter?" *Ecological Applications* 13 (sp1): 117–37.

———. 2014. "Making Marine Protected Areas Work." *Nature* 506 (7487): 167–68.

Harvey, David. 1996. "Valuing Nature." In *Justice, Nature and the Geography of Difference*, 150–75. Cambridge: Blackwell Publishers.

———. 2007. *A Brief History of Neoliberalism*. New York: Oxford University Press.

Hemmingham, Stephen. 1992. *France and the South Pacific: A Contemporary History*. Honolulu: University of Hawaii Press.

Hicks, Christina C., Joshua E. Cinner, Natalie Stoeckl, and Tim R. McClanahan. 2015. "Linking Ecosystem Services and Human-Values Theory: Ecosystem Services and Human Values." *Conservation Biology* 29 (5): 1471–80. doi:10.1111/cobi.12550.

Hicks, Christina C., Nicholas A. J. Graham, and Joshua E. Cinner. 2013. "Synergies and Tradeoffs in How Managers, Scientists, and Fishers Value Coral Reef Ecosystem Services." *Global Environmental Change* 23 (6): 1444–53. doi:10.1016/j.gloenvcha.2013.07.028.

Hicks, Christina C., Arielle Levine, Arun Agrawal, Xavier Basurto, Sara J. Breslow, Courtney Carothers, Susan Charnley, et al. 2016. "Engage Key Social Concepts for Sustainability." *Science* 352 (6281): 38–40.

Hughes, Terry P., Nicholas A. J. Graham, Jeremy B. C. Jackson, Peter J. Mumby, and Robert S. Steneck. 2010. "Rising to the Challenge of Sustaining Coral Reef Resilience." *Trends in Ecology & Evolution* 25 (11): 633–42. doi:10.1016/j.tree.2010.07.011.

Hviding, E. 2003. "Both Sides of the Beach: Knowledges of Nature in Oceania." In *Nautre across Cultures: Views of Nature and the Environment in Non-Western Cultures.*, edited by H. Selin, 245–76. Dordrecht: Kluwer Academic Publishers.

Igoe, Jim, and Dan Brockington. 2007. "Neoliberal Conservation: A Brief Introduction." *Conservation and Society* 5 (4): 432–49.

Ingold, Tim. 2000. "Culture, Nature, Environment: Steps to an Ecology of Life." In *The Perception of the Environment: Essays on Livelihood, Dwelling, and Skill*, 13–26. London: Routledge.

ISPF. 2012. "Premiers Résultats Du Recensement de La Population de La Polynésie Française 2012." Papeete, Tahiti: Institut de la Statistique de la Polynésie Française.

Jacoby, Karl. 2014. *Crimes against Nature: Squatters, Poachers, Thieves, and the Hidden History of American Conservation*. Berkeley: University of California Press.

Jentoft, Svein, Ratana Chuenpagdee, and Jose J. Pascual-Fernandez. 2011. "What Are MPAs for: On Goal Formation and Displacement." *Ocean & Coastal Management* 54 (1): 75–83. doi:10.1016/j.ocecoaman.2010.10.024.

Johannes, R. E. 2002. "The Renaissance of Community-Based Marine Resource Management in Oceania." *Annual Review of Ecology and Systematics* 33 (1): 317–40. doi:10.1146/annurev.ecolsys.33.010802.150524.

———. 1978. "Traditional Marine Conservation Methods in Oceania and Their Demise." *Annual Review of Ecology and Systematics* 9:49–64.

Juhasz, Allison, Ellen Ho, Erika Bender, and Peggy Fong. 2010. "Does Use of Tropical Beaches by Tourists and Island Residents Result in Damage to Fringing Coral Reefs? A Case Study in Moorea French Polynesia." *Marine Pollution Bulletin* 60 (12): 2251–56. doi:10.1016/j.marpolbul.2010.08.011.

Kahn, Miriam. 2011. *Tahiti Beyond the Postcard: Power, Place, and Everyday Life*. Seattle: University of Washington Press.

Kareiva, Peter. 2006. "Conservation Biology: Beyond Marine Protected Areas." *Current Biology* 16 (14): R533–35.

Kirch, P. V. 1984. *The Evolution of the Polynesian Chiefdoms.* Cambridge: Cambridge University Press.

Kittinger, John N., John M. Pandolfi, Jonathan H. Blodgett, Terry L. Hunt, Hong Jiang, Kepā Maly, Loren E. McClenachan, Jennifer K. Schultz, and Bruce A. Wilcox. 2011. "Historical Reconstruction Reveals Recovery in Hawaiian Coral Reefs." *PLoS ONE* 6 (10): e25460. doi:10.1371/journal.pone.0025460.

Kohn, Eduardo. 2015. "Anthropology of Ontologies." *Annual Review of Anthropology* 44 (1): 311–27. doi:10.1146/annurev-anthro-102214-014127.

Kull, Christian A. 2002. "Madagascar Aflame: Landscape Burning as Peasant Protest, Resistance, or a Resource Management Tool?" *Political Geography* 21:27–53.

Labrosse, P. J. Ferrais, and Y. Letourneur. 2006. "Assessing the Sustainability of Subsistence Fisheries in the Pacific: The Use of Data on Fish Consumption." *Ocean and Coastal Management* 29:203–21. doi:10.1016/j.ocecoaman.2006.2.006.

Larson, Anne M., and Fernanda Soto. 2008. "Decentralization of Natural Resource Governance Regimes." *Annual Review of Environment and Resources* 33 (1): 213–39. doi:10.1146/annurev.environ.33.020607.095522.

Latour, Bruno. 1993. *We Have Never Been Modern*. Cambridge, MA: Harvard University Press.

———. 2014. "Agency at the Time of the Anthropocene." *New Literary History* 45 (1): 1–18. doi:10.1353/nlh.2014.0003.

Lauer, Matthew, and Shankar Aswani. 2009. "Indigenous Ecological Knowledge as Situated Practices: Understanding Fishers' Knowledge in the Western Solomon Islands." *American Anthropologist* 111 (3): 317–29. doi:10.1111/j.1548-1433.2009.01135.x.

Laurans, Yann, Nicolas Pascal, Thomas Binet, Luke Brander, Eric Clua, Gilbert David, Dominique Rojat, and Andrew Seidl. 2013. "Economic Valuation of Ecosystem Services from Coral Reefs in the South Pacific: Taking Stock of Recent Experience." *Journal of Environmental Management* 116 (February): 135–44. doi:10.1016/j.jenvman.2012.11.031.

Le Roux, Brigitte, and Henry Rouanet. 2004. *Geometric Data Analysis: From Correspondence Analysis to Structured Data Analysis*. Norwell, MA: Kluwer Academic Publishers.

Leach, Melissa, Robin Mearns, and Ian Scoones. 1999. “Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management.” *World Development* 27 (2): 225–247.

Lebel, Louis, John M. Anderies, Bruce Campbell, Carl Folke, Steve Hatfield-Dodds, Terry P. Hughes, and James Wilson. 2006. “Governance and the Capacity to Manage Resilience in Regional Social-Ecological Systems.” http://digitalcommons.library.umaine.edu/sms_facpub/52/?utm_source=digitalcommons.library.umaine.edu%2Fsms_facpub%2F52&utm_medium=PDF&utm_campaign=PDFCoverPages.

Leenhardt, Pierre, Matthew Lauer, Rakamaly Madi Moussa, Sally J. Holbrook, Andrew Rassweiler, Russell J. Schmitt, and Joachim Claudet. 2016. “Complexities and Uncertainties in Transitioning Small-Scale Coral Reef Fisheries.” *Frontiers in Marine Science* 3 (May). doi:10.3389/fmars.2016.00070.

Leenhardt, Pierre, Rakamaly Madi Moussa, and René Galzin. 2012. “Reef and Lagoon Fisheries Yields in Moorea: A Summary of Data Collected.” *SPC Fisheries Newsletter* 137. http://www.spc.int/DigitalLibrary/Doc/FAME/InfoBull/FishNews/137/FishNews137_27_Leenhardt.pdf.

Lemos, Maria Carmen, and Arun Agrawal. 2006. “Environmental Governance.” *Annual Review of Environment and Resources* 31 (1): 297–325. doi:10.1146/annurev.energy.31.042605.135621.

Levine, Arielle. 2007. “Staying Afloat: State Agencies, Local Communities, and International Involvement in Marine Protected Area Management in Zanzibar, Tanzania.” *Conservation and Society* 5 (4): 562–85.

Levy, Robert L. 1973. *Tahitians: Mind and Experience in the Society Islands*. Chicago: University of Chicago.

Lison de Loma, Thierry Lison, Craig W. Osenberg, Jeffrey S. Shima, Yannick Chancerelle, Neil Davies, Andrew J. Brooks, and René Galzin. 2008. “A Framework for Assessing Impacts of Marine Protected Areas in Moorea (French Polynesia) 1.” *Pacific Science* 62 (3): 431–41.

Lubchenco, Jane, and Kirsten Grorud-Colvert. 2015. “Making Waves: The Science and Politics of Ocean Protection.” *Science* 350 (6259): 382–83.

Mauss, Marcel. 1967. *Essai Sur Le Don*. Norton Library. New York: W.W. Norton.

McClanahan, Timothy R., Michael J. Marnane, Joshua E. Cinner, and William E. Kiene. 2006. "A Comparison of Marine Protected Areas and Alternative Approaches to Coral-Reef Management." *Current Biology* 16 (14): 1408–13. doi:10.1016/j.cub.2006.05.062.

McGrath, David G., Leandro Castello, Oriana T. Almeida, and Guillermo M. B. Estupiñán. 2015. "Market Formalization, Governance, and the Integration of Community Fisheries in the Brazilian Amazon." *Society & Natural Resources* 28 (5): 513–29. doi:10.1080/08941920.2015.1014607.

MEA. 2003. *Ecosystems and Human Well-Being: A Framework for Assessment*. Washington, DC: Island Press.

Moberg, Fredrik, and Carl Folke. 1999. "Ecological Goods and Services of Coral Reef Ecosystems." *Ecological Economics* 29 (2): 215–233.

O'Garra, Tanya. 2009. "Bequest Values for Marine Resources: How Important for Indigenous Communities in Less-Developed Economies?" *Environmental and Resource Economics* 44 (2): 179–202. doi:10.1007/s10640-009-9279-3.

Oliveira, Luiz Eduardo Chimello de, and Fikret Berkes. 2014. "What Value São Pedro's Procession? Ecosystem Services from Local People's Perceptions." *Ecological Economics* 107 (November): 114–21. doi:10.1016/j.ecolecon.2014.08.008.

Oliver, Douglas L. 1974. *Ancient Tahitian Society*. Vol. 1. Honolulu: University of Hawaii Press.

Olsson, Per, Carl Folke, and Fikret Berkes. 2004. "Adaptive Comanagement for Building Resilience in Social-Ecological Systems." *Environmental Management* 34 (1): 75-90. doi:10.1007/s00267-003-0101-7.

Ostrom, Elinor, Joanna Burger, Christopher B. Field, Richard B. Norgaard, and David Policanscky. 1999. "Revisiting the Commons: Local Lessons, Global Challenges." *Science* 284:278–82.

Pascal, N., and G. LePorte. 2015. "Valeur Monétaire Des Écosystèmes Coralliens Et Associés De Moorea." Coral Reefs in a Changing World. Moorea: Centre de Recherche Insuliares et Observatoires Ecosystemique, Technical Report.

Pedersen, Morton Axel. 2012. "Common Nonsense: A Review of Cetain Recent Reviews of The 'ontological Turn.'" *Anthropology of This Century*, no. 5. http://aotcpress.com/articles/common_nonsense/.

PGEM, Moorea. 2004. *PGEM Map.pdf*. Moorea, French Polynesia: PGEM de Moorea.

Poe, Melissa R., Karma C. Norman, and Phillip S. Levin. 2014. "Cultural Dimensions of Socioecological Systems: Key Connections and Guiding Principles for Conservation in Coastal Environments." *Conservation Letters* 7 (3): 166–75. doi:10.1111/conl.12068.

Poirine, Bernard. 2010. "The Economy of French Polynesia: Past, Present, and Future." *Pacific Economic Bulletin* 25 (1): 24–34.

Rey, Jeannot. 2016. "Moorea - Moorea Rahui Souhaite Imposer Le Principe D'une Gestion Lagonaire Communautaire." *La Depeche de Tahiti*. September 12. http://www.ladepeche.pf/moorea-moorea-rahui-souhaite-imposer-principe-dune-gestion-lagonaire-communautaire/.

Robbins, Paul, Kendra McSweeney, Thomas Waite, and Jennifer Rice. 2006. "Even Conservation Rules Are Made to Be Broken: Implications for Biodiversity." *Environmental Management* 37 (2): 162–69. doi:10.1007/s00267-005-0009-5.

Rossiter, Jaime Speed, and Arielle Levine. 2014. "What Makes a 'successful' Marine Protected Area? The Unique Context of Hawaii′s Fish Replenishment Areas." *Marine Policy* 44 (February): 196–203. doi:10.1016/j.marpol.2013.08.022.

Ruddle, Kenneth. 1988. "Social Principles Underlying Traditional Inshore Fishery Management Systems in the Pacific Basin." *Marine Resource Economics* 5:351–63.

Salvat, Bernard, and Claire Pailhe. 2002. "Islands and Coral Reefs, Population and Culture, Economy and Tourism: World View and a Case Study of French Polynesia." In *Tourism, Biodiversity and Information*, edited by F. Castri and V. Balaji, 213-31. Leiden: Backhuys Publishers.

Saura, Bruno. 2009. *Tahiti Ma'ohi: Culture, Identité, Religion et Nationalisme En Polynésie Française*. Culture Oceanie. Au Vent des Iles.

Scott, Michael W. 2013. "The Anthropology of Ontology (Religious Science?)." *Journal of the Royal Anthropological Institute* 19 (4): 859–872.

Secretariat of Convention on Biological Diversity. 2010. “TARGET 11.” Convention on Biological Diversity. https://www.cbd.int/sp/targets/rationale/target-11/.

Segi, Shio. 2013. “The Making of Environmental Subjectivity in Managing Marine Protected Areas: A Case Study from Southeast Cebu.” *Human Organization* 72 (4): 336–46.

———. 2014. “Protecting or Pilfering? Neoliberal Conservationist Marine Protected Areas in the Experience of Coastal Granada, the Philippines.” *Human Ecology* 42 (4): 565–75. doi:10.1007/s10745-014-9669-1.

Shenon, Philip. 1995. “Tahiti’s Antinuclear Protests Turn Violent.” *The New York Times*, September 8. http://www.nytimes.com/1995/09/08/world/tahiti-s-antinuclear-protests-turn-violent.html.

Sheppard, Peter J., Scarlett Chiu, and Richard Walter. 2015. “Re-Dating Lapita Movement into Remote Oceania.” *Journal of Pacific Archaeology–Vol* 6 (1). https://www.researchgate.net/profile/Peter_Sheppard/publication/275213760_Re-dating_Lapita_movement_in_Remote_Oceania/links/55d3e03008aec1b0429f3f8d.pdf.

Smith, Lisa M., Jason L. Case, Linda C. Harwell, Heather M. Smith, and James K. Summers. 2013. “Development of Relative Importance Values as Contribution Weights for Evaluating Human Wellbeing: An Ecosystem Services Example.” *Human Ecology* 41 (4): 631–41. doi:10.1007/s10745-013-9597-5.

Song, Andrew M., Ratana Chuenpagdee, and Svein Jentoft. 2013. “Values, Images, and Principles: What They Represent and How They May Improve Fisheries Governance.” *Marine Policy* 40 (July): 167–75. doi:10.1016/j.marpol.2013.01.018.

Stoker, Gerry. 1998. “Governance as Theory: Five Propositions.” *International Social Science Journal* 50 (155): 17–28. doi:10.1111/1468-2451.00106.

Thompson, Mary C., Manali Baruah, and Edward R. Carr. 2011. “Seeing REDD+ as a Project of Environmental Governance.” *Environmental Science & Policy* 14 (2): 100–10. doi:10.1016/j.envsci.2010.11.006.

Trapon, Mélanie L., Morgan S. Pratchett, and Lucie Penin. 2011. “Comparative Effects of Different Disturbances in Coral Reef Habitats in Moorea, French Polynesia.” *Journal of Marine Biology* 2011:1–11. doi:10.1155/2011/807625.

Ullah, Isaac I.T. 2014. “Cross Cultural Data for Multivariate Analysis of Subsistence Strategies: R Script.” *Figshare*. doi:10.6084/m9.figshare.1404233.

Ullah, Isaac I.T., Ian Kuijt, and Jacob Freeman. 2015. "Toward a Theory of Punctuated Subsistence Change." *Proceedings of the National Academy of Sciences* 112 (31): 9579–84. doi:10.1073/pnas.1503628112.

Unlukaplan, Ilter. 2011. "Multivariate Investigation of Governance Indicators in European Union." *Journal of US-China Public Administration* 8 (1): 66–76.

Venkatesan, Somhya, Michael Carrithers, Matei Candea, Karen Sykes, and Martin Holbraad. 2008. "Ontology Is Just Another Word for Culture." *Critique of Anthropology* 30 (2): 152–00.

Viola Moorea. 2016. "Viola Moorea, Gallery." Accessed April 1. http://www.voilamoorea.com/?lang=en#Galerie.

Walker, Barbara Louise Endemaño. 2001. "Mapping Moorea's Lagoons: Conflicts over Marine Protected Areas in French Polynesia." In *Proceedings of the Inaugural Pacific Regional Meeting of the International Association for the Study of Common Property, Brisbane, Australia, September*, 2–4. http://dlc.dlib.indiana.edu/dlc/handle/10535/1734.

Walker, Barbara, and Michael A. Robinson. 2009. "Economic Development, Marine Protected Areas, and Gendered Access to Fishing Resources in a Polynesian Lagoon." *Gender, Place, and Culture: A Journal of Feminist Geography* 16 (4): 467–84.

Walley, Christine J. 2004. *Rough Waters: Nature and Development in an East African Marine Park*. Princeton: Princeton University Press.

West, Paige. 2005. "Translation, Value, and Space: Theorizing an Ethnographic and Engaged Environmental Anthropology." *American Anthropologist* 107 (4): 632–42.

———. 2006. *Conservation Is Our Government Now: The Politics of Ecology in Papua New Guinea*. New Ecologies for the Twenty First Century. Durham: Duke University Press.

———. 2016. *Dispossession and the Environment: Rhetoric and Inequality in Papua New Guinea*. New York: Columbia University Press.

West, Paige, and Dan Brockington. 2006. "An Anthropological Perspective on Some Unexpected Consequences of Protected Areas." *Conservation Biology* 20 (3): 609–16. doi:10.1111/j.1523-1739.2006.00432.x.

Yonger, Marie. 2002. "Approche de La Pêcherie Récifo-Lagonaire de Moorea (Polynésie Française): Évaluation de La Production Halieutique et de La Population de

Pêcheurs.” Master’s thesis, AgroCampus Ouest, Fishers and Acquatics Sciences Center.

APPENDIX A

CONTINGENT VALUATION SURVEY: ENGLISH

Beginning Questions:

1) Will you tell me a story about your relationship with the lagoon?

Section 2: Photo Valuation Exercise

Instructions:

What are Ecosystem Goods and Services:

The phrase Ecosystem Goods and Services refers to the material and non-material benefits that humans derive from the environment. Goods are the tangible benefits that people can get from the environment, such as fish or invertebrates. Whereas, services are the non-tangible benefits, such as coastal protection or recreational benefits. The concept of Ecosystem Goods and Services are used to understand how people 'value' a specific environment so we know what is important to people.

Point System:

During this exercise, I would like you to partition your ‘points’ between the following 12 categories based on the relative importance of each concept. Therefore, you would allot more ‘points’ to categories that you think are more important. You can allot any amount of points to any category you like, or you do not have to give any points to a category if you do not think it is important.

Point Assignment:

Category	Point Assignment	Notes
Bequest		
Coastal Protection		
Cultural Heritage		
Economic Gain		
Education		
Fishery (subsistence)		

Habitat		
Recreation		
Sanitation		
Sense of Place		
Tourism		
Other		

Follow-up Questions:

Have these values changed since you were young?

During this exercise is there any other story you thought of pertaining to the lagoon that you would like to share?

Section 3: CV Exercise Evaluation

Likart Scale Questions

1 = Strongly Disagree **3** = Neither agree nor disagree **5** = Strongly Agree

- This exercise is an accurate representation of how I think/feel about marine resources.

  1 2 3 4 5

- Is it worthwhile to say that some ecosystem services are more important than others?

  1 2 3 4 5

- I think ecosystem services are a useful way to think about my relationship to the marine environment.

  1 2 3 4 5

Qualitative Questions

- Do you think this exercise reflects how you think /feel about the marine environment? Why or why not?

- Is there anything missing from this exercise in regards to how you know/experience/feel about the marine environment? If so, what?

- What would you add or change about this exercise to make it more meaningful?

Section 4: Demographic & Background Information

Age: _____ Gender: M / F / Other **Education: _____ Commùn:_____**

Ancestry: _____ Religion:_____

Profession: Tourism Fisher Research Scientist Government Other:_____

What percentage of your HH income comes from this job? ≤25% ≤ 50% ≤75% ≤100%

What are other sources of income for your household? _____

Do you go fishing? Y / N **How much time do you spend fishing? _____**

If you sell fish, where do you sell them? Roadside Market Clients Other

What other activities do you do in/with the ocean?

_____

_____

Notes:

APPENDIX B

CONTINGENT VALUATION SURVEY: FRENCH

Question de début :

Est-ce que tu voudrais me raconter une histoire sur le lagon?

Section 2: Photo Valuation Pratique

Les Produits et les services écosystémiques:

La phrase «Les produits et les services écosystémiques» se réfère aux avantages matériels et non matériels que les humains tirent de l'environnement. Les marchandises sont les avantages tangibles que les gens peuvent obtenir de l'environnement, comme les poissons ou les invertébrés. En considérant que, les services sont les avantages non tangibles, tels que la protection du littoral ou de prestations de loisirs. Le concept de biens et services écosystémiques sont utilisés pour comprendre comment les gens mettent une «valeur» à un environnement spécifique afin que nous sachions ce qui est important pour eux.

Système de Points:

Au cours de cet exercice, je voudrais que vous partagez vos «points» entre les 12 catégories suivantes en fonction de l'importance relative de chaque concept. Par conséquent, vous

donnez plus de «points» à des catégories que vous pensez **ê**tre plus importantes. Vous pouvez attribuer un montant de points à une catégorie que vous aimez, ou ne pas donner de points à une catégorie si vous ne pensez pas qu'elle est importante.

Assignement des points:

Catégorie	Point Assignement	Notes
Appartenir a un endroit		
Education		
Gain Economique		
Legs/Don		
L'Habitat		
L'Héritage culturel		

Loisirs		
La Pêche		
Protection du Littoral		
Propreté		
Tourisme		
Autre		

Question pour ensuite:

Est-ce que ton valeurs a changé depuis tu étais jeune ?

Pendant cette exercice est-ce qu'il y a une autre histoire a laquelle tu penses que tu voudrais me raconter ?

Section 3: Exercice d'évaluation

Questions de classé

1 = Pas d'accord du tout **3 =** Ni d'accord ni en désaccord **5 =** Completement d'accord

- Ces catégories sont une représentation exacte de ce que je pense des ressources marines.

  1 2 3 4 5

- Il est utile de dire que certains services écosystémiques sont plus importants que d'autres.

  1 2 3 4 5

- Je pense que les services écosystémiques sont un moyen utile de réfléchir à ma relation avec l'environnement marin.

  1 2 3 4 5

Questions Qualitatives

- Est-ce que vous pensez que cette pratique est une représentation exacte de ce que vous pensez/réfléchissez des ressources marines ? Pourquoi or pourquoi pas ?

- Est-ce qu'il y a quelque chose absent dans cet exercice sur ce que vous pensez de l'environnement marin ? Si oui, quoi ?

- Qu'est-ce que vous changeriez sur cet exercice pour le rendre plus significatif?

Section 4: Information Démographique

Âge: _____ Sexe: H / F / Autre **Scolarité Accompli: _____**

Commun:_____

Ascendance :_____ Religion :_____

Vivre en Moorea depuis: _____ D'où avant: _____

Profession: Tourisme Pêcheur Scientifique Gouvernement Autre:_____

Quelle est la proportion de revenu mensuel de votre foyer qui provient de ce travail?

≤25% ≤ 50% ≤75% ≤100%

Quels sont les autres modes de revenu mensuel de votre foyer? _____

Est-ce que vous mangez du poisson ? _____

Est-ce que vous péchez ? O / N **Combien de fois par semaine allez-vous pêcher ?_____**

Si, vous péchez pour vendre, où et comment vendez-vous vos prises?

Dans la rue Sur le marché Aux Clients Autres:_____

Quelles sont les autres activités vous faites dans le lagon ou la mer?

_____

Remarques: