INDIGENOUS-LED CONSERVATION AND RESTORATION: A CASE STUDY OF THE MARINE PROTECTED AREA IN NAIDIRI VILLAGE, FIJI

by

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B.A., University of Guelph, 2020

THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN NATURAL RESOURCES AND ENVIRONMENTAL STUDIES

UNIVERSITY OF NORTHERN BRITISH COLUMBIA

February 2025

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Abstract

This thesis investigates the implementation of an Indigenous-led Community-Based Marine Protected Area (CBMPA) in Fiji through a case study of Naidiri village located on Viti Levu island in Nadroga-Navosa Province. This involves describing the cumulative impacts of social-ecological change operating across spatial and temporal scales that have impacted the coral reef ecosystem and conservation and restoration practices taken by the village in response. Data were collected through 24 semi-structured interviews with *iTaukei* (Indigenous Fijian) in Naidiri and participant observation by the author. The data show that the coral reef ecosystem is central to the ontology of *iTaukei*, but over the last several decades, reef health has declined as the result of cumulative anthropogenic impacts operating across scales (e.g. climate change and overexploitation). In 2007, youth from Naidiri implemented a CBMPA and undertook restoration efforts, including coral planting. The creation of the CBMPA has altered how *iTaukei* engage with their marine environment with differing impacts among villagers. For example, the creation of the CBMPA restricted hunting octopus, predominantly a women's activity and central to their cash income, whereas at the same time, the CBMPA has generated new economic opportunities through tourism. This research highlights the importance of gender considerations and Indigenous rights to lands and resources in marine conservation as a tool for building resilience.

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List of Acronyms

CBMPA	Community-Based Marine Protected Area
CBNRM	Community-Based Natural Resource Management
CBPR	Community-Based Participatory Research
COTS	Crown of Thorns Starfish
FVRF	Fijian Vanua Research Framework
GDP	Gross Domestic Product
IPCC	Intergovernmental Panel on Climate Change
IPON	Indigenous People's Observatory Network
LMMA	Locally Managed Marine Area
MPA	Marine Protected Area
NNPC	Nadroga-Navosa Provincial Council
NOAA	National Oceanic and Atmospheric Administration
OISCA	Organization for Industrial, Spiritual and Cultural Advancement
PIR	Pacific Islands Region
SES	Social-Ecological Systems
SIDS	Small Island Developing State
TCPS	Tri-Council Policy Statement

Glossary of Fijian Terms and References

Bure	Traditional Fijian home structure made with natural materials and a thatched roof.
Duva	<i>Derrie trifoliata</i> is a herbal medicinal plant once commonly used in the PIR to fish. The roots of the plant were pounded and then put in the ocean, where the toxins would seep out and kill nearby fish. The fish would then be collected and eaten by community members.
Grog	Also commonly referred to as kava, <i>grog</i> is a medicinal root plant of cultural importance in Fiji. <i>Grog</i> is made from crushed root of the <i>yaqona</i> plant and strained with water. It is served during ceremonial <i>sevusevu</i> , and it is etiquette for guests visiting an <i>iTaukei</i> village to offer kava to the chief and/or the <i>turaga-ni-koro</i> .
iTaukei	The official term used to describe Indigenous Fijians. Means 'Owners [of the land and resources]'.
Kana	Depending on its use, kana is Fijian for 'eat' or 'food'.
Koros	Villages. In the traditional village structure, several <i>koros</i> made up a <i>tikina</i> , or district, which are part of a greater <i>yasana</i> (province).
Mataqali	Means clan, or landholding unit. Each <i>iTaukei</i> individual is born into a <i>tokatoka</i> (family group), several of which make up one <i>mataqali</i> and its associated terrestrial land.
Qoliqoli	Traditional fishing grounds in Fiji, to which an <i>iTaukei</i> (Indigenous Fijian) community holds customary rights to manage.
Sevusevu	A traditional Fijian ceremony which occurs when visitors arrive at a village. Kava is gifted to the <i>turagao-ni-koro</i> by the guests and a kava drinking ceremony is held with the village, the <i>turagao-ni-koro</i> and the visitors.
Sulu	Traditional Fijian skirt worn by iTaukei women.
Tabu	Means 'no-take', often used to refer to a section of the marine seascape within which restrictions are imposed for marine resource extraction (e.g. no fishing).
Talanoa	A traditional Fijian conversational structure which can be applied to conduct interviews. During <i>talanoa</i> , stories are shared, as well as insights into local realities and aspirations. This allows for authentic and multi-directional sharing of information.

Tikina	A district made up of several <i>koros</i> (villages). A <i>yasana</i> (province) is made up of multiple <i>tikina's</i> .
Tikina-malomalo	The district Naidiri belongs to is the <i>tikina-malomalo</i> . Eight villages belong to this <i>tikina</i> : Naidiri, Malomalo, Nalele, Batiri, Togobula, Sanasana, Vusama and Navisabasaba.
Tokatoka	Family group. Each <i>iTaukei</i> Fijian is born into a <i>tokatoka</i> and has a certain role within that family unit. Each village is comprised of several <i>tokatoka</i> , which make up one <i>mataqali</i> (clan).
Turaga-ni-koro	Village headman. Each <i>iTaukei</i> village is represented by a locally elected or appointed <i>turaga-ni-koro</i> , who plays a role in the day-to-day governing of the village.
Vakatatabu	A form of <i>tabu</i> specifically implemented to honor the passing of a chief. This is done as a sign of respect and usually entails a fishing ban for 100 nights, after which a feast is organized in the chief's honor.
Vanua	Means the land, the waters, the ancestors, the spirits and the people. The concept of <i>Vanua</i> is a traditional belief in an intrinsic connection between <i>iTaukei</i> with their environment. This includes the <i>iTaukei</i> that make up the <i>yavusa</i> (the larger tribe), the <i>mataqali</i> and <i>qoliqoli</i> . The <i>Vanua</i> is governed by a hereditary chief.
Vanua o Tabanivono-wai	Naidiri belongs to the <i>Vanua o Tabanivono-wai</i> , which includes the villages of Naidiri, Malomalo and Nalele as well as their associated <i>mataqali</i> and <i>qoliqoli</i> .
Yavusa	A tribe of people who share a common ancestor. Each <i>yavusa</i> is made up of several <i>mataqali</i> (clans).
Yasanas	Provinces. Fiji is divided into 14 <i>yasanas</i> , each of which is governed by a provincial council, and further divided into <i>tikinas</i> (districts).

Acknowledgement

This thesis is dedicated to the Naidiri Youth Group, who continue to inspire me and many others with their dedication and commitment to protecting their coral reef. A special vinaka vakalevu to Vasenai Lewanivunawi and Manoa Duwai for the continued support, time and commitment to this work. None of this would have been possible without your guidance and the many laughs shared over the years of working together on this research. Vinaka to Liti Lewanivunawi, Rupeni Nakata, Samuela Nawaqalevu, Inoke Nakata, Kevueli Malaka, Varanisese Marava, Aparosa Duwai and the entire community of Naidiri for opening both your homes and your reef to me with such warmth. Thank you to my supervisor, Dr. Tristan Pearce, for your continued guidance and enthusiasm for this research and for trusting me to work in such a special place. To my supervisory committee, Dr. Kerrie Pickering and Dr. Catherine Nolin, thank you for your continued mentorship and for inspiring me with your methodological approaches to this work. It has been an honor to get to work and learn from you both. I would also like to thank my Environmental Change Research Group (ECRG) colleagues Stephanie Chan, Halena Scanlon, Annie King, James Whitehead and Mackenzie Ostberg for their friendships over the years. It is not often one gets to work with their close friends, and I value the time we got to share together. To my partner Laughlin Franklin, thank you for your tireless support, encouragement and motivation over the last two years. This success is yours to share. Lastly, I would like to thank my parents Luc and Dena Rozon. Your appreciation for the lakes, rivers and oceans of this world have shaped me, and have been the guiding motivation for completing this work.

Author Statement

My name is Yanik Rozon. I am from a small rural town in Eastern Ontario, Canada, and grew up speaking French as my first language. I learnt to speak and write in English when I was 10 years old. I come from a family of three girls, of which I am the youngest. I have spent most of my life, and now my career, learning about and spending time in the natural world. My relationship with the environment is one I hold closely, and, in many ways, it informs my approach to this research. Throughout my undergraduate degree in International Development Studies at the University of Guelph, I specialized in Environmental Development and spent summer months working as a field technician and researcher on a project investigating little brown bats (*Myotis lucifugus*). This research aimed to better understand the rapid decline in population numbers in relation to white-nose syndrome and human land-use changes as key drivers of the species decline. The project deepened my understanding of the many direct and indirect ways in which humans can impact the natural world.

In 2019, I conducted an internship in Fiji, working with the local non-profit Live and Learn Environmental Education. During this time, I worked on the UN-Habitat Fiji Resilient Informal Settlements project. This involved working alongside informal settlement communities to learn more about their experiences coping with climate change and identifying opportunities for adaptation. This experience led me to grasp the often-unseen cost of sustaining the lifestyles of many of us inhabiting the Global North. It also displayed the resilience and incredible adaptability of human beings. The ability to adjust and transform, even as political, economic, and environmental conditions pose seemingly insurmountable challenges. Upon graduation, I worked with the local Akwesasronon First Nations group as the project coordinator for the St. Lawrence River Strategy, creating a framework for community action along the Upper St.

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Lawrence River in partnership with the Mohawk Council of Akwesasne. The aim of this project was to develop a shared vision for change and a common agenda for restoring and preserving the Upper St. Lawrence River, as developed through Two-Eyed Seeing. Through this work, I learned about different approaches to research and the value of bringing together different perspectives and knowledge systems to manage shared resources. These experiences have been instrumental in shaping my worldview and are the foundation on which I have stood as I have completed this research thesis.

When I began my graduate research, I learnt of Naidiri's story. I was told of a coastal *iTaukei* village in Fiji whose coral reef ecosystem had become degraded and who had implemented a community-based marine protected area to try and restore the reef for future generations. My supervisor, Dr. Tristan Pearce, had worked with Naidiri for several years, and the village was keen to expand the work to focus on their marine protected area. As a visitor to Fiji, it was imperative to the success of the project that it was co-led by the village. The project aimed to elevate the stories, traditions, and experiences of people from Naidiri with their coral reef and marine protected area strategy.

My time living and working with Naidiri over the last two years (September 2022 – December 2024) has been one of the greatest privileges of my life, both as an academic and as an individual. My connection and communication with the village continue to this day and are relationships I hold dearly. Naidiri's story provides captivating insight into the many challenges facing humanity and the natural world occurring on a global scale, and how these can manifest locally. Theirs is a story unique to them, though the lessons, knowledge gained, and discoveries may speak to many coastal communities around the world. I am honoured to present their case study as part of this research thesis.

Chapter 1: Introduction

1.1 Research rationale

Coral reefs are experiencing mounting pressures from global anthropogenic impacts, including climate change-induced sea level rise, ocean acidification, extreme weather events, land and sea use changes, overexploitation, and pollution (DeMers & Kahui 2012; Delevaux et al. 2018; Heinze et al. 2021; Roberts et al. 2017; Mycoo et al. 2022). These environmental stressors not only damage reefs and contribute to increased mortality rates of coral, but also impact the greater marine social-ecological systems (SES) of which they are part of. In the Pacific Islands Region (PIR) coral reef ecosystems are central to many people's livelihoods, providing food security, regulating social and political relationships, and defining cultural identities (Ruddle 1998; McMichael et al. 2021). Historically, coastal environments in the PIR were governed by traditional marine tenure that helped to mitigate direct human impacts on coral ecosystems to protect their productivity and longevity. These practices, including gear restrictions, periodic reef closures, limited entry, and protection of spawning habitats, were enforced through social norms and sanctions to help sustain healthy populations of marine resources (Robinson 2008; Takasaki 2016; Friedlander & Gaymer 2019). However, changes over the past century have, in some instances, moved Community-Based Natural Resource Management (CBNRM) away from local customary law, resulting in the loss of community resource rights. Globalisation and subsequent changes to education systems, urbanization, commercialization and commodification of marine resources, modernization for economic development, and globalized external markets, have driven top-down marine conservation approaches that are increasingly being identified as unsustainable (Ruddle 1998). It is now widely recognized that environmental challenges and resource management are best addressed

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and more sustainable when communities are central in decision-making processes (Ruddle 1998; Kumar 2005; Roberts et al. 2017; Ferro-Azcona et al. 2019; Chacowry 2023).

One such form of CBNRM is when a community implements a Marine Protected Area (MPA). An MPA, traditionally used in Fiji and called *tabu* sites, is when a section of the marine environment is identified and no-take rules (e.g. no fishing) are enforced. This was traditionally practiced to honour the passing of a chief as a specific form of *tabu* called *vakatatabu*¹, to preserve marine resources for special events (e.g. weddings, and funerals) and to assist in the recovery of over-fished reefs. Since the mid 1990s, there has been a surge in the implementation of MPAs or tabu sites implemented by local communities. This has been in part due to the role of numerous non-governmental organizations and natural resource management government ministries (e.g. the Ministry of Fisheries) who have raised awareness of MPAs among local communities and who provide external support in their establishment and management (Robinson 2008; Takasaki 2016; Friedlander & Gaymer 2019). These initiatives have seen successful, leading to the formation of the Fiji Locally Managed Marine Area (LMMA), a network of stakeholders (government agencies, local communities, the University of the South Pacific, NGOs, among others) which facilitate information sharing and collective capacity building.

Much has been written about the biophysical dimensions of MPAs (e.g. Game et al. (2009) assessment of the relationship between MPA management strategies and mean fish biomass). While there is a growing body of scholarship on the socio-cultural dimensions of MPAs (e.g. Harvey et al. 2017; Hoppit et al. 2022; Gill et al. 2023), some authors have called on the need for greater consideration of socio-cultural dimensions when it comes to assessments of

¹ Vakatatabu is a form of tabu specifically implemented to honor the passing of a chief. This is done as a sign of respect and usually entails a fishing ban for 100 nights, after which a feast is organized in the chief's honor.

MPA success (Robinson 2008; Bennett & Dearden 2014; Rasheed 2020; Smallhorn-West et al. 2020), especially pertaining to gender considerations in the PIR (Kleiber et al. 2018; Michalena et al. 2020) and Indigenous governance of MPAs (Ban & Frid 2018; Rasheed 2020). Understanding these socio-cultural dynamics is necessary for recognizing local perspectives of marine conservation efforts, capacities to conserve, and proper assessments of conservation success (Bennett & Dearden 2014; Takasaki 2016).

This thesis responds to these knowledge gaps by investigating the implementation of an Indigenous-led community-based marine protected area (CBMPA) in Naidiri Village, Fiji, in response to cumulative social-ecological changes. The research has three objectives:

- 1. characterize *iTaukei*² relationships with the coral reef ecosystem;
- document the ecological and social drivers of change that have affected the coral reef ecosystem and implications for local livelihoods; and
- 3. describe the strategies employed to manage and cope with these changes, with a particular focus on the implementation of the CBMPA.

1.2 Main concepts defined

This thesis engages with various key concepts and terms. These include cumulative impacts, social-ecological systems (SES) resilience, and adaptive management. Cumulative impacts can be defined as changes in the environment caused by the interactions of both human activities and natural processes which can accumulate over time and across space (Government of Canada 2024). SES resilience is the ability of a complex adaptive system composed of both human (social) and biophysical (ecological) subsystems which are highly interconnected to

² *iTaukei* is the official term used to describe Indigenous Fijians. Means 'Owners [of the land and resources]'.

maintain the same functions and structures to changing social and environmental conditions by absorbing, resisting and recovering from disturbances (Berkes & Folke 1998; Walker et al. 2004; Perry et al. 2011; Harvey et al. 2017; Wilson et al. 2020). Adaptive management is an iterative process of management goals and methods defined by continuous improvements and changes made in identifying shortfalls, challenges and new information as they arise (Walters & Hilborn 1978; Ban et al. 2012). These concepts will be explored in depth in 'Chapter 2: Literature Review'.

1.3 Thesis organization

This thesis is organized into seven chapters, with the introduction being the first. Chapter 2 summarizes the scholarly literature that informs this work, situating the research within four main bodies of scholarship, as well as identifying research gaps. 'Chapter 3: Case Study' provides a contextual overview of the village of Naidiri, and Chapter 4 discusses the methods used to collect data. The fifth chapter discusses results, which informs understandings of *iTaukei* relationships to their marine environment, how the social-ecological system has changed over time, and how the community has responded to these changes. 'Chapter 6: Discussion' is an exploration of these results and discusses how these findings inform scholarly literature relevant to this work. Lastly, 'Chapter 7: Conclusion' summarizes the study while identifying areas for future research.

Chapter 2: Literature Review

The purpose of this literature review is to give context for the research and to critically review existing scholarship related to CBMPAs in the PIR. First, marine SES are described together with the concepts of resilience and adaptation. Second, key global drivers of biodiversity loss are reviewed for marine SES specifically focusing on the PIR. Thirdly, scholarship on community-based natural resource management and MPAs is reviewed, followed by an overview of scholarship on gender and marine conservation, and research conducted along the Coral Coast and in Naidiri. Lastly, knowledge gaps are identified, and opportunities for research are described.

2.1 Marine Social-Ecological Systems (SES)

Social-ecological systems are complex adaptive systems comprised of human (social), and biophysical (ecological) subsystems which are highly interconnected, operating through interdependent feedback relationships. The social dimension refers to cultural, economic, political, and ethical aspects, while the ecological dimension refers to the natural resource and ecosystem components (Berkes & Folke 1998; Perry et al. 2011). In identifying this concept, Berkes & Folke (1998) proposed that ecosystem changes do not only impact human societies but that societal responses can also improve or exacerbate changes within the ecosystem (Perry et al. 2011). Coastal and marine areas are amongst some of the most complex social-ecological systems, providing biodiversity hotspots to unique flora and fauna, reproductive habitats for marine species, and playing an essential role in adapting and mitigating the impacts of anthropogenic changes. Marine SES also provide vital social, cultural, economic, ecological and spiritual benefits to human societies, contributing widely to diverse livelihoods and the wellbeing of a large portion of the global population. Many Indigenous peoples globally are part of

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these complex marine SES, which are intrinsically linked to their worldviews, beliefs, and social, economic, and cultural activities. The surge in anthropogenic impacts on coastal and marine SES within the last few decades has brought into focus the importance of understanding community resilience and adaptive capacity to these changes (Dam Lam et al. 2019; Ferro-Azcona et al. 2019).

2.1.1 Resilience and adaptive capacity

Interest in the resilience and adaptive capacity of marine SES has surged in the last decade, despite the first publication on these concepts dating back to 2002 (Ferro-Azcona, 2019). Authors have defined these terms in several different ways, however, these largely mean the same thing.

Harvey et al. (2017) define resilience as "the ability of an ecosystem to maintain the same structure and functioning in a changing environment, including resistance to stress and recovery from disturbances." Wilson et al. (2020) define resilience within the context of climate change as "the ability of an ecosystem to resist, recover or adapt to climate change while maintaining key ecosystem functions and services." Comparatively, Walker et al. (2004) define resilience as "the ability of a social-ecological system to absorb disturbances and reorganize itself during the process of change, so that it essentially maintains the same functions, structures, identity, and feedbacks." Ferro-Azcona et al. (2019) expand these definitions to the ability of social-ecological systems to self-organize, learn, and adapt during this process of change.

Adaptive Capacity is defined by Adger (2006) as "the ability of a system to evolve in order to accommodate environmental hazards or policy change and to expand the range of variability with which it can cope." Important to this notion is the idea that adaptive capacity is not static (Smit & Wandel 2006). As such, a community's ability to respond to changing environmental

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and social conditions through learning, accumulating new knowledge, managing risks, and developing effective management plans will vary across time due to changing economic, social, political, and institutional conditions (Smit & Wandel 2006; Bennett et al. 2016).

Adaptive capacity and resilience are distinct but interrelated concepts: while adaptive capacity is a property of social-ecological system resilience, which facilitates a system transforming when its current state is unsustainable, resilience includes adaptation as a fundamental feature which operates over time (Ferro-Azcona et al. 2019). Social-ecological systems can also be described as complex adaptive systems. In this regard, defining resilience and adaptive capacity is founded on the perception of the social-ecological systems as a highly dynamic system, not of one in static equilibrium. This perspective centers human societies as active agents who are central to the functioning of ecological systems, just as much as the ecological systems are central to the functioning of human societies. Through this lens, the resilience of a marine SES is linked to the dependency of a community on the coastal ecosystem (Ferro-Azcona et al. 2019).

2.2 Anthropogenic drivers of change in marine SES

The last few decades have seen a surge in anthropogenic impacts on marine SES. The Intergovernmental Panel on Climate Change (IPCC) identified five groupings of direct drivers of global biodiversity loss: 1) climate change; 2) land/sea use change; 3) direct exploitation of natural resources; 4) pollution, and; 5) invasive species (Jaureguiberry et al. 2022; Mycoo et al. 2022). These are illustrated below in Figure 2.1.



Figure 2.1 Five direct drivers of global biodiversity loss impacting coral reef ecosystems adapted from Jaureguiberry et al. (2022).

Due to the interconnected nature of marine SES, these anthropogenic activities have not only contributed to mass global biodiversity loss and the degradation of key marine and coastal habitats but have also had significant negative impacts on social livelihoods and well-being. Understanding how these pressures are influencing biodiversity loss and the broader social-ecological systems of which they are a part is necessary to develop holistic adaptation and mitigation approaches, as well as to inform policy and action targets (Jaureguiberry et al. 2022). These broad categories of anthropogenic pressures will guide the following review of cumulative changes in marine SES.

I use these groupings to summarize some of the anthropogenic impacts experienced by marine SES within the PIR (Table 2.1). It is important to note that other indirect threats, including demographic, socioeconomic, and technological changes, as well as the governing structures and societal values which underpin them, are not included in the analysis but are crucial in achieving a holistic understanding of threats to marine SES.

Anthropogenic Threats	Impacts to Marine SES
Climate Change	Sea Level Rise:
	• Impacts from sea level rise are numerous, ranging from shoreline retreat, permanent inundation, saltwater intrusion to freshwater resources, loss of arable land, damage or destruction to built infrastructure, degradation of coastal ecosystems, and beach erosion (Albert et al., 2016; Aucan, 2018; McMichael et al. 2021; Merschroth et al., 2020). Coral Bleaching
	 Ocean warming, deoxygenation, and ocean acidification are increasing, causing coral bleaching, lower concentrations of dissolved O₂, and fragile skeletal structures, respectively (Roberts et al. 2017; Harvey et al. 2017; Heinze et al. 2021). Extreme Weather Events
	• Increased frequency and severity of extreme weather events are degrading coral reefs, eroding coastlines, increasing shoreline retreat and beach loss, and damaging built infrastructure (Harvey et al. 2017; Mycoo et al. 2022).
Invasive Species	Crown-of-thorns starfish (COTS)
	• COTS feed on coral reefs and can lead to mass die-offs. COTS outbreaks are believed to be linked to anthropogenic disturbances (Zann et al. 1990; Babcock et al. 2016; Lang et al. 2023).
Direct Exploitation of Natural	Overfishing
Resources	• Inshore and offshore fishing has increased because of growing international markets for fish, technological innovation, and limited regulation, stressing many coastal communities and marine environments globally (Perry et al. 2011; DeMers & Kahui 2012).
Land/Sea Use Change	Agricultural expansion and logging
	• Commercial agriculture expansion and logging are resulting in increased sedimentation and nutrient runoff, threatening coral reef environments and requiring integrated land-sea management (Delevaux et al. 2018; Pacific R2R 2022).
Pollution	Human pollution
	 Burning and burying waste is a continued practice in Small Island Developing States (SIDS) and in Fiji, posing health risks to humans and the environment (Sewak et al. 2021). Agricultural runoff and elevated nutrient levels near hotels have
	been shown to reduce coral reef health along the Coral Coast (Hoffman 2002; Mosley & Aalbersberg 2003)

Table 2.1 Anthropogenic impacts on marine SESs within the PIR

2.2.1 Climate change

Climate change-driven impacts are occurring globally, with amplified risks for Small Island Developing States (SIDS) due to their relatively small land areas, boundedness, and remoteness from more populated parts of the world (Mycoo et al. 2022). Climate change impacts have included warming temperatures, increased frequency and severity of tropical cyclones, increasing rainfall, coral bleaching, sea level rise, landslides, and droughts. This section will focus specifically on sea level rise, coral bleaching, and extreme weather events in the PIR, as these are contributing to some of the greatest negative measured impacts on marine SES (Albert et al. 2016; McMichael et al. 2021; Roberts et al. 2017).

2.2.1.1 Sea level rise

Climate change-induced sea level rise is anticipated to be one of the greatest challenges to humanity in the coming decades, with populations in low-lying areas in SIDS amongst the most exposed to its impacts (Albert et al. 2016; Merschroth et al. 2020; McMichael et al. 2021; Mycoo et al. 2022). Global sea level rise is a result of thermal expansion of oceans due to warming temperatures and increased runoff from the melting of continental glaciers. Changes in sea level rise varies globally, though the rate of global mean sea level has accelerated over the last century between 0.12m and 0.21m from 1902 to 2015. It is projected that the sea level will be 0.4m to 0.8m higher around the PIR by the end of this century, depending on greenhouse gas emission trajectories and rates of sea ice mass loss (Aucan 2018; McMichael et al. 2021). Projections were determined by assessing current and projected mean sea levels in the Pacific Islands. Aucan (2018) assessed current absolute sea level rise from 1993 to 2017 as monitored by satellite altimetry, determining a 3-6mm per year increase for the Pacific islands, with considerable variation between islands. Sea level rise also causes more severe and frequent extreme sea level events, coastal flooding events of short duration which can result in severe impacts to coastal regions. With current projections for rising sea levels in the PIR, this would increase extreme sea level events and ultimately result in greater biophysical and socioeconomic impacts (Aucan 2018; McMichael et al. 2021).

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Though the impacts of sea level rise and extreme sea level events on coasts and shorelines are site-specific, potential impacts are numerous, ranging from shoreline retreat, permanent inundation, saltwater intrusion to freshwater resources, loss of arable land, damage or destruction to built infrastructure, degradation of coastal ecosystems and impacting beach erosion, a process already vulnerable to other human-induced biophysical changes (Albert et al. 2016; Aucan 2018; Merschroth et al. 2020). Human environmental impacts such as reef-rock and beach-sand mining can exacerbate the effects of sea level rise (Nunn 2013).

The Government of Fiji has stated that sea level rise and related impacts will make habitation in low-lying villages unsustainable in the long term, and in 2017 identified 830 communities as being vulnerable to sea level rise and potentially requiring relocation³. Of these, 48 communities were identified as urgently requiring relocation. The Fijian government has produced the National Climate Change Relocation guidelines and is one of the first countries globally to do so (Ministry of Economy 2018; McMichael et al. 2019; McMichael et al. 2021). However, while relocation is often positioned as an inevitable certainty because of rising sea levels and associated impacts, climate-related mobilities (and immobility's) require greater examination of human multiplicities. As McMichael et al. (2021) investigated, some individuals, households and/or communities may be unable to relocate due to financial, resource, legal or political constraints, while some may willingly choose to stay. The choice to stay despite knowledge of existing and/or perceived risks can be for a variety of reasons: a willingness to ensure socio-cultural continuity, food security, proximity to the *qoliqoli⁴* and ocean, access to

³ This includes the village of Nalele, which is part of the same *tikina-malomalo* as Naidiri village, though Naidiri itself is not on this list (Fiji Government 2014).

⁴ *Qoliqoli* are traditional fishing grounds in Fiji, to which an *iTaukei* (Indigenous Fijian) community holds customary rights to manage.

farmland, familiarity of *iTaukei* village life, maintaining connections to ancestors, sustain cultural identity and/or, continue place-based knowledges and cultures. The decision to remain emerges from attachment to place, with many communities and individuals choosing instead for in situ adaptation to rising sea levels (McMichael 2021). As sea level rise projections are estimated to continue to worsen, understanding how adaptation unfolds is important in understanding the lived experiences of those inhabiting coastal communities in the PIR.

2.2.1.2 Coral bleaching

Since the beginning of the industrial revolution in the late 18th century, oceans have absorbed over one-third of total carbon dioxide emitted and 93% of heat caused by human activity. This has resulted in ocean warming, deoxygenation and ocean acidification, which are having significant repercussions on marine ecosystems, biodiversity and their wider marine SESs (Roberts et al. 2017; Heinze et al. 2021).

Increasing temperatures threaten marine species, many of which are reliant upon an optimal temperature window for their physiological functioning. Coral reefs, for example, are highly sensitive to temperature changes, as bleaching events occur when temperatures reach 1-2 degrees Celsius above summer maximum temperatures. While bleaching events may be temporary, prolonged episodes can result in mass mortality rates. As current international targets are set to limit warming to less than 1.5 degrees Celsius, the next few decades are projected to see a continued increase in the frequency and severity of wide scale bleaching events, threatening over 90% of reefs globally (Harvey et al. 2017; Heinze et al. 2021; Mycoo et al. 2022). As reefs provide important ecosystem services such as coastal protection and fish nurseries, this decline is likely to have significant repercussions for marine SES. Increasing ocean temperatures are also

resulting in decreasing solubility of O₂, impacting marine species which inhabit regions with sufficiently high concentrations of dissolved oxygen (Heinze et al. 2021).

Ocean acidification is further threatening marine species, as acidified seawater tends to dissolve calcium carbonate (CaCO3), an important mineral for shell-building and which many marine organisms require for their shells and/or skeletal structures. Corals are vulnerable to ocean acidification, with decreased aragonite availability leading to fragile structures (Heinze et al. 2021). Skeletal damage can also make corals more sensitive to extreme weather events and storms, which are projected to continue increasing in intensity and frequency (Harvey et al. 2017).

2.2.1.3 Extreme weather events

Climatic changes have been found to increase the frequency and severity of extreme weather events, which can have detrimental ecological and societal impacts. Tropical storms can largely degrade coral reefs, creating coastal erosion, and increasing shoreline retreat and beach loss (Harvey et al. 2017; Mycoo et al. 2022). These extreme weather events also negatively impact coastal communities, particularly in countries where high amounts of infrastructure are located on the coast. For example, in 2016, tropical cyclone Winston resulted in over 20% of Fiji's annual Gross Domestic Product (GDP) in damage costs. As projections show the likelihood of intensification of storms, coastal communities globally are likely to continue to incur significant costs, structural damage to built infrastructure, damage to reef ecosystems and impacts to broader marine SES (Roberts et al. 2017; Mycoo et al. 2022).

2.2.2 Invasive species

Shifting salinity and the warming of oceans is expected to affect ocean currents, influencing the distribution of marine taxa. This redistribution of species may result in species moving toward more temperate waters, and potentially contributing to the occurrence of new invasive species (Roberts et al. 2017). Although native to the Pacific region, outbreaks of the crown-ofthorns starfish (COTS) (Acanthaster planci) are believed to be linked to anthropogenic disturbances. The COTS poses a significant threat to coral reefs due to their tendency to feed on corals and their occurrence in high densities. The vast mortality of corals resulting from COTS outbreaks has led to direct control efforts, and since the 1960's divers have removed and/or killed over 17 million COTS throughout the Indo-Pacific. However, long-term management of COTS requires understanding the root cause of outbreaks to prevent and manage their impacts. Several hypotheses have been put forward to explain the occurrence of population outbreaks, suggesting anthropogenic changes in environmental conditions as an underlying cause. Ecologists and biologists have acknowledged that it is likely a cumulation of diverse incidences, which undermine the capacity of coral reefs to withstand outbreaks (Zann et al. 1990; Babcock et al. 2016; Lang et al. 2023). Some research suggests coastal development may be a contributor, resulting in elevated nutrient levels from phytoplankton blooms providing additional food sources for COTS. Overfishing is also likely to contribute to COTS outbreaks by removing natural predatory fish species (Babcock et al. 2016). This is further supported by research findings from Sweatman (2008) indicating that outbreaks were up to three times more likely to occur in reefs subject to fishing versus in MPAs.

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2.2.3 Overexploitation

In the last century and a half, the growth of international markets for fish, technological innovation and limited regulation has imposed significant stress on many coastal communities and marine environments globally (Perry et al. 2011; DeMers & Kahui 2012). Countries around the world have experienced negative socioeconomic, environmental and cultural consequences, the most recent of which has included the PIR. Fisheries development has included both inshore and offshore fisheries experiencing modernization, intensification and commercialization. Historically, countries such as Fiji had established long-standing traditional management structures to effectively regulate coastal resources, though recent developments have shifted coastal resource access and management from predominantly traditional structures to be more open to the general public (Demers & Kahui 2012; Norton & Varani 2023; Latu 2024). Demers & Kahui (2012)'s overview of Fiji's fisheries development from the 1940s to 2012 claims that "Urbanization and the commercialization of fishing activities, however, led to the destabilization of those traditional management structures, effectively turning Fiji's previously restricted coastal resources into open access resources." Despite this significant change, most research has focused on fisheries in the Northern Atlantic Ocean and the North Sea, restricting the ability to inform policy to better manage fisheries in the PIR (DeMers & Kahui 2012).

2.2.4 Land/sea use changes

Commercial agriculture expansion and logging are resulting in increased sedimentation and nutrient runoff, threatening coral reef environments. This land-use change and resulting pollution are impacting both terrestrial and marine ecosystems. Deforestation leading to excess sediments in watersheds has been shown to reduce habitat quality by decreasing water clarity, cause shading, and smother corals and benthic organisms. Nutrients often bind with sediments and may

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promote benthic algae growth, further disrupting marine benthic, coral, and fish species (Delevaux et al. 2018). Historically, marine and terrestrial ecosystems in the PIR were managed separately, though it has been identified that efforts to address coral reef degradation will require integrated land-sea management to ensure connectivity amongst ridge-to-reef landscapes (Delevaux et al. 2018). In 2016, the Ridge to Reef program was launched in Fiji, co-financed by the Fiji Government, United Nations Development Program, and numerous private sector and environmental non-governmental organizations. The aim of the initiative is to integrate terrestrial and marine management by addressing anthropogenic pressures from land/sea use changes and pollution, such as industrial waste and sewage, deforestation, urban run-off and growth and protecting biodiversity resources (Pacific R2R 2022).

2.2.5 Pollution

Proper waste management is a complex issue in SIDS throughout the PIR, in part a result of limited space for landfills and the increasing demands of tourism-based economies (Sewak et al. 2021). In Fiji, there is no national waste management plan, or solid waste management policy (SPREP 2022). As such, burning and burying waste continues to be a common practice in many Pacific Island nations, posing significant human health risks and environmental harm (Sewak et al. 2021). Other pollution sources include agricultural runoff from chemical fertilizers, which negatively impact coral reef health in Fiji (Hoffman 2002), and elevated nutrient levels near hotels, which have been shown to reduce coral health along the Coral Coast (Mosley & Aalbersberg 2003). With tourism and the presence of hotels and resorts along the coast projected to continue to increase throughout Fiji, the continued lack of a waste disposal management plan and waste policy raises concern for the health risks posed to coral reefs.

2.2.6 Cumulative impacts

The terms cumulative impacts and cumulative effects are often used interchangeably despite the notable difference between the terms 'effect' and 'impact'. As defined by Blakely & Franks (2021): "effects and impacts de facto are distinct, and the act of determining whether an impact has occurred following some measurable effect is a subjective exercise that reflects the values of those making the assessment. In other words, an effect is not necessarily regarded as an impact if it does not affect a component of the environment in any significant or substantial way, as deemed by society." Definitions of the terms cumulative impacts and cumulative effects are varied, though largely similar. The Canadian Council of Ministers of the Environment describes cumulative effects as "the changes in the environment caused by multiple interactions among human activities and natural processes, which accumulate across time and space" (Government of Canada 2024). For clarity, the term 'cumulative impact' exclusively will be used throughout this thesis.

Many authors highlight the importance of understanding the cumulative impacts of multiple stressors on marine SES (Perry et al. 2011; Harvey et al. 2017; Roberts et al. 2017; Delevaux et al. 2018; Ferro-Azcona et al. 2019; Wilson et al. 2020; Mycoo et al. 2022; Jaureguiberry et al. 2022). Identifying and understanding how multiple stressors interact is required to accurately understand how coastal communities and marine ecosystems are impacted and to inform the development of management actions (Guarnieri et al. 2016; Jaureguiberry et al. 2022; Simeoni et al. 2023). However, the ways in which these pressures interact are not well understood (Roberts et al. 2017; Jaureguiberry et al. 2022). Interactions amongst stressors may be additive, antagonistic, or synergistic, though the highly dynamic nature of interacting stressors can be hard to assess (Roberts et al. 2017; Blakely & Franks 2021). As shown in Figure 2.2, the

findings demonstrate how anthropogenic drivers play out differently in marine, terrestrial and freshwater realms, while Figure 2.3 displays the impact of anthropogenic impacts on biodiversity loss in different continental regions. In all ecological realms and global regions, land/sea use change, direct exploitation and climate change are identified as the main drivers of biodiversity loss. As such, preventing further biodiversity loss requires a shift from the current dominant emphasis on mitigating climate and adaptation changes to addressing the cumulative impacts of all five drivers of anthropogenic changes. This is necessary to develop holistic adaptation and mitigation approaches, as well as to inform policy and action targets (Jaureguiberry et al. 2022).



Figure 2.2 a) Overall hierarchy of five direct drivers of biodiversity loss globally; b) hierarchy of drivers within terrestrial, marine and freshwater realms (Jaureguiberry et al. 2022).



Figure 2.3 Hierarchal dominance of the five direct drivers of anthropogenic changes on biodiversity loss in different continental regions (Jaureguiberry et al. 2022).

2.3 Community-based natural resource management

Community-based natural resource management (CBNRM) is the management of natural resources that involves the participation and active engagement of local communities, incorporating traditional forms of access and management, knowledge systems, and local institutions (Ruddle 1998; Kumar 2005). The concept of CBNRM was coined in the 1950s and started to be used in coastal management policies by the 1970s. This occurred following the recognition of the limited efficiency of top-down approaches to coastal management and the simultaneous success of participatory approaches (Kumar 2005; Chacowry 2023). It is now widely recognized that environmental challenges and resource management are best addressed and more sustainable long-term when communities are central in decision-making processes

(Ruddle 1998; Kumar 2005; Roberts et al. 2017; Ferro-Azcona et al. 2019; Johnson et al. 2020a; Chacowry 2023).

Within the PIR, traditional community-based systems rooted in customary law typically governed marine natural resource management. This involved gear restrictions, allocation of resources and access, and self-monitoring and enforcement by local authorities (Sloan & Chand 2016). In many ways, traditional CBNRM was parallel to conventional fisheries management, including gear size, species catch, entry and seasonal restrictions. Over the last century, countries in the PIR have experienced dramatic social, political, and economic changes that have affected traditional CBNRM through shifts away from customary law and community land and resource rights. Amongst these include the legacy of colonialism, urbanization, commercialization and commodification of marine resources, changes in education systems, resource extraction, globalized external markets, and shifts in governing structures and policies (Ruddle 1998; Sloan & Chand 2016; Friedlander 2018).

2.4 Marine Protected Areas (MPAs)

The purpose of an MPA is to protect defined seascapes, species, and habitats. MPAs are typically implemented and managed through top-down methods of governance and impose restrictions on human activities that are deemed to be detrimental to the health of the area (e.g. fishing, harvesting, resource extraction) (Wilson et al. 2020; Hoppit et al. 2022; Villaseñor-Derbez et al. 2023). MPAs are commonly used as a cost-effective ocean conservation strategy, which can increase local biodiversity, protect sensitive habitats and threatened species, support adjacent fisheries, and restore functional food webs, amongst other benefits. There are different types of MPAs, the most common of which are permanent closures, often referred to as no-take zones. Dynamic MPAs, also commonly referred to as multiple-use MPAs or rotational MPAs,
are a form of marine reserve with temporary and/or limited access to extractive practices (Game et al. 2009; De Santo 2013). In this thesis, the term 'MPA' will be used to reference a top-down approach to marine reserve governance, which encompasses both no-take and dynamic MPAs, unless a distinction is required. The past two decades have seen a global surge in the use of MPAs as nations work towards achieving 30x30 – designating 30% of all global oceans as MPAs by the year 2030 – to fulfill commitments made at the Convention on Biological Diversity within the Kunming-Montreal Global Biodiversity Framework (Roberts et al. 2017; Wilson et al. 2020; Gill et al. 2023). With anthropogenic changes impacting ocean conditions globally, MPAs are being used to help buffer marine communities against these impacts (Wilson et al. 2020). However, despite these potential benefits, research on MPAs and their efficiency as a form of marine resource management remains contested, with considerations raised about MPA size and management, the distribution of accrued costs and benefits, and their adaptability to an everchanging climate.

2.4.1 MPA size and management

In discussing the rapid global growth of MPA number and size, De Santo (2013) and Gill et al. (2023) raise concerns surrounding the rush to meet global conservation targets. The past two decades have seen a 15-fold increase in the number of MPAs globally, a rapid expansion that is predicted to continue to increase as countries rush to meet global conservation targets (Gill et al. 2023). In their analysis of global MPA percentage targets, De Santo (2013) argues that this focus weakens the science-policy interface while undermining social justice considerations within global biodiversity conservation. The ability to effectively monitor and enforce compliance to achieve desired MPA biological and social targets is questioned in both 'enormous' MPAs (De Santo 2013), and even within small-scale MPAs (Harvey et al. 2017; Gill

et al. 2023). Harvey et al. (2017) argue that one of the greatest determinants of MPA success is contingent on their effective implementation and ongoing management.

2.4.2 Distribution of costs and benefits

There is a growing body of literature on the social dimensions of MPA and evaluating their costs and benefits (Charles & Wilson 2009; Pietri et al. 2009; Harvey et al. 2017; Sowman & Sunde 2018). While MPAs are typically implemented with the intention of improving the conditions of marine SES through increased productivity, there is potential for disproportionate and inequitable costs and benefits to be experienced by community members (Charles & Wilson 2009). Differential resource access is important to consider, potentially leading to the reinforcement of elite voices amongst members and the displacement of individuals who traditionally use the area for resources (Kumar 2005; Robinson 2008; Charles & Wilson 2009). Considering broader sociocultural issues and realities is necessary to understanding how MPA costs and benefits are likely to be experienced and to mitigate outcomes. In their analysis of human-displacement within MPAs, Charles & Wilson (2009) discuss economic diversification within policy to ensure alternative livelihoods are achievable for those initially impacted by the creation of an MPA. As experiencing the benefits of MPAs may take time to materialize, supplementing the implementation of an MPA with other economic opportunities can help ensure that the long-term benefits of MPAs are experienced, while reducing some of the immediate costs (Corals for Conservation 2023).

2.4.3 Adaptive MPAs

Within the context of anthropogenic climate change, MPAs do not often account for potential changes in future climate scenarios. In addition to addressing present issues, some

authors (e.g. Harvey et al. 2017; Wilson et al. 2020) argue for the importance of MPA design to consider future threats to ensure the resilience of coral reefs and reef species over time. In their systematic literature review of adapting MPAs to ongoing climate change, Wilson et al. (2020) assess five common existing frameworks for biodiversity conservation and demonstrate how climate change adaptation can be integrated into all stages of MPA design and management. As seen in Figure 2.4, considerations are ideally included early in the process as well as iterative throughout.



Figure 2.4 Simplified framework of five existing frameworks for biodiversity conservation displaying how to integrate climate change adaptation in all stages of MPA planning, management and design (Wilson et al. 2020).

In assessing MPA design and the implementation of climate change adaptation, Wilson et

al. (2020) outline the most common adaptation strategies as: increasing resilience; protecting

climate refugia; protecting future habitat; increasing connectivity; increasing heterogeneity; reducing other stressors, and; increasing adaptive capacity (Wilson et al. 2020). Amongst these, increasing connectivity was the most recommended climate change adaptation strategy. Many studies have remarked on the importance of MPA networks in managing the impacts of climate change (Harvey et al. 2017; Wilson et al 2020; Hoppit et al. 2022). Individually, small, unconnected MPAs are vulnerable to the changing conditions of the surrounding seascape. Increasing connectivity through MPA networks can enable adaptation to the highly heterogeneous nature of climate change impacts, providing a strategy known as 'adaptation networks' which increases adaptive capacity (Wilson et al. 2020). While Wilson et al. (2020) framework is specific to climate change, the importance of adaptive MPAs and the connectivity of MPA networks can be said for all five main drivers of anthropogenic changes. In 2000, the Locally Managed Marine Area (LMMA) Network initiative was launched to rectify the highly top-down approach to marine conservation which was occurring throughout the PIR and to increase resource and information sharing amongst community-based MPAs (LMMA Network 2023). In their report of the 'status and potential of locally-managed marine areas in the South Pacific', Govan (2009) identify that Fiji's LMMA network covers over 22% of all inshore fishing areas. This was achieved by more than 200 villages across 14 provinces throughout Fiji, and represents a total of more than 10,000km² (Govan 2009; Robertson et al. 2020).

It is important to note that while incorporating climate change adaptation within MPA design and establishing MPA networks for greater adaptation potential is important, MPAs do not always enable marine ecosystems to resist climate-driven events such as warming temperatures and acidification. While there is evidence of greater resistance and recovery amongst coral reef communities located within MPAs following disturbances, these marine

ecosystems nonetheless remain at risk of harmful anthropogenic impacts which threaten their integrity and long-term survival (De Santo 2013; Mellin et al. 2016; Wilson et al. 2020; Gill et al. 2023). It is necessary to highlight the need for dramatic reductions in carbon emissions as one of the only comprehensive solutions to mitigate the impacts of climate change on marine ecosystems.

2.5 Community-based marine protected areas

Community-based marine protected areas (CBMPAs) are areas where local resource users choose to impose restrictions on human activities and are typically designed, implemented, and managed by the local community (Villaseñor-Derbez et al. 2023). CBMPAs ensure local participation and an increased sense of ownership amongst involved community members, increasing the probability of achieving long-term management and effective conservation of marine reserves (Robinson 2008). The implementation and ongoing management of CBMPAs as a form of CBNRM has also been shown to empower local communities, providing an opportunity to merge local social-ecological benefits and progress towards achieving global targets (Robinson 2008; Roberts et al. 2017). With the use of CBMPAs as localized marine conservation efforts increasingly being used globally, there is a growing body of literature on CBMPAs, ranging in geographic scope from India (Gurney et al. 2015), Solomon Islands (Aswani & Weiant 2004; Hamilton et al. 2012), Philippines (Pollnac et al. 2001; Diedrich et al. 2017), Portugal (Guimaraes et al. 2023), Papua New Guinea (Hamilton et al. 2011), Mexico (Villaseñor-Derbez et al. 2023), Fiji (Gurney et al. 2015b; Gurney et al. 2021), among others.

In their cost-benefit analysis of 9 CBMPAs in Mexico, Villaseñor-Derbez et al. (2023) quantify the relationship between socioeconomic benefits and operational costs of CBMPAs, differentiating between the costs of MPAs typically accrued by general society, who also largely benefit, versus the disproportionate cost to localized communities with exclusive access regimes, while benefits remain largely public due to the spillover effect. They go on to suggest that in some communities, allowing for a limited amount of extraction from a CBMPA could help finance the management and monitoring of operational costs (Villaseñor-Derbez et al. 2023).

2.5.1 CBMPAs in the PIR

In their review of over 2,500 reefs worldwide, Cinner et al. (2016) identified that amongst reefs located in regions where human populations and ecosystem resource use are high, the healthiest reefs are those managed through customary marine tenure, within which there is elevated local engagement in management. Historically, Indigenous communities in the PIR practiced traditional marine customary tenure founded on culturally accepted unwritten rules and regulations (Robinson 2008; Takasaki 2016). In Fiji, the hierarchal lineage of *iTaukei* Fijian structures consists of Vanua-yavusa-mataqali-tokatoka. Each iTaukei Fijian is born into a tokatoka, a certain role within the family unit. Each village is comprised of several tokatoka, which are part of one *matagali*, or clan. Several *matagali* make up the *yavusa*⁵, the larger tribe, of which several *yavusa* belong to a certain *Vanua*⁶, which are associated with a particular landmass or territory. Customary laws guarantee collective ownership over coastal zones and land. While terrestrial land is communally owned by the *mataqali*, marine environments are separated into customary fishing grounds, locally known as *goligoli*. There are over 400 *goligoli* in Fiji, to which a Vanua or several yavusa, several villages, hold customary rights (Muehlig-Hofman et al. 2006; Takasaki 2016). Traditionally, the management of *goligoli* included

⁵ *Yavusa* is a tribe of people who share a common ancestor.

⁶ Vanua means the land, the waters, the ancestors, the spirits and the people. The concept of Vanua is a traditional belief in an intrinsic connection between *iTaukei* with their environment. This includes the *iTaukei* that make up the *yavusa* (the larger tribe), the *mataqali* and *qoliqoli*. The Vanua is governed by a hereditary chief.

practices such as gear restrictions, periodic reef closures, limitations to entry and protection of spawning habitats, effectively enforced through social norms and sanctions. One of the most common practices of customary marine management is the *tabu*, often applied as a complete restriction over a marine resource which is designated for a certain period of time. Communities respect the *tabu*, fearing retribution from ancestral gods if sanctions are not followed (Robinson 2008). The 1970s saw a decline in the number of community-based *tabu* areas, though there has been a resurgence in their practice since 1990 due to the national government formalizing marine spaces and integrating them into the contemporary system (Robinson 2008; Takasaki 2016).

2.6 Gender and marine conservation

Many authors have identified the importance of gender considerations in marine conservation and management (Harper et al. 2013; Ram-Bidesi 2015; Kleiber et al. 2018; Rohe et al. 2018; Michalena et al. 2020; Mangubhai et al. 2022; Ruano-Chamorro et al. 2024). Gender refers to socially and culturally constructed roles and expectations that women and men have in social and political life, which usually determines which activities one can undertake. In this way, gender is inherently connected to power relations, cultural norms and traditions (Rohe et al. 2018; Ruano-Chamorro et al. 2024). In the context of marine conservation and management, gender shapes an individual's ability to participate, and the losses and benefits experienced (Ruano-Chamorro et al. 2024). A study conducted by Harper et al. (2013) found that in the Pacific, women account for 56% of all small-scale fisheries catches, representing a total annual revenue of US\$110 million. This economic contribution and women's substantial contributions to fisheries overall, however, continue to be overlooked in management and policy (Harper et al. 2013; Michalena et al. 2020).

Throughout the PIR, the ways in which women and men engage in fishing is typically determined by their gender (Rohe et al. 2018; Michalena et al. 2020). Women traditionally concentrate their harvest on inshore areas, using practices requiring less gear. Some of these practices include harvesting marine invertebrate species (e.g. shells, sea cucumbers) (Purcell et al. 2016), catching octopuses (Vuki & Vunisea 2016) and handline fishing, often staying near their homes to tend to household chores around fishing activities, such as cooking, looking after the sick and attending to children (Ram-Bidesi 2015). Many of these fishing activities can be categorized as reef-gleaning. Gleaning is a fishing activity traditionally practiced in Oceana which involves walking through intertidal zones during low tide in search of marine species that can be consumed or sold. It plays an important role in contributing to household food security (Kleiber et al. 2018; Pike et al. 2024). It is common for women in the PIR to bring children of both sexes with them to fish and glean, passing down their fishing skills and knowledge about marine species to the next generation. As highlighted by Ram-Bidesi (2015), this represents an opportunity to pass down responsible marine stewardship principles. Comparatively, men typically engage in fishing for finfish, which often requires being situated further from the home (Kleiber et al. 2018; Ram-Bidesi 2015). As a result, women have specialized knowledge and skills relevant to marine and coastal resource management which differs from that of men. Despite this, women are often excluded from fisheries management decision-making processes (Ram-Bidesi 2015; Michalena et al. 2020).

There is a growing body of literature examining the role of gender in small-scale fisheries governance (Kleiber et al. 2018; Michalena et al. 2020; Lawless et al. 2021; Mangubhai et al. 2022; Purcell et al. 2024). Some of these authors have called on the need for greater inclusion of gender-specific considerations in assessments of MPAs used in conservation and fisheries

management (Kleiber et al. 2018) and the need for more qualitative and quantitative evidence from the PIR of the participation of women in fisheries (Michalena et al. 2020). Other authors have investigated perceptions of equity and fairness of marine conservation initiatives and management as it relates to gender, stating that "ensuring fairness in conservation is a moral imperative" (Ruano-Chamorro et al. 2024). The findings from Ruano-Chamorro et al. (2024) assessing equity in marine management efforts in Fiji found that women were largely excluded from decision-making processes and bore the most cost, while men were perceived as benefiting the most. Despite this, community perceptions of the cost-benefits were believed to be fair. Ruano-Chamorro et al. (2024) link this to the role of patriarchal traditional governance systems which tend to disadvantage women, highlighting the importance of social and cultural gender considerations and how these shape perceptions of equity and fairness in marine conservation and management. Other authors have also identified the potential contribution of traditional patriarchal governance systems, which shape local decision-making governing natural resources (Vunisea 2008; Vuki and Vunisea 2016). As such, it is important that gender considerations in marine conservation implementation and management consider local political, social, and cultural processes which shape gendered relationships to marine conservation efforts, as well as how the distribution of cost-benefits are perceived and experienced.

Gendered considerations are also important in ensuring that the ecological benefits of marine conservation efforts are achieved. For example, Michalena et al. (2020) assessed the importance of inclusive gendered approaches to marine conservation for greater community engagement, Ruano-Chamorro et al. (2024) highlighted that compliance is directly driven by perceptions of fairness, and Rohe et al. (2018) and Mangubhai et al. (2022) identified that gender inequality in decision-making can limit the effectiveness of MPAs. Recognizing the contribution of women in

the PIR in small-scale fisheries and better understanding their relationships to, perceptions of, and how they are impacted by marine conservation processes and management is necessary for the achievement of ecological benefits of MPAs as well as to move towards greater social equity and human well-being in the marine conservation space.

2.7 Coral Coast and Naidiri

Much has been written on the biophysical conditions of the coral reef along Fiji's Coral Coast (O'Garra 2012; Dell et al. 2015; Ram & Terry 2016; Finkl & Makowski 2022; Shadrack et al. 2020; Wandres et al. 2020; Goberdhan & Kininmonth 2021). For example, Wandres et al. (2020) discuss distant-source swells along the Coral Coast; Ram & Terry (2016) investigated suspended sediment delivery patterns along the Coral Coast, and; Goberdhan & Kininmonth (2021) explored the relationship between annual coral growth rates and corresponding environmental variables. Some authors have explored the biophysical reef conditions within MPAs along the Coral Coast, including Shadrack et al. (2020), who assess coral reef sediments within a CBMPA along the Coral Coast's Maui Bay, and Dell et al. (2015), identifying the impact of MPAs not only on fish species abundance and diversity but also to diet compositions and trophic biology of member individuals. From a socio-cultural lens, Meheux et al. (2010) looked at community participation in disaster management in three villages on the Coral Coast, including Malomalo. Further, two authors have completed their thesis dissertations in Naidiri village. Pickering (2020) investigated relationships between social-ecological changes and food security in three rural *iTaukei* villages, one of which was Naidiri, and found food security to be most influenced by local environments and not peripherality. Salunkhe (2024) completed a thesis dissertation on Naidiri's CBMPA as a Nature-based Solution (NbS) to climate change, providing an ecological assessment of the CBMPA on coral cover and fish abundance and diversity.

These articles provide context to the biophysical dimensions along the Coral Coast (O'Garra 2012; Dell et al. 2015; Ram & Terry 2016; Finkl & Makowski 2022; Shadrack et al. 2020; Goberdhan & Kininmonth 2021), to the disaster preparedness' of nearby villages (Meheux et al. 2010), and insight of Naidiri's food security and some of the ecological benefits of the CBMPA (Pickering 2020; Salunkhe 2024). However, much remains to be understood about the cumulative social-ecological changes which have impacted Naidiri's marine SES over time, as well as the socio-cultural dimensions of Naidiri's CBMPA.

2.8 Knowledge gaps and research opportunities

Much has been written on the biophysical dimensions of MPAs globally (Hamilton et al. 2011; Hamilton et al. 2012; Mellin et al. 2016; Villaseñor-Derbez et al. 2023), in Fiji (Clements et al. 2012; Bonaldo et al. 2017) and along the Coral Coast (O'Garra 2012; Dell et al. 2015; Ram & Terry 2016; Finkl & Makowski 2022; Shadrack et al. 2020; Goberdhan & Kininmonth 2021). There is a growing body of scholarship investigating the socio-cultural dimensions of MPAs. As discussed previously in this literature review, this includes literature on MPA size and management (De Santo 2013; Harvey et al. 2017; Albers et al. 2020; Gill et al. 2023), costbenefit distributions of MPAs (Charles & Wilson 2009; Sowman & Sunde 2018; Gurney et al. 2021), adaptive MPA design and management (Harvey et al. 2017; Wilson et al. 2020; Hoppit et al. 2022), gender considerations in MPA design and management (Harper et al. 2013; Ram-Bidesi 2015; Kleiber et al. 2018; Rohe et al. 2018; Michalena et al. 2020; Lawless et al. 2021; Mangubhai et al. 2022; Purcell et al. 2024; Ruano-Chamorro et al. 2024), among others. In their review of scholarship on MPAs and human well-being, Rasheed (2020) highlights that while there is a growing body of literature on the socio-cultural dimensions of MPAs, most MPA studies continue to prioritize biological indicators to measure MPA success. Rasheed (2020) and

other authors (e.g. Bennett & Dearden 2014; Gurney et al. 2015; Diedrich et al. 2017; Smallhorn-West et al. 2020) call on the need for MPA assessments of effectiveness and equity that extend beyond biological indicators. Greater socio-cultural considerations are crucial to MPA success, as described by Gurney et al. (2015): "a key factor said to contribute to this lack of success is insufficient consideration of socioeconomic factors in planning and management". Other authors have identified gaps in existing literature when considering gender-specific assessments of MPAs (Kleiber et al. 2018), specifically as it pertains to women's participation in fisheries in the PIR (Michalena et al. 2020). Many authors have also highlighted the limited number of peer-reviewed studies on Indigenous governance and MPAs (Ban & Frid 2018; Rasheed 2020). For example, Ban & Frid's (2018) systematic literature review on the nexus of MPAs and Indigenous governance and management found only 15 publications on the topic, representing less than 0.5% of all MPA literature.

This research seeks to respond to these knowledge gaps by contributing to research on the socio-cultural dimensions of MPAs with considerations given to the gender dynamics of MPA decision-making processes and the role of Indigenous governance in MPA implementation and management in the PIR. It will do so through a case study of the coral reef assemblage and CBMPA in Naidiri village, Nadroga-Navosa, Fiji.

Chapter 3: Case Study

3.1 Background

The use of case studies is widely employed in scientific research and involves in-depth place-based research using real-life contexts to base a detailed examination (Ford et al. 2010). This case study was selected because of existing research relationships and expressed need by the Naidiri Youth Group. Naidiri is a coastal Fijian village of approximately 130 people (100% *iTaukei*) located on the southwest coast of Viti Levu in Nadroga-Navosa Province, Fiji (-18.125990 & -182.640409), as seen in Figure 3.1.



Figure 3.1 Some of the islands which make up Fiji's 330 plus islands include Viti Levu, where Naidiri is located on the southwest coast in the province of Nadroga-Navosa.

Fiji is located in the South Pacific Ocean and is defined as a SIDS. Fiji is an archipelago of over 330 islands, a land mass representing 18,333 km² with a population of 884, 887 (Fiji Bureau of Statistics 2018; Fiji Ministry of Economy 2021). The country's Exclusive Economic Zone is 70 times its landmass, at approximately 1.3 million km². This vast marine area is central to the livelihoods, traditions, culture, and art of Fijian people (Rowlands et al. 2005). The province of Nadroga-Navosa is located on the West coast of Fiji's largest island, Viti Levu. The province comprises 122 villages, many of which are coastal and located on the Coral Coast. The Coral Coast is the world's largest coral reef which is accessible from the mainland, extending 63 kilometres and up to 1,000 meters offshore. It is home to over 200 species of corals and approximately 1,200 marine fish species (Rowlands et al. 2005). This natural reef barrier provides a sheltered tidal lagoon and habitat for marine life to inhabit and for villagers to harvest.

Naidiri is comprised of approximately 24 households. Many of these house intergenerational families, often including nuclear families living with patrilineal relatives. Naidiri village is 300 meters east of Malomalo village, which is home to approximately 179 residents. A primary school and church located in Malomalo serves both villages, while Naidiri has its own community center. A tidal river separates the two villages, and people frequently walk through the stream to cross over. Public buses are the main transportation to and from Naidiri and pass three times a day. Taxis and private vehicles can access the village, but due to costs are infrequently used modes of transportation. Figure 3.2 shows some of the homes in Naidiri village, which include traditional *bures*⁷ as well as modern builds (Pearce et al. 2020). Figure 3.3 shows Naidiri village from the beachfront and the proximity of some of the homes to the ocean.

⁷ A *bure* is a traditional Fijian home structure made with natural materials and a thatched roof.



Figure 3.2 Homes in Naidiri village. The traditional *bure* house facing the village center is the household of the *turaga-ni-koro*⁸ (village headman).



Figure 3.3 View of Naidiri village homes on the beachfront, showing the proximity of the houses to the coastline.

The village structure in Naidiri is reflective of the traditional *iTaukei* Fijian structure. Fiji is

divided into 14 yasanas (provinces), each of which is governed by a provincial council. Each

⁸ *Turaga-ni-koro* is the village headman. Each *iTaukei* village is represented by a locally elected or appointed *turaga-ni-koro*, who plays a role in the day-to-day governing of the village.

yasana is further divided into *tikinas* (districts) which are composed of several *koros* (villages). These villages are typically made up of *mataqalis* (clans), which are often comprised of even smaller *tokatokas* (family groups). Families within a village have different responsibilities within the village governance system. For example, some families are the spokesman for the chief and are the primary line of communication between their community and the chief. Each village is represented by a local *turaga-ni-koro* (village headman) who is elected or appointed by the village and who receives a small government allowance for his work. Groups of *koros* (villages) can be part of a *Vanua*, which encompasses the people who inhabit these villages as well as the *qoliqoli* and *mataqali*⁹. The *Vanua* is governed by a hereditary chief who is the primary decision-maker for natural resources and their management. Once a chief has made a decision, it is considered to be final and to be respected by the communities of the *Vanua* (Vunidilo n.d.).

Naidiri is located in the *yasana* (province) of Nadroga-Navosa, which is further divided into 22 *tikinas* (districts), made up of 122 *koros* (villages). Naidiri is one of eight villages within the *tikina-Malomalo* (Malomalo subdistrict) which includes the neighbouring village of Malomalo, as well as the villages of Nalele, Batiri, Togobula, Sanasana, Vusama and Navisabasaba. Three of these villages, Naidiri, Malomalo and Nalele, are part of the same *Vanua*, called the *Vanua o Tabanivono-wai*, and as such, they share access to the *qoliqoli* (traditional fishing grounds) and *mataqali* (land). The chief in Malomalo is the chief of the entire *Vanua o Tabanivono-wai* and is the ultimate decision-maker governing the three villages' natural resources and their management, which includes the *qoliqoli*. Naidiri's *iTaukei* governance structure and hierarchy is represented visually in Figure 3.4.

⁹ *Mataqali* means clan, or landholding unit. Each *iTaukei* individual is born into a *tokatoka* (family group), several of which make up one *mataqali* and its associated terrestrial land.



Figure 3.4 The Naidiri *iTaukei* governance structure from the provincial to the village level.

Though access to the *qoliqoli* is shared, the three villages typically fish and interact with the reef within their own village boundaries. The same is true for the shared *mataqali* (traditional land), which has been sub-divided and which is used for farming vegetable and fruit crops, as well as to

raise livestock such as cows and pigs. Naidiri's *mataqali* is located approximately 2 km east of the village. A study in Naidiri village conducted by Pickering (2020) found that 92% of participants harvested food from the sea, and 88% from their farms. Seafood is harvested by both women and men for household consumption and, at times, to contribute to household income (Pickering 2020).

3.2 Legal and customary governance of the Fijian qoliqoli

Natural resources in Fiji are governed by a dual system, reflecting the country's plural legal system. Prior to colonization by the British in 1874, iTaukei communities held marine tenure communally. These property rights were exclusive, governing lagoons, reefs, and mangroves. The British sought to impose a British property governance system over land and marine tenure. This was contested by chiefs in Fiji, who explained how land, reefs, and fishing rights were communal property, and as such, no individual could cede it over (Sloan & Chand 2016). As described by Sloan & Chand (2016), "the *iTaukei* traditionally viewed the concepts of self as one that was deeply intrinsic to the land and sea and together this concept was called 'Vanua'. The Vanua symbolizes a traditional belief in an intrinsic connection that the people have with their environment and in this, the land and sea are considered together to form part of this definition." It was eventually decided that resources would be held under British rule, which would uphold iTaukei customs and traditions. Today, iTaukei communities hold customary marine tenure and possess common property rights of inshore fisheries, and *iTaueki* communities have exclusive rights to harvest fish and may also possess management rights, as they have for millennia. However, the State retains the power to alter property allocation and rights, resource use, and legislation. As such, neither *iTaukei* communities nor the State hold all rights over the *goligoli* (Sloan & Chand 2016).

Land and resource rights are further complicated by the inhabitation of the islands of Fiji by approximately 43% of Indo-Fijian individuals, descendants of the Indian indentured laborers who were brought over by the British during colonization to work the sugarcane plantations. iTaukei Fijians communally hold approximately 87% of land, limiting Indo-Fijians access to land and fishing rights. Land and marine tenure continue to be an area of political controversy and tension since independence from British rule in 1970, and Fiji has experienced numerous government coups and instability as a result. Since 1987, there have been four government coups d'état, the most recent of which occurred in 2006, led by Bainimarama of the FijiFirst party (Lal 2009; Lal 2012). During his time in power, Bainimarama implemented legislative reforms which ultimately weakened iTaukei's rights to goligoli governance. This included the introduction of the Regulation of Surfing Areas Decree 2010, which limited goligoli rights more generally. Prior to the decree, traditional rights holders could charge surfers for reef access on the basis of their customary governance. The new decree vested ownership rights to the State over any surfing area, defined as "reefs or other foreshore or offshore areas ... together with any surrounding areas ... used ... for any water sport" (Latu 2024). Bainimarama also disbanded The Great Council of Chiefs, an advisory board to the Prime Minister concerning the good government of and well-being of *iTaukei*. The December 2022 democratic election in Fiji resulted in a new government party taking power, a coalition government led by Sitiveni Rabuka, and has already resulted in changes made to *qoliqoli* legislation (Norton & Varani 2023). Constitutional arrangements saw the restoring of the Great Council of Chiefs, as well as a review of the Surfing Areas Decree 2010 and other legislative reforms and proposals to enhance customary and traditional modes of governance (Latu 2024).

3.3 Naidiri's CBMPA

As is common in many villages across Fiji, Naidiri has several village-scaled committees that meet and engage in different issues. This includes a Women's Group¹⁰, a Church Group, and the village Youth Group¹¹. The Youth Group was initiated in 2007 for members ranging from 13 to 35 years of age to manage Naidiri's CBMPA. The CBMPA is often referred to as the $tabu^{12}$ by community members in Naidiri. While the two terms (CBMPA and *tabu*) are often used interchangeably, the term CBMPA will be used throughout the following chapters, with the exception of direct quotations by community members. The CBMPA in Naidiri is now managed collaboratively with the Ministry of Fisheries and the Nadroga-Navosa Provincial Council (NNPC). Youth Group members meet every two weeks to discuss ongoing and future projects. Since the initiation of the CBMPA, the Youth Group has implemented several different coral planting initiatives and have begun hosting tourist visitations to their reef, generating income for their group and the wider Naidiri community. Since 2019, they have been working in partnership with the non-profit Corals for Conservation and its founder and director, Dr. Austin Bowden-Kerby, to plant corals within the CBMPA. Dr. Bowden-Kerby's approach to coral planting applies a 'Reefs of Hope' paradigm which prioritizes the restoration of coral species that indicate the ability to withstand increased water temperatures. Coral fragments from known and predicted heat-resistant species are mounted onto A-framed structures (called A-frames) built from metal wiring. This aims to create dense coral patches which provide immediate fish habitat, therefore

¹⁰ The Women's Group is part of a national association in Fiji funded by the Women's Fund Fiji.

¹¹ The Youth Group is a registered club with Fiji's Ministry of Youth and Sports. Youth clubs are intended to empower young people to engage in leadership and skill building opportunities while supporting socio-economic initiatives in their communities (Ministry of Youth and Sports 2020).

¹² *Tabu* means 'no-take', often used to refer to a section of the marine seascape within which restrictions are imposed for marine resource extraction (e.g. no fishing).

aiming to promote additional food security for the communities who manage the CBMPAs and its A-frames (Bowden-Kerby 2023; Corals for Conservation 2023). On February 2nd 2022 on World Wetlands Day, Fiji's Ministry of Environment declared Naidiri's CBMPA as a Marine Biodiversity Park (Deo 2022; Reddy 2022). As of September 2023, the village Youth Group launched a website to increase ecotourism engagement and tourist visitations to their CBMPA (Naidiri Marine Biodiversity Park 2023).

Chapter 4: Methods

4.1 Research approach

The founding conceptual framework for this research was Community-Based Participatory Research (CBPR), a collaborative method of research which provides equity and power sharing between the researcher and community. As defined by Eriksen et al. (2021), the principles of CBPR include building and maintaining relationships between communities and researchers, establishing reciprocity and trust amongst communities and researchers, and empowering communities to conduct research important to them and through culturally relevant ways. As such, adhering to and respecting cultural traditions and building trust and collaboration between myself and the village was of uttermost importance throughout the duration of the project. All stages of the research were undertaken with representatives from Naidiri village and in partnership with the NNPC. This included: problem identification, structuring the research question, data collection, data analysis, preliminary findings check, write-up, and dissemination of results. Communication was achieved through weekly messaging, phone calls, and, when possible, in-person interactions within Naidiri village. As described by Collins et al. (2018), true community engagement in CBPR is an ongoing and iterative process. As such, transparent and effective communication with the community of Naidiri was not only prioritized during the research period, but also prior to its commencement and after data collection was completed.

This research was conducted at the request of Naidiri village, building on my supervisor Dr. Tristan Pearce's long-term relationship with the village and the NNPC. Initial conversations surrounding Naidiri's desire for collaborative research investigating cumulative environmental changes to their coral reef ecosystem began in 2015. Dr. Pearce's ongoing communication with Naidiri throughout the eight years following this initial conversation and leading up to this

project provided critical insight into the ways in which Naidiri village and their Youth Group wished to partner on the research. Dr. Pearce visited Naidiri in April 2023 to finalize the research question, discuss how the remainder of the research should proceed, and coordinate logistics for the data collection period. Following his return, a Fiji Research Permit was acquired through the Ministry of Education, Heritage & Arts with support from *iTaukei* Affairs as well as the NNPC. This project was accepted as part of a larger research endeavour titled COVID Observatories, which brought together researchers investigating the impacts of the COVID-19 pandemic on Indigenous communities around the world. The COVID Observatories was funded from 2020 to 2022, after which its collaborators partnered on a new initiative titled the Indigenous Peoples Observatory Network (IPON). IPON aims to better understand the nexus of the impacts of climate change on food security and Indigenous communities around the world. This research project was amalgamated as part of the IPON initiative starting in May 2024. Study protocols were also approved by the University of Northern British Columbia's Research Ethics Board and the Tri-Council Policy Statement (TCPS)¹³, which are responsible for reviewing research activities prior to their commencement and ensuring compliance with all requirements (see Appendix 1) (TCPS 2022).

There is a global movement to decolonize research methodologies when conducting research with Indigenous peoples (Smith 2021). As highlighted by Smith (2021), the use of the term indigenous is problematic as it collectivizes highly distinctive groups in varying geographic regions. Research employed when working with Indigenous peoples must therefore account for distinctive methodologies, protocols, and practices. As this research works with *iTaukei* Fijians in the PIR, it was integral to frame this research in Pacific research methodologies. As described

¹³ The Tri-Council Policy Statement (TCPS) is instrumental in conducting ethical research involving humans. It can be accessed here: https://ethics.gc.ca/eng/documents/tcps2-2022-en.pdf

by Naepi (2019) "Pacific research methodologies are an act of decolonial resistance that recognizes the legitimacy of Pacific ontologies and epistemologies, enabling research that is truly reflective of Pacific peoples." This allows Pacific people to engage in research methodologies that recognize their knowledge systems, identities, and experiences. With these considerations in mind, this research was guided by the Fijian Vanua Research Framework (FVRF) developed by *iTaukei* academic Nabobo-Baba (2006; 2008). The framework recognizes that Fijians have been passing down knowledge for millennia through various forms, including stories, paintings, art, songs, poems, and others. It was created to recognize Fijian knowledge, worldviews, philosophies, and culture. This framework ensures that *iTaukei* are not subjected to research being conducted but rather are part of the decision-making processes, methods, and principles chosen for the research. The framework outlines eight primary guiding principles to working ethically, equitably, and to produce locally relevant research specific to *iTaukei* people. This methodological approach is structured to guide the research to be both collaborative and grounded in *iTaukei* knowledge and worldviews. It also outlines nine Steps to Vanua Research (Nabobo-Baba 2006; 2008). These eight guiding principles and the nine steps and how they have guided the research are described in detail and attached as Appendix 2. These guiding principles are aligned with the principles of CBPR, which aims to build relationships between communities and the researchers, honor reciprocity and trust, and conduct culturally relevant research which works to empower communities (Eriksen et al. 2021).

4.2. Data collection

Data were collected¹⁴ during a 6-week period between May and June 2023. Mixed-methods data-collection techniques were used, employing data triangulation to identify convergence and increase the accuracy of findings (Johnson et al. 2020b). The methods applied included semi-structured interviews using open-ended questions (n=24) conducted as *talanoa*¹⁵ discussions, participant observations and the use of secondary sources (published research, government documents, and climate data).

A set of three sampling techniques were used to recruit respondents. Key informants (village headman, local research partner) sampling was first employed, which assisted in identifying who else should be spoken with. This snowball sampling technique primarily led to identifying long-term residents of Naidiri who frequently fished and were likely knowledgeable of the historical environmental and social change processes that had impacted the coral reef ecosystem. As representation was necessary for understanding asymmetric vulnerabilities shaped by power relationships, quota sampling was used to achieve equal representation of respondents according to gender and age (Table 4.1) (Johnson et al. 2020b). In accordance with Johnson et al. (2020b) review of achieving rigour in qualitative research, the sample size was determined once a point of saturation was reached. Saturation is considered once no new information, or no new themes, are emerging from data collection (Johnson et al. 2020b). In total, 24 semi-structured interviews were conducted. An additional 3 interviews were conducted with external participants who were selected due to their long-term relationships with Naidiri and their insight into environmental and

¹⁴ It is important to note that 'data' in this case includes stories, conversations, and sharing of *iTaukei* worldviews, beliefs, and practices. The term 'collected' does little to convey the reciprocity of these ongoing *talanoa* discussions.

¹⁵ *Talanoa* is a traditional Fijian conversational structure which can be applied to conduct interviews. During *talanoa*, stories are shared, as well as insights into local realities and aspirations. This allows for authentic and multi-directional sharing of information.

social change processes. The 3 interviews with external participants were not included in the analysis of semi-structured interviews, though they were used to contextualize results.

4.2.1 Ethical considerations

Important ethical considerations for this research were followed to ensure free, voluntary, and informed consent as a continuous process throughout the research (Johnson et al. 2020b; Pope & Mays 2020; TCPS 2022). This was achieved by informing the entire community of Naidiri of the intent of the research project during the *sevusevu¹⁶* held prior to beginning interviews, acquiring verbal consent before all interviews, confirming each interview participant's chosen degree of anonymity in the research, and member checking upon my second visit to Naidiri (more on this in '4.4. Dissemination of results'). The TCPS (2022) specifies the importance of documented consent as part of the research process. The policy expands on what constitutes 'documentation', specifying that this extends beyond written documentation: "In some types of research, and for some groups or individuals, written signed consent may be perceived as an attempt to legalize or formalize the consent process and therefore may be interpreted by the participant as a lack of trust on the part of the researcher. In these cases, oral consent, a verbal agreement or a handshake may be required, rather than signing a consent form. In some cultures, the exchange of gifts symbolizes the establishment of a relationship comparable to consent." (TCPS 2022). With this in mind, verbal consent was chosen in accordance with Nabobo-Baba (2006) in conducting research with *iTaukei* communities. A written consent form (Appendix 3) was created for those interested in having a copy of the agreement and provided the structure for verbally reviewing the details of the agreement. For

¹⁶ A *sevusevu* is a traditional Fijian ceremony which occurs when visitors arrive at a village. Kava is gifted to the *turagao-ni-koro* by the guests and a kava drinking ceremony is held with the village, the *turagao-ni-koro*, and the visitors.

example, all interview participants were asked if they were comfortable with being audio recorded, if they wanted their full names (surname and given name) and ages used in association with the project, and if they consented to the use of direct quotations being used within publications and/or research findings. As consent is an iterative process throughout the entire duration of the research project (Pope & Mays 2020), verbal consent for the use of participant interview data and chosen degrees of anonymity were re-confirmed with all interview participants during dissemination in June 2024.

Age cohort	Male	Fema	ale <i>iTa</i>	ukei
18-24	1	0	1	
25-34	2	2	4	
35-44	4	3	7	
45-54	2	6	8	
55-64	2	0	2	
65-74	0	0	0	
75+	1	1	2	
Total	12	12	24	

Table 4.1 Demographic characteristics of interview participants

As demonstrated by McCubbin et al. (2015), interviews were conducted in a way which does not precondition responses and does not prompt climatic factors. Doing so enabled individual identification of environmental changes to be situated within other socioeconomic and cultural changes (McCubbin et al. 2015). An interview guide provided the framework for thematically grouped open-ended questions (Appendix 4). For example, open-ended questions included prompts such as "what changes have you seen on the reef?" Posing questions in such a way allowed participants to discuss positive and/or negative environmental changes observed over time and opened the conversation for discussing the social change processes which may have enabled such changes (Table 4.2).

Themes	Example questions		
Background information	How long have you lived in Naidiri? Do you live in		
	this house? Do you have children?		
Relationship to the reef	Do you fish or collect other marine species? How		
	often? For what purpose (consumption, sharing, sell at		
	market)? How is the reef important?		
Environmental and social changes observed	What does a healthy reef look like? Is the Naidiri reef		
	healthy? What changes have you seen on the reef?		
	What caused these changes? How have these changes		
	affected how you use the reef?		
Perceptions of CBMPA and strategies to cope	Can you tell me about the CBMPA? When was it		
	created? Why was it created? What did you think when		
	they created it? What do you think of it now? How is		
	the CBMPA managed? Are there other ways changes		
	were addressed?		

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Table 4.2 Themes	guiung	iaianoa	uiscussions	and examp	ne questions	ashcu

In keeping with the Fijian *Vanua* Research Framework, interviews were conducted as *talanoa*-style discussions, a Fijian interview method in which stories are shared, as well as insight into local realities and aspirations. This allows for an authentic sharing of information to occur (Nabobo-Baba 2006; Pearce et al. 2017; Pearce et al. 2020). Interview participants could choose to speak in Fijian or English. This was made feasible due to the presence of my research partner, who was present at all interviews conducted with Naidiri community members and who is fluent in both languages. If an interview was conducted in Fijian, it was translated in real time. If an interview was audio recorded, it was later transcribed and verified by the local research partner. All interviews conducted with Naidiri community members were audio recorded, and all quotes included in 'Chapter 5: Results' are verbatim from these interview recordings. To ensure participants felt comfortable throughout the interview process, they were asked to choose the location of their interviews. Most interviews were conducted in participants' homes, while others over shared meals, at community workshops, or even in their place of work. Most interviews occurred in small groupings of 2-3 people.

I recorded participant observations during my stay in Naidiri using a field diary and voice recordings to record daily observations. This reflexive method allowed for documenting thoughts and ideas about the research process, observations, maps, as well as my personal emotions experienced throughout the process (Hay & Cope 2021). Participant observations and secondary sources were then used to contextualize interview findings.

4.2.2 Local research partner

My local research partner, Vasenai Lewanivunawi, was instrumental in completing the data collection for this research. Vasenai is highly involved in the community, a member of both the Women's Group and the Youth Group. These connections were important to establishing my own relationships with members of Naidiri during my stay. Vasenai provided me with important information regarding gender norms, gender-specific traditions, and ways of being in an *iTaukei* village. For example, women in the village traditionally wear a long sulu¹⁷, wrapped around their waist which goes to their ankles. Women typically cover their shoulders and do not wear clothing that is too tight or revealing. It is also important that women do not put anything on their backs and shoulders, such as bag straps or produce bags. Following traditional village customs is intended to demonstrate respect. During my time in Fiji, I made sure to follow these local protocols. Vasenai's insight and assistance were instrumental in navigating the gendered aspects of this research. It also provided me with the opportunity to join her as she went about her everyday tasks, often overlapping with those of other women in the village. This allowed me to create stronger connections with participants and provided opportunities for ongoing conversations to be shared.

¹⁷ A *sulu* is a traditional Fijian skirt worn by *iTaukei* women.

4.3 Data analysis

The software NVivo was used in order to conduct a thematic content analysis. This process involved uploading all written transcripts and reading through them to identify main themes. Once a topic of interest was identified (e.g. the historical use of *duva*¹⁸), a code was created (e.g. fishing practices), and the corresponding section of the interview was placed within that code. This process was repeated for all transcripts. Once all interviews were analyzed and coded, each code was read through, and the main themes identified (e.g. fishing practices have changed over time). The findings of this data analysis process are written in the following chapter.

4.4 Dissemination of results

Once 'Chapter 5: Results' was written, I had the opportunity to return to Naidiri for twoweeks and share my research findings with the community. This was done to ensure the accuracy of findings prior to commencing the writing of 'Chapter 6: Discussion' and 'Chapter 7: Conclusion' and to ensure community members felt accurately represented and their voices heard throughout the research process. Research booklets were created and distributed among community members. The contents of the booklets were reviewed in depth during a meeting with the Naidiri Youth group, as well as during visits to many of the interview participants. These booklets aimed to achieve three primary objectives:

- tell the story of Naidiri and their CBMPA;
- share research findings through accessible methods; and
- discuss the communities' future goals and objectives for their marine SES.

¹⁸ Duva (*Derrie trifoliata*) is a herbal medicinal plant once commonly used in the PIR to fish. The roots of the plant were pounded and then put in the ocean, where the toxins would seep out and kill nearby fish. The fish would then be collected and eaten by community members.

These objectives were identified following conversations with community members who highlighted the importance of telling their story in the hopes of inspiring other communities in Fiji to engage in marine conservation efforts. The target audience for these booklets was the general public, tourists, government agencies (e.g. the Ministry of Fisheries), and other coastal *iTaukei* communities. The information shared was succinct, used simple language, and numerous graphics were created to communicate research findings through visual means. With the help of two community members, Vasenai and Manoa, we were able to translate the written contents of the booklets into Fijian. A Fijian version of the booklets has since also been created.

I received some excellent feedback from the community on the booklets, which has been implemented. The final version of the booklets will be shared with Naidiri when I return in April 2025. I believe it is important to highlight some of the main points raised:

- more images showing community members, especially members of the Youth Group; and
- update the 'Coral Reef Restoration' graphic to include initiatives implemented following my first visit to Naidiri (between July 2023 – June 2024).

I share these in order to highlight two things: the importance that community members not only hear themselves reflected in the work, but also, when possible, *see* themselves, and; how quickly things can change within a year's time.

The final English version of the research booklet is attached as Appendix 5.

4.5 Research limitations

There are some research limitations worthwhile noting. As I am not *iTaukei*, this limited my ability to comprehend the worldviews which framed community perceptions of relationships with the reef and how these have changed over time. Further, as I do not speak the Nadroga-Navosa Fijian dialect, this required me to rely on my research partner during *talanoa*. This poses

the risk of subjective interpretations and biases to filter into the information being exchanged. Another notable research limitation is the prevalence of gender roles as it relates to marine resource extraction in Naidiri. As a woman, I was not privy to all conversation topics, in particular with some of the men. The information which transpired during *talanoa* discussions with these men is likely different than if the research was conducted by a male researcher, and if I was *iTaukei*. These limitations were addressed by working closely with my research partner, living in the community on two separate visits and, at times, having some of the men from the chiefly advisory lineage be present during interviews. Naidiri follows a customary *iTaukei* chiefly structure, with the patrilineage family line of the Lewanivunawi family considered to be advisors to the chief. This makes them a well-respected family in the village. In noting the limitations of me being a none-*iTaukei* female researcher, my research partner Vasenai Lewanivunawi would at times seek out the support from her father and brother for *talanoa* with men in the village.

Chapter 5: Results

This chapter presents the findings from the analysis of interview data coupled with insights from field observations and secondary sources, when appropriate. The chapter is divided into three main themes consistent with the research objectives. These are: *iTaukei* relationships to the coral reef, cumulative impacts of change in the marine SES, and the implementation of a CBMPA.

5.1 Relationship with the reef

The coral reef ecosystem is central to the everyday lives of *iTaukei* community members in Naidiri. How people interact, perceive, and place value on the reef is guided by their worldview, gender, economics, and subsistence. Some of these relationships have, and continue, to evolve in response to changing social and environmental conditions. This section presents the results which arose through *talanoa* with community members describing their relationships to the coral reef ecosystem.

5.1.1 Subsistence and cultural relationship

Traditionally, the reef in Naidiri was used for subsistence. A variety of marine resources were harvested for consumption (e.g. different fish identified as important protein sources, octopus, invertebrates, sea grapes). Diets were predominantly composed of marine resources, coupled with agricultural crops (e.g. root crops such as taro, mangos) and livestock farming (e.g. poultry, beef). As customary in *iTaukei* villages, individuals would typically take only what they needed from the sea to feed themselves and their families. Anything remaining was distributed to other community members. This practice of strong community support and sharing was instrumental in ensuring the prosperity of all individuals within a community during times of

seasonal shortages. As discussed by Friedlander (2018), access to the reef and harvesting marine resources was managed through chieftainships based on patrilineal inheritance and required certain cultural protocols to be followed. The ways in which access to the sea is granted has changed over the last century. Aporosa Duwai (male, 47yrs), the village headman, described how any form of fishing and interaction with the sea used to require permission from ancestors who protected marine life. Today, access to the sea is much more open, including to those who live outside of the village.

"It's different than the old days. The ancestors would really protect the marine life. Before, when someone would ask to use the sea they would have to go through a process. They have to ask the ancestors and most they would say no. Now it's just they go anyhow, they just go and use the sea. Today, even the people from outside who want to come and do the sea urchin, they just go. Not like before where they come and ask. No respect, they just go. Before they have manners, they come and have respect. They come and ask. It's like today its depleting. People from other villages would come and ask permission from *qoliqoli* owners. Today they just go. Because the old government, they just give the right to everyone to go out to the sea. Because they want to rule over the fishing ground too, and so they give the right to everyone to just go."

Aporosa described how today, even people from outside of the village who do not have traditional rights to the *qoliqoli* are able to take marine resources from the sea. He discussed how this is tied to the previous Central government, which changed fishing regulations and access to move away from *iTaukei* rights and grant more access to the general public. This is reflected in the review by Latu (2024) of the previously elected FijiFirst government's reform of institutional arrangements which ultimately weakened the legal recognition of *iTaukei* governance over their *qoliqoli* and reinforcing the rights of the State. During the time of this discussion (May 2023), the new coalition government had recently come to power (December 2022).

Tevita Natoga (male, 61yrs) discussed how relationships to the sea have also changed due to the increase of tourists.

"Before some tourist when they come they use bikinis to go swimming. Some of the Fijians see them, they say don't. We have to wear clothes, go to the sea because something in the sea."

Tevita shared how going into the ocean used to require certain protocols to be followed. Clothing had to be appropriate to respect what is in the ocean. For example, it is customary that women's legs, knees and shoulders are covered, while the head must remain bare. Vasenai Lewanivunawi (female, 28yrs) elaborated on this, discussing how the practice of displaying respect through how one presents themselves was also practiced widely within the village.

"Because Fijian way most things you have to respect. Way of dressing. Before, it was really strict in the village. Every people who come to the village with long hair, even mine, it's *tabu* [not allowed]. It's not good for you to tie or for you to have long hair. You have to cut as Fiji boy. Short. That's the traditional way. [Now] it's open. Westernization has gone through the village. Some of the old ladies they have long hair today. Before it was very strict."

Vasenai explained how customary *iTaukei* practices required clothing to be appropriate and hair for all people to be kept short in length and not be tied up. This was intended to show respect. The shift away from such practices is connected to the increasing influence of Western societies throughout Fiji.

There is an element of sacrality when discussing the *qoliqoli* and the marine seascape. Tevita mentioned this when talking about their fishing ground. "Fishing ground all over Fiji is a sacred place to all [*iTaukei*] Fijians." Traditional fishing grounds and the sea at large are often referred to as sacred to *iTaukei* Fijians. Changes to the ways in which the sea is interacted with, especially within their own *qoliqoli*, therefore raises concerns amongst some community members. As described by Loata Nailumu (female, 49yrs), the sea can recognize such changes and respond.

"Some people say if you keep on doing the [harvesting of] sea urchin everyday, the weather will be bad. The waves will be bad. Maybe the sea urchin make the waves bad. Because this period of time, this year starting in January, people are doing sea urchin everyday. Maybe that's the reason why many bad tides. Tidal waves. The things in the sea they are related to each other. If something comes away, this one angry. It's like people. If you keep taking the sea urchin everyday, the sea waves will get angry."

Loata discussed the seasonal harvesting of sea urchin which begins in January in the village, and how overharvesting may be what is evoking the rough waters and changes in tides being experienced. She described the interconnectedness of marine life and how changes to one will subsequently result in a change/response throughout the system. Reference to the waves and sea as a sentient being was also echoed by other community members.

"The history, it's like there's one rock. This rock is planted. This rock is in Sanasana. If you hit that rock, there will be big waves. Before when someone is fishing around at nighttime and hit that rock, there will be big waves. That rock is like the source of big waves. Before when they have big waves, they know someone hit the rock. Today, no. Maybe there's plenty tourist where the rock is. Intercontinental Resort. The rock is where Intercontinental Resort is. Maybe most tourist come, they don't know the use of the rock and they're hitting it. Doing lots of things on the rock, maybe." – Taraiviri Masarau Duwai (male, 51yrs)

Taraiviri mentioned the presence of a rock situated in the ocean nearby the coastal community of

Sanasana, which is in the same *tikina*¹⁹ as Naidiri. Before, if this rock was hit, it would trigger a

response from the ocean in the form of big waves. However, today due to the presence of the

Intercontinental Resort and subsequent increased presence of tourists in the region, this is no

longer occurring. Tevita (61yrs) also discussed how the ocean responds to photos being taken.

"Yes. The flash of the – when you take photo, the wave knows it too. When you take photo, just by the flash they know something is happening. They'll come in cruel, rude. That's why you have big waves, strong waves. You shouldn't take photos on the beach. The waves they have eyes too. If the flash goes, they know. When they take photos of the waves, the waves get angry and becomes bigger."

Tevita shared the importance of ensuring there is no flash when photographing the sea. This is

necessary to be respectful and not evoke an angry response. He went on to share stories of

¹⁹ Tikina is a district, made up of several koros (villages). A yasana (province) is made up of multiple tikina's.
tourists who took underwater photographs of marine life, only to be attacked by the wildlife they were photographing.

5.1.2 Gendered relationship

The ways in which people in Naidiri interact with the coral reef ecosystem are largely gender-based. Most men and women interviewed go out to the sea every day, so long as the waves that day are not too rough. Many have learnt to fish as early as primary school, with their parents (most often their mothers) taking them out to the sea and showing them how to fish, catch octopus, and harvest other forms of marine life. As is the cultural norm in Fiji, women will typically move to their husband's villages once they are married. Because of this, some of the women who were previously from non-coastal villages (e.g. the interior of Fiji, bigger cities such as Sigatoka) who are now living in Naidiri had to learn coastal reef fishing techniques once they relocated. It is common for women in the village to participate in reef gleaning, catching octopus, handline fishing, and harvesting edible seaweeds and different shellfish (e.g. sea urchins, trochus). Of the 11 women who participated in semi-structured interviews, 10 reported catching octopus. The best location to harvest octopus is reported to be just in front of the village at low tide,, where the CBMPA is now situated. The women use a long metal spear to catch the octopus and are very knowledgeable on methods to find them. Varanisese (83yrs) describes some of the tricks used. "We usually look for the eyes of the octopus. Due to the body change but we can still see the eyes." As octopuses can change colours to blend in with their surroundings, Varanisese and other women have learnt to identify the inconspicuous signs of where they are, including locating their eyes. Another strategy discussed by the women in the village is to look for the build-up of small rocks. Octopuses nest in hollowed-out rock sections and will typically conceal themselves using many small rocks to hide the opening. In spotting these, the women

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can use their spears to 'poke' at the openings, forcing the octopus from its hiding spot. This is practiced when the tide is low. These specialized skills and knowledge of octopus behavior and habitat have been passed down from one generation of women to the next (Ram-Bidesi 2015). Figure 5.1 shows a women hunting octopus with her two children at low tide.



Figure 5.1 A woman goes out during low tide with her two children to catch octopus. She holds a metal spear in her left hand and a bag for the octopus over her right shoulder.

Some women also discussed how traditionally, women participated in basket and mat weaving using pandanus leaves. However, this practice is now only practiced by some of the older women in the community (see Figure 5.2 and 5.3), and concerns were raised about the passing down of knowledge to the next generation. Varanisese is the eldest member of Naidiri village at 83 years old and makes baskets and mats daily as a source of income. "The basket for \$10. Orders, people order and then I use the coconut leaves to make the basket and the fans and then make them." The leaves from coconut trees are harvested, dried out in the sun, and then cut up into long, thin strips, 1-2cm wide. These are then weaved together to make the artisanal mats and baskets. As discussed by Scanlan (2008), the skill of pandanus-leaf weaving of mats and baskets is traditionally practiced by women and passed down over generations. In Naidiri, this diminishing practice has contributed to an increased reliance by the women in the village to harvest and sell marine resources for income.



Figure 5.2 Varanisese making a basket using coconut leaves. Once made, these were laid out in the sun to be dried.



Figure 5.3 Liti prepares the dried coconut leaves into thin strips. These were later used to make a new mat for their family home.

The men in Naidiri village often fish using spear guns and gill nets during high tide. Spear gun fishing is typically done at night and can be done inside the reef or out in the open ocean. As some fish species are diurnal, fishing at night while the fish sleep can make it easier to spear the immobile fish. Men will most often harvest finfish, though some will also hunt sharks and turtles in the ocean beyond the reef. It is common for men in Naidiri to go out in groups for long periods of time out in the open ocean to spearfish. Gill nets are used in the shallower regions of the reef. Gillnets are a wall of netting that hangs vertically, attached to a line on which are spaced-out floaters (see Figure 5.4). This method requires the use of two or more people, with each holding an end of the gill and dragging it through the water to catch nearby fish.



Figure 5.4 Rupeni standing in the shallow reef with his gill net. Small red floaters attached to the gill net can be seen floating to his left.

5.1.3 Economic relationship

An important consideration in investigating Naidiri community member's relationship to their coral reef ecosystem is the economic dimensions. It is common in the village for an individual to go out and fish and share their catch with their extended families and neighbors. The same is true for what is farmed. If more fish or cassava (common root crop farmed) is gathered than needed, community members will share this with others, without requesting anything in return. Participants who engage in fishing and the extraction of marine life from the sea will often do so for their own subsistence, as well as that of their wider community. It is also common for individuals to fish and extract marine life for economic reasons, however as described by Aporosa (47yrs), this was not always a common practice.

"Before our ancestors don't sell anything in the sea. They just use it for consumption. Before they don't sell octopus, or fish. They just have it as a family and eat it. The big reason today why the depletion of the sea start, mainly is money. People think of money and sell everything. Before they just use if for their home needs. Before they didn't have big stores." Relationships to the sea used to be practiced for subsistence, which consisted of not taking more than required. While subsistence relationships are still prevalent in the village, the majority of community members now also partake in fishing or harvesting other marine resources with the intent of selling to middlemen buyers, nearby hotels, companies, and/or local markets. Aporosa connects this shift to the increased presence of stores throughout the country, and the desire for money to purchase goods and services from these businesses. He further links this shift to the depletion of marine species. Vasenai (28yrs) expands on this idea.

"It's like before they used it as a sacred place. Just take a bit from the sea, just enough for everybody. Today when the sack is full then we bring another sack, another sack."

Vasenai remarks on the overexploiting of marine resources for profit, referring to the use of large canvas bags when women and men go out to the sea. Marine life that is caught is placed in the bag, and once a bag is filled, a new bag is brought. This is widely practiced for the selling of sea cucumbers and sea urchins, which are not commonly consumed in the village but are widely sold. Catching and processing of sea urchins is practiced by some community members and sold to middlemen buyers for profit (see Figure 5.5). Rufina (37yrs) describes some of the details of the arrangements established amongst community members in Naidiri for selling certain marine species.

"We sell white and brown. There's a company too, Chinese company too, because they eat that. Sea cucumber, crown-of-thorns. They sell it too. Maybe \$5 or \$10, bucket full."

Rufina details the sale of sea cucumber to a local buyer. A full bucket of the sea cucumbers can be sold for FJ \$5-\$10. It is common for community members in Naidiri to have informal arrangements set up with middleman buyers to regularly (weekly/bi-weekly) purchase certain marine species. As highlighted by Dacks et al. (2018), the role of middlemen buyers as drivers of fisheries catch is largely overlooked. In Naidiri, it is evident that arrangements with middleman buyers are a contributing factor to the depletion of marine resources.



Figure 5.5 Sea urchins are processed after being harvested from the ocean. These will be sold to a middlemen buyer.

5.2 Cumulative impacts on the marine SES

The marine SES in Naidiri has experienced numerous and varied changes over time as observed by community members. These cumulative impacts have occurred across temporal scales within the boundaries of the Naidiri coral reef ecosystem.

5.2.1 Timeline of change

One of the most discussed changes observed within the sea over time was changes to marine life. These observations were mostly regarding changes in fish: size, abundance, and species diversity; coral: abundance and species diversity; octopi: abundance and size and; the abundance and presence of certain invertebrates, including lobsters, giant clams, sea urchins, and sea cucumbers.

Observed changes to marine life within the geographic boundaries of the Naidiri *qoliqoli* fluctuated over time. Community members often referred to these changes as occurring across a timeline, in which three distinct periods with corresponding marine life fluctuations can be distinguished. This timeline is best described by Tevita (61yrs).

"Before there was big, big fish. After that, in between, they were coming to small size. Today, when the *tabu* is there, then the small fish are getting bigger but not yet the ones they used to see. That's when getting bad. Now it's getting better because of the *tabu*. Before before, in 1977, to during the 2000. In between [is] when they haven't created the *tabu*. 1977 was the plenty. 1995 the size of the fish getting smaller. Before it was big and plenty."

Tevita describes three distinct time periods. From the 1970s to 1990s, the reef was full of fish, of various species which were generally large in size. The second time period is from 1990s to when the CBMPA was implemented in 2007. During this time, a significant decline in fish sizes, species, and abundance was observed. The third time period is from 2007 to the present (2023), which observed increases in fish sizes, abundance, and species diversity, though these have not reached the same levels as within the first time period described. These improvements are attributed to the presence of the CBMPA. The timeline with three distinct time periods was mentioned by other community members, such as Loata (49yrs).

"Before it was very healthy. In between then and now, it's coming back. It's not there, but it's coming back."

The concept that the reef is slowly returning to the state it was in around the 1970s is a sentiment shared by other community members. This is defined as seeing the return of fish species once common in the reef. Certain community members, such as Sam (30yrs), identified exact fish species which he observed returning to the reef:

"These are the fish. Humpback snapper, a few fish we had were lost in this area. Now we've seen they are coming back again. Many kinds. This yellow emperor, all the emperors. And this one, the Pacific Longnose parrot fish, amber parrot fish. Spotted parrot fish. We only have the surf parrot fish. We don't have the others anymore, but they start to come back in the *tabu*. This one, vermiculated spinefoot. This one here, the yellowfin surgeon fish. We hardly see them here. Now we have them back. This big fish [barracuda], we hardly see them before. That time, they used to have big schools of fish that they used to catch. Barracuda's. Just because of the changes that you see. Just last few weeks, I just went fishing at night and I saw them in the passage. I show dad and I tell him "now they start to come back." When I was young, we hardly see them here."

Sam describes the return of fish species which used to be common in the reef, but have not been seen for quite some time. He mentions a school of barracudas he saw while night fishing, located in the passage community members take to access a break in the reef which leads into the open ocean.

While numerous interview participants mention the return of certain species of fish once common to the region, fish diversity is still not what it once was. Loata (49yrs) explains how some of the fish she remembers seeing in the reef are no longer present: "Some fish they are missing, they're extinct." Liti (48yrs) expands on this, describing how some of the fish species that were once common in their reef can now only be observed outside of their coral reef in the open ocean.

"The fish, now it's just some fish. Plenty kind of fish we see before. Now, just some kind. Before we see the big fish come here. Now, no. We can't see those kinds of fish here. When they go and fish outside [of the reef], they will see it. But here, no."

Fluctuations over time have also been observed for other marine life, many of which correspond to the three identified time periods, and which follow similar trends in abundance, species, and changes in size to that of fish. Varanisese (83yrs) comments on how octopus size and abundance has changed over time.

"Before I go to the reef, before the degrading and gathering of octopus and all this stuff. Resources from the sea. Before I could fill up my basket with all this stuff. But just last year I didn't go out to the sea, I saw changes. There's less octopus, less fish. But due to them having the *tabu* there's more fish. [Before they were] usually bigger size. Like when I stand and hold the octopus, my height. This time, can't see that bigger octopus. Only small ones."

Varanisese shares how when she used to catch octopus, she would fill a basket and they could

measure up to her height in length. She connects this decline to the degradation and

overexploitation of marine resources. Many community members also discussed observing

changes to coral, both within and outside of the CBMPA.

"Now we see the coral, beautiful eh? That coral is different colour, different type. Before, it's all brown. The coral all the same, all brown. Today different type, different colour. Inside the MPA, the coral are alive. Also the outside. The outside too its like new, it's healthy. Before, all brown. All the stone. No coral, only stones." – Taraiviri (51yrs)

Taraiviri describes how, previously, the reef was mostly stone, and the coral which was present

was brown. Today, colourful coral can be found both inside and outside of the MPA. Joseva

(48yrs) ties this increase in coral cover to the work of the Youth Group:

"Before there was no coral here. I don't know why. But now, the youth have plenty of corals. Big change over here."

Joseva remarks on not knowing the origin of the decline in coral in the reef before the Youth

Group implemented the MPA. Other community members, such as Tevita (61yrs), have

assumptions as to the cause of decline:

"Before there's plenty coral but now the wave is breaking the coral. Most people selling the coral. [Before], different colours. Orange, brown, white. Before we have orange, brown and white, plenty. But in between and after this, don't have it. Before it was everywhere the coral. Now it's starting to grow but just in the *tabu* area. Haven't seen outside."

Tevita talks about numerous potential causes of decline, including waves breaking coral, and coral mining activities. These will be discussed further in the sections 'land/sea use change: coral mining', and 'climate change: sea level rise, storm surges, and changes to wave patterns' (respectively) of the results chapter. Tevita again references the abundance of coral 'before',

referring to the first distinct time period of the 1970s – 1990s. The 'between' time period of 1990s – 2007 is said to have seen an absence of different colours of coral, which are now observed to be coming back. Changes in different invertebrate species have also been observed. While discussing changes with Liti (48yrs) and Sam (30yrs), Sam mentions how lobsters used to be common: "Before we use to catch the lobsters here. I was still schooling. Now they hardly come along the reef.", to which Liti adds "They are coming back again." There have also been changes to giant clams found in the reef.

"The clam is very expensive. This size [points to full hand] or this size [half way up arm], the clam is very expensive. Before, the clam is also extinct. Because of overfishing. After that when they started the *tabu* the fisheries bring the clam. The giant clam to make babies. It's working. When you go down that side you see many small clams. This side [points south] and that side [north], many clams now. Outside of the *tabu*." – Rupeni (58yrs)

The giant clams can get very large in size, and can be sold for a generous profit. Rupeni connects their disappearance from the reef as a result of overfishing, and their return due to the assistance of the Ministry of Fisheries who brought juvenile giant clams to restoke the reef in 2016. They have since repopulated both inside and outside of the MPA. This is a notable change, as giant clams are considered indicator species of a healthy reef (Caras & Pasternak 2009). There have also been observed increases in the abundance of sea cucumbers and sea shells: "Yes! Big changes [in the reef]. There is plenty of fish in the reef and even more sea cucumber and seashells" – Mijieli (43yrs). All the changes discussed over time on the reef are illustrated in Figure 5.6 below.



Figure 5.6 Changes observed across time to coral reef species, including fish, octopus, coral, and invertebrates (e.g. giant clam).

5.2.2 Drivers of change

Cumulative impacts in the marine SES have been driven by changes in governance,

population, and human activities.

5.2.2.1 Changes in governance

Changes in governance and *qoliqoli* rights are attributed as a reason for the observed changes

to the reef. Aporosa (47yrs) explains this impact.

"The government before it was really bad. He take the land, he take the fishing ground, everything. And he gave every person the right to do whatever he want in the sea. But this government, no. He already gave it back. We didn't have any rights to stop anyone from coming to the sea. The owner has no rights."

Aporosa mentions the previously elected government (the FijiFirst party) that weakened

legislation surrounding iTaukei's rights to qoliqoli governance. The mention of "taking the

fishing ground" is likely in reference to the Regulation of Surfing Areas Decree 2010 which

shifted ownership rights from traditional rights owners to the State (Latu 2024). Aporosa's

comment that the new government has already "given it back" likely refers to the newly elected

government restoring the Great Council of the Chiefs and reviewing legislative reforms such as

the *Surfing Areas Decree 2010*, which would once again strengthen *iTaukei* rights to *qoliqoli* governance.

5.2.2.2 Livelihood changes

Some community members shared how there has been an increase in Naidiri's population, which has resulted in more people going to the sea than before. "The population. Less population before, now overpopulation people going to the sea." – Manoa (43yrs). This increase in Naidiri's population has been coupled with changes to economic opportunities. Rupeni (58yrs) describes this change.

"The cyclone Oscar. The cyclone Oscar broke the bridge. Damaged the bridge. The Sigatoka bridge and the Suva river bridge. Trim line. That's why plenty people see the money in the sea. Before, every house used a contract number for the sugar cane. They just planting sugar cane and harvesting and bring the money. Now, finished. No more. Yeah. In this village plenty people build [houses] for the sugar cane."

Rupeni explains how many homes in Naidiri were initially built because of the sugarcane tram line which passes through the village and the economic opportunities which it represented. This tram line transported sugarcane from plantations to where they would be processed and sold. Many community members in Naidiri participated in growing and selling sugarcane, until cyclone Oscar hit Fiji in 1983 (Browne & Krishna 1983). This significantly damaged bridges where the tram line crossed, disabling the ability to transport sugarcane across the country. This coincided with increasingly competitive global sugarcane markets, making the reparation of the tramline an unviable option (Serrano 2007). As a result, many community members in Naidiri chose to shift from growing and selling sugarcane to marine-based livelihood practices. Vasenai (28yrs) explains this shift:

"There was two sources of income: sugarcane plantation [and] seafood. We always use sugarcane. Then the bridge broke, damaged the transportation for sugarcane, doesn't work. So they switch to seafood."

The damage from the cyclone subsequently altered livelihoods, resulting in an increased dependence on marine resources.

5.2.2.3 Overexploitation

Overexploitation of marine resources was identified in the data as a prominent socialecological change. Overtime, fishing practices within Naidiri's reef have changed and evolved. This has included the practice of using the Fijian root plant *duva* (*Derris trifoliata*), and technological developments including the introduction of the diving torch and the growing popularity of oxygen tanks used by poachers.

Duva

A fishing practice which is attributed with having significant impacts to Naidiri's marine SES is the use of a herbal medicinal plant called *duva*. This was commonly practiced from approximately 1995 to when the CBMPA was implemented in 2007. As Aporosa (47yrs) describes,

"In the middle, before in the middle, there's plenty method of fishing. We used the herbal medicine to make the fish drunk and then we kill it. Before the herbal medicine it kill big, small fish, both. They all dead."

A variety of fishing practices were used in this time period, including the use of the duva, which

was a potent medicine that would kill all sizes of fish. Rupeni (58yrs) explains how the duva was

used.

"Yeah we use one kind of medicine to kill the fish. Herbal medicine. Tree roots. You use it when it's very hot. When it's very hot, you heat the root and take it under the water, pound it. Put it in the hole where the fish are, making the fish all dead. All the fish. Tiny, medium, large, all dead. It was very strong. When the sea goes low tide, early in the morning, you do it. One group like 20 people this side, 20 people that side, all these people all doing it. When we come back, we pick the fish. All the fish dead. After that, the [Ministry of] fisheries tell us "don't use this root to kill the fish."

The root of the plant was harvested, pounded, and put into the reef under a bed of rocks where the fish reside. As toxins seeped from the roots, they killed all marine life around them, both big and small. This not only killed fish, but other marine life as well, such as corals and sea cucumbers. He mentions the influence of the Ministry of Fisheries implementing restrictions on its use. Manoa (43yrs) describes this shift in behaviour restricting the use of the *duva*: "Yes. A powerful plant. So around that time we come to know the importance of protecting, then we try to ban it. And now no one does it." Manoa refers to a shift in mindset towards valuing the protection of marine resources. Iliesa (41yrs) expands on this notion, relating this shift in behavior to the implementation of the CBMPA: "When the *tabu* starts, we stop. Not allowed to use the *duva*." Once commonly practiced in the Naidiri reef to catch fish, the use of *duva* stopped around the time when the CBMPA was implemented, a transition which the Ministry of Fisheries influenced.

Torch fishing

Another change to fishing practices took place with the introduction of the diving torch, said to be introduced around the 1990's. Manoa (43yrs) recounts how this changed fishing practices:

"And that time I still remember when they introduced the diving torch for at night. Because when I was in class four, there was still no torch. I remember we used to go out to the sea with the benzene lamp. The benzene lamp we just hold it up like this. And they introduced this diving torch which you can use underwater. And this torch makes a big difference. Because when you fish like this with the diving torch, can just catch whatever you want. Small, big. Before when you use the benzene lamp you hardly see the fish. You can't go to the deep [sea] area. When they introduce this diving torch, and I can see from here to there, the fish start to decrease. I still remember I was still in primary school. This torch thing they introduce like 1990, 1991. It was easy for them to go and catch the fish at nighttime. This government, [they said] the only two things that decrease the fish and all the marine life, overfishing. And the second one is this one. The torch. Diving at night."

Prior to the introduction of the diving torch, benzene lamps were commonly used, limiting visibility for fishing at night. When the diving torches were introduced around the 1990's, fishing at night while fish slept became more accessible, and Manoa connects this to the visible decrease in fish populations. The use of the diving torch also enabled the catch of smaller, juvenile fish to be made. Manoa comments that the Ministry of Fisheries stated the introduction of the diving torch as well as overfishing as a primary cause for the depletion of fish and other marine life.

Oxygen tanks and poaching

Many community members shared stories they had heard or experienced witnessing

poachers inside or just outside of the reef who used scuba diving oxygen tanks to catch fish. Liti

(48yrs) explains the use of this fishing method by poachers:

"Before, the fisherman they use the gas, they come here and I think that's why the fish don't come. They come by boat, like that. Come by night and day and use just like that. But now, no more. Some fisherman they sell fish like that in the towns, markets, in their own house. They have a boat and use that [tank]."

It was once common for poachers to come to the Naidiri reef and use oxygen tanks to catch fish,

both at night and during the day, which they would then sell for a profit. Manoa (43yrs)

describes the financial incentive for poachers to use oxygen tanks:

"Sometimes you see the boat. But they know it, they can't come close to the reef. They just follow. And most of them have been here since the tanks. This passage here, there's so many unicorn fish. The big, big size. At night time, they always sleep. And this one is very expensive when we sell it. And this gang just come and we experience that. I think this is 2010 it started."

Poachers position themselves just outside of Naidiri's reef, near the MPA, where they know

valuable fish such as the unicorn fish reside. Manoa believes that this started around 2010.

Accounts of poaching both within and outside of the CBMPA were discussed, and community

members connect this to the observed decline in fish species within the reef. "The thing that makes the fish finish, extinct, is because of the gas. You know, what the divers always use. Oxygen tanks." – Panapasa (77yrs). Panapasa states that the disappearance of certain fish species within their reef is a result of the use of the oxygen tanks. The use of oxygen tanks to fish is not a legal practice in Fiji, as described by Sam (30yrs) "It's not allowed to use that gas tank for fishing. You can only use it for scuba diving but not to catch fish."

5.2.2.4 Land/sea use changes

Land and sea use changes including coral mining, sand mining, and deforestation were identified as causes of social-ecological changes to Naidiri's coral reef ecosystem.

Coral mining

A noticeable change in the way the sea is used remarked upon by community members has been the mining of coral. Though this never occurred in Naidiri's reed, it was once a common practice in the nearby *qoliqoli*, located in front of Malomalo village.

"Before they were selling the coral. They have to damage the coral. Use the spade. They use it to break the coral and sell it. Before they have to fill the tray, the wooden one. They fill that full everyday. He was doing that too. When I come here and they were telling me that, "before we were selling the coral, good money." – Rufina (37yrs)

Rufina describes how a spade was used to break off the coral, which were then loaded onto a palette. Every day a wooden palette would be filled and sent off to the purchasing company. This company paid well, and employed people from Malomalo and Naidiri village, including Rufina's husband. It is estimated that this happened sometime between the years 2003 to 2007. While selling of live coral is no longer practiced in the Naidiri/Malomalo *qoliqoli*, there continues to be some selling of the dead coral that has washes up on the beach. Sam (30yrs) shared some concerns regarding this practice.

"But nowadays, we still doing it – but this is my thought, my thinking. Because we used to take the dead coral inside the septic tank. We used to do that. For that, we used the dead coral that's burry under the sand. We used to wait until the flood comes, wash the sand out so we can see the dead coral, and then we always pick up that dead coral. I think those dead coral are also holding the sand. They hold the sand from being swept out. Just like the tree roots, they hold the soil. Many people they just come, ask for the dead coral. We give it. We don't think how it's affecting the village. We're still giving it. But we don't know that maybe that's why sand is being washed out."

Dead coral that washed up on the beach was used for building septic tanks. Today, when neighbouring villages ask for some of the dead beach coral, community members in Naidiri will often give it away. Sam questions if this may be impacting sand cover in Naidiri's *qoliqoli*. He remarks that the dead coral may act similarly to tree roots by preventing coastal erosion. Mining coral has been shown to decrease coral cover and fish abundance and species richness, increasing coastal land retreat and decreasing the ability to withstand storm surges and hurricanes (Caras & Pasternak 2009).

Sand mining

A change to land use addressed by some community members included the practice of sand mining in Malomalo. This practice consists of using a tractor shovel to extract sand located approximately 100m inland from Malomalo's waterfront, extending inland another 1-2 km (see Figure 5.7). Sand mining is occurring in two locations in Malomalo by two different companies: on a personal property, the family of which has made an agreement with the purchasing company who they sell the sand to, and on a shared lot belonging to the village of Malomalo. Sand mining on the latter lot was agreed upon by the community of Malomalo and profits are shared throughout the village. While sand mining is occurring outside of Naidiri village, some community members question if it is having repercussions on their shared *qoliqoli* and beachfront.

"Inland, in front of the school. Maybe that's the reason why [sand cover on the beach has changed]. They sell lots of sand. They dig, go sell it, after that the sand that's meant to be on the beach it goes [inland to replace it]." – Vasenai (28yrs)

Vasenai comments that the practice of sand mining occurring in Malomalo near the elementary school may be tied to the observed decrease in sand cover on Naidiri's own beachfront. Some community members did not express concern over the practice of mining sand, while others such as Sam (30yrs) were concerned.

"It's [sand mining] not good because that's not good. I think that's the cause of this. It can cause this."

Sam comments that the practice of mining sand is not good, claiming that it could be the cause

for the sand depletion on the beachfront in Naidiri.



Figure 5.7 Sand mining sites in Malomalo village. The photo on the left was taken approximately 100m inland from the ocean, while the photo on the right is located 1-2km inland.

Deforestation and runoff

A second observed land use change has been the logging of trees approximately 3-5km inland from Naidiri's coral reef (see Figure 5.8). This large plot of land is situated southeast of

Naidiri village and is divided between families from Malomalo and Naidiri. The plot of land is predominantly used for farming, though families are permitted to use it as they see fit. During *talanoa* discussions, some Naidiri community members discussed the ridge-to-reef connection amongst their terrestrial and marine resources, and how logging may be impacting their coral reef.

"The logging it's like opposite. There are coconut trees there. We usually go for gathering. The village, one of the families in Malomalo, that's their land where they're logging. [They sell] the trees. I think also impacts the sea, due to the rain and also washes away the soil and stuff to the sea, eh? Due to them cutting down the trees we don't have any shelter for the organisms. Due to this unfortunate weather, rain and all the stuff wash away the soil and out to the sea. Makes the water muddy." – Francie (25yrs)

Francie mentions how the logging is done by a family in Malomalo on their share of the land,

and coconut trees are sold. She ties this logging to increased sediment runoff into the sea during episodes of heavy rain.



Figure 5.8 The clear-cut site where logging of coconut trees is occurring is situated approximately 3-5km inland from Naidiri's beachfront.

Many community members shared observations of the negative impacts of sediment runoff on corals. Sam (30yrs) describes this change and where it is occurring.

"Also, when there is a lot of rain, it is bad for the corals. The rain washes out sediments into the river and into the ocean, it covers the corals. You can see a thick layer on them when this happens. Because of how the coast is, there are three close inlets where the rivers flow into the ocean. One on either side of Naidiri, and another close by. We cannot plant coral there. Yesterday, during the youth meeting, that is what they were discussing, expanding the MPA, making it bigger. But we can't plant in front of the river because of the runoff. Instead, there, we have to plant mangroves."

Sam mentions the three inlets which pour into Naidiri's *qoliqoli*, bringing inland water and sediments into the sea. These coat and kill nearby coral, which makes it an undesirable location for coral planting activities to take place. Discussions surrounding expanding the communities MPA and coral planting will be further discussed in the results section 'Responding to change'. Figure 5.9 displays the satellite location of these inlets, while Figure 5.10 provides a visual of the state of the reef in these inlets.



Figure 5.9 The three inlets where inland water flows into the ocean. At the base of these inlets, no corals grow, evidenced by the bare sand patches. Image adapted from Google Maps (2023).



Figure 5.10 Corals situated within one of the inlets. The photo on the left shows little marine life growing, while the photo on the right is of dead coral in this section of the reef.

5.2.2.5 Climate change

During *talanoa* discussions, some community members connected observed changes to their marine SES to climate change. Specifically, the changes observed were coral bleaching, sea level rise, storm surges, and changes in wave patterns.

Coral bleaching

Coral bleaching due to warming water temperatures as a result of climate change was mentioned by some community members as an observed change to their marine SES. Some community members referred to the occurrence of coral bleaching events within their reef.

"Yes, coral bleaching. Yes we are having one [coral bleaching event] right now. There have been a few. In 2013 or something, few years back when we started the *tabu*, there was big bleaching. Hot, very hot, coral were dying, everything was dying." – Sam (30yrs)

Sam refers to a significant coral bleaching event around 2013 during which coral and other marine species were dying. He also makes reference to the current occurrence of a coral bleaching event while the *talanoa* is occurring (May 2023). The impacts of these significant marine heat waves were said to impact not only coral but fish species as well. A specific episode which led to the massive die-off of fish in the reef was mentioned while discussing observed changes with Sam (30yrs) and Rupeni (58yrs). Sam describes one event, which had occurred around 2008-2010.

"Just some few years back, 2010 onwards, dead fish were on the shore. Because it was very hot, very hot. All kinds of fish. This much, from this size [end of finger] to big ones [arm length]. Just like all the seaweed and coral on the sea, they were all dead. All dead fish. Even the villages can smell the scent. Just 10-years back. 2009, 2010 onwards. When I was in class 8. Maybe 2008. It was like 1 month. We thought, what many people in the village were saying, the fishing vessels that catch the fish and then chuck it. But no. Sometimes when we go out there, the fish are still alive. But we can't [go out], because the water was too hot. That was the first time it happened. When we walk around the sand, we don't want to walk there because it smells. That was the biggest bleaching that happened here."

Sam connects this massive die-off of fish in the reef to a bleaching event, which killed fish ranging from small to large, and which were then washed ashore. The event was initially believed to have occurred due to a fishing vessel throwing away fish into the sea, until community members realized it was due to extremely high water temperatures, which even they could not withstand.

Sam's observations correspond to the National Oceanic and Atmospheric Administration (NOAA) data on coral bleaching events in Fiji which report an Alert Level 1 bleaching that occurred around March 2009 (Figure 5.11) and an Alert Level 2 bleaching event which occurred around February-March of 2014 (Figure 5.12) (NOAA 2008-2009; NOAA 2014-2015). During my time in Naidiri in May 2023, there were also discussions surrounding the bleaching event that was underway. Some of these impacts were visible in the reef, as can be see in Figure 5.13.



Figure 5.11 NOAA data graph displaying the occurrence of coral bleaching events for the years 2008 and 2009. An 'Alert Level 1' bleaching event can occurred around March 2009 (NOAA 2008-2009).



Figure 5.12 NOAA data graph displaying the occurrence of coral bleaching events for the years 2014 and 2015. An 'Alert Level 1' and 'Alert Level 2' bleaching event occurred around February – March 2014 (NOAA 2014-2015).

While the cause of coral bleaching was identified by some community members as a result of

exceedingly high water temperatures, others attributed this to muddy water entering the reef.

"This climate change, the rain keep on going. And the flood. Mud water goes to the sea, makes the coral bleached." – Inore (42yrs)

Inore ties climate change to the increase in rainfall and subsequent flooding, leading to sediments

depositing on corals and causing them to bleach.



Figure 5.13 Bleached coral located within Naidiri's CBMPA in May 2023.

Sea level rise, storm surges, and changes to wave patterns

One of the most remarked upon changes to Naidiri's marine SES are the impacts of sea level rise, storm surges, and changes to wave patterns. This has resulted in changes to sand cover both to Naidiri's beachfront and inside the reef, as well as the increased frequency of bad weather events.

Sea level rise, storm surges, and changes to wave patterns are said to have caused a decrease in sand present on the beachfront which has exposed underlying rock formations, as well as the reef becoming increasingly shallow due to sand buildup. Panapasa (77yrs) remarks on these changes.

"There's less sand, because of strong waves. And the sea it's like getting shallow. Maybe when the high waves come, take the sand, put it in deep water, make the water shallow. And expose all the big stones."

Panapasa ties the decrease in beach sand cover and exposure of underlying rocks to the growing presence of strong waves, which are said to pull the sand into the water, changing the reef's

depth. The observed changes to sand cover on the beach are likely tied to sand mining activities occurring inland. In their assessment of the impacts of sand mining activities, Rangel-Buitrago et al. (2023) highlight that beaches are "dynamic environments", and geomorphological disturbances are likely to "trigger a morphological response to regain the balance between sand supply, transport, and accumulation."

Others, including Varanisese (83yrs), connect changes to sand cover to sea level rise.

"Before the beaches used to be sandy, but now you see rocks. Before there was just sand. Now because of the rise of sea level washing away the sand, now you can see the rocks. It wasn't like that before."

Varanisese describes how their beachfront used to be sandy. Once the sand washed away due to

sea level rise, it exposed the underlying rock formations below. Taraiviri (51yrs) explains the

repercussions this change has had on the community's relationship with their beachfront.

"Before this place, the kids play rugby here. The sand was so thick. But today no, they can't play. The rocks are everywhere, the stones are everywhere."

Changes to sand cover on the beachfront has impacted the youth's ability to participate in the

common Fijian practice of playing rugby on the beach. Exposed rocks can be seen in Figure

5.14.



Figure 5.14 Exposed rocks on Naidiri's beachfront during low tide. This section of Naidiri's *qoliqoli* is situated in front of the village and was once an ideal location for youth to play rugby.

The buildup of sand within the reef has also had perceived impacts. Sam (30yrs) discusses

how the increasing growth of seaweed is affecting coral.

"There is one change that is very very – we don't really like it because it's happening in the *tabu*. There is sand that is piling up and the weeds are growing on top of it. It's new. That's the change which is not good. We don't know what is good about that thing, but to us it's bad because it covers many rocks, many corals, and burries the coral."

Sam comments on the growth of seaweed on sand piling up within the reef, and the communities concern for this change due to it burying the reefs coral. He specifies that while they are not certain whether this is ecologically good or bad, it is a change negatively perceived by the community.

Community members also remarked on the impacts of increasingly bad weather on their marine SES. It is important to note that discussions referencing 'good weather' and 'bad weather' by community members in this section are terms used to describe ocean fluctuations,

and not atmospheric changes. Panapasa (77yrs) comments on how this bad weather is now frequent within Naidiri's *qoliqoli*.

"This is the most change [we have experienced]. It's not good weather for long, it's bad weather. It's rough. Two or three days good weather, the rest, bad. A week can take [before it is good again]. Before it was good. Before it can take months, maybe six months to be good weather. After that one week you have strong waves. Now it's everyday."

Panapasa describes how previously, their reef would experience months of good weather where

the waves were not too rough. This would be followed by a week or so of stronger waves, before

returning to normal. Panapasa explains how this has changed, with most days of bad weather and

two to three intermittent days of good weather. As described by Liti (48yrs) community

members do not go to the sea during bad weather events.

"Before, there used to be good weather for two, three months. Only one week and then it begins again bad weather. It's changing. No one day good [weather], one day rough. Yesterday good, today it's not good again. All year [it's like this]. No fishing when it's rough."

Liti mentions how the sea is changing due to frequent bad weather which is prominent

throughout the year. These rough seas limit community member's ability to go fish within their

reef. Another concern regarding the increased frequency of bad weather is the impact on corals.

As explained by Tairaiviri (51yrs) chunks of broken-off and dead coral often litter the beach

after a bad weather event.

"Strong waves hit the coral and the coral break. After that the strong waves when they go to the sea, the coral lie all around [on the beach]. It's all broken. It depends on the strong waves. Caused by strong waves."

Tairaiviri connects changes to coral within their reef to the severity of strong waves breaking off

coral. Manoa (43yrs) shares these concerns, particularly during storm surge events.

"Storm surge. When there's a storm, I always worry about the coral. Especially the staghorn coral because it breaks easily."

Manoa worries for the well-being of the coral within their *qoliqoli* during episodes of storm surges, as these can easily break off corals such as the staghorn coral. Days following a storm surge, it is common for the beach to be littered with large pieces of broken coral, as can be seen in Figure 5.15.



Figure 5.15 Broken and bleached coral washed ashore on Naidiri's beachfront after an episode of particularly bad weather in May 2023.

5.2.2.6 Crown-of-thorns starfish

COTS are native to the PIR, however, in the last decade, their presence in Naidiri's reef has required ongoing removal to regulate their numbers. Youth Group members now engage in regular reef checks, removing COTS when they are spotted. This is done to prevent COTS from eating and killing corals.

5.2.2.7 Pollution

Another observed change to the marine SES in Naidiri's *qoliqoli* is pollution. Sam (30yrs) discusses how burning and dumping waste on the beach used to be a common practice, and while it is no longer allowed, some community members still do it.

"Dumping like, rubbish in the sea. Tin, metal, cans. Before it was normal for the village to dump. Before it was normal for the village to burn garbage. [Now] you're not allowed to dump, but some people still careless. Still do it. All along the beach. Take the garbage, throw it. Sometimes they go there, burn it, maybe afternoon. It's not good."

During my time in the village, burning waste (e.g. food scraps, plastic wrappings, dried leaves) was frequently observed happening on the beach (see Figure 5.16). This is due to the lack of municipal waste disposal management, leaving community members to have to burn their garbage or find other ways to dispose of it.



Figure 5.16 Garbage being burnt on Naidiri's beach in front of the village.

Pollution in Naidiri's reef has also occurred during bad weather events, such as hurricanes. These events can result in house materials being blown into the ocean, which are not always easy to dispose of. As mentioned by Vasenai (28yrs), "You know some of the tin [roof slabs] are in the sea still today. Whenever there's big waves, it always digs the sand, you can see some tins there." Some roof slabs remain scattered throughout Naidiri's *qoliqoli* and can be seen when strong waves clear up the sand that has been deposited on the tin. Panapasa (77yrs) shares how a lot of the tin from roofs got blown into the reef during a hurricane:

"Plenty damage. The houses flown away. The house blew away. There's a hurricane that come windward, come this side. Blow all the houses to the sea. All the roofs blow to the sea. When it's finished, they see the sea was full of tin. Long time ago. It's [hurricane] Oscar, or maybe Bebe."

Panapasa discusses the occurrence of hurricane Oscar or Bebe which hit Naidiri and caused significant destruction to many houses. He mentions that after the hurricane had passed, the sea

was full of tin roof slabs, some of which remain today and can be seen in Figure 5.17.



Figure 5.17 Tin roof slabs visible in Naidiri's reef during low tide.

Pollution within the reef is not isolated to Naidiri's qoliqoli. Manoa (43yrs) discusses how

the reef north of Malomalo is highly polluted.

"[U]pstream that way, near Natadola, the reef is very bad, very unhealthy. You can snorkel, but you won't see much. Because people, they just throw their waste right in the water. They don't take care of the reef, they throw their garbage in."

Manoa connects the lack of observable biodiversity and poor health of the reef as a result of excess garbage being thrown into the ocean. The area being discussed is situated north of Malomalo village heading towards the Natadola Bay Golf Course.

Table 5.1 summarizes the 15 identified cumulative pressures, the scale at which they manifest, the impacts they have had on the marine SES and a sample quote from community members.

Driver of Change	Scale	Impact	Sample Quote
Government changes to <i>qoliqoli</i> rights	National	Decreased ability of <i>iTaukei</i> communities to manage access to their <i>qoliqoli</i> .	"People from other villages would come and ask permission from <i>qoliqoli</i> owners. Today they just go. Because the old government, they just give the right to everyone to go out to the sea." – Aporosa
Westernization	Global	Increased presence of tourists and globalization processes has altered traditional <i>iTaukei</i> relationships with the sea and ways of demonstrating respect.	"Because Fijian way most things you have to respect. Way of dressing. Before, it was really strict in the village. [] That's the traditional way. Now it's open. Westernization has gone through the village." - Vasenai
Commercialization of inshore fisheries	Global	Increased economic incentives (e.g. presence of stores and of middlemen buyers) altering previously subsistence-based relationships to the reef.	"People think of money and sell everything. Before they just use if for their home needs. Before they didn't have big stores." - Aporosa
Duva	Local	Use of root plant <i>duva</i> linked to overexploitation of marine biodiversity (e.g. mortality of juvenile fish).	"All the fish. Tiny, medium, large, all dead. It was very strong. When the sea goes low tide, early in the morning, you do it. One group like 20 people this side, 20 people that side, all these people all doing it. When we come back, we pick the fish. All the fish dead. After that, the [Ministry of] Fisheries tell us "don't use this root to kill the fish." - Rupeni
Introduction of the torch	Regional	Introduction of the underwater flashlight ('torch') increased efficiency of night fishing, contributing to overexploitation.	"They introduced this diving torch which you can use underwater. And this torch makes a big difference. Because when you fish with the diving torch, can just catch whatever you want. Small, big. Before when you use the benzene lamp you hardly see the fish. You can't go to the deep sea area. When they introduce this diving torch, and I can see from here to there, the fish start to decrease." - Manoa
Oxygen tanks and poaching	Regional	Though illegal, the introduction of oxygen tanks used for fishing is linked to poaching activities near/within Naidiri's reef.	"The fisherman they use the gas, they come here and I think that's why the fish don't come. They come by boat, like that. Come by night and day." - Liti
Cyclones	Global	Cyclone Oscar caused infrastructural damage to tram lines which altered employment within the sugar cane plantation industry, increasing local dependence on marine resources for subsistence and income.	"There was two sources of income: sugarcane plantation [and] seafood. We always use sugarcane. Then the bridge broke, damaged the transportation for sugarcane, doesn't work. So they switch to seafood." - Vasenai

Table 5.1 Drivers of change impacting the marine SES in Naidiri village

Coral mining	Regional	Coral in front of Malomalo village used to be mined and sold, contributing to significant decline in coral cover and harming other marine life.	"Before they were selling the coral. They have to damage the coral. Use the spade. They use it to break the coral and sell it. Before they have to fill the tray, the wooden one. They fill that full everyday." - Rufina
Sand mining	Regional	Sand continues to be mined and sold in Malomalo. This is believed to be contributing to geomorphological disturbances in natural sand cycles, resulting in changes to sand cover on Naidiri's beachfront and within the reef.	"Maybe that's the reason why [sand cover on the beach has changed]. They sell lots of sand. They dig, go sell it, after that the sand that's meant to be on the beach it goes [inland to replace it]." – Vasenai
Deforestation and runoff	Regional	Inland deforestation is linked to increased sediment runoff into the reef, which covers and kills corals.	"When there is a lot of rain, it is bad for the corals. The rain washes out sediments into the river and into the ocean, it covers the corals. You can see a thick layer on them when this happens." - Sam
Marine heatwaves	Global	Marine heatwaves in Naidiri's reef have resulted in coral bleaching events, as well as leading to the massive die-off of fish.	"Yes, coral bleaching. Yes we are having one [coral bleaching event] right now. There have been a few. In 2013 or something, few years back when we started the <i>tabu</i> , there was big bleaching. Hot, very hot, coral were dying, everything was dying." - Sam
Sea level rise/storm surges/ changes to wave patterns	Global	Decreasing presence of sand on the beachfront is exposing underlying rock formations and causing the reef to become more shallow due to sand buildup.	"There's less sand, because of strong waves. And the sea it's like getting shallow. Maybe when the high waves come, take the sand, put it in deep water, make the water shallow. And expose all the big stones." - Panapasa
Increased frequency of bad weather events	Local	Impacts ability of community members to fish in the reef and engage in subsistence activities.	"Before, there used to be good weather for two, three months. Only one week and then it begins again bad weather. It's changing. Now one day good [weather], one day rough. Yesterday good, today it's not good again. All year [it's like this]. No fishing when it's rough." - Liti
	Local	Bad weather events often break off corals, which can harm and/or kill them.	"Strong waves hit the coral and break the coral. After that the strong waves when they go to the sea, the coral lie all around [on the beach]. It's all broken." - Tairaiviri
Crown-of-thorns starfish	Local	COTS outbreaks must be regulated through regular reef checks and COTS removal.	N/A

Pollution	Local	Human waste is often dumped and burnt on the beach.	"Before it was normal for the village to burn garbage. [Now] you're not allowed to dump, but some people still careless. Still do it. All along the beach." – Sam

5.3 Responding to changes

A variety of coping strategies have been employed by community members in Naidiri to cope with the impacts of cumulative SES changes. The most significant of these adaptations has been the implementation of a CBMPA within their reef. Other responses have included planting corals, beach cleanups, and creating wave barriers to cope with sea level rise.

5.3.1 Implementation of a community-based marine protected area

A CBMPA was implemented in Naidiri's *qoliqoli* in 2007. It is important to note that the CBMPA in Naidiri is split into two separate sections. The first of these was implemented in 2007, originally measuring approximately 100m x 100m and has since expanded to measure approximately 240m x 260m. The second CBMPA, directly adjacent south to the first, is a rotational CBMPA which measures 260m x 280m and was implemented in 2018 (see Figure 5.18). The rotational CBMPA arose from the Youth Group wanting to increase the size of the CBMPA, but taking into consideration the impacts this would have on women in the village and those who face physical limitations to cover large distances daily. As will be discussed, the two CBMPA's are managed slightly differently. In the following sections, reference to the CBMPA encompasses both the rotational and fully closed CBMPAs. Any distinction between the two sections will be made explicit by specifying if it is the fully closed or rotational CBMPA.

The following sections will discuss how the CBMPA began, local perceptions of the CBMPA, how it is managed, and perceived impacts outside of the CBMPA boundaries.


Figure 5.18 Two CBMPA sites in Naidiri's reef. The CBMPA on the left is marked by solid red lines and is fully closed. The CBMPA on the right is marked by dotted red lines and is the rotational CBMPA. Image adapted from Google Maps (2023).

5.3.1.1 How the CBMPA began

The story of how the CBMPA in Naidiri began was shared by one of the two founders of the

CBMPA, Manoa (43yrs).

"Yeah. Rice and tea. It was when our family house was still there, and If was there. I come and check the rice and tea for dinner, and I go check his house and he says "us too we have rice and tea." I say "what about we go down and catch some fish?" We come to my house, grab my tools, my mask. You know where the fish buoy? That was the very place where we were diving that night. Right in front of here. And we were freaking out at the size of the fish we catch. And you can't believe it. Because we were diving at night. I think both of us were looking forward. You dive at night, you get big fish. But it was 2007. And after that, this size of fish Yanik [shows half his palm size]. You know, when we came back, I said, "OK, you cook it." I went to my house and bath, and he cooked it. And after when we were having our *kana*²⁰ [food], I was telling him, boy. In 10 years to come, in 20 years to come, this place there's going to be no fish. That is when we came up with this idea to do the *tabu*."

Manoa tells the story of when he and Ifereimi Manulava (referred to as 'If') decided to go night fishing to have fish with their dinner of rice and tea. While fishing, they were stunned that despite fishing at night, they only caught small fish. Thinking about what this would mean in decades to come, they came up with the idea of implementing a CBMPA in their reef. While asked how they knew of the concept of a *tabu*, Manoa shared that, as an *iTaukei* Fijian, it is a concept he had always been familiar with.

"Yeah because here it's normal, especially for a Fijian. They do a *tabu* for their own fishing ground. It's something like this. If a village chief dies, so if he dies, for example, Abo, our village chief, and all the village elders say OK, let's make it a *tabu* for the reef for 300 nights. You know? Or 1 year. Just to restock the reef. And it's to honor him. It's like that. So that *tabu* when we start to grow up we hear it and we know about it. About the *tabu*."

Manoa explains how a *tabu* is often implemented when a village chief passes and is implemented for a designated period of time to honour them and restock the reef. This coincides with Fache & Breckwoldt (2018) paper reviewing MPAs in Fiji overtime, who highlight the practice of *vakatatabu*, a "fishing ban in a certain inshore area after the death of a chief, as a sign of respect for this chief and to stockpile finfish and invertebrates for the commemoratory feast organized on the 100th night after his decrease." This traditional practice is still common today.

Manoa and If began the process of implementing the CBMPA by bringing up their intention of starting the CBMPA in the reef during a village meeting. Manoa specified that the idea was supported by some of the elders in the village, and that anyone from the village can decide to start a CBMPA. However, while putting their idea to fruition and beginning to implement the CBMPA, Manoa faced a lot of resistance from the greater community of Naidiri.

²⁰ Depending on its use, *kana* is Fijian for 'eat' or 'food'.

He explains how when placing the buoys in the reef to identify the boundaries of the new

CBMPA, they were often destroyed by community members.

"It was a gallon and we used to find around any rope to tie it. And most of the time all the ladies – the very first time there was a village meeting at the hall, I was there and I said "We are doing this *tabu* because of blah blah blah." Same time, all the village ladies say, "Hey, can't!" Because most of them do the octopus, their octopus house right in there in that area. And they are against it. When we were doing this buoy, especially the buoy, most of the girls and the gentlemen didn't even try to listen to us. When they want to cross the *tabu*, they just cross. Every woman that used to go fish in there, you see in their bag, the knife will be in their fishing bag. So that knife, they always come and smash out the buoy. Yes, they slash the buoys. Still tied to the rope, but now underwater. But we don't give up. Just keep on doing."

The area initially marked as the CBMPA was situated right in front of Naidiri village, and was

the primary area where octopus resided. The women in the village, as well as some of the men,

did not initially respect the designated boundaries of the CBMPA, which were identified with

buoys made from plastic gallon jugs. Manoa explains how they would often slash these jugs with

a knife. Despite the lack of compliance, Manoa continued to replace the buoys. There was,

however, an event that did finally deter Manoa from continuing the CBMPA.

"After 1-week we went to the workshop, that's when we came back, that's when we did the cone method. And there was a big storm surge. It was 8 am in the morning, before the sunrise. And I wake up early to go get If, because can hear the waves. Together we went to the beach. Our mesh. It was completely messed up and on the beach. And after that we didn't do it for another year. We just leave it. No more *tabu*, no more buoy. After one whole year, If and I ask ourselves, "we need to do it again." We need to remember for our future generations coming. We have to do it again. And we started again, myself and him."

After attending a workshop led by OISCA (Organization for Industrial, Spiritual and Cultural Advancement), learning to plant some corals using the cone method, Manoa planted some of these on a mesh frame within the CBMPA. However, not long after, a big storm surge hit Naidiri's reef, beaching the mesh framing and destroying all the corals he had planted. He decided he had enough, and for an entire year stopped trying to enforce the CBMPA. After a year, Manoa and If decided to implement it again, for the sake of their future generations. This

time, they decided to acquire the chiefs blessing in the hopes that this would obtain support from the community. As customary in *iTaukei* communities, kava was purchased and presented to the chief by men whose lineages identify them as 'spokesmen to the chief'. Joseva (48yrs) recounts this visit.

"I was the one that take the kava and brought it to the chief to ask for this *tabu*. Me, Manoa, and Sam. Before, our traditional way, we are the spokesman of the chief. Only our family. We are the spokesman. So I take this kava and I present it to the chief and ask him about what the youth are planning to do. This *tabu* here, it's for the youth. Not for the village. It's for the youth, that's what I tell the chief. The youth want to ask you if you can approve for them the *tabu*, and he said "Yeah, it's ok. That's good." And he wanted that *tabu* to go up until the big stone. But the villagers said no. Because we are also eating from there. Catching fish, octopus. When the chief says yes, no one can say no. The *tabu* is for the 3 villages. Naidiri, Malomalo and Nalele. They own this *tabu*. But it is the chief's decision."

Joseva explains how meeting with the chief of their *Vanua o Tabanivono-wai*, Joseva, Manoa and Sam received support to implement the CBMPA and were advised to make it as large as the boundaries of their *qoliqoli*, which extends north to an identifiable landmark referred to as the 'big stone'. This is situated approximately 1km north of Naidiri village, and can be seen in Figure 5.19.



Figure 5.19 The 'big stone' landmark referred to by the chief indicates the northernmost boundary of the *qoliqoli* and where he recommended the CBMPA be extended.

The decision to implement the initial CBMPA was made by two male community members in 2007. Following community resistance, it was the male 'spokesmen to the chief' who approached the chief of the *Vanua o Tabanivono-wai*²¹ in 2009 and sought his blessing for the CBMPA. As such, there was little to no involvement of Naidiri's women in these decisionmaking processes. However, taking into consideration the well-being of the women in Naidiri and their reliance on the reef for catching marine life, they decided to make the CBMPA boundaries smaller. Manoa (43yrs) explains this decision.

"We ask his permission, say what us gang is trying to do. And he was really happy. Because we think of our future generation. And he tell us "You can move your buoys wherever you want it." He said to make it big, and wherever we want. So by thinking of the ladies here,

²¹ Naidiri belongs to the *Vanua o Tabanivono-wai*, which includes the villages of Naidiri, Malomalo and Nalele as well as their associated *mataqali* and *qoliqoli*.

like I was telling you because our fishing ground is not very big. Most of us here, no job. Especially the women, families, fish, *kana* every day. And some of them sell it. So have to make some room for them too. That's why just 240m by 260m. Respectful of the ladies. Most of them do octopus, line fishing."

Manoa describes the chief's enthusiasm for the CBMPA and his suggestion to make it big. He

explains how given most villagers reliance on the reef for consumption and income, they decided

to make it smaller to start and slowly expand the boundaries over time. Today, the fully closed

CBMPA in Naidiri measures 240m by 260m and the no-take rules are followed by community

members in Naidiri and surrounding villages. Sam (30yrs) explains how, once the chief gave his

support for the CBMPA, the villagers began to oblige to the no-take rules.

"People still going in the *tabu*. When Manoa and If put their floats around, and said it's a *tabu*, people were still going. Until we went to the chief and extend it. When he close it, no one ever go in again. Everyone stopped. Because this place, it's not owned by individuals. It's owned by *Vanua*."

Sam explains how the reason behind everyone following the chief's support of the CBMPA is

due to the *qoliqoli* belonging to the entirety of the Vanua o Tabanivono-wai and not to any

individual.

5.3.1.2 Local perceptions of the CBMPA

The majority of interview participants remarked that since the implementation of the

CBMPA, there has been a visible increase in marine species. Inore (42yrs) remarks on this

change.

"Yeah. Sometimes I see the octopus and then I take it home. Plenty fish. But this *tabu*, it's good. We see a lot of new things. The corals, the new fish coming. Bring plenty fish for the *tabu*. We see the coral, the different coral. And too much moving in the *tabu*. Plenty of sea cucumber, different kinds. Clam too. It's good the *tabu* when I go to the other side to the deep sea, there's a lot of fish from there. Before, that side is a lot of fish. It's like this side, from the *tabu*. The fish we see here we see that side. Before we did not see that fish here."

Inore claims that due to the CBMPA, there has been a visible increase in octopus, fish, corals, sea cucumbers, and clams, as well as an increase in diversity in fish, corals, and sea cucumbers. Many of the fish that could only previously be seen in the open ocean are now also commonly found in the CBMPA. As discussed in section '2.1. Timeline of biodiversity changes', the CBMPA was identified by community members as one of the primary reasons for the increase in marine species abundance, diversity, and size, which was observed following its implementation in 2007 to the present day (May 2023). These findings are supported by the transect sampling conducted by Salunkhe (2024) of Naidiri's CBMPA which found greater abundance and diversity of fish and coral cover inside of the CBMPA boundaries compared to those outside of the CBMPA.

"Before there's plenty fish. In between there's nothing because of overfishing. Then, the *tabu* comes. When they do the *tabu*, then the fish come back." – Adi (35yrs)

What the reef might look like if the CBMPA remains was discussed by some individuals, who were hopeful that fish size and abundance would continue to improve.

"When my dad still alive, they catch these size of fish [full arm length] where the *tabu* isinside, outside – they catch this size of fish. My time, no. Today, we see the fish like this [points to elbow] inside the *tabu*. Starting to get bigger fish. In 20 or 30 years, if the *tabu* is still there, I think the fish must come like this [full arm length]." – Rupeni (58yrs)

Rupeni remarks that the fish sizes observed in the first time period (1977 – 1995) could measure an arm length in size. During the second time period, they were significantly smaller. Today, they are starting to increase in size, about half an arm's length. He remarks that if the CBMPA were to remain for an additional 20-30 years, the fish could return to the size they once were.

While these perceptions of the CBMPA are positive, as discussed in the previous section on '3.1.1. How the CBMPA began', the initial perceptions of the CBMPA were not favored by all those in Naidiri. In particular, this was not favoured by the women due to the placement of the CBMPA area on the primary octopus fishing grounds. Community members discussed a few speculations for the change in attitude, the most common of which was that it would secure a better future for the next generations.

"But it's good, eh? To protect the rules of the *tabu*. But it's just, with time, eh? It look for our kids, maybe 20 years later, they're going to see how the *tabu* doing. They're going to just have some fish. Easier." – Iliesa (41yrs)

Iliesa comments that individuals respect the no-take rules of the CBMPA to guarantee the success of the CBMPA long term. If this is maintained for 20 years or so, it will enable their kids to have a much easier time catching fish. Other reasons attributed to the shift in perspective of the CBMPA were said to be a result of community members in Naidiri getting used to the change in their daily routines. Taraiviri (51yrs) remarks on this shift.

"When it started, people are very sad. Because this was the main place to fish. When it's going, then it started getting better. After years, then they started getting used to it. They're used to going to further places. Before you can't. You just stay around here. Cook the casava, after that go to come back. Today, you cook, go far away in the afternoon, then come back. It's always like that. When they first start it, many people don't like it because they're used to fishing mainly here. It was sad for us to stop. After a while then we're used to it. Not sad."

Taraiviri explains how initial sentiments towards the CBMPA were sad, as this required a shift in how people went about their days. They now had to factor in covering a much greater distance to go fishing, and work around when they would be able to cook. He explains how over time, as people got used to it, they no longer minded. As well as thinking of future generations and adapting daily routines to accommodate for the CBMPA, some interview participants believe that the growing support for some people has been due to an economic incentive.

"Before, lots of people don't want it because everyday they go catching fish, octopus, the women. They don't want the *tabu*. But this time, they know that some money coming from the *tabu*. Now they can say yes to expanding the *tabu*. Now we see all the guests are coming. The tourists. They come for snorkel and bring money." – Inore (42yrs)

Inore explains how tourists now pay to come snorkel in their CBMPA, which has had an impact on perceptions of the CBMPA in the village. Tourists will often come by boat from the nearby resorts, including the Intercontinental Resort. Naidiri charges \$40 FJD per adults, and \$25 FJD per child to snorkel in their reef. Inore mentions that this new economic opportunity would likely result in the women now saying yes to expanding the boundaries of the CBMPA. A few community members commented on wanting to make the CBMPA bigger. It was remarked that this would result in greater fish abundance and size of fish in the reef. When asked if he believed the CBMPA would be extended, Rupeni (58yrs) said he believed it would, though shared some concerns about this change.

"Yeah. But the place, all of the women, they want to catch the octopus. It's not good. They use this place, just this place to catch. Some are not fit and have to go up there." He remarks that the CBMPA is located on the primary octopus fishing ground, and the women are now travelling a greater distance to get them. Rupeni discusses how expanding the CBMPA may further limit those who are physically unable to travel longer distances. During *talanoa*, some community members reported no longer going into the reef since the implementation of the CBMPA. The added distance now required to travel to fish in the reef was unachievable due to physical limitations (e.g. a bad hip).

5.3.1.3 CBMPA management

The fully closed CBMPA and rotational CBMPA are managed differently. The northernmost CBMPA is fully closed, and strict no-take rules are always enforced. The rotational *CBMPA* is managed differently.

"The second MPA. Only if any function that's held here in Naidiri, then the whole village can go and fish there. Rather than going for a long walk at the passage, just make it close. Only the ladies can go there and do the octopus. But when the ladies go there, they can't handline fishing, no." – Manoa (43yrs)

The rotational CBMPA is mostly closed, except for special village functions (e.g. wedding, funeral). During this time, people are allowed to extract marine life using only handline fishing. Day-to-day, all activities are restricted, except women are allowed to catch octopus. No other forms of marine life are allowed to be caught.

Since its implementation in 2007, the CBMPA in Naidiri has been managed by the village Youth Group. Manoa and If created the Youth Group to spearhead the implementation and ongoing management of the CBMPA. Today, there are approximately 20-30 youths aged 13 to 35 from Naidiri involved in the Youth Group. Youth Groups are common amongst *iTaukei* villages and supported by the Ministry of Education and the Ministry of Youth and Sports. Through the Ministry of Youth and Sports – Youth Services, the Youth Group registers by submitting regular reports and meeting all requirements (e.g. all completed forms must be endorsed by the *turaga-ni-koro*) (Ministry of Youth and Sports 2020). The group is structured with one member who is elected as the head of the group, a secretary and a treasurer. The group meets every two weeks or so to discuss topics ranging from finances, general project updates, and future plans. The presence of the Youth Group in the village has been empowering for youth members, who are highly involved and motivated by the opportunities the MPA has presented them.

Though all members of the group are involved in ensuring the no-take rules of the CBMPA are respected, many individuals have commented that the primary enforcer of the no-take practice has been Manoa. Manoa was selected to be the communities 'Head of Marine Protection' by the Ministry of Fisheries since the implementation of the CBMPA. During *talanoa* discussions, many individuals shared stories of Manoa chasing away people who were caught fishing within the CBMPA. This includes both poachers as well as Naidiri residents.

"One person was there, going fishing. Manoa came back from the farm, they were sitting by the sea like this, just fishing. And Manoa is calling from here, "Hey! You! Get out of there!" That lady still doing fishing. Manoa go, bring the fishing line like this, take it home. She won't say anything because in the general meeting, the village meeting, Manoa talk to the people. All the members of the village are not allowed to go fishing there. That's why he take the fishing line. She was angry at Manoa. He take the fishing line and bring it home." – Rufina (37yrs)

Rufina tells the story of a woman from Naidiri caught fishing inside of the CBMPA. When Manoa saw her, he confiscated her fishing line. Despite being upset about the interaction, she did not say anything as she knew Manoa would bring it up at their monthly village meeting and that the village would disapprove of her action. Other ongoing management efforts by the Youth Group include conducting regular reef checks to inspect the state of the A-frames and coral growth recovery, and to mitigate any new threats. This includes removing the COTS to prevent their predation on corals and, at times, removing octopus to prevent their predation on giant clams. Figure 5.20 shows Manoa removing both a COTS and an octopus from within the CBMPA during a routine reef check.



Figure 5.20 Manoa removing a crown-of-thorns starfish and octopus from within the CBMPA to prevent their predation on octopus and corals.

As previously mentioned, the Youth Group now brings in money from tourist visitations to the CBMPA to snorkel. With these funds, they have begun building a changeroom and bathroom for the tourists. Joseva (48yrs) explains how this has impacted the dynamics amongst the Youth Group and the rest of Naidiri village.

"We have an account for the people who come snorkel, the account go and put the money. That's what the villagers want. They want that money to go to the village. They [the Youth Group] have more projects to do, eh? They need to finish that. After that they need to make a walkway from there to the shore. The youth have their plan, and once everything is ok, they will look at the village. If the village wants something, like a brush cutter, the youth can buy it for them. But now they have to leave the youth."

Some people in the village want the Youth Group to share the profit they are bringing in with the entire village. Joseva explains how the Youth Group has plans underway to finish building the changeroom, as well as creating a walkway to the sea. Once those are complete, the Youth Group intends to increase the share of their profits with the village. Currently, if the village wants to buy something, such as a lawn mower, the Youth Group will use some of their funds to purchase it. Kevu (27yrs) explains that this is often what the Youth Group discusses in their meetings. "Any expense, now they ask us. Like to buy *grog*²² [kava]. That's why we always have our meetings, discuss if we agree and then give them."

The profits being brought in from the CBMPA are also gaining attention from the other surrounding villages in the *Vanua o Tabanivono-wai*. Kevu discusses some concerns regarding this.

"Yeah, we are hearing stories. From that way. Right now it's still ok. Time will come and the chief will pass away, then the *Vanua* might come and want to take over the *tabu*. Because we have sacrificed a lot for this."

²² Also commonly referred to as kava, *grog* is a medicinal root plant of cultural importance in Fiji. *Grog* is made from crushed root of the *yaqona* plant and strained with water. It is served during ceremonial *sevusevu*, and it is etiquette for guests visiting an *iTaukei* village to offer kava to the chief and/or the *turaga-ni-koro*.

Kevu explains how members from Naidiri have begun hearing stories from Malomalo about wanting to change who manages the CBMPA and its finances if the chief were to pass away. Currently, the Youth Group are the primary decision-makers of the CBMPA, as the current chief of the *Vanua o Tabanivono-wai* has granted them the ability to do so. As the chief is 92, however, discussions have begun amongst the Youth Group and others in Naidiri about what it could mean for the long-term management of the CBMPA if the current chief were to pass away and someone new replaced him. Joseva (48yrs) shares his thoughts on the matter.

"It's good now the *tabu* is just with the youth, it's easy to control everything. What I'm worried about is when the two villages come in. When they come in, there will be plenty ideas, plenty boss. Yeah that's because the Naidiri youth knows everything. You can go bring coral and plant coral."

Joseva explains how the current management of the CBMPA with the Youth Group makes it easy to manage and make decisions. He worries that if this management is transferred to the entire *Vanua o Tabanivono-wai* (all three villages, including Malomalo and Nalele), there would be too many ideas and decision makers. This could disrupt the ability to efficiently manage the CBMPA. He explains how, as Naidiri's Youth Group has been involved in managing the CBMPA since the beginning, they are well-informed and aware of best practices, such as how to effectively plant corals.

At the time of these *talanoa* discussions, Joseva was drafting a document with the Nadroga-Navosa Provincial Council to be signed by the current chief of the *Vanua o Tabanivono-wai*. This document would essentially secure the ability of Naidiri's Youth Group to be the exclusive caretakers of the CBMPA, even if the current chief were to pass away and someone new was to become chief. Vasenai (28yrs) explains how if the management of the CBMPA were to go to the three villages, the rotational CBMPA would become closed. "But now, the other *tabu* [rotational CBMPA], the other buoy that side, only one occasion than you do fishing there. If the three villages come, over there no more fishing. Can't. And it will be very strict."

If the three villages were to take over the management of the CBMPA, the no-take rules would become much stricter.

5.3.1.4 Spillover effect

Observations by Naidiri community members regarding the increase in marine species within

the CBMPA have also been said to have occurred outside of CBMPA borders. Loata (49yrs)

shares how this has been observed of coral.

"The coral are grown. Growing. There's plenty, inside and even outside the MPA. Because the youth they've planted it. And many people aren't going like they did before."

Loata attributes this change to the Youth Group planting corals within the CBMPA, as well as

there being less people going into the reef within the CBMPA. The spillover of marine species

from within the CBMPA has also been observed for fish and giant clam species.

"But they just fish outside, and most of them coming outside, coming outside. And they don't even know what's in there. They put their eggs up – the clams. And they float and only the current is going to take them. The fish too. The spillover, there's plenty that come out from the protected area. You have one glass, keep putting the water. After that when the thing full, spill out. Same thing, with the fish." – Manoa (43yrs)

Manoa explains how community members in Naidiri fish only outside of the CBMPA, but are seeing an increase in fish outside of its boundaries. He shares how when a clam releases its eggs, the current may take them, bringing them beyond the boundaries of the CBMPA. Manoa goes on to explain the concept of the spillover effect, using an example of adding water to a glass. Once the glass is filled with water, if you try to add more, the water will spill out beyond the glass. In the case of the CBMPA, once it is filled with fish, they will move beyond the CBMPA boundaries. Manoa also mentions that community members in Naidiri have only seen what spills

out of the CBMPA, with many of them not having seen what is inside. Kevu (27yrs) shares a similar thought.

"Man, I'm just thankful for this *tabu*. It has been great to others, especially ourselves. We always want to go there all the time. Yesterday we go see all the fish, it was so fun. Now, even the villagers haven't seen what's inside. The tourists come, and they see, but not even the villagers."

Kevu expresses his gratitude for the CBMPA and the opportunities it has afforded himself and the Youth Group, as well as how much he enjoys spending time in it discovering its marine life. He comments that what the Youth Group and the tourists get to see and experience, many of the villagers in Naidiri have not had the chance to see.

5.3.2 Coral planting

A second strategy to cope with changes to the marine SES has been planting corals within the CBMPA. Over the years, a number of different coral panting strategies have been engaged, which have been tested out through trial and error. The first two methods employed were the cone and U-nail methods. Manoa and If had the opportunity to attend a 1-week workshop hosted by the Japanese non-profit VESA at the Beachcombers resort to learn how to do these, but found challenges with them both. The cone method required purchasing materials costing around \$150 FJD, which made it inaccessible. They also found the cone method unable to withstand storm surges. The same was true for the U-nail method.

"The thing I didn't use it. This one, the U-nail. Because once you nail it if you're gonna nail it hard, the coral right here where you hit the nail, the coral break. If you don't want it to break, you can't hit hard. So when the storm comes, it can come out." – Manoa (43yrs)

Manoa explains how the U-nail method works, taking a fragment of coral and using a U-shaped nail and a hammer to insert it into a rock face. However, if too much force is applied, this would break the coral – not enough force, and a storm surge could rip it out. Manoa shares that his

favourite planting methods today are the cookie method, the rope nursery, and the A-frames. The cookie method requires taking a coral fragment and inserting it into a disk-shaped cement mixture, which is then tied to a mesh wiring underwater. After growing for a few months, the 'cookie' (coral implanted in cement) is then removed and transplanted to the sandy ocean floor where it will continue to grow. Manoa shared how he learnt this method on his own using resources he found online. What distinguishes a 'good' coral planting method to one that is ineffective is its compatibility with the conditions of Naidiri's reef. Manoa explains this.

"The other thing is most other places doing this coral planting are not like this reef. This reef when it gets angry, storm surge it's very very bad. I mean the weather, the wave and the current. Too strong, not like some other places with a new reef. But I think it just don't go hard. But here it's very different. This place here when we do one method, one style of planting, we have to think of storm surge, of the big waves. When the thing grows, when the storm comes, then good, steady."

Manoa explains how unlike other reefs in Fiji, theirs experiences a high frequency and severity of strong currents and waves. The methods employed to plant coral must therefore be able to withstand strong shocks.

"They've changed. Climate change. But even me, I see that A-frame method, it's really strong and really suits that staghorn coral. Staghorn coral, if you leave a big branch there and a storm comes, it can just wash it away and break it. But when you grow it in the A-frame, really hard to break even a branch. Very hard."

Manoa discusses how the A-frame method is well suited to the increase in bad weather resulting from climate change. Staghorn coral on its own is a relatively fragile coral species, breaking off easily. However, when grown on the A-frame, the staghorn coral becomes strong. This is because coral fragments from the same 'mother' staghorn coral plant are chosen. As the individual fragments grow on the A-frame, if they are from the same 'mother' species and are therefore genetically similar, they will fuse together as they continue to grow. This creates a strong webbed grouping of corals, which can better withstand bad weather events.

Manoa and the Youth Group have and continue to try new methods of coral planting, as well as adapting current practices as conditions change. To date, they have a total of 14 A-frames in their reef. 4 were planted in May 2023, 7 in June 2022, and 4 in 2019. Of these, only 1 washed ashore during a strong weather event, and the 14 remain in Naidiri's reef today. These A-frames were all planted with Dr. Austin Bowden-Kerby from Corals for Conservation. It is believed that the A-frame dating back to 2019 may be the oldest in Fiji, perhaps even in the world. Figure 5.21 shows the process of mounting corals to the A-frame structures, which is done outside of the water while pouring water over the corals to keep them wet. Once this is done, the A-frames are brought back into the reef, where a coral nursery is attached between two A-frame structures (see Figure 5.22). There, the A-frames are cemented into the reef bed and will be left for years to come (see Figure 5.23).



Figure 5.21 Naidiri Youth Group and Corals for Conservation team members tying selected heatresistant corals (*Acropora*) onto an A-frame structure.



Figure 5.22 A-frames from 2022 in Naidiri's CBMPA. Between the A-frame structures is what is called a coral nursery, in which coral fragments are attached to a rope.



Figure 5.23 Dr. Austin Bowden-Kerby swimming over two of the four A-frames inserted in Naidiri's CBMPA in 2019. The presence of fish and growth of corals are evident on and around the A-frames.

While discussing coral planting in Naidiri's CBMPA, Manoa mentions the importance of sharing this knowledge with youth.

"My sons, I always tell them the importance of mangroves, planting mangroves and coral planting. And I was planning – I forgot to say at the last meeting, to ask all the parents if the next public holiday we could release the sons, going to teach them to do the coral planting. You know? They have to learn it. And they really love it, they really love it. They're always asking me. Because these are the future leaders. Whenever their time comes, 10-15 years to come, they'll know how to do it, keep it going. Know the importance of marine life. Because most of the time when they go out fishing, they always catch this size of fish [finger length]. Just with their spear. They just kill anyhow. And I was telling them "Keep that, keep that. That's for another 3, 4, 5 years." What I'm trying to do is teach them the importance of keeping the marine area. It's for them, and their kids."

Manoa begins by discussing how he often shares with his sons the importance of planting mangroves and corals, and intended to ask at the last village meeting if he could bring out some youth during the next public holiday and teach them how to plant corals. This would ensure that the knowledge they have accumulated over the years is passed down to the next generation, so that they may someday also participate in coral planting. He explains how this will also provide an opportunity to teach them the importance of marine life and not catching juvenile fish. Manoa also shares how youth from Naidiri as well as other villages, including Sanasana and Malomalo, have expressed an interest in learning to plant corals within their *qoliqoli*. He hopes to someday share what he has learnt with them.

5.3.3 Beach cleanups

In an effort to keep their beachfront clean, Naidiri participates in the occasional beach cleanup. This implies cleaning out the tin roof slabs still in the sea, as well as garbage found in the sea or on the beachfront. Some community members reported that this is an event which occurs monthly. "Every month we have to go to the village meeting. We have to do some cleanup like that, every month. Because the headman of the village has to write the report and take it to the [provincial council]. The headman, they have their allowance too. That's why they have to write the report every month. No report, no allowance." – Rufina (37yrs)

Rufina reports that the *turaga-ni-koro* (village headman) must fill out a monthly report to the Nadroga-Navosa Provincial Council in order to get his monthly pay. Part of the report requires that activities such as a beach cleanup be conducted. Sam (30yrs) recounts how the cleanups have actually not happened for some time, and that he would like to initiate one again soon.

5.3.4 Wave barriers

Some community members have attempted to address the changes to sea level rise, storm surges, and changes to wave patterns by creating wave barriers. This has included adding a physical barrier by adding stones, as well as planting trees.

"These people they are doing the wave barrier. They are putting stones. It's like a wave barrier. Before we did it. Before the sea comes right here [to the house]. Now we put the plant every tree everywhere to stop the waves." Taraiviri (51yrs)

Taraiviri explains how prior to doing a wave barrier and planting trees along the shoreline, the water levels could reach the house we were in during the *talanoa*. Other community members, such as Vasenai (28yrs), described an inability to prevent the impacts of sea level rise, storm surges, and changes to wave patterns from occurring.

"What can we do to fix strong waves coming? We can't. We can just work on our place. We can't work outside."

Vasenai speaks about limits to prevent strong waves from impacting their marine SES as

confined to their own community. She mentions how they cannot work 'outside' of their reef.

Vaseva (49yrs) expands on this.

"Even though there's a *tabu* in the sea, when the strong wave wants to hit, it can just come anytime. Can't stop it. Just like a tsunami when it came."

Vaseva explains how even though they have the CBMPA, it cannot prevent the occurrence of strong waves from negatively affecting their reef, just as they cannot prevent the impacts of tsunami's when they strike. The stressors described as being beyond their scope of influence due to the scale at which they are occurring are considered exogenous, while other pressures, such as mitigating crown-of-thorns outbreaks, are considered endogenous as they are modifiable at the community of Naidiri's scale of influence (Kuempel et al. 2021).

Chapter 6: Discussion

This research shows that multiple social-ecological changes operating across scales have negatively impacted the health of Naidiri's coral reef ecosystem. Historically, the reef was essential for survival and *iTaukei* depended on the reef to meet their basic food needs and livelihoods. Relationships to the reef were, and continue to be, highly gender-based, with women typically hunting octopus and harvesting invertebrates while men spearfish. The subsistencebased nature of relationships to the coral reef evolved over time with the advent of globalization and material goods, and most community members today participate in selling marine resources (e.g. fish, octopus, invertebrates) at local markets and/or to middlemen buyers. The overexploitation of marine resources driven by processes of technological development and nation-wide capitalism has been coupled with environmental changes occurring across scales, leading to the demise of reef health. The youth in Naidiri village responded to the decline in reef health by implementing a CBMPA and planting corals in the reef. These conservation and restoration practices have been successful in rehabilitating the reef, though reef health is still not what it once was. The success of these efforts is attributed to the rights of *iTaukei* to manage their coastal and marine resources and the utilization of an adaptive management strategy for governing the CBMPA.

The findings that environmental changes impacting the reef are operating across scales are critical for resource management. Naidiri's marine SES has experienced multiple cumulative social and environmental changes, from the 1970s to today. Approximately 15 pressures have been identified, occurring across different scales (global, national, regional, and local) and across different timelines resulting in localized impacts on the marine SES. These are summarized in Table 5.1. Naidiri community members described these drivers of change as having and/or

occurring across time, with perceptions of reef health starting to diminish in the 1990s. This is consistent with literature by Demers & Kahui (2012) and Friedlander (2018) documenting the monumental shift in inshore fisheries of the 1970s by the national government and institutions such as the Fiji Development Bank to encourage the commercialization and development of inshore fishing areas. It is likely that these impacts took time to materialize, and by the 1990s, reef health was visibly degrading. Other historical developments in Naidiri which have indirectly negatively impacted reef health include the shift from predominantly subsistence-based relationships to the reef to one of marine resource extraction for cash income. This is synonymous with scholarship (Ruddle 1998; Demers & Kaui 2012; Friedlander 2018) which describes regional and national efforts to transform subsistence fishing into more profitable operations by introducing external incentives for individual profit. The findings from Naidiri are a case study example of the resulting overexploitation of marine resources and the weakening of traditional morals that previously governed marine resource management. The transformation of how marine resources are perceived by community members in Naidiri was further exacerbated by the occurrence of Cyclone Oscar in 1983, which caused significant damage to sugarcane plantation infrastructure (Browne & Krishna 1983). The widespread loss of employment in this economic sector resulted in an influx in the number of people from the village relying on marine resources for profit.

The commercialization and development of inshore fisheries was further catalyzed through technological changes. Community members in Naidiri associate the arrival of the diving torch in the 1990s and oxygen tanks in the 2010s with overfishing in their reef. Not only is this being done by community members, but they have also experienced increased poaching within their *qoliqoli*. Such gear changes facilitate poaching at night, making it difficult to prevent the

extraction of marine resources by outsiders. This diminishes the role and power of local management and traditional authority in the village to regulate marine resource harvesting (Ruddle 1998).

Findings from this research also show that resource extraction activities, including a history of coral mining and the continued practices of sand mining and deforestation, have had significant negative repercussions on the coral reef. These extractive practices are driven by national modernization and economic development processes, which seek to increase opportunities for profit through local marine and terrestrial resource extraction (Ruddle 1998; Ministry of Agriculture 2014). Further, the findings from this work detail the growing impacts of urbanization and tourism, leading individuals in Naidiri village to choose employment opportunities within resorts and city centers and impeding the continuation of traditional *iTaukei* lifestyles. This supports the findings by Movono et al. (2018) of the reality faced by many iTaukei communities throughout Fiji to engage in non-traditional livelihood practices outside of the village, as it enables higher living standards and increased purchasing ability. Those who choose to stay in the village often face limited employment opportunities, and most individuals' income comes from selling marine and terrestrial resources. Addressing the harmful practices of deforestation and sand mining must therefore account for existing limited economic opportunities within the village and seek to provide alternative livelihood options (Pollnac et al. 2001; Charles & Wilson 2009).

Of the 15 identified social-ecological pressures that have occurred to the reef in Naidiri over time, 8 of these were identified by the community as being the most prevalent today. These include human pollution, changes in governance, illegal poaching, sand mining, deforestation

and runoff, coral bleaching, sea level rise and outbreaks in the crown-of-Thorns starfish. These eight pressures are illustrated below in Figure 6.1.



Figure 6.1 The eight social-ecological stressors which are prevalent in the coral reef ecosystem today of greatest concern to the community of Naidiri.

The use of both marine conservation and active coral reef restoration has been instrumental in revitalizing the health of Naidiri's coral reef. This research shows that observed improvements to the health of the coral reef are attributed to the implementation and local management of the CBMPA and coral planting efforts by Naidiri's Youth Group. Improvements in the abundance and species diversity of fish, invertebrates, and coral have been observed both within the boundaries of the CBMPA, as well as outside due to the spillover effect (Goñi et al. 2008). The findings from this research of the notable increase in fish biomass due to the presence of the CBMPA are reflected in existing MPA literature (Strain et al. 2019; Villaseñor-Derbez et al. 2023), while the notable increase in coral cover differs from MPA literature of the oftenmarginal increases to coral cover as a result of MPAs (Strain et al. 2019). This is likely a result of the coral planting initiatives conducted within the CBMPA boundaries. The practice of 'planting' corals, sometimes referred to as coral gardening, is a form of active reef restoration and is increasingly gaining attention as the best approach to reversing coral reef degradation (Lirman & Schopmeyer 2016; Rinkevich 2021). Some authors have stated the importance of implementing both MPAs and active coral reef restoration in areas where reefs have been degraded, and that not implementing a variety of restoration measures limits the success of MPAs (Rinkevich 2008). It is therefore unsurprising that the utilization of both the CBMPA and the A-frame structures for coral restoration by Naidiri's Youth Group had a synergetic effect, expediting coral cover recovery than if only the CBMPA were implemented. However, further research is required to better understand the precise relationship dynamics between coral planting using the A-frame method within CBMPA boundaries. This is not only important ecologically, but as enhancing the recovery of degraded coral reefs could expedite improving food security for the coastal communities whose lives and livelihoods are interconnected within these marine SES.

The findings from this work also highlight the inherent limitations of the CBMPA in addressing all cumulative impacts, as these are both endogenous and exogenous in nature. Naidiri community members mention their inability to address climatic factors of sea level rise and coral bleaching events, as these are occurring beyond their scope of influence. While the CBMPA and coral planting initiatives have been effective in adapting to some of the cumulative social and environmental factors negatively impacting the reef, these must be met with global reductions in greenhouse gas emissions to address climatic stressors of sea level rise and coral bleaching events. This corroborates with the findings from other authors who emphasize the importance of multifaceted responses to cumulative impacts (Guarnieri et al. 2016; Friedland 2018; Kuempel et al. 2021).

Local conservation and restoration activities were made possible because of resourceownership laws in Fiji that give power to *iTaukei*. The findings from this work show that the implementation of the CBMPA in Naidiri village had differential impacts on community members and that some of these impacts were mitigated through adaptive management. While initial efforts to implement the CBMPA were met with a lot of resistance from the community, over time perceptions of the CBMPA changed and today, perceptions are largely positive. The findings from this work suggest four reasons for the attitudinal changes: 1) the support for the CBMPA by the chief of the *Vanua o Tabanivono-wai* indicates continued adherence to customary marine resource management within the *iTaukei* village; 2) slowly increasing the CBMPA size enabled community members to adapt their daily routines, while the rotational CBMPA status mitigated further negative impacts to the women's traditional livelihoods; 3) tourist visitations to the CBMPA has provided a new source of income for the Youth Group and Naidiri village, and; 4) the visible increase in marine species biomass and coral cover has spurred community support for the CBMPA to ensure continued benefits for future generations.

6.1 Customary management

The implementation of the CBMPA was initially met with a lot of resistance from the community, with some individuals even slashing the buoys indicating the CBMPA boundaries. However, the adherence to traditional authority in the village is evident in the findings that no-take rules were followed once the chief of the *Vanua o Tabanivono-wai* expressed his support for the CBMPA. Once the chief granted permission for the Youth Group to manage the CBMPA, community members began to follow the no-take rules. This finding is consistent with literature by Friedlander (2018) of the continued compliance throughout Oceana which respects traditional authority surrounding marine resource management. While previously mentioned findings from

this work identify the impacts of commercialization and development processes on traditional authority governing marine resources, it is evident that certain traditional values and beliefs within the *iTaukei* community remain strong (e.g. abiding by the chiefs' decisions surrounding the management of marine resources; perceptions of the *qoliqoli* as sacred).

6.2 Gendered impacts

Women in Naidiri village were disproportionately negatively impacted by the CBMPA due to its location on prime octopus fishing grounds situated right in front of the village. This included: greater displacement of women than men, disruptions to their daily routines, and imposed restrictions on their primary source of income without their consultation in decisionmaking processes. As customary in *iTaukei* villages, women are expected to tend to the home, prepare daily meals and participate in the collection of foods such as octopus and invertebrates (Robinson 2008; Ram-Bidesi 2015; Pickering 2020). While men could continue to engage in fishing activities in the deep sea outside of the CBMPA boundaries, the women's occupation of inshore fishing grounds resulted in a greater sense of displacement and disrupted their ability to participate in both traditional *iTaukei* housekeeping roles and income-generating activities. These results align with findings by Rohe et al. (2018), which found that women who had been excluded from decision-making processes to choose the placement of a CBMPA were not compliant with the marine closure due to its location in an area mainly used by women to fish. The findings from Naidiri indicate that the first two years of the CBMPA's implementation (2007-2009) were unsuccessful in conserving the coral reef due to a lack of compliance by women in Naidiri, as well as some male community members. This is unsurprising due to the reported lack of inclusion of Naidiri women during the initial implementation and management stages of the CBMPA. Including women in the initial decision-making processes, for example,

could have informed the location chosen for the CBMPA and reduced the disproportionate negative impacts they experienced.

The Youth Group has worked to mitigate some of these disproportionate impacts through adaptive management actions. While the chief granted the Youth Group permission to extend the CBMPA boundaries to encompass the entire *qoliqoli*, the group chose to keep the CBMPA relatively small (100m x 100m) to start. This allowed the women to adapt their daily routines to accommodate the extra time now required to access open fishing grounds. The size of the notake CBMPA was slowly increased over time, and today measures 260m x 260m. In 2018 the youth group implemented the rotational CBMPA (280m x 260m), which allows women to hunt octopuses within its boundaries while prohibiting all other forms of daily extractive activities. Community support for these dynamic CBMPA boundaries and management actions coincides with literature on adaptive management within MPAs. Adaptive management has a rich history in managing small MPAs under customary law, as this governance structure facilitates quick adaptation responses to changing circumstances (Ban et al. 2012; Weeks & Jupiter 2013; Friedlander 2018). The gradual increase in support of the CBMPA from its implementation in 2007 to today is in part attributed to the utilization of an adaptive management structure, which has addressed some of the disproportionate impacts experienced by women.

Further, some community members reported no longer being able to fish in the reef at all since the implementation of the CBMPA due to the added distance now required to fish outside of the CBMPA boundaries. This included elderly community members and individuals with physical disabilities, both male and female. This finding is synonymous with literature by Ruano-Chamorro et al. (2024) and Ban et al. (2019) on the diverse effects on people's wellbeing that can result from conservation initiatives and the importance of intersectional assessments of

inequities. In Naidiri, the CBMPA affected groups of individuals differently because of overlapping systems of discrimination due to socio-cultural norms, gender, and age (Nightingale 2011). As a result, some individuals have borne more costs and fewer benefits from the implementation of the CBMPA than others in the community.

It is important to note that there remain community members in the village who are still not in favor of the CBMPA, many of which are women. However, when asked about their perceptions of the CBMPA, many of these individuals were hesitant to speak honestly, or would not divulge their sentiments. This was often the case when other community members were around, especially when male family members were nearby. This indicates that individual sentiments towards the CBMPA today may not be entirely in favor of the conservation effort but that some individuals feel the need to mask their displeasure and concerns. This is likely influenced by what is described by Vunisea (2008) as the "culture of silence", describing the common cultural practice in the PIR of not speaking unless addressed or asked, respecting the perspectives of elders, and not contradicting what has been agreed to. This is particularly true for women and young people, with cultural norms dictating what can(not) be discussed and limiting participation in decision-making processes (Vunisea 2008; Ruano-Chamorro et al. 2024).

It would be of value for future research assessing community perceptions of CBMPA implementation and management to adopt a gendered and equity lens, working with women and other marginalized groups (e.g. those who are physically disabled, elderly) to create spaces where individuals feel comfortable expressing their true sentiments of the marine conservation efforts. Doing so would work to identify continued barriers to CBMPA accessibility, an important first step to identifying how these barriers can be addressed.

6.3. Ecotourism

As previously discussed, identifying alternative income sources is integral to MPA success (Pollnac et al. 2001; Charles & Wilson 2009; Bowden-Kerby 2023). The decision to initiate tourist snorkelling visitations to the CBMPA as a form of ecotourism within the village created a new revenue stream. This management decision acquired further support for the CBMPA by some members of the community, while simultaneously sparking concerns about the inequitable distribution of benefits received. As most of the income was going towards supporting initiatives by the Youth Group (e.g. building a changeroom for tourists), community members expressed that the benefits reaped should be equally distributed amongst all community members. Many authors have discussed the importance of addressing disproportionate costs and benefits among individuals in a community when implementing MPAs (Charles & Wilson 2009; Pietri et al. 2009; Harvey et al. 2017; Snowman & Sunde 2018). This is necessary to ensure compliance with MPA rules by local communities and, ultimately, the overall success of MPAs as conservation strategies (Charles & Wilson 2009). The Youth Group responded to community concerns by adapting their financial plans to ensure a proportion of all profits from tourist visitations would be re-invested into the village. This has worked not only to mitigate uneven cost/benefit distribution but to achieve continued community support for the CBMPA. It is also important to address the potential harm of reliance on tourism for revenue, as highlighted for Fiji and many other PIR countries during the COVID-19 global pandemic. Tourism represents one of the greatest contributors to Fiji's GDP, and as such, the COVID-19 pandemic had devastating impacts on the country's economy and the communities whose livelihoods are closely tied to tourism (Connell 2021; OECD 2022). Prior to COVID-19, tourism accounted for 38.9% of Fiji's annual GDP, which fell by 15.5% in 2020 and is still recovering (OECD 2022). While the rise of

ecotourism in the village represents new economic opportunities and benefits for the community, it is important that other income-generating avenues be pursued and new opportunities be identified in order to avoid reliance on this revenue stream.

6.4 Future generations

This research has found that a significant contributing factor to attitudinal changes regarding the implementation of the CBMPA was in observing the increase in fish biomass and coral cover, and what this could mean for future generations. These observations spurred community discussions of the spillover effect being experienced, and projections that benefits would continue for generations to come. This social learning of the perceived and potential benefits of the CBMPA has worked to inform future management and planning decisions of the CBMPA (Ban et al. 2012; Weeks & Jupiter 2013). The Youth Group intends to work to continue to improve the management of the CBMPA through intergenerational knowledge sharing by: 1) teaching youth coral planting techniques they have learnt over a decade of trial and error, 2) formally training youth to conduct daily reef checks and monitoring, and 3) expanding social learning processes to nearby communities who have expressed interest in implementing their own CBMPAs.

Research by Ban et al. (2012) and Bryce & Hunter (2024) has identified the need for greater consideration of socio-cultural considerations on adaptive management in MPAs, as this field currently deals predominantly with issues relating to physical and ecological dimensions. The findings from this work demonstrate the importance of socio-cultural considerations in managing CBMPAs, to ensure that as conditions change and management adapts, heterogenous impacts on community members are properly mitigated.

6.5 Future of the CBMPA

When considering the future of the CBMPA in Naidiri, this research highlights the importance of considering the dynamicity of political, social, and environmental factors. Some of the factors which may impact the future of the CBMPA include (but are not limited to): Central government changes, a new chief of the *Vanua o Tabanivono-wai*, and climate change and other anthropogenic pressures.

Fiji's political history has seen marine tenure and *qoliqoli* rights continue to be an area of political controversy and tension (Lal 2009; Lal 2012; Sloan & Chand 2016). The recent 2022 election and the newly elected government's restoration of the Great Council of Chiefs and their consideration of other legislative reforms and proposals to enhance customary and traditional modes of governance may strengthen Naidiri village's rights to manage their *qoliqoli* and, subsequently, their CBMPA (Norton & Varani 2023; Latu 2024). For example, this may influence the ability of the village to respond to illegal poaching from outsiders, a contributing factor to the overexploitation of marine resources. However, as was observed during the governing of the FijiFirst party, the State has the power to weaken *qoliqoli* rights, and, subsequently, the ability of *iTaukei* communities to enforce compliance with community-based marine conservation efforts. The continued dominance of the State to alter legislation over customary governance in Fiji's plural legal system represents an uncertain future for the long-term security of *iTaukei* to govern CBMPAs.

A second important consideration is the current age of the chief of the *Vanua o Tabanivonowai*. A new chief could choose to alter the management of the CBMPA from Naidiri's Youth Group to instead be done by all three villages. However, as expressed by some community members in Naidiri, a transfer in management raises concerns that there would be too many

decision-makers with conflicting priorities and values. The intent to formalize the Youth Group's management of the CBMPA with the NNPC did not materialize. However, it indicates the Youth Group's desire to continue to be the primary decision-makers of the CBMPA long-term.

Lastly, the ongoing impacts of climate change and other anthropogenic pressures outside of Naidiri's scope of influence continue to threaten the health of the coral reef both within and outside of the CBMPA boundaries. Looking at coral bleaching projections alone indicates a dire future for the health and survival of coral reefs globally, with international targets of limiting warming to 1.5 degrees Celsius representing a threat to over 90% of all coral reefs (Harvey et al. 2017; Heinze et al. 2021; Mycoo et al. 2022). Naidiri's emphasis on planting corals which can better withstand marine heatwaves strives to increase the resilience of not only their coral reef but also their greater marine SES to future coral bleaching events.

Chapter 7: Conclusion

This thesis investigated the implementation of an Indigenous-led CBMPA in Naidiri village, Fiji, in response to the cumulative impacts of social-ecological changes. Social-ecological changes affecting the coral reef ecosystem and their drivers were first identified and then examined in the context of processes which shape how local people experience and respond. Increasingly, MPAs are being used to respond to mounting pressures on marine ecosystems. While there is a growing body of scholarship on the socio-cultural dimensions of MPAs, there is a need for greater consideration of gender-specific assessments of MPAs, especially as it pertains to women's participation in the PIR (Kleiber et al. 2018; Michalena et al. 2020), as well as consideration of Indigenous governance in MPA design and management (Ban & Frid 2018; Rasheed 2020). Further, most research to date has focused on investigating single drivers of change, with less known of the cumulation of social and environmental pressures over time (Jaureguiberry et al. 2022). This research responded to these knowledge gaps, investigating the cumulative social and environmental pressures on a coral reef ecosystem over time and assessing the socio-cultural implications of implementing a CBMPA as an adaptation response, with a focus on the gender dynamics of CBMPA implementation and management and the role of Indigenous governance. This aim was achieved through the following three objectives: (1) characterize *iTaukei* relationships with the coral reef ecosystem; (2) document the environmental and social change processes that have affected the coral reef ecosystem and the implications for local livelihoods; and (3) describe the strategies employed to manage and cope with these changes, with a particular focus on the CBMPA. This chapter summarizes key findings from this work, identifies how they inform the broader scholarship on CBMPAs and cumulative impacts, highlights practical contributions of the research, and identifies opportunities for future research.

7.1 Summary of key findings

1. Cumulative social and environmental pressures occurring at different scales of influence and across time have impacted the marine SES in Naidiri village.

Both endogenous and exogenous social and environmental stressors have impacted the marine SES in Naidiri village. Some of these non-localized pressures reflect processes of modernization and economic development occurring throughout the country and have altered local livelihoods from being predominantly subsistence-based to increasingly engaging in fishing for financial gain. This has resulted in the overexploitation of marine resources and engaging in resource extractive practices of sand mining and deforestation. Policy interventions and the diversification of livelihoods and income sources are necessary to ensure the continuation of traditional *iTaukei* lifestyles and the ability to manage marine resources locally. These will be discussed further in sections '7.3. Practical contributions' and '7.4 Recommended Fiji government policy changes'.

2. Reef health has improved since the implementation of the CBMPA and the initiation of coral planting in the reef.

The communities' response to cumulative social and environmental pressures through the implementation of the CBMPA and coral planting initiatives has succeeded in improving reef health. Though reef health has not returned to the state it once was, there have been observed improvements in the abundance and species diversity of fish, invertebrates, and coral cover and the benefits of the spillover effect being experienced. The extent of coral cover recovery within the CBMPA is likely a result of the use of the A-frame coral planting method, which expedited the recovery process than if only the CBMPA were implemented. This research also demonstrates the limitations of the CBMPA in addressing climatic pressures of sea level rise and
coral bleaching which are increasingly experienced in the reef, and the importance of global reductions in greenhouse gas emissions to mitigate these impacts.

3. The impacts of the CBMPA on local livelihoods were differentiated by gender, and some of these impacts were mitigated through adaptive management practices.

The findings from this research highlight the importance of socio-cultural considerations in managing CBMPAs (Ban et al. 2012; Bryce & Hunter 2024). The implementation of the CBMPA in Naidiri village had differential impacts on women and men due to gendered relationships to the coral reef, which inhibited initial community support for the marine conservation effort. The change in local perceptions of the CBMPA over time is in part attributed to the community's continued adherence to customary rule by the Vanua o Tabanivono-wai chief and his support for the CBMPA. As the traditional governance structure of local management can quickly adapt to changing circumstances, this enabled the Youth Group to employ adaptive management strategies (Ban et al. 2012; Weeks & Jupiter 2013). Specifically, the Youth Group adapted their management practices by slowly increasing the size of the CBMPA over time so that community members could adapt their daily routines, re-distributing finances from the new ecotourism revenue to make it more equitable, and adapting future management decisions to prioritize intergenerational knowledge exchange and training. However, some community members continue to be displeased with the presence of the CBMPA. This highlights the complexity and dynamicity of marine conservation spaces, and the need to work with different groups of individuals within a community on a continuous basis to ensure all voices and concerns are effectively heard, considered and included, especially as it pertains to gendered considerations in marine conservation and management.

7.2 Scholarly contributions

This research contributes to existing scholarship on cumulative social and environmental pressures in highlighting the importance of understanding cumulative impacts (Perry et al. 2011; Guarnieri et al. 2016; Harvey et al. 2017; Roberts et al. 2017; Delevaux et al. 2018; Ferro-Azcona et al. 2019; Wilson et al. 2020; Mycoo et al. 2022; Jaureguiberry et al. 2022; Simeoni et al. 2023). This research identifies 15 interacting social and environmental stressors on the coral reef ecosystem in Naidiri. Each of these stressors has manifested endogenously or exogenously to impact the marine SES in unique ways, at times interacting with one another to create exacerbated impacts.

Considerations of socio-cultural dimensions in MPA implementation and management are growing (Charles & Wilson 2009; Harvey et al. 2017; Sowman & Sunde 2018; Wilson et al. 2020; Gurney et al. 2021; Hoppit et al. 2022; Gill et al. 2023). However, some authors have identified the prevailing emphasis on biological indicators in measuring MPA success (Bennett & Dearden 2014; Rasheed 2020) and have called on the need for greater considerations of gender in the PIR (Kleiber et al. 2018; Michalena et al. 2020), and the role of Indigenous governance in MPA implementation, management, and assessments of success (Ban & Frid 2018; Rasheed 2020). This research addresses these knowledge gaps, highlighting how Indigenous-led natural resource governance may facilitate processes of adaptive management to address heterogenous socio-cultural impacts of CBMPA implementation and management which disproportionately impacted women.

Lastly, the findings of this research reinforce previous work on the benefits that can be accrued when a variety of restoration methods are used in response to degraded coral reef environments (Rinkevich 2008). The utilization of the A-frame structures for active coral reef

restoration within the CBMPA boundaries and the subsequent increase in coral cover recovery corroborates the use of both conservation and restoration methods as adaptation responses to cumulative environmental and social impacts.

7.3 Practical contributions

Many authors have discussed the relationship between resource extraction activities, poverty, and a lack of policy to regulate these practices (Ruddle 1998; Tobey & Torell 2006; Caras & Pasternak 2009; Rangel-Buitrago et al. 2023; Shah & Race 2024). Addressing the continued practices of deforestation and sand mining must therefore account for existing limited economic opportunities within the village and seek to provide alternative livelihood options (Pollnac et al. 2001; Charles & Wilson 2009). For example, programs such as the *Traditional Contemporary Arts & Crafts Income-Generating Program* by the nonprofit Rise Beyond the Reef work with *iTaukei* women in remote villages to provide alternative income sources while preserving traditional practices. By providing leadership training opportunities and connecting women to regional and international markets to sell their artisanal products (e.g. traditional basket weaving), women are presented with income-generating opportunities as well as a way to promote and preserve traditional *iTaukei* practices.

Practical contributions from this work also include considerations for the future management of the CBMPA. The Youth Group intends to train youth from the village to conduct daily reef checks and monitoring to improve mitigation and adaptation responses to stressors as they arise. The Youth Group has also expressed an interest in scaling up their marine conservation efforts to neighboring villages and other coastal communities in Fiji. By sharing their approach to coral planting and adaptive management of the CBMPA, the Youth Group hopes to empower others to initiate and/or engage in marine conservation within their own communities. This represents an

opportunity for practitioners (e.g. local non-profits, local governments, academic groups) to collaborate with the Youth Group and provide adequate training, advisory, and/or financial support to achieve their objectives.

7.4 Recommended Fiji government policy changes

This research also highlights a few strategic policy entry points to regulate cumulative social and environmental impacts. First, *iTaukei's* rights to manage and regulate their *qoliqoli* to prevent illegal poaching needs to be legally recognized in order to prevent overexploitation from outsiders and improve the regulation of marine resource extraction. Other research has highlighted the need for greater recognition of traditional marine resource management practices within the contemporary legal system (Ruddle 1998; Valmonte-Santos et al. 2016). The need to strengthen existing national policy has also been called on to restrict sand mining activities (Rangel-Buitrago et al. 2023), deforestation and subsequent sediment runoff (Shah & Race 2024), coral mining activities (Caras & Pasternak 2009), gear use and overfishing (Demers & Kahui 2012) and waste management laws (Sewak et al. 2021; SPREP 2022). Addressing ongoing cumulative social and environmental pressures through effective policy interventions is necessary to protect coral reef ecosystems and secure the continuation of *iTaukei* ways of life.

7.5 Opportunities for future research

This research identifies the following opportunities for future research:

 Cumulative impacts: All 15 identified cumulative impacts could be further investigated to better understand their individual impacts on the marine SES in Naidiri. Future research could also benefit from an in-depth analysis of the relationship between these stressors.
For example, a research study could be conducted on the interacting stressors of historical

coral mining, the continued practice of sand mining, and increasing sea level rise. This research would provide critical insight into the exacerbating nature of these stressors to better inform policy development and practical efforts to mitigate coastal erosion.

- CBMPA and coral planting: There is a need for further research to investigate the relationship dynamics between CBMPAs and coral planting using the A-frame method. Ideally, future research could aim to quantify the ecological changes over time (e.g. coral cover, fish biomass) that have occurred within CBMPA boundaries where coral planting initiatives **have** occurred, compared to within CBMPA boundaries where coral planting initiatives **have not** occurred. A comparative analysis of this nature would contribute to scholarship on the effectiveness of active coral reef restoration efforts and marine conservation zones as adaptation responses to degraded coral reef ecosystems.
- Gendered impacts of CBMPAs: This study highlights the gendered nature of how the CBMPA is experienced by community members. New research could focus on the lived experiences of *iTaukei* women and their perspectives of the CBMPA. Specifically, this research could investigate: (1) the relationship between *iTaukei* women and their marine environment before and after the implementation of the CBMPA, (2) document traditional octopus-catching livelihoods and how this has changed due to the CBMPA, and (3) women's participation (or lack thereof) in decision-making surrounding CBMPA management. A separate study could also be conducted on accessibility and CBMPAs. Some of the interview participants in this study lived with physical disabilities (e.g. the inability to walk without the assistance of a wheelchair or cane, elderly participants who had difficulty travelling long distances on foot) and remarked that their access to the sea and ability to pursue traditional livelihoods was affected by the implementation of the

CBMPA. Research investigating the nexus of accessibility and CBMPAs within different communities would provide further insight into heterogenous experiences of CBMPAs and how individual circumstances might hinder support of and engagement with CBMPAs. Identifying barriers to entry is an important first step towards developing solutions which strive to mitigate the socio-cultural impacts of CBMPAs.

• Future of the CBMPA: How Naidiri's CBMPA will adapt to ever-changing social, political, and environmental factors remains to be seen. A study conducted in the future (e.g. 10 years) on the management and status of the CBMPA in Naidiri would provide insight into how some of these factors (e.g. policy changes, local management structures, climate and anthropogenic pressures, and perhaps other socio-political, economic and/or environmental factors) have impacted the CBMPA, and subsequent adaptation responses by the community. This research would serve to inform the design, implementation, and management of future CBMPAs to be better prepared for changing conditions as they arise.

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Appendices

Appendix 1: UNBC ethics approval



RESEARCH ETHICS BOARD

MEMORANDUM

To: Tristan Pearce

From: Isobel Hartley, Research Ethics Officer, Research Ethics Board

Date: February 15, 2023

Re: E2020.1126.058.02 The COVID Observatories: Monitoring the interaction of pandemics, climate risks, and food systems among the world's most disadvantaged communities

Thank you for submitting a request for renewal to the Research Ethics Board (REB) regarding the above-noted proposal. Your request has been approved.

We are pleased to issue renewal approval for the above-named study for a period of 12 months from the date of this letter. Continuation beyond that date will require further review and renewal of REB approval. Any further changes or amendments to the protocol or supporting documents must be approved by the REB.

Please refer to the <u>Chair Bulletins</u> found on the REB webpage for updates on *in-person* interactions with participants during the COVID-19 pandemic. If questions remain, please do not hesitate to email <u>reb@unbc.ca</u>.

Good luck with the continuation of your research.

Sincerely,

M. Lodal Hastly

Isobel Hartley, Research Ethics Officer, Research Ethics Board

The eight guiding principles for the FVRF are as follows:

PRINCIPLES OF VANUA RESEARCH FRAMEWORK

RESEARCH CARRIED OUT NEEDS TO BENEFIT PEOPLE Especially the researched community

RESEARCH WITH A FOCUS ON INDIGENOUS PEOPLES' NEEDS Research should focus on Indigenous peoples' needs and must take into account Indigenous cultural values, protocols, knowledge processes and philosophies.

RESEARCHER FLUENCY IN THE FIJIAN LANGUAGE

And/or the dialect of the researched community.

INDIGENOUS PERSONS ON THE RESEARCH TEAM

Researcher to ensure Indigenous persons are on the research team.



RESPECT AND RECIPROCITY

Researchers need to acknowledge and affirm existing elders and Vanua structures and protocols and show appreciation to people through Fijian gifting.

BUILDING LOCAL CAPACITY THROUGH CO-OPTED MEMBERS Researchers need to ensure that local people are co-opted as members of the research team to facilitate local capacity-building benefits.

REPORTING AND MEANINGFUL FEEDBACK

Researchers need to build accountability into their research procedures through meaningful reporting and feedback to the relevant people and community.



Vanua chiefs must gift permission to all research carried out in the Vanua.

Fijian Vanua Research Framework, adapted from Nabobo-baba (2006).

These principles guided this thesis work. The ways in which the principles were followed are outlined below:

- 1. Research that is carried out on Fijians needs to benefit people, especially the researched community: this research was initiated and guided at all stages by the community of Naidiri, with the intent of better understanding the socio-ecological pressures affecting their coral reef ecosystem and the impact of their CBMPA as an adaptation response. This research brings to light various social-ecological pressures affecting the marine SES in the village and differential impacts on community members as a result of the CBMPA and provides ways forward to addressing these challenges.
- 2. Research with a focus on Indigenous peoples' needs. It must take into account Indigenous cultural values, protocols, knowledge processes and philosophies: the needs of the community and the benefits which could be attributed from this research were identified by the community at the onset of this research. I spent over 4-weeks in Naidiri getting to know the community, building relationships and trust and familiarizing myself with cultural protocols and philosophies prior to commencing interviews.
- **3.** Researcher fluency in the Fijian language or dialect of the researched community: The Nadroga-Navosa dialect was the most common dialect in the village, followed by English. While I made efforts to learn as much Nadroga Fijian as I could prior to and during fieldwork, I was not able to communicate beyond simple greatings and terms. As such, this principle could be greatly improved. The translation by my local research partner was vital to *talanoa* with interview participants, particularly those who were older and who spoke very little/no English.
- 4. The use of Indigenous persons in the research team: Local research partners were essential to every step of the research process, from developing the research questions, *talanoa* with community members, reviewing the preliminary research findings, sharing results with the village and producing the research booklets. Their involvement engaged the greater community of Naidiri, leading to more participation, enriching the research findings and ensuring as many different perspectives and voices were included.
- 5. Respect and reciprocity researchers need to acknowledge and affirm existing elders and *Vanua* structures and protocols and must show appreciation to people through Fijian gifting: Respect was expressed constantly by acknowledging *Vanua* structures and local protocols, and reciprocity was expressed by returning the research findings to the community in a form of their choosing. Gifting was conducted daily through the purchase of market and grocery store foods, toys and stationery for children, and financial compensation to research partners and their families.
- 6. Building local capacity through co-opted members researchers need to ensure that local people are co-opted as members of the research team to facilitate local capacity-building and ensure benefits to the research community: The outputs from this work include the thesis document and the research booklets. Following the

completion of the thesis, research findings will be published in a journal. Local research partners and the community of Naidiri have been included as the co-authors of the research booklets, and Youth Group members interested in contributing to the publication of research findings will be invited to collaborate on the publication.

- 7. Researchers need to build accountability into their research procedures through meaningful reporting and meaningful feedback to the relevant people and community: Results were shared in person upon my return to the village and verified ahead of time with research partners. These were also shared through the research booklets and a presentation on the booklets was presented to the Youth Group to acquire their feedback. Finally, research findings were shared at a global conference to further tell the story of the Youth Group and their CBMPA, as requested by the Youth.
- 8. *Vanua* chiefs, as well as village chiefs and elders at all levels, must give permission to all research done in the *Vanua*: A *sevusevu* was conducted at the onset of the research by my supervisor Dr. Tristan Pearce, as well as at the beginning of both of my stays in Naidiri to acquire consent to continue the research with the community.

The application of the FVRF and the eight guiding principles has aimed to ensure that the research was conducted ethically, equitably, and to ensure that the findings were relevant to *iTaukei* people. These principles were foundational to accomplishing the 9 Steps Research as outlined by Nabobo-Baba (2006; 2008) and illustrated below.



Steps of Vanua Research by Nabobo-Baba (2006; 2008)

The ninth step, '*Me Vakilai*: transformative process & change', will continue to be worked towards by publishing in peer-reviewed publications, conference presentations, and the English and Fijian research booklets. The last component, 'Lifelong connection formed', are a result of the steps followed. These continue today and will carry on beyond this thesis.



Information Letter and Consent Form

Date:

Participant Name:_____

Nahoho Village Marine Impact Assessment

Research Team:

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Purpose of Project

This project will work with the Nahoho Youth Group to tell the story of Nahoho's relationship with the coral reef ecosystem and what they are doing to protect it. The goal of the project is to document the environmental changes that have operated over time to impact Nahoho village's coral reef ecosystem and the implementation of a marine protected area (MPA). We are interviewing community members and decision-makers on a regular basis to document their stories, experiences, and responses to changes on the reef. This knowledge will help to understand and communicate the unique challenges, resilience factors, and needs of Indigenous communities and inform decision-making at local and global levels.

Risks to participating in the project

While answering some of the questions during the interview you may recall memories or experiences that make you feel sad or upset. If this happens please tell the interviewer and they will discuss these feelings with you. You can stop the interview, skip a question, pause the interview or withdraw your participation at any time without giving a reason or experiencing any negative consequences. If you would like to talk to a counsellor or healthcare worker in Fiji, you can call this number anytime for free and confidential help, Lifeline Fiji Ph: 132-454

In the unlikely case of data privacy being breached or released, there may be a risk that others in the community may disagree with your opinions on certain questions. To avoid this risk, it is best to share only what you would feel comfortable sharing in a public setting.

Benefits to participating in the project

Your contribution to this study will help generate information to guide decision-making regarding the health of the coral reef ecosystem.

Confidentiality, Anonymity and Data Storage

If you choose to keep your identity confidential, all personal identifiers (your name, for example) will be removed from the data and replaced with a code (random letters and numbers). This will connect to a master list that will be stored separately from the information you provide in the interview. All data, including confidential information in the master list, will only be accessed by the research team members.

The research team will keep your identity confidential, and will not connect it to anything you say unless you give permission to do so. Your identity will remain confidential to the extent allowed by law. The researcher has a duty to report to authorities any information about a child at risk of abuse. The researcher may be required by subpoena (required by government or a court as evidence) to release information gathered during this project.

During the project, the master list of confidential personal identifiers will be stored on the research teams' encrypted computers and external hard-drives. At the end of the project (May 1, 2024), the confidential list linking your information to your personal identifiers will be deleted. All data (voice recordings or interview transcripts, and personal identifiers you don't want kept confidential) will be stored on the research teams' encrypted laptop computers and encrypted external hard-drives until the end of the project, and on Dr. Tristan Pearce's encrypted external hard-drive for up to 5 years. These computers and external hard-drives are locked and encrypted to make sure that all data remains secure.

Study Results

Research findings will be shared in the community through a plain-language summary report and community presentation. You will receive a copy of the plain-language summary report. Aggregate data (overall key themes and findings) will be reported in research findings. However, some direct quotations may also be used to highlight key points. Your own direct quotations will only be used if you give permission to use them. If one of your direct quotations is used, names or other information that may identify you will only be included if you give consent to use your name in connection with the information you provide.

Questions, Concerns or Complaints about the project

If you have any questions about what we are asking of you, you are free to contact Lui Manuel or Dr. Tristan Pearce at the phone number(s) and/or email(s) listed above.

If you have any concerns or complaints about your rights as a research participant and/or your experiences while participating in this study, contact the UNBC Office of Research at 250-960-6735 or by e-mail at <u>reb@unbc.ca</u>.

Withdrawal:

Taking part in this study is entirely up to you. You have the right to refuse to participate in this study. If you decide to take part, you may choose to pull out of the study at any time up until the project report is completed without giving a reason and without any negative impact to you. If you choose to withdraw from the study your information will be withdrawn and securely destroyed.

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Consent:
I have read or been described the information presented in the information letter about the project and
I have been given a copy of this form.

YES NO

I have had the opportunity to ask questions about my involvement in this project and to receive additional details I requested.

YES NO

I understand that questions will be asked and I may skip any of these questions without giving a reason and with no consequences.

Yes No

I understand that if I agree to participate in this project, I may withdraw from the project at any time up until the report completion, without giving a reason and with no consequences.

YES NO

I agree to be recorded.

YES NO

I agree that my name can be used in association with this project.

YES NO

I give permission for direct quotations that I give to be used in publications/research findings.

YES NO

As a part of this study, the research team may seek to re-contact and/or re-visit you in order to review and clarify your responses. The research team will also return to the community at some point to go through interpretations of the responses, and the research findings. Do you give your permission to be re-contacted and/or re-visited by the research team to review and clarify your interview data, and to go over the results of the study?

YES NO

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Signature:	Date:
NAME (please print):	
Signature of witness:	Date:
NAME (please print):	

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Appendix 4: Semi-structured interview guide

Semi-Structured Interview Guide

The following is a set of questions about the marine protected area (MPA) in Nahoho we will ask during May-June 2023. Because it is a semi-structured interview, the responses are expected to be open-ended, and we may ask additional but related questions to follow up on with what respondents may say. The interview should take about 30min-1hour.

Questions about yourself:

- 1. Can you tell me a little about yourself? How long have you lived in Nahoho? (if not your whole life, where have you lived before?) What sort of things do you do in the village?
 - a. Age, gender, household demographics (can be collected subtly with research partner)

Questions about using the reef:

- 2. Can you tell me about the reef? Stories about the reef?
- 3. What does the reef mean to you?
- 4. Do you collect food on the reef? If so, what do you collect? How often? When? For what purpose (local consumption, sharing, sell at market)?
- 5. How do you feel when you are on the reef?

Questions about how people should treat the reef:

- 6. Can anyone go on the reef?
- 7. How should one treat the reef?
- 8. Are there rules for how to treat the reef? Who makes these rules? Who enforces them? What would happen if you broke a rule?

Questions about what changes have been observed in the reef:

- 9. Can you tell me what a healthy reef looks like?
- 10. Is the Nahoho reef health? If not, why not? What made the reef unhealthy?
- 11. What changes have you seen in the reef (from long ago to today negative and positive)
- 12. What has changed and when did it start (for each change identified)? What caused this change? How have these changes affected how you use the reef?

Questions about the marine protected area:

- 13. Tell me about the marine protected area (tabu)
- 14. When was it created? Who created it? Why was it created?
- 15. How was the marine protected area created? Who decided?
- 16. What are some challenges in creating the MPA | in managing the MPA?
- 17. What you think of the MPA?

Summary:

- 15. What do you think about the future of the reef? Are you optimistic? If so, why? If not, why?
- 16. Do you think more should be done to help the reef? If so, what could be done?
- 17. Is there anything else that you would like to share?









OUTLINE

04 NAIDIRI'S STORY 06 **TIMELINE OF CHANGE** 08 YOUTH TAKE ACTION 12 **CORAL REEF RESTORATION** 14 **A-FRAME PROGRESSION** 16 **CURRENT IMPACTS ON THE REEF** 18 A BETTER TOMORROW 19 ACKNOWLEDGMENTS 3

NAIDIRI'S STORY



o The village of Naidiri is located on the **coral coast** of Fiji's largest island, Viti Levu. In this way, the sea is a **very important** source of *kana* (food).

The community has a close **relationship** to the **coral reef**, many people practicing traditional *iTaukei* (Indigenous Fijian) livelihoods. Women catch octopus and handline fish, while men spearfish.



This included the **mining** and **selling** of **corals**, and the use of the toxic plant root *duva* for fishing. The root was pounded and put into the reef, killing fish and other marine species, irrespective of size.

In the mid 1990s, Naidiri's reef started to experience many **stressors** occurring at the same time.

While duva and coral mining are **no longer practiced**, their impacts continue today, and **new stressors** are now prevalent. This booklet reviews the **timeline of biodiversity change** observed on the reef, and how the community of Naidiri has responded through **conservation** and **restoration** efforts.
TIMELINE OF CHANGE

The following graphic displays a timeline of the changes observed on Naidiri's



1970s

1990s

LEGEND

WATER LEVELS Water levels have changed from the 1970s to 2024. Water levels are now higher due to sea level rise.	SAND Sand c on the has wa exposit beneat	COVER over was once plentiful waterfront. Now, sand shed away into the reef, ng the rock layer h.
CORAL 1970s-1990s: coral was plentiful and varied in colours in the reef. 1990s- 2007: a significant decline in coral cover was observed. Those that remained were often brown or white in colour. 2007-2024: there has been an increase in coral cover, as well as different coral species returning to the reef. Coral bleaching events are now more common.	FISH 1970s t plentifu were m often la a signif species was ob amoun increas have re	to 1990s: fish were al in the reef and there any different kinds, arge in size. 1990s-2007: icant decline in fish s, abundance, and size served. 2007-2024: the t and size of fish have red, and certain species eturned to the reef.

reef from 1977 to 2024.



2007

2024



GIANT CLAM

The giant clam was plentiful in the reef from 1970s to 1990s. In the 1990s, the giant clam disappeared from the region. It was re-introduced in 2007, and are now growing in size and abundance.

R

OCTOPUS

Around 1970s to 1990s, octopus were large in size and commonly found in the reef. Since the 1990s to 2024, there are less octopus, and those caught are often smaller in size.

. MARINE PROTECTED AREA

The permanent *tabu* was implemented in 2007. In 2021, a temporary *tabu* was implemented, which restricts fishing but permits women to hunt octopus and is open for special occasions. In total, the two *tabu* cover an area of 1.4km2.



....

A-FRAME

Coral restoration has been ongoing since 2007. Different methods have been used, including the 'A-frame' method which plants 'super corals'. From 2007-2024, a total of 14 A-frames have been planted.

YOUTH TAKE ACTION

After observing a **big decline** in the amount and size of fish caught, youth from Naidiri started to talk about what they could do to help the reef return to the state it once was.

"We need to think about our **future generations**", said MPA founder Manoa Duwai.

And so the **Naidiri Youth Group** was created, and set out to **take action** to conserve and restore their reef.





When we were having our kana (food), I was telling him, boy. In 10 years, this place there's going to be no 💦 fish. That is when we came up with this idea to do the tabu." -MANOA DUWAI Aanoa Duwai, founder of the MPA



The **chief** granted the Youth Group permission to implement a *tabu* in the *qoliqoli* (traditional fishing grounds).

A *tabu* (no-take area), also referred to as a **Marine Protected Area (MPA)**, is a form of **marine conservation** which impose restrictions on fishing and the extraction of other marine life within it's boundaries.

While many people in Naidiri were happy about the *tabu*, its location in front of the village was also on **prime octopus habitat**. As many women in Naidiri pursue traditional livelihoods of hunting octopus, this impacted them negatively.

To mitigate these negative impacts, in 2021 the Youth Group implemented a second *tabu*, this one of **temporary status**.

This area restricts all fishing activities, with the exception of octopus hunting and harvesting fish for **special occasions** (example: weddings, village functions).

Naidiri village and the Youth Group have been **hard at work** managing their *tabu* ever since.





= permanently closed tabu
.... = temporary tabu

CORAL REEF RESTORATION

The youth group and community of Naidiri have also begun **planting corals** using different restoration methods, and engaging in other forms of **adaptive management**.

Where these initiatives have taken place are numbered in the graphic above, and are described on the next page.





2023

2024

A-FRAME PROGRESSION

The photos above show the difference 1 year can make for coral growth on the A-frame.

The photo on the **left** shows members from the Youth Group **securing the A-frame** in the reef floor in May 2023.

The photo on the **right** was taken on year later, in May 2024. The **coral growth** and **presence of different fish species** shows how quick progress can occur when reef restoration is done properly, and by a **dedicated team**!



The reef has seen a significant CHANGE IN CHANGE IN CHANGE IN CHANCE

POLLUTION

CROWN OF THORNS

The reef has seen a **significant improvement** since the implementation of the *tabu* area, with many fish now returning to the reef, and increasing in size. Corals and other marine life have also made significant improvements.

However, many different **stressors** continue to be present today.

Changes in governance

may alter *iTaukei* rights to locally manage their *qoliqoli*.

Human pollution, such as the presence of plastic in the reef, can pose a threat to the lives of marine life.

The **Crown-of-Thorns** starfish, which eats corals, is now commonly found in the reef and has to be removed. NAI RE



Climate change is rising sea levels, as well as increasing ocean temperatures, causing massive coral bleaching events.

The introduction of **oxygen tanks** in the early 2000s has been linked to increased **poaching** within and near the *tabu* area.

Practices of **sand mining** occurring 1-5km inland are thought to impact the reef by altering natural sand cycles.

Inland **deforestation** causes increasing sediment runoff into the sea, killing corals.

While these stressors may not have big impacts individually, they can **cumulate over time** to cause significant **harm** to the reef, it's marine species, and the livelihoods of the people of Naidiri.

A BETTER Tomorrow



The Youth Group in Naidiri continue to work hard to protect their reef, manage their *tabu*, and adapt to new stressors. They now welcome **tourist visitations** to snorkel and discover their *tabu*.

By sharing their story, they hope to secure a better tomorrow for **future** generations, and hope to inspire other youth throughout Fiji to get involved in marine conservation.









THANK YOU

This work was made possible by the hard work and dedication of the Naidiri Youth Group, Naidiri village, and others. A special thank you to:

Inoke Balagita Francie Bawaqa Austin Bowden-Kerby **Rufina Bua** Vasena Buka Aporosa Da Aporosa Duwai Manoa Duwai Sera Duwai Sitiveni Kurisaru Taraiviri Masarau Duwai Milika Kanaqele Inoke Lewanivunawi Liti Lewanivunawi Vasenai Lewanivunawi Panapasa Limavatu Kevueli Malaka Varanisese Marava Charlie Mungin Mijeli Nahoba Loata Nailumu Rupeni Nakata Sanaila Nalasi Joseva Nagota Tevita Natoga Asinate Navasua Samuela Nawaqalevu Adi Manu Qalo Iliesa Ratu Akshay Salunkhe Gauri Salunkhe Vereji Tabuivale



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