The role of equity in small-scale fisheries management

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‘Justice is the first virtue of social institutions, as truth is of systems of thought’

John Rawls

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Abstract

Equity concerns abound in environmental governance. Conservation and natural resource management initiatives involve cost and benefit sharing and decision-making processes with implications for resource sustainability and human wellbeing. Promoting distributional (i.e., fairness of the distribution of costs and benefits) and procedural (i.e., fairness of the decision-making process) equity is a moral endeavour and it is considered instrumental for realising social and ecological success. However, the meaning of equity and the social conditions that lead to it remain poorly understood. In addition, there is little empirical evidence of the link of equity to success.

The broad objectives of this thesis are to contribute to a better understanding of equity, explore what are the social conditions related to it, and quantify the association between equity and management outcomes. To this end, this thesis draws on multiple bodies of literature, including natural resource management and conservation, environmental justice, and psychology of social justice, to explore distributional and procedural equity in the context of natural resource management and conservation, particularly of small-scale fisheries co-management.

A key gap in the literature and practice of conservation and natural resource management is a lack of understanding of procedural equity. The focus of Chapter 2 is to address the first research question of this thesis: *What does procedural equity entail in conservation and natural resource management?* To this end, I integrated key literature from environmental justice, psychology of justice, and participatory conservation to identify procedural equity criteria and developed a framework to advance procedural equity in conservation decision-making. This framework organizes the criteria into three domains (Process properties, Agency of participants, and Interpersonal treatment) underpinned by the equity dimension of recognition. In addition, I identified seven policy levers that can be used to enhance procedural equity criteria. Overall, this chapter promotes a better understanding of what procedural equity entails and how it can be promoted in conservation.

The three empirical chapters of my thesis explore equity in the context of small-scale fisheries co-management. Equity issues are of particular importance in co-management systems. Co-management is widely advocated for managing common pool resources (e.g., fisheries, pastures, forests) and it is assumed to be more equitable than other governance

approaches (e.g., state-led). Still, the capacity of co-management systems to enhance equity is a subject of debate and has not received enough attention. Specifically, understanding discrepancies in how a fisher is impacted by co-management relative to other fishers or others in the community (i.e., disparity) is important because disparity can influence people's feelings and behaviors, with implications for the sustainable management of natural resources. In addition, understanding what social conditions are related to disparities is essential to design equitable policies and practices. Chapter 3 focuses on addressing the research question, *What are the disparities in the way fishers´ livelihoods are affected by co-management, and what socioeconomic and institutional characteristics are related to disparities?* In this chapter, I use data from interviews with 1191 fishers associated with 48 coral reef co-management arrangements across Kenya, Tanzania, Madagascar, Indonesia, and Papua New Guinea to examine how socioeconomic and institutional characteristics were associated with subjective (or perceived) and objective disparities (losses and gains) from co-management. I found that more fishers perceived equality than disparities in the distribution of co-management impacts. Of those that perceived disparities, more fishers perceived losses than gains. I also found that disparities are related to a range of socioeconomic (e.g., distance to markets and wealth) and institutional characteristics (e.g., gear, access, and area restrictions). These findings shed light on potential entry points for equitable co-management, such as reducing poverty, promoting participation in decision-making processes, fostering conflict resolution mechanisms, and prioritizing gear restrictions over area restrictions.

Yet, disparities (or inequality) do not necessarily imply inequity. Equity is plural and context-dependent, and people can use multiple justice principles (e.g., equality, proportionality, need-based) to judge the fairness of a situation, such as a distribution or a decision-making process. Thus, understanding equity perceptions and how these vary within communities in co-management systems is essential. In particular, understanding how the combination of social identity characteristics (e.g., the intersection between gender and migrant status) is related to distributional and procedural equity is key. In Chapter 4, I ask: *How are distributional and procedural equity perceptions related to the intersection of gender and other social identity characteristics?* To this end, I use data from interviews with 193 *iTaukei* individuals in ten communities in Fiji and assess how perceptions of distributional and procedural equity differ by gender and how the intersections between gender and other social identity characteristics relate to these perceptions. I found that people perceived that the community benefited most from co-management, that women bore most of the costs, and that

perceptions of distributional and procedural equity were relatively high regardless of gender. These results suggest that special attention should be paid to these social identities to promote equity. In addition, this chapter highlights the importance of using an intersectional lens to better understand equity issues in natural resource management and conservation.

The instrumental role of equity is often used to advocate for equity in natural resource management and conservation. However, empirical evidence of the relationship between equity and management and conservation outcomes is sparse. In Chapter 5, I ask: *How perceptions of distributional equity and procedural equity are related to key co-management outcomes?* To address this question, I used data from 56 fisheries co-management arrangements in Chile and assessed how perceived distributional equity and key elements of procedural equity (i.e., participation in decision-making and trust in leaders) are related to three key perceived social co-management outcomes (perceived impacts on wellbeing, satisfaction with co-management outcomes, and satisfaction with fisher associations). I found that perceived distributional equity was positively related to the three co-management outcomes and that each procedural equity element was related to one outcome (participation was related to perceived positive impacts on wellbeing, and trust in leaders was related to satisfaction with fisher associations). In addition, I found that high levels of distributional and procedural equity increased the odds of positive co-management outcomes up to 175 times. These results suggest that distributional and procedural equity may be instrumental in achieving better management outcomes, especially if distributional and procedural equity are promoted together.

This thesis advances the literature on natural resource management and conservation by providing a better understanding of equity and offering insights that can guide future research on equity and practice aimed at promoting equity. Broadly, I emphasize that realising equity may require different approaches depending on the type of equity being pursued and the specific context, and that attention to intersectionality is critical. In addition, fostering the recognition of sociocultural diversity, stakeholder agency, the application of process properties (e.g., transparency, accountability), and high-quality interpersonal treatment are essential to advancing procedural equity. In terms of the instrumental role of equity, promoting distributional and procedural equity may enhance positive management outcomes, especially if they are promoted together.

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Outputs related to the thesis

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Other publications

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Conference presentations

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Gelcich S., Martinez-Harms, M.J., Tapia-Lewin, S., Lavin, F., Ruano-Chamorro, C. (2019). *Co-management of small-scale fisheries and ecosystem services.* Conservation Letters 12:e12637. https://doi.org/10.1111/conl.12637.

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Lau, J., Ruano-Chamorro, C., Lawless, S. & McDougall, C. (2021). *Gender transformative approaches for advancing gender equality in coral reef social-ecological systems: Good Practice and Technical Brief.* CARE International.

Lau, J & Ruano-Chamorro, C. (2021). *Gender Equality in Coral Reef Social-ecological systems: Literature Review*. CARE International

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Ruano-Chamorro, C. *Gender Transformative Approaches in coastal livelihoods and their application to coral reefs*. Connecting conservation and development: Gender transformative approaches in coastal livelihoods. CARE-WWF Alliance webinar series, 2022.

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Chapter 1

General Introduction

Chapter 1: General Introduction

1.1. Equity in natural resource management and conservation

Equity is fundamental to environmental governance, particularly in the conservation and management of natural resources (Fabinyi et al. 2015; Martin 2017). Environmental governance involves multiple stakeholders with diverse needs, preferences, knowledge, and identities, and produces costs and benefits that affect the lives of people in varied ways. The way sociocultural diversity is recognized, people's voices are taken into account, and costs and benefits are distributed will determine whether conservation and management are equitable (McDermott et al. 2013; Sikor et al. 2014; Martin 2017), which is thought to have important implications for social and ecological sustainability (Pascual et al. 2014).

Achieving equity in conservation and natural resource management is important for both ethical and instrumental reasons. First and foremost, equitable conservation and natural resource management is a moral imperative (Martin 2017). Fairness is considered one of the five foundations upon which people base their moral concerns (Haidt 2012). Second, social psychology literature suggests that equity can affect human wellbeing (Prilleltensky 2012) and behavior (Crosby 1976; Tyler 2015). For instance, equity is related to positive identity constructions (e.g., group belonging, self-esteem) (Lind & Tyler 1988; Copranzano et al. 2001), and legitimacy and collective action (Tyler 2015), which are key for the sustainable management of natural resources (Ostrom 1990). Several studies suggest that equity is related to positive outcomes in conservation and natural resource management contexts, such as an increase in legitimacy (Turner et al. 2016), and management support (Diedrich et al. 2017; Friedman et al. 2020) and satisfaction (Lauber & Knuth 1997; Lauer et al. 2018), and that inequity can lead to negative outcomes such as non-compliance and anti-conservation behaviors (Twinamatsiko et al. 2014; Mariki et al. 2015; Rohe et al. 2018; Raycraft 2020).

The importance of achieving equity in conservation and natural resource management has been recognized in multiple environmental and development global policies (Dawson et al. 2018a). For instance, issues related to distributional equity, such as access and benefit-sharing, are stated in the United Nations Sustainable Development Goals Life below water (Goal 14) and Life on land (Goal 15). In addition, the UN Convention on Biological Diversity (CBD) included in its Strategic Plan of Biodiversity 2011-2020 the Aichi Target 11, which posited that protected areas 'should be equitably managed' (CBD 2010). Recently, the

Parties to the CBD adopted the Kunming-Montreal Global Biodiversity Framework (CBD 2022), a global biodiversity agenda with targets for urgent actions to be completed by 2030, which highlights the importance of equitable governance and the respect and recognition of local communities and Indigenous Peoples. For instance, Target 3 states that 30% of the planet 'should be conserved and managed through (…) equitably governed systems of protected areas and other effective area-based conservation measures, recognizing Indigenous and traditional territories (…) recognizing and respecting the rights of Indigenous people and local communities, including over their traditional territories'. However, the ability to promote equity in practice is hindered by the lack of conceptual clarity of equity in these policies.

1.2. Conceptualizing equity in natural resource management and conservation

Equity, justice, and fairness are similar concepts that are often used as synonyms. For instance, in conservation, these concepts are used interchangeably (Friedman et al. 2018). In addition, their definition can change depending on the discipline (Luckasiewicz et al. 2017). Broadly, 1) equity refers to what is right and fair (OED 2022), and it is more commonly used in global policies (e.g., CBD, SDGs) than justice and fairness; 2) justice is considered the 'first virtue of social institutions' (Rawls 1971: p3) and is concerned with broader aspects than equity (Martin 2017), such as the underlying issues that lead to inequities (e.g., power, race, class) (Dawson et al. 2018a); and 3) fairness is often referred as perceptions of equity, which are underpinned by justice principles (Friedman et al. 2018; Gurney et al. 2021b).

Social and environmental justice theories define equity as a multidimensional concept with three interrelated dimensions encompassing key environmental equity concerns (Scholsberg 2007; Fraser 2009; Walker 2012; Sikor et al. 2014) (Figure 1.1): (1) *distributional equity*, which encompasses the fair distribution of benefits and costs from management and conservation; (2) *procedural equity*, which addresses the fairness of the decision-making process; and (3) *recognition*, which entails acknowledging and respecting sociocultural diversity, including differing values, identities, cultures, types of knowledge, institutions, power, capacities, and rights. In this thesis, I primarily focus on distributional and procedural equity. This is not because I do not feel that recognitional equity is not important, but rather because I had to completely revise my thesis due to the COVID-19 pandemic travel restrictions, which meant that I had to rely on existing data from my supervisors, which did not include information on recognitional equity.

Figure 1. 1. Dimensions of equity. Based on Scholsberg 2007, Fraser 2009, Walker 2012, Sikor et al. 2014.

What is equitable can be examined from both normative and empirical perspectives. A normative approach is prescriptive (i.e., what 'ought' to be fair) and seeks to find a universal idea of equity that can be applied to any situation, and it is commonly used by philosophers (e.g., Rawls 1971). Early environmental justice literature focused on assessing equity by examining how inequalities in the spatial distribution of toxic waste facilities were related to poverty and race (Walker 2012; Agyeman et al. 2016). On the other hand, an empirical approach is descriptive (i.e., what 'is' fair) and recognizes that equity is subjective (i.e., what is equitable depends on the eyes of the beholder) and plural (McDermott et al. 2013; Sikor et al. 2014) and examines what is perceived as fair. Plurality refers to the fact that people often do not agree on what is fair and people can use multiple justice principles or criteria to judge what is fair (Martin et al. 2014; Gurney et al. 2021b). This concept of plurality can be understood through Amartya Sen's parable of the flute (Sen 2009). A wooden flute needs to be distributed between three children, and all of them provide different reasons why they should have it. The first child believes he/she should own the flute because he/she is the only one who knows how to play it; the second child thinks he/she should get the flute because he/she is the poorest child and has no other toys; the third child claims the flute because he/she is the one who made it. According to Sen, what is equitable in this situation depends on the person judging the distribution. For instance, a person prioritizing libertarianism will

prioritize giving the flute to the child who made it to ensure the protection of private property; a person prioritizing egalitarianism will give the flute to the poorest child to reduce inequality; while a person prioritizing utilitarianism will give the flute to the child who can maximize pleasure by playing the flute. Sen's parable shows that people can disagree on what is fair and use different justice principles that can be equally valid in a specific situation.
In addition, an empirical approach to equity recognizes that what is equitable depends on the specific social, economic, political, historical, and cultural context (Sikor et al. 2014). For instance, people from different cultures use different justice principles to judge the fairness of a situation (Schäfer et al. 2015). Recent environmental justice theory, especially in natural resource and conservation contexts, applies an empirical approach to understanding the equity concerns of people on the ground and analyzing what principles of justice people use to assess what is fair in a given situation (Dawson et al. 2018b; Lecuyer et al. 2018; Martin et al. 2019; Lau et al. 2021a).

1.3. Research gaps and relevant literature

Although equity has been a focus of research in conservation and natural resource management literature, important research gaps remain. In this thesis I have identified four key broad research gaps:

1.3.1. Procedural equity

Most studies on equity and natural resource management and conservation focus on how the costs and benefits of interventions are distributed (i.e., distributional equity) (Friedman et al. 2018). However, understanding of what procedural equity entails and how to enhance it remains limited (Reed 2008; Dawson et al. 2018a). For instance, justice and equity are key concepts in the participatory conservation literature (i.e., the literature focused on participatory decision-making processes in conservation), but they are often not defined (e.g., Reed 2008). In addition, studies draw on a variety of frameworks and theories that define procedural equity differently (e.g., Leventhal 1980; Webler & Tuler 2000; Dalton 2005; Borrini-Feyerabend et al. 2013; Schreckenberg et al. 2016; Zafra-Calvo et al. 2017), the way procedural equity is assessed is inconsistent (e.g., Martin et al. 2014; Dawson et al. 2018b; Bennett et al. 2020; Friedman et al. 2020; Estévez et al. 2021), and most studies in conservation operationalize procedural equity as participation (Friedman et al. 2018), which

is problematic because, although participation is key to promote procedural equity, it is not sufficient.

The assumption that procedural equity is achieved through participation is particularly relevant in the case of co-management. Co-management systems are collaborative management arrangements that involve multiple stakeholders in the decision-making process (Berkes 2009) and are widely promoted to manage common pool resources worldwide, including forests, fisheries and pastures (Berkes 2009; Oldekop et al. 2016; Gelcich et al. 2019). Co-management is believed to be more equitable than other governance approaches, such as top-down management, because it promotes the participation of local communities, and it is expected to be better tailored to the local context (Berkes 2009). However, there are documentations of inequities in co-management arrangements, such as elite capture (Bene et al. 2009; Cinner et al. 2012) and inequitable access to decision-making (Gustavsson et al. 2014; Baker-Médard 2017). In general, procedural equity is still poorly assessed in co-management systems. Understanding the concept of procedural equity is critical because it may be more important than distributional equity in some situations. For instance, procedural equity may be more relevant when distributional principles are difficult to implement in practice (Tyler 2015) and when people value more non-material needs such as self-determination, self-belonging, and self-esteem (Brockner & Wiesenfeld 1996) which can be satisfied through procedural equity (Copranzano et al. 2001). In addition, a lack of understanding of procedural equity hinders the ability of scientists and practitioners to properly evaluate and foster procedural equity in natural resource management and conservation. In this thesis, I address this gap by undertaking a non-systematic review of three key bodies of literature (environmental justice, social psychology of justice, and participation in conservation), identifying and integrating key criteria for a fair decision-making process, and developing a framework for enhancing procedural equity in conservation.

1.3.2. Disparities and socioeconomic and institutional characteristics

Studies assessing distributional equity in natural resource management and conservation contexts have focused particularly on how management costs and benefits are distributed according to social identity characteristics (e.g., gender, age, wealth) (Cinner et al. 2012; Gurney et al. 2015; Ward et al. 2018; Gill et al. 2019). Still, there is a lack of studies assessing relative social impacts (i.e., disparities) or how a person is impacted by

management or conservation relative to a reference group (e.g., the community where the person lives). Understanding disparities is key because people continuously compare themselves to others to identify their social position within a group, and this has implications for how people feel and behave (Crosby 1976), which can have consequences for the sustainable management of natural resources. For instance, fishers in Texas did not support management because they perceived they were more negatively impacted than other groups of fishers (Loomis & Ditton 1993). Understanding what social conditions are related to disparities is also essential to inform targeted policies and practices that account for equity issues. As previously mentioned, this is particularly important in the context of co-management. Despite the importance of understanding disparities, it remains unclear the degree to which co-management leads to disparities and what social conditions are related to these disparities. To address this gap, I examined the disparities in how users' livelihoods are impacted by management relative to others and how socioeconomic and institutional characteristics are related to these disparities.

1.3.3. Perceptions of distributional and procedural equity and social identity characteristics

Assessing perceptions of equity is crucial because these have implications for ethical and effective management (Pascual et al. 2014). Equity perceptions can influence wellbeing (Prilleltensky 2012) and are a key driver of human behavior (Tyler 2015). Particularly, understanding how perceptions of equity vary across different social groups is critical because what is perceived as equitable changes depending on the eyes of the beholder (McDermott et al. 2013; Sikor et al. 2014). Particularly, social identity characteristics can shape people's capacity to benefit from and participate in management (Cinner et al. 2012; Rohe et al. 2018; Elias et al. 2020) and thus influence distributional and procedural equity perceptions. For instance, women are often excluded from decision-making processes regarding the use and management of natural resources (Vunisea 2008; Rohe et al. 2018; Lawless et al. 2019). As a result, women may receive fewer benefits from these arrangements and perceive procedural unfairness. In addition, social identity characteristics, such as gender and migrant status, marital status, age, education, and wealth, can overlap or intersect (e.g., being migrant men) and shape patterns of discrimination (Crenshaw 1989) with implications for distributional and procedural equity (Lawless et al. 2019; Elias et al. 2020; Ferguson 2021).

Assessing how perceptions of equity vary across different social groups can indicate which social groups are being marginalized and negatively impacted by management and provide insights on what actions should be taken to address inequities. Studies examining equity perceptions are nascent in natural resource management and conservation and have tended to be conducted in terrestrial contexts (Martin et al. 2014; Dawson et al. 2018b; Lecuyer et al. 2018; Zafra-Calvo et al. 2019; Friedman et al. 2020). In addition, a small number of qualitative (e.g., Lecuyer et al. 2018; Abebe et al. 2020; Lau et al. 2021a) and quantitative (e.g., Martin et al. 2014, 2019; Bennett et al. 2020; Gurney et al. 2021b) studies have assessed how perceptions of distributional and procedural equity differ across social identity characteristics, with quantitative studies focusing on predefined equity indicators (e.g., Zafra-Calvo et al. 2019; Bennett et al. 2020; Chen et al. 2022), and preferences for distributional equity principles (Martin et al. 2014, 2019; Gurney et al. 2021b) and forms of participation (Martin et al. 2014). Studies assessing how the various components of social identity intersect to shape perceptions of distributive and procedural equity remain scarce. To address this gap, I explore how gender and other key social identity characteristics are related to overall perceptions of procedural and distributional equity from an intersectionality perspective in the context of co-management of small-scale fisheries.

1.3.4. The instrumental role of equity

Although it is often assumed that promoting equity can lead to positive social and ecological management outcomes (Pascual et al. 2014), there is still little evidence regarding the instrumental role of equity in natural resource management and conservation. Specifically, most studies have looked at equity as a management outcome and few as a driver of management outcomes (Friedman et al. 2018; Gill et al. 2019). There is a limited number of qualitative studies suggesting a link between distributional and procedural equity (Rohe et al. 2018; He et al. 2021) and a small number of quantitative studies assessing the relationship between either distributional (Diedrich et al. 2017) or procedural equity (Turner et al. 2016; Lauer et al. 2018) and management outcomes such as support for conservation (Diedrich et al. 2017), legitimacy (Turner et al. 2016) and management satisfaction (Lauber & Knuth 1997; Lauer et al. 2018). I address this gap by assessing quantitatively how both distributional and procedural equity are related to key natural resource management outcomes, including perceived impacts on wellbeing and management satisfaction.

1.4. Thesis objectives and research questions

The broad objectives of this thesis are to contribute to a better understanding of equity, explore how key social characteristics are related to equity, and quantify how equity is related to outcomes in natural resource management and conservation. I address these objectives and the critical research gaps previously identified through the following research questions (Figure 1.2):

1) What does procedural equity entail in conservation and natural resource management? (Chapter 2)
2) What are the disparities in the way fishers' livelihoods are affected by co-management and what socioeconomic and institutional characteristics are related to disparities? (Chapter 3)
3) How are perceptions of distributional and procedural equity related to the intersection of gender and other social identity characteristics? (Chapter 4)
4) How perceptions of distributional equity and procedural equity are related to key co-management outcomes? (Chapter 5)

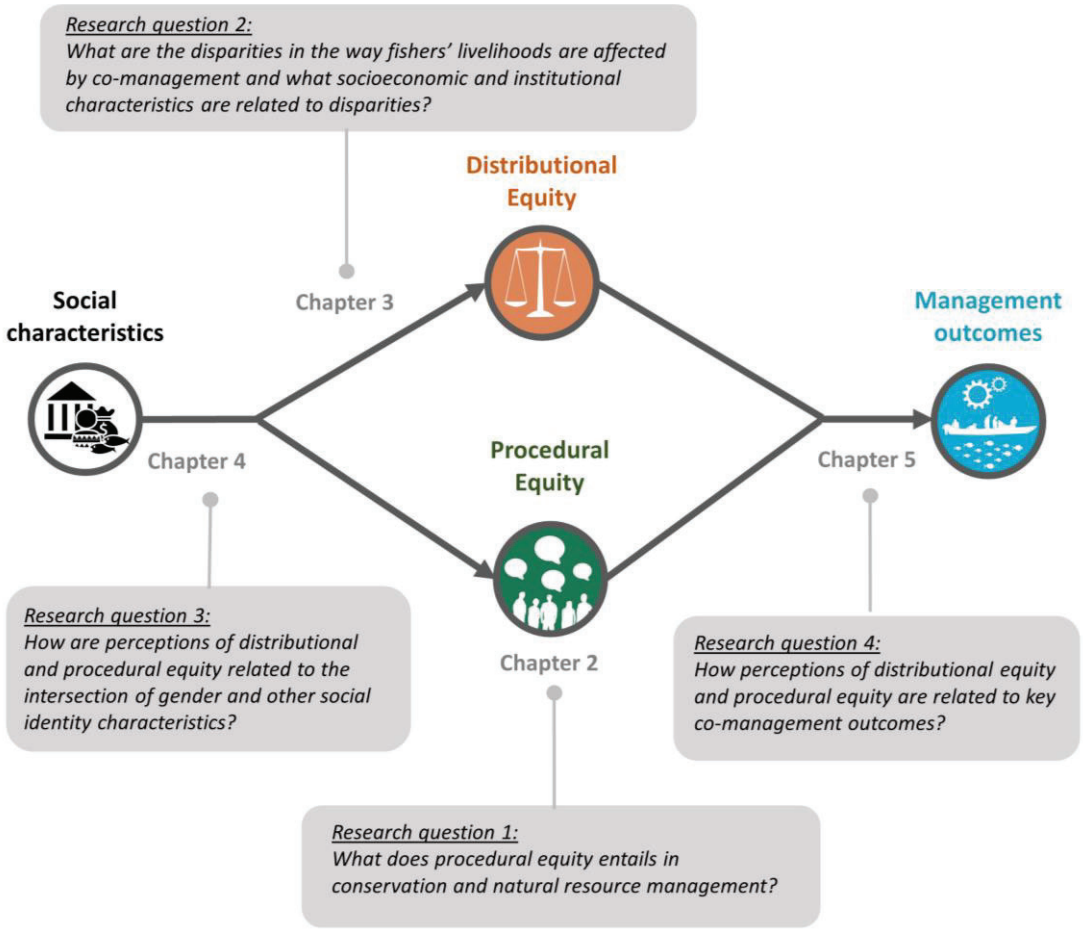

Figure 1. 2. Chapter structure and research questions of the thesis.

1.5. Small-scale fisheries co-management as a case study

In this thesis, I focus on distributional and procedural equity in small-scale fisheries co-management. Small-scale fisheries, which support the livelihoods of more than 400 million people worldwide (FAO et al. 2022), are commonly managed through co-management arrangements. A recent study suggests that at least 20% of the global catch from small-scale fisheries is managed through co-management (ibid). However, equity remains poorly assessed in fisheries co-management (Quimby & Levine 2018). Particularly, there is a lack of understanding regarding what type of inequities are created by co-management and under which conditions. Therefore, examining distributional and procedural equity is critical to inform pathways to promote equitable and effective fisheries co-management. I have explored distributional and procedural equity in fisheries co-management arrangements across multiple countries in both temperate and coral reef systems. Specifically, I have analyzed co-management arrangements from five Indo-Pacific countries (Kenya, Tanzania, Madagascar, Indonesia, and Papua New Guinea) in Chapter 3, from Fiji in Chapter 4, and from Chile in Chapter 5. More information on these systems is provided in the relevant chapter.

Chapter 2

Advancing procedural equity in conservation

Chapter 2: Advancing procedural equity in conservation[1]

2.1. Abstract

Equitable participation in conservation decision-making is a moral imperative and critical to achieving social and ecological goals. However, understanding of what constitutes a fair decision-making process in conservation remains limited. Integrating key literature from environmental justice, psychology of justice, and participatory conservation, I identify eleven procedural equity criteria, many of which have been overlooked in conservation literature. I develop a framework to help promote procedural equity in conservation decision-making which organizes the criteria into three key domains (Process properties, Agency of participants, Interpersonal treatment), which are underpinned by the equity dimension of recognition. I highlight seven policy levers that can be used to enhance procedural equity (e.g., scalar and contextual fit, conflict resolution, facilitation). However, advancing equitable decision-making using this framework requires addressing a number of key challenges, in particular, those related to broader structural power inequalities, and elucidating and accounting for plural and situated conceptions of procedural equity. I outline a number of pathways to overcome these challenges, including promoting knowledge co-production and self-reflexivity.

2.2. Introduction

Stakeholder participation in decision-making processes is considered critical for achieving successful conservation (CBD 2010; Persha et al. 2011; Brooks et al. 2013). From a moral perspective, the participation of those most affected by decision-making processes is a fundamental human right (e.g., Rio Declaration 1992, Arhus Convention 1998) and a key component of equitable or fair decision-making processes. From an instrumental perspective, stakeholder participation can enable social and ecological benefits by facilitating the inclusion of local and diverse knowledges, and by promoting management legitimacy, thereby fostering support and compliance with rules (Reed 2008; de Vente et al. 2016; Epstein 2017).

[1] Adapted from **Ruano-Chamorro, C.,** Gurney, G., Cinner, J. (2021). Advancing procedural justice in conservation. Conservation Letters. e12891.

Much attention has been given to participatory decision-making processes in conservation literature (hereafter 'participatory conservation literature') and practice over the last few decades. Participation typologies have commonly been used to describe different levels of participation across a spectrum of stakeholder power and control (e.g., Pretty 1995; Lawrence 2006; Pomeroy & Douvere 2008). For instance, Pomeroy and Douvere (2008) adapted Arnstein's (1969) Ladder of Participation to the conservation context and identified six types of participation that range from 'communication' at the bottom of the ladder to 'negotiation' at the top. Principles or criteria of best practice have also been commonly used to conceptualize meaningful participation in conservation (e.g., Dalton 2005; Reed 2008), such as Reed's (2008) influential eight participation principles of good practice. However, despite increasing attention to participation in conservation, efforts to enhance participation in conservation practice have been shown to not always lead to positive outcomes across the range of conservation approaches (e.g., community-based conservation, collaborative management) (Wells et al. 1992; Brechin et al. 2003; Meguro & Inoue 2011; Quimby & Levine 2018). For example, a study of forest-dependent communities found that those who participated more in conservation decision-making were less likely to be satisfied with participation (Friedman et al. 2020). In addition, a growing body of literature on marine ecosystem governance has found that efforts to increase participation are often associated with low levels of trust and legitimacy, which is known as the 'legitimacy paradox' (Fudge 2018).

I suggest that achieving meaningful participation that leads to positive outcomes in conservation requires a more nuanced understanding of procedural equity in conservation. Procedural equity is concerned with the fairness of how decisions are made and by whom (Martin et al. 2015). Perceptions of procedural equity influence emotions and attitudes, with important implications for subjective wellbeing and people's behavior (Lind & Tyler 1988), especially in group settings (Tyler 2015). Importantly, because perceptions of procedural equity are thought to be a key driver of perceived legitimacy (Tyler 2006; Levi et al. 2009), limited attention to procedural equity in participatory marine decision-making processes could provide one potential explanation for the legitimacy paradox described above. Further, procedural equity has critical implications for the ecological outcomes of conservation because environmental management and conservation often rely on cooperation and collaboration with local stakeholders (Pascual et al. 2014). For example, a lack of procedural equity has been linked to anti-environmental behavior (Mariki et al. 2015; Raycraft 2020) and

frustration and dissatisfaction with participatory processes (Booth & Halseth 2011). Additionally, promoting procedural equity can contribute to decolonizing conservation science and practice by fostering knowledge co-production, including in relation to the integration of scientific and traditional knowledges in framing conservation problems and shaping solutions (Reyes-García & Benyei 2019).

However, understanding procedural equity and how it can be promoted in conservation is limited (Dawson et al. 2018a). Equity is often mentioned in the participatory conservation literature but is rarely defined. For example, although Reed (2008) points to equity in his eight participation principles (specifically, that 'participation needs to be underpinned by a philosophy that emphasizes empowerment, equity, trust and learning'), he does not unpack what equity entails. Indeed, a recent review of the conservation literature (Friedman et al. 2018) found that procedural equity tends to be operationalized simply as involvement in decision-making, with the level of participation generally not specified. Thus, a more nuanced understanding of procedural equity in the context of conservation is needed.

To this end, I build on the participatory conservation literature by integrating insights on procedural equity from two key bodies of literature: environmental justice and psychology of justice. These literatures have arisen from the broad body of literature on social justice, which has developed over the centuries in multiple disciplines from both a normative and empirical standpoint (Sabbagh & Schmitt 2016). In general, philosophers, such as Rawls, Cohen, and Habermas, have focused on identifying normative justice principles (i.e., what is morally right in universal terms), while multiple social science disciplines (e.g., economics, sociology, psychology) have examined empirical conceptions of equity (i.e., what is perceived as fair in a particular context) – with some exceptions, (e.g., some philosophers, such as Miller, have focused on contextual approaches, while some psychologists, such as Haidt, have focused on universal approaches).

Justice literature from social psychology (hereafter 'psychology of justice') has tended to focus on an empirical understanding of procedural equity (Sabbagh & Schmitt 2016), including in relation to what people perceive as fair or unfair, and the drivers (e.g., contextual factors) and consequences (e.g., emotions, wellbeing, behavior) of equity perceptions, often in legal (e.g., legal dispute resolutions) and organizational (e.g., workplace) settings. Yet, the integration of the psychology of justice in participatory conservation literature remains nascent.

Environmental justice has advanced the understanding of equity in multiple environmental contexts, such as climate change (Jamieson 2010), water management (Syme et al. 1999), and Indigenous land rights (Agyeman et al. 2016). Environmental justice has tended to take a normative approach drawing on the work of political philosophers such as John Rawls, Nancy Fraser, and Iris Marion Young. Early scholarship focused on the unequal distribution of environmental hazards among different societal groups (Agyeman et al. 2016), whilst more contemporary literature has focused more broadly on three key equity dimensions: distribution (i.e., fair distributions of costs and benefits), procedure, and recognition (i.e., acknowledging and respecting sociocultural diversity) (Schlosberg 2007). Recently, the conservation literature has drawn on environmental justice (Sikor et al. 2014; Schreckenberg et al. 2016; Dawson et al. 2018b), including to assess the equity perceptions of local stakeholders (e.g., Martin et al. 2014, 2019; Gurney et al. 2021b) and protected area managers (Zafra-Calvo et al. 2019). Nevertheless, most studies to date have focused either solely on the dimension of distribution, or on the three equity dimensions together, with very little scholarship drilling down on the dimension of procedure (but see Friedman et al. 2020).

I undertook a non-systematic review of three bodies of literature (participatory conservation, environmental justice, and psychology of justice) to identify and integrate procedural equity criteria. I then conducted three Scopus searches to find key papers in the environmental justice, participatory conservation and psychology of justice literatures. I used the following keywords: procedural justice [OR] procedural equity [OR] procedural fairness; [AND] environmental justice [OR] participation [OR] stakeholder engagement; [AND] conservation [OR] natural resource management [OR] environmental management. The participatory conservation literature often refers to procedural justice without using specifically the term ‘procedural justice’ (or ‘procedural equity’ or ‘procedural fairness’). Therefore, my second Scopus search used the following keywords: justice [OR] fairness [OR] equity; [AND] stakeholder engagement [OR] participation; [AND] conservation [OR] natural resource management [OR] environmental management. To find key reviews theories and frameworks in psychology of justice literature, I used the terms: procedural justice [OR] procedural equity [OR] procedural fairness; [AND] social psychology. I selected reviews and frameworks that provided procedural equity criteria. From the key papers found, I forward and backward tracked them (i.e., we looked at the papers they cited and the papers that cited them) to find other key papers. I identified multiple criteria important for fair decision-making process

across the three bodies of literature and I grouped the criteria with similar meaning into one common procedural equity criteria (Table S1). In total I found 11 procedural equity criteria.

2.3. A procedural equity framework

I identified eleven procedural equity criteria, which I grouped under the three domains of process properties, agency, and interpersonal treatment (Figure 2.1, Table S1). In addition, I identified recognition of sociocultural diversity as an equity dimension that underpins procedural equity domains (Figure 2.1) and identified policy levers that promote procedural equity via the three domains and the equity dimension of recognition.

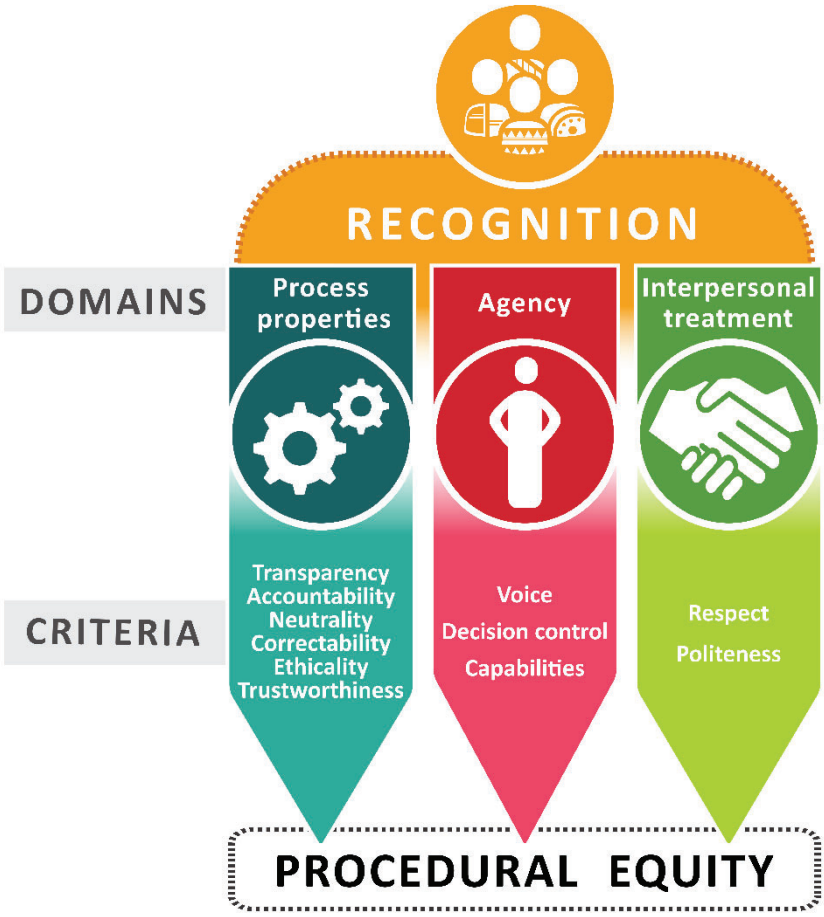

Figure 2. 1. A framework for promoting procedural equity in conservation decision-making. Integrating key literature from environmental justice, psychology of justice, and participatory conservation, I identified eleven procedural equity criteria. These criteria are organized into three key domains (Process properties, Agency of participants, Interpersonal treatment), which are underpinned by the equity dimension of recognition.

2.3.1. Recognition

Recognition refers to acknowledging and respecting sociocultural diversity, including in relation to values, identities, cultures, types of knowledge, institutions, power, capacities, and rights (Martin et al. 2016). Recognition is concerned with the societal structures that lead to inequities (Young 1990; Fraser 1997); for example, value systems institutionalised in conservation that fail to recognize diverse forms of knowledge, including that held by Indigenous peoples and local communities (Martin 2017). While recognition tends to be considered a dimension of equity at the same conceptual level as distributional and procedural equity (e.g., Sikor et al. 2014), emerging scholarship suggests that recognition underpins the other two dimensions (Lecuyer et al. 2018; Lau et al. 2021a). Aligning with the latter scholarship, I posit that the domains of recognition and procedural equity are so inextricably intertwined that procedural equity cannot be considered without attention to recognition equity. I thus include recognition equity in this framework (Figure 2.1).

The need to consider recognition begins with the very concept of conservation. Conservation is deeply imbued with Western concepts and values around people's relationships with nature (e.g., humans being *apart* from nature), which may not align with local values (e.g., many Indigenous peoples hold a relational value of humans as *part* of nature) (Lee 2016; Jupiter 2017). Given conservation approaches implemented across the globe tend to be developed in the Global North – for example, conservation plans designed for Fiji are commonly led by Australian organizations (Álvarez-Romero et al. 2018) – attention to recognition in the Global South is particularly needed (Martin et al. 2016; Gurney et al. 2021b). Recognizing other forms of knowledge, values, and human-nature relationships, especially those of Indigenous peoples, is crucial because what is recognized will shape who is involved in decision-making and whose voices are heard (Lecuyer et al. 2018; Lau et al. 2021a). Further, recognition is also about acknowledging that communities are heterogeneous. In conservation, communities have often been conceptualized based on residential location or resource use and assumed to be unified social structures (Agrawal & Gibson 1999). However, communities host multiple actors who hold different interests, values, power, and identities (Gurney et al. 2017).

2.3.2. Domains of procedural equity

2.3.2.1. Decision-making process properties

Decision-making process properties are key conditions to help enable a fair process, specifically to foster recognition, agency, and interpersonal treatment. For instance, process properties help level the playing field and facilitate interpersonal relationships. Reciprocally, process criteria are unlikely to be fulfilled for people suffering from low recognition, agency, and poor interpersonal treatment. Process properties have six criteria: transparency, accountability, neutrality, correctability, ethicality, and trustworthiness (Figure 2.1).

Transparency refers to whether the decision-making process is visible, the reasoning is communicated clearly, and goals and expectations are clear and agreed upon among participants from the outset (Rowe & Frewer 2000; Colquitt et al. 2001; Reed 2008). Transparency also involves providing information in an appropriate form and timeframe (Schreckenberg et al. 2016). For example, in Nova Scotia, fishers perceived procedural inequity because they could not understand the lawyers and government actors involved in decision-making regarding fisheries management (Barnett & Eakin 2015).

Accountability refers to holding responsibility for the decisions made and being answerable to the people affected by those decisions (Agrawal & Ribot 1999). When decision-making powers are transferred to local representatives, administrative bodies, or NGOs, downward accountability (i.e., being accountable to the local population) is critical to ensure procedural equity (Ribot 2001). For example, following the demarcation of a protected area in Laos, managers were not downwardly accountable because they did not comply with the agreements made with local communities and failed to deliver on promises of livelihood support (Dawson et al. 2018b). Mechanisms to promote accountability include elections, information provision, third-party monitoring and sanctioning (Ribot et al. 2006). Poor accountability can impede decentralization processes (Agrawal & Ribot 1999) and lead to inequitable distribution of benefits (Schlosberg 2007).

Neutrality refers to a decision-making process that is perceived as lacking bias, involving accurate use of information, honesty and consistency in treatment across time and people (e.g., lack of favoritism to certain social groups) (Leventhal 1980; Tyler 1989). Neutrality reduces the influence of harmful stereotypes and prejudice in decision-making (Lind & Tyler

1988; Tyler 1989). A lack of neutrality can lead to perceptions of an unfair process. For example, Barnett & Eakin (2015) found that fishers perceived decision-making processes related to quotas were unfair due to a lack of accuracy and neutrality of the information used by the federal government to determine quotas. Specifically, fishers thought that the techniques used to determine quotas did not account for the temporal and spatial heterogeneity of the resource and thus were inappropriate.

Correctability refers to the ability to modify or reverse decisions (Leventhal 1980). Opportunities to appeal a decision is a critical principle of procedural equity, particularly when there is corruption. In the Calakmul Biosphere Reserve in Mexico, a major concern for local stakeholders was whether a mechanism to allow revisions to management decisions was present (Lecuyer et al. 2018).

Ethicality refers to whether the decision-making process conforms to participants' moral standards. People assess the ethicality of a process (Leventhal 1980), and if ethical standards are not considered appropriate, people may perceive procedural inequity. For instance, ethicality may be associated with the absence of bribery, deception and invasion of privacy. Given moral standards differ in sociocultural context (Lau et al. 2021b), it is critical to consider situated ethical codes for decision-making processes.

Trustworthiness refers to whether decision-makers are perceived as benevolent, caring, and fair (Tyler 1989). In decision-making processes, participants judge the motivations of decision-makers, including whether they are concerned with participants' situations, needs and what is right and fair (Tyler 2015). These inferences provide stakeholders with insights into how they are likely to benefit in the long term and these influence perceptions of procedural equity in the short term (Tyler 1989). The trustworthiness of management authorities has been found to be a major procedural equity concern among local stakeholders in conservation settings (Lecuyer et al. 2018).

2.3.2.2. Agency

Agency refers to the 'capacity (or power) of an individual to act independently and to make their own free choices' (Brown & Westaway 2011). If stakeholders have agency, they can defend their interests and postures, increasing the likelihood of obtaining favorable outcomes and perceiving procedural equity (Thibaut & Walker 1975; Schreckenberg et al. 2016). In

addition, agency provides relational benefits, such as self-validation, emotional support, and a sense of belonging which also promotes procedural equity (Tyler 2015). However, power inequalities embedded in social structures shape the capabilities of individuals to exercise agency (Cleaver 2007). If power inequalities are not addressed, influential individuals can bias outcomes for their own benefit and marginalize others. Therefore, leaders and facilitators of decision-making processes (from both external or local organizations) should aim to redistribute power among participants by empowering (i.e., fostering the agency of) marginalized stakeholders by supporting their voice, decision-control and capabilities (Cleaver 2007).

Agency has three criteria: voice, decision control, and capabilities (Thibaut & Walker 1975; Reed 2008):

Voice and decision control together shape how stakeholders are represented in decision-making processes (Thibaut & Walker 1975; Leventhal 1980). Voice is the ability to express one's interests, needs and priorities, and provide information that can indirectly influence decisions. Decision control is the capacity to directly influence decisions. In some situations, having a voice promotes perceptions of procedural equity, even in the absence of decision control. In other words, if people feel decision-makers are seriously considering their opinions, needs and concerns, they may consider decision-making is fair even if the final decision does not align with their interests (Tyler 2015).

Capabilities refer to the actual ability of participants to have a voice and control over decisions. More specifically, capabilities refers to participants' access to the necessary resources, such as time, information, human, and material resources and skills to exercise agency (Rowe & Frewer 2000; George & Reed 2017). For example, building participants' capacity to understand technical knowledge (Buchy & Hoverman 2000; Reed 2008) or developing knowledge and awareness through relationship building and collaborative learning (George & Reed 2017) may be essential to ensuring procedural equity.

2.3.2.3. Interpersonal treatment

Interpersonal treatment refers to how people treat each other during interaction processes. High-quality interpersonal treatment is a manifestation of the belief in the other person's value during direct interaction processes (Grover 2014), and thus, one way in which

recognition can be exercised. Interpersonal treatment has important psychological implications; for instance, treating someone with respect provides information about a person's standing in society or a group, which leads to feelings of self-worth and a sense of belongingness (Lind & Tyler 1988; Tyler & Lind 1992). These are fundamental psychological and identity needs (Copranzano et al. 2001) which, if fulfilled, can promote wellbeing and perceptions of procedural equity (Lind & Tyler 1988; Tyler & Lind 1992). A handful of empirical studies have assessed the relationship between quality of interpersonal treatment and procedural equity in the context of conservation (Ebel et al. 2018; Lecuyer et al. 2018, 2019). One found that communities close to a protected area in Mexico perceived procedural inequity because government actors did not respect the information they provided and consequently they felt ignored (Lecuyer et al. 2018).

Interpersonal treatment has two criteria: respect and politeness, which are interrelated. Treating people respectfully and politely by listening and demonstrating consideration of their needs, opinions and contributions promotes feelings of dignity and self-worth (Tyler & Blader 2003). The literature recognizes two immediate motivations for respectful and polite treatment: due to the merit, related to, for example, ability, efforts, ideas, or position in a hierarchy (Grover 2014); and the normative belief that all individuals have dignity and should be treated with respect (Bies & Moag 1986). The psychology of justice research suggests that treating people with respect can serve as a motivation to cooperate in group settings (Tyler & Blader 2003; DeCremer & Tyler 2005).

In summary, this framework integrates three key bodies of literature (psychology of justice, environmental justice, and participatory conservation) to provide a more nuanced understanding of procedural equity and how to promote it in conservation. Equity in recognition paves the way for equity in the three procedural equity dimensions of process properties, agency and interpersonal treatment, and should be considered at the start of decision-making processes. Process properties are key criteria that can promote fair or equitable decision-making process. Processes with properties of transparency, ethicality, accountability, and neutrality, mechanisms to correct decisions, and high levels of trustworthiness can promote perceptions of procedural equity and can foster the other procedural equity domains and the dimension of recognition. In addition, process properties can be fostered by promoting agency, recognition, and high-quality interpersonal treatment. For instance, ethicality is unlikely to be fulfilled if there is a lack of recognition. In order to

ensure fair representation of stakeholders' interests and postures, agency in the form of voice and/or decision control is essential and may need to be strategically facilitated to equalize the distribution of power among participants. Finally, high-quality interpersonal treatment requires respect and politeness, influencing perceptions of social status, dignity, and procedural equity. Procedural equity criteria are interrelated; applying one criterion can promote other criteria (e.g., downward accountability is essential to promoting just representation) (Ribot 2001). While some of the identified criteria - namely voice, decision control, capabilities, transparency, and accountability - are well known in the conservation literature, I call attention to additional criteria that have generally been overlooked (i.e., neutrality, correctability, ethicality, trustworthiness, respect, and politeness), and integrate of all these procedural equity criteria in a unified framework (Figure 2.1).

2.4. Procedural equity levers

I identified seven policy levers or actions that decision-makers can take to promote procedural equity criteria. These are: 1) contextual fit; 2) scalar fit; 3) conflict resolution; 4) facilitation; 5) free, prior, and informed consent (FPIC); 6) integrating knowledge systems; and 7) adaptable and flexible processes.

Contextual fit. Tailoring decision-making processes to the relevant context is essential to promote procedural equity. For instance, successful recognition requires identifying the social subgroups and equity concerns that are relevant in a particular context (Gurney et al. 2015; Dawson et al. 2018b). Context is also relevant for high-quality interpersonal treatment. Many cultures share the concept of treating people with respect. However, how respect is shown differs among cultures and social groups (Allan & Davidson 2013).

Scalar fit. Attention should be given to scalar fit, including with respect to temporal and spatial scales. For example, time periods allocated to undertake conservation decision-making are not often adapted to Indigenous people's needs, leading to procedural inequity (Whyte 2020). In regards to spatial scales, as the world becomes increasingly connected, people living far from a particular place can affect and be affected by the change to that place and thus warrant recognition (Gurney et al. 2017). For example, Gurney et al. (2017) found that people living outside Australia had strong emotional connections to Australia's Great Barrier Reef, highlighting the need for transnational participation processes to recognize and incorporate these stakeholders in the management of this globally iconic ecosystem. Caution

should be exercised when considering scale because it is never neutral; what is defined as the appropriate decision-making level and who is considered a stakeholder or not shapes who has power in that process (Gurney et al. 2017) and 'who is considered legitimate in making justice claims' (Boillat et al. 2018).

Conflict resolution mechanisms. Conflict often arises in conservation settings when stakeholders have antagonistic perspectives or some stakeholders impose their preferences at the expense of others (Redpath et al. 2013). In these situations, conflict resolution mechanisms should be available to mitigate or eliminate the destructive nature of conflicts and promote procedural equity. For instance, a study of marine protected area governance in 88 countries found that stakeholders' satisfaction with conflict resolution mechanisms was strongly associated with the measures of recognition and transparency in decision-making (Zafra-Calvo et al. 2019).

Facilitation. Skilled, unbiased, open-minded, approachable and trusted facilitators can reduce misrecognition, promote equitable representation, mediate power imbalances, and support capabilities (Reed 2008; de Vente et al. 2016; Reed et al. 2018). Facilitators may focus on promoting a well-structured dialogue among stakeholders (Habermas 1984; George & Reed 2017) or intervene strategically in situations where there is conflict, power asymmetries, and limited understanding among participants. Strategic initiatives may account for differences in background and education among participants, improve access to informational, human, or material resources, and ensure that reticent and powerless individuals voice their interests. In addition, facilitators can maintain positive group dynamics, move relations towards more respectful treatment, increase trust among stakeholders, promote neutral mediation, and open and effective communication (Dalton 2005; Reed 2008; de Vente et al. 2016; Sterling et al. 2017).

Ensure Free Prior and Informed Consent (FPIC). FPIC is a key principle of international human rights policies (e.g., United Nations Declaration on the Rights of Indigenous peoples, Convention 169) and recognizes Indigenous people's right to self-determination (UNHR 2013). It can help guarantee the recognition and agency of Indigenous peoples, emphasizes the importance of respectful and polite treatment, and ensure that procedures follow ethical standards when Indigenous peoples or local communities are involved in conservation actions. FPIC promotes accountability, transparency, and the provision of clear, consistent, accurate, timely, and accessible information to everyone and helps to ensure conservation

actions free of coercion and manipulation (Schreckenberg et al. 2016; Zafra-Calvo et al. 2017).

Integrating knowledge systems: Recognition, agency and respect can be enhanced by promoting the use of multiple types of knowledge, iterative two-way learning, informed discussion and deliberative communication (Habermas 1984; Reed 2008; Martin & Rutagarama 2012). In Rwanda, local communities and other stakeholders engaged in deliberative workshops to identify and provide advice regarding national parks' objectives and priorities for management. These workshops were based on debates and negotiations that integrated diverse knowledges and promoted perceptions of equitable representation (Martin & Rutagarama 2012).

Adaptive and flexible: New stakeholders, information, or concerns may arise during a decision-making process. Thus, processes may require the establishment of new sharing information mechanisms or different forms of participation that adapt processes to stakeholder needs and equity concerns at a specific time. Finally, reflection and evaluation of decision-making processes are essential to improve existing practices (Rowe & Frewer 2000; Sterling et al. 2017). Particularly, adaptive and flexible processes can promote the ability to correct wrong decisions (i.e., correctability).

2.5. Application to conservation practice

I suggest that this framework is relevant for stakeholders (e.g., local community organizations, Indigenous groups, NGOs, government, researchers) in promoting procedural equity in all forms of conservation. Regardless of the governance approach (e.g., stated-led, co-management, community-based), the intended objective (e.g., biodiversity, resource management), or tool (e.g., Protected Area, Other Effective Conservation Measures (Gurney et al. 2021a), Biosphere Reserves (Reed & Price 2020)), conservation initiatives involve decision-making amongst multiple groups (e.g., communities, NGOs, government, private sector) often operating at different scales (Berkes 2007). Power inequalities are inherent in these processes and if not properly addressed, participation processes can exacerbate these inequalities. Whether conservation initiatives are state-led protected areas, small community-based management arrangements, or collaborative management arrangements, decision-making processes must be equitable. This is true with respect to the range of decisions being made, from those related to management plans (e.g., levels of natural resource extraction,

benefit and cost distribution, or sustainable livelihood programs), as well as more fundamental deliberations on the premise of conservation and the appropriateness (if at all) of different conservation policy tools in that context.

Fostering procedural equity in conservation decision-making using this framework requires first considering underlying value systems and power inequalities that shape **recognition** issues. For example, to properly recognize and integrate traditional knowledge in decision-making processes, it is essential to critically reflect on the underpinning value systems that render some forms of knowledge more valuable than others in conservation (Guibrunet et al. 2021). Doing so may require the creation of spaces and the development of skills to reflect on knowledge hierarchies and broader scale power dynamics. In addition, approaches that challenge cultural and social norms may be critical to recognizing marginalized social subgroups, such as women in many contexts (Mangubhai & Lawless 2021). Recognition of diversity can be exercised through a number of criteria and levels, including for example, treating people with respect and politeness during social encounters (i.e., interpersonal treatment) irrespectively of their own identity and without being influenced by harmful stereotypes and prejudices (i.e., neutrality).

Attention should be paid to **process properties** before, during, and after the decision-making process. Capacity building of those involved in the decision-making process can support the implementation of these process properties. For instance, capacity building may be essential to ensure that local actors can hold authorities to account and develop and use equitable information-sharing mechanisms that promote transparency. Local or external skilled and unbiased facilitators can promote neutral mediation and correction mechanisms should be available to appeal decisions.

Redistributing power among participants by fostering the **agency** of marginalized stakeholders (i.e., empowerment) and challenging power dynamics is critical to levelling the playing field. Depending on the situation, procedural equity may be achieved by promoting voice and/or decision control, which may require building capacities. Building the agency of local communities (e.g., self-esteem, confidence, knowledge, collective action) to shape decisions that influence their lives is essential, especially for marginalized groups. Managing inequitable power relations is also essential to redistributing power. The ‘critical companion’ posture is an example of how facilitators can deal with power inequalities during participative processes. It consists of making the underlying assumptions and objectives of the project and

its designers explicit to all participants and promotes critical reflection and the co-construction of its legitimacy (Barnaud & van Paassen 2013).

To ensure high-quality **interpersonal treatment**, communication among stakeholders that fosters the development of feelings of respect and dignity should be encouraged. However, appropriate manners for showing respect and dignity may change depending on the sociocultural context.

Additionally, this framework can be used to inform conservation monitoring and evaluation. Attention to equity is increasing in monitoring and evaluation (e.g., Schreckenberg et al. 2016; Zafra-Calvo et al. 2017; Gurney et al. 2019); notably, Zafra-Calvo et al.'s (2017) set of indicators for evaluating the three dimensions of equity with regards to protected areas has been used to assess stakeholders' equity perceptions of 225 protected areas in 88 counties (Zafra-Calvo et al. 2019). This framework could be used to inform the expansion of the procedural equity dimension of these efforts to include some key overlooked procedural equity criteria identified here (e.g., neutrality, correctability, ethicality).

Lastly, a key consideration in applying this framework is that it is not intended to provide a 'checklist' for achieving procedural equity. Rather I aim to elucidate the suite of procedural equity criteria, the importance of which will depend on the relevant sociocultural context. It is important to note that the criteria identified through this literature review are unlikely to represent all the criteria that are important in all contexts. New criteria may come to light with further research in other contexts, especially in non-Western cultures. Identifying those criteria most relevant in a particular context is an important direction for future research, as described below.

2.6. Challenges and future directions

Applying this procedural equity framework to stakeholder participation in conservation decision-making is not without its challenges. First, perceptions of procedural equity are plural and situated, with different criteria employed to judge the fairness of a decision-making process in different contexts (Lecuyer et al. 2018). For instance, in some cultures, a lack of voice may be seen as unfair, while in others, a lack of voice may align with the cultural norms and be legitimate (Brockner et al. 2001). Thus, understanding what constitutes procedural equity in a particular context (i.e., which of the criteria are most salient and how

they manifest) is key. To this end, future research could use this framework to help identify local norms of procedural equity using qualitative, quantitative, or mixed methods (Sikor et al. 2014; Dawson et al. 2018b). For instance, qualitative methods (e.g., interviews, focus groups) could be used to elucidate what procedural equity criteria are most important for stakeholders in a given context and how they shift over time. Quantitative methods (e.g., surveys, economic experiments) could be used to assess the generalizability of identified relationships, assess the trade-offs and synergies among criteria, or elucidate the social, economic and cultural characteristics that shape conceptions of equity (e.g., see Gurney et al. 2021b in regards to distributional equity). In addition, co-production research approaches, such as transdisciplinary and participatory action research, can be employed to understand and address stakeholders' procedural equity concerns. For instance, participatory action research is a collective and self-reflective process linked to action that allows participants from diverse backgrounds and identities to identify real-life problems and empowers them to become agents of change to improve their own lives (Baum et al. 2006).

The second key challenge to promoting procedural equity using this framework is the underlying power relationships and structures in conservation decision-making that produce and reproduce inequities. This framework is intended to focus in particular on the criteria that influence perceptions of procedural equity, and thus, is by no means intended to be an endpoint in the pursuit of procedural equity in conservation. Depending on the context, it may be necessary to challenge broader structural inequalities (e.g., power asymmetries arising from past colonization processes or traditional customs), which can shape people's perceptions of what is fair (Lau et al. 2021a). Doing so may involve a number of different pathways. First, fostering structural change in conservation decision-making processes through employing 'transformative approaches' that encourage stakeholders to critically address existing social norms and power structures (Mangubhai & Lawless 2021). Second, challenging the value system that underpins mainstream conservation actions and creating legal frameworks that legitimize alternative knowledges and plural values in conservation (Guibrunet et al. 2021). Third, addressing power inequalities embedded in the conservation community, such as those existing among researchers and local communities. For instance, participatory action research can promote fair research practices by promoting all dimensions of procedural equity (Figure 2.1) and challenging broader power relations and structures (Apgar & Douthwaite 2013). Fourth, the conservation community (including importantly, donors who often shape the agenda of conservation practice; Guibrunet et al. 2021) should

exercise self-reflexivity. Each of these steps is critical to fostering procedural equity in conservation, including via decolonization science and practice.

The third key challenge to implementing this framework is that doing so requires time and financial resources. Costs can be associated with, for example, ensuring equitable representation of stakeholders (e.g., travel costs), the time required to develop trusting relationships, understanding, self-reflection, and facilitation skills. While many conservation budgets are already stretched (Gill et al. 2017), there are significant payoffs of investing resources in promoting a procedurally fair decision-making process regarding both social and ecological outcomes of conservation, but more importantly, the ethicality of the initiative.

The fourth key challenge and direction for future research relates to more explicitly exploring the different schools of thought and approaches to research (e.g., empirical vs. normative) that characterize the literatures from which the procedural equity criteria were drawn. As described by Martin et al. (2016) with regard to the equity dimension of recognition, justice scholarship is plural, with the different disciplines and schools of thought (spanning the positivist-interpretivist epistemological divide) varying in terms of underlying assumptions, foci and approaches to knowledge.

2.7. Conclusion

Despite increasing attention to equity in conservation, understanding of what constitutes procedural equity and how it can inform stakeholder participation in conservation decision-making remains limited. Drawing from the literatures on the psychology of justice, environmental justice, and participatory conservation, I help address this gap by developing a framework that elucidates the multiple domains of procedural equity and how they can be promoted in conservation decision-making processes. To successfully apply this framework, it is critical to embrace the plurality and complexity of procedural equity conceptions, consider the broader scale structural power inequalities that shape conservation, and ensure timely and long-term funding that supports the policy levers for procedural equity identified here. These challenges are not insurmountable, and overcoming them to ensure conservation decision-making is equitable is crucial, not only from an ethical standpoint but also to achieving successful conservation that sustains the wellbeing of people and nature.

Chapter 3

Disparities in the impacts of co-management on fishers' livelihoods

Chapter 3: Disparities in the impacts of co-management on fishers' livelihoods[2]

3.1. Abstract

Natural resources are widely managed through collaborative governance arrangements (e.g., co-management) which often result in the uneven distribution of costs and benefits among fishers. Discrepancies in how a fisher is impacted by co-management relative to other fishers or others in the community (i.e., disparity) can negatively affect fishers' wellbeing, their support for management, and subsequently, ecological outcomes. Yet, disparities in the distribution of social impacts from co-management have rarely been assessed. I address this gap by examining disparities (losses and gains) in perceived livelihood impacts from co-management. Losses (or gains) occur when a fisher experiences a more negative (or positive) impact on their livelihood relative to other fishers or others in the community. I used data from interviews with 1191 fishers associated with 48 coral reef co-management arrangements across Kenya, Tanzania, Madagascar, Indonesia, and Papua New Guinea to examine how socioeconomic and institutional characteristics were associated with losses and gains from co-management. Overall, I found that more fishers perceived equality than disparities in the distribution of co-management impacts. Of those that perceived disparities, more fishers perceived losses than gains. I also found that disparities could be predicted by a range of socioeconomic characteristics, including distance to markets and wealth, and institutional characteristics of the co-management regime, such as gear, access, and area restrictions. This study provides insights on potential entry points that could be used by managers and policy-makers to promote equitable co-management of small-scale fisheries, such as the reduction of losses by increasing participation in decision-making processes, fostering conflict resolution mechanisms, prioritizing gear restrictions over area restrictions, and reducing poverty.

[2] Adapted from **Ruano-Chamorro, C.**, Gurney, G., Barnes, M.L., Gelcich, S., & Cinner, J. (2023). Disparities in the impacts of co-management on fishers' livelihoods. *Sustainability Science*. https://doi.org/10.1007/s11625-023-01361-w

3.2. Introduction

Common-pool resources across the world – including forests, fisheries, and pastures – are commonly governed under co-management governance arrangements (Berkes 2009; Oldekop et al. 2016; Gelcich et al. 2019). Co-management is intended to be a collaborative and participatory process often involving communities, governments, civil society, and research institutions (Berkes 2009), and aims to provide a degree of decision-making power to people who are affected by management decisions. By facilitating the incorporation of local values, needs, governance and, priorities, co-management is thought to lead to better outcomes for local people than more centralized governance approaches (Berkes 2009). However, the benefits and costs of co-management are often unevenly distributed among local people (Gurney et al. 2015; Ward et al. 2018), resulting in winners and losers (Cinner et al. 2014).

Discrepancies on how an individual is impacted relative to others in the community (i.e. disparities) have important implications for social and ecological outcomes (Pascual et al. 2014; Hamann et al. 2018). When co-management costs fall on those who are most deprived, disparities can further harm the most vulnerable people, increasing poverty and deepening social inequalities (Adams et al. 2004; Persha & Andersson 2014). Perceived disparities can influence peoples' attitudes and their willingness to engage with management initiatives (Fabinyi et al. 2015; Hamann et al. 2018). In particular, if disparities are considered unfair[3], management support and cooperation can be undermined, leading to social conflicts and non-compliance (Gurney et al. 2014), and ultimately, hampering management success (Loomis & Ditton 1993; Pascual et al. 2014; Fabinyi et al. 2015). Indeed, scholarship on distributional equity from psychology suggests that preferences for equitable distributions are rooted in

[3]Following McClanahan et al. 2012 (McClanahan et al. 2012) I use disparity to refer to discrepancies in perceived benefits (and/or costs) between an individual fisher and other fishers or the community more generally. The disparity metric in this analysis is a measure of the distribution of livelihood impacts from co-management in relative terms (i.e., how one individual is impacted relative to others) and it is different from a measure of absolute impacts (i.e., how one individual is impacted) which is more commonly assessed in natural resource management literature (Cinner et al. 2012, Gurney et al. 2015, Ward et al. 2018). The disparity measure I used in this study has three categories: losses, equality, and gains. Equality and equity are often used interchangeably in the literature, yet they are distinct concepts (McDermott et al. 2013). Equality refers to the equal distribution of benefits and/or costs among individuals or groups (i.e., the absence of disparity), and is one potential distribution that could be considered equitable. Distributional equity refers to the fair distribution of benefits and/or costs among individuals or groups (McDermott et al. 2013).

neurological and psychological processes, and are strongly related to attitudes, beliefs and behavior, including legitimacy and collective action (Dawes et al. 2007; Nishi et al. 2015; Tyler 2015). Importantly, subjective wellbeing has been shown to be strongly related to perceptions of (un)fair disparities (Wilkinson & Pickett 2009; Prilleltensky 2012).

Given the implications of distributional inequity on the social and ecological outcomes of co-management, disparities in socioeconomic impacts is a key consideration for co-management decision-makers. Depending on the context, decision-makers may be interested in promoting equality or even certain types of disparities. For instance, management strategies may be focused on promoting winners without increasing losers (i.e., making people better off without making anyone worse off) (Pareto 1906). Additionally, strategies may be focused on managing subjective or perceived disparities, which are considered a stronger predictor of individual and social outcomes than objective measures of disparity (Nishi et al. 2015; Hauser & Norton 2017; Starmans et al. 2017).

According to the theory of relative deprivation, the perception of being more negatively impacted than others (e.g., the community) can negatively affect people's wellbeing (Crosby 1976; Smith et al. 2012). Therefore, in the context of co-management, promoting perceptions of not being a loser may be important for promoting subjective wellbeing, and management support. In addition, understanding the social conditions associated with disparities in co-management outcomes is essential to inform targeted policies and practices that account for equity issues.

Despite the importance of understanding disparities in co-management, it remains unclear the degree to which co-management leads to disparities (i.e., objective disparity), the degree to which disparities are perceived (i.e., subjective disparity), and what socioeconomic and institutional characteristics are related to these disparities. Indeed, the literature on inequality and environmental management has largely focused on economic inequality (i.e., wealth or income) and its role as a driver of outcomes (Baland et al. 2007; Persha & Andersson 2014; Hamann et al. 2018), and on differential impacts among occupational or social groups (e.g., gender, religion) (Gurney et al. 2015; Ward et al. 2018; Gill et al. 2019).

In this paper, I build on this existing work by quantifying how specific socioeconomic and institutional characteristics relate to two types of disparities (subjective and objective) in livelihood impacts from coral reef co-management for 1191 fishers across 48 co-management

arrangements in five Indo-Pacific countries (Figure 3.1, 3.2). I used household surveys to elicit two forms of disparity based on a five-point Likert-type rating scale about the impacts of co-management on 1) the respondent's livelihood and; 2) the wider community (Figure 3.2). These surveys were also used in combination with key informant interviews to examine 17 socioeconomic and institutional conditions expected to be related to co-management outcomes.

3.3. Materials and Methods

3.3.1. Study sites and sampling approach

I used data from 48 independent coral reef fisheries co-management arrangements spanning five Indo-Pacific countries: Kenya, Tanzania, Papua New Guinea, Indonesia, and Madagascar (Figure 3.1) (Cinner et al. 2012). The data was collected in 2009 as part of large-scale study aiming to assess how ecological and social outcomes (e.g., livelihood impacts from co-management) are related to socioeconomic and institutional characteristics (Cinner et al. 2012). Two sampling techniques were used to select sites. In Kenya, it was possible to conduct random selection of villages due to the availability of a comprehensive list of co-management sites and the relatively small coastline. A random sampling was not possible in the other countries. In these countries, sites were purposively selected to represent a variety of social, economic and political systems, governance systems and user characteristics. Purposive sampling added variation in the predictor variables and reduced bias. However, it is important to consider that villages were not selected randomly, and therefore results should be interpreted with caution.

The data used in this chapter was collected through household surveys, semi-structured interviews with community leaders, co-management organization leaders, and other key informants (knowledgeable fishers, elders, and other stakeholders), and analyses of secondary sources such as population censuses. In total, I used data from 1191 fishers interviews, 53 key informant interviews, 54 community leader interviews, and 51 organizational leader interviews (Cinner et al. 2012). Two sampling techniques were used to target household heads (who were mostly men) engaged in marine resource use. In Kenya and Indonesia, respondents were randomly selected from lists of resource users provided by the leaders of the co-management arrangement. In the other sites, households were systematically selected, whereby a sampling fraction of every i^{th} house (e.g., 2^{nd}, 3^{rd}, 4^{th}) was determined by dividing

the total village population by the desired sample size. Between one and five key informants were interviewed per co-management site using semi-structured interviews. Key informants were targeted using non-probability sampling techniques (e.g., convenient sampling). The information gathered in this project was triangulated and compiled in a dataset (Table S2). This research was approved by the JCU Human Ethics Committee (approval number H3020). Prior informed oral consent from participants was obtained. Written consent was not obtained due to low literacy rates.

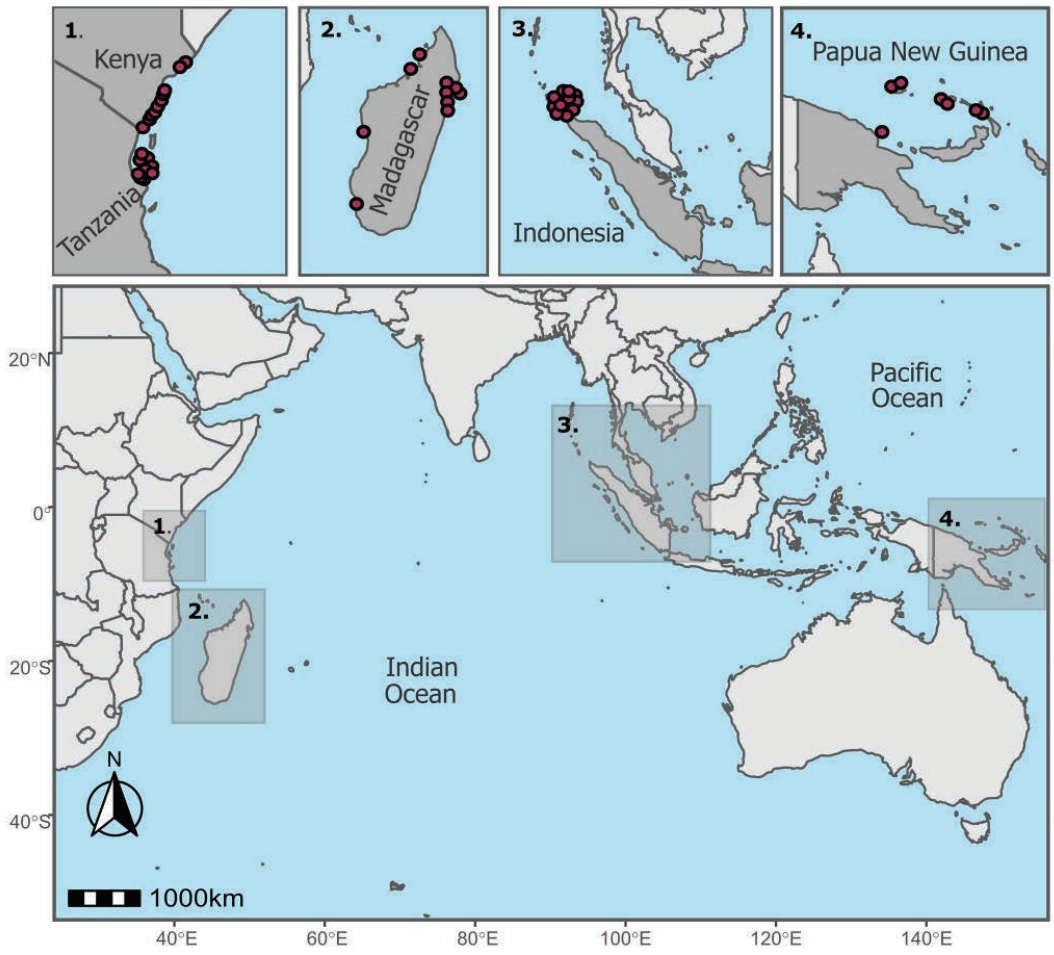

Figure 3. 1. Map with co-management sites in 1) Kenya and Tanzania, 2) Madagascar, 3) Indonesia, and 4) Papua New Guinea. Approximate locations of co-management sites are indicated with red dots.

3.3.2. Disparity metric (response variable)

Fishers were asked to indicate: 1) the degree to which they perceived co-management had a positive, neutral, or negative impact on their livelihoods (individual impact). Livelihood was conceptualized and explained as a broad concept of wellbeing (not solely referring to employment) (Allison & Ellis 2001); and 2) the degree to which they perceived co-management had a positive, neutral, negative impact on the broader community (community impact). Both responses were on a 5-point Likert-type scale, 1 being a very negative impact on livelihoods, 5 very positive impact, and 3 being neither. From these questions, I created two metrics of disparity, which I refer to as subjective and objective disparity (Figure 3.2):

> **Subjective disparity** was calculated by subtracting a respondent's score for community impact from their score for individual impact. Subjective disparity thus captures whether the respondent self-identifies as a winner or loser (i.e., the perceived relative position of the individual within the community), which may affect their perceptions, attitudes, and behavior (e.g., relative deprivation) (Crosby 1976).
>
> **Objective disparity** was calculated by subtracting the mean of individual impact from each respondent's individual impact score. Objective disparity is thus the relative position of the respondent among sampled fishers (i.e., the level of impact a fisher perceives to have received relative to other fishers). This measure of disparity is captured through perceptions and is different from other measures of objective disparity commonly used in the literature (e.g., Gini index, inequality based in income). However, its calculation contains the average of the perceptions of sampled fishers and thus can be considered objective relative to the subjective measure of disparity used in this study. Although it may not necessarily be perceived by respondents, research has shown that objective disparity matters for people's wellbeing (Townsend 1987; Wilkinson & Pickett 2009). The uneven allocation of costs and benefits may increase existing inequalities and levels of poverty and lead to social conflict and a wide range of governance problems (Persha & Andersson 2014).

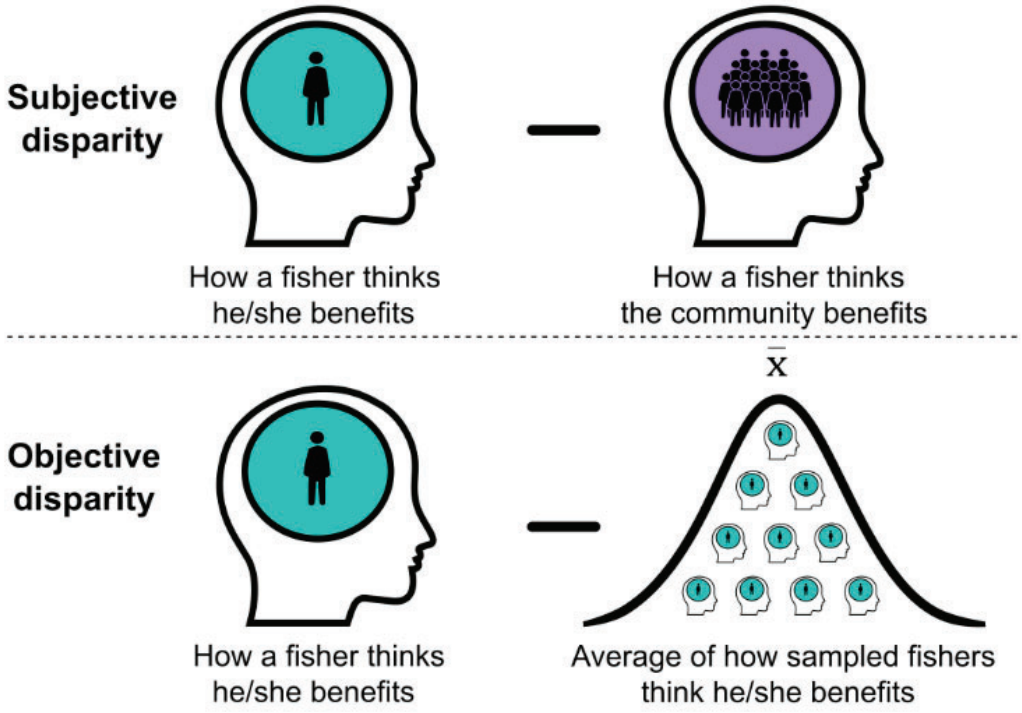

Figure 3. 2. Subjective and objective disparity metrics in this study. Subjective disparity refers to the level of impact that an individual fisher perceived to receive from co-management, minus the impact that individual fisher perceived the community receives. Objective disparity refers to the level of impact that an individual fisher respondent perceived to receive from co-management, minus the average of the impact perceived by all sampled fishers in the community. Each disparity metric was broken down into three categories: a) losses (subjective disparity <0; objective disparity <-0.5); b) equality (subjective disparity = 0; objective disparity ≥ -0.5 and ≤ 0.5); c) gains (subjective gain >0; objective gain>0.5).

Thus, the subjective metric considers how a fisher thinks the community benefits, while the objective measure integrates perceptions of sampled fishers (Figure 3.2). I broke down subjective and objective disparity metrics into three categories each (losses, equality, gains). Values equal to zero (or between 0.5 and -0.5 in the case of objective disparity metric) were categorized as equality, values below zero (or below 0.5) were categorized as losses, and values above zero (or 0.5) were categorized as gains. Losses occur when a fisher experiences a more negative impact relative to the rest of the community (or fishers in the case of objective disparity), gains occur when a fisher experiences a more positive impact relative to the rest of the community (or fishers), while equality occurs when a fisher experiences same impacts relative to the rest of the community (or fishers). Hence, I obtained four response

variables, which related to whether fisher experienced or perceived an equality outcome versus an: 1) objective gain; 2) objective loss; 3) subjective gain; and 4) subjective loss. For example, a subjective gain would be when a fisher perceives that he or she benefits more than he or she perceives the community benefits. An objective gain refers to when a fisher's perception of the impact on their livelihood is higher than the average of all sampled fishers' perceptions from that community.

3.3.3. Socioeconomic and institutional characteristics (predictor variables)

I examined the relationship between disparities and 17 socioeconomic and institutional characteristics, which were selected based on institutional analysis theory (Ostrom 2009) and their relevance to this specific context according to co-management theory and research (Cinner et al. 2012; Ward et al. 2018; Gurney et al. 2019; Epstein et al. 2021) (Table S2).

I examined eight individual-level and two community-level socioeconomic characteristics (Table S2) which can influence whether people engage in collective resource management (Ostrom 2009; Ward et al. 2018; Epstein et al. 2021) and how cost and benefits are distributed (Gurney et al. 2015; Gill et al. 2019). Socioeconomic characteristics, such as gender, migrant status, wealth, and education, shape hierarchical structures that privilege certain individuals (e.g. wealthy and highly educated people) while marginalizing others (e.g. women, migrants) who are often excluded from decision-making processes and bear the costs of management (Persha & Andersson 2014; McClanahan & Abunge 2016; Gustavsson et al. 2021). In addition, participation in community events can increase social capital and promote management equity (Diedrich et al. 2017), but also exacerbate inequalities as those individuals with more connections may have more ability to influence decisions and benefit from co-management (Smith 2012). Fishery dependency, operationalized here as primary marine livelihood and occupational diversity, can also influence how fishers benefit from co-management (Cinner et al. 2012; MacNeil & Cinner 2013). For instance, highly-dependent fishers may be more vulnerable to restrictions than those with lower dependency and experience higher negative impacts from co-management (McClanahan et al. 2009). Finally, trust in leaders may influence perceive benefits and disparity because fishers who trust leaders may perceive that management is effective (Jones et al. 2017) and that leaders take into account their interests and do what is right and fair (Ruano-Chamorro et al. 2022). At the community level, proximity to markets may positively impact local livelihoods by providing access to resources and economic opportunities (Bene et al. 2010), although it may crowd out

intrinsic incentives (Cinner et al. 2021). In addition, large population size can diminish or enhance collective action (Poteete & Ostrom 2004) and thus the delivery of equitable livelihood outcomes to local communities.

I examined seven key characteristics that were informed by Ostrom's eight design principles for devolved commons management (Ostrom 1990). Institutional characteristics are key to understanding the likelihood of collective action and, thus, the possibility of achieving ecological and social benefits (Ostrom 1990) and can influence how users receive and perceive benefits and costs (Cinner et al. 2012). Clearly defined boundaries and operational rules can exclude certain people or social groups, negatively impacting their livelihoods while benefiting others, leading to unequal distribution of impacts in the community. The operational rules considered in this study include access restrictions (i.e., restricted or prohibited access to fishing grounds to non-members), area restrictions (i.e., prohibition of fishing in certain areas) and gear restrictions (i.e., prohibition of certain gears). Participation in resource management decision-making is key to achieving procedural equity (Ruano-Chamorro et al. 2022) and good governance (Lockwood 2010). Specifically, the active participation of local users in decision-making processes can promote procedural fairness (Ruano-Chamorro et al. 2022) and, thus, equitable distribution of outcomes. Graduated sanctions promote compliance by punishing severe or repeated rule violations (Ostrom 1990) and can increase the likelihood of obtaining both benefits and costs from co-management (Cinner et al. 2012), while the presence of effective mechanisms to solve conflicts in co-management arrangements is essential to promote equity (Gurney et al. 2019; Ruano-Chamorro et al. 2022). A more detailed description of institutional and socioeconomic characteristics that can influence social outcomes in co-management arrangements is provided in Table S2.

3.3.4. Analyses

I conducted four mixed effect binomial logistic regression models, including site as a random effect, to quantify the relationship between the predictor variables and the likelihood of an equality outcome vs subjective loss (Model 1), subjective gains (Model 2), objective losses (Model 3), and objective gains (Model 4). For example, in Model 1, I examined what differentiates those experiencing subjective losses from those experiencing subjective equality. Similarly, in Model 2, I examined what differentiates those experiencing subjective

gains from those experiencing subjective equality, and so on. I followed an information theoretic approach to model selection (Grueber et al. 2011) (Appendix B).

3.4. Results

Equality was the most frequent category of the objective and subjective disparity metric (i.e., losses, equality, gains) and comprised the majority of outcomes in the subjective, but not the objective metric (Figure 3.3). In other words, fishers generally perceived more equality (i.e., fishers felt they were benefiting the same as the rest of the community) than what was measured in more objective terms (Figure 3.3). The frequency of objective losses and gains was similar (Figure 3.3B), while the frequency of subjective losses was higher than the frequency of subjective gains (Figure 3.3A), meaning that fishers were more likely to see themselves as losers than as winners relative to sampled fishers.

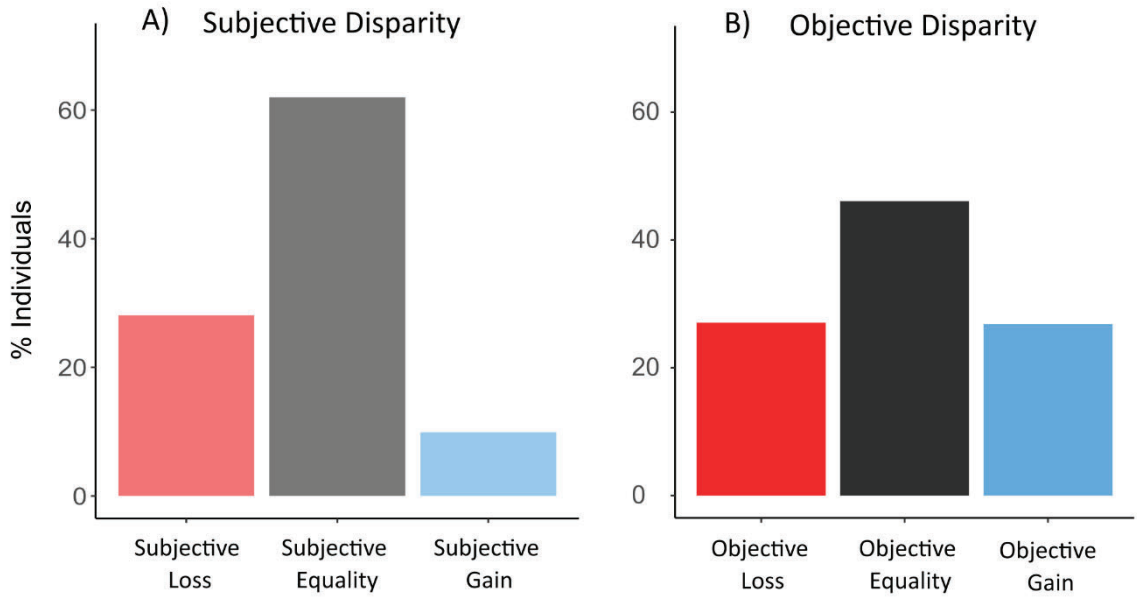

Figure 3. 3. Distribution of subjective and objective disparity metrics. A) Percent of individual fishers who perceived more negative impacts from co-management relative to the community (red); the same impacts than the community (grey); and more positive impacts than the community (blue). B) Percent of individual fishers who perceived more negative impacts from co-management relative to sampled fishers (red); the same impacts relative to sampled fishers (black); and more positive impacts relative to sampled fishers (red).

Although objective and subjective disparities were related (Chi-square = 178,59, df=4, p-value<2.22 e-16), there were substantial variations in fishers' objective compared to their subjective disparity (Figure 3.4). Many fishers perceived subjective equality when experiencing objective gains (n=203) and objective losses (n=102) (Figure 3.4). Furthermore, it was more common for a fisher to perceive subjective losses when they experienced objective losses than for a fisher to perceive subjective gains when experiencing objective gains (i.e., 56% of the fishers experimenting objective losses perceived subjective losses, while only 16% of fishers experiencing objective gains perceiving objective gains) (Figure 3.4).

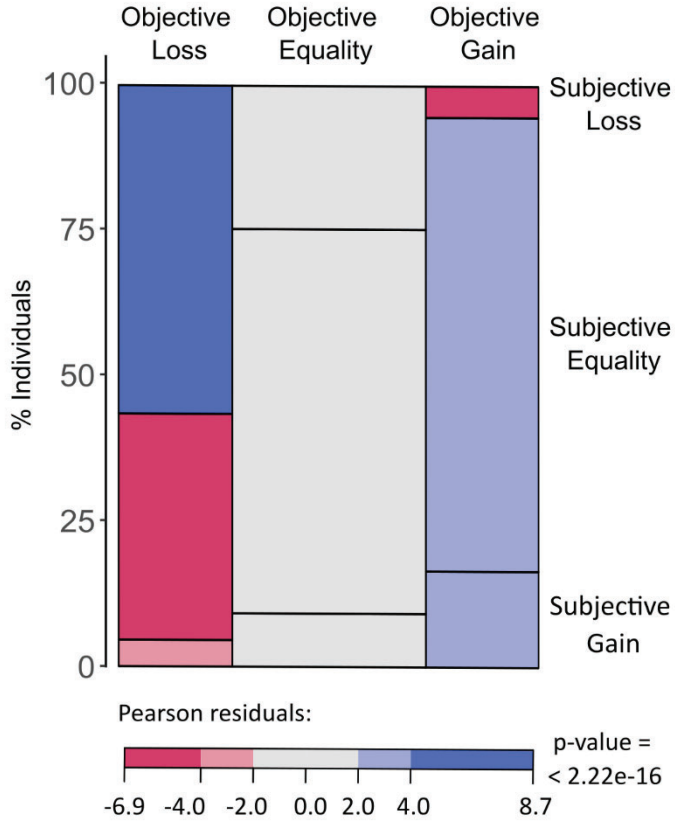

Figure 3. 4. Mosaic plot and percentage of fishers experiencing combinations of objective and subjective disparity categories (losses, equality, gains). The widths of the columns indicate the percentage of the number of observations in each objective disparity category, and the widths of the rows indicate the percentage of the number of observations in each subjective disparity category (e.g., 56% of fishers experienced both objective and subjective losses, and 78% of fishers who experienced objective gains perceived subjective equality). Chi-square test and Pearson residuals are shown. Blue indicates that the observed value is higher than expected than if the data were random; red indicates that the observed value is lower than expected than if the data were random.

3.4.1. Relationships between institutional and socioeconomic characteristics and disparities

I used four binomial mixed-effects models to examine how the likelihood of an equality response versus each of the four different types of losses and gains were related to seven institutional and 10 socioeconomic characteristics (Table S2) that have been previously shown to be important in shaping co-management outcomes (Ostrom 2009; Cinner et al. 2012; Ward et al. 2018; Gurney et al. 2019; Epstein et al. 2021). I found four socioeconomic characteristics and five institutional characteristics were significantly related to disparities (Figure 3.5). I also found that overall, losses were more likely to be influenced by these characteristics as opposed to gains.

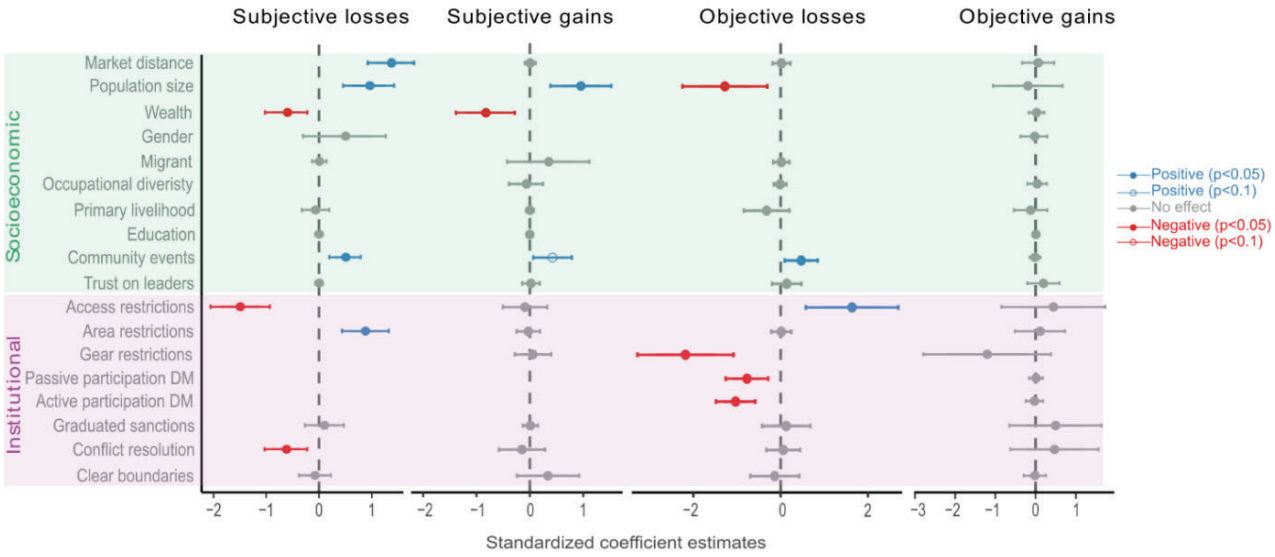

Figure 3. 5. Relationship between socioeconomic and institutional characteristics and subjective and objective disparity metrics. Relationships are indicated with the model-averaged standardized coefficient estimates of binomial logistic mixed effect models. Community is included as a random effect in the models. Error bars indicate 95% confidence interval. Effect sizes have been standardized by subtracting their mean and dividing by two times their standard deviation.

Socioeconomic characteristics were related to three of the response variables (subjective losses, subjective gains, and objective losses). Population size and participation in community events were the only socioeconomic characteristics related to both subjective and objective disparity (Figure 3.5). In communities with large population sizes, fishers were more likely to

see themselves as winners and losers relative to the rest of the community (i.e., experience subjective losses and gains), and were less likely to experience objective losses. Fishers who participated in community events were more likely to experience subjective gains and subjective losses, and more likely to experience objective losses. Wealth was both negatively related to subjective losses and gains, and thus, wealthier fishers were less likely to perceive disparities (both losses and gains). In addition, distance to markets was positively related to subjective losses. In other words, fishers living in communities with lower market access (i.e., farther from markets) were more likely to see themselves as losers.

Institutional characteristics were related to two response variables (subjective losses and objective losses) (Figure 3.5). Rules relating to access, gear, and area restrictions had a different relationship with the two types of disparities. Specifically, fishers in sites with access restrictions were less likely to perceive subjective losses but more likely to experience objective losses; fishers in sites with area restrictions were more likely to perceive subjective losses; while fishers in sites with gear restrictions were less likely to experience objective losses (Figure 3.5). In other words, fishers affected by access restrictions were more likely to perceive being equally impacted by co-management relative to the community, although fishers were more likely to experience negative impacts from access restrictions than other fishers in objective terms. In contrast, fishers in communities with area restrictions were more likely to see themselves as losers; whilst in communities with gear restrictions, fishers were less likely to experience objective losses relative to other fishers. Two additional institutional characteristics were related to different types of disparities. Participation in the decision-making process was negatively related to objective losses (Figure 3.5), suggesting that higher levels of participation in decision-making reduces objective losses (or promotes equality). Finally, the presence of effective conflict resolution mechanisms was negatively related to subjective losses (Figure 3.5).

3.5. Discussion

Together, this study revealed three key results with important implications for co-management. First, fishers can overestimate equal outcomes, and when they do perceive disparities, losses are more likely to be perceived than gains. Second, losses and gains were related to distinct socioeconomic and institutional characteristics, with some characteristics related to only losses, and others to both gains and losses. The third key result is that

socioeconomic and institutional characteristics tend to be related either to subjective or objective disparity.

3.5.1. Subjective and objective disparity

Fishers perceived higher levels of equality (i.e., subjective equality) than indicated by the objective disparity measure (i.e., objective equality). This may be because fishers perceive the decision-making process of their respective co-management arrangements as fair, which may lead to perceptions of equality in co-management impacts regardless of the actual distribution (Gustavsson et al. 2021). In cases where disparities were perceived, I found that fishers perceived more than twice as many losses than gains. This result may be indicative of the concept of loss aversion, which refers to the cognitive bias that people have towards perceiving that losses hurt twice as much as the satisfaction of an equivalent gain (Kahneman & Tversky 1979). Indeed, I found that fishers perceived more subjective losses when they experienced objective losses compared to their perception of subjective gains when they were experiencing objective gains. If they perceive these losses as unfair, fishers may be experiencing relative deprivation (Crosby 1976; Smith et al. 2012). This feeling of being worse off than others can lead to frustration, anxiety, dissatisfaction, anger, or resentment and promote social conflicts, distrust, and anti-social behavior (Crosby 1976; Wilkinson & Pickett 2009; Smith et al. 2012). In a co-management context, relative deprivation may lead to unethical and inefficient management interventions because it can negatively affect people's wellbeing, reduce support for co-management (Gelcich et al. 2007; Wangel & Blomkvist 2013), and ultimately lead to management failure. For instance, fishers in Texas felt relative deprivation because fishing regulations only affected them and not fishers who fish in other bays, which caused opposition towards fishing regulations (Loomis & Ditton 1993).

3.5.2. How socioeconomic and institutional characteristics are related to disparities: Losses and gains

The second key finding is that losses and gains were related to distinct socioeconomic and institutional characteristics, with some characteristics more likely to be related to only losses (e.g., distance to markets, gear and area restrictions), and others more likely to be related to both gains and losses (e.g., population size, wealth). These findings can help identify individuals and contexts in which undesirable outcomes of co-management are more likely to

result, which could then be targeted with additional support. Additionally, if further investigations reveal that the relationships between these socioeconomic and institutional characteristics are causal, these characteristics could be used as levers for change.

Losses were less likely to occur where there was participation in decision-making, conflict resolution mechanisms, gear restrictions, absence of area restrictions, and in communities near markets. Participation in decision-making and effective conflict resolution mechanisms have been shown to promote perceptions of procedural equity (i.e., fair decision-making process) (Ruano-Chamorro et al. 2022), which in turn can lead to perceptions of distributional equity. Gear restrictions in this context may reduce objective losses because coral reef fishers often use multiple gears, or alternatively, gear restrictions may be viewed as a means to reduce competition from fishers using other gears. As a result, fishers may be less vulnerable to gear restrictions than to other restrictions, such as area restrictions. Consistent with my results, other studies have found that fishers often have more positive perceptions of gear than area restrictions (McClanahan et al. 2012; Barley Kincaid et al. 2014; McClanahan & Abunge 2016).

My finding that perceived losses were less likely in communities close to markets could be due to a number of mechanisms. Market proximity may reduce dependency on middlemen, potentially leading to higher bargaining power and earnings (Maire et al. 2020; Rojas et al. 2021). Alternatively, the relationship between market proximity and perceived losses could be due to an increase in fishers' preferences for equality. Indeed, research from human evolutionary biology suggests that market integration gives rise to prosocial norms, including a preference for distributional equality, which can facilitate mutually beneficial exchanges among strangers who do not have established social relationships (e.g., kinship, reciprocity) (Henrich et al. 2010). Conversely, other studies have found that market engagement can reduce preferences for equal or pro-poor distribution of conservation benefits (Martin et al. 2019; Cinner et al. 2021; Gurney et al. 2021b) and lead to an unequal distribution of market benefits among fishers (Ferguson 2021). Indeed, the influence of markets on human preferences and behavior and, thus, conservation and management outcomes continue to be debated (Maire et al. 2020; Cinner et al. 2021). This relationship is likely complex, dependent on the social-ecological context, and potentially non-linear (Epstein et al. 2021).

Both gains and losses were more likely to be experienced and/or perceived when fishers were poorer, more involved in community events, and lived in communities with a larger

population. Previous research has also shown that poorer fishers are more likely to perceive both negative and positive impacts (e.g. fisheries displacement and higher catch) from marine protected areas in Kenya (Cinner et al. 2014). One possible explanation is that poorer people are more vulnerable (Cinner et al. 2009), which means that any change to their livelihoods has a greater impact than on wealthy people. Further, concerns about scarcity can influence cognitive processes (Shah et al. 2018), leading people to be more psychologically sensitive to the impacts (both positive and negative) of co-management. With regards to the positive relationship I found between involvement in community events and the experience of both gains and losses, increased connectedness through these events could be exacerbating disparities and benefiting certain groups over others, as well as making disparities within the community more visible (Ballet et al. 2007; Cook 2014). Lastly, the relationship between population size and management outcomes is complex, context-dependent (Poteete & Ostrom 2004), may be non-linear (MacNeil & Cinner 2013), interacts with other factors (MacNeil & Cinner 2013), and is generally unclear. Therefore, further examination is required to better understand the mechanisms through which population size shapes co-management disparities.

3.5.3. How socioeconomic and institutional characteristics are related to disparities: objective and subjective

The third key finding is that socioeconomic and institutional characteristics tend to relate to either subjective or objective disparity, with just three characteristics associated with both types of metrics. For instance, conflict resolution was only related to subjective disparity and participation in decision-making was only related to objective disparity. Conflict resolution mechanisms may provide tangible ways of solving problems within the community and reduce fishers' perceptions of being a loser. On the other hand, fishers involved in decision-making, and thus possibly able to satisfy their needs for procedural equity and self-determination (Decaro & Stokes 2013), may tend to perceive similar impacts from co-management (i.e., objective equality). The presence of access restrictions was negatively related to subjective losses and positively related to objective losses. The likelihood that fishers experience losses relative to other fishers (i.e. objective losses) may be increased because certain groups (e.g. clans) within the community may hold different access rights (Lau et al. 2021a) and impact fishers' livelihoods unevenly. In addition, access rights embedded in customary governance systems may be seen as legitimate (Osei-tutu et al. 2021) and lead to perceptions of equality (i.e. low subjective losses).

Therefore, the conditions related to a fisher receiving more losses or gains than other fishers are not always the same conditions that relate to the same fisher seeing themselves as a loser or a winner relative to the community they belong to. In essence, socioeconomic and institutional characteristics may have different influences on how fishers' livelihoods are affected relative to other fishers (i.e., objective disparity), and on how fishers' livelihoods are affected relative to how fishers perceive the community to be affected (i.e., subjective disparity). These findings provide entry points for managing either subjective or objective disparities. For example, to foster objective equality, managers may promote participation in decision-making and implement gear restrictions rather than access restrictions. Alternatively, whilst objective equality is likely a frequent goal in co-management, promoting subjective equality or perceptions of being a winner might be an equally valid goal given the influence of fairness perceptions on attitudes, behaviors, and wellbeing. Thus, this study provides guidance on the different strategies that could be implemented depending on the outcome of interest.

3.5.4. Limitations

This study takes an important first step in evaluating different types of disparity in co-management, and exploring how these outcomes are related to key socioeconomic and institutional characteristics, but has some limitations that could be addressed in future studies. First, while this study provides some evidence of the direction and magnitude of the relationship between disparities and the examined socioeconomic and institutional characteristics, it is not designed to establish whether those relationships are causal. A second limitation is that this study does not assess how different types of co-management arrangements (e.g., locally led protected area, national park co-management customary management) are related to disparity, a key research gap that should be addressed in future research. A third limitation of this study is that I examined distributional equality and not distributional equity. Distributional equality involves distributing benefits and/or costs equally amongst people. Although equality is often equated with equity, a fair distribution of benefits or costs can follow other distributions or principles. Indeed, social justice theory identifies three major distributional justice principles: need, equality, and proportionality (Deutsch 1975). Which of these principles is considered fair can vary according to the situation at hand, including the socio-cultural context and the nature of the benefit (Martin et al. 2019; Gurney et al. 2021b). For example, in Fiji, distributing material benefits arising

from a co-managed marine protected area according to customary rights (a proportionality distributional justice principle) was perceived as fairer than distributing benefits equally, according to need, or proportionally to opportunity-costs associated with displaced fishing effort (Gurney et al. 2021b). Equity or fairness is a powerful human motivator, and it has a strong influence on feelings and behaviors. Given it is often equity and fairness, rather than equality, that people care about and which therefore influences behavior (Starmans et al. 2017). Future research is needed to evaluate if the disparities I identified are perceived as fair or not and whether a positive relationship between disparity and co-management characteristics implies that co-management is leading to equitable or inequitable disparities.

3.6. Conclusion

Co-management has positive and negative impacts on people's livelihoods which are often unevenly distributed. These disparities or uneven distributions of co-management impacts have both ethical and instrumental implications for environmental management. Therefore, understanding what co-management disparities exist and the conditions under which disparities are likely to occur is critical for promoting equitable and effective management. Here, I provide some of the first evidence on how disparities are experienced in objective and subjective terms, and how they are related to key socioeconomic and institutional characteristics. In the analysis of 1191 fishers across 48 co-management arrangements in five Indo-Pacific countries, I found that objective and subjective equality were more prevalent than disparities (losses and gains), and it was more common for a fisher to perceive losses than gains. I also found that disparities were related to a variety of socioeconomic (e.g., distance to markets, population size, and wealth) and institutional (e.g., area restrictions, conflict resolution mechanisms) characteristics.

These findings suggest that different strategies can be implemented to promote or reduce the different kinds of disparities I examined (i.e., objective versus subjective disparities, and losses versus gains). However, there are two key aspects to consider when implementing these strategies to ensure equitable and effective management. First, it is critical to unravel whether equality or different types of disparities are considered equitable or fair by local fishers because it is often not equality that concerns people, but rather equity. Second, given that disparities can have consequences for other social and ecological aspects of the system, it is critical to understand the trade-offs of managing disparities. For example, this study suggests that improving market access for small-scale fishers may promote equality and

reduce losses. However, market engagement can pose risks to small-scale fisheries; e.g., it can lead to overexploitation (Cinner et al. 2016), a reduction in preferences for distributional equality (Gurney et al. 2021b), or may crowd out critical aspects of pro-environmental behavior (Cinner et al. 2021), including willingness to engage in collective action (Gurney et al. 2016).

Chapter 4

An intersectionality perspective on equity in coastal Fiji

Chapter 4: An intersectional perspective on equity in coastal Fiji

4.1. Abstract

Promoting equity in environmental governance is morally right and can help achieve positive social and ecological outcomes. To this end, understanding equity perceptions of community members affected by conservation and natural resource management initiatives is key. Given that communities are composed of members with different identities shaped by a combination of social characteristics (e.g., gender, migrant status, marital status), their ability to benefit from management and participate in decision-making is likely to be heterogeneous. Thus, examining how distributional equity (i.e., fairness of the distribution of management impacts) and procedural equity (i.e., fairness of decision-making process) are perceived by community members from an intersectional perspective is crucial. Here, I assess how perceptions of distributional and procedural equity differ by gender and how the intersection between gender and other social identity characteristics relates to those. I found that respondents assumed that the broader community benefited the most from management, while women were assumed to be most negatively affected by management. In general, respondents' perceptions of distributional and procedural equity were high regardless of gender. However, migrant men, widows, youth, and people with low or high levels of education were less likely to perceive distributional fairness, while migrants and people with high education were less likely to perceive procedural fairness. These results provide insights into what patterns of perceived (in)equity exist in small-scale fishing Indigenous communities in Fiji, which can inform how to advance equity in this context. In addition, this study highlights the importance of using an intersectional lens to better understand equity in natural resource management and conservation.

4.2. Introduction

Conservation and natural resource management initiatives can have large and diverse effects on people's wellbeing (Gurney et al. 2014; Ban et al. 2019; Gill et al. 2019), with important implications for social equity. Of particular relevance to human wellbeing and social equity is whether the distribution of conservation costs and benefits and decision-making processes are fair. In this chapter, following environmental governance literature, I use 'fairness' to describe individuals' perceptions arising from judgements of situations related to dimensions of equity (e.g., distribution, procedure) and which are informed by principles of justice (e.g.,

equality, need) (Adger et al. 2016; Lecuyer et al. 2018; Gurney et al. 2021b). Ensuring fairness in conservation is a moral imperative and necessary to recognizing and respecting the rights that underpin human wellbeing and dignity (Schreckenberg et al. 2016; Martin 2017). Perceived fairness of the distribution of costs and benefits and/or decision-making processes is considered a key driver of attitudes and behavior (Fehr & Schmidt 1999; Zapata-Phelan et al. 2009), including legitimacy (Tyler 1997), and cooperation (Tyler 2015). Given that conservation and management of natural resources rely on cooperation and collaboration between stakeholders (Ostrom 1990; Gelcich et al. 2013), fairness perceptions likely impact social and ecological outcomes. Indeed, perceptions of inequity have led to conflict, sabotage, and protests and jeopardized conservation efforts (Gurney et al. 2014; Mariki et al. 2015; Raycraft 2020). Thus, perceptions of equity are being increasingly assessed in conservation and natural resource management practice (Zafra-Calvo et al. 2017; Gurney et al. 2019; Franks & Pinto 2021). Further, the importance of equity is increasingly recognized in multiple environmental agreements, such as the Sustainable Development Goals. Of particular note, is the Kumming-Montreal Global Biodiversity Framework adopted in 2022 under the world's most influential environmental agreement, the Convention on Biological Diversity (CBD), which has references to equity throughout its goals, targets, and implementation advice (Gurney et al. 2023).

4.2.1. Empirical environmental justice research

Recent environmental justice scholarship has focused on understanding perceptions of equity in conservation, which has been called an *empirical approach to equity* (McDermott et al. 2013; Sikor et al. 2014; Schreckenberg et al. 2016). An empirical analysis of equity focuses on understanding what ideas of equity exist in an environmental context, what are the reasons for the diversity of viewpoints, and how these are shaped by the situation and people's social identities (Martin 2017). Empirical approaches conceptualize equity as plural and influenced by the socio-cultural context (i.e., what is fair depends on the eyes of the beholder) (Walker 2012; Sikor et al. 2014). This approach differs from the normative equity perspective historically used by philosophers, which seeks to find universal justice principles to determine what is right or wrong (e.g., Rawls 1971). Environmental justice theory posits three key equity dimensions (Scholsberg 2007; Walker 2012; Sikor et al. 2014): (1) distributional equity – the fairness of the distribution of benefits and costs from management; (2) procedural equity – the fairness of the decision-making process; and (3) recognitional

equity – acknowledging and respecting sociocultural diversity, including in relation to values, identities, cultures, types of knowledge, institutions, power, capacities, and rights.

Understanding how inequities are experienced by different social groups is critical to achieving equitable and effective conservation (Dawson et al. 2018b; Gill et al. 2019). Communities are heterogeneous (Agrawal & Gibson 1999; Gurney et al. 2015) and harbor a diversity of social identities (based on gender, ethnicity, age, class, etc.) that shape people's capacities to benefit from and participate in management, and thus influence perceptions of equity. Most studies have focused on how impacts are distributed among groups (Cinner et al. 2014; Gurney et al. 2015; McClanahan & Abunge 2016), as well as identifying who can participate in management and the decision-making processes (Gurney et al. 2016; Chaudhary et al. 2018; Friedman et al. 2020). However, assessing winners and losers by looking at how impacts are distributed and who participates in management is not enough to understand how inequities are experienced. Being a winner (experiencing benefits or participating in decision-making) or a loser (experiencing costs or being excluded from decision-making) does not necessarily lead to perceptions of distributional and procedural (in)equity (Lau et al. 2021a; Ruano-Chamorro et al. 2022).

Understanding how equity in conservation and natural resource management is experienced by different groups is critical but remains understudied. Only a handful of qualitative studies have examined how perceptions of fairness in an environmental context differ among different social categories (e.g., women and men of different age categories, different types of resource users) (Lecuyer et al. 2018; Abebe et al. 2020; Lau et al. 2021a). While, quantitative studies have focused on how equity indicators (Bennett et al. 2020; Chen et al. 2022), preferences for distributional justice principles (Martin et al. 2014, 2019; Gurney et al. 2021b), and preferences for participatory approaches (Martin et al. 2014) are shaped by social identity characteristics. However, there is a lack of understanding of how distributional and procedural equity perceptions differ by gender and how gender intersects with different social identity characteristics to shape perceptions of distributional and procedural equity in conservation and environmental resource management.

4.2.2. Gender

Gender is a key element of social identity, with important implications for equity in conservation and natural resource management (Kleiber et al. 2018; Lau 2020; Gustavsson et

al. 2021). Gender refers to socially constructed expectations associated with being a woman or a man (UN Women 2001). It is inherently connected to power relations, cultural norms, and traditions which shape how individuals experience benefits and losses and their ability to participate in management and conservation (Kleiber et al. 2017; Rohe et al. 2018; Lawless et al. 2019). For instance, women tend to have less control over assets and resources to support their livelihoods (Meinzen-Dick et al. 2011), be excluded from decision-making processes more than men (Vunisea 2008; Rohe et al. 2018; Lawless et al. 2019), and bear the negative impacts of conservation (Tarisesei & Novaczek 2006; Kleiber et al. 2018; Rohe et al. 2018). Yet, whether these gender inequalities lead to perceptions of distributional and/or procedural (in)equity remains unclear (e.g., Lau et al. 2021a).

Exploring how gender shapes equity perceptions can help to identify the root causes of gender inequities. For instance, understanding whether women and men perceived the decision-making process as fair or unfair can help identify ways to ensure that women and men are treated fairly (e.g., both women's and men's voices are heard, and they are treated with respect). Achieving gender equity is considered key to promoting human rights, sustainable development, and effective environmental management and conservation (Agarwal 2009; Revollo-fernández et al. 2016; Baker-Médard 2017; Galappaththi et al. 2022) and is increasingly being integrated into conservation and management policy (e.g., Convention of Biological Diversity, Sustainable Development Goals). In addition, gender is an entry point for looking at broader justice issues. Once gender blindness is overcome, awareness of constraining power relations and discriminatory structures (e.g., norms, customs) increases (Lawless et al. 2019), including in relation to forms of oppression associated with other social identities (e.g., gender and migration status) (Ferguson 2021).

4.2.3. Intersectionality

Gender intersects with other components of social identity to shape power relations and forms of discrimination and oppression in conservation and natural resource management (Lau & Scales 2016; Ferguson 2021; Sengupta & Harris 2022). Indeed, previous research has shown that the intersection between gender and characteristics such as ethnicity, socio-economic status, nationality, and age, have significant implications for people's decision-making power (Kaijser & Kronsell 2014; Colfer et al. 2015; Elias et al. 2020) and thus the distribution of costs and benefits from management. Thus, the concept of *intersectionality* acknowledges that humans have different components of social identity that contribute to

their unique social position in society (Crenshaw 1989). Thus, employing an intersectional lens can provide a deep understanding of how overlapping systems of discrimination can be confronted to address inequities (Nightingale 2011; Axelrod et al. 2022). Intersectionality and the environment have been studied in other fields, such as feminist political ecology (Nightingale & Ojha 2013; Kaijser & Kronsell 2014) and development (Carr & Thompson 2014), but these insights have been less integrated into conservation scholarship and practice (e.g., Rohe et al. 2018, Lynch & Turner 2022). Only a few studies have examined the intersection between gender and other social identity categories in relation to adaptation (Colwell et al. 2017), distribution of benefits from sea cucumber trade (Ferguson 2021), resource use (Lau & Scales 2016; Rohe et al. 2018), and participation in governance (Rohe et al. 2018; Elias et al. 2020).

Thus, there is a need to better understand how gender intersects with other social identities and how these influence resource users' perceptions of procedural and distributional equity in conservation and natural resource management. In this chapter, I examine a) perceptions about the distribution of positive and negative impacts from management and b) perceptions about decision-making processes for the use and management of marine resources. I aim to assess how distributional and procedural equity perceptions differ by gender and how gender intersects with other social identity characteristics to shape distributional and procedural equity perceptions. Using data from ten Indigenous Fijian (*iTaukei*) communities in Nakorotobu and Rakiraki districts that practice traditional management, I examine i) How do perceptions of winners and losers of management impacts differ by gender?; ii) How do perceptions of distributional equity and procedural equity differ by gender?; iii) How do reasons given for perceptions of distributional and procedural (in)equity differ by gender?; and iv) How are perceptions of distributional and procedural equity related to intersectionality?.

4.3. Material and methods

4.3.1. Study site

In Fiji, small-scale fisheries are key to people's livelihoods, subsistence, and culture (Veitayaki 2000; Gillett 2016; Valve 2022). Fiji's annual per capita fish consumption is between 44 and 62 kg (ibid). Fisheries are a major source of protein for coastal communities (Pacific Community 2008) and a key element for cultural practices, such as funerals (Vave

2022). *iTaukei* women account for a significant portion of communities' annual catch, and their role has expanded from primary subsistence to selling some of their catch to contribute to household income (Thomas et al. 2021). Yet, women's role in household food security has often been ignored because their fishing activities are often unpaid, informal and considered household chores (ibid).

In Fiji, the management of resources is underpinned by customary tenure systems. *iTaukei* customary tenure rights are recognized in formal law (*iTaukei* Land and Fisheries Commission) and clans have communal property rights over the land and access rights over marine resources in inshore waters (defined as foreshore to the outer reef) (Sloan & Chand 2016). At the same time, the State retains rights to the seabed and the power to control and regulate marine resources, and *iTaukei* communities have access rights to subsistence fisheries but require licenses for commercial fishing (Sloan & Chand 2016). *iTaukei* communities have historically managed their resources through traditional management systems (Veitayaki 2000; Vave 2022) and include the selective exclusion of outsiders from fishing areas, permanent or temporary no-take zones (i.e., tabu), seasonal bans of certain species, and the prohibition of certain fishing practices (e.g., dynamite, fish poison) (Jupiter et al. 2014; Vave 2022).

The traditional governance system is embedded in a patriarchal and hierarchical culture that shapes decision-making at the village, district, and provincial levels (Nainoca 2011; Vuki & Vunisea 2016). Decisions related to customary fishing grounds are made by the *Bose Vanua*, a committee of the districts' high chiefs. In addition, decisions at the community level are made in consultation between community members and their traditional leader (Vunisea 2008), who usually has the greatest say in decision-making (Nainoca 2011). In addition, social and cultural norms and relations shape women's and men's ability to access resources and participate in decision-making processes (Vunisea 2008; Thomas et al. 2021). 'The *culture of silence*, where people usually do not speak unless spoken or asked a question, where people respect the views of elders and do not contradict what has been agreed to is rife in many Pacific Island cultures' (Vunisea 2008, p42).

4.3.2. Sampling

In 2016, data from 193 individuals was collected in ten villages in Nakorotobu and Rakiraki districts in Ra Province using household surveys, which were undertaken as part of a broader

social-ecological systems monitoring program (Gurney et al. 2019). Within each village, households were systematically sampled. A sampling fraction of every i^{th} household (e.g., 2^{nd}, 3^{rd}, 4^{th}) was determined by dividing the total village population by the desired sample size (De Vaus 1991). Between 10 and 20 surveys were conducted in each village. The number of surveys was dependent on the population size and the time available at each site. To ensure the representation of men and women, a stratified sampling approach at the household level was used. Surveys were conducted by trained interviewers in the local *iTauke*i language.

4.3.2.1. Perceptions

People were asked open-ended questions to assess perceptions of winners and losers from coastal marine management. Management referred to the governance system as a whole, including all types of rules used to manage coastal marine resources, and this was specified to respondents at the beginning of the survey. Individuals were specifically asked: who is most positively affected by management in this community? (i.e., who are the winners) and who is most negatively affected by management in this community? (i.e., who are the losers) (Table 4.1). In addition, individuals were asked to rate how fair the distribution of positive and negative impacts from management was (i.e., distributional equity), and how fair the decision-making process about marine resources was (i.e., procedural equity) on a 5-point Likert scale (Table 4.1). Afterwards, individuals were asked open-ended questions about the reasons behind the ratings for both distributional and procedural equity.

4.3.2.2. Social identity characteristics

Together with gender, data collection also included information on other social identity characteristics (Table 4.1) that may intersect with gender to shape the distribution of management outcomes (e.g., impacts), the way people are involved in the decision-making process of resource management (Vunisea 2014; Lawless et al. 2019; Ferguson 2021), and thus perceptions of distributional and procedural equity (Gustavsson et al. 2021). Social identity characteristics were selected based on their relevance in the context of the study and the literature.

Table 4. 1. Description of variables used to examine distributional and procedural equity perceptions and social identities.

Variables	Description	Type of variable
Winners and losers		
Winners	Who is most positively affected by management in this community? (open-ended question)	Categorical (multiple categories)
Losers	Who is most negatively affected by management in this community? (open-ended question)	Categorical (multiple categories)
Equity dimensions		
Distributional equity	In general, do you think the distribution of the positive and negative impacts from management is fair? (5- point Likert scale).	Ordinal (1-5)
	Why? (open-ended question)	
Procedural equity	In general, do you think the way that decisions are made about marine resource use and management is fair? (5- point Likert scale).	Ordinal (1-5)
	Why? (open-ended question)	
Social identity characteristics		
Gender	Women/ men	Categorical (2 levels)
Migrant status	Migrant is used to describe someone who married into a village, while a non-migrant is someone from the village.	Categorical (2 levels)
Marital status	Single/ Married/ Widow	Categorical (3 levels)
Education	Primary/ Secondary/ Tertiary	Categorical (3 levels)
Age	Years	Continuous
Wealth	Material Wealth (MSL). Index based on the presence and absence of household assets.	Continuous

4.3.3. Analysis

4.3.3.1. Coding

Open-ended responses were written down and translated into English by Indigenous interviewers. Some respondents did not answer the open-ended questions about winners (n=28), losers (n=31), and 'why' questions regarding distributional (n=71) and procedural (n=36) equity. I coded people's responses into themes. First, I coded responses regarding who is most positively (and negatively) affected by management (e.g., community, women)

and the coding was checked by co-authors. All categories emerged from the data. The coding of the 'why?' question (which was asked after asking respondents about their perceptions regarding distributional and procedural equity) required a more complex coding process. I conducted the first round of coding and began by open identifying similar responses and grouping them. I conducted the second round of coding by drawing on environmental justice (McDermott et al. 2013; Sikor et al. 2014; Schreckenberg et al. 2016; Ruano-Chamorro et al. 2022), environmental governance (Borrini-Feyerabend et al. 2013; Bennett & Satterfield 2018), and human wellbeing (Kaplan-Hallam & Bennett 2018) frameworks and psychology of justice theory (Tyler 2015). In the second round, I open-coded similar responses into themes and this process was influenced by the body of literature I drew on. In the third round, I re-coded the themes in collaboration with co-authors with relevant local knowledge. In this process, a consensus was reached. Afterwards, I grouped themes into subdimensions and into three main dimensions (distribution, procedure, and management performance) to facilitate the interpretation of the results. I split the dimension 'distribution' into distributional equity criteria, which refers to how benefits and costs and distributed (e.g., equality), and content, which refers to what is being distributed. I also split the dimension 'procedure' into procedural equity criteria, including agency, process properties (e.g., transparency, accountability, neutrality), interpersonal treatment (Ruano-Chamorro et al. 2022) and additional elements related to the decision-making process. In addition, I split the dimension 'management performance' into compliance and management quality (e.g., poor enforcement). I coded most of the respondents' answers into one theme, but, when necessary, I coded the respondents' answers into two themes (seven and five times for winners and losers, respectively, and seven and 18 times for distributional and procedural fairness, respectively).

4.3.3.2. Quantitative Statistical Analysis

To assess the effect of intersectionality and social identity characteristics (Table 4.1) on perceptions of distributional and procedural equity, I compared six candidate Bayesian cumulative mixed-effects models for each response variable (six models for distributional equity and six models for procedural equity). For each response variable, I developed one model without an interaction (the additive model) and five interaction models (Table 4.2). I used a Bayesian approach with the Hamiltonian Monte Carlo algorithm implemented in Stan through the brms package in R (Bürkner & Vuorre 2019) for 5000 iterations, 1000 burn in,

and four chains. I used weakly informative priors; thus, the posterior distribution was informed only by the data. I included social identity characteristics as covariates in all the models (Table 4.2) and village as a random effect. For all analyses, continuous variables were standardized by subtracting the mean and dividing by 2 standard deviations (Gelman 2008).

I conducted posterior predictive checks to examine model fit and checked residuals against fitted values. I compared the different models (Table 4.2) through leave-one-out information criteria (LOOIC) to assess relative model fit. In addition, I checked the proportional odds assumption by fitting an adjacent category model (i.e., it does not assume an equal effect of the predictor across categories of the ordinal dependent variable) and comparing it against the cumulative model through LOOIC (Bürkner & Vuorre 2019).

Table 4. 2. Description of the six different models used for each response variable (distributional equity and procedural equity), resulting in 12 models in total.

Model name	Description
M1	Perceived fairness (distributional or procedural) = gender + migrant status + marital status + education + wealth +age.
M2	Perceived fairness (distributional or procedural) = gender * migrant status + marital status + education + wealth +age
M3	Perceived fairness (distributional or procedural) = gender *marital status + migrant status + education + wealth +age
M4	Perceived fairness (distributional or procedural) = gender * education + marital status + migrant status + wealth +age
M5	Perceived fairness (distributional or procedural) = gender * wealth + education + marital status + migrant status +age
M6	Perceived fairness (distributional or procedural) = gender *age + wealth + education + marital status + migrant status

4.4. Results

4.4.1. Gender and perceptions of winners and losers

Respondents generally agreed on who were the winners and losers from management (Figure 4.1). Most respondents (66% of total responses) identified the broader community as the winner of management (Figure 4.1A), and 52% of the total responses indicated that no one

was a loser (Figure 4.1C). However, 24% of the total responses indicated that women were the losers (Figure 4.1C). Women tended to report more frequently that women were the losers, and the difference between women's and men's responses were 7% (i.e., two-thirds of the people who mentioned that women were the losers were women). Thirteen per cent of the responses indicated that the community was the loser (Figure 4.1C). Few other social groups were consistently mentioned by respondents as the winners and losers. There was never more than a 5% difference in responses between men and women (Figure 4.1 B and D).

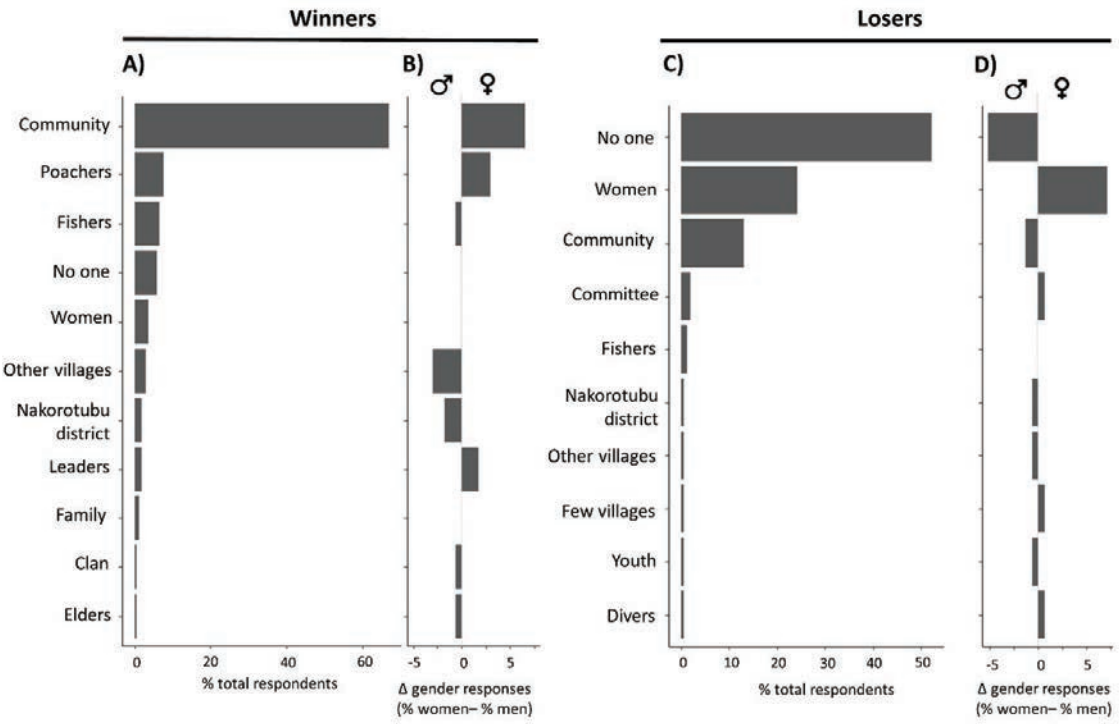

Figure 4. 1. Perceived winners and losers from management. A) Total responses to the question 'who is most positively affected by management in this community?' (winners) and B) differences in responses between women and men regarding winners. C) Total responses to the question 'who is most negatively affected by management in this community?' (losers) and D) differences in responses between women and men regarding losers. Most people perceived community as the group most positively impacted by management (winner) and women were the group most negatively impacted by management (loser).

4.4.2. Perceptions of distributional and procedural equity

Overall, most men and women perceived high levels of distributional and procedural equity (Figure 4.2). The distribution of positive and negative impacts from management was perceived as fair ('fair' and 'very fair' combined) by 66% of women and 79% of men, and

the distribution of impacts was perceived as unfair ('unfair' and 'very unfair' combined) by 21% of women and 17% of men. In addition, 75% of men and 68% of women perceived procedural fairness (i.e., 'fair' and 'very fair' combined), and 19% of men and 20% of women perceived procedural unfairness (i.e., 'unfair' and 'very unfair' combined).

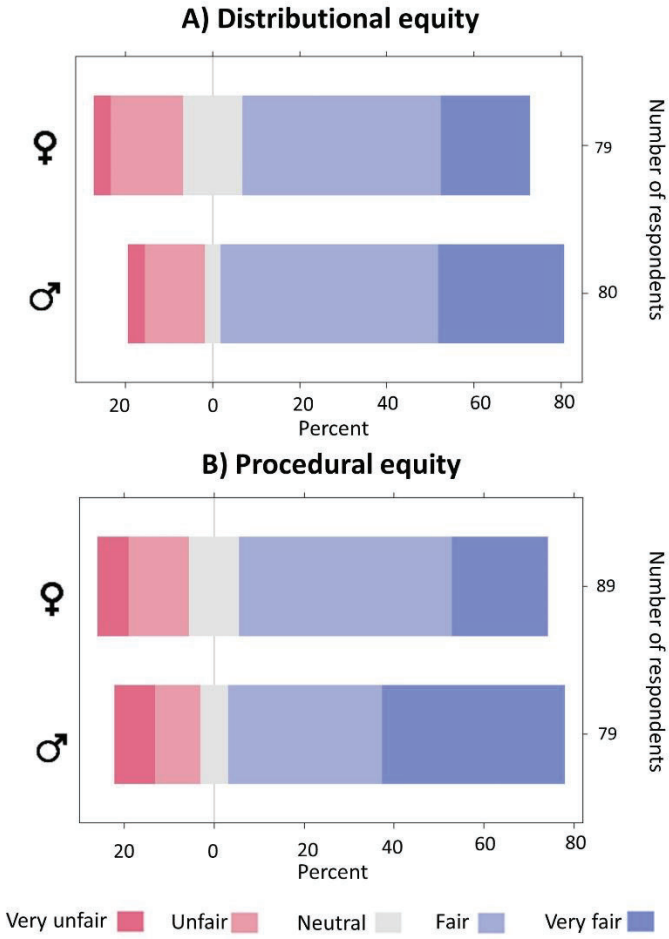

Figure 4. 2. Perceptions of A) distributional equity (i.e., how fair is the distribution of management impacts) and B) procedural equity (i.e., how fair is the decision-making process regarding marine resources) among women and men.

Respondents provided various reasons for their perceptions of distributional (in)equity (Table 4.3, Figure 4.3A). Two distributional criteria (i.e., public good and equality) emerged as to whether management was considered fair. Public good was defined broadly as everyone benefiting from management, and equality as benefits from management being shared equally within the community. Specifically, 20% and 10% of responses indicated that the distribution

of costs and benefits was perceived as ‘fair’ or ‘very fair’ because of community benefits and equal shares in benefits, respectively.

A variety of benefits from management also emerged as themes for distributional fairness, with respondents mentioning both broad and specific benefits. Specific benefits included resource sustainability (e.g., increase in the abundance of fish and invertebrates, resource protection), food supply, provision of catch for cultural activities, source of income and security, and benefits for future generations. A total of 33.6% of responses indicated fair distribution due to the benefits from management, with resource sustainability mentioned most frequently (17.5% of responses). Respondents who believed the distribution of benefits and costs were unfair or very unfair cited inequality, reduced resource access, reduced resource access for women, poor management quality, and poor compliance. Inequality refers to respondents perceiving that some groups (e.g., families, villages, chief) benefited more than others, and reduced resource use indicates that respondents perceived reduced access to fisheries due to management. Reduced access to resources referred to women being negatively affected more than half of the times it is mentioned. Poor compliance and poor management quality referred to some people not respecting the tabu and lack of punishment for non-compliers, respectively. On every theme, there was never more than a 5% difference in responses between men and women, meaning that they broadly agreed on the reasons for both procedural and distributional equity (Figure 4.3B).

Respondents provided various reasons for procedural (in)equity (Table 4.4, Figure 4.3C). The most frequent procedure themes involved community agreements, participation, leaders decision-makers, and respected and trusted leaders. Community agreements and leaders decision-makers refer to characteristics of the traditional governance systems in which decisions are agreed upon at the village and are often taken by leaders at district meetings (e.g., *Bose Vanua*). ‘Participation’ generally refers to respondents’ perception that everyone participates in decision making, and ‘respected and trusted leaders’ refers to respondents’ perception that leaders are fair, knowledgeable and respected. Specifically, 11.8% and 7.4% of responses indicated that decision-making processes were perceived as ‘fair’ or ‘very fair’ respectively, because of community agreements and leaders making decisions, while 11.2% and 4.3% of responses indicated that people viewed decision-making processes as ‘fair’ or ‘very fair’ because everyone participates, and leaders are trusted and respected respectively. The provision of management benefits, particularly resource sustainability, and the fact that

everyone benefited (public good) also emerged as important themes for procedural fairness, as well as compliance, which was defined as people respecting the *tabu*. Specifically, responses reported fair or very fair decision-making process due to resource sustainability (5.6%), public good (8.7%), and compliance (5.0%). The most frequent theme for procedural unfairness was poor participation in decision-making (7.4%). Other reasons for procedural inequity involved inequality (2.4%) and poor management quality (5%) and poor compliance (2.5%). There were no differences regarding procedural equity reasons between women and men (Table 4.4, Figure 4.3D).

Table 4. 3. Reasons for distributional (in)equity. Reponses that did not fit any category are included in the 'Other' dimension (Table S5).

Dimension	Subdimension	Fair (and neutral) Distribution		Unfair (and neutral) Distribution	
		Theme	Description	Theme	Description
Distribution	Distributional criteria	*Community benefit (public good)*	Everyone benefits; benefits are shared in the village	*Inequality*	Some (e.g., families, villages) benefit more than others, the chief gets most of the benefits, the youth are most affected
		Equality	Benefits are shared equally in the village		
	Content	*Resource sustainability*	More fish and invertebrates, benefits of protection are seen, fish are preserved and maintained	*Resource non-sustainability*	Abundance decline
		Benefits	Benefits from tabu, prosperity	*Reduced resource access*	Stop fishing from daily places and need to travel further. Community can't fish but people with licenses can
		Cultural benefits	Abundance of catch during special/cultural occasions	*Reduced resource access women*	Women are negatively impacted (e.g., they have to go further to fish)
		Food benefits	Supply of food	*Costs*	Brings hardship
		Income benefits	Send children to school, source of income and security		
		Future generations	Benefit future generations		
Procedures	Process properties	*Transparency & accountability*	Good communication between leader and community	*Poor participation*	Unfair decision-making
Management performance	Management quality	*Good management quality*	Management team is doing a good job in maintaining resources and biodiversity	*Poor management quality*	Poachers are not punished
	Compliance	*Good compliance*	Everyone follows, respects and observes the tabu	*Poor compliance*	No respect for tabu (poaching)

Table 4. 4. Reasons for procedural (in)equity. Reponses that did not fit any category are included in the 'Other' dimension (Table S6).

Dimension	Subdimension	Fair (and neutral) procedures		Unfair (and neutral procedures)	
		Theme	**Description**	**Theme**	**Description**
Distribution	Distributional criteria	*Public good*	Everyone benefits in someway not necessarily equal	*Inequality*	Chiefs benefit, only some can harvest the tabu
		Equality	Benefits are shared equally	*Resource non-sustainability*	Tabu is not working (e.g., no difference in fish size)
	Content	*Resource sustainability*	Positive ecological impacts (e.g., increased abundance, size, protection)	*Reduced resource access women*	Women need to walk far to catch fish
		Benefits	General benefits, satisfied needs, prosperity	*Costs*	More payment for a fishing license
		Cultural benefits	Help on special (i.e., cultural) occasions		
		Food benefits	Source of protein, food for special occasions		
		Income benefits	Protect source of income		
		Education and knowledge	Capacity building (recognize the importance of protecting fishing grounds)		
		Future generations	Benefits for future generations		
		Resource access women	Women's wishes to open tabu granted		
		Reduced resource access	Travel far (but at the same time assistance is provided in times of needs).		
Procedures	Agency	*Community agreements*	Decisions are agreed on at village meetings	*No agreement*	People are not coming to an agreement

		Participation	Mostly, it refers to everyone's participation in decision-making processes (e.g., participation is shared fairly, everyone participates)	*Poor participation*	Low participation in decision-making
		Leaders are the decision-makers	Decisions are agreed upon at Bose Vanua and/or districts meetings		
	Process property	*Leaders respected and trusted*	Leaders, chiefs or elders are perceived as fair, knowledgeable and they are respected	*No neutrality*	Biased decision-making
	Interpersonal treatment	*Respectful treatment*	People respect each other		
Management performance	Management quality	*Good management quality*		*Poor management quality*	Poachers are not punished, no proper monitoring of the tabu. Resource management is not done properly (e.g., not looking after resources properly, being inactive in governing resources, lack of management)
	Compliance	*Good compliance*	People respect the tabu	*Poor compliance*	People break the rules of the tabu

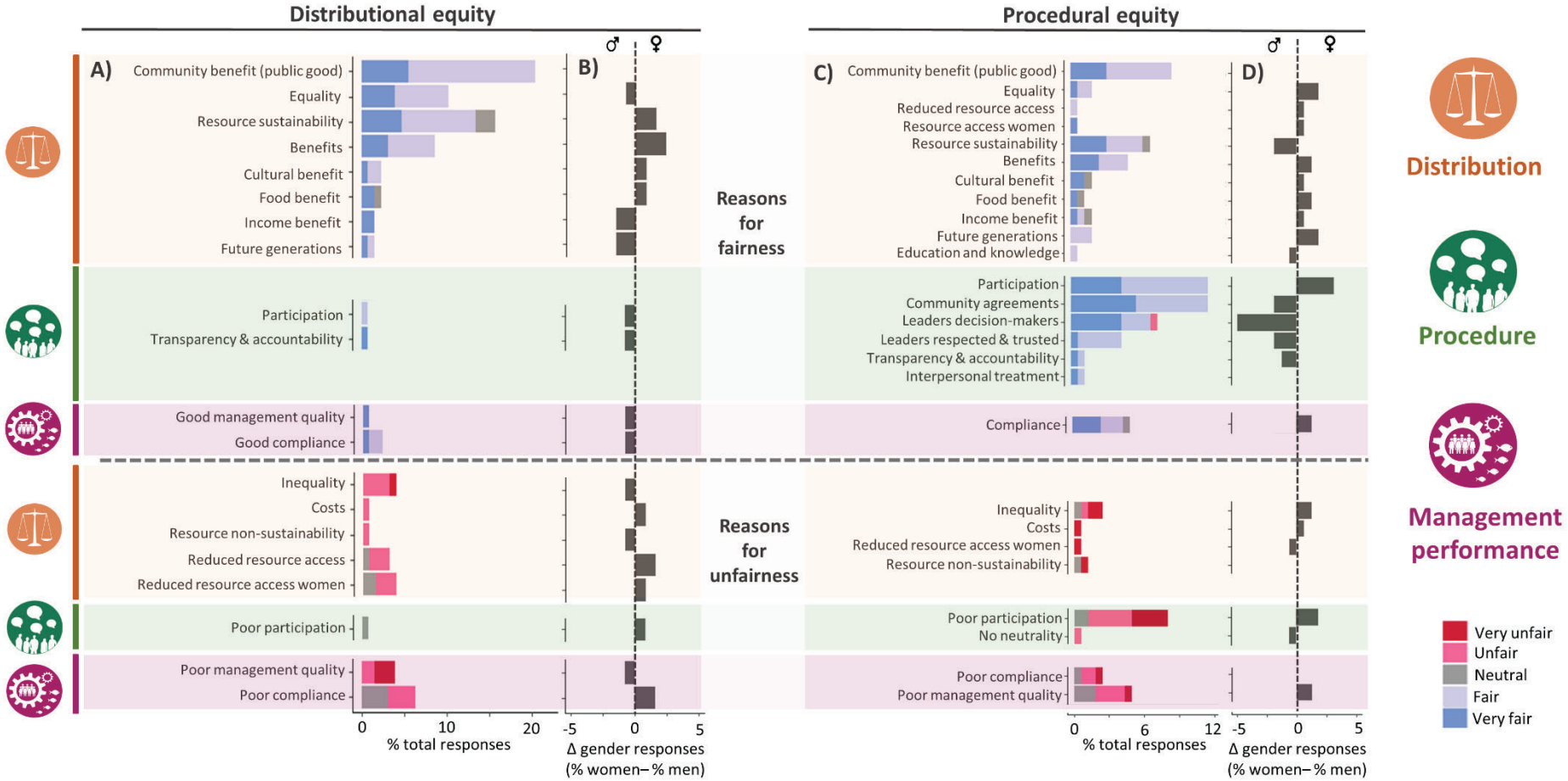

Figure 4. 3. Reasons why people perceive A) distributional (un)fairness regarding the distribution of management impacts and C) procedural (un)fairness regarding the decision-making process. Difference in gender responses regarding B) distributional and D) procedural equity. Open-ended questions regarding why they perceived distributional (in)equity and procedural (in)equity were coded into themes and grouped into three dimensions (distribution, procedure, and management performance). Reasons for fairness ('very fair' and 'fair') are indicated in blue above the dotted line. Reasons for unfairness ('very unfair' and 'unfair') are indicated in red below the dotted line.

4.4.3. Distributional equity and social identity characteristics

I found one model with a significant interaction between gender and a social identity characteristic, namely migrant status (Table S7, S9). This model had the highest predictive accuracy (Figure 4.4, Table S7, S9). From this model, we can conclude that with at least 80% probability, the interaction between gender and migrant status had an effect on perceptions of distributional equity (Figure 4.4). Specifically, migrant men (n= 21) were more likely to report perceiving distributional equity as being 'very unfair' and 'unfair' and less likely to perceive distributional equity as 'very fair' relative to non-migrant men (n=66), while there was no difference between migrant women and non-migrant women (Figure 4.5). Although migrant men were slightly more likely to report 'unfair' distribution and less likely to report 'very fair' distribution than non-migrant and migrant women, the overlap of the credible intervals is substantive and thus the difference has high uncertainty (Figure 4.5).

In addition, formal education, marital status, and age were related to perceptions of distributional equity. Individuals with primary and tertiary education were less likely to perceive distributional equity than individuals with secondary education, and widows (mostly women) were less likely to perceive distributional equity than married individuals. Age was positively related to perceptions of distributional equity at 80% CI, suggesting that older people are more likely to perceive distributional equity than younger people.

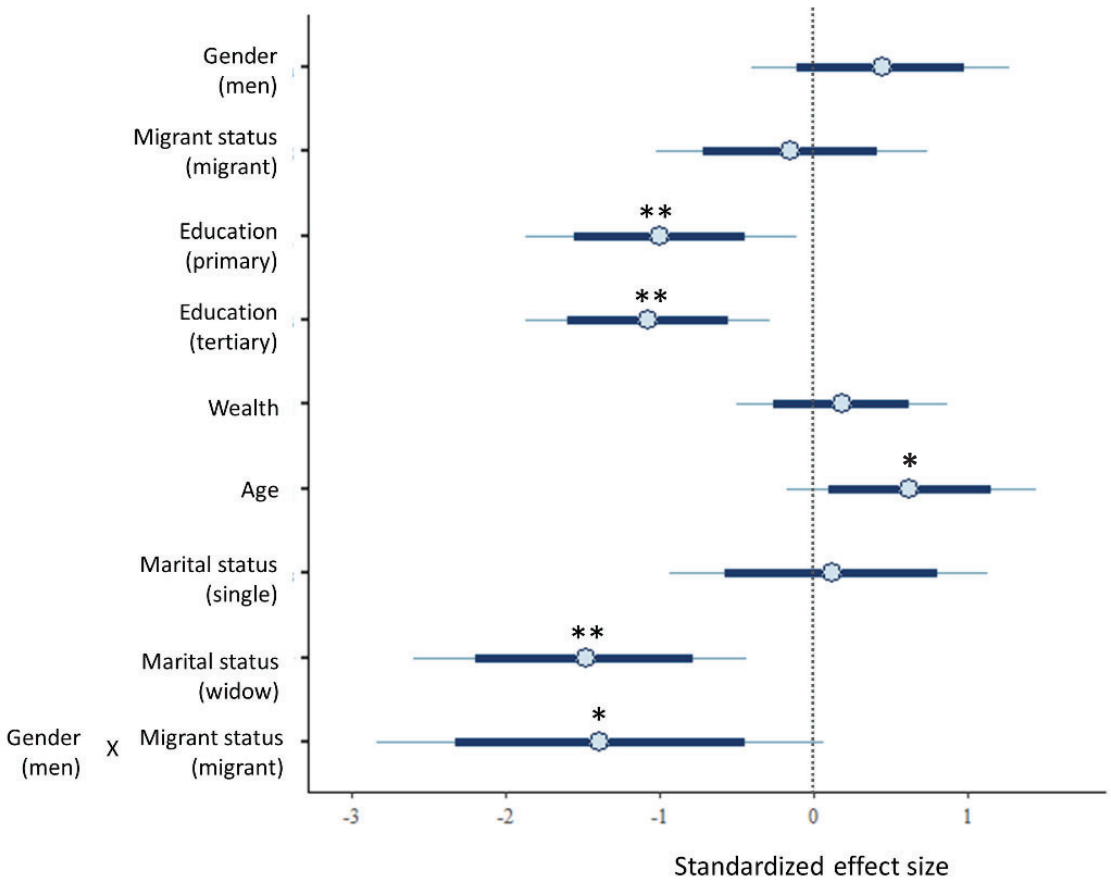

Figure 4. 4. Effect size of the interaction between gender and migrant status and other social identity characteristics on perceptions of distributional equity. Parameter estimates are Bayesian posterior means and 95% and 80% uncertainty intervals. ** Covariates with an effect on perceptions of distributional equity. *Interaction and covariate with an effect on perceptions of distributional equity with higher uncertainty (i.e., it crosses the zero). My analysis indicates that older people with primary and tertiary education (relative to the baseline of secondary education) and widows (relative to married people) are more likely to perceive distributional inequity while maintaining the other covariates constant. In addition, with 80% certainty, there is an interaction between gender and migrant status.

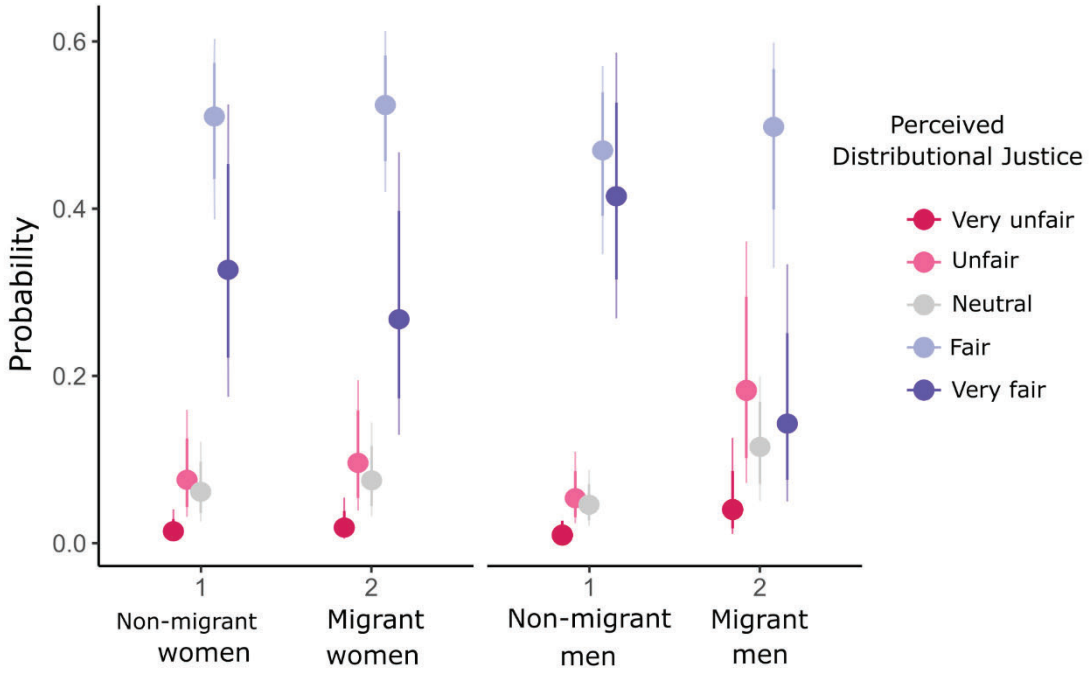

Figure 4. 5. Marginal effects on perceptions of distributional equity based on the model with the interaction between gender and migrant status. Points indicate posterior mean estimates of the probability of responses in each category of distributional equity. Error bars indicate 80% and 95% credible intervals. My analysis shows that migrant men were more likely to report perceiving distributional equity and less likely to perceive distributional equity relative to non-migrant men, while there were no differences between migrant women and non-migrant women.

4.4.4. Procedural equity and social identity characteristics

None of the models showed a significant relationship for perceptions of procedural equity and interactions between the gender and social identity characteristics (Table S10). The model with more predictive accuracy for procedural equity was the additive model (Figure 4.6, Table S8, S10). Education was the social identity characteristic with a stronger relationship with perceptions of procedural equity, and it was consistent across all models (Figure 4.6, Table S10). Those with tertiary education were more likely to perceive procedural inequity than people with secondary education. In addition, migrant status was negatively related to perceptions of procedural equity with an 80% CI, suggesting that migrants were less likely to perceive procedural equity.

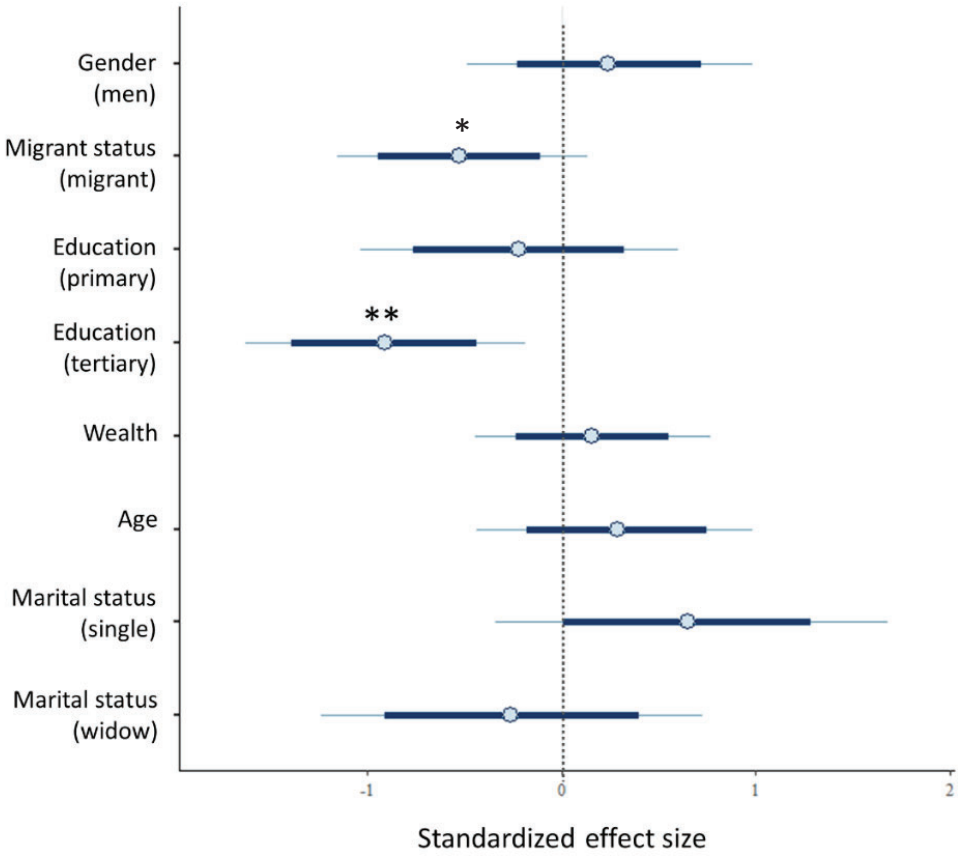

Figure 4. 6. Effect size social identity characteristics on perceptions of procedural equity. Coefficient estimates of the additive model. Parameter estimates are Bayesian posterior means and 95% and 80% uncertainty intervals. ** Covariate with an effect on perceptions of procedural equity. *Covariate with an effect on perceptions of procedural equity with higher uncertainty (i.e., it crosses the zero). My analysis shows that people with tertiary education (relative to the baseline of secondary education) and migrant (relative to non-migrants and with 80% certainty) were less likely to perceive procedural equity.

4.5. Discussion

This study has four main findings: 1) people generally perceived high levels of both distributional and procedural equity; 2) there were no large differences between women's and men's perceptions of distributional and procedural equity, even though both women and men perceived women as the losers (i.e., the group most negatively affected by management); 3) gender interacts with migrant status; migrant men perceived slightly more distributional inequity and less distributional equity

compared to non-migrant men; and 4) four social identity characteristics other than gender were related to perceptions of distributional and/or procedural equity.

4.5.1. High levels of distributional and procedural equity

In general, people perceived high levels of distributional equity in the system I studied. People provided three main reasons why they felt the distribution of costs and benefits was fair (or very fair): 1) benefits were distributed equally (i.e., equality), 2) everyone benefited in some way (i.e., community benefit or public good), and 3) management provides benefits such as resource sustainability and cultural benefits. The first reason suggests that the key justice criterion 'equality' matters for perceptions of fairness regarding the distribution of costs and benefits from management. These results are consistent with those of a previous study conducted in these communities, which showed that the majority of respondents considered equality as fair (Gurney et al. 2021b). The relevance of the equality principle aligns with justice research on social psychology which suggests that equality tends to be preferred in collective cultures (e.g., Fiji) (Mahler et al. 1981), and when the maintenance of enjoyable social relations based on mutual respect is prioritized (Deutsch 1975). In addition, these results suggest that inequality and costs (e.g., reduced resource access) are related to perceived distributional unfairness. The second reason suggests that 'community benefit (public good)' is another important justice criterion shaping perceptions of distributional equity in this context. Furthermore, with respect to the third reason, most of the benefits referred to by respondents are available to the entire community (e.g., resource sustainability, cultural benefit), which may also indicate the importance of the public good criterion. Similarly, a study in China found that the public good criterion (i.e., using forest funds for community-based infrastructure and other public goods) was perceived as the fairest way for everybody to benefit (He et al. 2021). Even though the equality principle was considered inherently fair in that case, it was the least preferred due to pragmatic reasons such as logistic difficulties in collecting money for public funds.

People also generally perceived high levels of procedural equity. I found that people perceived the decision-making process to be fair (or very fair) because management provided benefits and everyone benefited (public good). Procedural equity is often thought to shape perceptions of distributional fairness (i.e., outcomes are perceived as fair when the procedures that support them are also perceived as fair) (Thibaut & Walker 1975; Paavola 2007). However, these results suggest that perceived outcomes (e.g., distribution of benefits, provision of benefits) may also determine perceptions of procedural equity. This finding is consistent with experimental research on the psychology of justice, which suggests that when there is insufficient information about the decision-

making process, people use other cues, such as fairness or favourability outcomes, to make judgments about procedural fairness (van den Bos 1999; Blader 2007). These results suggest that it is not only important to ensure procedural equity to promote distributional equity but also the other way around.

People also perceived procedural fairness because ‘everyone’ participated in the decision-making process. In theory, being able to express opinions and concerns and provide information that can indirectly or directly influence the decision (i.e., having agency) is key to achieving procedural equity (Schreckenberg et al. 2016; Zafra-Calvo et al. 2017; Ruano-Chamorro et al. 2022). However, in this case, ‘everyone’ may not imply that all the people in the community have a voice as, in the Pacific, there are cultural barriers that limit the ability of some people to have a voice and influence decisions (Vunisea 2008; Lawless et al. 2019; Nelson et al. 2022). Particularly, in Fiji, chiefs often have decision-making authority (Nainoca 2011), men hold most political and traditional leadership positions (Vuki & Vunisea 2016), and communal agreements, which is a common decision-making approach, do not necessarily imply that all community members have a voice (Vunisea 2008). In addition, participation may involve different ways of exercising agency beyond having a voice in decision-making processes (e.g., participation through husbands, women representing other women) that satisfy people’s psychological needs for procedural equity and self-determination (Decaro & Stokes 2013) and that may be more valuable for some individuals or social identities than for others (Singh 2008). Poor participation was also a reason for procedural unfairness.

My findings also suggest that people perceive decision-making processes are fair because they follow traditional governance procedures (i.e., community agreements, leaders decision-makers, and leaders trusted and respected). Intrinsically connected to culture and based on complex social relationships, customary tenure systems in Fiji emerged centuries ago to regulate the access and use of marine resources (Veitayaki 2000; Vave 2022). Along with the traditional governance system, justice principles may have evolved to fit the social-ecological context (Decaro & Stokes 2013) and become legitimate equity norms that facilitate cooperation, stable social interactions within groups (Tyler 2015), and effective institutions (Fisher et al. 2018; He et al. 2021). For instance, a study conducted in these communities revealed that people considered distributing economic benefits among people with customary rights as the fairest distributive principle (Gurney et al. 2021b).

People’s reasons for procedural (in)equity were also related to management performance, including the level of compliance and management quality (e.g., enforcement). Specifically, good compliance (i.e., people respecting *tabu*) was mentioned as a reason for procedural equity, while poor

compliance (i.e., people did not respect the *tabu*) and poor enforcement (i.e., poachers were not punished) were key reasons for perceptions of procedural unfairness. Perceived fairness is often seen as a key driver of compliance and management quality in the psychology of justice (Tyler 2015) and in environmental management (Pascual et al. 2014) literature. For instance, a study from the Solomon Islands suggests that women did not comply with the *tabu* because the decision-making process was unfair (Rohe et al. 2018). My results suggest that perceived compliance and management quality may also be drivers of equity perceptions. These results align with a study in a biosphere reserve in Mexico which found that respect for decisions and their further enforcement was an important equity claim made by local stakeholders (Lecuyer et al. 2018). Overall, these results suggest that management performance (e.g., compliance, enforcement) may also be important in promoting distributional and procedural fairness.

4.5.2. No gender differences in perceptions of distributional and procedural equity

The second key result was that I did not find large differences between women's and men's perceptions of distributional and procedural equity, even though people perceived that women bore most of the management costs and are often excluded from decision-making (Vunisea 2008). This result aligns with findings from a study in Papua New Guinea where women were prevented from using a collective fishing method and did not perceive this as unfair (Lau et al. 2021a). In one Papua New Guinean community, people perceived that fishing benefits should be earned through hard work; one particular technique used by women was seen as too easy and destructive and thus, preventing women from fishing was not perceived as unfair (ibid). In the context of my study, perceptions that everyone in the community benefits (or benefits equally) may be more important for overall perceptions of distributional equity than the costs suffered by a particular social group.

In addition, women may perceive indirect benefits beyond their personal fishing improvement. For instance, in the Philippines, women were less likely than men to perceive positive effects from a marine protected area, but they would still recommend it (Kleiber et al. 2018). Perceptions of equity may also be influenced by constraining social structures (e.g., gender and cultural norms), gendered power relations (Bina 2001; Baker-Médard 2017; Lawless et al. 2019; Galappaththi et al. 2022) and the legitimate traditional governance systems which tend to disadvantage women (Vunisea 2008; Rohe et al. 2018; Baynes et al. 2019). In addition, psychological mechanisms (e.g., system justification) can motivate people to legitimize and support social institutions that impact them negatively (Jost et al. 2010; Tyler 2015). For instance, a study in Laos suggested that the positive

aspects of a national park were overemphasized by locals to justify the hardships they faced (Martin & Myers 2018).

4.5.3. Intersectionality: Gender interaction with migration

The third key result was that gender interacts with migrant status, such that migrant men perceived distributional outcomes from management as both less fair and more unfair than their non-migrant counterparts. Specifically, an interaction between migrant status and gender was related to perceptions of distributional equity (i.e., migrant men were slightly more likely to report distributional inequity and less likely to report distributional equity than non-migrant men). This finding was counter to my expectation that particular sub-groups of women may feel that management was unjust. One plausible explanation for my finding has to do with how customary ownership of natural resources is controlled through patrilineal decent, meaning that migrant men may not have analogous ownership and access rights and may thus not feel they benefit as much as others. Other studies have shown that migrants perceived lower benefits from co-management (MacNeil & Cinner 2013) and were less involved in decision-making processes (Cinner 2009). Similarly, a study in Palau found that migrant men had less access to resources (boats) than migrant (married) women and non-migrant men (Ferguson 2021). In this context, migrant men may view the distribution of costs and benefits from management as unfair compared to non-migrant men. In the Pacific, migrant men who do not have tenure rights have less agency in community decisions (Lawless et al. 2019) and, thus, are less likely to benefit relative to non-migrant men and may become rapidly aware of the power imbalances.

4.5.4. Other socioeconomic predictors of perceived equity

Finally, I found that four social identity characteristics other than gender (i.e., marital status, migrant status, level of formal education, and age) were positively related to perceptions of distributional and/or procedural equity. I found that being a widow and having a primary education was negatively related to perceived distributional fairness, and having tertiary education was negatively related to both perceived distributional and procedural fairness. Widows (who were mostly women in my sample) may perceive less distributional fairness because they are benefiting less than when they were married and may perceive relative deprivation (i.e., feeling of being worse off than before) (Crosby 1976). For instance, in Fiji, migrant widows may not be able to maintain the same access to resources once their husbands have passed away, and some may prefer to return to the villages of their birth where access to resources is more guaranteed. Non-migrant widows may not be able to

participate as much as their husbands had previously in decision-making processes and are less able to secure household benefits. A tertiary education could be related to perceptions of unfairness because it leads to exposure to alternative equity norms. Indeed, Gurney et al. (2021b) examined perceived fairness of several distributional justice principles in the same villages and found an increasing level of formal education was positively related to perceived fairness of all justice principles apart from the customary-rights-based principle (the traditional fairness norm). The negative relationship between primary education and perceived fairness could be because people with less education have fewer resources (e.g., knowledge, and skills) and less capacity to benefit from and participate in management. This aligns with other studies that found a positive relationship between education and fairness perceptions (Bennett et al. 2020; Chen et al. 2022). These results suggest that increasing education (until a certain level) may be a way to increase perceived fairness. However, as individuals become more educated, their notions of fairness may shift and deviate from local principles of fairness.

My study showed that perceived distributional unfairness was more likely if people were young and migrant men, whilst procedural unfairness was related to being a migrant. Youth and migrants are often marginalized social groups and face many challenges in fisheries management. They often have less access to rights (Arulingam et al. 2019; Lawless et al. 2019), less ability to participate in the decision-making process (Vunisea 2008; MacNeil & Cinner 2013; Arulingam et al. 2019; Abebe et al. 2020), and less access to management benefits, which may lead to inequity perceptions (Abebe et al. 2020). In addition, existing social structures, power relations, and hierarchical traditional governance systems (often dominated by elders and non-migrant men) may constrain young and migrant people's access to decision-making processes, benefits, and resources (Arulingam et al. 2019; Lawless et al. 2019) and lead to inequities. Particularly, in the context of this study, young people are not consulted in decision-making processes, and challenging elders is considered disrespectful, which further limits young people's ability to access decision-making processes.

4.5.5. Future directions

This study is a first step towards a better understanding of equity in conservation and natural resource management. Here I suggest future key research directions to continue advancing this understanding.

A specific understanding of what are the criteria underpinning perceptions of equity is critical to inform equitable management. Notions of fairness are plural and situated (Sikor et al. 2014), and

people can use multiple criteria to make judgements regarding the fairness of distribution (e.g., equality, need, proportionality) (Deutsch 1975) or decision-making process (e.g., voice, decision control, respect) (Ruano-Chamorro et al. 2022). Future studies could focus on understanding how preferences for justice criteria regarding the distribution of management impacts (e.g., equality, public good) (e.g., see Gurney et al. 2021b for an example regarding payments for ecosystem services distribution) or the decision-making process (see Ruano-Chamorro et al. 2022) differ among social identity groups. For instance, I found that everyone participating in decision-making was an important reason for procedural equity. However, it is unclear what form of agency (e.g., voice, influence on decisions) is relevant in this context and for whom. Do people perceive procedural equity because everyone attended the meeting? Or because everyone can speak up in meetings? Or because everyone is heard and respected during meetings? Are other ways of exercising agency that are considered fair? Importantly, perceptions of what is considered fair are dynamic; therefore, as communities navigate social and ecological change, perceptions of what is fair can also change across social identities.

My analysis suggests that aside from the interaction between gender and migration status discussed above, the other interactions I tested in my candidate models (i.e., between gender and age, wealth, marital status, and education) did not have strong statistical support (Table S9, S10). Importantly, intersectionality may manifest in different ways, such as inequalities in access (Ferguson 2021), participation in decision-making (Lawless et al. 2019), or experienced impacts (Rohe et al. 2018) that may not be captured by evaluations of equity perceptions. Future studies could use qualitative methods to identify the most relevant interactions between social identity characteristics leading to inequity in a specific context. For instance, qualitative methods can be used first to identify the most salient intersectionality issues, which can inform quantitative analysis (Ferguson 2021).

Recognition is a key dimension of equity (Sikor et al. 2014) that underpins distributional and procedural equity (Lecuyer et al. 2018; Lau et al. 2021a). Understanding people's claims regarding recognition is important to better understand why people perceive distributional and procedural (in)equity and how to promote equitable management. My study suggests that there are two potential aspects that may be related to recognition issues in this context. The first one is the recognition of the diversity of social identities within a community (e.g., migrant men, young people, and widows). Future studies could focus on better understanding what social identities are (mis)recognized and why. For instance, studies could investigate how misrecognition of social identities is related to distributional and procedural inequality, whether these patterns align with perceived equity, and what

should be done to promote recognition (e.g., affirmative action, institutional and structural reforms to achieve status equality) (Martin et al. 2016). In addition, as ‘everyone benefits’ and ‘everyone participates’ are key reasons for distributional and procedural equity, future studies could unpack what social identities are being recognized in the idea of ‘everyone’.

The second potential avenue of future research related to recognition focuses on respect towards the traditional governance systems, which has been identified as a recognitional concern in another area in the Pacific (Lau et al. 2021a). Future studies could assess how recognition of traditional governance systems differs across social identity categories (e.g., Abebe et al. 2020) and how these shape perceptions of distributional and procedural fairness. For instance, people with high levels of education or younger people may have less respect for traditional governance systems, which may shape their perceptions of procedural fairness. Equity concerns can be related to a wide variety of recognitional issues which are context-dependent and difficult to predefine (Dawson et al. 2018b). Therefore, future studies could use qualitative methods to identify what recognitional issues are relevant in a specific situation.

Finally, future research could also assess what underlying factors shape equity perceptions. My results suggest that traditional governance procedures (e.g., community agreements, respected and trusted leaders) may influence equity perceptions. Specifically, cultural and gender norms and power relations embedded in these traditional systems, which are often subconscious and reproduced in everyday social interactions (McDougall et al. 2021), may be shaping beliefs about what is considered fair (Lau et al. 2021a). Therefore, future studies could investigate how social structures (e.g., cultural and gender norms) and power relations embedded in traditional governance systems are creating inequalities and shaping perceptions of equity to provide insights on how to achieve conservation justice. However, analysis of people’s perceptions of fairness is limited in their ability to detect structural injustices that impact people’s wellbeing (Lau et al. 2021a). Other methods, such as feminist political ecology (e.g., Nightingale & Ojha 2013), could be used to understand better how social structures and power relations shape equity perceptions.

4.6. Conclusion

Promoting equity in environmental governance is a moral imperative and can help achieve positive management and conservation outcomes. Within communities, people have different identities, which determine their status, roles, and access to resources and, thus, their ability to benefit from management and participate in decision-making. Understanding how people with different identities

based on social characteristics and their interaction perceive distributional equity (i.e., how fair is the distribution of management impacts) and procedural equity (i.e., how fair is the decision-making process) is critical to moving toward equitable governance. I found that, although management does not impact everyone equally (the community as a whole benefited the most, while women were the group who bore most of the costs), perceptions of distributional and procedural fairness are generally high regardless of gender in this traditional governance system. In addition, I found that migrant men, widows, young people, and those with high and low education were less likely to perceive distributional equity. In contrast, migrants and people with high education were less likely to perceive procedural equity. Overall, this study highlights the importance of paying attention to the heterogeneous experiences of (in)equity within communities, particularly to the intersecting identities of community members, to design better processes and policies that can promote equity in natural resource management and conservation. In addition, this study highlights the importance of better understanding underlying causes leading to (in)equity (e.g., social structures and power relations) to achieve conservation justice.

Chapter 5

Social equity in fisheries co-management is related to positive outcomes

Chapter 5: Social equity in fisheries co-management is related to positive social outcomes

5.1. Abstract

Social equity is not only considered ethical but also thought to be instrumental in achieving positive natural resource management outcomes. However, there are few empirical studies demonstrating a relationship between equity and ocean sustainability outcomes. Here, I use data from 56 fisheries co-management arrangements in Chile to assess how perceived distributional equity and key elements of procedural equity (i.e., participation in decision-making and trust in leaders) are related to three key perceived social co-management outcomes (perceived impacts on wellbeing, satisfaction with co-management outcomes, and satisfaction with fisher associations). I show a positive relationship between a) perceived distributional equity and the three social co-management outcomes, b) participation and positive impacts on wellbeing, and c) trust in leaders and satisfaction with fisher associations. In addition, I found that the odds of achieving positive social co-management outcomes were up to 175 times larger with high levels of distributional and procedural equity versus low levels of distributional and procedural equity.

5.2. Introduction

Equity refers to what is fair and right (OED 2022). It is similar to the concept of justice, which is considered 'the first virtue of social institutions' (Rawls 1971:3), and to Adam Smith's view of the 'impartial spectator whose judgement is not biased by any personal stake' (Konow 2003: 1189). Normative approaches to equity (e.g., Rawls 1971) seek to define universal principles of what is fair. Although people's motives for wanting equity are universally shared (Folger 1998; Graham et al. 2009), perceptions of what is fair vary not only between people but also between contexts for the same person (Sabbagh & Schmitt 2016). Empirical approaches to equity recognize that people have different perceptions of what is fair and use a range of justice principles (e.g., egalitarianism, libertarianism, need-based) to make judgements regarding fairness in a specific situation (McDermott et al. 2013; Sikor et al. 2014). In addition, justice theories from multiple disciplines posit that peoples' equity concerns are associated with two key dimensions: distribution and procedure (Scholsberg 2007; McDermott et al. 2013; Tyler 2015). Distributional equity refers to how benefits and costs are distributed between people. This could refer for instance to exposure to pollution or access to benefits from conservation. Procedural equity refers to the fairness of the

decision-making process and is concerned with who is making decisions and how decisions are made (Ruano-Chamorro et al. 2022).

Equity is important for both ethical and instrumental reasons. Promoting equity is an end in itself - it is a moral imperative and necessary to recognize and respect the rights that sustain human wellbeing and dignity (Schreckenberg et al. 2016; Martin 2017). Yet promoting equity can also be a means to achieve other positive outcomes in a given situation. Social psychological research has shown that equity is related to multiple individual and organizational outcomes in the workplace, such as work performance, job satisfaction, organizational commitment, counterproductive behavior, turnover intention, and health (Cohen-Charash & Spector 2001; Colquitt et al. 2001; Greenberg 2011). In addition, equity is related to positive attitudes towards the government (Tyler 1994b; Carman 2010) and the police (Sunshine & Tyler 2003; Mazerolle et al. 2013), and satisfaction in a variety of settings such as criminal courts (Casper et al. 1988; Tyler 1988), contract disputes (Hollander-Blumoff & Tyler 2008), airport screening (Hasisi & Weisburd 2011), and natural resource management (Lauber & Knuth 1997; Lauer et al. 2018).

There are various mechanisms through which equity can lead to positive outcomes in a system. Shared equity principles can be used as guides for social coordination (Tyler 2015), long-term beneficial exchange relationships (Henrich et al. 2010), and the creation of effective institutions for collective action (He et al. 2021). In addition, according to needs-based models of justice (Copranzano et al. 2001), equity can satisfy multiple psychological needs with critical implications for wellbeing. Equity can satisfy people’s needs for control by allowing them to predict and manage processes that will affect their lives (Copranzano et al. 2001), and satisfy people’s identity needs (e.g. belonging and self-regard) by promoting high-quality interpersonal treatment based on dignity and respect (Lind & Tyler 1988). Equity can also satisfy people’s needs for a meaningful existence (i.e., seeking to be virtuous in a just world) by ensuring that people’s core moral principles are upheld (Folger 1998). In addition, satisfying these fundamental needs by promoting equity may lead to intrinsic motivation (Zapata-Phelan et al. 2009) and cooperation. For instance, the group engagement model posits that procedural equity experienced within a group creates and maintains people’s favourable identity, which in turn strongly influences cooperation (Tyler & Blader 2003). Finally, equity can also shape outcomes through legitimacy. Equity can shape the perceptions of the legitimacy of decisions and authorities and promote their willingness to comply with rules and defer to those authorities (Tyler 2015).

Although the positive effect of equity on natural resource management outcomes is commonly discussed in the environmental management literature (Pascual et al. 2014; Martin 2017; Crosman et al. 2022), empirical evidence is scarce. Indeed, existing literature on environmental management tends to examine equity as an outcome rather than a driver (Gill et al. 2019). To my knowledge, a handful of qualitative studies have suggested a link between perceptions of inequity and anti-conservation, non-compliant behaviors (Twinamatsiko et al. 2014; Mariki et al. 2015; Rohe et al. 2018; Raycraft 2020), and highlighted the importance of local equity norms to building effective institutions for collective action (He et al. 2021). In addition, few studies have quantitatively assessed the effect of equity on legitimacy (Turner et al. 2016), management satisfaction (Lauber & Knuth 1997; Lauer et al. 2018) and support (Diedrich et al. 2017; Friedman et al. 2020). However, these studies have mostly focused on one dimension of equity and one management outcome at a time.

Here, I use an empirical approach to equity to explore how distributional and procedural equity affects perceptions of key social outcomes in fisheries co-management across 56 fishing communities in Chile. Co-management governance approaches are participatory decision-making processes that involve a wide range of actors, including communities, governments, civil society, and research institutions (Berkes 2009). By facilitating the incorporation of local values, needs, governance and, priorities, co-management is thought to be more equitable and results in better outcomes than more centralized governance approaches (Berkes 2009). As a result, co-management has gained global recognition as an approach to managing common-pool resources including fisheries, pastures, and forests, having a significant impact on the livelihoods of millions of people and the ecosystems they rely on. However, empirical studies suggest that co-management can be both equitable (Oldekop et al. 2016; Yang & Pomeroy 2017; d'Armengol et al. 2018) and inequitable (Cinner et al. 2012; Ward et al. 2018). Whether the level of (in)equity is associated with negative or positive outcomes in co-management systems is still poorly understood.

I examine i) how perceptions of distributional equity are related to three key co-management social outcomes (perceived impacts on wellbeing, satisfaction with TURFs, and satisfaction with fisher associations), and ii) how elements of procedural equity (participation in the decision-making process and trust in leaders) are associated with these three socials co-management outcomes.

5.3. Material and methods

5.3.1. Area of Study

Chilean artisanal fishing contributes to 40% of the national total landings obtained from fishing (industrial and artisanal) and aquaculture (SERNAPESCA 2021). Part of the artisanal fishery (~35,000 fishers) operates under a Territorial User Rights for Fisheries (TURF) arrangement (FAL 1991) implemented in 1997 (Gelcich et al. 2010). TURFs are co-management arrangements under which registered fisher associations are granted exclusive access rights to extract benthic resources within delimited areas of the inshore seabed, and fishers are responsible for the monitoring and enforcement of the area (Gelcich et al. 2010). All fisher associations have a directorate that consists of a President (i.e., the leader), a treasurer and a secretary which is elected every two years by the its members (Crona et al. 2017). Within TURFs, artisanal fishers collect more than 60 different species of invertebrates and algae mostly through diving, such as the gastropod loco (*Concholepas concholepas*), the red sea urchin (*Loxechinus albus*), keyhole limpets (*Fissurella spp.)* and kelp (e.g., *Lessonia trabeculata*) (Gelcich et al. 2010). TURFs were implemented with the idea that securing access and sharing control over marine resources would incentivize fisher associations to manage resources collectively and sustainably (Ostrom & Schlager 1996). In 2018, 531 active TURFs were covering an area of 1,240 km^2 (Ariz et al. 2018).

Three decades after its implementation, evidence suggests that TURFs can provide the conditions for sustainable (Gelcich et al. 2019) and equitable management. For instance, greater resource abundance and species richness have been found in highly-enforced TURFs relative to open access areas (Gelcich et al. 2012), and TURFs have strengthened fisher associations and increased social capital within communities (Gelcich et al. 2013; Rosas et al. 2014). Women's participation appears to have been promoted by the implementation of TURFs (Gallardo-Fernández & Saunders 2018), and the distribution of quotas within the TURFs is agreed upon collectively at the fishers general assembly. Yet, TURFs can also lead to inequities (e.g., lack of recognition of traditional governance systems) with implications for sustainable management (Gelcich et al. 2006).

5.3.2. Data collection

I studied 56 independent and randomly selected fisher associations (referred to as *Caletas*) spanning 11 of the 15 regions in Chile (Figure 5.1). In each association, a random sample of ten fishers who were not members of the directorate was targeted. The target was reached in 35 associations. In other associations, nine (n=3), eight (n=8), seven (n=4), six (n=1), five (n=2), three (n=2), and two (n=1)

fishers were surveyed (Table S2). Sampling took place in 2014 in a face-to-face manner. In total, 532 surveys were conducted, which included Likert-scale type questions regarding three key social co-management outcomes (perceived impacts on wellbeing, satisfaction with TURF management, and satisfaction with the fisher association) (Table 5.1), perceptions of distributional equity, elements of procedural equity (i.e., participation in decision-making process and trust in leaders) (Table 5.2), expected profits from TURFs, and social identity characteristics (Table S1). One leader of each association was also interviewed to obtain market distance data (Table S1). Surveys were conducted in Spanish by four trained interviewers.

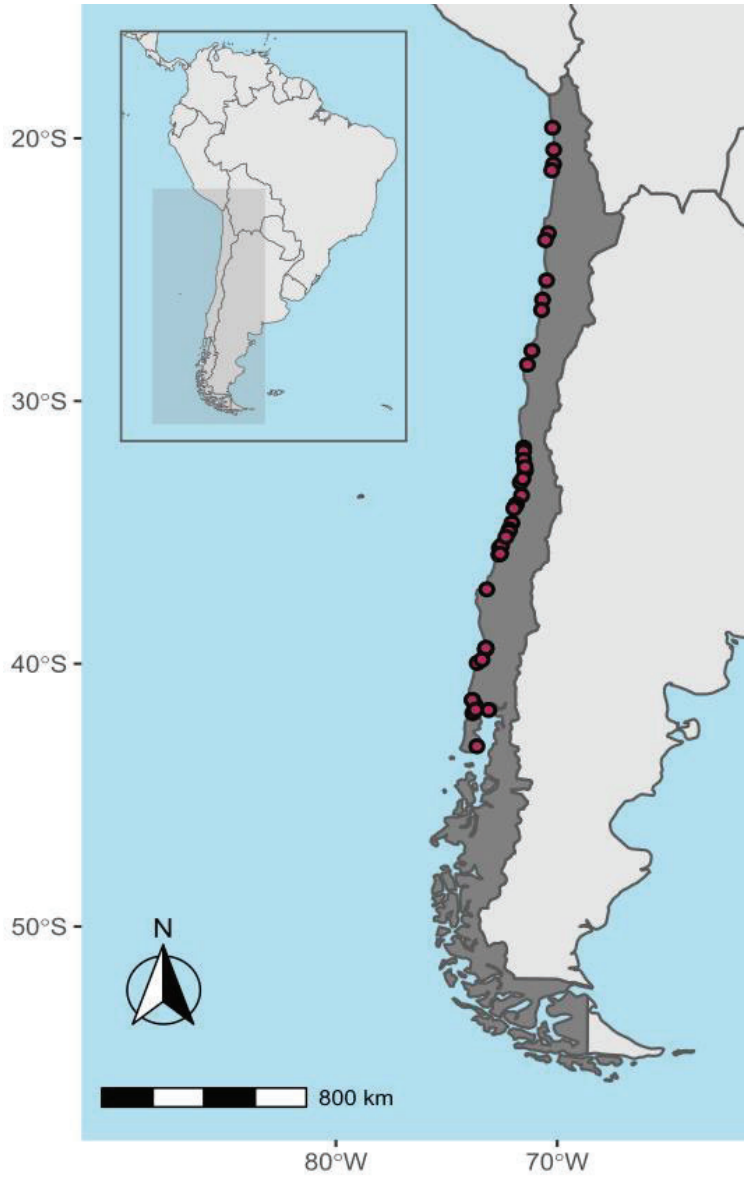

Figure 5. 1. Map with the specific location of study sites (fisher associations or *Caletas*).

Table 5. 1. Social co-management outcomes including subjective wellbeing, satisfaction with TURFs, and satisfaction with fisher association, which are used as dependent variables in three ordinal regression models (Figure 5.2).

Social Outcome	Description	Operationalization
Perceived impact on wellbeing	TURFs can provide a range of benefits (or costs) (Gelcich et al. 2019). This outcome examines how individual actors perceive the TURF as a contribution to or undermining their wellbeing. Wellbeing can have material, relational, and subjective dimensions, and I left it to respondents to interpret wellbeing as they experienced it, rather than pre-defining a dimension. Ensuring positive impacts on wellbeing is important for ethical and instrumental reasons. It is an end in itself, it can lead to management support and compliance with rules, and ultimately may lead to ecological positive outcomes.	Perceived impact of TURFs on individual wellbeing. Likert-type response including high negative impact/ negative impact/ neutral/ positive impact/high positive impact.
Satisfaction with best TURF	In environmental management research, satisfaction has been used as an indicator of positive evaluations regarding decision-making processes and decision-makers (Lauber & Knuth 1999; Halvorsen 2001), and legitimacy (Bennett et al. 2019). Satisfaction with the best TURF refers to perceive benefits associated with the performance of a TURF (i.e., the area that delimits the exclusive access rights of fishers from a specific registered organization on certain benthic species), which is more specifically related to ecological and economic outcomes than the measure of impacts on wellbeing. Many fisher associations have multiple TURFs, some of which are dysfunctional, so I was interested in examining their satisfaction with their highest performing TURF. Benefits from TURFs may be perceived differently by different fishers. For instance, some fishes (e.g., skilled divers) may be more able to benefit from a TURF than others (e.g., elders). Satisfaction can provide a useful indicator of management outcomes (Crona et al. 2017; Lauer et al. 2018; Crandall et al. 2019). Satisfaction is a measurement of the alignment between social expectations with perceived outcomes and captures the idea of social impact (Lauer et al. 2018). Individuals satisfied with the management of a system may be more likely to have confidence in the system and support it (Crona et al. 2017).	Level of individual satisfaction with the best TURF. Likert-type response ranging from 1 to 7.
Satisfaction with fisher association	Satisfaction with the fisher organization indicates positive evaluations of the organization performance.	Level of individual satisfaction with the fisher association.

		Likert-type response ranging from 1 to 7.

Table 5. 2. Equity indicators (Figure 5.2.).

Equity dimension	Equity indicator	Description	Operationalization
Distributional Equity	*Distributional Equity*	Distributional equity refers to the fairness in the distribution of costs and benefits (McDermott et al. 2013), and it is a key equity dimension (Deutsch 1975; Scholsberg 2007; Walker 2012; Tyler 2015).	Level of satisfaction (from 1 to 7) with how equitable the outcomes from TURFs are distributed.
Procedural equity	*Participation in decision-making*	Active participation in decision-making, or voice, indicates the ability of individuals to express their opinions, concerns, interests, and needs, and it is a criterion of procedural equity (Ruano-Chamorro et al. 2022, Figure 5.2). Degree of participation is often used to operationalize procedural equity in the environmental management literature (Gustavsson et al. 2014; Friedman et al. 2018).	Level of participation in decision-making processes regarding the management and/or use of marine resources (none/passive/active).
	Trust in leaders	Trustworthiness is a criterion of procedural equity (Ruano-Chamorro et al. 2022, Figure 5.2) and it refers to 'whether decision-makers are perceived as benevolent, caring, and fair' (Tyler 1989). Here I use trust in leaders of fisher associations as a measure of trustworthiness. Fishers who trust the leader (i.e., the president of the fisher association) may perceive that the leader takes into account their interests and do what is right and fair (Ruano-Chamorro et al. 2022), and are therefore more likely to develop long-term commitments with organizations (Tyler 1989) and to perceive legitimacy (Turner et al. 2016). In turn, this may make fishers more likely to perceive other social outcomes (e.g., satisfaction with fisher association and satisfaction with TURF management outcomes).	Level of trust from 1 (very low trust) to 5 (very high trust).

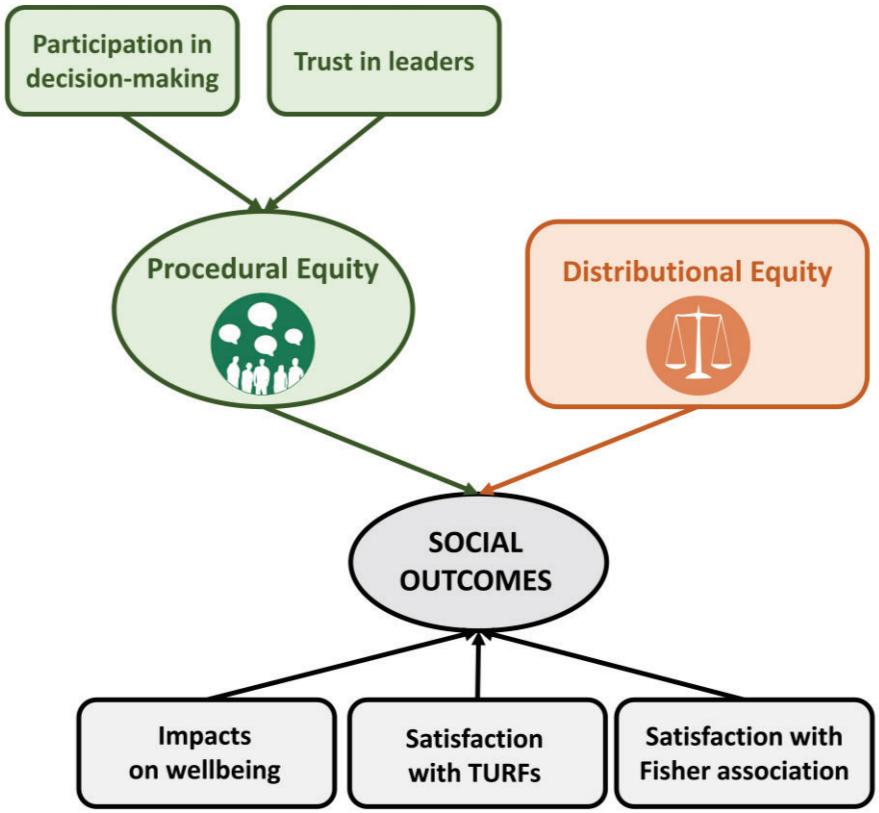

Figure 5. 2. Conceptual framework illustrating the hypothesized instrumental role of equity (Pascual et al. 2010, Martin et al. 2014) in a TURF (Territorial Users Rights for Fisheries) system in Chile. Active participation in decision-making and trust in leaders are two key procedural equity criteria (Ruano-Chamorro et al. 2022).. Impacts on wellbeing, satisfaction with (the best) TURF and satisfaction with the fisher association are three key social co-management outcomes that can have implications for management effectiveness (Crona et al. 2017; Lauer et al. 2018; Crandall et al. 2019). Squares indicate the variables and circles indicate concepts.

5.3.3. Data analysis

I grouped the lowest ordinal categories of the dependent variables due to the low sample size in these categories. Specifically, for perceived impacts on wellbeing I grouped the categories 'very negative' and 'negative', and for both satisfaction variables, I grouped the categories 1, 2, 3, and 4. In Chile, schools' ratings below four (out of 7) are considered a failure. I also grouped the lowest categories of participation ('no participation' and 'passive participation') in decision-making due to the low sample size of fishers not participating (n=5). To examine how perceptions of distributional equity and selected elements of procedural equity (i.e., participation in decision-making and trust in leaders) were related to perceptions of key social co-management outcomes (i.e., wellbeing, satisfaction with

TURFs, and satisfaction with the fisher association) (Table 1) I fitted three cumulative mixed-effects models (one per co-management outcome, Figure S2) with logit link function. The cumulative model assumes that there is an unobserved continuous latent variable Y' (e.g., latent perceived impacts on wellbeing) underlying the observed ordinal variable Y (e.g., perceived impacts on wellbeing) which follows a logistic distribution and that there are K thresholds τ_k (which are also called intercepts in cumulative models) which partition Y' into K+1 observable ordered categories of Y (Bürkner & Vuorre 2019). To control for social characteristics that have been linked to perceptions of management outcomes, I included ten socioeconomic characteristics in the model (Appendix D, Table S10). In addition, because self-interest motivations can conflate with equity (Tyler 2015) and economic benefits are an important predictor of outcomes, I also controlled for expected benefits from TURFs (Appendix D, Table S10).

I used a Bayesian approach using the Hamiltonian Monte Carlo algorithm implemented in Rstan (Stan Development Team 2018) through the brms package (Bürkner & Vuorre 2019) within the R statistical and Graphical Environment (R Core Team 2022). I used weakly informative priors. A total of 2000 iterations with a warmup of 1000 and a thinning rate of five were performed in each of the four chains. The chains were all well mixed and converged upon a stable posterior (all rhat values below 1.05). I included fisher association (or *Caleta*) as a group-level effect and controlled for socioeconomic variables and TURF profits (Appendix D, Table S10). I checked the proportional odds assumption by fitting an adjacent category model with category-specific effects and comparing it against the cumulative model through leave-one-out cross-validation (LOOIC) (Bürkner & Vuorre 2019). I standardized continuous variables by subtracting the mean and dividing by 2 standard deviations (Gelman 2008). The model was validated via DHARMa (Hartig 2022) residuals and the models performed better than the null models. To visualize the relationship between the aspects of equity and perceived social co-management outcomes, I plotted the standardized coefficient of distributional equity, trust in leaders, and participation in decision-making on the latent continuous variable (Y') of each social co-management outcome. I calculated the difference in log odds (average) of each social outcome between the lowest equity value and the highest equity value. I exponentiated the difference to obtain the odds of perceiving an outcome at the highest value of equity relative to the lowest value of equity.

5.4. Results

My results show that distributional and procedural equity have a positive effect on the three social co-management outcomes (Figure 5.3). Particularly, perceptions of distributional equity are

positively related to all the social outcomes (Figure 5.3A, D, G). Holding all other factors constant, the odds of perceiving positive impacts on wellbeing are, on average, 9 times higher for people who perceive distributional equity compared to those who do not perceive distributional equity (Figure 5.3A). In addition, the odds of being satisfied with TURFs are 45 times higher for people who perceive distributional equity compared to those who do not perceive distributional equity (Figure 5.3D). Finally, the odds of being satisfied with the fisher association are 26 times higher for people who perceive distributional equity compared to those who do not perceive distributional equity (Figure 5.3G).

Procedural equity also demonstrates positive relationships with two out of six possible social outcomes (Figure 5.3C and H). Active participants in decision-making are 1.95 times more likely to perceive positive impacts on wellbeing than people who participate passively (Figure 5.3C). In addition, the odds of being satisfied with the fisher association are 31 times higher for people who have high levels of trust in leaders compared to those who do not trust leaders at all (holding other factors constant; Figure 5.3H). When distributional and procedural equity are combined, the odds of people perceiving positive social outcomes are even higher for wellbeing and satisfaction with the fisher association. Together, perceiving high levels of both distributional and procedural equity increases the odds that people perceive positive impacts on wellbeing 18 times, and satisfaction with fisher associations 175 times (holding all other factors constant; Figure S5).

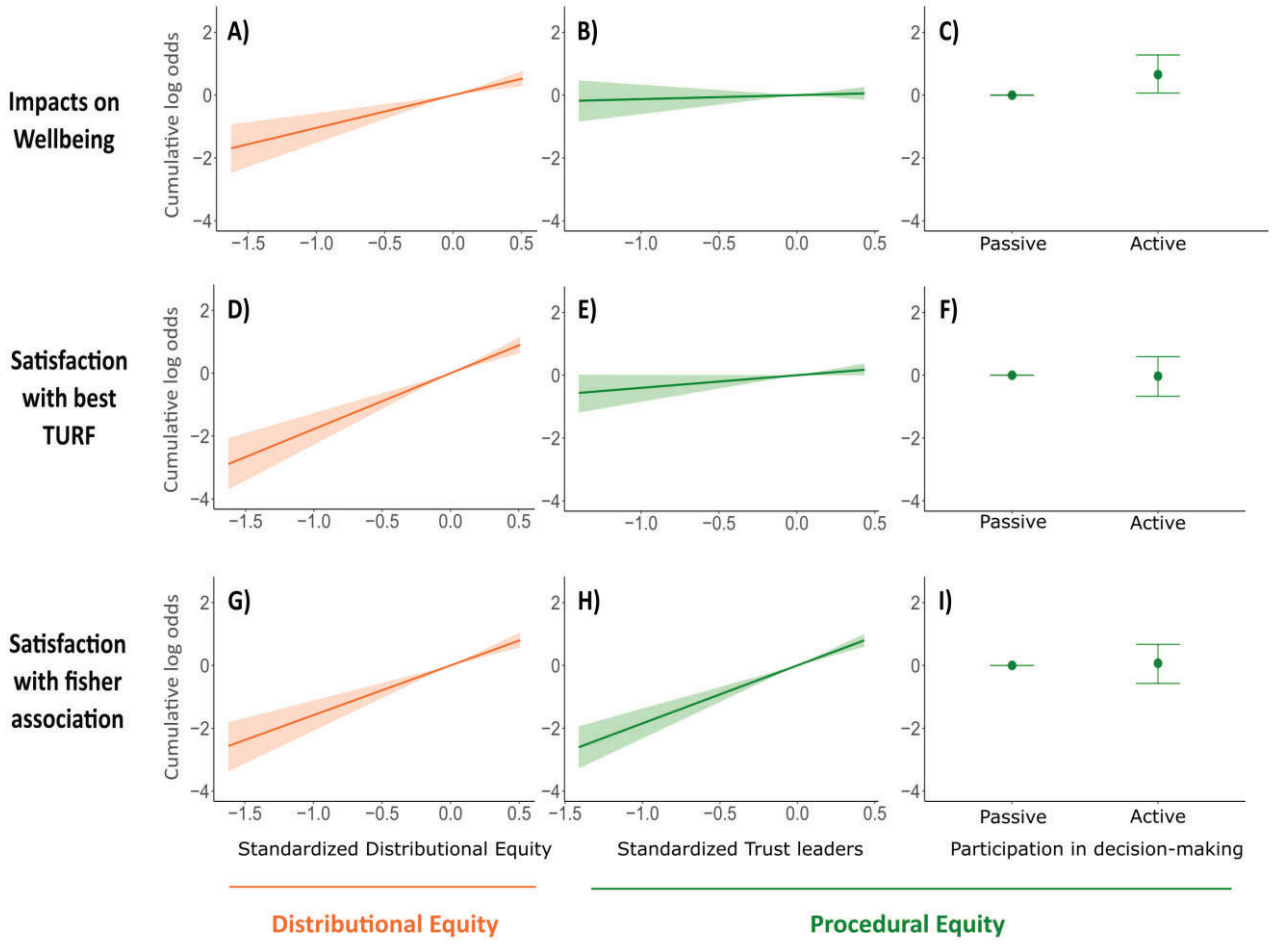

Figure 5. 3. Relationship between equity (distributional and procedural equity) and social co-management outcomes. Standardized size effect of distributional equity (A, D, G), trust in leaders (B, E, H), and participation in decision-making (C, F, I) on the latent (not observable) continuous variable of wellbeing, satisfaction with TURFs, and satisfaction with fisher associations while holding other covariates constant. Orange indicates distributional equity and green indicates procedural equity elements. The lines and points represent the posterior draws of the predictor, and the shaded areas and error bars are the 95% credible intervals.

5.5. Discussion

Equity is thought to be important in its own right but also instrumentally such that more equitable situations are expected to promote positive social and environmental outcomes, though empirical evidence particularly from the field of ocean sustainability is lacking. Here I have quantified how different types of equity are related to perceptions of key social co-management outcomes to reveal that some types of equity matter for co-management effectiveness.

5.5.1. General effect of distributional equity on social co-management outcomes

The first key finding of my analysis is that perceptions of distributional equity are positively related to three social co-management outcomes (i.e., positive impacts on wellbeing, satisfaction with TURFs, and satisfaction with fisher associations). Overall, I found that the odds of perceiving a positive impact on a social co-management outcome are between 9 and 45 times higher for fishers who perceive high levels of distributional equity relative to fishers who perceive low levels of distributional equity. My results are consistent with other studies suggesting a link between distributional equity and management outcomes (Loomis & Ditton 1993; Dawson et al. 2017; Burbano & Meredith 2020), such as increased legitimacy (Gross-Camp et al. 2012) and management support (Baynes et al. 2015; Diedrich et al. 2017). In addition, my results also align with literature in economics (Fehr & Schmidt 1999; Wilkinson & Pickett 2009) and psychology (Crosby 1976; Colquitt et al. 2001; Prilleltensky 2012; Tyler 2015) which suggest a link between distributional equity and positive outcomes. One potential reason for the positive relationship between perceptions of distributional equity and the three social co-management outcomes may be due to the fishers' agreement regarding distributional equity principles. For instance, in co-management arrangements in Chile, the distribution is agreed upon by the general assembly of fishers. In some cases, the distribution may be based on equality, and in others, divers may get an extra share, or a share goes to the association's running costs. The consensus regarding distributional equity principles can serve as a guide for social coordination and cooperation, which can promote beneficial long-term exchange relationships for all (Tyler 2015), and generate positive impacts on wellbeing, and satisfaction with TURF and fisher associations.

5.5.2. *Certain types of procedural equity are important for different social co-management outcomes*

The second key finding is that different procedural equity elements are positively related to select social co-management outcomes. Specifically, active participation in decision-making was positively related to positive impacts on wellbeing (i.e., the odds of perceiving a positive impact on wellbeing are almost two times higher for fishers who participate actively in decision-making processes relative to fishers who participate passively), and trust in leaders was positively related to satisfaction with fisher associations (i.e., the odds of perceiving high satisfaction with fisher associations are 31 times higher for fishers who highly trust leaders relative to fishers who don't trust leaders). However, for four out of six possible relationships, I did not find strong evidence that my indicators of procedural equity were associated with social co-management outcomes. Overall, my results align with the

expected positive effect of procedural equity in outcomes, though my findings suggest some nuance in that specific aspects of procedural equity are associated with select social outcomes.

The positive effect of participation on natural resource management outcomes has been reported by multiple studies (e.g., Persha et al. 2011, Cinner et al 2012, Gurney et al 2016). Consistent with this literature, my results suggest that active participation is related to positive impacts on wellbeing. Being able to participate actively (having a voice) and being heard might satisfy human fundamental needs such as the need for control and identity needs (Copranzano et al. 2001) and lead to positive impacts on wellbeing. I did not find an effect of active participation on the other social outcomes (satisfaction with the best TURF and satisfaction with fisher associations). Other procedural equity criteria, such as decision control (i.e., the ability to influence decisions and outcomes), may be needed for active participation to have an effect on satisfaction with fisher associations and TURF outcomes. For instance, a study associated to a restoration project in the United States found that the relationship between stakeholders' voice and management satisfaction was mediated by the ability to shape decisions and outcomes (Lauer et al. 2018), which suggests that only having a voice may not be enough to promote satisfaction. Another study in the Caribbean found that the quality of participation in marine protected area (MPA) planning and management, an index which included voice, decision control, adequate information sharing, transparency in decision-making, and fair decision-making, was related to positive social and ecological outcomes (e.g., perceived overall satisfaction, changes in coral conditions) (Dalton et al. 2012). In addition, the literature on the psychology of justice suggests that active participation (i.e., voice) can interact with trust in authorities in different ways depending on the type of outcome. For instance, one study found that voice had only an effect on the outcome (i.e., satisfaction with outcomes) when there was no information regarding the trustworthiness of an authority (van den Bos et al. 1998), while another study found that voice had a larger effect on the outcome (i.e., cooperation) when authorities were trusted (De Cremer & Tyler 2007). Some outcomes may also be influenced by other contextual conditions, which may reduce the relative effect of participation. For instance, TURF outcomes can be affected by a high level of poaching or low ecological productivity (which I was unable to include in my models due to lack of comparable data) which may effectively make satisfaction with the TURF so low that participation is irrelevant (Gelcich et al. 2017, 2019).

Overall, my finding of a positive strong relationship between trust in leaders and satisfaction with fisher associations is consistent with the literature on environmental management and the psychology of justice. Trust in leaders is a common measure of leadership (Cinner et al. 2012) and social capital

(Portela & Neira 2013; Diedrich et al. 2017) which are critical for the sustainable management of natural resources (Gutiérrez et al. 2011; Crona et al. 2017). For instance, trust in leaders (or authorities) is related to participation in co-management (Ho et al. 2016), legitimacy (Turner et al. 2016), and compliance (Cinner et al. 2012) in fisheries management contexts. In addition, the literature on the psychology of justice has highlighted the important role of trust in authorities (i.e., beliefs in the good intentions of authorities) as an antecedent of procedural equity with implications for group identity, positive attitudes, and cooperation (Lind & Tyler 1988; Tyler & Lind 1992; Tyler & Blader 2003). However, I did not find a relationship between trust in leaders and impacts on wellbeing and TURF satisfaction. It is possible that the relationship between trust in leaders and management outcomes is also complex, context-dependent, and dependent on other equity criteria or other equity dimensions. For instance, one study found that distributional equity was the key mechanism through which trust in leaders influenced perceived benefits from marine protected areas (MPAs) in the Philippines (Diedrich et al. 2017) and trust in leaders was not related to livelihood benefits in multiple co-management systems across the Indo-Pacific region (Cinner et al. 2012).

5.5.3. Importance of promoting distributional and procedural equity together

The third key finding is that distributional and procedural equity combined increase the odds of perceiving certain social co-management outcomes (i.e., positive impacts on wellbeing and satisfaction with fisher associations) more than separately (i.e., the odds of perceiving positive impacts on a social outcome are between 18 and 175 times higher for fishers who experienced high distributional and procedural equity relative to fishers who experienced low levels of distributional and procedural equity). These results support calls for the need to consider how dimensions of equity are interrelated in order to better understand issues of equity in any system (McDermott et al. 2013; Friedman et al. 2018; Lau et al. 2021a). In this study, I found that distributional and procedural equity have a higher positive effect on wellbeing impacts and satisfaction with the fisher association together than separately. The literature on the psychology of justice suggests that distributional and procedural equity are relevant for different situations (Cohen-Charash & Spector 2001). For instance, in situations where distributional principles are difficult to implement in practice, procedural equity may be more relevant (Tyler 2015), while procedural equity may be less relevant in situations where maintaining strong positive bonds is not important (e.g. competitive relationships) (Barrett-Howard & Tyler 1986). In addition, procedural equity tends to be more important than distributional equity for the evaluation of authorities and institutions (Tyler 1994a), and when people are more concerned with satisfying non-economic needs such as self-esteem (Brockner & Wiesenfeld 1996). In the

context of this study, it is possible that distributional equity and elements of procedural equity are providing different types of benefits (e.g., secure long-term benefits, group identity), which combined promote more positive management outcomes.

5.5.4. Critiques, caveats and future directions

This study is an important first step in examining how aspects of distributional and procedural equity relate to select ocean sustainability social outcomes, but there are several areas where future studies could expand. First, an important area of future research is to refine the equity indicators, since I used a limited set. I suggest it will be important for future studies to assess broader indicators of procedural equity (e.g., how fair is the decision-making process), and evaluate other procedural equity criteria (e.g., transparency, decision control) (Estévez et al. 2021; Ruano-Chamorro et al. 2022). In addition, future research could examine how key aspects of distributional and procedural equity are related to each other and how this relationship affects outcomes (i.e., is equity, additive, synergistic, or interactive). For example, the weakest link hypothesis from adaptation research suggests that different types of adaptive capacity interact such that people's adaptation opportunities are constrained by their lowest form of adaptive capacity, rather than enabled by their highest (Tol & Yohe 2007), and equity may operate similarly.

Future studies could also assess how perceptions of equity are related to other types of co-management outcomes. For example, future studies could assess how distributional and procedural equity are related to a broader suite of co-management outcomes such as subjective wellbeing, cooperation, and ecological outcomes. In addition, future studies could examine what are the key mechanisms through which distributional and procedural equity lead to outcomes in different settings. The importance of assessing these mechanisms has been highlighted in natural resource management literature but tends to focus on one mechanism (i.e. legitimacy) (Turner et al. 2016; Gurney et al. 2019). Social justice theory posits other mechanisms (e.g. group identity, morality) (Copranzano et al. 2001; Tyler & Blader 2003; Tyler 2015) through which equity can influence outcomes that could be relevant for natural resource management contexts. Finally, correlation does not imply causation and mine was an exploratory study that was purely correlational. Therefore, it is still unclear whether equity influences social management outcomes. Future research could assess the causal relationships between equity and management outcomes using impact evaluation methods (Ferraro and Hanauer, 2014). These causal analyses would also clarify the directionality of the relationship between equity and management outcomes (i.e., whether equity determines outcomes or

whether outcomes determine equity). As other studies suggest, it is possible that social management outcomes influence perceptions of equity (Lecuyer et al. 2018, Chapter 4).

5.6. Conclusion

Achieving equity in natural resource management is considered key for ethical and instrumental reasons. However, few empirical studies have assessed the relationship between equity and management outcomes. Here, I have examined two key dimensions of equity (distributional and procedural) in 56 fisheries co-management systems in Chile known as TURFs (territorial user rights for fisheries). Specifically, I measured perceived distributional equity of TURF benefits and key elements of procedural equity (i.e., participation in decision-making and trust in leaders) and assessed how these are related to three social co-management outcomes (i.e., perceived impacts on wellbeing, satisfaction with outcomes from TURFs, and satisfaction with fisher associations). I found that perceived distributional equity was positively related to the three social co-management outcomes, participation in decision-making was positively related to positive impacts on wellbeing, and trust in leaders was positively associated with satisfaction with fisher associations. In addition, I found that distributional and procedural equity combined had a stronger positive relationship with social co-management outcomes than separately. For instance, the odds of being satisfied with fisher associations were 175 times higher for fishers who perceived high levels of distributional equity and had high trust in leaders relative to fishers who perceived low levels of distributional equity and had lower levels of trust in leaders.

My study suggests that equity can be instrumental in achieving effective co-management. However, key aspects need to be considered to provide stronger evidence of the instrumental role of equity in natural resource management. First, future studies could assess how different types of equity, including different dimensions (i.e., distributional, procedural, and recognition) and criteria (e.g., decision control, transparency), relate to management outcomes. Second, future research could analyse the relationship between equity and other management outcomes, such as ecological outcomes and the multiple dimensions of human wellbeing (Kaplan-Hallam & Bennett 2018). Third, further investigations could determine the mechanisms through which equity is related to management outcomes. Finally, future research could determine if there is a causal relationship between equity and management outcomes.

Chapter 6

General Discussion

Chapter 6: General Discussion

Achieving equity in natural resource management and conservation is important from an ethical and instrumental standpoint. As a result, attention to equity in conservation and environmental intervention is rapidly increasing, as evidenced by its prominence in several global environmental agreements (e.g., the Convention on Biological Diversity, the UN Sustainable Development Goals, and the Intergovernmental Platform on Biodiversity and Ecosystem Services). Critical gaps in the literature include a lack of understanding about what procedural equity in conservation entails, a lack of knowledge about the social conditions that are related to (in)equity, and a lack of evidence about the instrumental role of equity in natural resource management and conservation. In this thesis, I contribute to filling these gaps by developing a framework for advancing procedural equity in conservation, exploring how key social conditions are related to equitable co-management, and quantifying the instrumental role of equity in social co-management outcomes.

To integrate the findings of all the chapters into a general discussion of the thesis, in this section I have framed equality (or the absence of disparity) as a form of equity. Equality is a principle of justice (or a criterion of equity) that people can use to judge the fairness of a distribution (Deutsch 1975). However, it is important to note that equality is a descriptive term (i.e., it describes a difference in something between different groups of people or individuals) that indicates 'the way things are' (Walker 2012). Therefore, the existence of equality is not necessarily implying fairness (i.e., 'how things should be') (ibid).

6.1. Chapter-specific key findings

6.1.1. Procedural equity

In Chapter 2, I synthesized the literature on environmental justice, psychology of justice, and participatory conservation to develop a framework for advancing procedural equity (i.e., fair decision-making process) in conservation, consisting of eleven criteria grouped into four domains: 1) recognition of sociocultural diversity; 2) agency of participants; 3) interpersonal treatment among participants; and 4) process properties that are required to promote fair decision-making. In addition, I identified seven levers that can enhance the different domains of procedural equity: scalar and contextual fit, conflict resolution, facilitation, Free Prior and Informed Consent, integrative knowledge systems, and adaptive and flexible process. This review has allowed me to suggest ways to advance procedural equity in natural resource management and conservation practice (see section 6.2.6).

6.1.2. Social characteristics related to equity

In Chapters 3 and 4, I assessed how key social characteristics are related to equitable co-management. I found that various social characteristics are related to the different forms of equity, specifically, objective and subjective disparity (Chapter 3) and perceptions of distributional and procedural equity (Chapter 4). Specifically, institutional characteristics (access, area, and gear restrictions, participation in decision-making, and conflict resolution mechanisms) were related to subjective and/or objective disparity, and specifically to losses (i.e., being more negatively impacted by co-management relative to the community from an objective or subjective perspective) (Chapter 3). Certain socioeconomic characteristics (market distance, population size, wealth, and community events) were related to objective and/or subjective disparities (losses and/or gains), and others (migrant status, gender, occupational diversity, primary livelihood, and trust in leaders) were not (Chapter 3). On the other hand, education, marital status, age, and the interaction between migrant status and gender were related to perceptions of distributional equity regarding the distribution of co-management impacts in Fiji, while wealth was not (Chapter 4). Only education and migrant status were related to perceptions of procedural equity in Fiji (Chapter 4).

Overall, I found that social characteristics were associated with different types of equity in varying ways. Different social characteristics were related to the two measures of disparity, objective disparity and subjective disparity (Chapter 3). In other words, the conditions that shape objective disparity may be different from the conditions that shape subjective or perceived disparity. In addition, the characteristics related to losses were different from those related to gains (Chapter 3). Thus, the inverse of the conditions that make some fishers lose (i.e., being more negatively impacted by management relative to others) may not contribute to making fishers win (i.e., being more positively impacted by management relative to others). Social identity characteristics were also related to perceptions of distributional and procedural equity in different ways (Chapter 4). Therefore, the conditions that make a person perceive that the distribution of costs and benefits is fair may not be the same as those that make a person perceive that the decision-making process is fair.

Chapters 3 and 4 allowed me to arrive at general conclusions regarding how social identity characteristics are related to disparity and equity perceptions. I found no social identity characteristics (e.g., education, immigrant status, wealth) that were consistently related to both disparity (experience or perceived) (Chapter 3) and perceptions of (in)equity (Chapter 4). It is possible that the social identity characteristics that influence perceptions of (in)equity are not the same as those that shape perceived or experienced inequality (i.e., disparity). However, it is

important to note that the analysis of disparity and perceived equity was conducted using data from different contexts. Social identity characteristics may have a different influence on disparity and perceived (in)equity in different contexts, as the underlying conditions leading to inequality or perceived (in)equity may change depending on the context. Therefore, the inconsistent results of the different studies (Chapters 3 and 4) may be due to the variation in contexts and not to the fact that social identity characteristics have a different effect on inequality (or disparity) and perceived (in)equity.

6.1.3. The instrumental role of equity

In Chapter 5, I assessed how distributional equity and elements of procedural equity (active participation in decision-making, trust in leaders) were related to three key social co-management outcomes in the Chilean TURF system. These were: 1) perceived impacts on wellbeing, 2) satisfaction with TURF outcomes, and 3) satisfaction with fisher associations. I found that perceived distributional equity was positively related to all three social co-management outcomes, and aspects of procedural equity were related to different outcomes. Specifically, active participation was positively related to perceived impacts on wellbeing and trust in leaders was positively associated with satisfaction with fisher associations. In addition, I found that the odds of achieving positive co-management social outcomes were up to 175 times larger when fishers perceive high levels of distributional and procedural equity versus low levels of distributional and procedural equity.

6.2. Cross-cutting key findings

6.2.1. Participation in decision-making

Participation in decision-making (hereafter ‘participation’) is a cross-cutting theme in all chapters of this thesis. Below, I summarize the findings related to participation. In Chapter 2, I found that the voice and decision control elements of participation are two criteria of agency, a key dimension of procedural equity together with recognition, interpersonal treatment, and process properties (e.g., transparency, accountability, neutrality) (Chapter 2). In Chapter 3, I found that both passive participation (e.g., attendance in meetings) and active participation (e.g., having a voice) were negatively related to objective losses. In other words, when people participated passively or actively in decision-making processes about resource use and management, they were more likely to experience that their livelihoods were equally impacted by co-management relative to the rest of the fishers in their community. In Chapter 4, the qualitative analysis suggests that the degree of community participation (e.g., whether all of the community is involved in decision-making) had an

important influence on perceived procedural (in)equity in traditional governance systems in Fiji. Finally, in Chapter 5, I found that active participation (relative to passive participation) was positively related to perceived positive impacts on wellbeing in co-management arrangements (i.e., fishers were more likely to perceive positive impacts on their wellbeing from co-management when they participated actively in the decision-making process than passively).

Together these results highlight that participation is important to achieve equity and positive management outcomes. Specifically, these results suggest that participation is particularly important for promoting objective equality (a type of distributional equity) and procedural equity. In addition, I found that passive and active participation may promote equality, that community participation (which may involve passive participation) may be key for promoting perceptions of procedural equity, and that active participation may lead to better management social outcomes (e.g., positive impacts on wellbeing) than passive participation. In addition, participation may not be sufficient to achieve procedural equity and may require recognition, agency, process properties and interpersonal treatment.

6.2.2. The level of equity in co-management systems

The analysis in Chapters 3, 4, and 5 allowed me to draw general conclusions about the level of equity in fisheries co-management systems. In general terms, I found that the level of equity (subjective disparity, perceived distributional equity, perceived procedural equity, elements of procedural equity) in these co-management systems is relatively high. For example, in five Indo-Pacific countries, 62% of the 968 surveyed fishers[4] perceived equality, and in Fiji, 72% of the 960 respondents[5] perceived distributional equity and 71% of the 169 respondents[3] perceived procedural equity. In addition, I found that the level of (in)equity depends on the type of equity being measured. For instance, Chapter 3 suggests that fishers perceived higher levels of equality than indicated by an objective measure and that fishers were more likely to perceive losses than gains. The results from these analyses also suggest that the likelihood of perceiving (in)equity is higher under certain social and institutional conditions (e.g., being close to markets and the type of restriction implemented) and for certain social identities (e.g., being a male migrant, widow, young, highly educated, wealthy) depending on the context.

[4] Fishers who provided answers regarding perceived individual and community livelihood impacts (Chapter 3).

[5] Fishers who provided answers regarding perceived or procedural equity in Fiji (Chapter 4).

Taken together, these results highlight that a) the level of equity is relatively high in these co-management systems and depends on the type of equity being measured; b) fishers tend to perceive greater equality than measured in objective terms and are more sensitive to losses than to gains; c) institutional and socioeconomic characteristics are related to different forms of equity in diverse ways; d) the degree to which individuals within a community experience inequities may vary according to social identity characteristics (e.g., wealth, migrant status, age) and their interaction (e.g., migrant status and gender); e) participation is important for procedural equity, but not sufficient. Recognition, interpersonal treatment, process properties and other agency criteria beyond voice and decision control are key to achieving procedural equity; and f) equity may promote positive social management outcomes, such as management satisfaction and positive impacts on wellbeing.

6.3. Contributions to natural resource management and conservation literature

6.3.1. Moving from participation to procedural equity

Participation is central to achieving equity and positive management outcomes (Reed 2008; Persha et al. 2011; Brooks et al. 2013). Particularly, participation is considered a pillar of co-management systems (Berkes 2009), and it is often conceptualized as synonymous with procedural equity (Friedman et al. 2018). However, participation is not a panacea (Bixler et al. 2018) and can come with benefits and pitfalls (Baker & Chapin III 2018). In this thesis, I contribute to this body of knowledge in four key ways:

1. By conducting a large-scale disparity analysis in 48 fisheries co-management systems showing that passive and active participation are negatively related to disparity (objective losses) in livelihoods impacts of co-management (i.e., fishers who participate passively or actively in the decision-making process are less likely to experience more negative livelihood impacts relative to other fishers in the community) (Chapter 3).

2. By assessing the reasons for perceived distributional and procedural equity in traditional governance systems in Fiji and finding that local conceptions of participation, and the lack thereof, are important reasons for procedural but not distributional fairness or unfairness (Chapter 4).

3. By providing evidence that active participation (relative to passive participation) is positively related to social management outcomes and, specifically, to positive impacts on wellbeing in co-management systems in Chile (Chapter 5).

4. By providing a framework for enhancing procedural equity in conservation (Chapter 2).

These analyses have allowed me to make key general contributions to the theory of participation and procedural fairness:

6.3.1.1. The role of participation

Overall, this thesis supports the hypothesis that participation is important to promote equity and achieve positive social outcomes in natural resource management and conservation. Specifically, the results of this thesis suggest that participation may be relevant to equality (i.e., reducing objective losses from co-management), perceptions of procedural equity, and perceived wellbeing impacts.

6.3.1.2. The forms of participation

In practice, participation can be interpreted in multiple ways and take multiple forms (Arnstein 1969; Pretty 1995; Cornwall 2008), and even be tokenistic and tyrannical (Cornwall 2008; Bixler et al. 2018). Overall, the results of Chapters 3, 4 and 5 suggest that different forms of participation in decision-making may be relevant to achieving different forms of equity (equality and procedural equity) and positive social management outcomes (positive impacts on wellbeing). I found that active participation is related to equality (Chapter 3) and positive impacts on wellbeing (Chapter 5), which aligns with conventional assumptions of participation (i.e., meaningful participation is better) (Arnstein 1969; Pretty 1995). I also found that forms of participation that are not active may be appropriate in specific contexts. For instance, Chapter 3 suggests that passive participation, which is theoretically considered tokenistic (Arnstein 1969; Cornwall 2008), is related to equality. In addition, in Chapter 4, I found that participation (e.g., everyone participates) and community agreements were key reasons for perceptions of procedural equity in traditional Fijian governance systems. However, ‘everyone’ in the community is unlikely to participate in the decision-making process in Fiji where women and other marginalized groups tend to be excluded from decision-making, a so called ‘culture of silence’ (Vunisea 2008). In these contexts, non-active participation may be considered equitable. This is consistent with psychological scholarship, which suggests that greater control over decision-making does not necessarily imply self-determination and procedural equity and that different forms of participation suit different contexts (Decaro & Stokes 2013).

6.3.1.3. Beyond participation

Participation is important for achieving procedural equity; however, it is not sufficient. Often, participation fails to recognize sociocultural diversity, which is fundamental to achieving equity (McDermott et al. 2013; Martin et al. 2016). For instance, conservation organizations often impose external worldviews on local communities (Guibrunet et al. 2021) and promote 'community participation' without recognizing the diversity of social identities within a community (Baker-Medard et al. 2021). To promote procedural equity, we need to look beyond participation and better understand what procedural equity entails. One of the main theoretical contributions of this thesis is to provide a better understanding of what procedural equity is and to develop a framework with new insights and practical guidance for promoting procedural equity in conservation.

6.3.2. Distributional equity

Distributional equity is a complex concept with multiple normative and empirical interpretations (Sabbagh 2001). Particularly in natural resource management and conservation, distributional equity has been evaluated in various ways (Friedman et al. 2018). Most often, the criterion of equality is used to determine equity (ibid). For instance, equality is often evaluated by assessing how costs and benefits are distributed across social identity characteristics (Cinner et al. 2012; Gurney et al. 2015; Gill et al. 2019). In this thesis, I extend this literature by evaluating distributional equity in terms of disparity (i.e., how one person benefited relative to a reference group) (Chapter 3). Understanding disparities is essential because they can have implications for ethical and effective management. For instance, disparities can exacerbate inequalities and harm those who are already more deprived, and relative deprivation can influence attitudes and behaviors (Crosby 1976), with important implications for sustainable management (Loomis & Ditton 1993). However, it is often equity rather than equality (or the lack of disparity) that matters most to people (Starmans et al. 2017). In this thesis, I also contribute to this literature by assessing perceptions of distributional equity, what social identity characteristics are related to it, what are the key reasons behind it (Chapter 4), and how it is related to social management outcomes (Chapter 5). General contributions related to these findings are discussed below.

6.3.3. Social characteristics related to equity

Despite the importance of understanding social characteristics related to equity, research on this topic has been limited, particularly in co-management systems. In this thesis, I contribute to this body of

knowledge by assessing how a number of social characteristics (institutional and socioeconomic) are related to different forms of equity in co-management systems. These analyses have allowed me to suggest that 1) the conditions that make a person perceive disparity may not be the same conditions that make a person experience disparity in objective terms, 2) the conditions that create losses may not be the same as the conditions that create gains, and 3) the conditions that create disparities in one place may not be the same as the conditions that shape perceptions of (in)equity in another place. In addition, my results suggest that different social characteristics may promote different types of equity within the same context. These findings align with the psychological and environmental justice literature, which indicates that: 1) objective disparities may be misperceived (Willis et al. 2022); 2) disparities may not necessarily be perceived as unfair (Crosby 1976), and thus disparity and equity may not be shaped by the same social conditions; and 3) equity is context-dependent, and the pre-existing economic, political, social conditions will shape people's ability to benefit from distributions and participate in decision-making (McDermott et al. 2013; Sikor et al. 2014). Therefore, the social conditions that create disparities or (in)equity perceptions in one place may not necessarily create disparities or shape perceptions of (in)equity elsewhere.

Social identity characteristics do not exist in isolation but are interwoven in complex ways to shape different experiences of inequity. Overlooking these complexities can exacerbate inequities and compromise management efforts. A key contribution of this thesis is the application of an intersectional lens to the assessment of equity perceptions in conservation and natural resource management scholarship. This analysis has allowed me to identify that male migrants are likely to perceive distributional unfairness in co-management systems in Fiji, so special attention should be paid to this group to promote equity in this context. Future studies could use a similar approach to better understand intersectionality in fisheries co-management.

6.3.4. Evidence of the instrumental role of equity

The instrumental role of equity is often advocated as one of two reasons why it is important to achieve equity in natural resource management and conservation (Schreckenberg et al. 2016; Martin 2017). However, few empirical studies have evaluated how equity is related to management outcomes. In addition, these studies consider only one type of equity at a time (either distributional or procedural). In this thesis, I contribute to this body of knowledge by assessing how both distributional and procedural equity relate to social co-management outcomes. My results reinforce the evidence found in other studies suggesting a positive effect of equity on management outcomes (e.g., Lauber & Knuth 1999; Diedrich et al. 2017; Lauer et al. 2018) and further suggest a potentially

larger positive effect on social outcomes when combining the two dimensions of equity (distributional and procedural).

6.3.5. The level of equity in co-management systems

Equity in co-management remains poorly defined and measured (d'Armengol et al. 2018; Quimby & Levine 2018). Many studies have documented inequalities or inequities in co-management (e.g., elite capture, unequal access to decision-making: Bene et al. 2009; Cinner et al. 2012; Gustavsson et al. 2014; Baker-Médard 2017). Others have reported a positive impact of co-management on equity. However, these studies typically refer to an increase in participation (Yang & Pomeroy 2017; d'Armengol et al. 2018) or empowerment (Oldekop et al. 2016). In general, in co-management, quantitative methods are often used to assess differences in distribution (e.g., differences in material gain) and participation, lacking attention to multiple forms of equity (e.g., distributional and procedural equity) (Quimby & Levine 2018) and how they are experienced and perceived within heterogeneous communities (Gibbes & Keys 2010).

I contribute to co-management literature by assessing plural forms of equity (objective and perceived disparity, perceived distributional and procedural equity, and elements of procedural equity) and providing alternative equity measures (e.g., disparity within the community, overall perceived procedural equity) in co-management systems across multiple countries. Particularly, using a rapid method to measure overall equity perceptions (i.e., asking respondents how fair is the distribution of impacts and how fair is the decision-making process) has allowed me to detect whether there is perceived (in)equity in co-management systems without predetermining what equity is. Predefined equity indicators are being used to measure equity (Zafra-Calvo et al. 2019; Bennett et al. 2020), including in co-management systems (Chen et al. 2022). Although they are critical for tracking objective (in)equities and monitoring progress towards equitable management and conservation (Zafra-Calvo et al. 2017), they may not necessarily reflect local conceptions of equity, as equity is plural and context-dependent (McDermott et al. 2013; Sikor et al. 2014). This rapid way of assessing overall perceived equity could be combined with predefined equity criteria indicators (e.g., Zafra-Calvo et al. 2017) to better understand whether equity exists and which equity criteria may explain perceived (in)equity.

In addition, I contribute to this literature by providing empirical evidence of the relatively high levels of perceived equity in fisheries co-management systems. However, the results of this thesis suggest that perceived equity (or equality) may not necessarily coincide with the level of objective equity (or

inequality). Other bodies of literature (e.g., resilience, health, psychology) have found that subjective and objective measures are often moderately related (Jones & d'Errico 2019, Schmalor & Heine 2022) and suggest that both measures play an important role in elucidating the full picture (Jones & D'Errico 2019) and in providing key insights to inform policy and practice. Particularly, paying attention to subjective measures is essential as these are often stronger predictors of key outcomes than objective measures (e.g., perceived inequality is a better predictor of subjective wellbeing than objective inequality (Vezzoli et al. 2023)).

This thesis further suggests that promoting equity in co-management may require different strategies depending on the form of equity being pursued and that it is important to pay particular attention to those who are negatively affected by co-management, as fishers may be more sensitive to losses than to gains (Kahneman & Tversky 1979). I also contribute by highlighting that individuals within communities may experience different levels and forms of (in)equity in co-management arrangements depending on social identity characteristics and how they intersect. Finally, my findings suggest that the high level of perceived equity in co-management may be promoting positive social co-management outcomes and that promoting distributional and procedural equity together may have a greater effect on social co-management outcomes than separately.

6.3.6. Summary of contributions to natural resource management and conservation literature

I contribute to this body of knowledge by offering novel conceptualizations and general insights that enhance the understanding of equity and can guide future research in natural resource management and conservation. In sum, I found that 1) achieving equity may require different strategies depending on the type of equity being sought, 2) participation is not sufficient to promote procedural equity, and recognition, agency, process properties, and interpersonal treatment are crucial, and 3) promoting distributional and procedural equity may enhance positive social management outcomes, especially if they are promoted together.

6.3.7. Contribution to practice

In this thesis, I contribute to natural resource management and conservation practice by providing some insights that may help promote equity:

1. Being clear regarding the type of equity that is being pursued is crucial because promoting different types of equity may require different strategies. In addition, it is important to take

into account both objective and subjective equity and pay attention to perceived losses, as fishers may be more sensitive to losses than gains.

2. Considering both distributional and procedural equity is essential to promoting equity and positive natural resource management and conservation outcomes. Procedural equity is often considered a driver or precondition for achieving distributional equity (Paavola 2007; Scholsberg 2007) and the results from Chapter 3 suggests that perceptions of distributional equity may also influence perceptions of procedural equity. In addition, Chapter 5 suggests that promoting distributional and procedural equity together may lead to better social outcomes than applying only one of these equity dimensions.

3. Another key contribution to practice is the procedural equity framework developed in Chapter 2, which helps inform the promotion of procedural equity beyond participation. This framework suggests what dimensions and criteria may be relevant to achieving procedural equity in a given context. First, fostering recognition of sociocultural diversity prior to the decision-making process may be critical (e.g., what are the underlying value systems and the social identity categories that are recognized?). Second, ensuring the implementation of process properties (e.g., transparency, accountability, neutrality) before, during, and after the decision-making process may also be essential. Promoting agency to redistribute power may also be crucial, especially with regard to marginalized groups. The type of agency needed to promote equity may involve facilitating the voices and/ the influence of individuals, social groups, or the community as a whole. Interpersonal treatment may also be essential to promote procedural equity and can be enhanced by promoting communication that fosters dignity and respect among participants. It is important to note that the relevance of these dimensions and criteria depends on the context.

4. Recognition issues may be related to the marginalization of certain social identity categories and respect for traditional governance systems. In the Fijian context, particular attention should be paid to the distribution and decision-making mechanisms to ensure the equitable inclusion of widows, migrant and/or migrant men, youth, and people with low and high education in small-scale fisheries. Particularly, as the number of young people around the world increases and people adapt to climate change by moving to other locations, youth and migrant identities become increasingly relevant. Importantly, applying an intersectionality lens to identify which combinations of identities form marginalized or privileged groups is critical to achieving equity. In addition, as the findings from Chapter 3 suggest, respect for

traditional governance systems may be key to perceptions of procedural equity. Moreover, attention should be paid to the underlying value systems and power inequalities that shape recognition issues.

5. Several strategies and levers may promote equity if causal relationships are confirmed in future studies. Potential strategies may depend on the type of equity that is being sought and the context. For instance, promoting education may promote perceived distributional fairness; however, as people become more educated, perceptions of distributional and procedural inequity may increase. If the goal is to reduce subjective disparities, strategies could focus on reducing poverty, increasing access to markets, and implementing effective conflict resolution mechanisms, while if the purpose is to minimize objective disparity, it may be necessary to promote participation in decision-making. The review of procedural equity (Chapter 2) provided additional suggestions on potential levers to promote recognition and procedural equity domains and criteria, which include: conflict resolution mechanisms, contextual fit, scalar fit, facilitation, Free Prior Informed Consent, integration of knowledge systems and adaptive and flexible process. Importantly, understanding the trade-offs of promoting equity is essential to ensure that equity does not lead to negative consequences. For instance, increased market access may promote equity and the overexploitation of marine resources (Cinner et al. 2016).

These insights can help promote equity, but challenges remain. A key challenge is that equity issues are context-dependent and dynamic (Dawson et al. 2018b). Therefore, the relevance of these insights may vary depending on the situation, and strategies to promote equity in one place may not work in another. In addition, achieving equity may require an adaptive process (ibid). Another important challenge is that achieving recognition, distributional, and procedural equity may require addressing the broader underlying power dynamics and structures that reproduce injustice (e.g., power inequalities inherited from colonisation processes and traditional customs). Pathways for challenging underlying relations and structures that sustain inequities may include transformative approaches (Ruano-Chamorro et al. 2022) and legal frameworks that legitimize alternative value systems (Guibrunet et al. 2021), among others.

6.4. Critiques and caveats

Most of the critiques and caveats of this thesis are related to the methods and nature of the data used. It is important to note that my original thesis plan mixed qualitative and quantitative methods, but

because COVID-19 boundary closures prevented me from going into the field just a week before my planned and approved fieldwork, I had to rely on existing data that was quantitative in nature and where, most of the time, equity was not the primary focus of the research. Each chapter of this thesis focuses on specific criticisms and caveats. Here I focus on broader criticisms and caveats of this thesis.

Assessing equity issues across multiple co-management systems and countries is an advantage but also a disadvantage. The use of multiple data sets has allowed me to capture different forms of equity in different places and to integrate multiple pieces of evidence to reach general and novel conclusions. However, I could only assess the types of equity available in these datasets, which did not allow me to capture a holistic and deep understanding of equity in a given context. In addition, due to the limitations of these data, I was unable to 1) assess objective equity (only objective disparity based on perceptions in Chapter 2), 2) assess how institutional characteristics are related to perceptions of distributional and procedural equity (only to equality in Chapter 2), 3) analyze the importance of procedural equity criteria in specific contexts, 4) assess how overall procedural equity is related to management outcomes, and 5) assess how equity is related to objective social and ecological management outcomes.

Another limitation of this thesis is that I have primarily used quantitative analysis methods to assess the equity types that were available in the dataset. Relying solely on quantitative analysis and predetermined indicators limits the ability to measure relevant forms of equity and justice (Dawson et al. 2017). For instance, the reference group used in the disparity measure (the community) in Chapter 2 may not be the reference group used by fishers to make the social comparison that shapes perceptions of (in)equity. In addition, there may be other equity concerns and perspectives involving subjects that were excluded from these studies (e.g., non-members of fisher associations, fishers without fishing rights) or that were not sufficiently well represented. Importantly, perceptions of equity may be determined by underlying issues, such as psychological factors, existing power dynamics, and structural barriers. These issues are often overlooked in quantitative analyses and were not considered in the available dataset. Finally, the data and methods used in this thesis were limited in their ability to identify relevant recognition issues.

Another important limitation of this thesis is its inability to infer causality. The analyses used in this thesis have allowed me to understand how social characteristics are related to equity and how equity is related to social management outcomes. However, correlation does not imply causation, and thus I have not been able to determine the mechanisms through which social characteristics influence

equity or how equity influences management outcomes. Yet, I have been able to suggest potential equity drivers and outcomes that can serve as a basis for future causality studies.

6.5. Future research

My thesis provides several directions for future research.

First, achieving equity will mean different things in different contexts because equity judgements are plural and situated. Future research could focus on understanding which recognition concerns and which procedural equity domains and criteria are most relevant in a certain context (see procedural equity framework in Chapter 2). It is important to pay particular attention to 'participation' because it may be applied as a mechanism to promote procedural equity but its meaning can take many forms in practice. Ignoring what form of participation fits in a certain context may limit its ability to enhance equity. In addition, despite the relevance of recognitional issues for understanding equity and justice issues (e.g., recognition underpins distributional and procedural equity) (Lecuyer et al. 2018; Lau et al. 2021a), there is a lack of studies focusing on recognition (Friedman et al. 2018). Future studies could use qualitative methods to identify locally relevant recognitional concerns (Dawson et al. 2017). See Chapter 4 for a more detailed description of future research on recognition.

Second, future studies could also focus on better understanding the correspondence between different approaches to equity (objective vs subjective equity and normative vs empirical equity). Assessing equity perceptions is critical to elucidate locally relevant equity concerns (Dawson et al. 2017). However, assessing equity perceptions is also limited in its ability to identify injustices that are caused by underlying structural issues (e.g., gender norms and psychological factors). For instance, according to the System Justification Theory, people see social institutions as legitimate even if these institutions affect them negatively (Jost et al. 2010). Objective inequities, such as inequalities that harm marginalized groups, may not be captured by equity perceptions assessments. Therefore, measuring both perceived and objective equity (and equality) may provide a more complete understanding of what (in)equities exist in a certain context. In addition, understanding whether normative justice principles, such as those included in equity policies, are considered fair in a certain context is key. Particularly, cultural norms and traditional governance institutions may not align with normative justice principles from international equity policies (e.g., Sustainable Development Goals, Convention on Biological Diversity, The Convention on the Elimination of all Forms of Discrimination Against Women), and thus, recognize traditional governance systems and gender

equity may conflict in practice (Kleiber et al. 2017). Future research could focus on better understanding tensions between cultural relativism and justice and identify strategies to promote equity in these situations.

Third, an important direction is to investigate how institutional and socioeconomic characteristics are related to objective and perceived equity and pay special attention to the underlying roots and causes of inequity (e.g., unequal access to rights, social, cultural and gender norms, power inequalities). In particular, future studies could further explore how context-relevant combinations of social identities (i.e., intersectionality) shape both objective and perceived equity in different contexts. In addition, further research is needed to better understand the reasons and mechanisms that cause particular social identities to experience inequities. Future research could also focus on understanding what psychological (e.g., system justification theory: Tyler 2015; Martin & Myers 2018) and cultural (e.g., collectivistic, individualistic: Leung 2005) factors and mechanisms shape equity perceptions.

Fourth, promoting a better understanding of how to achieve equitable and effective management and conservation is crucial. Equity and effectiveness are both desirable goals for a sustainable future and targets of international policies and conventions, including the recently adopted 30x30 target under the Convention on Biological Diversity, which aims to protect 30% of the planet by 2030 (CBD 2022). Future research could focus on understanding the relationship (trade-offs and synergies) between equity and management and conservation outcomes (e.g., resource sustainability, biodiversity conservation) (e.g., Klein et al. 2015) and the potential mechanisms influencing this relationship (e.g., group identity, legitimacy) (Tyler & Blader 2003; Turner et al. 2016; Gurney et al. 2019). Importantly, equity may be a mechanism to promote effectiveness. Thus, focusing on better understanding the instrumental role of equity is critical (i.e., does equity promote positive management and conservation outcomes?).

Fifth, future studies could apply mixed methods and alternative quantitative methods to better understand equity issues. For instance, qualitative methods could be used to identify relevant forms of equity (e.g., distributional and procedural equity criteria) in a specific context, including those that may be overlooked using predefined forms of equity. In addition, qualitative studies could be useful to dissect and contextualize the findings of quantitative analysis. For instance, interviews or focus groups could be conducted to explore the views of a specific social group (e.g., migrant men, widows) and identify possible key drivers or explanations for equity in a given context. Importantly, recognition issues are complex are difficult to predetermine (Walker 2012; Dawson et al. 2018b); therefore, qualitative studies could elucidate recognition concerns in specific contexts. In terms of

quantitative analysis, future research could assess the causal effect of potential drivers of equity, such as those suggested in this thesis, or the effect of equity on management and conservation outcomes (i.e., the instrumental role of equity) through impact evaluation, which involves focusing on design over methods and the use of counterfactuals (Ferraro & Hanauer 2014). Particularly, evidence on whether co-management leads to equity or inequity remains scarce. Future studies should conduct impact evaluation assessments (Ferraro & Hanauer 2014) to provide evidence of the effect of co-management on equity.

6.6. Conclusion

Advancing equity in conservation and natural resource management is a moral imperative and is considered key to building a socially and ecologically thriving future. In addition, promoting equity is an essential objective on the global political agenda and, as a result, equity is being advocated by multiple institutions worldwide. However, promoting equity is a complex endeavour and there is still a limited understanding of the meaning of equity, the mechanisms to promote it, and its potential effect on natural resource management and conservation success. My thesis makes a significant contribution towards filling these critical knowledge gaps using small-scale fisheries co-management as a case study. My thesis shows that different forms of equity are associated with different social characteristics which suggests that promoting equity may require different strategies depending on the type of equity that is being sought and the specific context. In addition, my thesis demonstrates the importance of applying an intersectional lens to the investigation of equity, it concludes that advancing procedural equity (i.e., fair decision-making process) may require promoting other elements beyond participation (recognition, interpersonal treatment, and process properties such as transparency and neutrality), and shows that equity is positively related to social management outcomes. A better understanding of the causality of the relationships identified in this thesis and the power dynamics and structural barriers underlying equity issues are key to advancing justice in natural resource management and conservation.

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Appendices

Appendix A Supplementary Material for Chapter Two

Advancing procedural justice in conservation

Table S1. Procedural justice criteria. We conducted a non-systematic review of three bodies of literature (Participatory conservation, Environmental justice and Psychology of justice) and identified key theories and frameworks that provided criteria to promote procedural justice in decision-making. Only criteria associated directly with justice, equity or fairness was included in this framework. Multiple criteria from the literature were identified (third column). Criteria with similar conceptual meaning were grouped under a 'Procedural justice criterion' (second column) and a 'domain' (first column).

Domain	Procedural justice criterion	Criterion from literature	Description	Body of literature	References
Process properties 	***Transparency***	*Transparency*	'The process should be transparent so that the public can see what is going on and how decisions are made' (Rowe & Frewer 2000). 'Participants clearly see how the process is structured and how a decision is reached' (Dalton 2005). Transparent and structured opportunities to engage (Reed et al. 2018).	Participatory conservation	(Rowe & Frewer 2000; Dalton 2005; Reed et al. 2018)
		Representativity	'The process of stakeholder selection has to be open and transparent.'	Participatory conservation	(Buchy & Hoverman 2000)
		Accountability	Ensure transparency, 'timely access to information about: what is at stake in decision-making; which processes and institutions can exert influence.'	Participatory conservation	(Borrini-Feyerabend et al. 2013)

		Transparency	Transparent decision-making process 'supported by timely access information in appropriate forms' (Schreckenberg et al. 2016). 'Local stakeholder groups accessing information about management and planning' (Zafra-Calvo et al. 2017).	Environmental justice	(Schreckenberg et al. 2016; Zafra-Calvo et al. 2017)
		Participation	'Meaningful participation requires information sharing through many multidirectional approaches that provide equitable knowledge-sharing opportunities and well-structured dialogue among participants.'	Environmental justice	(George & Reed 2017)
		*Recognition***	'Well-designed communication structures that promote information sharing among participants and the broader public to promote transparency and accountability.'	Environmental justice	(George & Reed 2017)
		Adequate information	'Being given adequate information.'	Environmental justice	(Gross 2007)
		Information	'All people should have access to high-quality information.'	Environmental justice	(Sovacool 2013)
		Informational justice or information	'Clear and adequate explanations of, or justification, for allocation decisions.' 'Supply adequate and correct information to all persons involved.'	Psychology of justice	(Colquitt et al. 2001; Vermunt & Steensma 2016)
	Accountability	*Accountability*	Ensure transparency regarding 'who is responsible for what; and how these people can be made accountable.'	Participatory conservation	(Borrini-Feyerabend et al. 2013)
		Accountability	'Accountability for actions and inactions' (Schreckenberg et al. 2016). 'Local stakeholders groups knowing to whom to raise concerns for solving issues related to management actions' (Zafra-Calvo et al. 2017).	Environmental justice	(Schreckenberg et al. 2016; Zafra-Calvo et al. 2017)

		*Recognition***	'Well-designed communication structures that promote information sharing among participants and the broader public to promote transparency and accountability.'	Environmental justice	(George & Reed 2017)
	Neutrality	*Neutrality*	'The neutrality factor refers to neutral decision making, based on objective facts and honesty, and it involves the absence of bias and prejudice' (Vermunt & Steensma 2016). 'Basically, people seek a *level of the playing field* in which no one is unfairly disadvantaged' (Tyler 2000). The definition and also when operationalized (e.g., Tyler 1997) contains concepts that are similar to accuracy, consistency, and lack of bias. Therefore, we decided to group them under neutrality to reduce framework complexity.	Psychology of justice	(Lind & Tyler 1988; Tyler 1989, 2000; Vermunt & Steensma 2016)
		Accuracy	'All decisions should be based on information that is good and accurate.'	Psychology of justice	(Leventhal 1980; Tyler 1989)
		Consistency	'Procedures are the same for different persons and consistent over time.'	Psychology of justice	(Leventhal 1980; Tyler 1989)
		Lack of bias	'Personal self-interest and preconceptions of allocators are not allowed to play a role in the decision.'	Psychology of justice	(Leventhal 1980; Tyler 1989)
		Impartiality	Impartiality of the decision-maker.	Environmental justice	(Gross 2007)
		Due process	'Neutral arbitration should be available to handle grievances.'	Environmental justice	(Sovacool 2013)
		Independence	'The participation process should be conducted in an independent, unbiased way.' (Similar to lack of bias).	Participatory conservation	(Rowe and Frewer 2000)
	Correctability	*Correctability*	'Existence of opportunities to ask for a modification of decisions, so persons have the right to appeal against a decision.'	Psychology of justice	(Leventhal 1980; Tyler 1989)

	Ethicality	*Ethicality*	Process compatible with fundamental moral and ethical values.	Psychology of justice	(Leventhal 1980; Vermunt & Steensma 2016)
	Trustworthiness	*Trustworthiness/ trust*	Beliefs about the good intentions of the authority (group leaders, managers, or those with power to make decisions about allocations). 'Belief that the intentions of third parties are benevolent, that they desire to treat people in a fair and reasonable way'. People 'judge whether a person is benevolent and caring, is concerned about their situation and their concerns and needs, considers their arguments, tries to do what is right for them, and tries to be fair' to assess a person's trustworthiness.	Psychology of justice	(Tyler 1989, 2000; Tyler & Lind 1992)
Agency 	*Representation** **(Voice and decision control)**	*Representation*	Opportunity for input, influence over final decisions (Dalton 2005, Reed 2008). 'Power dynamics effectively managed to give all participants equal opportunities to contribute knowledge and influence outcomes' (Reed et al. 2018). Integrate diverse interests. (Representativity) 'Ascertain power relationships between stakeholders' (Buchy & Hoverman 2000). It is important to consider if stakeholders have been clearly defined if members of stakeholder groups have the same voice and opportunity to participate, and how stakeholders' views have been obtained (Buchy & Hoverman 2000).	Participatory conservation	(Buchy & Hoverman 2000; Rowe & Frewer 2000; Dalton 2005; Reed 2008; Reed et al. 2018),

		‘The public participants should comprise a broadly representative sample of the population of the affected public’ (Rowe & Frewer 2000).		
	Fairness	‘Attend (be present), initiate discourse (make statements), participate in the discussion (ask for clarification, challenge, answer, and argue), and participate in the decision-making (resolve disagreements and bring about closure).’	Participatory conservation	(Webler & Tuler 2000)
	Legitimacy	‘Integrate diverse interests and ensure equal participation.’ ‘Mere participation does not guarantee the legitimacy of the process; other factors such as time and resource availability, potential misrepresentations or dealing with strategic behaviors have to be addressed’. Criterion similar to fairness criterion (Webler & Tuler 2000).	Participatory conservation	(Díez et al. 2015)
	Deliberation and inclusion	Deliberation involves ‘careful consideration and discussion’ and ‘implies that different positions of stakeholders are recognized and respected.’ ‘Inclusion is the action of including different participants in these processes.’	Participatory conservation	(Brown 2003)
	Early involvement	‘The public should be involved as early as possible in the process.’	Participatory conservation	(Rowe & Frewer 2000)
	Representativenesss	‘The concerns of all important (sub)groups and individuals are somehow represented in the allocation process.’ This is often realised by giving voice to individuals or through persons who represent the group (Vermunt & Steensma 2016).	Psychology of justice	(Leventhal 1980; Vermunt & Steensma 2016)
	Inclusiveness, full and effective participation.	Inclusiveness: ‘Assuring the representation of all affected social positions and perspectives in discussion and decision making’ (Hunold & Young 1998).	Environmental justice	(Hunold & Young 1998; Gross 2007; Schreckenberg et al. 2016;

			Full and effective participation: Meaningful influence (Schreckenberg et al. 2016). Measured as satisfaction with how decisions are taken in Zafra-Calvo et al. 2017. Stakeholders are heard and their 'contributions are valued, respected, and considered' (i.e., voice), and they have opportunities for affecting outcomes (i.e., influence) (George & Reed 2017). 'Participate in determining how issues are framed' (George & Reed 2017). 'Full participation in the process' (Gross 2007).		Zafra-Calvo et al. 2017)
		Consultation over time	'The decision-making process must allow for discussion over time, so that so that knowledge may be maximized at all stages of decision-making.'	Environmental justice	(Hunold & Young 1998)
		*Recognition***	'Broadly accessible to a diversity of stakeholders.' 'Special consideration and possibly accommodation made for affected groups, especially those marginalized in the past.'	Environmental justice	(George & Reed 2017)
		Due process	'Ensure stakeholder participation in policymaking process.' 'Communities must be involved in deciding about projects that will affect them; they must be given fair and informed consent […]; and neutral arbitration should be available to handle grievances.'	Environmental justice	(Sovacool 2013)
	Voice	*Legitimacy and voice*	Ensuring representation and voice of stakeholders ('have a say in advising and/or making decisions'), promoting active engagement, respect, maintaining active dialogue and seeking consensus, and providing special support to vulnerable groups (e.g., women, youth, Indigenous people) and prevent discrimination.	Participatory conservation	(Borrini-Feyerabend et al. 2013)

		Voice	'Ability to express an opinion.'	Environmental justice	(Gross 2007)
		Process control	'Control over the presentation of evidence'. 'Process control is, actually, a form of *voice*, i.e., people have a say, they have the right to present their personal view on reality and on the causal chain of events, but they don't have the formal power to make the final decision.'	Psychology of justice	(Thibaut & Walker 1975; Vermunt & Steensma 2016)
	Decision control	*Decision control*	Control over actual outcomes or decisions.	Psychology of justice	(Thibaut & Walker 1975; Vermunt & Steensma 2016)
		Influence on outcomes	Ability to influence the decision or final outcomes. Rowe and Frewer state that the influence should go beyond the procedures and have an impact on policy. Provide the same opportunities to participate and to influence outcomes (Reed et al. 2018). It is mentioned that managing power dynamics is necessary to provide everyone equal opportunities to contribute and recognize the value of all participants' contributions (Reed 2008, Reed et al. 2018).	Participatory conservation	(Rowe & Frewer 2000; Webler & Tuler 2000; Reed 2008; Reed et al. 2018)
		Shared decision-making authority and authoritative decision making	'Egalitarian participation […] in discussion and decision-making'. 'Decisions made by the participants should decide the policy solutions.'	Environmental justice	(Hunold & Young 1998)
	Capabilities	*Capabilities or resource accessibility*	Technical capabilities, information, material, human and material resources, and skills that are necessary to engage effectively in decision-making.	Participatory conservation	(Reed 2008)

			Rowe and Frewer (2000) mention that capabilities are important for participation efficiency but do not link them directly with fairness.		
		Representativity	'Ensure the [difference in the ability] to meet transaction costs of representation is not allowed to bias the consultative outcome.'	Participatory conservation	(Buchy & Hoverman 2000)
		Equal resource and access to information	Compensate weaker parties for power disparities by providing informational or economic support (Hunold & Young 1998).	Environmental justice	(Hunold & Young 1998)
		Capabilities	'Research and information development supported by the organization should be accessible to the broader community.' 'Build knowledge, skills and abilities to ensure that participants are able to meet current demands and address future challenges.' 'Knowledge and awareness should be strengthened through relationship building and collaborative learning.' 'Research and information developed by supporting organizations should be useful to and shared with the community.' 'Policy, planning and standard setting should be monitored to ensure the desired results.'	Environmental justice	(George & Reed 2017)
Interpersonal treatment	**Respect and politeness**	*Standing/ Treatment with dignity and respect*	Polite and respectful treatment and showing respect for one's rights provides information about the status of an individual within a group and are important in shaping perceptions of procedural justice. 'People value having respect for their rights and their status within society' (Tyler 2000).	Psychology of justice	(Lind & Tyler 1988; Tyler 1989, 2000; Tyler & Lind 1992; Tyler & Blader 2003)

	*Interpersonal justice*	'Degree to which people are treated with politeness, dignity and respect by authorities or third parties involved in decision-making processes' (Colquitt et al. 2001).	Psychology of justice	(Bies & Moag 1986)
	Respect	'Being treated with respect' (Gross 2007 based on theories of Psychology of justice).	Environmental justice	(Gross 2007)

*Representation is similar to voice and decision control. Following Thibault and Walker 1975, we used voice and decision control.

** In George and Reed (2017) recognition is described as a component of procedural justice. While we consider recognition as a dimension of justice at the same conceptual level as procedural justice, we included the recognition components identified by George and Reed (2017) in the domains of Process Properties and Agency.

Appendix B Supplementary Material for Chapter Three

Disparities in the impacts of co-management on fishers´ livelihoods

B1. Model selection

We followed an information theoretic-approach to model selection (Grueber et al. 2011). We generated a global model with all the predictor variables (Table S1) for each response variable (i.e., subjective losses, subjective gains, objective losses, and objective gains). Continuous variables were standardized by subtracting their mean and dividing by two times their standard deviation; variables thus take a $\alpha \pm 0.5$ value, and are on the same scale as binary variables, easing comparisons of relative effects of variables bearing different units (Gelman & Gill 2006). Covariates were checked for multicollinearity by calculating the variance inflation factor. From the global model we generated a submodel set (including the null model) using the dredge function implemented in the *MuMin* package (Barton 2009).

Model selection was made by comparing multiple models and ranking them based on Akaike's information criterion. Models within $\Delta AIC<2$ difference were selected and averaged using the model.avg function from the *MuMin* package (Barton 2009). Model averaging provides weighted parameter estimates based on the models that were selected and it provides estimates of uncertainty for parameters that account for model selection uncertainty and sampling variance (Burnham & Anderson 2002). Model selection resulted in a total model set of 14 for subjective losses, 46 for subjective gains, 26 for objective losses, and 384 for objective gains. Models were averaged using the zero method (or full average), rather than the natural average method (conditional average). In the zero method, the parameter estimate is substituted by a zero when the parameter is absent in a model, and this model is considered for the average calculation. In the natural average method, if a model does not have a parameter, the model is excluded from the average calculation of that parameter (Grueber et al. 2011). The zero method decreases the weight of parameters that are absent in some models and is preferable to determine the factors that have the strongest effect on the response variable (Nakagawa & Schielzeth 2010). The relative importance of each parameter was

also calculated by summing the Akaike weight from all models containing that variable. All analyses were conducted using R software (version 4.1.2).

B2. Institutional and socioeconomic characteristics

Table S2. Institutional and socioeconomic characteristics we examined as predictor variables in my models. KI= key informant interview, HS= random (in Kenya and some Indonesian villages) or systematic household survey, CL= community leader, OL= Organizational leader, SI= secondary information.

Predictor variables	Description	Method
Socioeconomics characteristics		
Market distance	Distance between the community and the provincial market (km).	CL, SI
Population size	Village population size. Obtained from local census or calculated by multiplying the average household size by the total number of households in the community.	HS, CL, SI
Wealth (Material style of life)	Principle component analysis of the material style of life 13 indicators including television, VCR, electricity, fan, pipe water, mobile phone, electric lighting, radio, bicycle, type of floor, roofs, and wall (Cinner et al. 2012).	HS
Gender	Male or Female	HS
Migrant	Whether the respondent was born in another village	HS
Occupational diversity	Number of different occupations per household.	HS
Primary livelihood	Whether the respondent ranked marine resource use (i.e., fishing, selling marine products, gleaning) as their primary occupation. Indicator of resource dependence.	HS
Education	Years of formal education	HS
Community events	Number of community events attended, such as feasts, ceremonies, celebrations, etc. The frequency of participation in community events was standardized to the mean for each country. Thus, we examined whether respondents participated in more of less than the average number of community events in the context of their specific country.	HS
Trust on leaders	Level of trust in community leaders. 5-point Likert- type scale.	HS
Institutional characteristics		
Access restrictions	Whether access to fishing grounds was restricted or prohibited to non-members	OL, CL, KI
Area restrictions	Whether fishing was prohibited in certain areas	OL, CL, KI
Gear restrictions	Whether certain gears were prohibited	OL, CL, KI
Participation in decision-making	Level of involvement in decision making: 0 = no attendance; 1 = passive participation (e.g., attending meetings but do not talk or	KI, SI

	participate); and 3= active participation (e.g., elected role, actively voice opinions in meetings, etc.)	
Graduated sanctions	A co-management site was considered to have graduated sanctions when key informants and community leaders affirmed that sanctions increased with the severity or number of offences committed.	KI, OL
Conflict resolution	Existence of mechanisms in place to resolve conflicts between organizational members and if they had resolved them successfully (none, few, half, most, or all of the conflicts). Reponses were treated as a five-point ordinal scale. Having no conflict resolution mechanisms was considered lower on the scale than having conflict resolution mechanisms but being unable to resolve any.	KI, OL, SI
Clear boundaries	Existence of clearly defined resource boundaries was recorded as yes or no, depending on whether all key informants agreed that there has never been confusion about the boundaries. In cases where there has been confusion, the interviewee was probed for further details and where possible, court cases or other documents were examined. Likewise, clearly defined membership was also recorded as yes or no depending on whether key informants agreed that there has not been confusion over who are members of the organization involved in co-management.	OL, CL, KI

B3. Relative importance of predictors

Table S3. Relative importance of predictors across the model sets for each of the response variables, based on the sum of Akaike weights of the models in which the variable is present.

Predictor variables		**Models**			
		Subjective losses	**Subjective gains**	**Objective losses**	**Objective gains**
Socioeconomic characteristics	Market distance	**1.00**	0.04	0.06	0.12
	Population size	**1.00**	**1.00**	**1.00**	0.20
	Wealth	**1.00**	**1.00**	-	0.07
	Gender	0.71	-	-	0.08
	Migrant	0.05	0.50	0.06	
	Occupation diversity		0.21	0.06	0.12
	Primary livelihood	0.25	0.02	0.70	0.31
	Education	0.05	0.02	-	0.03
	Community events	**1.00**	**0.98**	**1.00**	0.09
	Trust on leaders	0.05	0.09	0.48	0.56
	Access restrictions	**1.00**	0.20	**1.00**	0.35

Institutional characteristics	Area restrictions	**1.00**	0.08	0.05	0.14
	Gear restrictions	-	0.15	**1.00**	0.81
	Active participation DM	-	-	**1.00**	0.10
	Graduated sanctions	0.30	0.03	0.22	0.48
	Conflict resolution	**1.00**	0.36	0.13	0.49
	Clear boundaries	0.26	0.65	0.24	0.04

B4. Data availability

The data has been deposited on Research Data JCU and it is available at https://doi.org/10.25903/ypbj-zf68. The code can be accessed at https://github.com/cristinaruanochamorro/RuanoChamorroetal_2023_Disparity_Comanagement.

Appendix C Supplementary Material for Chapter Four

An intersectional perspective on equity in coastal Fiji

C1. Material style of life (i.e., wealth)

Table S4. Material style of life index. Factor loading of the first principal component analysis of five household assets. This component accounted for 51% of the total variance.

Material item	Factor loading
DVD	-0.44
Washing machine	-0.43
Fridge	-0.48
TV	-0.48
Satellite	-0.40

C2. Reasons for distributional and procedural equity

Table S5. Additional reasons for distributional equity.

Dimension	Fair (and neutral) Distribution		Unfair (and neutral) Distribution	
	Theme	Description	Theme	Description
Other	Other	'Members of the community are sometimes used to fish along the coastal areas'; 'Trade-off between distance and benefits'; 'Because the elders who are not informed about its important are breaking the rules.' 'Concerned that older people setting bad example to younger in that they open *qoliqoli* too often poach'; 'Fair because as far as she knows her and her husband is doing their work but not too sure the rest of the committee is'.	Other	NA

Table S6. Additional reasons for procedural equity.

Dimension	Fair (and neutral) Procedure		Unfair (and neutral) Procedure	
	Theme	**Description**	**Theme**	**Description**
Other	Other	'Ok at the moment. Major awareness is needed here'; 'But has its advantages and disadvantages'; appropriate rules (Rules are implemented accordingly to the resource system (e.g., catch sizes), 'Follows government structure', 'follows democratic process'.	Other	'Because only one person is in charge of the licenses'; 'Because the chief is not very supportive', 'proper channels are being followed'

C3. Cumulative regression models

Table S7. Description of different models used to assess the effect of intersectionality and social identity characteristics on perceptions of distributional justice, and their overall ranking based on leave one out information criteria (LOOIC).

Model name	Description	Overall rank (LOOIC)
M1	Perceived distributional fairness = gender + migrant status + marital status + education + wealth +age	2 (429.9)
M2	Perceived distributional fairness = gender * migrant status + marital status + education + wealth +age	1 (423.4)
M3	Perceived distributional fairness = gender *marital status + migrant status + education + wealth +age	5 (429.9)
M4	Perceived distributional fairness = gender * education + marital status + migrant status + wealth +age	6 (430.2)
M5	Perceived distributional fairness = gender * wealth + education + marital status + migrant status +age	4 (426.7)
M6	Perceived distributional fairness = gender *age + wealth + education + marital status + migrant status	3 (425.3)

Table S8. Description of different models used to assess the effect of intersectionality and social identity characteristics on perceptions of procedural justice, and their overall ranking based on leave one out information criteria (LOOIC).

Model name	Description	Overall rank (LOOIC)
M1	Perceived procedural fairness = gender + migrant status + marital status + education + wealth +age.	1 (478.1)

M2	Perceived procedural fairness = gender * migrant status + marital status + education + wealth +age	3 (423.4)
M3	Perceived procedural fairness = gender *marital status + migrant status + education + wealth +age	4 (481.1)
M4	Perceived procedural fairness = gender * education + marital status + migrant status + wealth +age	5 (482.2)
M5	Perceived procedural fairness = gender * wealth + education + marital status + migrant status +age	3 (480.2)
M6	Perceived procedural fairness = gender *age + wealth + education + marital status + migrant status	2 (480.1)

Table S9. Bayesian cumulative mixed-effects models. Variables influencing perceptions of distributional equity of positive and negative impacts from co-management. Posterior means and 95% credible intervals are shown. Quantitative variables (wealth and age) were standardized by subtracting the mean and dividing by 2 sd. LOO scores of all models were compared with the LOO score of the best fitting model. The lower the loo difference score, the better the predictive accuracy the model. Bold indicates if credible intervals include the zero.

Variables	Additive model	Migrant & Gender interaction model	Marital status & Gender interaction model	Education & Gender interaction model	Age & Gender interaction model	Age & Gender interaction model
Men	0.09 [-0.64 0.82]	0.39 [-0.45 1.22]	0.08 [-0.69 0.90]	0.09 [-0.77 0.99]	0.09 [-0.60 0.84]	0.08 [-0.62 0.77]
Marital status single	0.09 [-0.97 1.11]	0.13 [-0.88 1.16]	0.11 [-1.26 1.48]	0.09 [-0.94 1.15]	0.08 [-0.96 1.07]	0.06 [-0.98 1.12]
Marital status widow	**-1.33 [-2.38 -0.32]**	**-1.34 [-2.40 -0.29]**	**-1.35 [-2.50 -0.18]**	**-1.30 [-2.37 -0.26]**	**-1.31 [-2.39 -0.23]**	**-1.37 [-2.39 -0.35]**
Migrant	**-0.71 [-1.39 -0.03]**	-0.27 [-1.13 0.59]	**-0.70 [-1.41 -0.02]**	**-0.72 [-1.40 -0.03]**	**-0.72 [-1.44 -0.04]**	-0.71 [-1.39 0.04]
Primary education	**-0.85 [-1.66 -0.04]**	**-0.90[-1.71 -0.07]**	**-0.72 [-1.50 -0.08]**	-1.84 [-1.98 0.33]	**-0.85 [-1.67 -0.03]**	**-0.84 [-1.66 -0.06]**
Tertiary education	**-0.99 [-1.78 -0.19]**	**-1.06 [-1.86 -0.32]**	**-0.97 [-1.75 -0.20]**	-0.87 [-1.89 0.13]	**-0.99 [-1.78 -0.21]**	**-0.97 [-1.76 -0.23]**
Wealth	0.17 [-0.52 0.82]	0.20 [-0.45 0.86]	0.18 [-0.49 0.84]	0.18 [-0.51 0.87]	0.17 [-0.51 0.85]	0.41 [-0.38 1.21]
Age	0.50 [-0.26 1.29]	0.59 [-0.19 1.37]	0.47 [-0.29 1.24]	0.48 [-0.31 1.26]	0.45 [-0.64 1.55]	0.51 [-0.25 1.27]
Men x migrant		**-1.19 [-2.55 0.18]**				
Men x Marital status single			-0.04 [-1.83 1.79]			
Men x Marital status widow			0.12 [-1.72 2.6]			

Men x Primary education				0.20 [-1.31 1.72]		
Men x Tertiary education				-0.18 [-1.58 1.24]		
Men x age					0.08 [-1.21 1.39]	
Men x wealth						-0.63 [-1.91 1.68]
Loo difference score (elpd_diff)	-0.8	**0.0**	-3.2	-3.3	-1.7	-0.9

Table S10. Bayesian cumulative mixed effects models. Variables influencing perceptions of procedural justice. Quantitative variables (wealth and age) were standardized by subtracting the mean and dividing by 2 sd. The predictive accuracy of the models was compared using LOO (leave one out cross validation) scores. LOO scores of all models were compared with the LOO score of the best fitting model. The lower the loo difference score, the better the predictive accuracy the model. Bold indicates if credible intervals include the zero.

Variable	Additive model	Migrant & Gender interaction model	Marital status & Gender interaction model	Education & Gender interaction model	Age & Gender interaction model	Wealth & Gender interaction model
Men	0.31 [-0.40 1.00]	0.37 [-0.41 1.17]	0.12 [-0.66 0.94]	0.24 [-0.63 1.09]	0.30 [-0.40 1.01]	0.31 [-0.41 1.04]
Marital status single	0.55 [-0.41 1.52]	0.57 [-0.37 1.57]	0.29 [-1.03 1.64]	0.53 [-0.45 1.51]	0.53 [-0.45 1.59]	0.55 [-0.46 1.55]
Marital status widow	-0.23 [-1.15 0.76]	-0.23 [-1.17 0.75]	-0.47 [-1.58 0.60]	-0.16 [-1.14 0.89]	-0.25 [-1.31 0.82]	-0.23 [-1.21 0.70]
Migrant	-0.52 [-1.14 0.11]	-0.45 [-1.22 0.30]	-0.55 [-1.18 0.10]	-0.53 [-1.18 0.11]	-0.52 [-1.17 0.11]	0.52 [-1.16 0.12]
Primary education	-0.24 [-1.03 0.55]	-0.16 [-0.96 0.62]	-0.21 [-0.99 0.63]	-0.44 [-1.51 0.60]	-0.24 [-1.02, 0.57]	-0.24 [-1.03 0.57]
Tertiary education	**-0.91 [-1.62 -0.19]**	**-0.88 [-1.63 -0.16]**	**-0.92 [-1.63 -0.20]**	**-0.90 [-1.79 -0.02]**	**-0.91 [-1.61 -0.21]**	**-0.91 [-1.65 -0.21]**
Wealth	0.10 [-0.52 0.71]	0.12 [-0.50 0.72]	0.15 [-0.48 0.86]	0.08 [-0.56 0.70]	0.11 [-0.54 0.69]	0.16 [-0.61 0.94]

Age	0.21 [-0.48 0.89]	0.20 [-0.52 0.92]	0.26 [-0.44 1.01]	0.21 [-0.48 0.92]	0.26 [-0.731.22]	0.22 [-0.51 0.95]
Men x Migrant		-0.17 [-1.47 1.15]				
Men x Marital status single			0.53 [-1.29 2.38]			
Men x Marital status widow			1.05 [-1.01 3.14]			
Men x Primary education				0.45 [-1.06 1.96]		
Men x Tertiary education				0.01 [-1.43 1.36]		
Men x age					-0.08 [-1.31 1.18]	
Men x wealth						-0.18 [-1.40 1.03]
Loo difference score (elpd_diff)	0.0	-1.4	-1.5	-2.0	-1.1	-1.0

C4. Data availability

The dataset is confidential and cannot be shared. The R scripts used in this chapter will be uploaded to the institutional data repository of James Cook University upon publication.

Appendix D Supplementary Material for Chapter Five

Social equity in fisheries co-management is related to positive outcomes

D1. Methods

Control variables:

Socioeconomic characteristics:

Socioeconomic characteristics can determine how people benefit from certain outcomes and procedures, and thus influence wellbeing and satisfaction, and also equity perceptions through self-interest or egocentric bias. For instance, wealth is associated with a preference for economic efficiency-based principles and decreased preference for equality (Gurney et al. 2021b). In addition, people with different social identities (e.g., gender, migrant status) have different roles, power, and abilities to participate in decision-making processes and benefit from management, which can influence their perceptions of equity and management outcomes. See Table S1 for a detailed description of control variables.

TURFs profits:

Profit from management can have an effect on wellbeing and satisfaction with management. In addition, profits can also lead to equity perceptions through self-interest bias (Sabbagh & Schmitt 2016). Therefore, we include individual profit from TURFs in order to separate the effect of economic benefits and equity perception on management outcomes.

Table S11. Description of control variables. The control variables were collected through individual social surveys conducted with fishers. Information regarding distance to markets was collected through social surveys conducted with leaders.

Predictors	Description	Operationalization
Profit from TURFs	Self-interest motives are often confounded with justice motives (Tyler 2015). I included individual profit from TURFs in order to separate the effect of economic benefits and equity perception on management outcomes.	How do you think your profit would change without the TURF? (More, same, less)
Wealth	Wealth may have an effect on perceptions of equity (Gurney et al. 2021b) and livelihood impacts (Cinner et al. 2012).	Monthly expenditures
Gender	Women and men have different roles, power, and abilities to participate in decision-making processes and benefit from management. This may influence their perceptions of wellbeing and satisfaction with TURF management and the fisher organization.	Women or men
Migrant	Migrants are often marginalized from management arrangements, and thus being a migrant can influence perceptions of equity, wellbeing and satisfaction.	Whether the respondent is from another village.
Education	Educated people may be more able to access resources, influence decision-making process, access more benefits, and exposure to external equity norms (Gurney et al. 2021b) which may influence their perceptions of procedural and distributional equity, wellbeing, and satisfaction.	Highest level of education attained
Occupational multiplicity	Dependency on marine resources can lead to non-compliance (Cinner et at. 2012) and reduce management performance. Those who depend more on fishing are more sensitive to both positive and negative impacts from management than those who are less dependent. This may influence perceptions of equity and wellbeing (e.g., fishers who are more dependent on marine resources may prefer distributional principles, such as need, that are different from principles that are preferred by non-dependent fishers).	Number of different occupations. Indicator of resource dependence.
Primary livelihood		Whether respondent ranked marine resource use (i.e., fishing, gleaning) as their primary occupation. Indicator of resource dependence.
Trust in community	Trust in community and community events are indicators of social capital, and can influence perceptions of equity (Diedrich et al. 2017) and management outcomes (Gutiérrez et al. 2011).	Level of trust in community. Indicator of social capital
Community events		Number of community events outside the family

Market distance	Markets can influence equity perceptions and management outcomes. For instance, proximity to markets may provide access to resource and economic opportunities (Bene et al. 2010), it may reduce dependency on middlemen (Maire et al. 2020; Rojas et al. 2021), and lead to resource overexploitation (Cinner et al. 2016). In addition, markets can increase people´s preferences for equality (Henrich et al. 2010) but may also crowd out intrinsic behavior (Cinner et al. 2021).	Distance from the *Caleta* (cove) to the provincial capital

D2. Number and percentage of surveyed fishers in fisher associations.

Table S12. Number and percentage of surveyed members in each fisher association.

Fisher association	N members	N surveyed members	% Surveyed members
Los Verdes	25	10	40.0
El Quisco	74	11	14.9
Papudo	59	7	11.9
Laguna Verde	26	2	7.7
Chanavayita	34	11	32.4
San Marcos	50	11	22.0
Chanavaya	25	8	32.0
Rio Seco	27	11	40.7
Pisagua	40	10	25.0
Taltal	45	10	22.2
Portada Antofagasta	36	10	27.8
Coloso	50	10	20.0
STI Segunda	28	10	35.7
Pan de azucar	27	10	37.0
Carrizal Bajo	22	10	45.5
Bronce C	26	12	46.2
Coperativa Vilos	44	10	22.7
Chigualoco	38	6	15.8

Queule	130	11	8.5
Pinos queule	56	10	17.9
Los Molles	59	12	20.3
Maintencillo	42	12	28.6
Montemar	36	5	13.9
La Boca	31	11	35.5
Matanzas	27	7	25.9
Puertecillo	45	12	26.7
Chorrillos	46	9	19.6
Bucalemu	33	7	21.2
Mariscadero	14	8	57.1
Curanipe I	32	12	37.5
Loanco	40	12	30.0
Pelluhue	147	11	7.5
Putu	47	12	25.5
La Pesca	38	16	42.1
Duao	25	8	32.0
Pellines	34	8	23.5
Laraquete	44	12	27.3
Cocholgue	32	8	25.0
San Vicente	38	12	31.6
Yuste Futuro	19	10	52.6
Chauman	23	10	43.5
El Coral	24	10	41.7
Bahia San Antonio	22	8	36.4
STI Estaquilla	73	13	17.8
Estaquilla El Futuro	71	10	14.1
La Pampina	11	11	100.0
Caleta Carelmapu	110	5	4.5

Navegando Juntos Carelmapu	50	3	6.0
Quellon	280	7	2.5
Isla Chauhin	58	8	13.8
Lajas de Quenuir	25	8	32.0
Cheuque	19	13	68.4
Los molinos	46	9	19.6
Mehuin 1	50	9	18.0
Maiquillahue	33	11	33.3
Chaiuhin	35	3	8.6

D3. Correlations of predictors

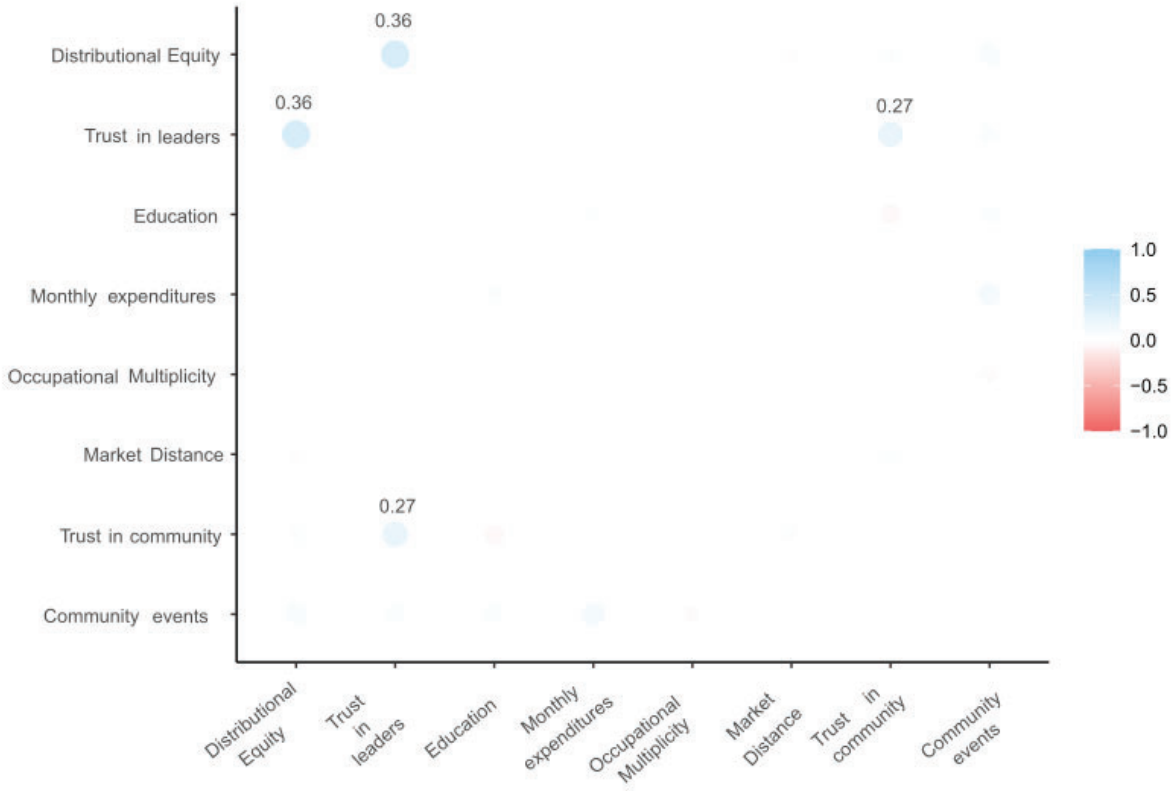

Figure S1. Correlation of standardized predictors.

D4. Results:

Fishers' perceptions of social co-management outcomes:

My results show that fishers' perceptions regarding the three key co-management outcomes were skewed towards positive responses (Figure S2). Most fishers perceived co-management had a 'very positive' (38%) or 'slightly positive' (37%) impact on their wellbeing. Fewer fishers perceived neutral (16%) and negative (8%) impacts on their wellbeing. More than half of the fishers (57%) rated their satisfaction with TURFs above 4, which equates to positive perceptions in Chile. Particularly, 30% of fishers scored their satisfaction with TURFs at 7, 27% of fishers with 6, and 25% of fishers with 5, and only 18% rated their satisfaction with scores equal to or below 4. In addition, more than half of the fishers (57%) also rated their satisfaction with fisher association above 4 (33% of fishers scored their satisfaction with TURFs with 7, 24% of fishers with 6, and 28% of fishers with 5) and only 14% rated their satisfaction with scores equal or below 4.

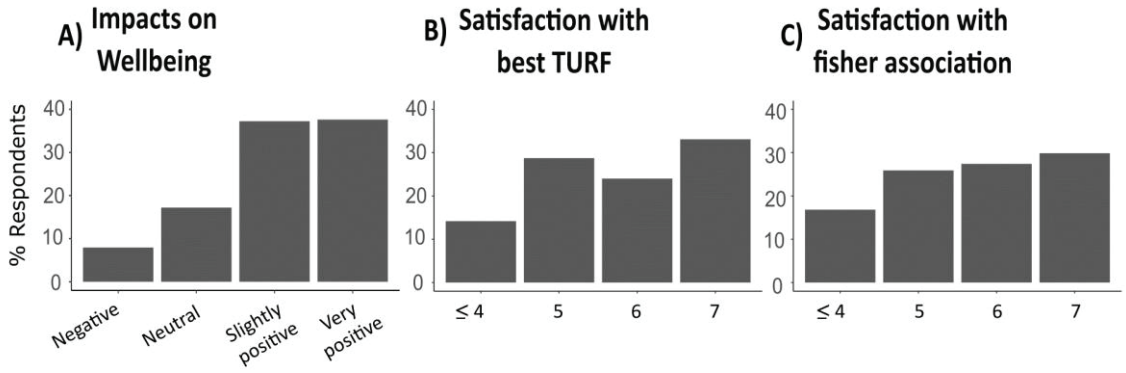

Figure S2. Percentages of fishers' perceptions of three key social co-management outcomes: A) perceived impacts on wellbeing, B) satisfaction with TURFs, and C) satisfaction with fisher associations.

My results show that, even though people's perceptions of social management outcomes (perceived impacts on wellbeing, satisfaction with TURFs, and satisfaction with fisher associations) were positive overall (Figure S2), perceptions of equity had a positive effect on the three co-management outcome models (Figures S3 and S4). Particularly, perceptions of distributional equity had a positive effect on the perceptions of the three

social co-management outcomes (Figures S3 and S4). With a 95% probability, I found that a unit of increase in perceptions of distributional equity is associated with 1.05 standard deviations increase in positive wellbeing impacts (95% CI: 0.57 – 1.54, Figure S3.A). In addition, with 95% probability, we can conclude that a unit of increase in perceptions of distributional equity is associated with 1.79 standard deviations increase in fishers' satisfaction with TURFs (95% CI: 1.27 – 2.30, Figure S3.B). My results also show that with a 95% probability, fishers' satisfaction with the fisher association increased by 1.55 standard deviations (95% CI: 1.08-2.03) with increasing perceptions of distributional equity (Figure S3.C).

In addition, participation in decision-making processes and trust in leaders were related to one co-management outcome. With a 95% probability, fishers who participated actively perceived 0.67 standard deviations (95% CI: 0.09 – 1.25) more positive wellbeing impacts than people who participated passively (Figure S3.A). In addition, trust in leaders was related to satisfaction with fisher associations. With a 95% probability, fishers' satisfaction with the fisher association increased by 1.87 standard deviations (95% CI: 1.40 -2.35) with increasing trust in leaders (Figure S3.C).

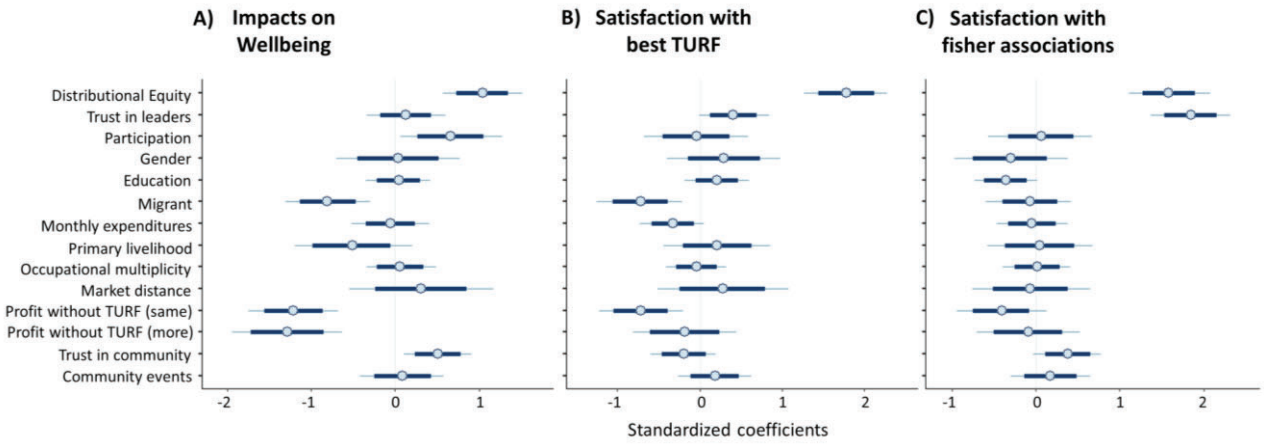

Figure S3. Effect size of distributional equity, procedural equity elements (participation in decision-making and trust in leaders), TURF profits and socioeconomic characteristics on A) perceived impacts on wellbeing, B) satisfaction with the best TURF, and C) satisfaction with the fisher association. Parameter estimates are Bayesian posterior means and 95% and 80% uncertainty intervals.

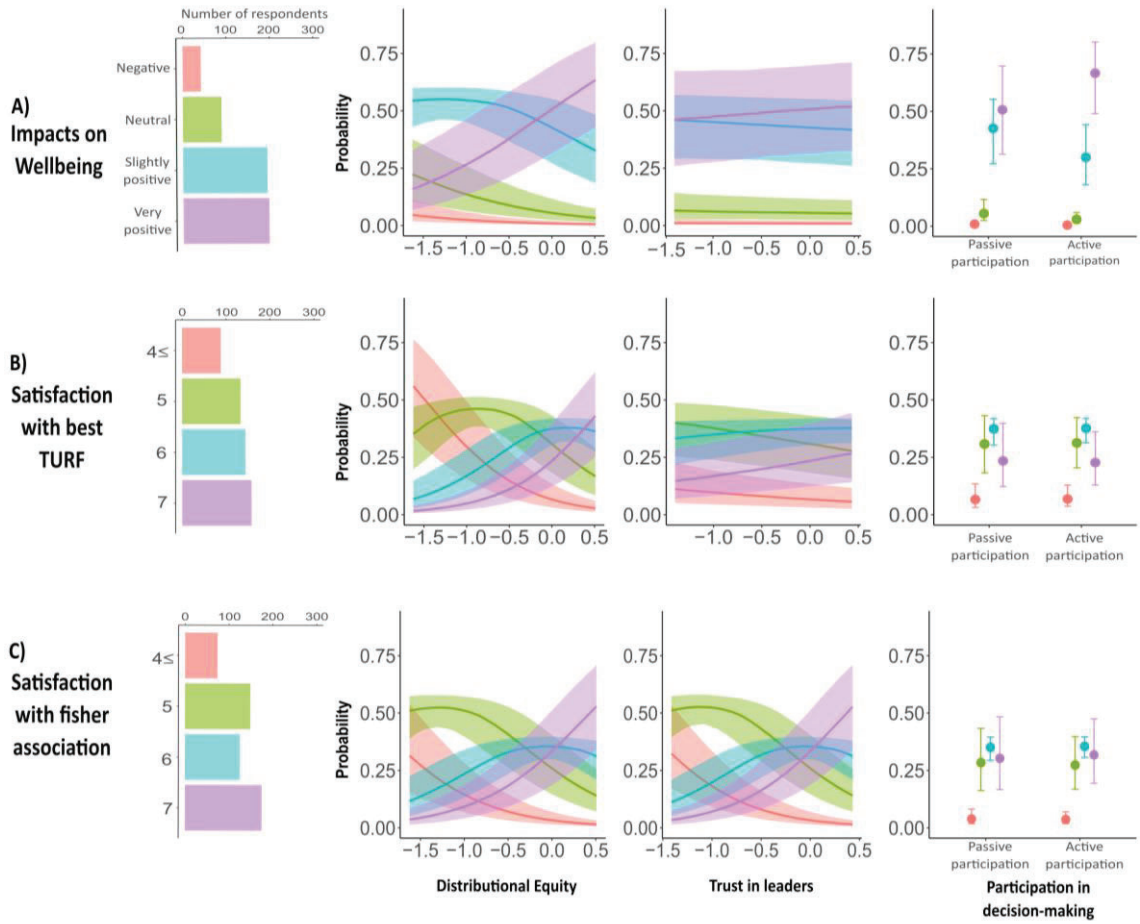

Figure S4. Number of respondents and predicted probabilities of each level of response variable A) perceived impacts on wellbeing, B) satisfaction with best TURF, and C) satisfaction with fisher associations given different levels of distributional equity, trust in leaders, and participation in decision-making. The lines and points represent the posterior mean estimates, and the shaded areas and error bars are their 80% credible intervals (80% is shown for visualization purposes).

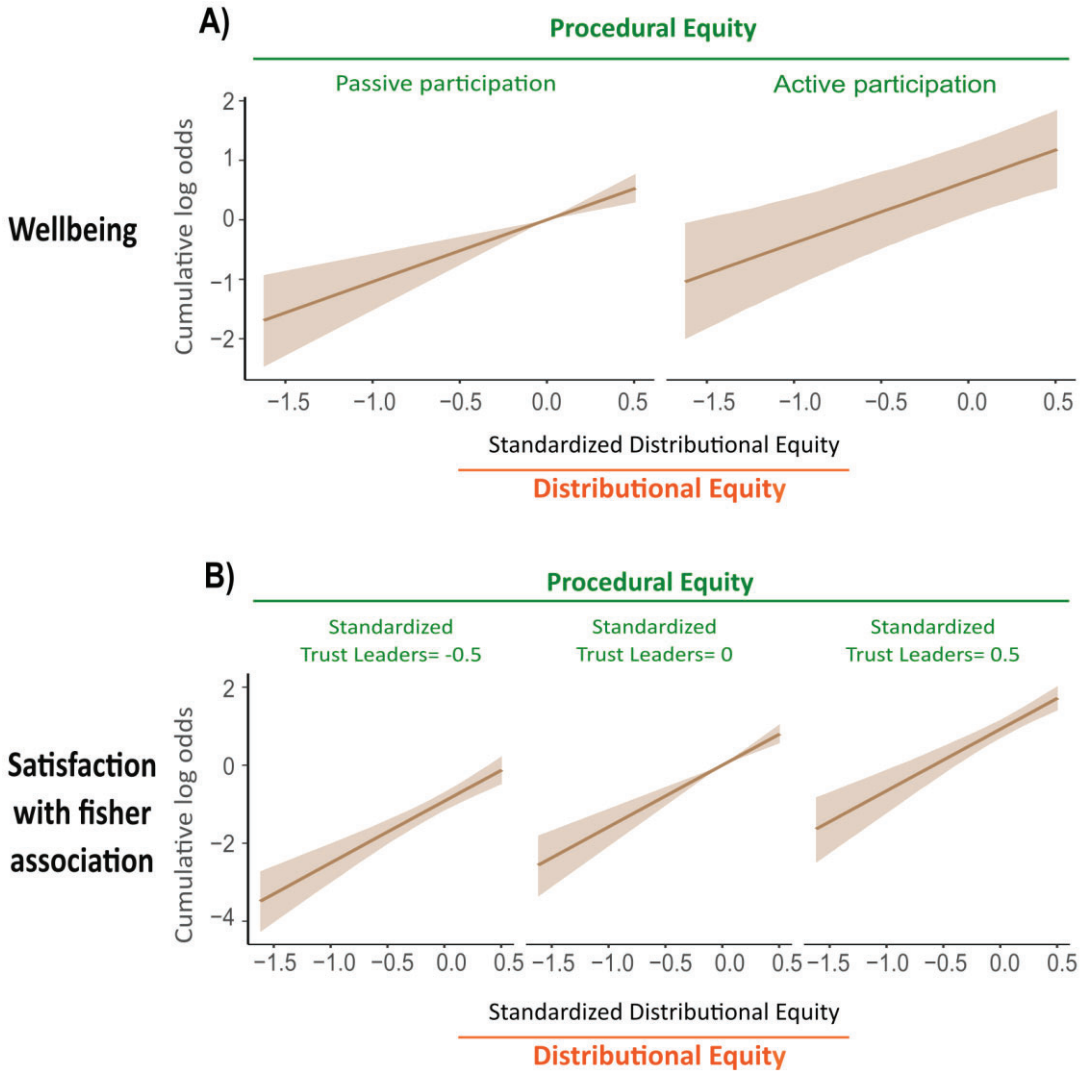

Figure S5. Relationship between distributional equity and the latent (not observable) continuous variable of social co-management outcomes at different levels of procedural equity. A) Relationship between standardized distributional equity and perceived impacts on wellbeing at different levels of participation in decision-making (passive and active participation). B) Relationship between standardized distributional equity and satisfaction with fisher associations at different levels of standardized trust in leaders. The lines and points represent the posterior draws of the predictor, and the shaded areas and error bars are the 95% credible intervals.

D5. Data availability

The data used in this chapter will be uploaded to the institutional data repository of James Cook University upon publication. is confidential and cannot be shared. The R

scripts used in this chapter will be uploaded to https://github.com/cristinaruanochamorro upon publication.