

**From Fisher Economicus to Fisher Socialis:
Investigating the Role of Fisher Behaviour for Effective
and Equitable Governance**

by

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Author's Declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Statement of Contributions

Maria B. Battaglia was the sole author for Chapters 1 and 5 which were written under the supervision of Dr. Derek Armitage and were not written for publication. Chapters 2 to 4 was based on manuscripts that were co-authored. Chapter 2 was co-authored with Evan J. Andrews and Derek Armitage. Chapter 3 was co-authored with Graham B. Epstein, Sarah E. Wolfe, Derek Armitage, and Jeremy Pittman. Chapter 4 was co-authored with Jeremy Pittman, Graham B. Epstein, Giulia Bernardi, and Derek Armitage.

Maria B. Battaglia was the lead author for all three co-authored manuscripts. As lead author of these three chapters, Maria B. Battaglia was responsible for contributing to conceptualizing study design, carrying out data collection and analysis, and drafting and submitting manuscripts. Co-authors provided guidance during each step of the research and provided feedback on draft manuscripts. Bibliographic citations for the co-authored chapters have been included below.

Chapter 2

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Abstract

The purpose of this dissertation is to advance the emerging field of fisher behaviour. The applied aim is to enhance fisheries and oceans policy, and primarily within the context of small-scale fisheries sustainability. In this dissertation, fisher behaviour is defined as the actions (or inactions) taken by fishers in response to internal and external stimuli and it describes the multitude of ways in which fishers interact with their social and ecological environment. Further, fisher behaviour can manifest through physical action, verbal expression, emotional responses, and cognitive processes.

Fisheries and oceans policy shapes and is simultaneously shaped by fisher behaviour because regulations and enforcement mechanisms that emerge from policy interventions signal what behaviours are allowed and which ones are not. Fishers, in turn, interpret these signals based on their values, needs, and perceptions of legitimacy over resource use. For this reason, when policy does not adequately reflect the diverse range of factors that shape fisher behaviour, regulations can become inefficient or inequitable and may result in poor social and ecological outcomes.

Despite the importance of behaviour and its central role in the pursuit of fisheries and oceans sustainability, fisher behaviour is complex and hence still not well understood. Historically, predominant paradigms of behaviour have been based in neoclassical economics' *Homo Economicus*. These models of behaviour predict that rational and self-interested individuals will always prioritize personal gain over the collective interest and, without external interventions, they will inevitably deplete shared resources. Yet, in the last few decades, empirical evidence has challenged these assumptions, and has shown that resource users, including fishers, are able and willing to engage in collective action to solve social dilemmas.

The scope of this dissertation is to use the emerging field of fisher behaviour as a critical lens to strengthen fisheries and oceans policy. To achieve this overarching aim, this dissertation is guided by three interrelated research objectives: 1) To advance and understand fisher behaviour as an emergent and critical, yet understudied, field through the development of a comprehensive conceptual typology based on selected literatures; 2) To map and synthesize the complex interactions between social norms (as a particular manifestation of fisher behaviour), collective action problems, and fisheries policy and to further unpack the role of social norms as a catalyst of collective action in natural resource systems, including in fisheries systems; and 3) To empirically examine the role of social norms and social networks as two fisher behavioural approaches and further assess their implications for policy.

The first objective provides the foundation of this dissertation and frames the context and significance of this research by presenting an overview of alternative behavioural approaches to understand fisher behaviour. The second and third objectives delve deeper into two behavioural approaches, and in doing so, they challenge one of the core assumptions of *Homo Economicus*: that humans are self-interested, hence incapable of solving collective action problems.

The research methodology used in this dissertation is informed by deductive and inductive approaches and the integration of qualitative and quantitative methods, alongside a theoretical exploration. To further understand fisher behaviour in real world settings, a case study was conducted in Sardinia, Italy, in the context of three small-scale fishing communities adjacent to the Asinara [Marine Protected Area \(MPA\)](#). Fieldwork was conducted both in-person and coordinated remotely in response to COVID-19 pandemic requirements. Research instruments were co-developed in collaboration with [Blue Marine Foundation \(BMF\)](#), a not-for-profit organization working in the area, and further reviewed by key community informants to ensure coherence with the local context. Further, informal conversations with research partners and members of the local communities added additional depth and confirmed the direction of the research findings.

In Chapter 2, a theoretical exploration of existing literature on fisher behaviour was adopted to provide a typology of key selected approaches that offer an interdisciplinary suite of entry points and complementary opportunities to advance the understanding of fisher behaviour. These approaches include theories, concepts, and perspectives from Critical Social Theory, Systems Approaches, Development Scholarship, and Institutional Scholarship. Two vignettes, one based in Italy, and one based in Canada, were included in this chapter to add further empirical weight to the chapter by delving deeper into two of the lenses presented in the typology.

In Chapter 3, a systematic scoping review was used to map and synthesize existing literature on social norms in fisheries. However, given the limited availability on empirical articles that focused solely on fisheries, the scope of the evidence synthesis was broadened to include other environmental contexts. As such, the systematic scoping review was conducted on peer-reviewed articles (n=69) to map and synthesize ways in which social norms are conceptualized, elicited, and measured in the empirical literature at the intersection of social norms and collective action problems in environmental settings. This evidence synthesis followed the [Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews \(PRISMA-ScR\)](#). Findings revealed that social norms can be conceptualized as collective or individual constructs, and they can be elicited or measured using a variety of qualitative and quantitative methods. Further, social norm definitions do not necessarily correspond to a unique elicitation method. These results suggest that

what may initially appear as lack of coherence is instead an opportunity to study social norms from various angles and perspectives.

In Chapter 4, structured surveys (n=81) were used to empirically examine the role of social norms and social networks in the Asinara MPA communities. Findings indicated that the existence of subgroups within networks does not necessarily hinder capacity for collective action, as analyses on the strength and distribution of social norms showed that cooperative behaviours within the Asinara MPA communities were still strong. Importantly, network analyses also elicited the presence of well-connected, central actors within each subgroup. This finding holds promising potential for collective action because central figures can leverage their positions to synthesize subgroup heterogeneity and generate innovative solutions to shared challenges.

Findings and insights of this dissertation contribute to advancing the emerging field of fisher behaviour, while offering alternative approaches to the paradigm of behaviour based in *Homo Economicus*. Context-relevant knowledge on fisher behaviour can be operationalized in policy settings to catalyze change using insights on who fishers are and the reasons behind their actions. For instance, Challenge 10 of the United Nations 2021-2030 Decade of Ocean Science for Sustainable Development aims to identify barriers to behaviour change to achieve ocean health. However, this aim cannot be achieved using models of human behaviour that underserve and oversimplify the complexity of empirical reality.

Findings from this dissertation translate into theoretical and empirical contributions by helping identify lenses and approaches to enhance fisheries and oceans policy, through a more comprehensive understanding of fisher behaviour. These insights can support policy in three complementary ways. First, knowledge on fisher behaviour can enhance coherence between policy and the social context within which policy instruments are embedded, which includes the behavioural elements of social systems, such as fishers' values, needs, and beliefs. Second, aligning policy with contextual knowledge about fisher behaviour can improve policy equity by bringing recognition to pre-existing forms of organization (e.g., social networks) and informal rules of behaviour (e.g., social norms) that fishers have developed over long periods of time and persistence. Finally, this research reveals that there are currently untapped opportunities to generate new evidence about fisher behaviour. However, these efforts will require challenging the assumptions that have long underpinned fisheries and oceans policy, and cultivating collaborations across academia, policy practitioners, and fishing communities to inform the development of new methodologies and contextually-relevant understandings.

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Dedication

To the small-scale fishing communities of Stintino, Porto Torres, and Castelsardo

Table of Contents

Examining Committee Membership	ii
Author’s Declaration	iii
Statement of Contributions	iv
Abstract	v
Acknowledgements	viii
Dedication	x
List of Figures	xv
List of Tables	xvi
List of Abbreviations	xvii
1 Introduction	1
1.1 Context, problem rationale, and research gap	1
1.2 Research purpose, objective, and key contributions	4
1.3 Conceptual overview and guiding framework	6
1.3.1 Governance, institutions, and fisheries and oceans policy	6

1.3.2	Fisher behaviour as lenses to strengthen policy	9
1.3.3	Social networks & social norms: Two behavioural approaches	12
1.4	Empirical context	15
1.5	Research design, methodology, and methods	18
1.5.1	Validity, reliability, and generalizability of findings	21
1.5.2	Ethical considerations and adaptations to COVID-19 pandemic	22
1.6	Organization of the dissertation and linkages across chapters	23
2	The emerging field of fisher behaviour	25
2.1	Chapter summary	25
2.2	Introduction	26
2.3	Foundations and alternatives for fisher behavioural research	27
2.4	Understanding who fishers are	31
2.5	Insights from the field of applied fisher behavioural research	33
2.5.1	Social norms in a small-scale fishery in Sardinia, Italy	33
2.5.2	Well-being and strategic behaviours in a small-scale fishery in Newfoundland and Labrador, Canada	35
2.6	Conclusion	37
3	Social norms, collective action, and environmental policy	39
3.1	Chapter summary	39
3.2	Introduction	40
3.3	Methods	41
3.4	Results	45
3.4.1	Objective 1	45
3.4.2	Objective 2	49
3.4.3	Objective 3	56
3.4.4	Fisheries: Taking a closer look	59
3.5	Discussion	68
3.6	Conclusion	71

4	Marine protected areas governance, social norms, and social networks	73
4.1	Chapter summary	73
4.2	Introduction	74
4.3	Theoretical framing	76
4.4	Methods	77
4.4.1	Case study context: the Asinara MPA	77
4.4.2	SSF in the Mediterranean	79
4.4.3	Data collection	79
4.4.4	Social network analysis	81
4.5	Results	82
4.5.1	Social network cohesion	82
4.5.2	Betweenness centrality	87
4.6	Discussion	91
4.7	Conclusion	94
5	Conclusion	96
5.1	Research purpose and objectives	96
5.2	Major findings	97
5.3	Theoretical and empirical contributions	100
5.4	Limitations and future research	104
5.5	Reflections	105
	References	107
	APPENDICES	124
A	Ethics protocol and supporting documents	125
A.1	Information letter	126
A.2	Recruitment form	129
A.3	Verbal consent form	131
A.4	Letter of feedback and appreciation	133

List of Figures

1.1	Empirical context: Sardinia, Italy (Figure 1.A), and the Asinara MPA (Figure 1.B). Country boundaries: ESRI 2023, MPA boundaries: by L.K. Banks 2023. MPA boundaries are approximate	16
2.1	Selected conceptual and theoretical approaches to understand fisher behaviour	30
3.1	PRISMA Flow Chart	46
3.2	Publications by year described in percentages of total publications	47
3.3	Geographical distribution of the synthesized evidence: number of case studies per country in which shading represents the frequency of case studies. Country boundaries: ESRI 2022. Map generated by L.K. Banks 2022.	48
4.1	Location of study area in Sardinia, Italy (Figure 1.A). Asinara MPA (Figure 1.B). Country boundaries: ESRI 2023, MPA boundaries: by L.K. Banks 2023. MPA boundaries are approximate	78
4.2	Network cohesion and subgroups	83
4.3	Information-sharing social norms across subgroups (Figure 3.a). Social norms about adherence to MPA regulations across subgroups (Figure 3.b)	86
4.4	Distribution of betweenness centrality scores	88
4.5	Betweenness centrality	89

List of Tables

1.1	Selected definitions of environmental governance	7
1.2	Selected definitions of institutions	9
1.3	Selected definitions of social norms	14
3.1	Search term string (Scopus syntax)	42
3.2	Screening criteria	44
3.3	Social norms conceptualizations	50
3.4	Case study and fishery characteristics	60
3.5	Social norms conceptualization and elicitation methods in fisheries	64
4.1	Descriptive statistics for the entire sample and across subgroups	84
4.2	Descriptive statistics for different variables across subgroups	87
4.3	Descriptive statistics across centrality scores	90
B.1	Selected survey questions	136
B.2	Significance of differences in sociodemographic variables across subgroups	137
B.3	Tukey HSD test for age variable	137
B.4	Significance of differences in perceptions about social norms across subgroups	138
B.5	Dunn’s test for post-hoc pairwise comparison on information-sharing (descriptive social norms) variable	138
B.6	Significance of differences in sociodemographic variables across centrality scores	139

List of Abbreviations

BMF Blue Marine Foundation [vi](#)

CBD Convention on Biological Diversity [74](#)

CFP Common Fisheries Policy [18](#)

COP Conference of the Parties [74](#)

DFO Department of Fisheries and Oceans, Canada [3](#)

EU European Union [3](#)

FAO Food and Agriculture Organization of the United Nations [41](#)

HSD Tukey's Honestly Significant Differences [83](#)

ITQs Individual Transferable Quotas [3](#)

MOU Memorandum of Understanding [20](#)

MPA Marine Protected Area [vi](#)

NL Newfoundland and Labrador [35](#)

PES Payment for Ecosystem Services [51](#)

PRISMA-ScR Preferred Reporting Items for Systematic Reviews and Meta-Analyses
extension for Scoping Reviews [vi](#)

SAC Special Area of Conservation [15](#)

SNA Social network analysis [77](#)

SSFs small-scale fisheries [3](#)

WoS Web of Science [42](#)

Chapter 1

Introduction

1.1 Context, problem rationale, and research gap

Understanding human behaviour has become central to the pursuit of sustainability in a range of contexts and applications, including fisheries and oceans sustainability (Andrews et al., 2021; Nielsen et al., 2024; Schill et al., 2019). Fisher behaviour is central to policy because policy shapes and is shaped by fishers' strategies, perceptions, beliefs, goals, and adaptations to social and ecological change (Andrews et al., 2021; Armitage et al., 2019; Chuenpagdee & Jentoft, 2009; Fulton et al., 2011; Salas & Gaertner, 2004; van Putten et al., 2012). The concept of 'fisher behaviour' can be described as the actions taken by fishers that follow cognitive, psychological, and social processing of information within the context of fisheries (Andrews, Pittman, et al., 2021). In this dissertation, I define fisher behaviour as the actions (and/or inactions) of individual fishers in response to internal or external stimuli and changes. Fisher behaviour can manifest through physical action, verbal expression, emotional responses, and cognitive processes. Further, fisher behaviour is the way that fishers interact with the social and ecological environment in which they are embedded, which includes the decisions that fishers take to use and manage fisheries and oceans resources, and the ways they decide to interact with other resource users.

Yet, fishers have been, and sometimes continue to be, mischaracterized in policy because historically-predominant approaches to understanding their behaviour are rooted in neoclassical economics (Fulton et al., 2011; Salas & Gaertner, 2004), which depicts humans, including fishers, as rational and infallible decision makers (e.g., Gordon, 1954). Specifically, neoclassical economics rests on the assumptions that: (i) humans' primary motivation is self-interest; (ii) humans have well-defined preferences and unbiased beliefs;

and (iii) according to these preferences and beliefs, they are able to make dispassionate decisions that are optimal, which implies they have (a) infinite cognitive abilities, and (b) infinite will-power, because they choose what is best for them and not what is momentarily tempting. Together these assumptions depict the *Homo Economicus*.

Homo Economicus has traditionally been one of the main models of human behaviour in natural resource policy, including fisheries and oceans policy. Notable in the commons tradition is Hardin's (1968) allegory of the Tragedy of the Commons, which describes how *Homo Economicus*' self-interest and rational nature will inevitably lead to the depletion of shared resources (e.g., fish stocks). Yet, such theoretical predictions have been refuted by empirical observation, especially starting in the 1980s. Seminal in this regard is Ostrom's (1990) work in small-scale resource systems (e.g., water, irrigation, forests), as it demonstrated through empirical observations that people can in fact cooperate and can effectively solve collective action problems. Collective action problems arise when individuals, such as in this case resource users, are faced with situations where they have an incentive to act in ways that would benefit them individually, yet this would come at the expenses of the collective good (Hardin, 1968; Olson, 1965; Ostrom, 1990). In this dissertation, I discuss how fishers solve collective action problems by organizing their actions and behaviours to manage, for instance, resource use.

The research described in this dissertation is timely and salient, because despite the gap between theory *Homo Economicus* and empirical evidence, models of behaviour based in neoclassical economics still often inform assumptions about how fishers behave (Andrews et al., 2021; Fulton et al., 2011; Salas & Gaertner, 2004). For example, the Treasury Board of Canada Secretariat of Canada (Treasury Board of Canada Secretariat, 2007) requires that regulatory proposals, including those concerning fisheries, undergo evaluation using time-consistent exponential discounting to predict future preferences of individuals, including fishers. A defense of neoclassical economics would argue that time-consistent, exponential models are accurate in their predictions, because even if not everyone has identical time preferences, any deviation from the predicted behaviour may occur randomly. As such, deviations from the predicted behaviour will average out when considered collectively and leave exponential discounting models unbiased. Nonetheless, empirical evidence shows that there are individuals who consistently and systematically exhibit bias and discount time differently. In environmental settings, hyperbolic discounting is often helpful to describe how resource users may have time-inconsistent preferences (Hepburn et al., 2010) and, in some cases, prefer smaller-yet-immediate rewards to bigger-yet-delayed rewards –see Johnson and Saunders (2014) for an example in a Caribbean small-scale fishery. Even if there are contexts in which hyperbolic discounting can provide a more empirically-accurate description of resource users' behaviours with respect to time preferences, I also acknowledge

that using hyperbolic discounting for government policy evaluation is not always supported or endorsed (e.g., Groom et al., 2005). More generally, fisheries and oceans policy that is rooted in neoclassical economics can reduce the complexity of human behaviour to favor mathematical rigour and simplicity. Yet, by doing so it fails to engage with a range of factors and conditions that shape fisher behaviour (Andrews et al., 2021; Johnson et al., 2018; Wijermans et al., 2020).

The scope of this dissertation is to use the emerging field of fisher behaviour as a critical lens to enhance fisheries and oceans policy. Importantly, this research focuses on [small-scale fisheries \(SSFs\)](#) systems. However, concepts and findings related to fisher behavior discussed in this dissertation may also be relevant to other fisheries contexts, such as commercial fisheries. Specifically, in this dissertation I focus on policies aimed at managing human activities, such as resource use patterns, on fisheries and oceans resources with the goal of achieving sustainable outcomes. Examples of such policies in Canada include the Policy for Canada’s Commercial Fisheries (Fisheries and Marine Service, 1976). This policy was drafted based on the premise that Canada’s commercial grounds were being overfished, leading to a tragedy of the commons. While this policy rejected the commodification of fishing grounds and market-based mechanisms, later events –e.g., the fish stock crises in both the Atlantic and Pacific coasts, led the [Department of Fisheries and Oceans, Canada \(DFO\)](#) to embrace neoliberal commodification approaches, including [Individual Transferable Quotas \(ITQs\)](#), to reduce the likelihood of fisheries collapse (Pinkerton et al., 2024). In other contexts, such as countries of the [European Union \(EU\)](#) where part of the empirical focus of this dissertation is based, examples of policies aimed at achieving sustainable outcomes include the European Green Deal, a set of policies within which the Biodiversity Strategy for 2030 is situated. The EU Biodiversity Strategy (European Commission, Directorate General for Environment, 2021) aims to protect 30 percent of land and marine areas by 2030. However, protected areas are sometimes created in places where fishing communities have traditional and customary access to fishery resources. For this reason, policies and instruments that do not account for the human (and behavioural) dimension of protected areas can result in adverse governance outcomes (Bennett et al., 2017; Charles & Wilson, 2009).

By establishing regulations and enforcement mechanisms, fisheries and oceans policy can signal what behaviours are allowed and which ones are not. Concurrently, fishers will interpret these signals based on their needs, motivations, expectations, and perceptions of legitimacy (Andrews et al., 2021; Jentoft & Chuenpagdee, 2009). However, when policy fails to align with the social and ecological context it aims to regulate, it can lead to ineffective regulations, low compliance rates, or crowding-out resource users’ intrinsic motivations (Allo & Loureiro, 2017; Cinner et al., 2021; Frey & Jegen, 2001; Thomas et

al., 2016).

For these reasons, knowledge on fisher behaviour can strengthen fisheries and oceans policy's effectiveness by improving fit (Epstein et al., 2015) between policy and the social and ecological context within which it operates. At the same time, knowledge of fisher behaviour can make fisheries and oceans policy more equitable by bringing recognition to and aligning with the existent practices, behaviours, and strategies employed by fishers and fishing communities to regulate resource use.

1.2 Research purpose, objective, and key contributions

In this dissertation, I seek to advance the understanding of fisher behaviour to enhance fisheries and oceans policy. While fisher behaviour is an emerging field, it is still an underdeveloped subject in fisheries research, and neoclassical economics models are still one of the approaches through which behaviour is assessed (Andrews et al., 2021; Fulton et al., 2011; Salas & Gaertner, 2004).

In this dissertation, I pursue three research objectives:

1. To advance and understand fisher behaviour as an emergent and critical, yet understudied, field through the development of a comprehensive conceptual typology based on key existing literature;
2. To map and synthesize the complex interactions between social norms (as a particular manifestation of fisher behaviour), collective action problems, and fisheries policy and to further unpack the role of social norms as a catalyst of collective action in natural resource systems, including in fisheries systems; and
3. To empirically examine the role of social norms and social networks as two fisher behavioural approaches and further assess their implications for policy.

The first research objective aims at advancing the emerging field of fisher behaviour and to develop a typology based on relevant literature. This typology draws from diverse bodies of literature, conceptualizations, and frameworks to provide a more comprehensive approach to understanding fisher behaviour. The second and third research objectives delve into two of the key approaches presented in the typology: social norms and social networks. Specifically, the second and third objectives critically engage with a core *Homo Economicus* assumption: that humans are self-interested and hence incapable of solving

collective action problems. To challenge this assumption, the second objective draws from literature on social norms and maps the ways through which individuals use social norms, which can be understood as informal rules of behaviour, to solve collective action problems in the broader context of natural resources, including fisheries. The third objective further builds on the second by empirically examining the ways through which fisher behaviour shapes and is shaped by the social context in which it operates. The third objective draws from literature on social norms and social networks to empirically examine how social relationships and interactions with others shape how fishers navigate the complexity of collective action problems. Hence, in this dissertation, social norms and social networks are framed as behavioural approaches because they reveal fundamental behavioural dynamics, such as how fishers self-organize to solve social dilemmas related to resource use.

The research presented in this dissertation makes an original and significant contribution to the advancement of knowledge in three main ways. First, this research (Chapter 2) advances the emerging field of fisher behaviour and presents a novel typology that links various bodies of scholarship that can better inform the understanding of who fishers are and the reasons behind their actions. By further engaging with fishery literature based in neoclassical economics approaches, this chapter provides a critique of approaches that are situated within these behavioural paradigms. Second, this research (Chapter 3) presents a global-level scoping review of empirical, peer-reviewed literature on social norms in natural resource and fisheries system contexts. Specifically, Chapter 3 advances the understanding of the complex interactions between social norms, as manifestations of behaviour, and collective action in policy by mapping and synthesizing existing literature and further examining ways in which social norms are conceptualized, elicited, and measured. Third, this research (Chapter 4) critically examines social norms and social networks as approaches to understand behavioural dynamics in three fishing communities in Sardinia, Italy. Chapter 4 addresses neoclassical economics prediction of resource users' inability to solve collective action problems by empirically examining how fishing communities can and do self-organize through social norms and social networks.

Together, the contribution of these manuscripts is to identify new pathways to design more effective and more equitable fisheries and oceans policy tools by aligning policy with empirically-grounded and context-relevant knowledge of fisher behaviour. The need to better understand fisher behaviour is relevant to current policy landscapes. For example, Challenge 10 of the United Nations 2021-2030 Decade of Ocean Science for Sustainable Development aims to identify and overcome barriers to behaviour change to achieve ocean health. However, this goal cannot be achieved by using models of human behaviour that discount and underserve the complexity of empirical reality. Instead, fisher behaviour knowledge can provide a valuable resource for policymakers and researchers working in

this area.

In the following sections of this introductory chapter, I first present a review of the literature and develop the conceptual framework guiding my research. Next, I outline the empirical context (i.e., case study setting for Objective 3), as well as the overall research design and methods used to collect, synthesize, and analyse data. The final section describes the organization and overall structure of the dissertation.

1.3 Conceptual overview and guiding framework

This dissertation engages with theoretical and conceptual foundations pertinent to three bodies of literature: 1) governance, institutions, and fisheries and oceans policy; 2) fisher behaviour as lenses to strengthen fisheries and oceans policy; and 3) social norms and social networks as two behavioural approaches. The first area of literature provides the foundation to understand the implications of mischaracterizing fisher behaviour in governance processes within which fisheries and oceans policy is embedded. This body of literature provides the basis to demonstrate how the emerging field of fisher behaviour can strengthen policy by making it more efficient and more equitable. As such, fisher behaviour is the second body of literature with which I engage. Finally, I delve deeper into two specific approaches to understand fisher behaviour by engaging with literature on social norms and social networks. The literatures on social norms and social networks serve the purpose of critiquing one of the fundamental assumptions of *Homo Economicus* -i.e., that humans are self-interested, hence unable to overcome collective action problems on their own.

1.3.1 Governance, institutions, and fisheries and oceans policy

Governance is the complex set of multi-level processes related to decision-making, formal and informal structures such as rules and regulations, social norms, practices, and actors that operate at different levels and within different capacities of this system (e.g., communities, individuals, state) (Armitage et al., 2012; Jentoft & Chuenpagdee, 2009). There are various definitions of governance, and these are typically grounded in the respective disciplines or applications in which they originate and/or are applied. I position this dissertation within the subset of environmental governance (selected definitions available in [Table 1.1](#)), whereby governance processes are understood in relation to the aim of achieving social and ecological sustainability (Armitage et al., 2012, 2017; Lemos & Agrawal, 2006). Specifically, I examine how governance processes either facilitate or hinder fishing communities in the pursuit of social and ecological sustainability.

In this context, it is further helpful to distinguish between the terms ‘governance’ and ‘management’. Management can be understood as the practical execution of specific objectives, whereas governance concerns the broader analytical lens of who sets the objectives, how objectives are determined (e.g., who influences decision-making processes), and how authority figures are held accountable for pursuing them (Armitage et al., 2017; Franks et al., 2024).

Table 1.1: Selected definitions of environmental governance

Definition	Source
The set of regulatory processes, mechanisms, and organizations through which political actors influence environmental actions and outcomes.	Lemos & Agrawal, 2006, p. 298
The interrelated and increasingly integrated system of formal and informal rules, rule-making systems, and actor-networks at all levels of human society (from local to global) that are set up to steer societies toward preventing, mitigating, and adapting to global and local environmental change and, in particular, earth system transformation, within the normative context of sustainable development.	Biermann et al., 2009, p. 3
Environmental governance is understood as the resolution of conflicts over environmental resources through the establishment, reaffirmation and change of institutional arrangements.	Paavola, 2016, p. 144

Governance is underpinned by formal (e.g., regulations that stem from policy) and informal (e.g., social norms) institutions. There are many ways of defining institutions (refer to [Table 1.2](#) for selected definitions), but in this dissertation I refer to them as mechanisms that regulate, constrain, and shape actors’ behaviours, and more specifically fisher behaviour (North, 1990; Ostrom, 1990; Young et al., 2008). Together with social and ecological change, formal and informal elements of governance influence resource users’ interactions with fisheries and ocean resources (Armitage et al., 2017; Haas et al., 2022). In this dissertation, I focus on how formal institutions, and specifically regulatory processes

within fisheries and oceans policy aimed at achieving sustainability, can be enriched by a deeper, more nuanced, understanding of fisher behaviour.

Like other types of public policy, fisheries and oceans policies are key decision tools used to regulate social systems (Lasswell, 1971). By being situated within the broader analytical lenses of environmental governance, the research in this dissertation explores avenues to strengthen those policies that are aimed at mitigating the impacts of human activities on fishery resources, such as unsustainable patterns of extraction.

The case for strengthening policy by closely aligning it with the specific context it seeks to regulate has long been advocated for (Korten, 1980). Yet, in many contexts, including fisheries and oceans governance, panaceas that aim to regulate a wide range of contexts using one-size-fits-all approaches continue to persist (Young et al., 2018). These approaches discount the complexity of the systems within which they operate and can potentially result in adverse governance outcomes (Ostrom, 2007; Young et al., 2018). For fisheries and oceans policy to be relevant it must align with its context, which includes the interests, needs, culture, and history of resource users and other local actors (Berkes, 2001; Steelman & Wallace, 2001).

There are different ways through which this goal can be achieved. For example, collaborative processes with local resource users and other key members of fishing communities can increase policy accountability and legitimacy (Jentoft & Chuenpagdee, 2009). In more recent years, the importance of social sciences for context-sensitive policy started to increase as an avenue to better inform the human dimension of regulatory processes (Bennett, 2019). Further, as policy ultimately seeks to regulate the behaviour of resource users, the significance of comprehensively understanding fishers' behavior for the development of context-sensitive policy has become increasingly of interest in the natural resources literature, including in the fisheries and oceans literature (Bowles, 2008; Fulton et al., 2011; Hepburn et al., 2010; Salas & Gaertner, 2004).

Yet, fisheries and oceans policy is still sometimes underserved by mischaracterizations of fisher behaviour (Andrews, Pittman, et al., 2021). Historically, fisheries and oceans policy has been dominated (Gordon, 1954; Scott, 1955), and sometimes continues to be influenced (e.g., Hilborn, 2007), by neoclassical economics approaches (Fulton et al., 2011; Salas & Gaertner, 2004). Regulatory approaches that are rooted in these assumptions often prioritize solutions that restrict users' participation through top-down regulations because based on the premises that as rational and self-interested individuals, resource users would be unable to self-organize. While the last four decades saw a shift away from the use of these approaches (e.g., the body of scholarship that emerged from the Bloomington School), policy that still discounts the complexity of fisher behaviour and its motivations

Table 1.2: Selected definitions of institutions

Definition	Source
Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction.	North, 1990, p. 3
A cluster of rights, rules, and decision-making procedures that gives rise to a social practice, assigns roles to participants in the practice, and guides interactions among occupants of these roles.	Young et al., 2008, p. xxii
Institutions can be defined as the sets of working rules that are used to determine who is eligible to make decisions in some arena, what actions are allowed or constrained, what aggregations rules will be used, what procedures must be followed, what information must or must not be provided, and what payoffs will be assigned to individuals dependent on their actions. All rules contain prescriptions that forbid, permit, or require some action or outcome.	Ostrom, 2015, p. 51

can be ineffective and may lead towards negative governance outcomes such as lack of compliance and collective action crowding-out (Allo & Loureiro, 2017; Cinner et al., 2021; Frey & Jegen, 2001; Fulton et al., 2011; Holling & Meffe, 1996; Thomas et al., 2016)

In this dissertation, I argue that a more nuanced understanding of fisher behaviour can illuminate alternative pathways to design more effective and more equitable regulatory arrangements by aligning fisheries and oceans policy (and the regulations that emerge from it) with the human and behavioural dimension of the context it seeks to regulate.

1.3.2 Fisher behaviour as lenses to strengthen policy

In this dissertation, I introduce fisher behaviour as an emerging research field. This field draws from diverse scholarly perspectives, conceptualizations, and methodologies that engage with the multifaceted, empirical nature of fisher behaviour (e.g., Allo & Loureiro,

2017; Andrews, Wolfe, et al., 2021; Schadeberg et al., 2021). Much of this scholarship (e.g., Salas & Gaertner, 2004; van Putten et al., 2012; Wieczorek et al., 2021) has been developed in reaction to theoretical predictions of fisher behaviour rooted in neoclassical economics principles and approaches.

The study of human behaviour more generally is becoming increasingly relevant in environmental governance because of its recognized potential in advancing policy by providing insight into people's actions and the reasons behind them (e.g., Bauwens, 2016; Fulton et al., 2011; Hepburn et al., 2010; Nielsen et al., 2024; Salas & Gaertner, 2004; Schill et al., 2019). For instance, Challenge 10 of the United Nations 2021-2030 Decade of Ocean Science for Sustainable Development highlights the necessity to identify strategies to achieve behaviour change in order to achieve ocean sustainability. Human behaviour refers to the complex and interconnected interactions that occur between an individual's characteristics, such as their values, attitudes, and preferences, and the systemic factors that shape an individual's experiences, such as social, physical, and systemic factors (Nielsen et al., 2024).

Despite the inherent complexity of human behavior, neoclassical economics emerged, after World War II, as the predominant model to describe, analyze, and predict human behaviour, likely due to its mathematical rigor and simplicity to solve (Thaler, 2016). Similarly to other policy contexts, fisheries and oceans policy has been predominantly shaped by, and still sometimes reflects the influence of neoclassical economics theory (Gordon, 1954; Hilborn, 2007; Scott, 1955). This approach operates on three assumptions that together define *Homo Economicus*. First, it assumes that individuals have well-defined preferences, unbiased beliefs, and unbiased expectations. Second, it presumes that people make rational decisions based on these preferences, beliefs, and expectations, thereby implying that humans have both infinite cognitive abilities and infinite willpower. Third, it supposes that self-interest is the primary motivator of human behaviour. Based on these assumptions, *Homo Economicus* predicts that, given the inherent costs of cooperation, individuals would always prioritize self-interest over collective interest and deplete shared resources (Hardin, 1968).

While neoclassical economics models have the advantage of providing mathematical simplicity, this oversimplification sacrifices the ability to capture the complexity and nuances of real-world scenarios. Hence, fisheries and oceans policy that is rooted in neoclassical economics runs the risk of neglecting the rich empirical reality that shapes fishers' perceptions, strategies, and responses to social and ecological change (Andrews et al., 2021; Fulton et al., 2011; Salas & Gaertner, 2004).

Concurrently, because *Homo Economicus* precipitates implications closely related to the

Tragedy of the Commons (Hardin, 1968), fisheries and oceans policy embedded in these approaches often supports arrangements aimed at the privatization and commodification of fisheries and oceans resources. An example of this type of mechanism in the context of fisheries are ITQs, which are policy tools that allocate specific portions of the total allowable catch to individual fishers or entities, allowing them to buy, sell, or lease their quotas to other fishers or entities (Boyce, 1992). However, applying ITQs as a blueprint to contexts without considering their operational context and relying on inadequate assumptions about human behavior can result in unintended consequences, such as cultural upheaval, social disruption, and financial hardship (Carothers & Chambers, 2012; Pinkerton & Davis, 2015; Young et al., 2018).

Starting in the 1980s, alternative approaches to neoclassical economics emerged. Unlike *Homo Economicus*, most of these approaches were based on real-world observations. In the context of natural resource governance, Ostrom's (1990) work was seminal in describing the ways through which people self-organize to regulate the use of common resources. In the case of fisheries, empirical observation showed that, in instances where formal institutions are not in place to regulate resource use, fishers self-organize to coordinate their activities at sea using unwritten rules of behaviour that formed and evolved over long periods of time and that are deeply anchored in local knowledge and cultural tradition (Caoci & Lai, 2007; Morelli, 1990).

Alternatives also emerged to describe fisher behaviour specifically. For example, interactive governance approaches (e.g. Chuenpagdee, 2011) shed light on how fisher behaviour is intricately interwoven within ecological, social, and governance dimensions –and the interactions between them. Livelihood approaches (Blythe et al., 2014), on the other hand, bring attention to the significance of other crucial aspects of a fisher's life, such as the impacts of ecological stressors on their quality of life or the need for livelihood diversification, and how these shape fishers identities and the decisions they make regarding their activities. In addition, gender approaches (Galappaththi et al., 2022) provide insight into how activities along the fisheries value chain are shaped by gender dynamics, revealing contexts where unequal distributions of responsibilities disproportionately affects women. Alternatively, social-ecological resilience approaches (Whitney et al., 2017) provide insights into how fishers adjust their strategies amidst times of uncertainty and rapid change. Together, these elements, whether they are individual characteristics (e.g., gender) or systemic conditions (e.g., ecological, social, and governance dimensions), interact in complex ways to shape fisher behaviour and fishers' responses to policy.

In Chapter 2 of this dissertation, I provide a list of 14 approaches (including the four mentioned above) to understand fisher behaviour. Some of these approaches were developed in response to (or at least they contrast) *Homo Economicus*. The aim of this chapter is

not to create an exhaustive list of fisher behavioural approaches, but rather to provide a snapshot of selected conceptual and theoretical approaches that could serve as entry points and complementary opportunities to enhance the understanding of fisher behaviour.

In this dissertation, I argue that an empirically-grounded and contextually-relevant understanding of fisher behaviour can improve governance by aligning policy with the richer environment in which behaviour is embedded, thus making policy more effective because tailored to a specific context. At the same time, I argue that a more nuanced understanding of fisher behaviour can enable governance to prioritize equity for fishers by designing policy arrangements that recognize, align with, and build on pre-existing strategies that fishers developed over long periods of time to adapt to change and make decisions over resource use. Drawing from insights into fisher behavior, I argue that fisheries and oceans policy aimed at achieving sustainability can mitigate the risk of adverse outcomes, such as inefficiency, low compliance rates, and undermining the intrinsic motivations of resource users.

1.3.3 Social networks & social norms: Two behavioural approaches

Governance and institutions shape, yet are simultaneously shaped, by fisher behaviour (Andrews et al., 2021; Fulton et al., 2011; Salas & Gaertner, 2004). In turn, behaviour shapes and is shaped by the social environment in which it exists, including interactions and relationships with other actors (Nielsen et al., 2024). In Chapters 3 and 4 of this dissertation, I focus on social norms, which are informal rules of behaviour that resource users utilize to regulate resource use, and on social networks, which are the social structures within which social norms exist and acquire significance.

Social norms are one of the means through which communities self-organize and solve collective action problems, such as the use of common resources, through behaviours such as cooperation and coordination (Cardenas, 2011; Ostrom, 1990). Traditionally, social norms have been a challenging topic to study and interpret, especially using neoclassical models of behaviour, because they did not ‘fit’ within the *Homo Economicus* predictions that people are self-interested and are hence unable to contribute to the collective good (Bicchieri, 2016; Krupka & Weber, 2013). Starting from the 1980s interest in social norms across various disciplines started to increase, generating a diversity of definitions and conceptualizations, which often reflected disciplinary orientations.

There is no single definition or conceptualization of social norms (refer to [Table 1.3](#) for selected definitions). However, social norms as a construct are often referred to as

informal rules of behaviour because they are used by communities as heuristics and guidelines to navigate social situations and social dilemmas (Bicchieri, 2006; Cialdini et al., 1991; Ostrom, 2005). Prominent theoretical and empirical frameworks that focus on social norms include Azjen’s (1991) Theory of Planned Behaviour, Cialdini et al.’s (1990) Focus Theory of Normative Conduct, and Bicchieri’s (2006) empirical framework. Most of these frameworks conceptualize social norms as behaviours upheld by expectations, beliefs, or perceptions about the behaviour of other or the behaviours that others would expect one to have (Ajzen, 1991; Bicchieri, 2006; Cialdini et al., 1990). Hence, in these frameworks, social norms exist as a function of someone’s perception of the distribution of a certain behaviour –and in cases where there is a discrepancy between the perception one has about a certain behaviour and the actual distribution of said behaviour there is an issue of pluralistic ignorance (O’Gorman, 1986).

Importantly, social norms do not exist in isolation from the social context within which they operate. Rather, they emerge, manifest, and evolve within social networks (Bicchieri, 2016). Social networks are used in a range of applications and contexts, including natural resource contexts and fisheries (e.g., Alexander et al., 2015; Bodin & Crona, 2009). In this dissertation, I acknowledge Borgatti and Halgin’s (2011) warning against the ‘realist’ (Laumann et al., 1983) notion that a predetermined network exists per se, and that it is up to the researchers to uncover it. In contrast, in this research (and specifically in Chapter 4) I take a ‘nominalist’ (Laumann et al., 1983) stance, which posits that each research inquiry defines and generates a different type of social network. For instance, in the context of studying information exchange within a fishery, questions about who shares information with whom would delineate an information-sharing network.

Social networks are social structures that consist of actors, also known as nodes, and ties that establish connections between actors. The structure of a network is determined by the various types of ties and the way in which they connect nodes. Additionally, network flows refer to what passes through ties when nodes interact. This exchange could be tangible (e.g., objects) or not (e.g., ideas) (Borgatti & Halgin, 2011; Wasserman & Faust, 1994). The literature further distinguishes between network bonding ties and bridging ties, whereby the first kind promote trust, reciprocity and therefore cohesion within groups. The second type of tie (bridging) can be used for information sharing and new knowledge acquisition and development across communities (Bodin & Crona, 2009; Granovetter, 1973; Newman & Dale, 2005)

Analysing social networks’ topology (i.e., structure) through social network analysis (Freeman, 2004) can benefit governance processes because network structure reveals what conditions are likely to contribute to or hinder behaviours (i.e., cooperation and coordination) that resource users utilize to solve collective action problems (Alexander et al., 2015;

Table 1.3: Selected definitions of social norms

Definition	Source
(The term social norms) can refer either to what is commonly done (...) or to what is commonly approved – that is what is socially sanctioned.	Cialdini et al., 1991, p. 202
Social norms are patterns of behaviour that are self-enforcing within a group: everyone conforms, everyone is expected to conform, and everyone wants to conform when they expect everyone else to conform.	Young, 2015, p. 359
A social norm is a rule of behaviour such that individuals prefer to conform to it on condition that they believe that (a) most people in their reference network conform to it (empirical expectations), and (b) that most people in their reference network believe they ought to conform to it (normative expectation).	Bicchieri, 2016, p. 35

Bodin & Crona, 2009; Bodin & Norberg, 2005). For instance, the more social ties, the higher the density of a network. The higher the network density, the more communication occurs, and the more trust builds (potentially). High density network structures can enable collective action by facilitating social cohesion, which is the “glue” that contributes to the development of shared social norms of behaviour (Alexander et al., 2018; Friedkin, 2004; Ostrom, 1990).

It is important to note, however, that the positive effects of network density do not increase monotonically: as density increases, so does the number of actors, which in turn may reduce the effectiveness of collective action and associated cooperative and coordinating behaviours (Bodin & Crona, 2009). Finally, lack of cohesion, and the presence of subgroups, does not necessarily represent an obstacle to collective action (Wasserman & Faust, 1994). Subgroups could imply less occasions for resource users to engage in exchanges, and building reciprocity and mutual trust (Bodin & Crona, 2009; Granovetter, 1973). Yet, when there are central actors who can and are willing to use bridging social ties to acquire new knowledge and synthesize it for the benefit of the collective, the presence of subgroups can be beneficial for community capacity to adapt to fast-changing social and ecological conditions (Berkes et al., 2003; Bodin & Norberg, 2005; Granovetter, 1973;

Newman & Dale, 2005; Walker et al., 2004).

For all these reasons, social norms and the social networks through which they manifest and evolve, can represent important bottom-up behavioural approaches for fisheries and oceans policy, because they can provide lenses that reveal what is happening locally and why (e.g., why and to what extent fishers are able and willing to cooperate and coordinate with each other to solve collective action problems). On the contrary, introducing external and top-down regulations into contexts characterized by strong social norms can be ineffective, result in crowding-out, low compliance rates, and potential conflict (Allo & Loureiro, 2017; Cinner et al., 2021; Frey & Jegen, 2001; Thomas et al., 2016). By integrating social norms and social network knowledge into policy, regulatory processes can be designed not only to be more effective, by increasing the ‘fit’ (Epstein et al., 2015) with the social and ecological context they are aiming to regulate, but also more equitable, because they are built on informal institutions that have formed, adapted, and changed, over long periods of time, persistence, and sometimes struggle.

1.4 Empirical context

This dissertation provides insights and analyses that emerge from global systematic reviews and syntheses (Chapters 2 and 3). However, a core objective of this research (Objective 3) is situated in the specific empirical context of the Asinara Marine Protected Area (MPA) in Sardinia, Italy (Figure 1.1). Established in 2002, the Asinara MPA has a total size of 108 km² and is divided in three zones, each varying in degrees of protection. Zone A, the integral reserve, spans 5% of the MPA. Zone B, the general reserve, covers 65% of the area. Finally, zone C, the partial reserve, extends over 30% of the MPA.

The MPA is managed by the Asinara National Park and Marine Protected Area authorities. Further, the MPA is designated as a [Special Area of Conservation \(SAC\)](#) of the Natura 2000 network, protected under the 1992 EU Habitats Directive (Council Directive 92/43/EEC), under which Europe’s threatened species and habitats are protected with the aim to preserve and restore biodiversity across land and marine spaces.

Before becoming a penal institution (1885-1997), the Asinara island was inhabited by fishing and farming communities. In 1885, these communities were relocated to the main island of Sardinia, which led to the establishment of the municipality of Stintino. Presently, Stintino resides under the administrative purview of Porto Torres and, for this reason, small-scale fishers from Stintino and Porto Torres hold fishing rights within the boundaries on the MPA. Further, small-scale fishers from the community of Castelsardo

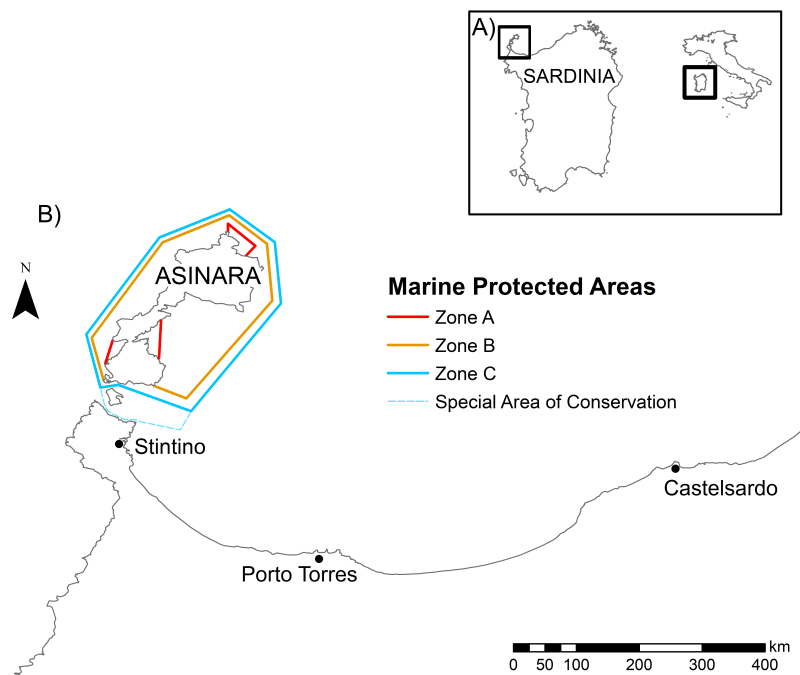


Figure 1.1: Empirical context: Sardinia, Italy (Figure 1.A), and the Asinara MPA (Figure 1.B). Country boundaries: ESRI 2023, MPA boundaries: by L.K. Banks 2023. MPA boundaries are approximate

are allowed to fish within the MPA boundaries, yet only for ‘*pescatourism*’ purposes (i.e., fisheries-related tourism as a strategy of livelihood diversification).

Small-scale fishing is the only fishing activity allowed within the Asinara MPA boundaries and only in certain zones. The majority of the fishing vessels do not exceed 12 meters in length and have between one to three crew members, including the boat captain, depending on the size of the vessel and the type of fishing being carried out. Although fishing can occur year-round, most fishing activities in the Asinara Gulf take place between early Spring (April) and Fall (October). Fishing is carried out by pots, nets, and longlines and the main targeted species include octopus (*Octopus vulgaris*), lobsters (*Palinurus elephas*), cuttlefish (*Sepia officinalis*), mullets (*Mullus surmuletus*), scorpionfish (*Scorpaena spp.*), and sparids (*Diplodus spp.*, *Spondylisoma cantharus*, *Dentex dentex*). During the summer months (June-August), which correspond to the Italian tourist season, fishers in possession of a licence issued by the Asinara National Park and Marine Protected Area are allowed to carry out *pescatourism* activities.

The Asinara MPA resource users are for the most part affiliated with local cooperatives, which provide an avenue to manage fishing and administrative activities collectively. For example, resource users use their local cooperative to navigate relationships with other groups, to negotiate catch prices, and to access markets that may be difficult to access individually. Further, as in many other parts of the Mediterranean, the Asinara MPA community is predominantly male and aging, as there is limited participation from younger generations. Finally, similarly to other global contexts, the Asinara MPA communities are experiencing escalating vulnerability associated with external drivers of change, such as climate change (Text Box 1).

In 2022, the Asinara MPA initiated discussions regarding the renewal of the MPA regulations. This process was conducted in consultation with representatives from the local resource users communities. The revisions included modifications to currently allowed activities, such as open and closed seasons for fishing, and gear alterations (e.g., nets length).

Text Box 1: SSF Vulnerability

In the Mediterranean, SSF constitute 80% of the total fishing fleet (FAO, 2022). SSF are defined by the EU as vessels no longer than 12 meters and that do not use tow gear (European Maritime and Fisheries Fund Regulation 508/2014). Though clear and concise, this definition fails to acknowledge the sector’s significant cultural, social, and economic roles, its vital support for coastal communities’ livelihoods, and its integral place in the local way of life.

SSF are experiencing escalating vulnerability, stemming from pollution, habitat degradation, overfishing, and the detrimental impacts of climate change on marine ecosystems (FAO, 2022; IPCC, 2022). Further, European policies, such as the [Common Fisheries Policy \(CFP\)](#), disempower European SSF by limiting the sector’s capacity to influence policy (Percy & O’Riordan, 2020). Together, these factors compound to exacerbate SSF vulnerability.

Because MPAs are often implemented in areas where communities live, work, and have longstanding customary and traditional access to fishery resources, these conservation tools have historically been criticized when authorities have externally imposed regulations without addressing the ethical considerations of fairness and equity of doing so (Di Franco et al., 2018; Garcia et al., 2014; Jones, 2014; Said et al., 2017). As such, for an MPA to be successful, it must go beyond its ecological objectives (Bennett et al., 2017; Cinner et al., 2014) and address the social implications of conservation by establishing protected areas, and associated regulations, that are not only effective, but also equitably governed (Convention on Biological Diversity, 2023). This aim is reflected in Target 3 of the Kunming-Montreal Global Diversity Framework. One way Target 3 can be achieved is by acknowledging and bringing recognition to the existing processes, practices, and knowledge systems that communities have established to regulate and navigate resource use. For example, it has long been documented that the Asinara fishing communities follow unwritten rules of resource use, deeply anchored in local knowledge and cultural tradition, to coordinate activities amongst each other (Caoci & Lai, 2007; Morelli, 1990). In this research, I focus on two social structures that are associated with communities’ behaviour and resource use: social norms and social networks.

1.5 Research design, methodology, and methods

In this section, I outline the methodological approach that I used to achieve the three objectives of this dissertation (Section 1.2). Methodologies describe the overarching design

of a research project, and they indicate the lenses through which the researcher gathers and interprets knowledge (Gray, 2004).

My research methodology is informed by both deductive and inductive approaches. Deductive approaches can be interpreted as a form of top-down reasoning because they involve moving from general principles to draw conclusions on specific cases. In contrast, inductive approaches can be thought of as a form of bottom-up reasoning because they involve formulating broader generalizations and overarching principles based on specific observations or evidence (Gray, 2004).

In Chapter 3, I used both deductive and inductive approaches to conduct a systematic scoping review on social norms and social dilemmas in environmental settings, including fisheries contexts. For example, while the search protocol I developed to query and assess the literature followed a deductive approach, the data analyses were informed by both deductive (a set of pre-determined codes) and inductive (coding that allows for patterns to emerge) approaches (Creswell & Creswell, 2023; Gray, 2004; Palinkas et al., 2015).

Chapter 4, instead, reflects an inductive approach because this research relied on the Asinara MPA communities' lived experiences and perspectives to generate overarching patterns on social norms, social networks, and behavioural dynamics. While positivist in orientation and perspective (Gray, 2004), as it mainly relied on structured surveys to elicit data and insight, and while also to some extent limited by restrictions associated with the COVID-19 pandemic, research in Chapter 4 relied on actively involving individuals and community partners to identify key issues and generate solutions grounded in local context and knowledge (Lenette, 2022).

In terms of methods, I integrated qualitative and quantitative methods alongside a theoretical exploration. Below, I provide an overview of the methods used in each of the manuscripts, however further details are available in the pertinent methods sections of Chapters 2-4.

In Chapter 2, I adopted a perspective article to advance the emergent field of fisher behaviour. In this manuscript, I offer opportunities to stimulate further discussion on fisher behaviour by synthesizing existing theories, concepts, and perspectives grounded in empirical evidence and observation. Chapter 2 provides the foundation of this dissertation and frames the context and significance of my research.

In Chapter 3, I mapped and synthesized the complex interactions between social norms, social dilemmas, and fisheries policy. To achieve this objective, I conducted a systematic scoping review of 69 empirical, peer-reviewed articles published between 1980 and 2022. Systematic scoping reviews are useful to identify key themes, gaps, and trends (Munn et al., 2018), while using systematic protocols for searching, screening, appraising and

synthesizing evidence (Tricco et al., 2018). This process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines (Tricco et al., 2018). Literature searches were completed between March 2022 and June 2022 and data was collected from Web of Science (WoS) and Scopus. A detailed description of the systematic review approach is included in Chapter 3.

In Chapter 4, I conducted in-person, structured surveys to empirically examine the role of social norms and social networks in the Asinara MPA communities in Sardinia, Italy. Surveys are a quantitative research method used to collect data from a sample of participants using questionnaires. For this research to be pertinent and useful, I initiated a collaboration with a not-for-profit organization, Blue Marine Foundation (BMF), and signed a [Memorandum of Understanding \(MOU\)](#) between them and the University of Waterloo in the Spring of 2022. While BMF is not a local organization, this institution has extensive experience collaborating with organizations in Italy and in Sardinia specifically, including an ongoing collaboration with the Asinara MPA. The Asinara MPA authorities further provided assistance by sharing their list of fishers' contacts. The community researchers (n=2) and I complemented this list through a modified snowball sampling approach (e.g., Wasserman & Faust, 1994). In snowball sampling approaches, researchers begin by identifying an initial group of participants, who are then asked to nominate others with whom they have social connections or relationships (Hay & Cope, 2021). However, there are some limitations to this sampling method, including when used in social network analysis. First, individuals who are not well-connected, or who do not have social relationships (i.e., isolates), may be underrepresented or not appear in the network, which can lead to obtaining a biased depiction of the population and to overstate the level of connectedness of the population. Second, reaching network saturation (i.e. capturing every actor of the social network) is not guaranteed when using snowball sampling (Hanneman & Riddle, 2005). In order to manage potential sources of bias and address these limitations, I initiated multiple snowball sampling processes by identifying multiple initial sets of actors through a series of visits to harbours, landing sites, and fishing cooperatives. This approach allowed me to manage the above-mentioned sources of bias while carrying out the sampling until network saturation was reached (Alexander et al., 2015; Hanneman & Riddle, 2005).

In total, I collected 81 surveys between April 2022 and February 2023. The response rate was 98%. All interviews were conducted in Italian (myself and community researcher are native Italian speakers) and they lasted between 40-90 minutes. Fieldwork was conducted both in-person and coordinated remotely by me (surveys were still conducted in person by the two community researchers trained by me) in response to COVID-19 pandemic requirements. Survey questions predominantly gathered sociodemographic information, as well as social norms and social network data. The questionnaires were co-developed

through formal and informal collaborations with key informants from the Asinara MPA communities, and BMF to ensure fit with local context and local needs.

1.5.1 Validity, reliability, and generalizability of findings

In this research, I followed procedures designed to address concerns related to the validity of the data collected and the reliability of data collection processes. Through these measures, I aimed to mitigate potential sources of bias (e.g., social desirability bias) that may have emerged during the research process.

The scope of Chapter 2 is to provide a range of selected complementary approaches that together provide entry points to better understand fisher behaviour from different perspectives and lenses. This chapter further critically engages with literature based in neoclassical economics, which has historically dominated fisheries policy, therefore directly or indirectly contrasting this literature with an alternate growing body of literature on fisher behaviour.

In the scoping review (Chapter 3), I employed a stepwise process, developed in consultation with a University of Waterloo librarian (Koffel, 2015), that followed the PRISMA-ScR guidelines (Tricco et al., 2018). The databases I chose (Scopus and WoS) were selected based on their performance both in terms of functionality and search reproducibility (Gusenbauer & Haddaway, 2020). Finally, I outlined the exclusion criteria that I applied at each step of the screening process, and I reported the screening outcomes in a PRISMA Flow Chart available in the pertinent section of Chapter 3.

In the case study of the Asinara MPA (Chapter 4), my efforts centered on two primary objectives to ensure validity and reliability: accurately capturing participants' ideas, behaviors, and perspectives, and minimizing potential ambiguities in the collected data (Adcock & Collier, 2001; Heale & Twycross, 2015; Noble & Smith, 2015). First, I addressed these concerns by seeking triangulations in the findings as data was mainly collected through surveys. For this purpose, I engaged in discussions with key informants and community partners to seek additional depth to the patterns that emerged from the analyses and to confirm the interpretation of the results. Second, before conducting surveys, I ensured that all participants were thoroughly briefed on the research objectives and the measures in place to safeguard their privacy and safety. This process involved sharing detailed information and providing participants with a written documentation outlining these aspects. This approach was aimed at cultivating an environment conducive to sharing information more openly. Third, I organized training sessions before community researchers started remote data collection. These sessions aimed to ensure that community researchers understood

the research objectives and data collection requirements. I further actively supervised the remote data collection process, maintaining regular communication with the community researchers to seek feedback and offer guidance when needed. By ‘remote’ data collection, I describe a process whereby I was remotely coordinating research activities, including data collection processes, meanwhile community researchers were conducting the surveys in person.

Chapter 4 is deeply rooted in the specific context, processes, and dynamics of the Asinara MPA communities. Researchers that prioritize approaches based in collaboration and participation can provide results with high internal validity by creating research instruments that reflect the specific context of the study area (Brydon-Miller et al., 2003; Lenette, 2022). This choice may undermine the broader applicability and generalizability of research findings. However, this research is meant to be grounded in the specific context of the Asinara MPA and, as such, to answer to the specific challenges and opportunities present in this unique social and ecological environment. At the same time, this chapter can also offer lessons that are relevant to a wider range of problem contexts. Specifically, it can provide valuable insight for governance processes that are seeking to strengthen formal institutional arrangements in the broader spectrum of natural resource use and common-pool resource users.

1.5.2 Ethical considerations and adaptations to COVID-19 pandemic

This research has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Board (REB #43416). The Ethics Protocol for the field research further complied with the standard guidelines of the latest edition of Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans (TCPS2) and it addressed all relevant considerations and risk mitigation strategies including informed consent during recruitments, privacy and confidentiality safeguards, and data storage and protection measures. Supplementary material that was shared with research participant is provided in [Appendix A](#).

The fieldwork portion of this research was adapted to meet the restrictions associated with the COVID-19 pandemic. To meet these restrictions, I developed a hybrid data collection plan in consultation with local partners and authorities. From April 2022 to August 2022, I conducted in-person fieldwork, meeting with local partners and key informants. Together, we co-developed and finalized data collection instruments and identified opportunities for my research to align with local needs and goals. Once the data collection

instruments were finalized, I began conducting in-person surveys from April 2022 to August 2022. I coordinated remote data collection from August 2022 until February 2023, whereby data collection was conducted, in person, by two local community researchers trained by me to ensure survey reliability and accuracy. Additionally, the community researchers also received training to adhere to ethical guidelines outlined in TCPS2. All remote field activities were led, coordinated, and monitored remotely by me using phone-based platforms (i.e., WhatsApp). All field research activities were conducted in compliance the Safety Plan for Minimizing Exposure to COVID-19 during Human Participant Research. In addition, we followed the public health guidelines issued by the relevant health authorities in Italy.

1.6 Organization of the dissertation and linkages across chapters

The next chapters are three standalone manuscripts (Chapter 2-4) and the concluding chapter (Chapter 5) of this dissertation. The manuscripts are related and build on each other. Together, the manuscripts reflect a conceptual whole and address the overarching objectives of this dissertation.

In Chapter 2, I advance the emerging field of fisher behaviour by presenting a typology that links selected bodies of scholarship on fisher behaviour. This chapter further engages with historically-predominant paradigms of behaviour based in neoclassical economics and, in doing so, it sets the context for Chapter 3 and 4. Specifically, in Chapter 3 and 4 I engage with one of the *Homo Economicus* assumptions (i.e., that people are self-interested) through two of the behavioural approaches presented in Chapter 2: social norms and social networks.

In Chapter 3, I focus on social norms and I present a global-level scoping review of empirical, peer-reviewed literature in the context of natural resources, including fisheries systems. This chapter advances the understanding of the complex interactions between social norms and collective action, and it maps the existing literature seeking for ways in which social norms are conceptualized, elicited, and measured. Finally, this chapter discusses opportunities to use social norms knowledge to advance policy.

In Chapter 4, I focus on social norms and they ways through which they manifest in social networks by empirically examining both behavioural dimensions in an MPA shared by three fishing communities in Sardinia, Italy. Through the analyses, I show ways through which communities self-organize using social norms and social networks. I further focus

the analyses on the structural characteristics of a network that can enhance or undermine collective action. I ultimately discuss how this behavioural knowledge can be used to improve fisheries and oceans policy.

In Chapter 5, I summarize the key findings that emerged from Chapter 2 to 4, and I focus on the original contributions that I made to advance knowledge, while reflecting on the conceptual, empirical, and applied insights of these advancements. I conclude Chapter 5 by discussing limitations and areas for future research.

Chapter 2

The emerging field of fisher behaviour

2.1 Chapter summary

This chapter advances an emergent field of fisher behaviour. In doing so, this chapter highlights the necessity of recognizing fisher behaviour as a subfield within the broader study of human behaviour, and the importance of understanding the reasons behind the actions (and inactions) of fishers. We achieve this aim by first critically engaging with historically predominant approaches (i.e., neoclassical economics' *Fisher Economicus*) that have informed, and that sometimes continue to inform, fisheries and oceans policy. Second, we provide a suite of selected conceptual and empirical behavioural perspectives that have emerged to provide alternatives to understand fisher behaviour. These approaches stem from Critical Social Theory, Systems Approaches, Development Scholarship, and Institutional Scholarship. Together, they offer alternatives and complementary entry points for a deeper, more nuanced, understanding of who fishers are. Two vignettes, one based in Italy and one based in Canada, delve deeper into two of these alternative lenses, adding empirical perspectives to the chapter. Knowledge on fisher behaviour can be operationalized in policy to make instruments (e.g., regulations) more efficient, and by increasing 'fit' between policy and the social and ecological context within which fishers operate. Fisher behaviour knowledge can also make policy more equitable, by bringing recognition to the diverse range of social, cultural, and emotional factors that simultaneously determine fishers' choices.

2.2 Introduction

People who catch fish for commercial and sustenance purposes are poorly understood in fisheries and oceans policy. Historically, neoclassical economics' *Homo Economicus* has arguably provided the predominant approach to understanding behaviour, including fisher behaviour (e.g., Gordon, 1954, Scott, 1955). While the past four decades provided alternative ways to think about human behaviour (*in primis* the body of scholarship that emerged from the Bloomington School), neoclassical economics still influences in substantive ways fisheries and oceans policy.

Homo Economicus depicts humans, including fishers, as rational, dispassionate, and infallible maximizers and, in doing so, it neglects to engage with the diverse worldviews, perceptions, goals, and motivations that may also shape fishers' behaviour and patterns of activities (Andrews et al., 2021; Johnson et al., 2018; Wijermans et al., 2020). In this chapter, we refer to this paradigm of behaviour as '*Fisher Economicus*' to highlight that it is based in the broader model of *Homo Economicus*, while drawing attention to the specific behaviours of fishers. As such, we argue that a more comprehensive and critical understanding of fisher behaviour can help make fisheries and oceans policy more effective, by reflecting the richer context in which behaviour is based, and increasing 'social-ecological fit' (Epstein et al., 2015). At the same time, a more nuanced understanding of fisher behaviour can help policy prioritize equity for fisheries, by drawing attention to fishers' struggles for well-being and livelihoods, and how fishers cope and adapt to social-ecological change (Andrews et al., 2021).

The chapter has four sections. First, we introduce foundational approaches and alternative approaches to understanding fisher behaviour, briefly tracking the evolution of fisher behavioural research. In doing so, we critically engage with the historically dominant assumptions of *Fisher Economicus* and provide a range of selected conceptual and theoretical fisher behavioural approaches that developed in response to (or at least contrast with) this paradigm of behaviour. Second, we reflect on who fishers are and, in doing so, we demonstrate the value of understanding the diverse motivations and contextual factors that influence and guide how fishers act and respond to change. Third, to demonstrate the utility of these 'alternative approaches' in better explaining the multifaceted reality of fisher behaviour, we present two vignettes, from Italy and Canada, that each draw on and explain a complementary approach in fisher behaviour research. Fourth, we synthesise insights from the vignettes, along with the current state of the fisheries and oceans literature, to highlight and mobilize a research agenda that links interdisciplinary perspectives on fisher behaviour with implications for fisheries and oceans policy.

2.3 Foundations and alternatives for fisher behavioural research

Neoclassical economics approaches have historically dominated natural resource policy, including fisheries and oceans policy, although early exceptions exist (see Charles, 1989; Cove, 1973). Notable in this regard is Scott Gordon's (1954) work, along with Anthony Scott's (1955) subsequent response, that advocated for solutions to the fisheries open access problem that relied on reshaping property rights regimes. Such debates about the privatization of fisheries and oceans, however, actually began much earlier with Hugo Grotius' (1609) *Mare liberum* and John Selden's reply (1635) *Mare Clausum*. Regardless, one of the most contested contributions to these debates was Garrett Hardin's (1968) allegory of the Tragedy of the Commons, which describes how humans, given their rational and self-interested nature, would inevitably deplete shared resources, unless externally regulated.

Neoclassical economics assumes that: (i) humans have well defined preferences, unbiased beliefs, and unbiased expectations; (ii) according to these preferences, beliefs and expectations, humans make dispassionate decisions that are optimal, which implies they have (a) infinite cognitive abilities and (b) infinite willpower; and (iii) humans' primary motivation is self-interest. Models of behaviour based in these assumptions have some advantages. For example, they are mathematically easy to solve. Mathematical rigour, however, comes at the expenses of capturing the complexity and nuances that characterizes real-world applications by downplaying the multifaceted reality that influences fishers' choices and behaviours. Importantly, assumptions about self-interest and rationality can support instruments and arrangements that privatize fisheries resources, or convert local institutions to externally-imposed regulations, because they imply that without external enforcement humans would deplete the commons (Pinkerton & Davis, 2015).

Individual Transferable Quotas (ITQs) are a concrete illustration of how policy based in neoclassical economics' assumptions often can converge towards the neoliberal notion of commodifying the commons and creating market-oriented solutions through privatization. ITQs are regulatory mechanisms used to distribute shares of the total allowable catch to fishers or companies, further enabling them to trade, purchase, or lease their quotas (Boyce, 1992) and they have been implemented by governments around the world in the late 20th century (e.g., Arnason, 1990; Boyce, 1992) to solve problems related to over-fishing (Costello et al., 2010). However, fishing rights allocated through ITQs are granted exclusively to individual license holders, with no legal obligation to account for others who rely on the license, such as crew members or workers in seafood processing plants. As such, when ITQs have been implemented as blueprints without considering the social context

within which they were being implemented, they have impacted local institutions and practices, traditional access rights, fishers' financial stability, and the equity of management arrangements (Carothers & Chambers, 2012; Pinkerton et al., 2024; Pinkerton & Davis, 2015; Young et al., 2018).

Beginning in the 1980s, alternative approaches to understanding resource user behaviour began to reshape policy strategies for natural resource governance. Elinor Ostrom's (1990) work was seminal for prioritizing empirical observation over theory in natural resources governance because it demonstrated that resource users can and do cooperate effectively to address collective action problems, even in the absence of formal institutions. In these years, there are also examples from the fisheries literature, for instance with description of how fishers organize access to fishing grounds using social norms deeply embedded in local cultural, traditions, and knowledge (Morelli, 1990).

Despite the shift towards empirically-based approaches to understanding behaviour, assumptions rooted in neoclassical economics continued to inform, at least in some ways and contexts, fisheries and oceans policy (Andrews et al., 2021; Fulton et al., 2011). For example, in a conceptual paper on fisher behaviour, Hilborn (2007, p. 288) illustrates the application of neoclassical economics to explain commercial fleets dynamics:

"Quite simply, fishing fleets can be thought of as a rational economic entity, that will, in aggregate, make decisions to maximize their well-being within the constraints of the legal and institutional incentives that are imposed on them. This provides a powerful framework for predicting the consequences of incentives."

When *Fisher Economicus* informs thinking about how fishers make decisions, policies favoring these perspectives precipitate problematic stereotypes about who fishers are, propagate overly simplistic depictions of how fishers drive and respond to change, and downplay important psychological, social, cultural, economic, environmental, and governance contexts in which behaviour is situated (Fulton et al., 2011; Schadeberg et al., 2021). These outcomes, in turn, limit the effectiveness and equity of regulatory interventions.

In this chapter, we synthesise 'fisher behaviour' as a core concept and as an emerging research area. In doing so, we highlight opportunities to better understand fisher behaviour and we further discuss implications for fisheries and oceans policy. As a concept, 'fisher behaviour' refers to the actions that follow the processing of cognitive, psychological, and social information in fisheries (Andrews et al., 2021). As an emerging research area, fisher behaviour draws from theory, evidence, and methods about human behaviour from a range of social sciences and humanities traditions and applications (Salas & Gaertner, 2004).

The need for a subfield of fisher behaviour, distinct yet embedded within the broader study of human behaviour, stems from the recognition that there are some unique aspects

related to fishing that warrant a closer, more focused look at fisher behaviour specifically. For instance, fishers rely on a resource that not only is mobile, but is also hidden. This resource context is different from other resources which may be stationary (e.g. forests, irrigation systems) and creates a unique set of challenges as a result. Further, fishing often occurs in open-access situations, where formal exclusion is challenging. This collective open-access condition creates an individual need to develop alternative strategies to secure fishing resources, and thus confounds behavioural choices. One outcome of this within fishing communities is to develop informal norms of behaviour, including norms of secrecy and norms of exclusion. Norms of secrecy serve as protective strategies to safeguard valuable fishing spots from competitors. When secrecy is not feasible, fishers often establish informal exclusion norms, where those who have discovered the fishing spot or possess the most knowledge and experience are granted privileged access (see Morelli (1990) for an example of norms of exclusion in Sardinia, Italy). Being aware of the ways in which fisher behaviour differs from other types of resource user behaviour, and human behaviour more generally, can have important implications for policy and policy instruments, as it provides important insights into fishers' actions and the reasons behind them.

The emerging field of fisher behaviour is informed by various traditions associated with behavioural research that engage in various descriptions, explanations, predictions, and evaluations (Andrews et al., 2021; Salas & Gaertner, 2004). In [Figure 2.1](#), we synthesize and outline a selected, non-exhaustive, range of these constructs and approaches, focusing on four scholarly traditions: Institutional Theories, Development Scholarship, Systems Approaches, and Critical Social Theory. The constructs and approaches were included because they were determined to be the most applicable to broader interests in expanding how we may understand fisher behaviour. Further, these scholarly traditions also engage with concepts that intersect with behaviour through both individual and collective perspectives, such as livelihoods, gender, governability, commons theory, social network approaches, and human values research. Importantly, these approaches also directly or indirectly engage with the shortcomings of neoclassical economics in their applicability to fisheries and oceans contexts (e.g., Bergseth et al., 2015; van Putten et al., 2012).

Approaches within Critical Social Theory can serve as lenses through which to critically understand determinants of fisher behaviour embedded in social structures that stem from power dynamics and sources of inequity. For example, interactive governance approaches bring attention to how fisher behaviour is embedded within interlinked systems encompassing ecological, social, and governing dimensions, and the interactions between them (e.g., see Chuenpagdee (2011) for an example in a Mexican fishery). In contrast, gender approaches can improve the understanding of how fishing can be influenced by gender dynamics and, consequently, how in some contexts there can be an unequal distribution of

CRITICAL SOCIAL THEORY

- Interactive Governance and Governability
- Governmentality and Power/Knowledge
- Critical Gender Studies

DEVELOPMENT SCHOLARSHIP

- Human Values Theories
- Well-being Theories
- Livelihoods Theories
- Vulnerability and Poverty Studies



SYSTEMS APPROACHES

- Social-Ecological Systems and Resilience
- Human Behavioural Ecology
- Critical Transitions and Regime Shifts

INSTITUTIONAL SCHOLARSHIP

- Collective Action Theories
- Social Norms Theories
- Social Network Theory
- Game Theory

Figure 2.1: Selected conceptual and theoretical approaches to understand fisher behaviour

responsibilities and burdens, with an emphasis on the disproportionate impact on women (e.g., see Frangoudes (2011) for an example in European fisheries).

Development scholarship encompasses various approaches and dimensions aimed at understanding and improving, for example, communities' livelihoods and well-being, and as such, indirectly critiquing neoclassical economics' narrow focus. Livelihood approaches, for instance, highlight how there are many important aspects of a fisher's life, such as the need for livelihood diversification, that simultaneously shape who fishers are and the choices they make in relations to fishing (e.g., see Blythe et al. (2014) for an example in Mozambique coastal fisheries).

Systems Approaches critique the lack of recognition of interdependencies between social and ecological dimensions of fisheries, further offering lenses to understand fishers as resource users embedded within these interdependent systems. For instance, social-ecological resilience approaches offer insights into how fishers adapt their behaviour during periods of rapid change, including, how fishers respond to uncertainties in the availability of resources to protect their livelihoods (e.g., see Whitney et al., (2017) for examples from around the globe).

Finally, Institutional Scholarship creates space to reflect on the interactions between formal and informal institutions, such as social norms or social networks, and how they synergistically determine collective behaviour, offering an alternative perspective to elements such as neoclassical individualism. For instance, social network approaches draw attention to fishers and the specific relations and patterns of relationship amongst them, further shedding light on what social structural characteristics favour (or hinder) collective action (e.g., see Alexander et al., (2015) for an example in the context of Jamaica).

The conceptual and theoretical approaches presented in [Figure 2.1](#) each have strengths and weaknesses, but they can serve as helpful (although incomplete) entry points to examine the complexity of fisher behaviour. Importantly, these concepts and approaches are not mutually exclusive, and they may be used in complementary ways to enhance the understanding of fisher behaviour.

2.4 Understanding who fishers are

Fisheries are linked natural, social, and governing systems. These systems flourish when there are healthy fish stocks and ocean ecosystems, when fishers are well and live in vibrant coastal communities, and when governing principles, regulations, and planning processes recognize fishers' needs and livelihoods (Jentoft, 2020). Further, fisheries are not all the

same. There are variations across fishery systems with regard to who is involved, how fish are caught and processed, what rights of access to ocean spaces are available, and what drivers of change affect their sustainability. As a result, fisheries and oceans policy is less effective when the range of goals and motivations that inform fishers' responses to change are not accounted for, and less equitable when the diverse strategies and struggles of fishers are neglected (Chuenpagdee & Jentoft, 2009). In short, fisheries and oceans policy need to fit the realities of a fishery system, including the dynamics influenced by fisher behaviour.

Through harvesting actions (and inactions), fishers drive and respond to changes in fish stocks and ecosystems. When fishers land their catches in coastal communities, they initiate a set of interactions and exchanges with other fishers, processors, merchants, and customers in the post-harvest value chain (Pradhan et al., 2022). Fishers are also key rightsholders and stakeholders in fisheries and oceans governance. They contribute useful, timely, and salient knowledge of social-ecological changes, often accumulated and shared among networks of fishers and community members (Ommer & Perry, 2022). Fishers may also provide leadership and advocacy for fisheries through individual and collective actions, and in some cases, they co-manage and collaborate in ocean decision-making that affects them (Sutton & Rudd, 2014). Many of these individual are gendered (Galappaththi et al., 2022; Lawless et al., 2019) adding additional complexity in efforts to understand fishers and their responses to internal and external drivers of change. Through all these activities, fishers shape sustainability outcomes, for better or worse, including influencing stock and ecosystem health, the adaptive capacity and well-being in communities, and the effectiveness and quality of fisheries and oceans governance (Chuenpagdee & Jentoft, 2009).

Understanding who fishers are, what they desire for their future, and which capacities and abilities they need to manifest change, are all important inputs to fisheries and oceans policy (Jentoft, 2020) for two related reasons. The first reason is to build appreciation for fishers' experiences and activities to improve the effectiveness and functionality of governance, such as the efficacy of policy and decisions (Fulton et al., 2011). Yet, in this regard, a key source of dysfunction is insufficient behavioural knowledge related to fishers' goals, motivations, and responses to complex social-ecological change. Improving the function of policy, then, with a more comprehensive understanding of fisher behaviour is one way to strengthen 'fit' with local context (Epstein et al., 2015), including the dynamics and feedbacks associated with fishers' activities.

The second reason is about building recognition and visibility of fishers in research and governance, including their experiences and concerns. Here, the focus is on revealing opportunities for justice in fisheries and oceans governance by bringing visibility to, and incorporating in policy, fishers' diverse needs, values, and experiences (Jentoft, 2020). A

lack of recognition and visibility is a source of injustice, where opportunities to empower fishing communities are either missed or developed using inaccurate depictions of fishers and fisher behaviour (Johnson et al., 2018).

2.5 Insights from the field of applied fisher behavioural research

In this section we offer insights and examples of applied fisher behavioural research using two vignettes as entry points to reflect on the different ways in which fishers can be better understood. It is not possible here to generate empirical insights on each of the potential concepts and theories outlined above. Rather, we draw on experiences and case study work from a small-scale fishery (SSF) in Italy to emphasize the significance of social norms approaches (from the collective body of Institutional Scholarship) and how these behavioural approaches can inform the creation of regulatory arrangements. Then, again based on place-based case study work, we use a second vignette to demonstrate the well-being behavioural approach (from the Development Scholarship set) across a 50-year period in a SSF in Canada where fishers are navigating rapid social-ecological change in an individual quota fishery.

Both vignettes, and the additional supplementary examples of additional theoretical framings, bring attention to understandings of fisher behaviour that are underserved by neoclassical economics. Ultimately, a more multi-dimensional and critical understanding of fisher behaviour should be reflected in how ideas about those behaviours are integrated into the tools and strategies of fisheries and oceans policy.

2.5.1 Social norms in a small-scale fishery in Sardinia, Italy

The aim of this vignette is to highlight the significance of social norms in shaping fisher behaviour. In doing so, this vignette frames social norms as a behavioural approach and provides a critique to one of the core assumptions of *Fisher Economicus*: that humans are self-interested and, as such, incapable of solving collective action problems.

Behaviour shapes and is simultaneously shaped by the social context within which it is embedded (Nielsen et al., 2024). Social relationships and interactions with others determine the choices that people make, including how resource users organize to navigate the complexity of collective action problems (Ostrom, 2000). Social norms can be understood

as informal institutions that communities establish and agree on to regulate resource use through behaviours such as cooperation and coordination (Cardenas, 2011; Ostrom, 1990). Research on social norms draws from a wide array of theoretical and empirical frameworks, such as Cialdini et al.'s (1990) Focus Theory of Normative Conduct, and Azjen's (1991) Theory of Planned Behaviour. In this vignette, social norms are framed as behaviours upheld by expectations, beliefs, or perceptions about commonly performed or accepted behaviours (Ajzen, 1991; Bicchieri, 2006; Cialdini et al., 1990). As such, social norms are not concepts that exist in isolation and they are relevant to specific social contexts as they form, manifest and evolve within social groups (Bicchieri, 2016). These social groups can be formalized as a social networks. In this regard, there are helpful connections with other perspectives on fisher behaviour, including those related to other institutional approaches and specifically social network approaches (Figure 2.1). Given their social relevance, social norms have been conceptualized as 'the grammar of society' (Bicchieri, 2006) and in some context they have proven to be more important than formal regulations (Allo & Loureiro, 2017). For these reasons, social norms are central elements to consider in fisheries and oceans policy, in order to make regulatory instruments more efficient and relevant to the social context within which they are embedded.

This vignette is based in the context of the Asinara Marine Protected Area (MPA) in Sardinia, Italy. The Asinara MPA was established in 2002 and it is 108 km² in size (see Chapter 4). Small-scale fishing is the only type of fishing allowed within designated parts of the MPA. The allocation of fishing permits is based on the type and quantity of gear used, which for most operators predominantly includes pots, gillnets, and longlines. The main target species are octopus (*Octopus vulgaris*), spiny lobsters (*Palinurus elephas*), and cuttlefish (*Sepia officinalis*).

In 2022, the Asinara MPA authorities initiated a renewal process of the local fishing regulations while adopting a co-management approach that involved members of the fishing community. This event made the Asinara MPA an ideal context in which to reflect about the relevance and implication of social norms, as these behavioural elements can inform strategies to enhance the effectiveness of formal regulations by highlighting the possible interplays between formal and informal rules that guide fishers' behaviours.

Structured surveys that included a social norms elicitation component revealed that amongst the Asinara MPA fishing communities there is a strong commitment to cooperative behaviours (i.e., norms of cooperation were strong). Fishers not only believe that most of their fellow fishers cooperate with others but also think that others expect them to cooperate for the collective good. This finding confirms the long-documented existence of social norms in the Asinara fishing communities, which have been present long before the

MPA designation (Caoci & Lai, 2007; Morelli, 1990). For the Asinara MPA authorities this finding is relevant, especially during a period of institutional transition, because, if properly accounted for, it could enhance the effectiveness of the new fishing regulations. Examples from the literature demonstrate that if social norms are not adequately considered, external regulations can become inefficient or even lead to crowding-out scenarios (Allo & Loureiro, 2017; Cardenas, 2011; Travers et al., 2011). For this reason, external regulations are most likely to succeed when align with and when they build on pre-existing behavioural dynamics.

Insights from the Asinara MPA context further shed light on how *Fisher Economicus* underserves the complex reality that determines fisher behaviour because it falls short in capturing the intricate web of social factors that shape fishers' actions and decisions. Social norms are powerful instruments that fishers use to shape and negotiate resource use. They are deeply ingrained in the local culture and have evolved over extended periods of perseverance and sometimes struggle. As such, social norms can be considered a bottom-up behavioural approach to make fisheries and oceans policy more effective.

2.5.2 Well-being and strategic behaviours in a small-scale fishery in Newfoundland and Labrador, Canada

This vignette highlights the well-being approach to fisher behaviour in a commercial SSF in [Newfoundland and Labrador \(NL\)](#), Canada (see Andrews et al., 2021). In NL, there are three commercial fishing sectors, including the inshore (less than 19.8m vessels in length), midshore (19.8m to less than 30.5m), and offshore sectors (more than 30m in length). The small-scale fleet is part of the inshore sector, using vessels less than 12m in length. The inshore fishery, including the small-scale fleet, has persisted through decades of marine crises including the collapse of the commercial Northern Cod fishery in 1992 and the challenges of rebuilding to a more shellfish dominated industry (Andrews et al., 2021). While all the sectors navigate rapid ocean changes, including declining but fluctuating stock sizes of key species, such as snow crab and Northern shrimp, the inshore fleet faces social and economic challenges during stock declines, difficulties associated with an ageing seafood workforce, as well as pressures to upgrade or exit the fishery through a licence buyout program (Andrews et al., 2021).

The well-being approach is a way to document fishers' goals for a meaningful life and to understand how these goals shape decision-making and behaviours in response to these changes. The approach draws from literature on well-being (e.g., Britton & Coulthard, 2013), particularly how people pursue different types of well-being when they express be-

haviour (Weeratunge et al., 2014). This approach includes material well-being (e.g., goals for larger catches, more profit, greater assets), relational well-being (e.g., high quality social and family relationships, desirable human-natural relationships), and subjective well-being (e.g., life satisfaction, positive emotional experiences) (White, 2008). In Andrews et al. (2021) individual fishers' behaviours in coastal communities were tracked over a 50-year period, and collected through a narrative interviewing approach. The study focused on the influence of different types of well-being on actions to diversify outside of the fishery, to invest in new gear, vessels and licences, as well as to enter and exit the fishery, a suite of choices that are referred to as strategic behaviour.

The role of diverse types of well-being shows how fishers' agency is shaped by a more diverse suite of goals, including but extending beyond material well-being, a goal most closely related to profit maximisation and with *Fisher Economicus* models. In this regard, there are parallels with other lenses that can be used to understand fisher behaviour (see [Figure 2.1](#)), including those related to livelihood theories and human values perspectives. Contrary to *Fisher Economicus* models in which decision-making is dispassionate, the study highlights diverse responses to navigating change based in emotional decision-making processes in the household, dockside, and on vessels, where many options for responses are considered. Experiences in NL illustrate that about half of the small-scale fishers largely pursued material well-being when they expressed behaviours such as when they entered and exited the fishery or chose to invest in new vessels or gear. The other half largely pursued relational well-being, making decisions to stay or re-enter the fishery based on remaining close to family and friends and remaining fishing in NL.

Using the well-being approach highlights how and why these fishers are navigating change in their decision-making and how, in turn, their behaviour leads to outcomes in terms of capacity and capitalization in fisheries. The well-being approach provides an entry point in revealing a hidden diversity within small-scale sector that has little to do with the policy and regulatory requirements of boat size, and more to do with how fishers interact with one another, their families, their communities and their environment across time and space with a range of preferences and goals for a meaningful life, suggesting the importance of understanding fisher behaviour with reference to interactive governance perspectives. Specifically, it highlights that there is a group of fishers whose desires for well-being in a SSF are not fully captured in policy processes that focus more on the economic and individualistic benefits of fishing and less on the relational well-being that small-scale fishing helps enrich. Using the well-being approach (and complementary perspectives from Development Scholarship and Critical Social Theory lenses – see [Figure 2.1](#)) can help reveal a recognitional injustice that arises from failing to account for the diverse desires of fishers within a governance systems. This includes policies that implicitly assume that fishers can

be bought out when they are no longer competitive.

2.6 Conclusion

This chapter characterizes fisher behaviour as an emergent research field informed by different scholarly traditions and practical applications. The first part of this chapter critically engages with historically dominant approaches *Fisher Economicus* that have informed, and sometimes continue to inform, fisheries and oceans policy. Then, the chapter provides a sampling of the diversity of behavioural constructs that offer a range of alternatives and complementary entry points to conceptualize and assess fisher behavior in fisheries and oceans policy [Figure 2.1](#).

The vignettes from Italian and Canadian fisheries emphasize two of these approaches providing more detail and depth to each of the behavioural approaches, while also drawing connections to additional theoretical framings to understand fisher behaviour. The vignette from Italy stresses the importance of prioritizing empirically-elicited drivers of behaviour, and specifically social norms, and it highlights how fishers do not operate solely out of self-interest but instead make decisions that are the product of the social context in which they are embedded. Instead, the vignette from Canada sheds light on the diverse range of values and goals that drive fisher behaviour, while acknowledging how profit maximization is only one of the potential goals shaping those behaviours. Simultaneously, we acknowledge a wide range of possible motivations and drivers of fisher behaviour which have not been explicitly addressed in this chapter. Inevitably, there are many elements that precede action and further manifest in fisher behaviour.

We offer three concluding insights on the emergence of fisher behaviour research. First, generating knowledge about fisher behaviour requires coordinating and cultivating collaborations between researchers, research practitioners, and fishing communities, with the aim to critically integrate different knowledge systems and approaches and debunk old assumptions that have long underpinned disciplines (Ommer, 2018). Such collaborations should prioritize empirical approaches that shape conceptual and empirical work in ways that augment our understandings of fisher behaviour. Second, knowledge on fisher behaviour must be leveraged in a way that balances simultaneously the functional (as demonstrated through the Italy vignette) and the justice (as demonstrated through the Canada vignette) implications of mobilising this type of knowledge. As such, knowledge on fisher behaviour must inform policy that is both relevant to the context in which it operates, while, concurrently, aligning with the needs, values, and worldviews of the fishers it aims to govern. Third, this chapter illustrates how unintended consequences in the pursuit of fisheries and

oceans sustainability are based in a misunderstanding of who fishers are. The goal of this chapter is to encourage researchers to engage with more diverse constructs and approaches to understand fisher behaviour, starting with discerning between research that is grounded in contextual, empirical evidence and research that is based in theoretical, *Fisher Economicus* approaches.

Chapter 3

Social norms, collective action, and environmental policy

3.1 Chapter summary

Social norms are informal rules of behaviour that people use to self-organize and solve collective action problems. Yet, their understanding remains limited and fisheries policy continues to be largely influenced by arguably predominant models of behaviour (i.e., *Homo Economicus*). We conduct a systematic scoping review to understand social norms in fisheries. To address the limited availability of articles focused on these systems, we broaden the scoping review to include, among fisheries, varied environmental settings (n=69). We map and synthesize the existing empirical evidence and examine how social norms are conceptualized, elicited, and measured. Our findings reveal a multitude of constructs and approaches in addressing these elements. Social norms can be conceptualized either as collective or individual constructs, and they can be elicited or measured using a variety of qualitative and quantitative methods and approaches. Importantly, a particular social norm definition or conceptualization does not necessarily correspond to a unique elicitation method. We argue that what may appear as lack of coherence can instead offer opportunities to explore social norms from various perspectives. We finally highlight how social norms knowledge can help illuminate new pathways to design more effective policy in settings looking to catalyze collective action, avoid poor ‘fit’, or crowding-out scenarios. Further, we discuss how this knowledge can be used as a bottom-up governance tool to prioritize more equitable institutional arrangements by aligning policy with existing social norms and local practices. Ultimately, the scoping review contributes to a better under-

standing of the complex interactions among social norms, social dilemmas, and institutions, and provides a valuable resource for policymakers and researchers working in this area.

3.2 Introduction

Fisheries are complex social and ecological systems in which outcomes depend on the attributes of fish resources, the people who harvest them, and the governance systems that structure fishers' interactions. Fisheries flourish when stocks are healthy, when coastal communities are thriving, and when people's knowledge, practices, and needs are effectively integrated into governance processes (FAO, 2015; Jentoft, 2020). However, governance, and the formal institutions that underpin it, have long neglected to explicitly address the complex nature of human behaviour (Andrews et al., 2021; Fulton et al., 2011; Salas & Gaertner, 2004; Wijermans et al., 2020). For example, the tragedy of the commons narrative, predicts the inevitable degradation of natural resources because it assumes *Homo Economicus* operates based on a narrow, short-term, and instrumental rationality (Gordon, 1954; Hardin, 1968; Scott, 1955). Instead, empirical evidence (e.g., Ostrom, 1990) shows that resource users can and do self-organize to provide public goods (e.g., rules and monitoring systems) to avoid the over-exploitation of common-pool resources, like fisheries.

One way that communities self-organize and solve collective action problems is by establishing social norms (e.g., Cardenas, 2011; Ostrom, 1990). Social norms are often framed as informal rules of behaviour (Bicchieri, 2006; Cialdini et al., 1991; Ostrom, 2005), or 'grammar of society' (Bicchieri, 2006), and serve as guiding principles to solve collective action problems. People follow social norms because what others do or think matters to them. Further, when situations are uncertain, social norms serve as tools to quickly assess what is the right thing to do: "If everyone is doing it, it must be the sensible thing to do" (Cialdini et al., 1990, p. 1015). Finally, in some settings, social norms can be more influential than written law (Allo & Loureiro, 2017). For these reasons, social norms provide an essential lens to understand resource users' behaviour more comprehensively. A deeper understanding of social norms will extend policy development beyond narrow neoclassical economic assumptions and include more nuanced reflections on human behaviour within context-specific policy environments.

Social norms' potential to inform policy is becoming increasingly recognized in the academic community (Nyborg et al., 2016). For instance, Constantino et al. (2022) argue how insights about social norms can be harnessed to catalyze behaviour change in the context of climate action. In the context of fisheries, there might be opportunities to use social norms knowledge to address Challenge 10 of the United Nations Decade of Ocean

Science for Sustainable Development (2021-2030), aimed at changing people’s behaviour to achieve ocean sustainability.

Nevertheless, opportunities to leverage the power of social norms in fisheries policy, and move away from models based in *Homo Economicus*, still remain unexplored. We argue that better understanding social norms can enhance fisheries policy in two complementary ways. First, social norms knowledge can strengthen policy effectiveness by increasing ‘fit’ (Epstein et al., 2015), between policy and the social context within which policy operates. Increased coherence between formal regulations and context can help avoid adverse governance outcomes such as crowding-out scenarios and lack of compliance with regulations (Cardenas, 2011; Narloch et al., 2012). Second, social norms knowledge can enhance policy equity, and cognitive equity (Martin et al., 2016) specifically, by aligning existing local practices with formal regulations. The need to bring recognition to existing local institutions is highlighted in the [Food and Agriculture Organization of the United Nations \(FAO\) Voluntary Guidelines for Securing Small-scale Fisheries](#) as a fundamental element to achieve respectful fisheries governance (FAO, 2015).

To address the gaps between theory, empirical reality, and policy implementation, as well as the lack of knowledge about social norms in fisheries policy, we conduct a scoping review of peer-reviewed, empirical, scientific articles (n=69, 1980-2022) and assess how social norms have been studied, conceptualized, and elicited by researchers. Our research is guided by three objectives: 1) To outline the state of the empirical, peer-reviewed literature on social norms in the context of social dilemmas; 2) To characterize the various ways in which social norms are conceptualized in the literature, including definitions and why people follow them; and 3) To categorize the methods and instruments used to measure or elicit social norms. Because the initial literature query returned a limited number of fisheries-specific articles, we extended the search to include diverse environmental settings and contexts, such as land management and forestry, where users face similar collective action problems.

3.3 Methods

The goal of a scoping review is to identify, catalogue, and map available evidence on a specific topic (Munn et al., 2018), while using systematic protocols for searching, screening, appraising and synthesizing evidence (Tricco et al., 2018). The area of social norms in the context of natural resources use and collective action problems can benefit from a scoping review as this method helps identify key theories, concepts, and definitions of this emerging field (Munn et al., 2018). Our review followed a four-step process: (i)

determine the research objectives; (ii) create a search protocol to explore the existing evidence; (iii) screen the results based on a pre-determined set of criteria; (iv) conduct an analysis of the resulting evidence to discern critical patterns and key information. This process was developed in consultation with a University of Waterloo librarian (Koffel, 2015) and it followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines (Tricco et al., 2018). We chose Scopus and [Web of Science \(WoS\)](#) as the targeted databases based on their performance in terms of functionality (i.e., the search behaves as expected) and search reproducibility (i.e., we expect identical searches to generate identical findings) (Gusenbauer & Haddaway, 2020). The targeted databases were queried using three sets of keywords –see [Table 3.1](#) for search string. Search strategies included abstract, titles, and keywords for the first two sets of keywords, and ‘all fields’ for the third set of keywords. We chose to use “all fields” for the third set of keywords because using “abstract, titles, and keywords” was returning a limited number of articles. The search terms reflected social norms in collective action settings within their two main classes of action (i.e., cooperation and coordination), and within the context of non-excludable resources (e.g, public goods and common-pool resources).

Although we acknowledge that our search strategy might exclude publications relevant to the literature on social norms that do not explicitly use the term ‘social norms’, we recognize the potential impact that this omission might have on our results. Consequently, we acknowledge that our findings are solely applicable to the literature that explicitly pertains to and uses the term ‘social norms’. Finally, the three sets of keywords were iteratively adjusted to ensure the search would return a pre-established test list –see Livoreil et al. (2017). Literature searches were completed between March 2022 and June 2022. The search term string is outlined below in [Table 3.1](#).

Table 3.1: Search term string (Scopus syntax)

Article title, abstract, keywords	"social norm*" OR "descriptive norm*" OR "injunctive norm*" OR "collective norm*"	AND
Article title, abstract, keywords	"collective action" OR cooperat* OR coordinat*	AND
All fields	"common pool resourc*" OR "commons" OR "public good*"	

Our initial search returned consistently 852 articles from WoS (n=338) and Scopus (n=514). To define a sample from the search results, three levels of screening were applied. In the first screening, all articles that were duplicates, published before 1980, not peer reviewed, and in a language other than English, were excluded (n=311). Although we acknowledge that relevant literature exists outside of peer-review and in languages other than English, we made a choice aimed at restricting the amount of literature to a feasible number for review (Petticrew & Roberts, 2006). The first screening returned a total of 541 articles.

A second screening was then applied to abstracts following the criteria outlined in [Table 3.2](#). These criteria were chosen to capture salient scholarship on social norms and collective action problems in the context of natural resource use and environmental settings. Articles were included if they engaged in a comprehensive examination of social norms, which could involve explicit or implicit definitions of social norms, descriptions of their role and significance within the community, or their measurement through quantitative or qualitative methods. Further articles were included if they were situated in the context of collective action problems and natural resources use, and if they were empirical. The second screening was completed by two screeners using Rayyan software (Ouzzani et al., 2016). Rayyan is a tool that helps expedite screening by using a process of semi-automation that learns the features of excluded and included articles to build a classifier that predicts on a 5-scale rating how closely non-screened articles match the included and exclude classes (Ouzzani et al., 2016). In a first phase, both screeners reviewed the same set of articles separately and made independent decisions on exclusion or inclusion. After each set of articles were screened, both reviewers met to discuss and resolve disagreement. Disagreements were solved through discussion and using the guidance provided by the Rayyan rating system. The second screening returned 81 abstracts.

Table 3.2: Screening criteria

Criteria	Description	Example of exclusion
Social norms	A main focus of the article must be social norms	No fulsome discussion of social norms such as where they exist, what drives them, how they are measured or elicited
Human population	Focus is on social norms and/or behaviour in human populations	Focus is on non-human populations (e.g., chimpanzees)
Based in the context of social dilemmas	Social norms as they exist in the context of a social dilemma with interdependent payoffs (i.e., public good provision, use of common-pool resources)	Social norms as they exist, develop, or change in contexts where payoffs are (more) independent (e.g., medical decisions, politics)
Based in the context of natural resource use	Collective action problems related to the use of natural resources	Collective action problems related to contexts such as gift exchanges, volunteering, voting
Must be an empirical article and embedded in the field	Real participants, real-world settings	Agent based modelling; laboratory experiments

A final third level of screening was undertaken to further assess the fit of the articles based on a full-text screen using criteria outlined in [Table 3.2](#). The screeners further excluded n=12 articles. The final sample included n=69 articles. The PRISMA Flow Chart is represented in [Figure 1.1](#).

We employed a qualitative coding approach to extract variables and data relevant to our research objectives. Both deductive approaches –i.e., a set of pre-determined codes, and inductive approaches –i.e., coding that allows for patterns to emerge, were used during this phase (Palinkas et al., 2015). While deductive coding answered questions related to the state of the literature (objective 1), inductive coding revealed core aspects and patterns

about how social norms are conceptualized and elicited or measured (objectives 2 and 3). Coding was undertaken using NVivo software.

The coding matrix was consolidated and finalized through one round of inductive coding. The assessment of each article included in the review is based on bibliographic information (e.g., authors, year of publication); characteristics of the evidence (e.g., geographic information, natural resource system analyzed); social norms conceptualization, measurement, or eliciting methods. The codes that emerged through these processes were further categorized in themes for further analysis and reporting.

3.4 Results

We assessed the empirical, peer-reviewed literature on social norms and collective action problems in the context of natural resources use and environmental settings. Our research motivation was a need to bridge a gap between theory, specifically the *Homo Economicus* concept in neoclassical economics, and the empirical evidence on how resource users, and fishers specifically, engage in decisions about social dilemmas. We organized results according to our three research objectives.

3.4.1 Objective 1

Our first objective consisted in delineating the scope of the empirical literature on social norms and collective action within environmental settings considering factors such as time period, geography, and system focus. The sample set included 69 articles authored by 185 authors. [Figure 3.2](#) illustrates the number of articles published per year, with the oldest article dating to 2004. Despite the sudden decline 2020, which could be possibly explained by the COVID-19 pandemic, [Figure 3.2](#) shows an overall upward trend in the literature, suggesting the emergent nature of this field in the literature.

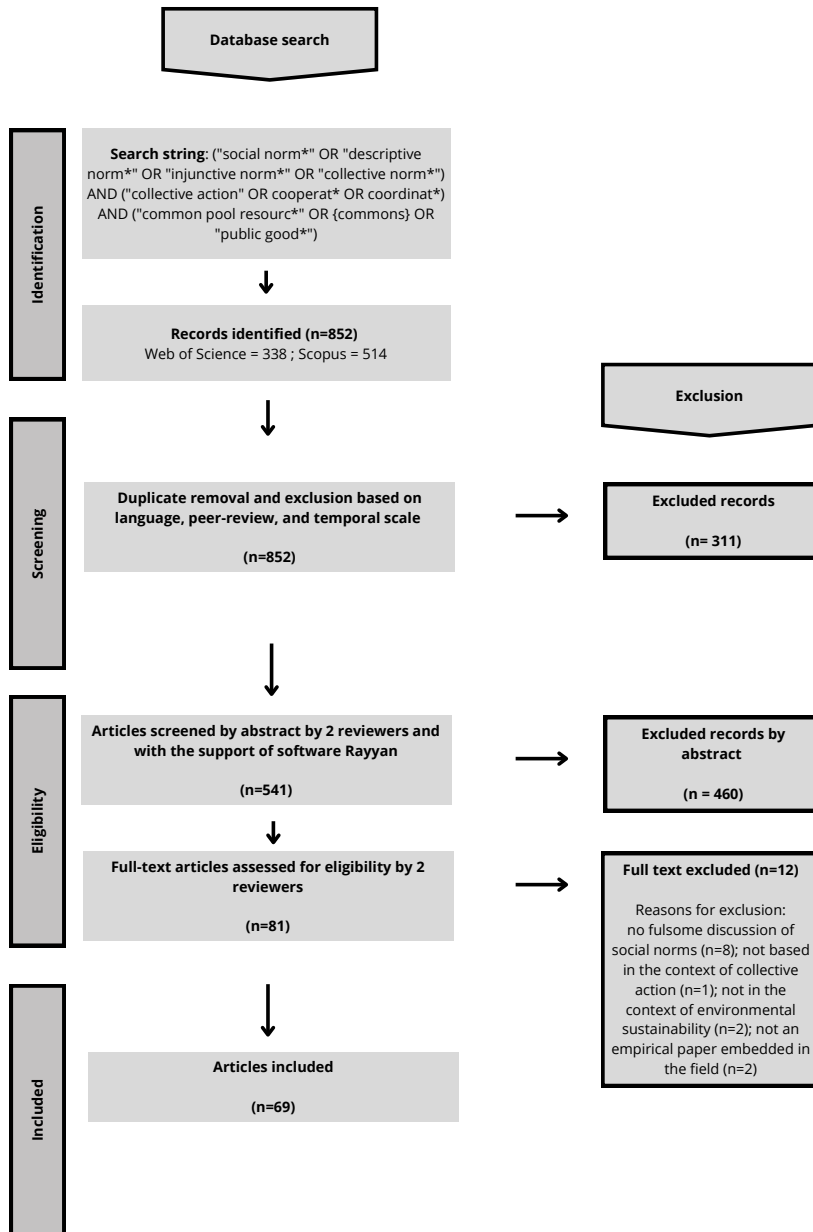


Figure 3.1: PRISMA Flow Chart

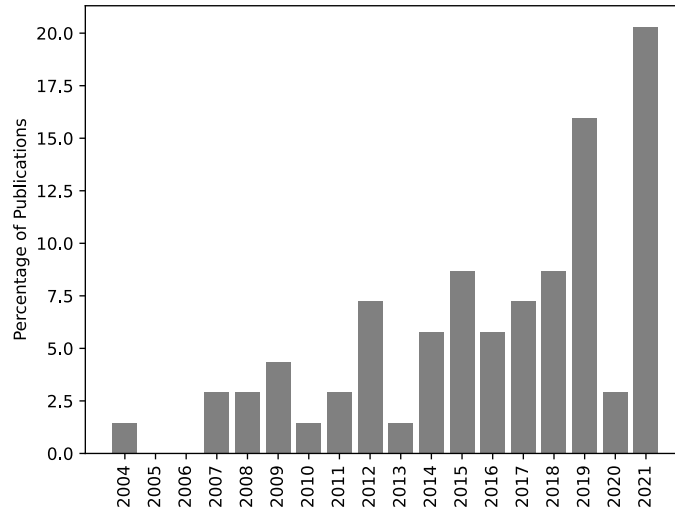


Figure 3.2: Publications by year described in percentages of total publications

These articles were published across 45 different peer-reviewed, academic journals. The journals included *Ecological Economics* (14.5%), the *International Journal of the Commons* (5.8%), and *Land Use Policy* (5.8%). The 69 articles reflected a range of focus areas, spanning from land management and forestry, to agriculture and food systems, fisheries, energy consumption, water management, waste management, wildlife conservation and management, and climate change and greenhouse gas emissions.

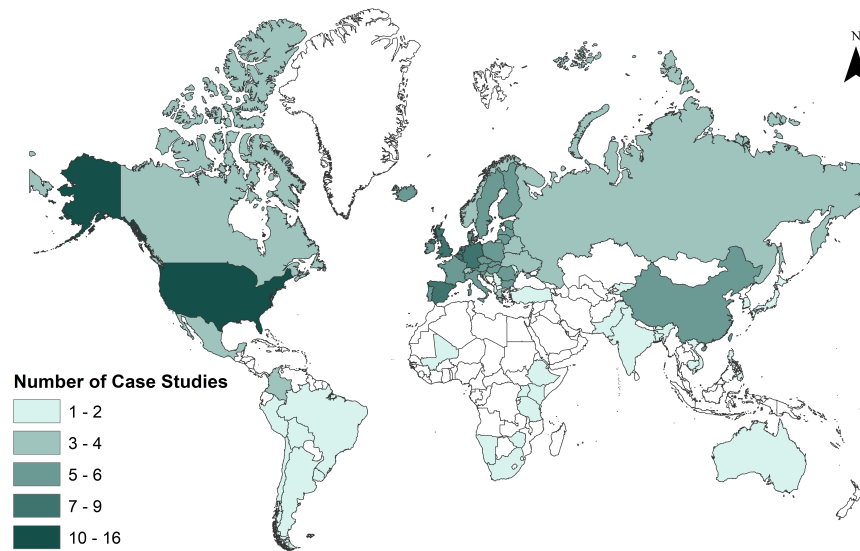


Figure 3.3: Geographical distribution of the synthesized evidence: number of case studies per country in which shading represents the frequency of case studies. Country boundaries: ESRI 2022. Map generated by L.K. Banks 2022.

The 69 articles included 246 case studies from 69 countries, spanning six of seven continents (excluding Antarctica). As shown in [Figure 3.3](#), the majority of the 246 case studies were situated in Europe (71.5%), followed by Asia (9.8%), North America (8.9%), South America (4.9%), Africa (4.5%), and Oceania (0.4%), with only one case from Australia. The 69 articles encompassed a variety of analytical levels, with 69.6% studying sub-national jurisdictions (e.g., communities, villages), 15.9% examining national-level contexts, 8.7% focusing on institutional settings (e.g., universities, energy cooperatives), and 5.8% investigating international contexts (e.g., Europe, European Union countries). Overall, there

was a lack of studies situated in the Global South, which highlighted an important opportunity for future research. Nevertheless, when focusing specifically on fisheries systems, more than half of the studies (55%) were conducted in the Global South.

3.4.2 Objective 2

Our second objective was to (i) characterize the conceptualizations of social norms in the literature on collective action and environmental settings; and (ii) delineate the reasons and circumstances under which people follow and adhere to them. The results are presented below.

a) How are social norms defined or conceptualized?

We found that the literature on social norms has been informed by various theoretical and empirical frameworks including Cialdini et al.'s (1990) Focus Theory of Normative Conduct, Bicchieri's (2006) empirical framework, Azjen's (1991) Theory of Planned Behaviour, and Lapinski and Rimal's (2005) Theory of Normative Behaviour. This variety inevitably resulted in multiple terminologies, definitions, and conceptualizations, which has both drawbacks and advantages for subsequent research. On one hand, this multitude creates a lack of coherence, but it also offers the advantage of accessing a wide range of definitions suitable for various ways of understanding empirical reality, different levels of analysis, and specific research questions. In this section, we explore these conceptualizations more deeply. We begin by categorizing definitions and conceptualizations of social norms into two distinct groups: those associated with collective constructs and those related to individual properties (Table 3.3). A similar approach was undertaken by Legros and Cislighi (2020). Within each of these two conceptual categories, there are multiple norms constructs as discussed below.

Table 3.3: Social norms conceptualizations

Construct	Definition/Meaning	Example authors
Collective Constructs		
Institutional arrangements, rules, and codes of conduct	Unwritten rules of behaviour, which coordinate people interaction, and that are sustained by informal sanctioning / they are socially enforced.	(Bicchieri, 2006; Cialdini et al., 1990; Ostrom, 2005)
Equilibria	Equilibria are situations where each person's action is the best response to the actions of others. This involves mutual adjustment of expectation, which are confirmed through time and experience.	(Bicchieri, 2006; Young, 2015)
Social capital	Social norms as an element of social capital. Other elements are rules, social networks.	(Ostrom, 1990, 1999; Pretty, 2003; Putnam, 1993)
Behavioural patterns	Social norm is a behavioural pattern to which individuals prefer to conform.	(Bicchieri, 2006; Lapinski & Rimal, 2005)
Individual Constructs		
Individual behaviours that depend on beliefs, expectations, or perceptions	Expectations, beliefs, perceptions, about what most people do, and/or what most people approve of doing.	(Ajzen, 1991; Bicchieri, 2006; Cialdini et al., 1990)
Cognitive shortcuts or heuristics	Social norms can be seen as cognitive shortcuts or heuristics that people adopt to navigate social interactions.	(Bicchieri, 2006; Cialdini et al., 1990)

Collective constructs

From the review, four types of collective constructs emerged: (i) social norms as institutional arrangements, rules, and codes of conduct, (ii) social norms as game equilibria, (iii) social norms as elements of social capital, (iv) social norms as behavioural patterns. We go through each one below.

(i) Social norms as institutional arrangements, rules, and codes of conduct

As informal institutions, rules, and codes of conduct, social norms emerge to coordinate people’s interactions around the use and management of natural resources (Bicchieri, 2006; Cialdini et al., 1990; Ostrom, 2005). For instance, in a shellfish fishery in Galicia, Spain, social norms regulate users’ extraction levels to avoid overexploitation (Allo & Loureiro, 2017). In these instances, social norms can be conceptualized as unwritten rules, learned and acquired over time and through repeated social interactions. Importantly, their violation is punishable through social mechanisms, such as social disapproval and ostracism. These mechanism makes social norms different from legal or regulatory systems, which not only are explicitly codified, but they are also punishable through formal sanction.

The relationship between formal and informal institutions is complex and not linear. Social norms can arise in the presence or in the absence of formal institutions, or emerge as ‘reactions’ to the introduction of formal regulations that groups deem inadequate. For example, in the analyzed literature we found that social norms emerged in contexts where groups considered formal institutions insufficient to regulate water access (Bros & Couttenier, 2015). Vice versa, formal regulations can be established to complement existing social norms, or to provide additional formal support where collective action is weak.

Another insight from our review was that understanding the role of social norms as rules is crucial in achieving policy fit (Epstein et al., 2015) when governments try to introduce external, formal rules in a community context. For example, in the Chon-Aksuu catchment, Kyrgyzstan, introducing [Payment for Ecosystem Services \(PES\)](#) to improve participation in the maintenance of a collectively-owned irrigation canal had synergistic, ‘crowding-in’, effects when PES complemented existing social norms, and adverse, ‘crowding-out’ effects when PES were incongruent with local informal rules (Kolinjivadi et al., 2019). These researchers and case studies have shown that it is essential to consider the alignment and fit of external, formal rules with local social norms to ensure that new rules do in fact contribute to positive governance outcomes.

(ii) Social norms as game equilibria

In game-theoretic frameworks, players establish equilibria, or social norms, through repeated interaction (Young, 2015). In these settings, adherence to a specific strategy, such as choosing to cooperate or coordinate, becomes increasingly appealing as more players adopt it, ultimately resulting in an equilibrium (Bicchieri, 2006). Challenging the zero-contribution thesis, researchers' empirical evidence showed that, in many natural resources governance settings, social norms enable collective action among resource users (Ostrom, 2000). For example, by adhering to social norms of reciprocity in refraining to free-ride when others cooperate, a social dilemma can be transformed into a game of multiple equilibria that deviate from the zero-cooperation solution (Baland & Platteau, 1996). In a multiple rounds common-pool resource game conducted in coastal and Andean regions of Colombia, Cardenas (2011) found that as the experiment progressed, resource users progressively adapted their strategies to align with the behaviour of other players and progressively moved towards an interior point equilibrium of cooperation (Cardenas, 2011).

Further, researchers in the experimental literature suggested that individuals also deviate from no-cooperation equilibria when there are sanctions, such as social enforcement (Falk et al., 2005). In a common-pool resource game conducted in Uruguayan fishing communities, not only did fishers adjust their decisions based on what other fishers did in previous rounds, but they also reduced their extraction levels when there was possibility for social disapproval (de Melo & Piaggio, 2015).

(iii) Social norms as elements of social capital

Social capital can be conceptualized as a multi-dimensional construct consisting of social norms, social networks, trust relationships, reciprocity and exchange (Pretty, 2003; Putnam, 1993). Social capital availability enables collective action over natural resource use by lowering transaction costs of cooperation and coordination through the reliance on pre-existing relationships, shared social norms, and mutual trust among individuals (Ostrom, 1999). In the Everglades Agricultural Area in Florida, United States, bridging (between-groups) and bonding (within-groups) social capital amongst different groups work in complementary ways to reduce agricultural nonpoint source pollution and improve water quality (Yoder & Roy Chowdhury, 2018). While bonding social capital reinforces cooperation among farmers through leveraging social norms of responsibility, bridging social capital facilitates information flow between regulators and farmers, aiding in the identification of best practices and garnering farmer support (Yoder & Roy Chowdhury, 2018).

(iv) Social norms as behavioural patterns

Unlike perceived social norms, discussed below as a category of individual constructs, collective norms were described in the sample articles as the actual prevalence of behaviour at the population, social group, or community level (Lapinski & Rimal, 2005). However, actual and perceived behaviour do not always align, and discrepancies can arise due to people’s misperceptions. Pluralistic ignorance (O’Gorman, 1986) occurs when people engage in a certain behaviour because they mistakenly believe that others in their social group endorse it or practice it (Bergseth & Roscher, 2018; Bicchieri & Mercier, 2014). For instance, in the Xishuangbanna National Nature Reserve in southwest China, illegal wildlife hunting and consumption persist due to pluralistic ignorance, whereby most individuals believe the behaviour is widely approved of, and hence engage in it based on this misperception, while privately condemning it (Commerçon et al., 2021). This example highlights how discrepancies between collective and perceived behaviour can arise especially when behaviours are conducted in private or are not easily observable (e.g., illegal behaviours). Pluralistic ignorance can sometimes be effectively addressed through communication (Bergseth & Roscher, 2018; Bicchieri, 2006).

Individual constructs

Individual constructs are often interpretations, or perceptions of collective constructs, yet they can also be strategies, or heuristics, that individuals use to navigate the uncertainty related to their interpretations of these collective constructs. We review below the two constructs that emerged from the scoping review.

(i) Social norms as behaviour dependant on beliefs, expectations, or perceptions

We found that in the majority of articles where individual constructs were privileged, social norms were conceptualized as people’s beliefs, perceptions, or expectations. Starting with Cialdini, Reno, and Kallgren’s (1990) Focus Theory of Normative Conduct, social norms are defined as descriptive social norms (beliefs about what is commonly done), and injunctive social norms (beliefs about what is approved of). Bicchieri’s (2006) empirically-tested framework also conceptualizes social norms as descriptive and injunctive, but introduces the notion that people’s preference to follow social norms must be simultaneously conditional on empirical expectations, or beliefs about what others do, and normative expectations, or beliefs about what others expect one to do. Injunctive and descriptive social norms differ conceptually and, in terms of motivation, injunctive norms carry the potential for social sanction (Cialdini et al., 1990). For this reason, it is crucial to distinguish between them, particularly in scenarios where both operate concurrently to influence behaviour.

While some researchers' articles privileged descriptive over injunctive social norms or vice versa, Thøgersen (2008) used Bicchieri's (2006) framework to test how descriptive and injunctive social norms interact synergistically to catalyze cooperation in social dilemmas, such as energy savings and recycling. A third construct that emerged from the sample was Ajzen's (1991) Theory of Planned Behaviour (TPB), which defines social norms as people's perceived social pressure about the appropriateness of certain behaviours. For example, Liebe and Dobers (2019) found that individuals' beliefs about what others think they should do significantly increased people's acceptance to build new wind power plants in Germany. Constructs that conceptualize social norms as beliefs, expectations, or perceptions further entail that individuals determine their actions by assessing others' behaviour and ideas within a social group that holds significance for them (Ajzen, 1991; Bicchieri, 2006; Cialdini et al., 1990).

(ii) Social norms as cognitive shortcuts or heuristics

Finally, people also use social norms as heuristics when they are uncertain about how to respond to or interpret a complex social situation (Bicchieri, 2006; Cialdini et al., 1990). Heuristics can be understood as mental shortcuts, or quick rules of thumb, that people use to simplify decision-making processes (somewhat similar to Cialdini et al.'s (1990, p. 1015): "If everyone is doing it, it must be the sensible thing to do"). These processes can be understood within the framework of bounded rationality, which departs from neoclassical economics and offers an alternative way to understand how people evaluate decisions based on limited information, finite amount of time, and available cognitive abilities (Gigerenzer & Selten, 2002; Simon, 1955). For example, in Sediba, South Africa, there are no formal institution regulating rangeland stocking rates and livestock owners rely on heuristics to restrict the over usage of the rangeland: every four years producers use heuristic rules –i.e., bulls' age and how many calves cows have had, to make choices with regards to selling cattle (Rasch et al., 2016).

b) Why, and under what circumstances, do people follow social norms?

To further explore the relationship between social norms and natural resources use, we reviewed the evidence for reasons and conditions that prompt people to comply with and uphold norms. From 69 articles, we found that decision contexts, situational cues, human tendencies to mimic others, and psychological and emotional mechanisms, all contributed to resource users' adherence to social norms.

First, decision environments, such as geographical or cultural contexts, help determine how and why people follow social norms. For example, spatial econometrics can be used to study how proximity to others influences people’s behaviour. In their article on neighbourhood effects, Tsusaka et al. (2015) describe how rice farmers in Bohol, the Philippines, are influenced by their neighbours’ behaviour but only in irrigated areas, as opposed to rainfed areas. This is because a gravity irrigation system must be collectively managed by their users, which offers opportunities for norms of cooperation among local groups to form. This finding corresponds the theory of norm evolution through common pool resource management whereby social norms emerge in contexts requiring collective action (Ostrom, 2000). Other contextual factors included regional and cultural contexts. A study on communal land management in northern Ethiopia’s Tigray region explained social norms as endogenously determined by regional conditions, such as land availability and accessibility (Oniki et al., 2020). Instead, cultural context, such as folk stories, village history, and identity, and its manifestation through social norms, contributed to upholding illegal wildlife hunting in Indigenous Dai rubber farmers communities in China (Commerçon et al., 2021).

Second, in uncertain settings people tend to rely on others’ behaviour to help interpret a situation and gauge appropriate responses (Baron et al., 1996). This tendency to mimic others as an adaptive social learning strategy is evident in the experimental literature, for example in game theoretic approaches, where players adjust their behaviour to match the actions of other players. Over rounds, players use this type of social information to create expectations, or social norms, about what is commonly approved of in that particular social setting, which eventually allows them to converge towards equilibria (Cardenas, 2011).

Third, we found that emotional mechanisms such as pride, desire for social approval, or conversely, guilt, shame, anger, fear of sanction and ostracism were powerful drivers of social norms (e.g., Barghusen et al., 2021; Bauwens & Eyre, 2017; de Melo & Piaggio, 2015; Javaid & Falk, 2015; Kolinjivadi et al., 2019; Narloch et al., 2012). In an irrigation game played with Punjabi farmers in Pakistan, some players extracted even less water than what they thought to be their fair share (i.e., the equilibrium quantity) because they wished to be perceived as a valuable member of their social group (Javaid & Falk, 2015). However, emotional mechanisms do not always shape norms adherence equally and depending on the behaviour in question, the same emotional mechanism may or may not hold the expected effect on people’s behaviour. For example, normative sanctioning does not always deter behaviour. In a wildscape gardening study conducted in Colorado, USA, it was found that individuals already engaged in planting native plants did not alter their behaviour in response to normative sanctioning; instead, not only did they persist in their actions, but they were also more inclined to promote wildscaping in their community (Jones & Niemiec, 2020).

3.4.3 Objective 3

Our third objective was to categorize the different methods researchers used to identify, elicit, or measure social norms. Our analyses revealed that twelve (12/69) sample articles used qualitative methods, while fifty-four (54/69) articles used quantitative methods. Two articles (2/69) used both qualitative and quantitative methods, and one article (1/69) did not measure social norms. We briefly discuss each approach by highlighting their strengths and limitations. Ultimately we acknowledge that a combination of qualitative and quantitative methods can offer convergence opportunities through triangulation (Thurmond, 2001).

Importantly, we highlight that a particular social norm definition or conceptualization did not necessarily correspond to a unique elicitation method. For example, in articles that defined social norms as beliefs, expectations, or perceptions, both experimental –e.g., framed field experiments (e.g., Leibbrandt et al., 2021), and non-experimental –e.g., a Likert scales (e.g., Thøgersen, 2008) quantitative methods were used to elicit social norms. Finally, social norms as beliefs, expectations, or perceptions were also elicited through qualitative methods such as through structured interviews (Mudaliar et al., 2021). Our finding implies that multiple methods and approaches exist for measuring and eliciting social norms.

a) Qualitative methods

Authors of eleven of the 69 articles (12/69) used qualitative methods to identify social norms, while two articles (2/69) used a mix of qualitative and quantitative methods. Articles that used qualitative methods employed participant observation, interviews, focus groups, or a combination of any of these methods. Researchers used qualitative methods to gain detailed, deep, and nuanced understanding of the social and ecological contexts in which social norms and collective action were embedded. For example, participant observation and semi-structured interviews provided insights into the complicated dynamics of social capital and how they facilitated cooperation to improve water quality, answering questions such as how farmers draw on and shape social norms, and in what ways social norms foster collective action (Yoder & Roy Chowdhury, 2018). Because qualitative methods prioritize people’s perspectives and worldviews, they allow individuals’ lived experiences to shape and inform research findings (Merriam & Tisdell, 2016). Overall, qualitative approaches allowed researchers’ work represented in our sample to unravel complicated dynamics and to provide in-depth insight into the complexity of human behaviour regulated by social norms.

b) Quantitative methods

Social norms have traditionally been a challenging subject to study quantitatively and they have often been either neglected or, at best, interpreted as outcomes that were otherwise hard to explain using conventional models of behaviour (Bicchieri, 2016; Krupka & Weber, 2013). Authors of thirty (30/69) articles in the sample used non-experimental methods, authors of twenty-five (25/69) articles used experimental approaches, and authors of one (1/69) article used a mix of experimental and non-experimental methods. We summarize the most relevant findings and examples below.

Non-experimental quantitative methods

Authors of two (2/69) articles in our sample used proxies to indirectly quantify social norms. In their article on social norms and volunteering in environmental organizations in several European countries, Garcia-Valiñas et al. stated that because “it is not possible to directly quantify social norms” (2012, p. 456) then *self-reported willingness to give income to reduce environmental pollution and whether or not the respondent paid taxes to reduce environmental pollution* were used as proxies instead. Similarly, in an article on communal land use in Ethiopia, proxies were used to quantify social norms related to natural resource management, specifically enclosure and activity, where the first indicated the portion of the enclosed communal land area, while the second quantified people’s working days for natural resource conservation activities (Oniki et al., 2020). Nevertheless, Oniki et al. (2020) acknowledged that one of the study limitations was the proxies’ reliability as reliable measures of social norms.

Instead, authors of twenty-nine (29/69) articles used non-experimental (28/69 articles), or a mix of non- and experimental (1/69 article) quantitative methods, to provide a direct measurement of social norms. In their article on Chinese waste disposal, Zhang and Zaho (2019), conceptualize social norms as one of three elements of social capital—alongside social networks and trust—following, amongst other definitions, Putnam et al.’s (1993) definition. The authors further used a World Bank’s scale (Grootaert et al., 2004) to create measurement questions for all three dimensions of social capital and finally modeled the construct using Principal Component Analysis, whereby the norms factor in the PCA was composed of assistances, reciprocities, thefts, disputes (Zhang & Zhao, 2019).

In the majority of the remaining quantitative, non-experimental, literature, authors measured social norms as beliefs, expectations, or perceptions about what others do and/or think should be done – although not all articles included both constructs as some authors were interested in either one or the other construct. In these cases, social norms were

elicited through questionnaires using different scales. For example, respondents were asked to estimate a percentage about the occurrence or appropriateness of a certain behaviour, e.g., shellfish gatherers in Galicia, Spain, were asked to estimate the percentage level of compliance with the law in their community (Allo & Loureiro, 2017). Others, instead, were asked to approximate their responses to different ratings of a Likert scale –e.g., respondents had to rate their level of agreement about the prevalence and acceptance of various behaviours such as using energy savings light bulbs (Thøgersen, 2008). Finally, questionnaires measured social norms by asking respondents to estimate binary majorities –e.g., Tibetan herders in Qinghai, China were asked whether they believed that the majority of people in their group would be willing to help remove illegal wildlife traps (descriptive portion), and whether the majority would disapprove of others who helped remove traps (injunctive portion) (Kerr et al., 2019).

These scales have both opportunities and limitations. For example, percentages offer accuracy in measurements, but some respondents may not be able, sufficiently confident, or willing to provide precise information. In these cases, Likert scales or binary assessments may offer quicker perception assessment of a behaviour’s prevalence or acceptance. Conversely, while these scales can be more efficient, they may sacrifice accuracy in measurement compared to elicitation methods such as percentages.

Experimental quantitative methods

Authors in twenty-six (25/69) sample articles used experimental methods including artefactual, field, and natural field experiments (Harrison & List, 2004), and authors of one (1/69) article used a mix of non- and experimental methods. Among the experimental literature, authors in nineteen (19/26) articles employed experimental games, including dictator games, ultimatum games, common-pool resources and public goods or public bads games.

While experiments provide the advantage of observing behaviour ‘in action’, without relying on self-reported behaviour measurements, these types of approaches also have limitations such as external validity, i.e., whether the behaviour elicited in the experiment correlates to behaviours beyond the study (Cardenas & Carpenter, 2008). As such, it remains debatable whether the behaviour observed in an experiment can or should be generalized in the real world (Jackson, 2012).

The second limitation is that experiments often incorporate social norms as post-hoc interpretations of observed behaviour (Krupka & Weber, 2013). Javaid and Falk (2015) conducted an artefactual field experiment based on Cardenas et al.’s (2008) irrigation game to model Punjabi farmers’ collective action challenges in the Indus Basin, Pakistan.

They showed that, as the game progressed, farmers actively adapted their strategies in response to their observations of other farmers' choices, and by a desire for group approval. Through an iterative adaptation process, farmers adjusted their strategies, resulting in a collective movement towards the socially optimum equilibrium during the experiment. This behavioural shift was interpreted as driven by the establishment of a social norm: "The fact that our players improve their individual and group earnings over the game rounds can potentially be explained by the establishment of a social norm" (Javaid & Falk, 2015, p. 28). In this example, social norms served as post-hoc interpretations of the observed behaviour. This elicitation approach can be problematic because it does not allow for differentiation between observed behaviour and social norms, in turn impeding the social norms' direct measurement and consideration of norms' impact on collective action.

Potential solutions: belief-elicitation protocols

Belief-elicitation protocols (e.g., Bicchieri & Xiao, 2009; Krupka & Weber, 2013) offer a potential solution to the challenges posed by approaches that constrain social norms to be post-hoc interpretations of behaviour (e.g., games) and approaches that are biased by self-reported measurements (e.g., questionnaires). Loft, Gehrig, Ngoc Le, and Rommel (2019) adapted Krupka and Weber's (2013) belief-elicitation protocol to elicit social norms of equity in the context of PES. Using a coordination game, participants were asked to rate the social appropriateness of four different payments schemes on a four-point scale that ranged from "very socially inappropriate" to "very socially appropriate". Participants were told that if their answer matched the answer of most other participants who previously answered the same question, then they would receive an extra monetary payoff. Hence, land users who participated to the coordination game had a financial incentive to state what they thought to be the correct estimate of a normative belief's prevalence.

3.4.4 Fisheries: Taking a closer look

Our initial review intention was to focus solely on fisheries, but a Scopus and WoS search revealed limited literature, prompting us to include additional natural resource systems. Eleven (11/69) articles discussed exclusively fisheries, while three (3/11) articles examined systems other than fisheries as described in [Table 3.4](#).

a) Objective 1 (Fisheries context)

More than half of the case studies (6/11 articles) were conducted in the Global South (Table 3.4). The sub-sample comprised a diverse range of fisheries, including four freshwater (Cavalcanti et al., 2010; Chiaravalloti & Dyble, 2019; Guckian et al., 2018; Travers et al., 2011), three saltwater (Allo & Loureiro, 2017; Gezelius, 2007; Leibbrandt et al., 2021), and one coastal lagoon (de Melo & Piaggio, 2015). However, details about this parameter were not provided for all the articles in the sub-sample. Within the sub-sample, three (3/11) articles defined their fishery as small-scale or artisanal (Allo & Loureiro, 2017; de Melo & Piaggio, 2015; Travers et al., 2011). Three (3/11) fisheries were a form of sustenance for local communities (Cavalcanti et al., 2010; Howe et al., 2016; Travers et al., 2011), almost half (5/11) of the fisheries provided the communities' main income source (Cavalcanti et al., 2010; Chiaravalloti & Dyble, 2019; de Melo & Piaggio, 2015; Gezelius, 2007; Leibbrandt et al., 2021), whereas communities situated in densely populated areas offered diversified income opportunities (de Melo & Piaggio, 2015). Only one (1/11) fishery in the sample was a recreational fishery (Guckian et al., 2018).

Table 3.4: Case study and fishery characteristics

Empirical case (number of case studies in parenthesis if n >1)	Collective action problem	Fishery characteristics	Literature
Atlantic blue whiting fishery, Seaborn Hills fishing community, Norway	Unsustainable patterns of extraction of blue whiting (catch limits not regulated)	Offshore trawl vessels, with each having between 8-10 crew members on board, fishing blue whiting. Community is highly dependent of fishing and related activities as main source of income. Respondents participate to fishing due to family links.	(Gezelius, 2007)

Shellfish gatherers from Galicia, Spain	Overfishing driven by illegal fishing (institutional weakness)	Inshore SSF conducted mainly by fisher who are women (>90% of respondents). 43% of respondents participate in the activity due to family links or tradition.	(Allo & Loureiro, 2017)
Fishing communities (n=5) in Laguna de Rocha and/or Laguna de Castillo, Uruguay	Overfishing (institutional weaknesses)	SSF in coastal lagoon. Gear includes nets for fish and traps for shrimp. Both men and women participate however proportions are not specified. For some communities in the sample fishing is the main source of income, whereas for other communities there are opportunities to differentiate income.	(de Melo & Piaggio, 2015)
Communities (n=10) in the coastal and Andean regions of Colombia	Overextraction and general collective action problems associated with common-pool resource use	No detail provided – article focuses on multiple systems including a fishery.	(Cardenas, 2011)

Fishing communities (n=2) of the Gulf corvina fishery, specifically San Felipe (pilot study) and El Golfo de Santa Clara, Mexico	Overfishing driven by illegal fishing (institutional weakness)	Size of fishery not specified, mainly relies on corvina fishery. Communities rely almost entirely on fisheries sector for income.	(Leibbrandt et al., 2021)
Fishing communities (n=6) in the protected area “Área de Proteção Ambiental Lago de Pedra do Cavalo”, Brazil	Overfishing driven by illegal fishing and unsustainable patterns of fishing (institutional weakness, unsustainable fishing gear)	Freshwater fishery, size of fishery not specified - 87% of the respondents are male fishers and fish predominantly fish and /or shrimp. Communities rely on fish for sustenance and income.	(Cavalcanti et al., 2010)
Recreational fishers in the Buckley River steelhead fishery, Canada	Adoption of best practices for catch and release recreational fishing	Recreational, catch and release, freshwater steelhead fishery. Majority of respondents (93%) are male fishers.	(Guckian et al., 2018)
Fishing community in the Pantanal wetland fishery, Brazil	General collective action problems associated with common-pool resource use and potential for overfishing	Freshwater fishery, size of fishery not specified. Fishing focuses on large fish and on bait (small fish and /or crab). Fishing represents over 90% of local income.	(Chiaravalloti & Dyble, 2019)
Communities (n=5) in Colombia sharing a fishery	General collective action problems associated with common-pool resource use	No detail provided—article focuses on multiple systems including a fishery.	(Rodriguez-Sickert et al., 2008)

Subsistence resource users in rural villages (n=3) on the Kamchatka Peninsula in Siberia, Russia	General collective action problems associated with common-pool resource use or public good contribution	No detail provided- article focuses on multiple systems, including a salmon fishery. Respondents are sustenance users and majority are female (66%) and indigenous (85%) users.	(Howe et al., 2016)
Communities (n=4) located in two protected areas, Kulen Promtep Wildlife Sanctuary and Preah Vihear Protected Forest, in the Northern Plains landscape, Cambodia	General collective action problems associated with common-pool resource use (institutional weakness, including few harvesting restrictions)	Small-scale, sustenance, freshwater fishery, with both men and women taking part to harvesting.	(Travers et al., 2011)

Seven (7/11) of the collective action problems discussed in the sub-sample articles (Table 3.4) were explicitly tied to overfishing or unsustainable patterns of extraction, which were in turn often linked to institutional weaknesses (Allo & Loureiro, 2017; Cardenas, 2011; Cavalcanti et al., 2010; Chiaravalloti & Dyble, 2019; de Melo & Piaggio, 2015; Gezelius, 2007; Leibbrandt et al., 2021). Almost all the instances of overfishing were associated with illegal fishing practices (Allo & Loureiro, 2017; Cavalcanti et al., 2010; Leibbrandt et al., 2021). Authors of five (5/11) articles also described more general collective action problems associated with common-pool resource use (Cardenas, 2011; Chiaravalloti & Dyble, 2019; Howe et al., 2016; Rodriguez-Sickert et al., 2008; Travers et al., 2011). Authors of one (1/11) article focused on adopting best practices of catch and release (Guckian et al., 2018). Overall, the sub-sample showcased a wide temporal range, with the oldest publication dating back to 2007 and the most recent one published in 2021.

b) Objective 2 and 3 (Fisheries Context)

Upon a closer examination of the fisheries systems, we found that, similarly to other systems analyzed in the scoping review, various approaches existed for conceptualizing, eliciting, and measuring social norms in this literature. Only authors of one (1/11) article in the sub-sample provided an explicit definition of what social norms are (Allo & Loureiro, 2017), and authors of three (3/11) articles did not provide any definition (Cavalcanti et al., 2010; de Melo & Piaggio, 2015; Howe et al., 2016) (Table 3.5). Instead, from seven (7/11) articles it was possible to infer how social norms were conceptualized (Cardenas, 2011; Chiaravalloti & Dyble, 2019; Gezelius, 2007; Guckian et al., 2018; Leibbrandt et al., 2021; Rodriguez-Sickert et al., 2008; Travers et al., 2011) –hence the distinction in Table 3.5 between ‘no definition’ and ‘no explicit definition’. Consequently, a significant analytical challenge was extrapolating the authors’ understanding and conceptualization of social norms, which varied in clarity and complexity.

Table 3.5: Social norms conceptualization and elicitation methods in fisheries

Empirical case	Collective action problem	Fishery characteristics	Literature
<p>No explicit definition</p> <p>It emerges that social norms are conceptualized as rules of acceptable behaviour</p>	<p>Desire to maintain a good reputation</p> <p>Expectations about what others do</p> <p>Expectation about what ought to be done</p>	<p>Qualitative methods, combination of observations and interviews</p>	<p>(Gezelius, 2007)</p>
<p>Social norms defined as “shared understandings about actions that are obligatory, permitted, or forbidden.” (Ostrom, 2000, pp. 143–144)</p> <p>Social norms as a kind of informal institution</p>	<p>Expectations about what others do</p>	<p>Quantitative methods, non-experimental, survey</p>	<p>(Allo & Loureiro, 2017)</p>

No definition	<p>Hope to maintain a good reputation</p> <p>Fear of social sanctioning</p> <p>Desire to avoid feeling shame</p> <p>Desire to conform</p>	Quantitative methods, experimental, framed field experiment (common-pool resource game)	(de Melo & Piaggio, 2015)
<p>No explicit definition</p> <p>It emerges that social norms are conceptualized as game equilibria, or as processes that guide behaviour towards equilibria</p>	<p>Expectations about what others do</p> <p>Aversion to feeling guilt, shame, embarrassment for not following the social norm</p> <p>Fear of social sanction</p>	Quantitative methods, experimental, artefactual field experiment (common-pool resource game)	(Cardenas, 2011)
<p>No explicit definition</p> <p>It emerges that social norms are conceptualized as behaviour upheld by empirical and normative expectations – following Bicchieri’s (2016) definition</p>	<p>Expectations about what others do</p> <p>Expectation about what ought to be done</p> <p>Aversion to feeling guilt for violating the social norm</p>	Quantitative methods, experimental, framed field experiment (common-pool resource game)	(Leibbrandt et al., 2021)
No definition	Expectations about what others do	Quantitative methods, non-experimental, survey	(Cavalcanti et al., 2010)

<p>No explicit definition</p> <p>It emerges that social norms are conceptualized as behaviour upheld about perceptions about what others do and what ought to be done –following Cialdini et al.’s (1990) definition</p>	<p>Expectations about what others do</p> <p>Expectation about what ought to be done</p> <p>Hope to maintain a good reputation</p> <p>Fear of social sanctioning</p>	<p>Quantitative methods, non-experimental, survey</p>	<p>(Guckian et al., 2018)</p>
<p>No explicit definition</p> <p>It emerges that social norms are conceptualized as “bottom-up” rules</p>	<p>Environmental uncertainty</p>	<p>Qualitative methods, combination of observations and interviews</p>	<p>(Chiaravalloti & Dyble, 2019)</p>
<p>No explicit definition</p> <p>It emerges that social norms are conceptualized as game equilibria, or as processes that guide behaviour towards equilibria</p>	<p>Fear of social sanctioning</p> <p>Aversion to feel guilt for not following social norm</p> <p>Expectations about what others do</p>	<p>Quantitative methods, experimental, framed field experiment (common-pool resource game)</p>	<p>(Rodriguez-Sickert et al., 2008)</p>

No definition	Social and environmental risk and uncertainty Hope to maintain a good reputation Fear of social sanctioning	Quantitative methods, experimental, framed field experiment (public good game)	(Howe et al., 2016)
No explicit definition	It emerges that social norms are conceptualized as rules Hope to maintain a good reputation Fear of social sanctioning Context	Quantitative methods, experimental, framed field experiment (common-pool resource game)	(Travers et al., 2011)

Authors of four (4/11) of these fishery-specific articles conceptualized social norms as informal institutional arrangements, rules, and codes of acceptable conduct (Allo & Loureiro, 2017; Chiaravalloti & Dyble, 2019; Gezelius, 2007; 2011). Authors of two (2/11) articles discussed and conceptualized social norms as game equilibria, or as mechanisms that steer behaviour towards equilibria (Cardenas, 2011; Rodriguez-Sickert et al., 2008). Finally, authors of two (2/11) articles described social norms as behaviours that depended on beliefs, expectations, or perceptions about what others do, and/or what others think should be done (Guckian et al., 2018; Leibbrandt et al., 2021)

Authors described a range of reasons as to why fishery users conform to social norms. In seven (7/11) articles, authors clearly described how the decision to follow a social norm was dependent on what others do, and/or think should be done (Allo & Loureiro, 2017; Cardenas, 2011; Cavalcanti et al., 2010; Gezelius, 2007; Guckian et al., 2018; Leibbrandt et al., 2021; Rodriguez-Sickert et al., 2008). A diverse range of emotions further emerged as key factors that sustained people’s adherence to social norms in eight (8/11) fisheries articles (Table 3.5). Emotions such as guilt, hope to uphold a positive reputation within the group, desire to conform to a certain behaviour, and aversion to social sanctioning, were

influential factors that determined why people followed social norms (Cardenas, 2011; de Melo & Piaggio, 2015; Gezelius, 2007; Guckian et al., 2018; Howe et al., 2016; Leibbrandt et al., 2021; Rodriguez-Sickert et al., 2008; Travers et al., 2011). Finally, authors of two (2/11) articles mentioned risk and uncertainty as elements that shape social norms adherence (Chiaravalloti & Dyble, 2019; Howe et al., 2016). For example, communities in Siberia, Russia developed social norms to encourage cooperation in response to the combined challenges of environmental uncertainty resulting from harsh weathers in Arctic and sub-Arctic regions, and social uncertainty stemming from political and economic instability triggered by Soviet collectivization and post-Soviet privatization (Howe et al., 2016). Instead, in the Pantanal wetland of Brazil, fishers counteract environmental uncertainty caused by the variable flood pulse by openly sharing information about fish locations, enabling them to adapt to the changing dynamics of the fishery and associated fish abundance and location (Chiaravalloti & Dyble, 2019). Both examples showed how communities establish social norms to mitigate individual vulnerabilities while enhancing collective resilience in the face of uncertainty.

For elicitation methods, multiple researchers (9/11) used quantitative methods (Allo & Loureiro, 2017; Cardenas, 2011; Cavalcanti et al., 2010; de Melo & Piaggio, 2015; Guckian et al., 2018; Howe et al., 2016; Leibbrandt et al., 2021; Rodriguez-Sickert et al., 2008; Travers et al., 2011), while two (2/11) articles used qualitative methods (Chiaravalloti & Dyble, 2019; Gezelius, 2007). Among the researchers using quantitative methods, authors of six (6/9) articles employed experimental approaches, with all but one using different variations of common-pool resource games. Details are available in [Table 3.5](#). Similar to the findings observed in the larger sample of 69 articles, there was limited coherence in the social norms' conceptualization, their underpinnings, and the ways they are measured or elicited within the fisheries context.

3.5 Discussion

In outlining the state of the empirical, peer-reviewed literature (i.e., our first objective), we found that there is a significant lack of empirical studies on social norms and social dilemmas in fisheries systems. At the same time, we found that the body of literature in the broader context of environmental settings has been growing since the 1980s. This result may indicate an increasing recognition of the limitations of predominant models of behaviour based in *Homo Economicus*, and a growing interest in identifying alternative explanations to people's behaviour in the context of social dilemmas.

This research further revealed that the field of social norms is vast and simultaneously

rooted in diverse disciplinary orientations (e.g., economics and psychology). This heterogeneity results in a variety of definitions and conceptualizations of social norms, reasons as to why people decide to follow them, and diverse methods to measure or elicit these social phenomena. While this finding may initially suggest lack coherence, we argue that this heterogeneity can instead offer valuable opportunities to approach the study of social norms from multiple angles and different perspectives, by accommodating different approaches to understand empirical reality, and offering distinct levels of analysis and tools tailored to address specific research questions.

In relation to our second objective, we found that social norms' definitions varied significantly in clarity and complexity, rendering the quantification of this objective unfeasible. We categorized social norms' definitions and conceptualizations into collective and individual constructs, as previously done by Legros and Cislighi (2020), while acknowledging the limitations of doing so, and recognizing that this is just one way of thinking about these different structures. While these two broader approaches may seem contradictory, integrating individual and collective constructs might be helpful to reveal the dialectical influence that individual and collective constructs have on each other. For instance, using both collective and individual constructs can reveal how social norms operate at the social system level and how they can, in some cases, express a group's code of conduct (Bicchieri, 2006; Cialdini et al., 1990; Ostrom, 2005), or a community's social capital (Ostrom, 1990, 1999; Pretty, 2003; Putnam, 1993), while still representing individuals' interpretations and perceptions of such collective constructs (Ajzen, 1991; Bicchieri, 2006; Cialdini et al., 1990). Importantly, in cases where there is a discrepancy between a perception someone has about a certain behaviour, and the actual distribution of said behaviour, there is an issue of pluralistic ignorance (O'Gorman, 1986). Pluralistic ignorance tends to arise when behaviours are not easily observable, such as it is the case for private or illegal behaviours (Bicchieri, 2016). This phenomenon can have negative implications for policy, if not properly accounted for. For example, if individuals believe that an illegal behavior is accepted or condoned within their social circle, they may be more inclined to engage in it themselves –see an example of negative consequences of pluralistic ignorance in the context of fish poaching in Bergseth & Roscher (2018).

Notably, our results highlighted that using a specific social norm definition can yield valuable insights with potential policy implications. For example, defining social norms as behaviours upheld by beliefs, expectations, or perceptions (Ajzen, 1991; Bicchieri, 2006; Cialdini et al., 1990), along with the assumption of a causal relationship between perceptions of a behaviour and actual behaviour, provides an opportunity for policy seeking behavioural approaches to change. By creating policy tools aimed at changing people's beliefs, expectations, or perceptions of what actions are commonly performed, or socially

acceptable, it is possible to effectively target changes in behaviour, or nudge people towards behavioural change –as discussed, for instance, in Constantino et al. (2022), Leibbrandt et al. (2021), and Nyborg et al. (2016).

In answering our third objective, we found that social norms in our scoping review sample were measured and elicited using different quantitative and qualitative approaches. This finding highlights how having access to different methods to study and elicit social norms can help formulate and answer specific questions through diverse analytical lenses. For instance, qualitative methods can enhance the understanding of complex dynamics and relationships between social norms and resource users’ lived experiences, worldviews, and ideas. Instead, quantitative methods can facilitate comparisons across different social groups within similar contexts. Alternatively, using both qualitative and quantitative approaches allows for triangulation (Thurmond, 2001). In our sample, Commerçon et al. (2021) suggest the use of triangulation as a solution to overcome possible response biases associated with asking questions about social norms regulating illegal behaviours in the context of wildlife hunting.

Within quantitative methods, we identified how non-experimental, self-reported measures of social norms have the advantage of allowing for direct measurement of norms. However, self-reported measures can introduce research bias related to respondents’ desire for social desirability (Krumpal, 2013). In contrast, experimental approaches offer the opportunity to observe behaviour “in action”, and if combined with belief-elicitation protocols (Bicchieri & Xiao, 2009; Krupka & Weber, 2013), these approaches can allow for social norms to go beyond being post-hoc interpretations of behaviours that are otherwise difficult to explain through traditional models of behaviour. We found only one article using belief-elicitation protocols in the reviewed literature (Loft et al., 2019), suggesting an important gap for further methodological development. Finally, combining experimental and non-experimental approaches can help improve a study’s external validity (Cardenas & Carpenter, 2008; Jackson, 2012).

The knowledge that emerges from this synthesis can be operationalized in policy settings where models based in neoclassical economics *Homo Economicus* are no longer sufficient, or perhaps inadequate, to describe, explain, and predict people’s behaviour. In particular, examples from the sampled literature highlighted that introducing regulations or instruments based in *Homo Economicus* in contexts where social norms exist and are strong, can be ineffective, lead to non-compliance, and can crowd-out collective action (Allo & Loureiro, 2017; Kerr et al., 2019; Narloch et al., 2012; e.g., Rodriguez-Sickert et al., 2008). From this perspective, knowledge on social norms can contribute to creating a better alignment, or ‘fit’ (Armitage et al., 2019; Epstein et al., 2015), between policy and the social context within which policy aims to operate. Simultaneously, aligning regulations with pre-existing

local institutions can advance policy recognitive equity (Martin et al., 2016), and further help achieve local and global targets and goals, such as respectful fisheries governance as described in the Voluntary Guidelines for Securing Small-scale Fisheries (FAO, 2015). Examples from the scoping review (e.g., Travers et al., 2011) highlighted that social norms can be powerful tools to encourage more bottom-up governance (i.e., more collaborative and/or decentralized) in systems that are conventionally ‘top-down’ (i.e., command and control) because knowledge on social norms can bring recognition to pre-existing processes that people adapted over long periods of time to navigate collective action problems and organize behaviours around resource use.

3.6 Conclusion

This scoping review was aimed at synthesizing the empirical evidence on the role of social norms in social dilemmas in environmental settings. While our initial aim was to focus only on fisheries systems, a preliminary Scopus and WoS search queries returned limited relevant literature on collective action and social norms within the fisheries constraint. This initial finding revealed that there are currently untapped opportunities for research to generate empirical evidence about how various actors in fishery systems establish, adapt, and use social norms to achieve desired collective action outcomes.

The limited fisheries literature prompted us to broaden the scope of the review and to include various environmental contexts. In doing so, we uncovered an exponential increase in publications since the 1980s, perhaps pointing towards an increasing necessity to consider models of behaviour that depart from *Homo Economicus*, and to explore other factors that determine people’s choices in the context of collective action problems.

Our synthesis further mapped the different ways in which social norms are conceptualized, measured, or elicited. While the pool of knowledge uncovered by the scoping review is vast and at a first glance contradictory, it simultaneously revealed opportunities and entry points to conduct research on social norms from different angles and perspectives.

Findings and insights that emerge from this article provide theoretical and empirical contributions to academic and practitioner communities by advancing knowledge at the intersection of social norms, collective action problems, and natural resources (including fisheries) use. The synthesized literature further provides evidence that addresses the gaps between behaviour predictions based in *Homo Economicus* (e.g., Gordon, 1954; Hilborn, 2007), and empirical evidence on how resource users actually behave –i.e., self-organizing through social norms (e.g., Ostrom, 1990). In doing so, this research contributes to the

existing and growing body of literature that questions the predominance of neoclassical economics models in describing human behaviour in relation to natural resource use and collective action problems (Andrews et al., 2021; Fulton et al., 2011; Nielsen et al., 2024; Salas & Gaertner, 2004; Schill et al., 2019; Wijermans et al., 2020). Knowledge on social norms can enhance fit between policy and the social context policy aims to regulate. Further, knowledge about social norms can enhance policy equity, by bringing recognition to pre-existing strategies, values, and behavioural dynamics that people and communities have developed over time, sometimes generations, to navigate resource use and social interaction.

Chapter 4

Marine protected areas governance, social norms, and social networks

4.1 Chapter summary

Establishing effectively and equitably governed marine protected areas (MPAs) in places where communities live and work requires addressing the social implications of conservation. Social norms and social networks are bottom-up processes through which resource users self-organize to solve collective action problems over resource use. Introducing external institutions, such as MPAs, where these processes exist and collective action is strong can lead to adverse governance outcomes, including lack of compliance, conflict, and crowding-out. This research elicits social norms and maps an information-sharing social network (n=81) of three small-scale fishing communities located near the Asinara MPA in Sardinia, Italy. Findings indicate that these communities are not grouped under one social network, and they are rather split into three subgroups. This first result may at first suggest limited capacity for collective action. Nevertheless, analyses on the distribution and strength of social norms denote that cooperative behaviours are still strong within the Asinara MPA communities. Importantly, the second part of the analyses revealed the presence of central actors in each subgroup who could act as bridges between the heterogeneous knowledge systems, ideas, and practices that have been developed separately in each subgroup. Leveraging this diversity can generate new solutions to commonly shared collective action problems. Knowledge on the social dimension of MPA governance can be used to achieve effective and equitable governance and meet local and international commitments such as the Target 3 of the Kunming-Montreal Global Diversity Framework,

the European Union Biodiversity Strategy for 2030, and the FAO Voluntary Guidelines for Securing Small-scale Fisheries.

4.2 Introduction

Neoclassical economic theory predicts that rational and self-interested resource users (i.e., *Homo Economicus*) will always prioritize personal gains over the collective interest, and inevitably deplete the commons (Hardin, 1968). One solution to this ‘tragedy of the commons’ is to restrict users’ access through privatization and/or top-down regulations. However, considerable empirical evidence shows that resource users do not behave as *Homo Economicus* predicts and they can solve collective action problems without the need for external interventions. One way resource users solve collective action problems is by self-organizing through social networks and by establishing social norms to reinforce behaviours such as cooperation and coordination. Introducing external and top-down regulations in contexts where these social processes already exist and are strong can be ineffective (Allo & Loureiro, 2017), and can crowd-out collective action (Cinner et al., 2021; Frey & Jegen, 2001).

In the context of fisheries, MPAs have often been criticized for being externally imposed on local communities and the institutions they have developed (Bennett et al., 2017; Cinner et al., 2014). MPAs are spatial tools commonly used to address biodiversity loss in marine and coastal systems (Day et al., 2019; Jones, 2014; Kelleher & Kenchington, 1992). However, MPAs are often created in areas where fishing communities live and work, which can generate conflicts, complex governance dynamics, and raise important questions about fairness and equity (Di Franco et al., 2018; Garcia et al., 2014; Jones, 2014; Said et al., 2017). For example, MPAs have been criticized for threatening fishers’ livelihoods, preventing customary and traditional access to coastal resources, and violating human rights (Bennett et al., 2020; Jones et al., 2020; Muhl et al., 2020).

MPA governance must therefore go beyond the focus on ecological objectives and address the social implications of conservation by establishing protected areas that are not only effective, but also equitably governed (Convention on Biological Diversity, 2023). This aim is reflected in the Kunming-Montreal Global Diversity Framework (Target 3) finalized at the [Convention on Biological Diversity \(CBD\) Fifteenth Conference of the Parties \(COP\)](#), and which builds upon the Strategic Plan for Biodiversity 2011-2020 and associated Aichi Biodiversity Targets. The objective to address social objectives is further reflected in global frameworks such as the Food and Agriculture Organization of the United

Nations (FAO) Voluntary Guidelines for Securing Small-scale Fisheries in the Context of Food Security and Poverty Eradication (FAO, 2015).

One way Target 3 and the FAO Guidelines can be achieved is by acknowledging and bringing recognition to the existing informal institutions that people developed over long periods of time to regulate resource use – this dimension of environmental justice can be referred to as ‘recognitive equity’ (Franks et al., 2024; Martin et al., 2016). In MPA governance, social norms are important informal institutions that emerge and evolve through the informal social networks in which they exist to guide the behaviour of actors within those networks (Kooiman & Bavinck, 2005; Lemos & Agrawal, 2006; Ostrom, 1990). Social norms and informal social networks are important catalysts of collective action, because they can, for example, facilitate knowledge acquisition, enable the diffusion of information, promote the commitment to shared behaviours, and help resource users navigate social and ecological change (Alexander, 2015; Armitage et al., 2017; Grafton, 2005; Pretty, 2003). In some contexts, social norms and networks have even proven to be more important than formal institutions, for example in instances related to compliance with regulations (Allo & Loureiro, 2017). For these reasons, these social processes are central elements to consider in MPA governance because they can inform what is happening locally and why (Alexander et al., 2015; Bodin & Crona, 2009).

This research examines social norms and social networks within three small-scale fisheries (SSFs) communities located near the Asinara MPA in Sardinia, Italy. Notably, the Asinara MPA is currently undergoing a phase of formal institutional transition (i.e., renewal of the MPA regulations), making it an ideal context in which to examine the presence, strength, and implications of social norms and networks. Specifically, this research is guided by three objectives: 1) To identify the key attributes of social networks within the Asinara MPA communities that are likely to enable collective action; 2) To empirically assess the presence of social norms and their strength within these social networks; and 3) To explore avenues for integrating insights from social network and social norms into governance strategies, particularly during phases of formal institutional transition. Understanding the social dimension of the MPA governance may reveal new pathways to achieve effective and equitable governance arrangements and meet local and international commitments such as the Target 3 of the Kunming-Montreal Global Diversity Framework (Convention on Biological Diversity, 2023) and the FAO Guidelines.

4.3 Theoretical framing

Governance is a complex system of processes that operate within and between states, local communities, and markets (Jentoft & Chuenpagdee, 2009). There are many different ways of defining governance and definitions are usually anchored in the discipline or literature within which they were developed and operate –e.g., environmental governance (Lemos & Agrawal, 2006). In this research, governance is defined as a multilevel system underpinned by formal and informal institutions, decision processes, and individuals that help communities navigate social and ecological change (Armitage et al., 2012; Armitage, Charles, et al., 2017; Lemos & Agrawal, 2006). Institutions can be understood as the formal (e.g., written regulations) and informal (e.g., social norms) rules that regulate, constrain, and shape actors’ behaviours (North, 1990; Ostrom, 1990; Young et al., 2008).

An important informal institution in fisheries is social norms (Kooiman & Bavinck, 2005). Social norms are the means through which communities self-organize and solve collective action problems through two main classes of behaviours: cooperation and coordination (Cardenas, 2011; Ostrom, 1990). Traditionally, social norms have been a challenging topic to study and interpret, especially using neoclassical models of behaviour, because empirical findings did not fit with the *Homo Economicus* predictions that people are universally self-interested and will deplete the commons (Bicchieri, 2016; Cardenas, 2011; Krupka & Weber, 2013). Beginning in the 1980s interest in social norms across various fields and applications started to increase, leading to a proliferation definitions and conceptual frameworks (e.g., Azjen’s (1991) Theory of Planned Behaviour, Bicchieri’s (2006) empirical framework, Cialdini et al.’s (1990) Focus Theory of Normative Conduct, and Lapinski and Rimal’s (2005) Theory of Normative Behaviour).

In this research, social norms are conceptualized as informal institutional arrangements and they are defined as rules of behaviours that are upheld by beliefs or perceptions about what others do, or think should be done (Bicchieri, 2006; Cialdini et al., 1990; Ostrom, 2005). Specifically, this research follows Bicchieri’s (2006) framework which frames social norms as behaviours that are simultaneously contingent upon both empirical expectations (perceptions about what others do), and normative expectations (perceptions about what others expect one to do). The former are referred to as *descriptive social norms*, while the latter are referred to as *injunctive social norms*.

Importantly, social norms develop and transform within social networks (Bicchieri, 2016). Social networks can be interpreted as social structures comprised of actors, or nodes, and the social connections between them, also known as ties. It is important here to note Borgatti and Halgin’s (2011) caution against the ‘realist’ notion (Laumann et al., 1983)

that a predetermined social network exists per se. In contrast, the ‘nominalist’ approach posits that each research question defines a social network (Laumann et al., 1983). In this research, an information-sharing social network is generated by asking questions about who resource users share information with. Information-sharing social networks can enhance collective action because they allow people to access knowledge, perspectives, and ideas that are needed to adapt to fast-paced social and ecological changes, such as regulatory transitions or changes in marine environments (Obregón et al., 2020; Salas & Gaertner, 2004; Turner et al., 2014; Wade et al., 2023).

Social network analysis (SNA) (Freeman, 2004) has been used in a range of applications and contexts, including SSFs and MPAs (e.g., Alexander et al., 2015; Armitage, Alexander, et al., 2017; Ramirez-Sanchez & Pinkerton, 2009). The analysis of social networks, and specifically social networks’ topologies, is becoming an essential aspect of natural resources research and governance. This is because social networks’ topologies can reveal the structural conditions likely to enhance collective action and a communities’ capacity to adapt to change, including institutional change (Alexander & Armitage, 2015; Bodin & Norberg, 2005; Cohen et al., 2012). For instance, as the number of social ties increases, the density of a network also increases, and with higher density, there are more opportunities for communication, greater trust and reciprocity, and a stronger adherence to shared norms (Alexander et al., 2018; Friedkin, 2004; Ostrom, 1990). Yet, the effects of network density do not always increase monotonically and as density increases, so does the number of actors involved, potentially leading to increases in transaction costs and a reduction in capacity for collective action (Bodin & Crona, 2009).

4.4 Methods

4.4.1 Case study context: the Asinara MPA

The Asinara MPA ([Figure 4.1](#)) in Sardinia, Italy, was established in 2002 and is 108 km² in size. The MPA is divided into three zones, each varying in degrees of protection. Zone A, the integral reserve, spans 5% of the MPA. Zone B, the general reserve, covers 65% of the area. Finally, zone C, the partial reserve, extends over 30% of the MPA. In addition to these zones, the strip of sea within 150 meters from the coast of Asinara is also off-limits to fishing.

The Asinara MPA is managed by the Asinara National Park and Marine Protected Area authorities (MPA authorities henceforth) and resource users are involved in decision-

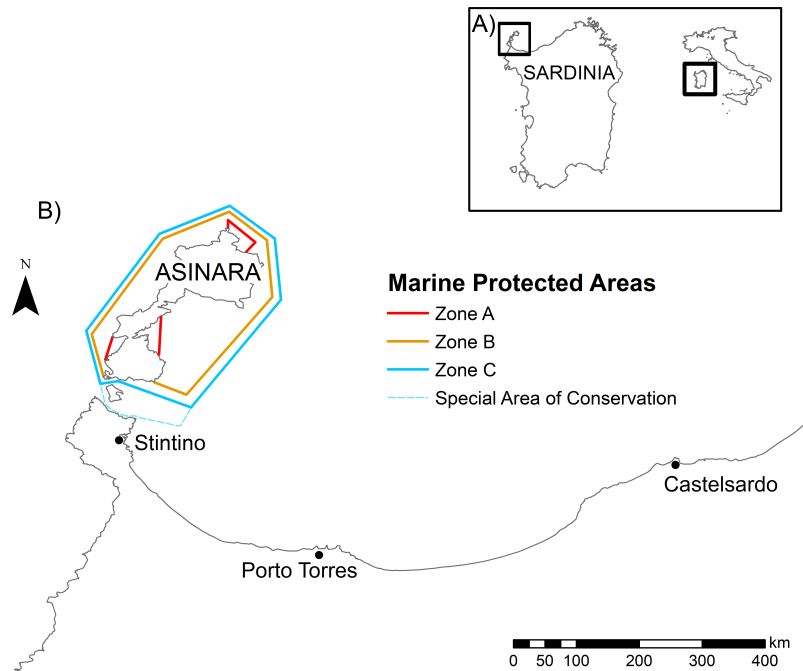


Figure 4.1: Location of study area in Sardinia, Italy (Figure 1.A). Asinara MPA (Figure 1.B). Country boundaries: ESRI 2023, MPA boundaries: by L.K. Banks 2023. MPA boundaries are approximate

making processes through a co-management approach. The Asinara MPA is further recognized as a Special Area of Conservation (SAC) of the Natura 2000 network, protected under the 1992 European Union (EU) Habitats Directive (Council Directive 92/43/EEC), under which Europe's threatened species and habitats are protected with the aim to preserve and restore biodiversity across land and marine territories. For example, the Asinara MPA seabed exhibits extensive stretches of *Posidonium oceanicae* habitat, one of the priority habitats under the Directive. The SAC overlaps with the MPA and further extends its limits southward of the Asinara island for a total an extension of about 118 km².

Before becoming a penal institution from 1885 to 1997, Asinara island harbored thriving fishing and farming communities. In 1885, these communities were relocated to the

main island of Sardinia, consequently leading to the establishment of the community of Stintino. Presently, Stintino resides under the administrative purview of the Porto Torres municipality. For this reason, not only resource users from Stintino, but also those from Porto Torres hold exclusive fishing rights within the boundaries of the MPA. Further, members of the community of Castelsardo are also allowed to fish within the MPA boundaries, yet only for *pescatourism* purposes (i.e., fishing-related tourism as a strategy of livelihood diversification). Small-scale fishing and *pescatourism* are the only fishing activities allowed within the MPA boundaries. Fishing is mainly carried out by pots, gillnets, and longlines and targeted species include octopus (*Octopus vulgaris*), spiny lobsters (*Palinurus elephas*), cuttlefish (*Sepia officinalis*), mullets (*Mullus surmuletus*), red scorpionfish (*Scorpaena spp.*), and sparids (*Diplodus spp.*, *Spondyliosoma cantharus*, *Dentex dentex*). Most of the catch is sold to a wholesaler, however a smaller portion can be sold directly at the landing sites.

In 2022, the Asinara MPA authorities initiated discussions regarding the renewal of the MPA fishing regulations. These processes are presently undergoing thorough discussions and refinements and they involve pertinent parties and stakeholders, including representatives from the fishing community.

4.4.2 SSF in the Mediterranean

In the Mediterranean, SSF constitute 80% of the total fishing fleet (FAO, 2022) and they are defined by the EU (Regulation (EU) No 508/2014) as vessels no longer than 12 meters and that do not use tow gear. Though clear and concise, this definition fails to acknowledge the sector's significant cultural, social, and economic roles, its vital support for coastal communities' livelihoods, and its integral place in the local way of life.

Mediterranean SSF are experiencing increasing vulnerability, stemming from pollution, habitat degradation, overfishing, and the detrimental impacts of climate change on marine ecosystems (FAO, 2022; IPCC, 2022). Further, EU policies, such as the Common Fisheries Policy (originally designed to meet the needs of industrial fishing), disempower SSF by limiting the sector's capacity to influence policy, further exacerbating their vulnerability (Percy & O'Riordan, 2020).

4.4.3 Data collection

To enhance the local relevance of this research, instruments were co-developed with Blue Marine Foundation (BMF), a not-for-profit organization with whom the University of Wa-

terloo signed a Memorandum of Understanding (MOU) in March 2022, and with two key informants.

To meet the restrictions associated with the COVID-19 pandemic, a hybrid data collection plan was developed in consultation with local partners. Between April 2022 and August 2022 data collection took place in person, whereas from August 2022 until February 2023 data collection was coordinated remotely and conducted in person by two local community researchers. All field research activities were conducted in compliance the Safety Plan for Minimizing Exposure to COVID-19 during Human Participant Research. In addition, the public health guidelines issued by the health authorities in Italy were followed. All surveys were conducted in Italian by native Italian speakers, and they lasted between 40 and 90 minutes.

Surveys (n=81) were conducted in the communities of Stintino, Porto Torres, and Castelsardo. The target population included individuals who self-identified as resource users who earned all or part of their income from small-scale fishing or from pescaturism activities within the Asinara Gulf and/or the Asinara MPA. All respondents were at least 18 years of age. The sample included full time, part-time, and seasonal workers across a range of roles such as boat captain, deckhand, or cook. The MPA authorities provided a list of registered fishers and, to capture as complete of a network as possible, the list was complemented through a modified snowball sampling approach to identify additional resource users (Wasserman & Faust, 1994). This process was achieved by asking respondents who had completed the survey to suggest other resource users within their network. In order to manage possible sources of bias associated with snowball sampling (Hanneman & Riddle, 2005), multiple snowball sampling processes were initiated by identifying various initial sets of actors through repeated visits to each landing site, fishing cooperatives, and fish markets. This process was carried out until network saturation was reached (Alexander et al., 2015; Hanneman & Riddle, 2005).

The survey was structured to collect a range of information about participants, including their social networks, sociodemographic information (e.g., age, gender as self-identified by participants), and data regarding social norms within the community (refer to [Table B.1](#) for selected survey questions). The social network data focused on information-sharing ties and were based on a name generator instrument with free recall (Marsden, 2014), such that respondents were asked to name others with whom they would share fishing-related information, such as gear or sea conditions. Social norm questions, meanwhile, collected information about descriptive and injunctive social norms (Bicchieri, 2016) by eliciting people’s beliefs about what others in their networks do (descriptive social norms) or what they think one should do (injunctive social norms). These questions were asked in relation to information-sharing social norms and social norms regulating adherence to formal

MPA regulations. This information would allow to gain a deeper understanding of the strength and existence of collaborative behaviours amongst resource users and help inform governance and management strategies.

Because the data was collected through surveys, additional depth and triangulation was sought by engaging in discussions with key informants and our local partner.

4.4.4 Social network analysis

This research employed a social relational network perspective (Alexander & Armitage, 2015), and associated methodologies, as conceptual model and method of analysis. The goal of employing this perspective was to emphasize the social dimension of MPA governance by turning the focus on resource users and the specific relations and patterns of relations amongst them (Alexander et al., 2015). Further, SNA (Freeman, 2004) was used to analyze social network linkages (i.e., information flows), and network structure (i.e., cohesion and centrality). Gephi, an open-source platform, was used to conduct SNA and generate visuals (Bastian et al., 2009). First, the analyses focused on structural characteristics at the level of the whole network, and investigated the level of social network cohesion, which was used as a proxy for social cohesion –as done by Alexander et al. (2015). Social cohesion describes the extent to which social connections keep communities together and it contributes to the development of shared behaviours and norms, which are fundamental to catalyze collective action and help communities navigate change (Alexander et al., 2018; Friedkin, 2004; Ostrom, 1990). From a structural perspective, network cohesion captures how tightly connected a social network is rather than being split into subgroups, such that a network with high cohesion does not have easily distinguishable subgroups (Wasserman & Faust, 1994). There are different ways to define and measure subgroups (see Borgatti et al., 1990), but generally subgroups are identifiable by the distribution of ties, whereby the density of relational ties between subgroups is lower than the density within subgroups (Bodin & Crona, 2009). Relational ties within cohesive subgroups can be referred to as bonding ties and ties that connect otherwise-disconnected actors or groups of actors can be referred to as bridging ties (Granovetter, 1973; Lin, 2001). Bonding ties promote trust, and in turn cohesion, which are important elements in the context of shared natural resources and generally help solving social dilemmas (Ostrom, 1990). In contrast, the presence of subgroups and low cohesion, can foster an “us-vs-them” thinking (Borgatti & Foster, 2003) and adversely impact resource users’ capacity for collective action and transition to new institutional arrangements (Bodin & Crona, 2009; Granovetter, 1973). As such, the degree of modularity in the Asinara MPA social network was examined to delineate cohesive subgroups and to reveal possible sets of nodes that have higher density of ties, or

connections, within each group, as compared to the density of ties between different groups (Blondel et al., 2008). For this part of the analyses, the modularity function in Gephi was used, which follows the algorithm developed by Blondel et al. (2008).

Second, the SNA focused on characteristics of individual resource users, with a specific emphasis on actors' positional attributes within the Asinara MPA network. While fragmentation (low network cohesion) is generally associated with limited capacity for collective action, it can also allow for heterogeneous subgroups to develop diverse ideas and knowledge systems (Crona & Bodin, 2006). If there are individuals who are able and willing to bridge otherwise-disconnected actors or groups of actors, this diversity can be leveraged to generate new perspectives to solve commonly-shared collective action problems and overall strengthen communities' capacity to adapt to changing conditions (Berkes et al., 2003; Bodin & Norberg, 2005; Granovetter, 1973; Newman & Dale, 2005; Walker et al., 2004). As such, the second part of the analyses focused on the measure of betweenness centrality, which is the propensity of an actor to lie on the shortest path between two other nodes in the network (Freeman, 1978) to identify who in the Asinara MPA social network could act as 'bridges' amongst subgroups. For this part of the analyses, the Gephi function for betweenness centrality was used, which follows the algorithm developed by Brandes (2001).

4.5 Results

The results of this research are organized in two main sections below. The first section outlines the results on social network cohesion, which are assessed by analysing the degree of modularity within the social network. This section also presents the results on the sociodemographic characteristics of each subgroup and the distribution of perceptions about social norms across subgroups. The second section describes the results on the positional attributes of individual nodes and focuses on actors with high betweenness centrality scores, further outlining their sociodemographic characteristics.

4.5.1 Social network cohesion

Analyses of network modularity identified three distinct, cohesive, subgroups –i.e., Subgroup 1, Subgroup 2, Subgroup 3, and only one isolate (Figure 4.2). The network ties illustrated in Figure 4.2 are undirected ties for information exchange, where one tie signifies mutual sharing, whether one way (A to B or B to A) or both (A to B and B to A). The figure colors indicate subgroup affiliation.

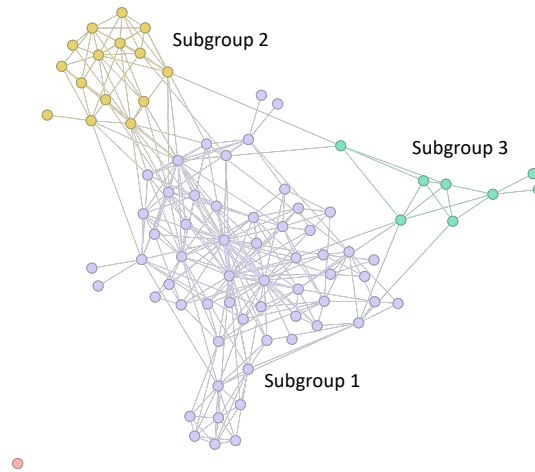


Figure 4.2: Network cohesion and subgroups

The surveyed sample consisted of 81 individuals. However, due to the presence of one isolate, the analyses on social network cohesiveness focus on data from 80 individuals. The characteristics and beliefs of the isolate are not described for privacy reasons related to sample size ($n=1$). Additionally, Figure 4.2 includes 82 nodes, as surveyed individuals mentioned one person who did not participate in the survey. Because this individual was not surveyed, data regarding their characteristics and preferences is unavailable.

Descriptive statistics for the sample are outlined in Table 4.1. The two dominant subgroups (Subgroup 1 and 2) collectively represent 89% of the entire social network, whereas Subgroup 3 constitutes 10% of the social network. Most (93%) resource users in Subgroup 1 are from the community of Porto Torres and most (93%) resource users from Subgroup 2 are from Stintino. Respondents from Subgroup 3 are mostly from Porto Torres (87%). Subgroup affiliation seem to overlap with the communities where people live.

When comparing the three subgroups, resource users in Subgroup 1 are on average younger ($\mu=48$, $\sigma=12$) than resource users in Subgroup 2 ($\mu=57$, $\sigma=14$), and Subgroup 3 ($\mu=56$, $\sigma=15$). The ANOVA test identified statistically significant (p-value: 0.036) age differences among the three subgroups (Table B.2). Subsequently, a Tukey's Honestly Significant Differences (HSD) test was conducted to pinpoint specific group differences

(Table B.3) and the analysis revealed statistically significant differences between Subgroup 1 and 2 (p-adj: 0.05).

Table 4.1: Descriptive statistics for the entire sample and across subgroups

Variable	Subgroup 1	Subgroup 2	Subgroup 3	Entire Social Network
Residence (percentage)				
Porto Torres	93%	7%	87%	77%
Stintino	3%	93%	12%	20%
Castelsardo	3%	-	-	2%
Other municipalities	1%	-	1%	1%
Cooperative (percentage)				
Cooperative A	71%	14%	37.5%	57%
Cooperative B	-	50%	-	9%
Minor local cooperatives	15%	-	-	11%
No cooperative	14%	36%	62.5%	23%
Age (mean, standard deviation)				
	$\mu = 48, \sigma = 12$	$\mu = 57, \sigma = 14$	$\mu = 56, \sigma = 15$	$\mu = 51, \sigma = 13$
Years of fishing experience (mean, standard deviation)				
	$\mu = 26, \sigma = 17$	$\mu = 34, \sigma = 21$	$\mu = 37, \sigma = 17$	$\mu = 29, \sigma = 18$
Women (percentage)				
	10%	7%	0%	8.7%
Pescatourism (percentage)				
	57%	64%	37%	56%
Captain (percentage)				
	48%	50%	50%	51%
n				
	58	15	8	81

Descriptive statistics further showed that resource users from Subgroup 2 have more years of fishing experience ($\mu=34$, $\sigma=21$) than resource users in Subgroup 1 ($\mu=26$, $\sigma=17$), yet less experience than resource users from the Subgroup 3 ($\mu=37$, $\sigma=17$). With regards to gender, individuals from Subgroup 1 have the highest percentage of resource users who are women (10%), followed by Subgroup 2 (7%), and finally Subgroup 3 with no women. For activity diversification, almost two thirds (64%) of resource users from Subgroup 2 are involved in *pescatourism*, followed by 57% of resource users from Subgroup 1, and 37.5% of resource users from Subgroup 3. In terms of cooperative affiliation, half (50%) of the resource users from Subgroup 2 are affiliated with their local cooperative (Cooperative B), about one third (36%) operate independently, and 14% are members of Cooperative A. On the other hand, majority (71%) of the resource users in Subgroup 1 are members of their local cooperative (Cooperative A), 15% are members of three smaller local cooperatives, and 14% are not members of any cooperative. Within Subgroup 3, 62.5% of the resource users function autonomously, without affiliating with any cooperative, while the remaining respondents are members of Cooperative A. Finally, within all three subgroups, vessel captains represent approximately half (48-50%) of the subgroup. Apart from age, none of these differences across subgroups were statistically significant (Table B.2).

Perceptions about social norms across subgroups

The three subgroups generally exhibited high adherence to social norms related to information-sharing and to adherence to the MPA regulations. This result underscores the presence of robust social norms within the Asinara MPA communities, emphasizing resource users' commitment to cooperative behaviors despite the presence of subgroups.

Descriptive statistics (Figure 4.3 and Table 4.2) show some variation in beliefs distribution about social norms related to information-sharing. Specifically, Subgroup 3 exhibited stronger beliefs about the presence of such norms compared to the other two subgroups, and it scored highest both for the descriptive ($\mu=4.50$, $\sigma=0.27$) and injunctive social norms ($\mu=4.38$, $\sigma=0.32$). This result means that this subgroup has the strongest belief that most resource users share and expect others to share information within the social network. In contrast, Subgroup 2 scored lowest between all three subgroups for both descriptive ($\mu=3.36$, $\sigma=0.27$) and injunctive ($\mu=3.57$, $\sigma=0.25$) social norms. Finally, Subgroup 1 sits in between the two groups for both descriptive ($\mu=3.76$, $\sigma=0.15$) and injunctive ($\mu=3.95$, $\sigma=0.18$) social norms.

A Kruskal-Wallis test (Table B.4) identified a statistically significant difference (p-value: 0.04) in the way subgroups perceive information-sharing descriptive social norms. A subsequent Dunn's test for post-hoc pairwise comparisons (Table B.5) specified that

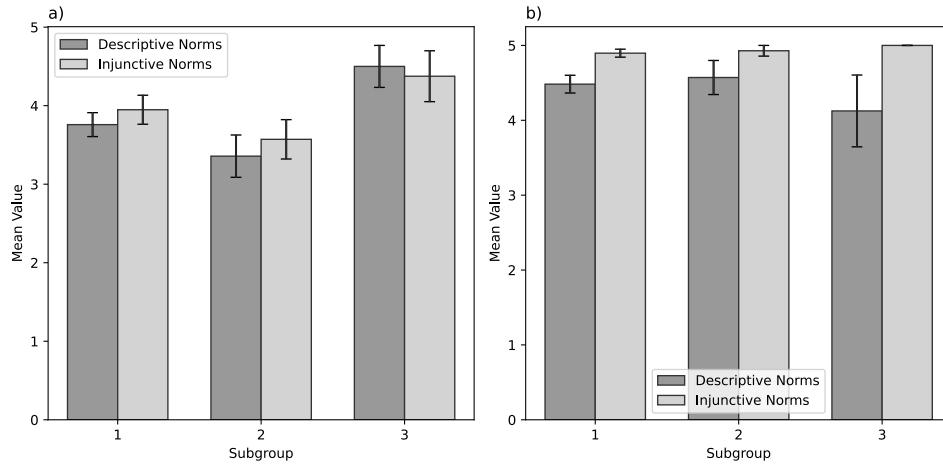


Figure 4.3: Information-sharing social norms across subgroups (Figure 3.a). Social norms about adherence to MPA regulations across subgroups (Figure 3.b)

Subgroup 2 does not believe as strongly as Subgroup 3 that others share information with the rest of the social network (p-value: 0.03).

With regards to social norms concerning the adherence to MPA regulations (Figure 4.3 and Table 4.2), Subgroup 2 scored highest for descriptive social norms ($\mu=4.57$, $\sigma=0.22$), and second highest for injunctive social norms ($\mu=4.93$, $\sigma=0.07$). This result indicates that this subgroup holds the strongest beliefs that most resource users follow MPA regulations. Subgroup 1 scored second highest for descriptive social norms ($\mu=4.48$, $\sigma=0.12$) and lowest for injunctive social norms ($\mu=4.90$, $\sigma=0.05$). Finally, Subgroup 3 scored lowest for descriptive social norms ($\mu=4.13$, $\sigma=0.48$), but highest for injunctive social norms ($\mu=5$, $\sigma=0$) –i.e., meaning this subgroup has the strongest belief that most people in the social network expect them to follow the MPA regulations. None of these differences were statistically significant (Table B.4).

Table 4.2: Descriptive statistics for different variables across subgroups

Variable	Subgroup 1	Subgroup 2	Subgroup 3
Information-sharing (descriptive social norms)	$\mu = 3.76, \sigma = 0.15$	$\mu = 3.36, \sigma = 0.27$	$\mu = 4.50, \sigma = 0.27$
Information-sharing (injunctive social norms)	$\mu = 3.95, \sigma = 0.18$	$\mu = 3.57, \sigma = 0.25$	$\mu = 4.38, \sigma = 0.32$
Adherence to MPA regulations (descriptive social norms)	$\mu = 4.48, \sigma = 0.12$	$\mu = 4.57, \sigma = 0.22$	$\mu = 4.13, \sigma = 0.48$
Adherence to MPA regulations (injunctive social norms)	$\mu = 4.90, \sigma = 0.05$	$\mu = 4.93, \sigma = 0.07$	$\mu = 5.00, \sigma = 0.00$

4.5.2 Betweenness centrality

The second part of the analyses focused on resource users' positional attributes within their social network. Specifically, SNA focused on betweenness centrality (Freeman, 1978). The surveyed sample comprises 81 individuals, but the results for measures of centrality include 82 resource users because one additional individual who was not surveyed was mentioned by others as part of their social network. Therefore, in this section results are based on a sample of 81 individuals when discussing all variables (e.g., sociodemographic characteristics), except for betweenness centrality.

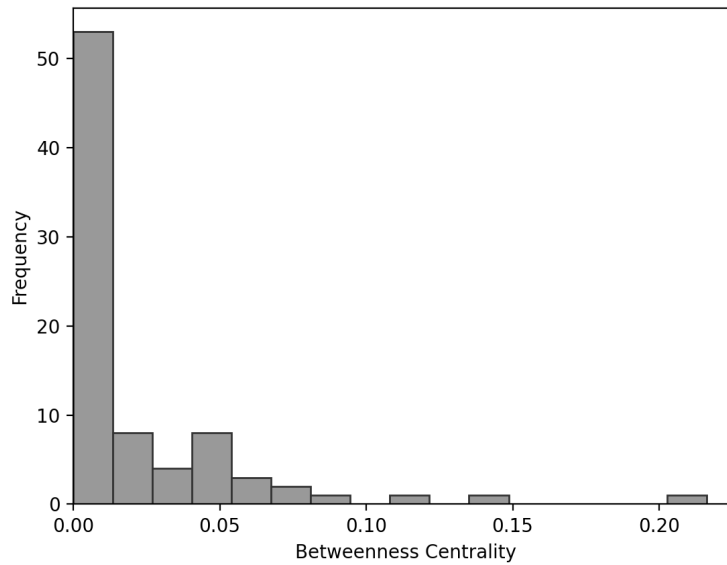


Figure 4.4: Distribution of betweenness centrality scores

The histogram in [Figure 4.4](#) represents the distribution of betweenness centrality scores in the Asinara MPA social network. Bins for the histograms were calculated in Python using the Freedman-Diaconis rule, which provides a data-driven approach to determine bin width. Betweenness centrality values were normalized in Gephi. The histogram is skewed to the left and shows scores ranging from a minimum value of 0 to a maximum value of 0.22. About 62% of the data takes on a betweenness centrality score between 0 and 0.01. The 70th percentile corresponds to a value of betweenness of 0.28, the 80th percentile to 0.04, the 90th percentile to 0.05, the 95th percentile to 0.08, and the 99th percentile to 0.16.

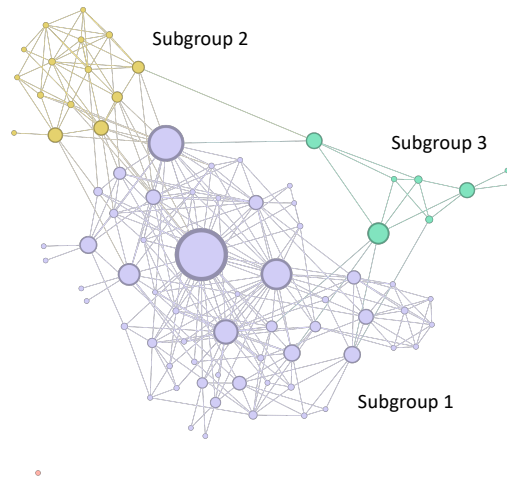


Figure 4.5: Betweenness centrality

Individuals with a higher betweenness centrality score constitute approximately 21% of the total sample ($n=82$) and they belong to Subgroup 1 (70%), Subgroup 3 (18%), and Subgroup 2 (12%). [Figure 4.5](#) provides a visual representation of the Asinara MPA social network where node size indicates the magnitude of betweenness centrality score and color indicates subgroup affiliation.

To gain a deeper understanding of the sociodemographic dimensions of the nodes with high betweenness centrality scores, the characteristics of the nodes with betweenness centrality equal to or higher than the 80th percentile were compared with the rest of the social network ([Table 4.3](#)) (i.e., respondents who scored below the 80th percentile).

Table 4.3: Descriptive statistics across centrality scores

Variable	Below 80 th percentile	At or above 80 th percentile
Residence (percentage)		
Porto Torres	71%	71%
Stintino	20%	29%
Castelsardo	8%	0%
Other municipalities	1%	0%
Cooperative (percentage)		
Cooperative A	56%	59%
Cooperative B	11%	0%
Minor local cooperatives	9%	18%
No cooperative	23%	23%
Age (mean, standard deviation)		
	$\mu = 50, \sigma = 14$	$\mu = 53, \sigma = 12$
Years of fishing experience (mean, standard deviation)		
	$\mu = 27, \sigma = 18$	$\mu = 34, \sigma = 15$
Women (percentage)		
	9%	6%
<i>Pescatourism</i> (percentage)		
	53%	65%
Captain (percentage)		
	37%	88%
n		
	64	17

Out of the group with a high centrality score, the majority (71%) resides in Porto Torres, while the rest (29%) resides in the community of Stintino. None of them reside in Castelsardo or other municipalities. The majority (59%) of these individuals are affiliated with their local cooperative (Cooperative A), while the rest either operate individually (23%), or are affiliated with other local minor cooperatives (18%). The average age within

this group is 53 years old, which is a few years older than rest of the social network average age of 50 years old. Further, these respondents have on average 34 years of fishing experience, which surpasses the rest of the network average of 27 years of experience. Most (94%) individuals with a high centrality score are men, which is higher than the rest of the network (91%). Regarding diversification of activities, about two thirds (65%) of this group engages in *pescatourism*, compared to the 53% engagement rate observed in the rest of the network. Finally, most (88%) of these respondents are captains, whereas only 37% of resource users are captains in the rest of the social network. A Chi-square test of independence (Table B.6) identified a statistically significant difference with respect to the presence of captains amongst the two groups (p-value: 0.00). All the other differences across variables were not statistically significant (Table B.6).

4.6 Discussion

The objectives of this research were to elicit the presence, strength, and implications of key social dimensions of the Asinara MPA and to identify opportunities to leverage this knowledge into strategies for establishing effectively and equitably governed MPAs. To achieve this overarching objective, this research examined the presence of social norms and the structural characteristics of an information-sharing social network.

The first part of the analyses focused on network cohesion, measured through the modularity function in Gephi (Blondel et al., 2008). A high level of network cohesion provides opportunities for frequent communication and interaction between actors, creating over time a fertile ground for the development of trust, reciprocity, and the capacity for collective action (Ostrom, 1999; Pretty & Ward, 2001; Putnam, 1993). However, instead of a single cohesive social network, the analyses identified three distinct subgroups (and one isolate) within the Asinara MPA. Subgroup affiliation overlapped with community of residence, although there was no statistical significance within this relationship. This finding follows the rationale that geographical proximity is a strong determinant of tie formation and maintenance between nodes (Rivera et al., 2010).

The lack of network-level social cohesion may initially appear as an obstacle to the capacity for maintaining collective action within the Asinara MPA communities. However, analyses on the distribution and strength of descriptive and injunctive social norms across the social network showed that there was a strong commitment to cooperative behaviours amongst resource users of the MPA (injunctive social norms were generally higher compared to descriptive social norms, possibly reflecting the influence of social desirability bias (Krumpal, 2013) leading respondents to over report their adherence to desirable

behaviours). The statistically significant difference detected in the way Subgroup 2 and Subgroup 3 perceived descriptive social norms regulating information-sharing (Table B.4) suggested that while Subgroup 2 had some skepticism regarding collaborative behaviours, the subgroup still maintained positive beliefs about others' willingness to cooperate. These findings confirm the long documented existence of social norms within the Asinara SSF communities, which resource users have been using for generations to regulate a range of collaborative behaviours, including access to fishing grounds, long before the MPA designation (Caoci & Lai, 2007; Morelli, 1990).

Additionally, the presence of subgroups is not inherently a limit to collective action. Network density is not a monotonic property of social networks, and 'too high' levels of tie density can lead to homophily and homogenization of ideas, information, and knowledge (McPherson et al., 2001). For this reason, the diversity that emerges from heterogeneous subgroups can benefit the collective when synthesized to find new solutions to commonly-shared collective action challenges (Berkes et al., 2003; Bodin & Norberg, 2005; Newman & Dale, 2005; Walker et al., 2004). A Mediterranean example of successful collective action emerging from diverse subgroups can be found in Salina, an island within the Aeolian archipelago in Sicily, Italy. In Salina, fishers from the SSF communities of Malfa, Santa Marina, and Leni, each with unique backgrounds and historical differences, formed a collaborative committee to catalyze the establishment of a local MPA (Leone, 2024). With further support from not-for-profit organization BMF, members from these communities successfully initiated bottom-up collective action, leading to the MPA approval by the local mayors and by the Ministry of Environment for future establishment (Leone, 2024).

The Asinara MPA subgroups showed differences across various aspects. Statistically significant differences in age (Table B.2) suggest that older individuals from Subgroup 2 likely have a deeper reservoir of ecological and traditional knowledge compared to resource users from Subgroup 1. Older resource users are often the most knowledgeable about longstanding traditions and practices and they can offer their expertise as foundation in which to root innovative solutions (Barthel et al., 2013; Morelli, 1990; Oteros-Rozas et al., 2013). Further, older generations are less likely to be affected by shifted baselines (Pauly, 1995) and can therefore provide support in reaching ecological targets by placing recent changes within a broader, long-term perspective (see Lovell et al. (2020) for an example of shifted baselines in the Caribbean).

The results highlighted additional, though non-significant, sociodemographic variations across the subgroups (Table 4.1). For example, resource users from Subgroup 1 had the highest rate (10%) of women participation compared to the two other subgroups. Yet this figure is still lower than the globally-reported ones of 19% for harvest-related activities and 40% general presence in the sector –i.e., all value chain activities (FAO et al., 2023). Despite

women's presence in fisheries, there are still barriers that undermine their meaningful participation in decision processes (Mangubhai & Lawless, 2021; Murunga, 2021) and bringing recognition to their roles could inform strategies to achieve gender equality in fisheries and MPA governance (Galappaththi et al., 2022).

Given the heterogeneity that characterizes the subgroups of the Asinara MPA social network, the second part of this research aimed at identifying the presence of individuals who could harness this diversity for the collective benefit. As such, the second part of the analyses focused on individuals' positional attributes within the network and analyzed the presence and characteristics of resource users who occupied central positions.

The results showed that, even with some variation, resource users with high betweenness centrality scores were present in all three subgroups (Figure 4.5). This finding suggests a high potential for successfully integrating the diversity of knowledge, practices, and ideas developed independently within each subgroup (even though it does not necessarily imply that these individuals are also willing to use their position for these purposes). Nodes in central positions were, on average, older, with more years of experience, mostly men, and more involved in pescatourism, compared to others in their social network (Table 3.3). However, none of these differences held statistical significance (Table B.6). Instead, there was a statistically significant difference in the rate of individuals holding the position of boat captain (Table B.6). This finding supports other work that indicates that central positions in networks are often occupied by people who hold formal and informal authority (Bodin & Crona, 2008) –although other research shows that this may not always be the case (e.g., Wade et al., 2023). Formal authority may come from boat ownership and command over crew and operations at sea, while informal authority may be attributed to the extensive years of fishing experience and knowledge about social and ecological dynamics (Wade et al., 2023). Together, these attributes may lead people to place greater trust in these individuals and make them more comfortable to share information with them (Burt, 2003; Granovetter, 1973), which may explain the centrality of boat captains in the Asinara MPA social network.

This research is subject to three main limitations. First, data was primarily collected through surveys, which might undermine the capacity to capture participants' ideas, behaviors, and perspectives comprehensively and accurately. To minimize potential ambiguities, triangulation was sought by engaging in discussions with key informants and community partners. These discussions led to adding additional depth to the patterns that emerged from the analyses and to confirm the interpretation of the results. A second potential limitation to the validity of this research findings stemmed from the fact that some of the data collected concerned sensitive information and potentially illegal behaviour (i.e., non-compliance with MPA regulations). To address this concern, all participants were

thoroughly briefed on the research objectives and measures in place to safeguard their privacy and safety prior to conducting the surveys. A third potential limitation concerns the generalizability of the findings. This research was designed with the intent be grounded in the specific context of the Asinara MPA and, as such, to answer to the specific challenges and opportunities present in this unique social and ecological environment. Nevertheless, this research can also offer lessons that are relevant to a wider range of problem contexts. Specifically, it can provide valuable insight for governance processes that are seeking to strengthen governance strategies in the broader spectrum of natural resource use.

4.7 Conclusion

Resource users behaviour, and fisher behaviour in particular, is more complex than what neoclassical economics may suggest (Andrews et al., 2021; Fulton et al., 2011; Salas & Gaertner, 2004). For this reason, traditional arrangements such as top-down and externally-imposed regulations may lead to adverse dynamics, including crowd-out scenarios and lack of compliance (Allo & Loureiro, 2017; Cinner et al., 2021; Frey & Jegen, 2001). Applied to the context of MPAs, this means that formal institutions are more effective, and more equitable, when they align with and recognize existing informal institutions. Eliciting social norms and analysing networks' topology can strengthen MPA governance because this knowledge can be used to highlight opportunities for formal institutions to build on these social processes in contexts where these are strong, and to reveal areas for additional support in contexts where collective action is lacking.

This research focused on the context of three SSF communities adjacent to the Asinara MPA, in Sardinia, Italy. When this research took place, the MPA was undergoing a phase of institutional transition as the MPA regulations were being renewed. Findings of this research show that the Asinara MPA communities are not one cohesive social network, and rather they are split into three subgroups. The presence of subgroups could represent an obstacle to collective action because social cohesion allows actors to interact and form relationships based on trust and reciprocity (Alexander et al., 2018). Nevertheless, the presence of strong descriptive and injunctive social norms indicates promising potential for successful cooperative behaviours. Further, points of tension between subgroups arising from different knowledge systems, perspectives, and ideas, can benefit the Asinara MPA communities because, if leveraged, they can uncover new pathways to solve collectively shared challenges and social dilemmas (Berkes et al., 2003; Bodin & Norberg, 2005; Newman & Dale, 2005; Walker et al., 2004).

For MPA authorities, knowledge about the presence, strength, and distribution of these

social dynamics can guide decision-making, especially during times of transition. For instance, being aware of the presence of subgroups allows for equitable participation in developing co-management plans by identifying communities or individuals that may be marginalized. Additionally, knowledge about the presence and location of central actors can help identify intermediaries between subgroups and between fishing communities and management authorities. Importantly, knowledge about social norms and social networks can help design strategies that are not only effective, but also equitable, because they are built on informal institutions and social processes that have developed and adapted to change over the course of time. Both these aims would help achieve international commitments, such as Target 3 of the Kunming-Montreal Global Diversity Framework (Convention on Biological Diversity, 2023), European Union Biodiversity Strategy for 2030 (European Commission, Directorate General for Environment, 2021), and global frameworks such as the Voluntary Guidelines for Securing Small-scale Fisheries in the Context of Food Security and Poverty Eradication (FAO, 2015).

Chapter 5

Conclusion

5.1 Research purpose and objectives

The purpose of this dissertation is to advance the emerging field of fisher behaviour with the applied aim to enhance fisheries and oceans policy. Fisheries and oceans policy shapes and is shaped by fisher behaviour, and the results of this research can advance policy development in two complementary ways. First, knowledge on fisher behaviour can make policy, and the policy instruments (e.g., regulations) that emerge from it, more efficient, by improving policy's fit with the context within which it aims to operate. Second, knowledge of fisher behaviour can support policy equity by increasing the alignment of formal regulations with pre-existing local institutions and rules of behaviour that fishers created and refined over long periods of time to regulate resource use. In this dissertation, I focus on policy that is created with the intent of achieving fisheries and oceans sustainability.

To achieve this purpose and related aim, in this dissertation I pursued three research objectives:

1. To advance and understand fisher behaviour as an emergent and critical, yet understudied, field through the development of a comprehensive conceptual typology based on key existing literature;
2. To map and synthesize the complex interactions between social norms (as a particular manifestation of fisher behaviour), collective action problems, and fisheries policy and to further unpack the role of social norms as a catalyst of collective action in natural resource systems, including in fisheries systems; and

3. To empirically examine the role of social norms and social networks as two fisher behavioural approaches and further assess their implications for policy.

To achieve these three objectives, I developed a typology and critical analysis of selected approaches to study and understand fisher behaviour (Objective 1); undertook a systematic scoping review of social norms (as a key behavioural approach identified in the typology) in the context of natural resource use and social dilemmas (Objective 2); and conducted an empirical investigation of two behavioural approaches (social norms and social networks) grounded in the context of the Asinara MPA in Sardinia, Italy (Objective 3). In doing so, the three objectives collectively advance the knowledge gaps I highlighted in the introductory chapter (Chapter 1).

The first objective provides the foundation of this dissertation because it frames the context and significance of informing policy with knowledge on fisher behaviour. Notably, the typology approaches depart from historically-predominant paradigms of behaviour based in neoclassical economics' *Homo Economicus*, and provide empirically-grounded insights into who fishers are and the reasons behind their actions. The second and third objectives delve into two of the key approaches presented in the typology: social norms and social networks. Specifically, the second and third objectives aim to critically engage with a core assumption of *Homo Economicus* that resource users are invariably self-interested and hence incapable of solving collective action problems.

5.2 Major findings

I present the research findings of this dissertation in three interrelated manuscripts (Chapter 2 to 4), each corresponding to one of the objectives I presented above. Through these three chapters I address the overall objective of this dissertation: to advance the understanding of fisher behaviour for fisheries and oceans policy, given the gap that exists between the theory of how humans behave and empirically-grounded observations of behaviour. In aiming to bridge this gap, I draw from complementary areas of scholarship that I presented in the introductory chapter (Chapter 1): governance, institutions, and fisheries and oceans policy; fisher behaviour as a lens to strengthen fisheries and oceans policy; and social networks and social norms as two approaches to understand fisher behaviour.

In Chapter 2, I develop a typology aimed at synthesizing existing theories, concepts, and perspectives that together provide insights into fisher behaviour. Some of these approaches formed in response to *Homo Economicus* models of behaviour. The aim of this

typology is not to compile an exhaustive list of existing approaches to describe, study, and measure fisher behaviour. Rather, the scope is to offer a selection of entry points and complementary opportunities to advance the understanding of fisher behaviour and therefore better inform and strengthen policy. Importantly, I characterize the research in Chapter 2 as a critical approach because its content is structured as a critique of historically dominant models of human behaviour based on *Homo Economicus*. To add depth to this critique, in the chapter I directly engage with historical and more current literature based in neoclassical economic theory (e.g., Gordon, 1954; Hilborn, 2007; Scott, 1955) and I contrast these approaches by providing examples of alternatives to conceptualize, assess, and operationalize fisher behaviour in policy. These alternatives include approaches based in Critical Social Theory, Development Scholarship, System Approaches, and Institutional Scholarship. However, I acknowledge there are other ways to categorize these different approaches. Within these four main categories of behavioural approaches, I describe examples from the peer-reviewed literature such as livelihood approaches (Blythe et al., 2014), social-ecological resilience approaches (Whitney et al., 2017), and interactive governance approaches (Chuenpagdee, 2011). I further add empirical weight to the critique through two vignettes, one in Canada and one in Italy, that discuss in depth two of the approaches: the well-being approach in Newfoundland, Canada and the social norms approach in Sardinia, Italy. In Chapter 2, I provide a tangible illustration of how mis-conceptualizing fisher behaviour can have unintended consequences in fisheries and oceans policy, and related governance goals. I conclude this chapter by highlighting opportunities for policy to further engage with empirically-grounded and contextually-relevant constructs of fisher behaviour, by carefully discerning between approaches that are based in abstract theory and approaches that take into account the complex reality of fisher behaviour.

In Chapter 3, I build on insights from Chapter 2 and I further engage with one of the behavioural approaches presented in the Chapter 2 typology: social norms. In this chapter, I develop a systematic scoping review to map and synthesize the interactions between social norms and collective action problems in natural resources systems, including fisheries systems. Chapter 3 has four main findings. First, while my initial intention was to focus this evidence synthesis only on fisheries systems, preliminary search queries of the literature databases (Scopus and WoS) indicated a paucity of literature within this specific context. For this reason, I extended the scope of the literature review to other natural resources and environmental settings, including fisheries. As such, a first finding that emerged from the evidence synthesis is that there are currently untapped opportunities for research to generate empirical evidence on social norms and collective action problems within the context of fisheries specifically. Second, through this chapter I provide a global-level synthesis of the state of the empirical and peer-reviewed literature on social norms

and social dilemmas in the context of natural resource use, and I uncover the exponential increase of publications since 1980. This second finding indicates an increase in interest on social norms and social dilemmas, possibly related to a growing interest in alternative explanations about resource users' behaviour in natural resource contexts that depart from *Homo Economicus* predictions (e.g., Tragedy of the Commons). Third, in Chapter 3 I found that there are many ways in which social norms are conceptualized and defined, and many different reasons as to why people decide to follow them. For instance, social norms can be conceptualized as individual or collective constructs (e.g., social norms can be individual behaviours upheld by personal perceptions about the behaviour of others, or elements of social capital), and resource users may prefer to follow them because they wish to maintain a good reputation within their social group, or because they may fear social sanctioning. Fourth, in Chapter 3 I found that social norms can be elicited or measured using either qualitative or quantitative approaches or both, when seeking triangulation, which provides access to different methodologies and analytical lenses to formulate and answer specific research questions. This diversity in conceptualizations, definitions, and methodologies, rather than being an indication of lack of coherence, can offer opportunities to explore social norms from various angles and perspectives.

Chapter 4 builds on insights from Chapters 2 and 3 and provides an empirical application, in the context of MPA governance, of two behavioural approaches presented in the Chapter 2 typology: social norms and social networks. The findings presented in this chapter draw from the insights, lived experiences, and perceptions of three fishing communities adjacent to the Asinara MPA in Sardinia, Italy. When this research took place, the Asinara MPA was undergoing a phase of institutional transition as the MPA regulations were being renewed in consultation with representatives from the fishing communities through a co-management process. Eliciting social norms and analysing social networks can inform processes of formal institutional transition, because knowledge about informal social processes can reveal areas where formal institutions can build on existing local institutions, and areas where additional support may be needed (Allo & Loureiro, 2017; Cardenas, 2011).

Chapter 4 has four main findings. First, this research revealed how the three Asinara MPA fishing communities are not one cohesive social network, but they are rather split into three separate subgroups (and one isolate). Membership to subgroups overlapped with community of residence (yet I was unable to establish statistical significance within this relationship). The presence of subgroups may at first appear as a limit to collective action capacity, since social cohesion is a strong catalyst of collective effort (Alexander et al., 2018). However, the presence of subgroups can provide a powerful resource when there are individuals who are able and willing to bridge heterogeneous groups and syn-

thesize the diverse practices, knowledge systems, and ways of doing things that subgroups developed separately, because this knowledge can be used to find innovative solutions to solve commonly shared challenges (Newman & Dale, 2005; Ramirez-Sanchez & Pinkerton, 2009; Turner et al., 2014; Wade et al., 2023). Second, results from this research revealed that within the Asinara MPA there are in fact individuals with high betweenness centrality scores (i.e., that are highly connected within the social network), and who could therefore play a powerful role in connecting and synthesizing separate subgroups' ideas and knowledge. Third, results from this research showed that despite the presence of three separate subgroups, the Asinara MPA resource users generally exhibited high adherence to social norms that regulate social interactions (i.e., people are committed to cooperate with each other), as well as social norms that regulate adherence to the MPA formal regulations (i.e., people are committed to cooperate with the MPA formal regulations). The presence of strong social norms within the Asinara MPA communities is a second promising indicator of resource users' capacity to successfully solve collective action problems. Fourth, I found statistically significant variations within the sociodemographic characteristics of the Asinara MPA communities, confirming groups' heterogeneity.

The overarching finding of Chapters 2 to 4 is that fisher behaviour is simultaneously determined by many relevant factors that together interact to determine fishers' actions (or inactions) and responses to change. In the next section, I discuss the meaning of these findings and how they can contribute to the advancement of knowledge of fisher behaviour for policy.

5.3 Theoretical and empirical contributions

Findings and insights from this dissertation translate into theoretical and empirical contributions because they help identify entry points and lenses to strengthen fisheries and oceans policy, and the regulations that emerge from it, through a more comprehensive understanding of who fishers are and the decisions they make in relation to their social and ecological environment.

The insights that emerge from Chapter 2 provide theoretical and empirical contributions to a range of disciplinary and practitioner communities by advancing the emergent field of fisher behaviour. The typology outlined in the chapter offers opportunities to stimulate further discussion on fisher behaviour by synthesizing existing theories, concepts, and perspectives. Importantly, the concepts and approaches described in the typology are not mutually exclusive, and they may complement each other by offering entry points and critical lenses to define, conceptualize, and assess fisher behaviour in fisheries and

oceans policy. In doing so, this chapter also offers a range of alternative approaches to historically-predominant theories of behaviour. For example, the social norms approach described in the first vignette confutes one of the core assumptions and implications of *Homo Economicus* behaviour in the commons (i.e., that resource users are self-interested and unable to coordinate resource use without external, top-down, interventions). Instead, the well-being approach presented in the second vignette documents how fisher behaviour is simultaneously determined by a suite of diverse and complex goals that extend beyond what neoclassical economics may suggest (e.g., for *Homo Economicus*, decisions are dispassionate but many of the behaviours highlighted in this vignette are motivated by emotions). I conclude Chapter 2 stressing how generating knowledge about fisher behaviour requires coordinating and cultivating collaborations across academia, practitioners, and fishing communities to critically integrate different approaches and knowledge systems. This needs has also been previously highlighted by others (e.g., Ommer, 2018), who have stressed the necessity of collaborating across disciplines and engaging with experts from diverse backgrounds (and importantly with fishing communities) to challenge old assumptions and generate new knowledge.

Key findings and insights that emerge from Chapter 3 provide theoretical and empirical contributions to academic and practitioner communities by advancing knowledge at the intersection of social norms, collective action problems, and natural resources use, including fisheries. The synthesized literature further provides evidence that addresses the gaps between predictions based in *Homo Economicus* theory (e.g., Gordon, 1954; Hilborn, 2007), and empirical evidence on how resource users actually behave –i.e., self-organizing through social norms (e.g., Ostrom, 1990). In doing so, these findings contribute to the existing and growing body of literature that questions the historical predominance of neoclassical economics models of behaviour because they discount the complex nature of fisher behaviour and human behaviour more broadly (Andrews et al., 2021; Fulton et al., 2011; Nielsen et al., 2024; Salas & Gaertner, 2004; Schill et al., 2019; Wijermans et al., 2020). The knowledge that emerges from this synthesis can be operationalized in settings where *Homo Economicus* is insufficient, or inadequate, to describe, explain, and predict resource users' behaviour. Introducing policy mechanisms and tools based in neoclassical economics assumptions in contexts where social norms exist and are strong, can be counter-productive, lead to non-compliance, and can crowd-out collective action (Allo & Loureiro, 2017; Cinner et al., 2021; Frey & Jegen, 2001). In a way, knowledge that emerges from this synthesis can be used to encourage bottom-up governance processes (e.g., collaborative and decentralized), in systems that are top-down (e.g., command and control), by prioritizing policy and regulatory tools that align with existing norms, strategies, and practices that resource users develop and use to navigate social dilemmas.

Additional theoretical and empirical contributions emerged from Chapter 4 through the empirical study conducted in three fishing communities adjacent to the Asinara MPA in Sardinia, Italy. Findings from this study contribute to advancing the growing body of literature on the social implications of designating and managing MPAs because implementing MPAs where coastal communities live and work can generate complex governance dynamics and raise questions related to justice and fairness (Di Franco et al., 2018; Garcia et al., 2014; Jones, 2014; Said et al., 2017). Specifically, findings from this research contribute to advancing understandings of how social processes, and specifically social norms and social networks (framed in this dissertation as two fisher behavioural approaches), can shed light on the human dimension of MPA governance (Charles & Wilson, 2009). First, knowledge about social network's topological properties can be operationalized to help MPA authorities identify strategies to strengthen regulatory processes, including co-management efforts (Alexander et al., 2015). For instance, social network analyses revealed that the Asinara MPA communities are composed of three separate and heterogenous subgroups, rather than one cohesive social network. These insights can inform co-management approaches to ensure that all members of the three communities have an equal opportunity to participate in management plans. Social network analyses also revealed that there are key actors who occupy central positions within the network (i.e., have high betweenness centrality scores) by being the ones who other resource users share most of their information with. Being aware of the existence of these figures within a community can benefit the MPA authorities because these individuals could cover critical roles, for example by acting as intermediaries between the fishing communities and MPA authorities. Second, knowledge on the presence, distribution, and strength of social norms provides insights on existing behavioural dynamics and informal rules of behaviour that resource users have developed over long periods of time to organize their actions in relation to ocean resources. This type of knowledge can be used to highlight potential gaps between written (formal regulations) and unwritten rules (social norms) (Allo & Loureiro, 2017). Importantly, knowledge about the presence and strength of social norms can highlight areas for formal institutions to build on these social processes where social norms are strong, while provide additional support where collective action is lacking. Finally, while the insights that emerged from Chapter 4 are meant to be grounded within the specific context of the Asinara MPA, findings of this research may be relevant to other contexts that are also seeking to improve formal institutional processes (e.g., changes in management plans) in the broader context of environmental governance.

The key insight that emerged from Chapters 2 to 4 is that a more comprehensive, empirically-grounded, and context-sensitive understanding of fisher behaviour can advance fisheries and oceans policy in two complementary ways. First, knowledge on fisher behaviour can enhance institutional fit (Cox, 2012; Epstein et al., 2015) with the social and

ecological context it aims to regulate. Specifically, a more comprehensive understanding of fisher behaviour can enhance social fit, which describes the alignment between institutions (e.g., regulations) and elements of a social system, such as people's values, beliefs, perceptions and, importantly, behaviours (Epstein et al., 2015; Meek, 2013). While there are examples within the literature that describe the success of processes that build on elements of social systems, including behaviour (Acheson, 2003; Travers et al., 2011), there are still untapped opportunities to use insights from the emerging field of fisher behaviour to achieve social and institutional fit within the context of fisheries. For instance, the typology described and represented in Chapter 2 provides a theoretical landscape that can be used as entry point for considering different fisher behavioural aspects (e.g., gender, vulnerability, livelihood approaches) that might enhance institutional fit from a social and specifically behavioural perspective. From this perspective, the research described in this dissertation provides a theoretical contribution to academic and practitioner communities by advancing the understanding of fit through a more comprehensive understanding of the role of fisher behaviour.

Second, aligning policy, and the regulations that emerge from it, with contextual knowledge about fisher behaviour can enhance policy equity, and cognitive equity specifically (Martin et al., 2016). In fisheries, this process includes bringing recognition to pre-existing strategies, values, and behavioural dynamics that fishers developed over time, sometimes generations, to navigate resource use and social interaction (Andrews et al., 2021). The need to recognize some of these dimensions is mentioned in the Voluntary Guidelines for Securing Small-scale Fisheries as a fundamental element to achieve respectful governance (FAO, 2015). Equitable governance is further recognized as a key element of Target 3 of the Global Biodiversity Framework (GBF) developed under the Convention on Biological Diversity (CBD). However, achieving equitable governance is not possible without accounting for the complexity of human behaviour.

Findings from this dissertation provide a theoretical contribution to academic and practitioner communities by offering a range of behavioural approaches that can be used as entry points to enhance equity in fisheries and oceans governance and policy. For instance, part of the challenge of equitably governing and managing protected areas emerges from the complexity generated by the diverse, perhaps sometimes competing interests, values, and norms of the fishing communities that inhabit and work in these areas. In Chapter 4, I used two behavioural approaches, to bring attention to this social dimension by describing and analysing group composition and heterogeneity and the presence and strength of behaviours related to cooperation.

5.4 Limitations and future research

In Chapter 2 I offered a typology of fisher behaviour by synthesizing existing theories, concepts, and perspectives that together offer complementary entry points into understanding who fishers are and why they make the decisions they make. While the research presented in this chapter aimed at offering opportunities to stimulate further discussion on fisher behaviour, it also does not exhaustively map the existing fisher behavioural literature, because my aim was bounded at providing a broad overview of selected approaches. Importantly, the themes under which I categorized the selected literature (i.e., Critical Social Theory, Development Scholarship, System Approaches, and Institutional Scholarship) were based on a subjective interpretation of the most suitable fit, and I acknowledge others may have made different choices. Nevertheless, this chapter can stimulate future conversation and research in the emergent field of fisher behaviour. For instance, there are still untapped opportunities to comprehensively, and perhaps systematically, map the existing literature on this topic. This effort could be undertaken, for example, through an evidence synthesis such as a systematic review.

The research I conducted in Chapter 3 is subject to two main limitations. First, literature on social norms and social dilemmas in fisheries systems was sparse. To adapt to this condition, I extended the search to other natural resource contexts where resource users may face similar conditions and problems related to collective action. Nevertheless, I was not able to comprehensively map and capture the specific conditions, strategies, and challenges of resource use dictated by a marine environment. A second limitation was that the sample of selected publications may not have included other relevant research conducted in languages other than English, outside of the peer-reviewed, empirical literature, and published before 1980.

The research in Chapter 4 is subject to four main limitations. First, data for this study was predominantly collected through structured surveys, which may have not comprehensively captured the nuances of participants' perspectives. To mitigate this limitation, efforts were made to triangulate the research findings through conversation with key informants and community partners. These discussions also served to validate the interpretation of the research outcomes and to add additional depth to the patterns that emerged from the analyses. Second, because the data collected in the field was in part related to sensitive information and illegal behaviours (i.e., compliance with MPA regulations), another potential limitation is related to the validity of my research findings. To minimize this source of bias (e.g., social desirability bias), I ensured that all participants were provided with thorough briefing on the research I was conducting and on the measures that were put in place to safeguard their privacy and safety. Third, since I designed this research for the

specific context of the Asinara MPA and to answer the specific challenges and opportunities present in this unique environment, another limitation concerns the generalizability of the findings (Noble & Smith, 2015). Nevertheless, this research can provide valuable insights and lessons for a wider range of contexts and, specifically, for governance processes that are seeking to strengthen formal institutional arrangements in the broader spectrum of natural resource use and common resources users. Fourth, a final limitation was imposed by the conditions and requirements associated with the COVID-19 pandemic, during which this research took place. Due to the pandemic, research timelines had to be compressed, which implied a constraint on the amount of the time I was able to spend with the Asinara MPA communities. In turn, this restriction posed a limitation to the opportunity to build stronger and deeper relationships with the communities, and hence to gain a deeper and more comprehensive understating of the context of the Asinara.

5.5 Reflections

My interest in human behaviour originates from my educational background in economics. Economics encompasses many areas, one of which is the study of how people allocate scarce resources. Most undergraduate and graduate programs in economics still favor neoclassical economics models to explain and predict how people achieve this aim. Students learn how to maximize complex utility functions to determine *Homo Economicus*' optimal preferences – a process similar to finding the vertex of a parabola, as some may remember from high school. By taking a quick inward look, it is evident that in our daily lives we do not optimize, and we certainly do not solve equations to determine optimal combinations. Instead, our choices and actions are simultaneously determined by a multitude of factors that interact to shape our behaviours and decisions.

Of course, neoclassical economists are aware of the complexity of human behaviour, and certainly do not optimize equations to determine their daily actions. A recent comment from my peer-review editor of Chapter 2 stated “I would guess that most economists would agree with this”, referring to a description my co-authors and I made about the inherent complexity of fisheries systems and fishers. The issue, however, is that this complexity is not always addressed, if not entirely discounted, in predominant models of human behaviour developed within neoclassical economics. Richard Thaler, a behavioural economist, provided an interesting analogy in this regard: “One begins learning physics by studying the behavior of objects in a vacuum; atmosphere can be added later. But physicists never denied the existence or importance of air; instead they worked harder and built more complicated models. For many years, economists reacted to questions about the realism of the

basic model by doing the equivalent of either denying the existence of air, or by claiming that it just didn't matter all that much" (Thaler, 2016, p. 1579).

As I mentioned in my introductory chapter, one possible line of defense of neoclassical economics is that, if we can assume that these elements that make reality and behaviour complex are negligible, irrelevant, and randomly distributed around the predicted behaviour (or around zero in mathematical terms), then these 'errors' will cancel out in aggregate. However, empirical reality shows that the way people behave is systematically different from neoclassical economics predictions of human behaviour. For instance, a well-known allegory based in neoclassical economics predicts that if *Homo Economicus* accesses a pasture, they will inevitably deplete it because it is rational for them to maximize their interests (Hardin, 1968). Interestingly, and perhaps since empirical observation started to contradict these predictions, group theory even argued that if rational individuals within a group share a common interest, and would all benefit from achieving a certain objective, it would only be rational for them to act in a manner that would help achieve that common objective (e.g., do not deplete shared resources) (Bentley & Odegard, 1967; Truman, 1963). As such, in this research I was first primarily interested in exploring alternative ways for understanding human behaviour, and then specifically to understand behaviour it in relation to collective natural resources use.

My final consideration concerns how to use knowledge on behaviour. Several policy landscapes, including in the ocean and fisheries sustainability context, are increasingly interested in changing peoples' behaviour. For example, UN Decade for Ocean Science (2021-2030) Challenge 10 calls for a change in humanity's relationship with ocean resources by identifying and addressing barriers to behaviour change. In the early stages of my PhD, I was also primarily interested in understanding fisher behavior to change it (and through market-based incentives). However, my perspective evolved significantly after attending a peer's PhD defense in the Fall of 2021. During the defense, the external examiner inquired about the ethical significance of instrumentalizing knowledge on behavior to then change it. This question, and subsequent interactions with my peers and supervisor, prompted a shift in my focus. In the research I presented in this dissertation, knowledge on fisher behaviour is to be used to more closely align fisheries and oceans policy with the social and ecological context it aims to regulate. In doing so, my hope is to better reflect, and bring recognition to, existing local institutions and forms of organization that resource users elaborated over long periods of time, sometimes generations, to manage their resources.

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APPENDICES

Appendix A

Ethics protocol and supporting documents

¹

¹The Italian translation of the following documents is available on request.

A.1 Information letter

INFORMATION LETTER

Title of the study:

Catalyzing fisher behaviour for viable small-scale fisheries: The role of social norms

Faculty Supervisor: Derek Armitage, PhD, School of Environment, Resources and Sustainability, University of Waterloo, Canada. Phone: 1-519-888-4567, ext. 45795, Email: derek.armitage@uwaterloo.ca

Student Investigator: Maria B. Battaglia, MA, School of Environment, Resources and Sustainability, University of Waterloo, Canada. Email: mbbattaglia@uwaterloo.ca

To help you make an informed decision regarding your participation, this letter will explain what the study is about, the possible risks and benefits, and your rights as a research participant. If you do not understand something in the letter, please ask one of the investigators prior to consenting to the study.

What is the study about? You are invited to participate in a research study about small-scale fisheries in Sardinia, Italy. This study is being undertaken as part of my (Maria B. Battaglia) PhD research. This research is part of the Vulnerability to Viability Global Partnership. This project aims to identify factors contributing to small-scale fisheries' vulnerability and collaborate with communities, non-governmental organizations, governments, and universities to enhance small-scale fisheries' viability.

This initiative is also linked to the student investigator's doctoral degree in the School of Environment, Resources and Sustainability at the University of Waterloo under the supervision of Professor Derek Armitage (who is also member of the Vulnerability to Viability Global Partnership). I would like to provide you with more information about this project and what your involvement would entail if you decided to take part.

This initiative seeks to answer questions that relate to the social dimension of small-scale fisheries and further assess its implications for sustainable access to marine food resources and food security. These are important questions that are at the core of supporting more socially and ecologically sustainable governance outcomes in Sardinian small-scale fisheries.

1. YOUR RESPONSIBILITIES AS A PARTICIPANT

What does participation involve? Participation in the study will consist of attending one, in-person, survey administered by me or a community researcher. The survey

is expected to last 60 minutes. The survey will be held at your local fish landing site or harbour. The research includes a short demographic survey (age, gender, etc.) in order to include important variables that may play a role in determining some of the economic and social choices that you make as a fisher. Then, it will ask you questions related to your social networks, your perspectives, beliefs and experiences related to your fishing grounds and other fishers.

Who may participate in the study? In order to participate in the study, you must be at least 18 years of age.

2. YOUR RIGHTS AS A PARTICIPANT

Is participation in the study voluntary? Participation in this study is voluntary. You may decline to answer any of the survey questions if you so wish. Further, you may decide to end the survey at any time without any negative consequences. Any information you provided up to that point will not be used. You can request your data be removed from the study until January 2023 as it is not possible to withdraw your data once the student investigator's (Maria B. Battaglia) thesis has been submitted.

Will I receive anything for participating in the study? To thank you for your time and participation you will receive a token of appreciation.

What are the possible benefits of the study? Participation in this research may not provide any personal benefit to you. We hope that the results of this research will be of benefit to those organizations directly involved in the study, other organizations not directly involved in the study, as well as to the broader research and local community.

What are the risks associated with the study? There are no known or anticipated risks associated with participation in this study. If a question, or the discussion, makes you uncomfortable, you can choose not to answer. See above for more details on voluntary participation.

Will my identity be known to others? The research team will know what you said. Your participation will be considered confidential by the research team and identifying information will be removed from the data that is collected and stored separately. Your name will not appear in any paper or publication resulting from this study.

Will my information be kept confidential? Your identity will be confidential. Collected data will be securely stored for a minimum of 7 years on password protected computers. Please note that it will not be possible to remove your data once results have been submitted for publication (approximately December 2022). Data will be stored in an encrypted folder on my password protected laptop. Only the research team will have access to the data. No identifying information will be used in my thesis or any presentations or

publications based on this research. Whenever information is transmitted over the survey privacy cannot be guaranteed. There is always a risk your responses may be intercepted by a third party (e.g., government agencies, hackers). University of Waterloo researchers will not collect or use internet protocol (IP) addresses or other information which could link your participation to your computer or electronic device without first informing you.

3. QUESTIONS, COMMENTS, OR CONCERNS

Who is sponsoring/ funding this study? This study is funded by the Vulnerability to Viability Global Partnership, a 7 year project funded by the Social Sciences and Humanities Research Council of Canada.

Has the study received ethics clearance? This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Board (REB #43416). If you have questions for the Board contact the Office of Research Ethics at 1-519-888-4567 ext. 36005 or reb@uwaterloo.ca.

Who should I contact if I have questions regarding my participation on the study? For all other questions or if you would like additional information to assist you in reaching a decision about participation, please contact the student investigator by email at mbbattaglia@uwaterloo.ca. You can also contact the principal investigator, Professor Armitage by email at derek.armitage@uwaterloo.ca

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A.2 Recruitment form

VERBAL SCRIPT FOR RECRUITMENT

P = Potential Participant; I = Interviewer

I – Hello, My name is [insert student investigator or community researcher name] and I am a student investigator/community researcher for a research project conducted by the University of Waterloo, Canada. As part of this research, I am conducting surveys with Sardinian fishers to discover their perspectives on local fisheries. I would like to speak with you about your beliefs and experiences related to your profession. Is today a convenient time to give you further information about the survey?

P - No, not today [agree on a more convenient time to conduct the survey].

OR

P - Yes, could you provide me with some more information regarding the surveys you will be conducting?

I - Background Information:

- I will be undertaking surveys starting in April 2022;
- The survey would last about one hour, and would be arranged for a time convenient to your professional schedule;
- Involvement in this interview is entirely voluntary and there are no known or anticipated risks to participation in this study;
- The questions are quite general (for example, [Who do you talk to in your fishing community when it comes to knowledge about fishing?]);
- You may decline to answer any of the interview questions you do not wish to answer and may terminate the survey at any time;
- Your identity will be confidential;
- The data collected will be kept in a secure location for a minimum of 7 years time;
- If you have any questions regarding this study, or would like additional information to assist you in reaching a decision about participation, please feel free to contact Derek Armitage 1-519-888-4567, ext. 45795;

- This study has been reviewed and received ethics clearance through a University of Waterloo, Canada, Research Ethics Board; and
- After all of the data have been analyzed, an executive summary of the research results will be shared with you.

With your permission, I would like to show you an information letter which has all of these details along with contact names and numbers on it to help assist you in making a decision about your participation in this study.

P - No thank you.

OR

P - Sure [get contact information from potential participant e.g., phone number].

I - Thank you very much for your time. May I call you in 2 or 3 days to see if you are interested in being interviewed? Once again, if you have any questions or concerns please do not hesitate to contact me at my 1-416-471-3022.

P - Good-bye.

I - Good-bye.

A.3 Verbal consent form

VERBAL CONSENT SCRIPT

Title of the study:

Catalyzing fisher behaviour for viable small-scale fisheries: The role of social norms

Faculty Supervisor: Derek Armitage, PhD, School of Environment, Resources and Sustainability, University of Waterloo, Canada. Phone: 1-519-888-4567, ext. 45795, Email: derek.armitage@uwaterloo.ca

Student Investigator: Maria B. Battaglia, MA, School of Environment, Resources and Sustainability, University of Waterloo, Canada. Email: mbbattaglia@uwaterloo.ca

Hello. I'm [insert student investigator or community researcher's name]. I am conducting research about small-scale fisheries and fisher behaviour in Sardinia. This survey is part of Maria Battaglia's PhD research at the University of Waterloo, Canada. Maria Battaglia works under the supervision of Dr Derek Armitage, University of Waterloo, Canada. Thank you for your interest in participating in this research. Have you had time to read to go through the Letter of Information we provided you with?

[If the LOI was provided in advance and the participant responds that they have read/ community researchers read them the LOI]

Great, then I would like to take a moment to review some main points from the Letter of Information before we continue.

[Proceed to review the highlights of the LOI, be sure to read risks and what will happen with their data, and confirm the important points about voluntary participation and withdrawal listed below.]

[If the participant responds that they did not read the LOI in advance, then proceed to go through the full LOI in detail with the participant and confirm the important points about voluntary participation and withdrawal listed below.]

Confirm the following to the participant:

- Your participation in this study is voluntary;

- If you do not want to answer some of the questions you do not have to, but you can still be in the study;
- You can decide to stop at any time, even part-way through the survey for whatever reason;
- If you decide to stop during the survey, we will ask you how you would like us to handle the data collected up to that point, whether returning it to you, destroying it or using the data collected up to that point;
- You can ask to remove your data from the study up until approximately January 2023; and
- This study has been reviewed and cleared by the University of Waterloo Research Ethics Board (REB #43416). If you have questions for the Board contact the Office of Research Ethics at 1-519-888-4567 ext. 36005 or reb@uwaterloo.ca.

Do you have any questions or want me to go over any study details again?

Consent questions: Do you agree to participate in this study?

If yes,

- Would you like a copy of the study outcomes? If yes, where should we send them (email, mailing address, whatsapp)?
- Do you agree to allow your anonymized study data to be stored and used for future research as described in the Letter of Information?

If no, "Thank you for your time."

A.4 Letter of feedback and appreciation

LETTER OF FEEDBACK AND APPRECIATION

Dear (insert participant's name):

Thank you again for your willingness to participate in my study on small-scale fisheries in Sardinia, Italy. We greatly appreciate your willingness to meet with us and to share your thoughts, perceptions, and beliefs. This research will seek to answer questions that relate to the social dimension of small-scale fisheries in Sardinia, Italy.

We have greatly valued your participation in this research study and your willingness to share about your experience. If you have any questions or concerns, or if you would like additional information about this research, please contact the student investigator, Maria Battaglia, by email at mbbattaglia@uwaterloo.ca. You can also contact the principal investigator, Derek Armitage, by email at derek.armitage@uwaterloo.ca

Collected data will be securely stored for a minimum of 7 years on password protected computers. You may withdraw your consent and request that your data be removed from the study by contacting the researchers within this time period. Please note that it will not be possible to remove your data once results have been submitted for publication. Only researchers associated with this project will have access to the data. Whenever information is transmitted over the internet privacy cannot be guaranteed. There is always a risk your responses may be intercepted by a third party (e.g., government agencies, hackers). University of Waterloo researchers will not collect or use internet protocol (IP) addresses or other information which could link your participation to your computer or electronic device without first informing you.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Board (REB #43416). If you have questions for the Board contact the Office of Research Ethics at 1-519-888-4567 ext. 36005 or reb@uwaterloo.ca.

We hope that the results of this research study will be of benefit to those organizations directly involved in the study, other organizations not directly involved in the study, as well as to the broader research community and Sardinian communities.

Again, thank you so much for your time and effort that made this research study possible.

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Appendix B

Supplementary material Chapter 4

Table B.1: Selected survey questions

Theme	Survey Questions
Sociodemographic Information	Residence, cooperative membership, age, years of fishing experience, gender as self-identified by the study participant, residence, whether participant participates in pescatourism.
Perceptions about what others do	<p>Please indicate how much you agree or disagree with the following statements from 1 = totally disagree to 5 = completely agree:</p> <ul style="list-style-type: none"> • “I believe that the majority of fishers in the Asinara MPA share information with other fishers.” • “I believe that the majority of fishers of the Asinara MPA respect the MPA regulations.”
Perceptions about what others expect one to do	<p>Please indicate how much you agree or disagree with the following statements from 1 = totally disagree to 5 = completely agree:</p> <ul style="list-style-type: none"> • “I believe that the majority of fishers of the Asinara MPA expect that I would share information with other fishers.” • “I believe that the majority of the fishers of the Asinara MPA expect that I would respect the MPA regulations.”
Social Network	Please mention the names of Asinara MPA fishers with whom you share information.

Table B.2: Significance of differences in sociodemographic variables across subgroups

Variable	Test	Results	Statistical significance
Residence	Chi-square test for independence	Chi-2 statistic: 56.95, p-value: 1.26	FALSE
Cooperative	Chi-square test for independence	Chi-2 statistic: 52.00, p-value: 1.14	FALSE
Age	ANOVA	F-Statistic: 3.47, p-value: 0.036**	TRUE
Years of fishing experience	Kruskal-Wallis test	H-test statistic: 3.26, p-value: 0.20	FALSE
Women participation	Chi-square test for independence	Chi-2 statistic: 0.99, p-value: 0.61	FALSE
<i>Pescatourism</i>	Chi-square test for independence	Chi-2 statistic: 1.52, p-value: 0.47	FALSE
Role (captain)	Chi-square test for independence	Chi-2 statistic: 0.019, p-value: 0.99	FALSE

Significance is reported for the following levels: *p<0.1; **p<0.05; ***p<0.01

Table B.3: Tukey HSD test for age variable

Group 1	Group 2	Mean diff.	p-adj.	Lower	Upper
Subgroup 1	Subgroup 2	8.96	0.05*	-0.13	18.05
Subgroup 1	Subgroup 3	7.35	0.28	-4.15	18.86
Subgroup 2	Subgroup 3	-1.61	0.90	-15.13	11.92

Significance is reported for the following levels: *p<0.1; **p<0.05; ***p<0.01

Family-wise error rate (FWER)=0.05

Table B.4: Significance of differences in perceptions about social norms across subgroups

Variable	Kruskal-Wallis test & results	Statistical significance
Information-sharing (descriptive social norms)	H-test statistic: 6.43, p-value: 0.04**	TRUE
Information-sharing (injunctive social norms)	H-test statistic: 4.09, p-value: 0.13	FALSE
Adherence to MPA regulations (descriptive social norms)	H-test statistic: 1.08, p-value: 0.58	FALSE
Adherence to MPA regulations (injunctive social norms)	H-test statistic: 0.58, p-value: 0.75	FALSE

Significance is reported for the following levels: *p<0.1; **p<0.05; ***p<0.01

Table B.5: Dunn’s test for post-hoc pairwise comparison on information-sharing (descriptive social norms) variable

Subgroup	Subgroup 1	Subgroup 2	Subgroup 3
Subgroup 1	1	0.15	0.13
Subgroup 2	0.15	1	0.03**
Subgroup 3	0.13	0.03**	1

Significance is reported for the following levels: *p<0.1; **p<0.05; ***p<0.01

Table B.6: Significance of differences in sociodemographic variables across centrality scores

Variable	Test	Results	Statistical significance
Residence	Chi-square test for independence	Chi2-statistic:1.69; p-value:0.43	FALSE
Cooperative	Chi-square test for independence	Chi2-statistic:4.71; p-value:0.45	FALSE
Age	ANOVA	F-statistic: 0.55;p-value:0.46	FALSE
Years of fishing experience	ANOVA	F-statistic:1.76; p-value:0.19	FALSE
Women participation	Chi-square test for independence	Chi2-statistic:0.00; p-value:0.98	FALSE
<i>Pescatourism</i>	Chi-square test for independence	Chi2-statistic:0.34; p-value:0.56	FALSE
Role (captain)	Chi-square test for independence	Chi2-statistic: 11.89; p-value: 0.00***	TRUE

Significance is reported for the following levels: *p<0.1; **p<0.05; ***p<0.01