Leadership in small-scale fisheries

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Abstract

Small-scale fisheries (SSF) management approaches which place communities at the centre of decision making are becoming increasingly popular. Local leadership is crucial to participative methods due to increased responsibility placed on local actors. Despite its importance, an initial literature review revealed limited, focused SSFs leadership research. This thesis aimed to contribute to the emerging field of SSF leadership and increase understanding of leadership processes. My objectives were to identify key leadership research gaps, explore how leadership interacts with other important contextual conditions, decipher the influences on effective leadership, and discuss how leadership can facilitate more effective SSFs management. I used a multi-method approach to research leadership at a global scale which includes Qualitative Comparative Analysis (QCA) and interviewing. My research finds leadership to be complex, uncertain and dynamic. Leadership acts alone or in combination with other contextual conditions, to influence positive and negative, social and ecological outcomes. Numerous factors influence the propensity of an individual to engage with leadership, such as worldviews, resource constraints at the individual and community level, and interactions with other social actors. Despite the move to participatory approaches there are still numerous concerns about SSFs management, such as the sustainability of community-based organizations. A key finding is that leadership will have an increasingly important role to play in improving the longevity of community-based organizations through processes such as leaderful organizations, succession planning, and capacity building. Leadership is a new research field; therefore this work is of an explanatory nature in terms of its focus and use of novel methodologies. My research identifies important areas for further analysis, such as deciphering the influence of high level leadership on local processes, and investigating how to develop leaderful organizations. Future research should build on my findings to enhance knowledge of leadership functions and processes.

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Declaration

I declare that the work contained in this thesis is my own work and has not been submitted for any other degree or award. The contribution of co-authors for accepted or prepared papers for submission are detailed in the preface of the respective chapters. All data analysis and writing of this thesis is my own work.

Chapter 1 Introduction

Millions of people worldwide rely on small-scale fisheries (SSF). SSF are found in coastal marine areas, brackish water lagoons, and along freshwater lakes, rivers, and reservoirs. The SSF sector, including fishing and fish farming, is estimated to employ 37 million people worldwide, with an additional 100 million people finding employment in full-time and part-time associated activities (FAO, 2016b). SSFs are crucial in poverty alleviation and food security (Allison and Ellis, 2001; Barnes-Mauthe et al., 2013; Garcia and Rosenberg, 2010) especailly in areas with limited alterative livelihood and subsistence options. In addition, SSFs globally contribute to cultural heritage in terms of providing a sense of well-being and identity (FAO, 2005; Béné, 2006). As impressive as these statistics are, many believe that they do not reflect the true importance of SSF as, in some cases, SSFs are undefined and unconsidered by national policies (FAO, 2016a; Pauly, 2006).

Despite the importance of SSFs, the health of marine and freshwater ecosystems are diminishing worldwide. Overfishing is recognized as a leading environmental and socioeconomic problem, which has reduced biodiversity, caused habitat destruction, and modified the functioning of marine and freshwater ecosystems (Pikitch et al., 2004; Worm et al., 2009). The collapse of fish stocks and the degradation of marine and freshwater environments are likely to have far reaching, unpredictable and devastating consequences for the people who depend on SSFs for subsistence, nutrition, and income (Barnes-Mauthe et al., 2013; Pauly, 2006).

Governance of SSF is challenging due to the complexity and interconnectivity of social, ecological, and economic processes (Mahon et al., 2008). As such, SSFs are assumed to have relatively low governability potential (Jentoft and Bavinck, 2014) as management decisions are frequently made under conditions of uncertainty (Dewulf et al., 2005). The low governability potential is exacerbated by conventional top-down, centralized SSF management approaches which treat fisheries as predictable and controllable (Mahon et al., 2008), rely on biological models (Kolding and van Zwieten, 2011), and ignore key uncertainties of ecological systems (Folke et al., 2005). Importantly, the connection between resources and resource users, and the social realities on the ground have largely been ignored by conventional management (Hauck, 2008). Due to the current environmental status of marine and freshwater ecosystems, it is often argued that conventional management has failed to incorporate sustainability into SSFs (Cochrane et al., 2011; Imperial and Yandle, 2005; Pero and Smith, 2008).

Consequently, several alternatives to conventional SSF management have been developed and widely practiced over the past 30 years. Common themes of alternative methods include decentralization or devolved management, increased participation of local

actors, and a focus on the interactions between social and natural processes (Andrew et al., 2007; Cochrane et al., 2011). Decentralized governance systems transfer decision making power to local government agencies, whilst devolved governance involves the transfer of decision making power to local resource users (Rudd et al., 2003).

Devolved SSF management approaches operate through various institutional structures. The structure implemented can be identified in part by the nature and extent of stakeholder participation (Gray, 2005). Community-based fisheries management (CBFM) engages local stakeholders in decision making (Jentoft, 2000) and technically operates without the input of governmental actors. Community engagement is assumed to encourage compliance with regulations (Eggert and Ellegård, 2003; Gutierrez et al., 2011; Jagers et al., 2012; Sutinen et al., 1990), increase community ownership of SSF (Gutierrez et al., 2011), reduce conflicts (Jentoft, 2005), reduce transactions costs (Carlsson and Berkes, 2005; Rudd et al., 2003), and improve the integration of local, traditional and scientific knowledge (Berkes, 2009; Carlsson and Berkes, 2005; Wiber et al., 2009). Alternatively, co-management refers to the sharing of responsibility and authority for resource management between government agencies and local SSF communities (Pomeroy, 1995). Several forms of co-management exist which are determined by the degree of power sharing (Figure 1-1).

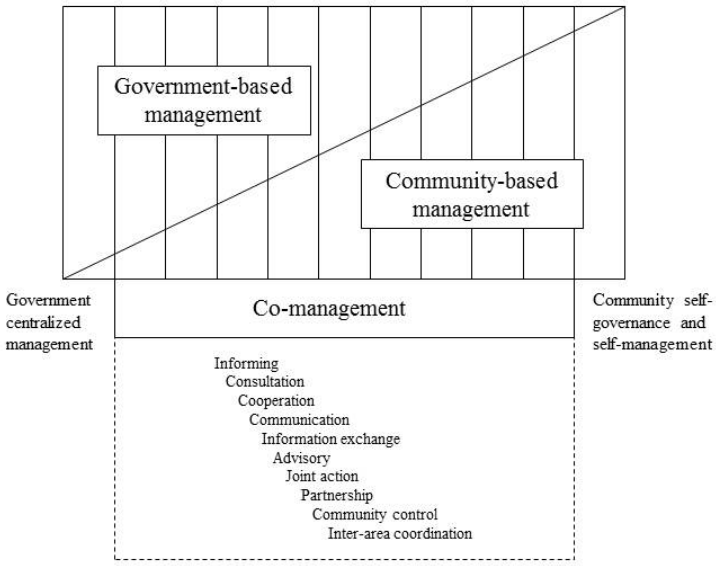

Figure 1-1 - Hierarchy of co-management arrangements taken from Pomeroy (1995) (which was adapted from Berkes (1994).

In reality, the delineation between CBFM and co-management is difficult to clearly identify (Sen and Raakjaer Nielsen, 1996). Co-management, and in many cases CBFM, require the establishment of a supportive government structures and an enabling legal environment to be effective (Pomeroy and Berkes, 1997). The structure of SSFs

management and the degree of government involvement will depend on context-specific conditions such as local capabilities, knowledge, and aspirations of community members (Sen and Raakjaer Nielsen, 1996), and the motivations of governmental counterparts. As SSFs are characterized by diversity and complexity, and no two fishing communities are the same, a one-size-fits all mentality for SSFs management is unsuitable (Acheson, 2006; Pomeroy and Berkes, 1997).

Extensive research has been conducted to identify determinants that are important to the successful implementation of participatory management over the last 30 years. Pomeroy et al, (Pomeroy et al., 2001) grouped influencing determinants, first identified by Pollnac (in Pomeroy (1996)), into 3 levels:-

- Supra community level – Determinants that are external to the community which include supportive legislation and supportive government administration;

- Community level – Determinants that are found within the community and include, appropriate scale and defined boundaries, clearly defined membership, group homogeneity, local participation, leadership, community organizations, long term support from local government unity, property rights, adequate financial resources, partnerships, accountability, conflict resolution mechanisms, clear objectives, and management rules enforced;

- Individual and household level –Individuals are responsible for making the decision to carry out certain SSFs activities (such as participation in management and rule compliance). Therefore, individual incentive structures and personal capabilities are crucial to successful SSF management;

Due to the nature of CBFM and co-management, additional responsibility is placed upon local institutions and actors to sustainably manage SSFs. The engagement of local leaders is therefore crucial for success, as they are tasked with performing key management functions (Armitage, 2005; Rudd et al., 2003). Leaders are key individuals who by their skills, experience, and personal characteristics are justified in being a central and influential role in social processes (Kingdon, 2003). They are especially crucial given their influence on the overall success of organizations (Hollander, 2012). Local leaders perform a range of essential roles which include providing support for the implementation of management activities (Thompson et al., 2003), activating collective action and social

capital (Krishna, 2002), helping articulate vision, and enhancing community capacity (Sutton and Rudd, 2014).

Leadership is increasingly being recognized as a critical component for successful SSF management (Aburto-Oropeza et al., 2011; Al Mamun, 2015; Basurto, 2013; Gutierrez et al., 2011; Marschke and Sinclair, 2009; Ostrom, 2009; Pomeroy et al., 2010; Pomeroy et al., 2001). Despite the importance of leadership, little in-depth, focused research has been conducted on SSF leadership. As such, there are many unknowns about the intricacies and complexities of leadership. Therefore, much research is required to increase understanding of leadership processes, and potentially facilitate more effective CBFM and SSFs co-management.

1.1 Aims and objectives

My research aim is to critically assess local leadership in SSF.

The objectives I set out to accomplish were:

1. Identify key knowledge gaps in SSF local leadership;
2. Determine how different contextual conditions interact with leadership to influence SSF outcomes;
3. Explore factors that influence leadership at the local level;
4. Increase understanding of how leaders can help reduce uncertainty and facilitate more effective management and sustainable SSF;
5. Provide direction for future SSF leadership research.

1.2 Breakdown of chapters

In Chapter Two I complete a broad review of local leadership in SSF, in natural resource management, and in other sectors. The aim of this chapter is to strategically identify key leadership knowledge gaps relevant for CBFM. I organized results to highlight information about the characteristics of leaders, a leader's connection with community members and actors external to the community, and the context within which leaders function. I define these interactions as the "3Cs" of local leadership (Sutton and Rudd, 2014).

In Chapter Two, I found that past SSF leadership research has generally focused on the coarse-scale characteristics of leadership, and the functions they perform (Sutton and Rudd, 2014). Work in other fields suggests that SSF leadership research should have a more detailed focus on the contextual influences on leadership. Chapter Three is a direct follow on from Chapter Two. In Chapter Three, I evaluate how SSF leadership and other important contextual conditions act alone, or in combination, to influence social and

ecological outcomes. This was achieved by analyzing 50 context-rich case studies from Southeast Asia using Qualitative Comparative Analysis (QCA). QCA, a novel methodology in SSFs research, encourages theory-informed analysis that accounts for context, and can identify necessary and sufficient conditions for 'successful' and 'unsuccessful' SSFs outcomes (Sutton and Rudd, 2015). Conditions are selected and organized using Ostrom's (2009) framework for analyzing SESs.

Like Chapter Three, Chapter Four is a direct follow on from Chapter Two. In Chapter Four, I address major knowledge gaps in the understanding of factors that influence the effectiveness of local leadership in SSF. I collect experiences of local leadership from 54 interviews with international SSF researchers and practitioners. Major themes are organized using modified versions of the Institutional Analysis and Development (IAD) framework, the Value-Belief-Norm (VBN) theory, and Schwartz's theory of cultural values. I identify themes that shape leadership engagement and effectiveness at multiple levels, including precursors to individual action, institutional constraints at the individual level and community level, and high level governance issues.

In Chapter Five, I critically review the difficulties of managing SSFs under conditions of uncertainty. Uncertainty is high due to the complexity and interconnectedness of social, political, ecological and economic processes, which reduces the governability potential of SSFs. Uncertainty, is exacerbated by the over-reliance on 'expert science'. Fisher's knowledge is a rich source of contextual information and is assumed to help reduce levels of biophysical and institutional uncertainties. Combining scientific and fisher's knowledge in knowledge integration projects is key to achieving more effective SSFs governance. In Chapter Five, my objective is to assess factors that influence knowledge integration and the uptake of that knowledge into policy making. I report on results from 54 interviews (also used in Chapter Four) with SSFs researchers and practitioners from around the world. I frame analysis in terms of scientific credibility, societal legitimacy, and policy saliency. I focused on how participants associated with SSFs are partially or fully successful in reducing uncertainty via push-and pull- oriented boundary crossing initiatives.

Strong leadership is vital to the longevity of SSF organizations and to securing sustainable SSFs. Despite this, I found limited in-depth and focused SSF leadership research. My work is therefore important given the need to increase understanding of leadership processes, and timely due to the recent surge in interest in SSF leadership. I provide in depth analyses, using novel techniques, of how leadership influences SSF outcomes, the factors that determine the success of local leaders, and the role leaders play in reducing the uncertainties associated with SSF management. Enhancing knowledge on

the processes of leadership has the potential to facilitate longer lasting community-based organizations; not only in SSFs but also in other natural resource management.

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Chapter 2 Deciphering contextual influences on local leadership in community based management

2.1 Preface

SSFs are an important resource for millions of people worldwide in terms of income, poverty alleviation, and food security. Conventional fisheries management is generally based on a top-down and centralized structure of decision making. However due to the number of overfished populations and the deteriorating state of ecosystems, there has been much criticism for conventional fisheries management (Baum and Worm, 2009; Jackson et al., 2001; Lotze et al., 2006). Consequently, there has been a surge of popularity in bottom-up, CBFM, and co-management processes which aim to reconnect resource users with decision making.

Over the past three decades, much research has been conducted to identify determinants of successful CBFM. However, little research has been conducted to decipher the role leadership has in SSF management. Given the likely influence leadership has on determining success or failure in CBFM, it is important to increase our understanding of the roles played by these key actors. In this paper I aim to identify key leadership knowledge gaps by conducting an extensive, strategic review of leadership in fisheries, natural resources and other sectors. I focus on the characteristics of leadership, the connections leaders have within and beyond their communities and the context within which leaders function, which I term the "3Cs" of leadership.

This paper was written in the style of Marine Policy to which it was submitted and accepted for publication, subject to minor corrections but without changes to the original text. For consistency and ease of reading, citations have been changed to follow the standard for this thesis (author and year, rather than number) with figures inserted close to their first reference in the text rather than separate as in the publisher's version.

I declare that the work submitted is my own. The contribution of the co-author is as follows:

Dr. Murray Rudd: supervision, review and editing

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Deciphering contextual influences on local leadership in community-based fisheries management

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2.3 Abstract

Community-based fisheries management (CBFM) strategies have been adopted in a variety of small-scale fisheries around the world. Within these management structures, leaders are increasingly regarded as essential for viable CBFM, yet systematic analysis into the intricate mechanisms of leadership are limited. This paper aims to identify key knowledge gaps of leadership in CBFM by strategically reviewing research from fisheries and natural resource management, and from other sectors. The focus is on the interaction between leaders, their connections with and beyond their communities, and the context within which leaders function. Insights from over 30 case studies suggest previous work on leaders and leadership generally focused on relatively coarse-scale characteristics of leadership and the functions that leaders perform. Ecological and social context influence leaders' ability to help deliver successful CBFM. The personal and professional attributes of leaders themselves may be beneficial or inhibitory for CBFM depending on that context. It is therefore essential that future research builds on current insight in order to decipher the implications of contextual influences on local leadership and, by extension, the level of CBFM success.

Keywords: Leadership; natural resource management; community-based management; social capital

2.4 Introduction

Complex fisheries require management systems to be adaptive, flexible, and progressive (Olsson et al., 2004a; Ostrom, 2009). Although some have argued that fisheries management is increasingly effective (Hilborn, 2007), the number of overfished populations and the deteriorating state of marine ecosystems (Baum and Worm, 2009;

Jackson et al., 2001; Lotze et al., 2006) is indicative of fisheries management failures (Botsford et al., 1997). To deal with the short-comings of traditional, centralized, and top-down approaches to fisheries management and the increase of adaptive capacity, many researchers and practitioners have over the past two decades advocated bottom-up, community-based fisheries management (CBFM) (Beddington et al., 2007; Chuenpagdee et al., 2005; Gilmour et al., 2013; Jentoft, 2000; Pinkerton, 1994; Shackleton et al., 2002; Wiber et al., 2009). CBFM involves the participation of communities and resource users in decision making (Armitage, 2005; Jentoft, 2000; Pinkerton, 1994). Such engagement is hypothesized to encourage compliance with regulations (Eggert and Ellegård, 2003; Gutierrez et al., 2011; Jagers et al., 2012; Sutinen et al., 1990), foster a sense of community ownership over fisheries (Gutierrez et al., 2011), reduce conflict over scarce resources (Jentoft, 2005), reduce transaction costs (Carlsson and Berkes, 2005; Rudd et al., 2003), and improve management through the integration of local, traditional and scientific knowledge (Berkes, 2009; Carlsson and Berkes, 2005; Wiber et al., 2009).

The success of CBFM is dependent on the capacity and capabilities of a community (Armitage, 2005; Rudd et al., 2003) and its members. Pomeroy et al (1999) identified three levels at which determinants of successful CBFM can be identified: first, determinants external to the community; second, determinants at the community level (e.g., defined boundaries, distinct membership, group homogeneity, participation, effective community organization, property rights, conflict resolution, and leadership (Ostrom, 1990)); and third, individual level determinants that affect incentive structure and individuals' capabilities to act collectively (Armitage, 2005).

The role of leadership in management has been studied in varying levels of depth in natural resoure management and other fields (Black et al., 2011; Bodin and Crona, 2008; Cheng and Sturtevant, 2012; Faucher, 2010; Ford et al., 2013; Nakagawa and Shaw, 2004; Pagdee et al., 2006; Pero and Smith, 2008; Webler and Tuler, 2006). Leaders are key individuals who by their skills, experience and personal characteristics are justified in being a central and influential role in social processes (Kingdon, 2003). Leadership has also been highlighted as an important expected success factor in fisheries management (Bodin and Crona, 2008; Gutierrez et al., 2011; Walters, 1997). Leaders are increasingly being regarded as essential components of CBFM (Gutierrez et al., 2011), however systematic analysis into the intricate mechanisms of leadership in relation to specific contextual conditions is limited.

Given the likely influence of leadership in determining success or failure of CBFM, it is important to increase our understanding of the role of these key individuals or groups. This paper identifies key leadership knowledge gaps relevant for CBFM by strategically

reviewing leadership in fisheries, natural resources and other sectors. The emphasis is on the interaction between the characteristics of leaders, their connections with and beyond their communties, and the context within which leaders function (henceforth the "3C's"). The objective is to build baseline knowledge regarding leaders and leadership that can be used to inform CBFM capacity-building investments and future research on determinants of successful CBFM. This work helps highlight the complexities and importance of contextual differences that affect CBFM success, the motivations and values that guide behavior, and the intricate relationships between leaders and their constituencies in a CBFM context.

2.5 Methods

This review used case studies that focused in part or fully on leaders and leadership roles in fisheries, natural resource management, and other sectors. Due to the intricacies of leadership and the complex social, political, economic, and legal landscapes in which they play a key role, a case study approach is appropriate for identifying important cross-cutting themes regarding leadership as a determinant of CBFM (Drury et al., 2011).

Case studies were chosen strategically on dimensions of similarity so that comparisons could be made, as well as diversity (Dolan, 2009), to illustrate the wide array of contexts within which leaders situate. Case studies were identified through academic literature searches. Key words used in searchers included 'leader', 'leadership', 'champion' and 'entrepreneur', depending on the field of study, context, and types of document being studied. Searches and case studies were chosen to ensure diversity between cases to maximize potential for learning. Case studies were categorized into three groups: fisheries; natural resources; and other sectors. They were organized around the "3C's": leaders' characteristics; leaders' connections; and the contexts within which leaders work.

2.6 Results

Case studies used in this review were those that specifically attributed success or failure, in combination with other contextual conditions, to a local leader and their activites. After screening, cases were dropped that didn't provide relevant, or any additional information that wasn't provided by other cases. Appendix 1 (pg. 180) highlights key findings from 32 screened case studies; nine were from fisheries management, 11 from natural resource management, and 12 from other industries.

2.6.1 Characteristics of leaders

2.6.1.1 Insights from fisheries management

Fisheries management case studies describe several leadership functions: providing energy and consistency (Gilmour et al., 2013; Hauck and Sowman, 2001), ensuring stability and accountability in times of upheaval (Njaya, 2007; Pollack et al., 2008); providing links to external agents (Bodin and Crona, 2008); and negotiating with stakeholders to promote the benefits of cooperating. A leader's understanding of their followers, their attitudes and behavioural tendencies are important (Gilmour et al., 2013). Understanding of community processes is established through constant interaction with community members over long periods of time and results in heightened levels of trust (Bodin and Crona, 2008).

Potential leaders in fisheries require motivation. Centrally placed individuals' without appropriate motivation, due to lack of incentives or knowledge, acted as barriers to less central but highly motivated individuals in Mombasa, Kenya (Crona and Bodin, 2006). A leader's capability was developed by training in conflict resolution mechanisms, and awareness building of local knowledge and community processes (Hauck and Sowman, 2001).

2.6.1.2 Insights from natural resource management

Personal attributes of an individual can justify leadership roles. Personal leadership skills may include: self-organizing and governing; conflict management competencies; technological expertise; general management experience (Cheng and Sturtevant, 2012); creating a vision for change (Olsson et al., 2004b); developing and utilising social networks (Cheng and Sturtevant, 2012; Olsson et al., 2004b); identifying policy opportunities (Klooster, 2000; Olsson et al., 2004b); securing funding (Olsson et al., 2004b); and creatively linking solutions to problems (Font and Subirats, 2010). Leaders should act on behalf of those they represent and consider the costs and benefits of their efforts, as well as balance personal and community interests (Vedeld, 2000).

2.6.1.3 Insights from other industries

Mobilizing community residents by encouraging collective action is an important leader role, as demonstrated in slum upgrading programs in Asia (Minnery et al., 2013) and disaster rehabilitation in Japan (Nakagawa and Shaw, 2004). Success in the promotion of automobile products was attributed to the continual effort of a product champion gathering support, advancing ideas, and adjusting sales pitches to suit target audiences (Howell, 2005).

An individual's motivation for becoming a leader may be politically oriented. By investing time and energy in community products, a leader can utilize the experience and exposure to kick start a career in politics (Krishna, 2007). Lack of motivation and negative perceptions about leadership can, however, deter potential individuals participating in leadership activities, as found in US community colleges (Boggs, 2003). Training is essential in enhancing individual capabilities and self-belief in those capabilities, and restoring faith in leadership practice (Boggs, 2003; Nakagawa and Shaw, 2004).

2.6.2 Connections of leaders

2.6.2.1 Insights from fisheries management

In Swedish near-shore fisheries, a centralized, cross boundary network, that was tightly connected around one actor, encouraged adaptive management, rule compliance and shared management objectives (Sandström and Rova, 2010). Similarly in Kenya, the central role of a leader's extensive social network links to community and local authorities resulted in increased social influence (Bodin and Crona, 2008). However, a lack of connection to financial contacts, limited the leader's ability to integrate their community into market based activities (Bodin and Crona, 2008).

2.6.2.2 Insights from natural resource management

Social networks can facilitate the exchange of information and help coordinate activities (Olsson et al., 2004b). A leader of the Lower Helgea River (Sweden) management reorganization program gathered the support of individuals from influential organizations, including universities, the Swedish Wildlife Fund, hotels, the tourism board, the National Museum, and a national research council. As a result, he was able to address a range of issues with the pool of skills he had assembled (Olsson et al., 2004b).

Connectivity can, however be detrimental to community based-management due to a so-called dark side of social capital. For instance, leaders in Mali relied on their connections with state officials to solve community conflicts, which reduced their own problem solving credibility within their communities (Vedeld, 2000).

2.6.2.3 Insights from other industries

Centrality in a social network is considered to be positively correlated with an actor's performance capabilities (Sparrowe et al., 2001). Individual centrality was linked to positive perception of project learning and satisfaction (Baldwin et al., 1997). As early as the 1900s, politicians were aware of the value of social networks. Joseph Chamberlain, politician at the turn of the century, used wide ranging and multi-faceted networks,

covering numerous social classes and religious divides to connect with individuals in his constituency (Szreter and Woolcock, 2004).

2.6.3 Contexts within which leaders work

2.6.3.1 Insights from fisheries management

The evidence on whether a leader needs to be local is somewhat mixed. The failure of CBFM in Chesapeake Bay, USA was attributed to the lack of a leader from the community (Beem, 2007). The most trusted leaders in Mombasa fisheries were those who had resided in the community for a long period of time, with similar backgrounds to resource users (Bodin and Crona, 2008). Other experiences in South Africa suggest a leader may be able to perform well regardless of their origins is key to CBFM (Hauck and Sowman, 2001).

Traditional leaders can either become facilitators or barriers to CBFM. CBFM experiences from Malawi and Mozambique demonstrated that traditional leaders can be highly effective as advisors or can marshal networks to exclude the participation of local fishers (Njaya, 2007). Legitimacy in CBFM leadership was attributed to transparent elections, in Kleinmond, South Africa, committees were formed to represent local communities, but elected representatives sometimes came under the influence of powerful elites and failed to account for the interests of their communities (Hauck and Sowman, 2001).

A leadership group can bring resilience to management systems. In the Philippines, reliance on one leader resulted in vulnerable projects. When a leader died, left office, or moved from the community, there was no substitute to fill the leadership vacuum they left behind (Pomeroy et al., 2001). Leader groups comprised of different individuals can, on the other hand, increase capacity and resilience. A partnership between a Chilean researcher and a civil administrator in Cape Horn was highly effective (Pollack et al., 2008). In Mombasa, however, leadership team homogeneity acted as a barrier to synthesizing new information and creating new opportunities (Bodin and Crona, 2008). Communication between leaders is crucial, especially for migratory fish stocks. CBFM in Lake Chiuta, Malawi was undermined by a lack of coherence in objectives between leaders in Malawi and leaders across the border in Mozambique (Njaya, 2007).

2.6.3.2 Insights from natural resource management

There were mixed messages on possible determinants of successful leadership from the natural resource management case studies. The influential leader of the Helgea River management project was originally curator of the local museum, therefore very much part

of the community (Olsson et al., 2004b). The Little Miami River Partnership board members explicitly recognized concerns about lack of local passion and motivation among the board due to the absence of local participation at this level of leadership (Bonnell and Koontz, 2007). A traditional leader in Jambi Province, Indonesia used group money and his power in inappropriate activities, which proved to be ineffective for community-based forestry management (Komarudin et al., 2008). Similarly forestry elites in San Martin, Mexico dominated management and leadership, and through intimidation and manipulation, they discouraged community participation in forest affairs (Klooster, 2000).

Leaders may be given more legitimacy by being elected by community members (Crawford et al., 2006). Legitimacy in Indonesian forestry was achieved by rotating leader roles to allow for the enhancement of skills and to reduce corruption (Komarudin et al., 2008). However, elections in China were poorly executed due to poor literacy and community capabilities (Xu and Ribot, 2004), exposing the potential weakness of even election processes. Homogeneity within an Indonesian MPA leadership group was beneficial for management (Crawford et al., 2006) and heterogenerous traits of Malian leaders were detimental as the two groups has significantly different economic objectives, which lead to increased conflict (Vedeld, 2000). Heterogeneity, however proved crucial for the Lower Helgea management committee, as their diverse collective pool of skills, expertise, and contacts allowed them to tackle a wider array of management issues (Olsson et al., 2004b).

2.6.3.3 Insights from other industries

New, local, young, and educated leaders in Indian villages were able to gain tangible benefits for their rural agrarian communities (Krishna, 2002). These new local leaders were found to be more connected with communities than local government and caste leaders (Krishna, 2007). As shown in natural resource management, local people in car clubs and disaster rehabilitation efforts are attractive candidates for leader roles (Meaton and Low, 2003; Nakagawa and Shaw, 2004). Coordination between leaders was crucial to management success. Lack of coherence and consensus building between new leaders in Ghodach, Northern India, resulted in distrust and scepticism (Krishna, 2007). Community leaders in Japan however, demonstrated great social cohesion and trust-building through participation in recreation and local festivals (Nakagawa and Shaw, 2004).

2.7 Discussion

2.7.1 Characteristics of leaders

Successful leaders are in possession of a range of attributes that afford them their leader role (Appendix 1 pg. 180). They are often a trusted and respected member of a community, with experience and expertise, knowledge of community systems, tenacity, and a commitment to community vision. For leaders of CBFM, the ability to predict and influence local behavior is key, as the uncertainties of human behavior can undermine management success (Fulton et al., 2011). Local contextual knowledge is also crucial, perhaps as or more important from a social perspective than even from an ecological perspective.

Leaders instigate and catalyze a range of activities to progress along an intended trajectory (Folke et al., 2005; Walker et al., 2002); they help articulate visions, enhance community capacity, build social networks, and organize change. As such, the values, personalities and motivation of a leader shape development of an organization (Giberson et al., 2005). Consequently, it is paramount that the motivations of a community leader and their relationship with their constituencies are explored so that appropriate, context specific CBFM policy can be designed.

2.7.2 Connections of leaders

It is assumed that social capital and networks are central to collective action (de Nooy, 2013; Pretty, 2003; Rudd, 2000). An individual's embeddedness within those networks is an important attribute of a leader (Baldwin et al., 1997). Structural characteristics of social networks provide leaders with a mechanism for the diffusion of ideas, information, and knowledge (Crona and Bodin, 2006). Leaders utilize and enhance bridging social capital, the ability of groups to engage with other communities and external agencies (Pretty, 2003; Rudd, 2000).

It is often suggested that people are more influenced by, and have more in common with, those people they frequently interact with (Crona and Bodin, 2006; Kadushin, 1966). For example, small scale fishing community members often have similar backgrounds, livelihood patterns, ethnicities, and religious views. The bridging function that leaders may play between communities or otherwise unconnected actors is important (Burt, 2001, 2004). Local leaders who are positioned to act as links between communities open crucial doors to social learning and creativity (Burt, 2004), as they are exposed to different ideas, views, and knowledge types. Opportunities also come to leaders who play a gate-keeping role as they can take advantage of their connections to control the flow of information between networks (Burt, 2002, 2001).

The combination of increased social capital and trust in strong leaders can facilitate successful collective action (Nakagawa and Shaw, 2004). However, the presence of social capital and strong leadership is unlikely to be enough to ensure successful CBFM on its own given its potential to work as a positive or negative force, and due to the array of conditions that may facilitate or hinder community capacity to manage local resources (Rudd et al., 2003).

2.7.3 Contexts within which leaders work

Leaders work in a multitude of contexts, at different hierarchical levels, and in diverse biophysical and social settings and structures. Contextual differences may facilitate or hinder good leader practice. Leaders that understand the community they represent are crucial to community based management; in many cases that means they are from those communities (Beem, 2007; Meaton and Low, 2003; Olsson et al., 2004b). However, some case studies also suggest that a leader can also be effective, regardless of their background (Dolan, 2009; Pollack et al., 2008). It could be suggested therefore, that leaders' reputations, and the trust between a leader and their community, is more important than a leaders' origin. Therefore, although being local to the community is an important attribute of being a successful leader it does not appear to be a necessary condition, but part of a broader set of complex, compound sufficient conditions. Constant interaction between communities and their leaders build norms and trust, which can lead to the formation of reputation (Ostrom, 1998). However, trust may take a long period of time to build and may be easily broken (Ostrom, 1998); therefore it may be beneficial for a leader to reside in their leadership position for a long period of time (and always be aware of their interactions with constituents). A leader, who enjoys the trust of their constituency, may expect increased community support and has the potential to unlock and utilize community knowledge (Rudd, 2000).

The case studies frequently noted the significant influence of traditional leaders, or elite members of the community, and the influence they have on community processes. The presence of traditional leaders, including religious leaders, caste leaders, and elites, in community-based management is often associated with embedded power inequalities and the inappropriate use of community resources (Hauck and Sowman, 2001; Kull, 2002; Larson and Ribot, 2004; Njaya, 2007). The tension between the potential gains from community-based management, and the vulnerability of disadvantaged or marginalized members of local communities highlights potential challenges (Iverson et al., 2006) of relying on traditional leadership. When planning and implementing CBFM initiatives, there needs to be an adequate understanding of the incentives facing traditional leaders and

local elites (Balooni et al., 2010) and the potential consequences, positive and negative, of drawing on people with traditional power advantages as key players in CBFM.

There has long been recognition of how the role of community works in community-based management (Agrawal and Gibson, 1999). It features prominently in debates over the proper scope of governance and decisions to devolve (i.e., transfer central government powers to local resource users) or decentralize (i.e., shift central government authority to local government managers) (Rudd et al., 2003). The definition of the word 'community' can itself be contentious, as a simple explanation of a 'community' often obscures underlying complex interactions at multiple scales (Berkes, 2004). Berkes, (2004), described two positions in the debate over the merits of community conservation. The first holds that the failure of community conservation is due to the improper implementation of community projects, especially in terms of the devolution of authority and responsibility (Murphree, 2002; Songorwa, 1999). The second argues that conservation and development objectives are inherently different, so should therefore not be tackled together (Redford and Stearman, 1993). This research suggests fundamental issues; a focus on just leadership still needs to be addressed before CMFM can reach its full potential reach its full potential.

A group of community leaders, rather than an individual (Hauck and Sowman, 2001; Olsson et al., 2004b), provides a pool of resources that can contribute to, team resilience and longevity, and reduces the possibility for leader 'burnout' (Beem, 2007; Huxam and Vangen, 2000; Oh et al., 2004; Razzaque et al., 2000; Sparrowe et al., 2001). Engaging individual leaders within a leader group requires dynamic interactions in an action network to effectively utilize different expertise (Czarniawska, 1997). Different functions of leadership can be championed by different team members in response to a disturbance or event (Garud and Karnoe, 2004). However, most leader groups naturally appoint an individual member as chair or convenor. This position critically influences the effectiveness of leadership roles: dominant individuals have the power to control decision making, yet a weak individual may leave committees directionless (Huxam and Vangen, 2000). It is important to identify any actors within a group that could become uncooperative as overt or covert obstruction can be very damaging to group dynamics and leadership team effectiveness (Sparrowe et al., 2001).

In addition to personal characteristics and local community conditions, external political contexts also influence and constrain leadership potential (Razzaque et al., 2000). CBFM requires varying degrees of government support and cooperation at different stages of the implementation processes (Lane and McDonald, 2005) and can often be hampered by a lack of communication, willingness to cooperate, and coordination between and

within government agencies (Wiber et al., 2010). Higher level authority can also place restraints on leaders to perform essential community-based management functions (Gilmour et al., 2013). Providing an arena for leaders to build and enhance cross-scale relations is more likely to result in sustainable solutions than rigid institutional structures (Bodin and Crona, 2009; Meinzen-Dick et al., 2002; Stein et al., 2011).

2.8 Ways forward and conclusion

This review emphasizes the critical importance of leaders in CBFM, natural resource management, and other fields. Previous work on leadership in fisheries management generally focused on coarse-scale characteristics and functions leaders perform. For example, Gutierrez, and colleagues (2011) analyzed fisheries co-management globally and found leadership to be the single most important factor contributing to management success (defined in terms of ecological outcomes). It is essential that future research builds on these insights, to better decipher how contextual differences influence CBFM success.

As with any social phenomena, causal complexity (i.e., the possibility that multiple combinations of factors may lead to successful outcomes (Basurto, 2013; Ragin, 1989; Rudel, 2008) necessitates context-dependent analyses and attention to how different pathways might lead to success in some situations but not in others. Future assessments of CBFM leadership should strive to identify conditions that are necessary and/or sufficient to facilitate effective collective action (Rudd et al., 2003). Information from this review suggests a hypothesis that strong leadership can be a sufficient condition (in combination with contextual conditions that vary across regions and fishery types) for effective CBFM but it may not be a necessary condition (i.e., given the potential for strong leadership alone to have negative impacts when self-interest predominates over community interests). By identifying sufficient and necessary conditions, it may be possible to identify more robust policies to account for local contexts and incentive structures, and to map pathways to desirable CBFM outcomes. While we found no examples of testing for leadership as a necessary and/or sufficient condition in fisheries management, there are a growing number of examples from terrestrial resource management and other fields [e.g., (Ford et al., 2013; Villamayor- Thomas, 2012)].

Although leadership is an important factor contributing to CBFM viability and success, it is by no means the only condition that influences success and its influence is certainly context-dependent. To decipher the influence of contextual factors in successful CBFM requires a more systematic approach that relates contextual conditions, management structure and characteristics, and socio-ecological outcomes. Contextually

rich CBFM case studies are needed to assess the role of local leadership in CBFM; this could be fertile ground for current and future research programs focused on CBFM.

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Chapter 3 The effect of leadership and other contextual conditions on the ecological and socio-economic success of small-scale fisheries in Southeast Asia

3.1 Preface

Successful CBFM or co-management is dependent on contextual conditions (Agrawal, 2002; Armitage, 2005; Rudd et al., 2003). However, systematic analysis into the contextual influences on SSF leadership is limited (Sutton and Rudd, 2014). As Chapter Two highlighted, research in SSF leadership has generally focused on identifying the coarse-scale characteristics and functions leaders perform

Like other social systems, SSF are characterized by casual complexity (i.e. the likelihood that multiple combinations of conditions may lead to the same outcome (Basurto, 2013; Ragin, 1989; Rudel, 2008). In Chapter Three, I contribute to increasing understanding of leadership by exploring how SSF leadership and other theoretically guided contextual conditions interact to form causal pathways that lead to positive (and negative) outcomes of CBFM in SSF.

The methodology I use to identify causal pathways is Qualitative Comparative Analysis (QCA), which is a novel technique in SSF research. QCA facilitates the identification of necessary and/or sufficient conditions, accounts for context, and bridges small-*n* and large-*n* research. A key advantage of QCA is that it accounts for causal complexity which assumes some conditions only influence the outcome when other conditions are also present, and equifinality which assumes multiple paths of different conditions lead to the same outcome (Schneider and Wagemann, 2012)

This paper is written in the style of Ocean and Coastal Management to which it was submitted and accepted for publication, subject to minor corrections but without changes to the original text. For consistency and ease of reading figures are inserted close to their first reference in the text rather than separate as in the publisher's version.

I declare that the work submitted is my own. The contribution of the co-author is as follows:

Dr. Murray Rudd: supervision, review and editing

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The effect of leadership and other contextual conditions on the ecological and socio-economic success of small-scale fisheries in Southeast Asia

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3.3 Abstract

Small scale fisheries (SSF) and communities that rely on them are increasingly at risk from social and environmental pressures. Leadership is commonly thought to be a crucial contextual condition to help alleviate those pressures in a variety of SSFs globally. This paper aims to explore how SSF leadership and other important contextual conditions act, alone and in combination, to influence desired social and ecological outcomes in SSFs. Fifty case studies from Southeast Asia were analyzed using Qualitative Comparative Analysis (QCA). QCA encourages theory-informed analysis that accounts for contextuality and can identify necessary and sufficient conditions that lead to 'successful' SSF outcomes. Our results demonstrated that multiple configurations of causal conditions – pathways – led to success and failure among SSF management efforts documented in the Southeast Asian case studies. Local leadership was found to be an important determinant of ecological and social success for many case studies but the absence of a local leadership does not necessarily signal community-based fisheries management will fail. Strong local leadership could, in fact, play an important role in achieving negative outcomes in some circumstances. Effective local leadership can be supported via high level institutions and communities, through access to resources, and simply through community-oriented motivations or intentions among leaders. While the SSFs in this study were diverse and complex socio-ecological systems, regularities among potential determinants of SSF success could be identified, suggesting that key ecological and social conditions affecting both social and ecological outcomes may, in the future, be used to identify interventions to support SSF management. This study highlighted the importance of research that considers societal processes and their interactions with the environment, and of the importance of

continued efforts to fully document SSF management innovations and institutions over time.

Keywords: Artisanal fisheries; community capacity; context; determinants of success; enabling conditions; Qualitative Comparative Analysis

3.4 Introduction

Small scale fisheries (SSFs) provide a testing ground for operationalizing conceptual and methodological approaches for user-inspired research in complex socio-ecological systems. SSFs are crucially important for the livelihoods and food security of hundreds of millions of people globally (Allison and Ellis, 2001). Resource depletion and habitat degradation in the aquatic environments, coupled with human population growth and increasing demand for marine products, places fisheries and rural populations increasingly at risk (Allison and Ellis, 2001; Pauly et al., 2002). Community-based fisheries management (CBFM) has been widely proposed as a central strategy to enhance SSF fisheries sustainability as it places communities and local resource users at the heart of decision making (Berkes, 2003; Jentoft, 2000; Pinkerton, 1994); that may encourage compliance (Eggert and Ellegård, 2003; Sutinen et al., 1990), create a sense of ownership (Gutiérrez et al., 2011), reduce resource user conflicts (Jentoft, 2005), reduce management transaction costs (Hanna and Munasinghe, 1995; Rudd et al., 2003), and improve the integration of different knowledge types (Berkes, 2009; Carlsson and Berkes, 2005; Wiber et al., 2009). Irrespective of the social and ecological benefits that may be derived from better SSF management and governance, the knowledge to be gained from SSF research may also provide valuable lessons for researchers and policy-makers beyond the sector who address place-based adaptation to environmental change.

Successful community-based natural resource management is dependent on contextual conditions (Agrawal, 2002; Armitage, 2005; Rudd et al., 2003). Pomeroy et al. (2001) identified three levels at which contextual conditions influence the success of CBFM: first, conditions external to the community; second, conditions at the community level such as Ostrom's (1990) criteria of defined boundaries, distinct membership, group homogeneity, participation, effective community organization, property rights, conflict resolution, and leadership; and, third, individual level conditions that affect incentive structure and individuals' capabilities to act collectively. There is still substantial uncertainty about which contextual conditions are most important in supporting successful community-based natural research management (Agrawal, 2002; Basurto, 2013). It is

important that researchers move away from a 'checklist' approach (i.e., that all conditions need to be present or absent for the outcome to occur) (Basurto, 2013; Ostrom, 2007) and instead focus on how different contextual configurations interact (Basurto, 2013; Pollnac et al., 2001; Rudel, 2008).

Leadership is emerging as a key condition important for success in community-based and co-managed fisheries (Bodin and Crona, 2008; Gutiérrez et al., 2011; Sutton and Rudd, 2014). Leaders are key individuals who by their skills, experiences, and personal characteristics justifiably play a central role in community processes (Kingdon, 1984). Contextual conditions such as social support systems, community endorsement of and support for management initiatives, social networks, and higher level social, economic, and environmental factors can influence successful leadership. However systematic analysis into the intricate mechanisms of leadership in relation to specific contextual conditions is limited (Sutton and Rudd, 2014).

Our aim in this paper is to explore how SSF leadership and other factors of potential theoretical importance act in concert to form causal pathways leading to positive (and negative) ecological and social outcomes of CBFM in SSF. This explanatory research sought to identify necessary and/or sufficient conditions for successful CBFM, defined in both ecological and social terms, and to decipher how local leadership was facilitated or hindered by other contextual conditions. We used Qualitative Comparative Analysis (QCA) (Ragin, 1987; Schneider and Wagemann, 2012) to account for contextuality, bridge the small-*n* to large-*n* research gap, and identify necessary and sufficient conditions underlying successful SSFs. Our hypothesis was that successes (and failures) in CBFM are a result of complex, but partially identifiable, configurations of contextual conditions that may vary in scope (i.e., ecological and social factors) and across temporal or geographic scales.

3.5 Methods

3.5.1 Case study selection

To be able to address our research objectives we required information from context-rich case studies that focused on local management SSFs. Case studies from Southeast Asia were identified through an extensive search of academic journals, organization websites and project reports. Southeast Asia is an ideal setting for exploratory research because it demonstrates a high level of diversity in SSF management across a range of regional socio-ecological conditions and there is a rich history of CBFM success and failure from many well-documented cases, providing scope for a regional meta-

analysis. Care was taken to include a range of cases which exhibited both successful and unsuccessful features of CBFM.

Over 70 candidate studies were screened and 50 case studies with the most comprehensive information available selected. Two case studies were selected from Malaysia, four from Thailand, twelve from Indonesia, seven from Vietnam, eighteen from Philippines, and seven from Cambodia; the number of cases studies from each country reflected the wealth of information available from Southeast Asian CBFM research over the past 20+ years. We note that cases were examined as reported in the literature, so the conditions we used in our analysis may deviate from the current situations for particular fisheries.

For an analysis of ecological and social outcomes, QCA can facilitate analyses of up to seven potentially causal conditions for 50 case studies. Candidate cases must have met three requirements: communities must be dependent on fisheries resources for subsistence and/or livelihoods; a community fishery structure (either traditional or more recent) must have been in place and have had some degree of management responsibility devolved to local resource users; and data on key social, governance, and ecological conditions were available.

3.5.2 Qualitative Comparative Analysis

QCA extends John Stuart Mill's long-standing approaches to identifying single-cause attribution of outcomes (Befani, 2013). QCA was developed as a tool to analyze causal relationships between a set of conditions and an outcome (Schneider and Wagemann, 2012) and has served as an important bridging methodology between small-*n* case-based research and large-*n* statistical analyses. Its roots are in set theory; defining relevant conditions and outcomes in set theoretic terms allows for the identification or necessary and/or sufficient conditions leading to outcomes of interest (Schneider and Wagemann, 2010, 2012). A necessary condition is one where all cases displaying the outcome also display the condition, whereas a sufficient condition is one where all cases displaying the condition also display the outcome. There have recently been increasing numbers of QCA applications (Rihoux, 2006; Rihoux et al., 2013) but it has been used only occasionally in fisheries and coastal wetland research (e.g., Bodin and Österblom, 2013; Kosamu, 2015; Pahl-Wostl and Knieper, 2014).

QCA identifies necessary and sufficient conditions that can alone or in combination lead to an outcome of interest, thereby exhibiting causal complexity (i.e., some conditions may contribute to an outcome only when in combination with other conditions) and equifinality (i.e., multiple pathways may lead to a single outcome) (Rihoux, 2006;

Schneider and Wagemann, 2012). In QCA analyses, 'goodness of fit' can be measured by a model's consistency and coverage for necessary and sufficient conditions (Schneider and Wagemann, 2012). Consistency refers to the degree to which cases sharing a particular causal condition result in the given outcome. Coverage is the degree to which a causal condition accounts for the empirical instances of the outcome. Raw coverage is the proportion of all cases' set membership in the outcome that is covered by a single sufficient pathway of an equifinal solution whereas unique coverage is the percentage of all cases' set membership in the outcome uniquely covered by a single path (Schneider and Wagemann, 2012). These measurements may reveal that among many sufficient expressions only a few contribute to the majority of coverage in causally complex combinations (Ragin, 2006).

The most popular software package with which to implement QCA is Ragin's fuzzy set QCA (fsQCA) (Ragin and Davey, 2014). By using fuzzy sets it is possible to compare cases in more depth and to incorporate an assessment of their degree of membership in a set (Ragin, 2000). Building upon standard (crisp set) dichotomous variables, whereby cases are coded 0 to indicate full non-membership or 1 for full-membership, fuzzy sets allow cases to be coded in terms of degree of membership within a set.

The use of fsQCA first requires the calibration of quantitative and qualitative data into membership scores (Basurto and Speer, 2012; Ragin, 2000). Fuzzy sets can be defined and coded based on research objectives, theoretical frameworks, and the nature and quality of the data (Katila, 2008). In our research, coding was purposefully assigned based on theoretical perspectives from the CBFM and natural research management literature (e.g., Armitage, 2005; Carlsson and Berkes, 2005; Jentoft, 2000, 2005; Ostrom, 2009; Pollnac et al., 2001; Rudd et al., 2003; Wiber et al., 2009) and coded in such a way to ensure coding of full set membership (i.e., fully in a set = 1.00) always signalled the presence of a condition assumed important for successful CBFM. Data was mostly coded on a four point fuzzy scale (0.00, 0.33, 0.67, and 1.00), where 0.00 was fully out the set and 1.00 was fully in. Remaining data were either coded on a crisp set basis (0 or 1) or on a 6 point fuzzy scale (0.00, 0.10, 0.40, 0.60, 0.90, and 1.00), depending on the quality of data and the amount of information available.

The fsQCA software generates, complex, parsimonious, and intermediate solutions. In this research, we report only parsimonious solutions (Rihoux, 2006; Schneider and Wagemann, 2006). Parsimonious solutions include all logical remainders without evaluation of their plausibility (Ragin and Rubinson, 2009). Simply, QCA techniques strive to achieve a reduced or 'parsimionious' explanation of the phenomenom under

scrutiny while still providing analysis of causal complexity (Schlosser et al., 2009). Parsimonious solutions assume that all configurations for which there are no empirical instances would result in a positive outcome if they were actually observed. If we assumed that, if observed, none of the logical remainders would give rise to a positive outcome, we would then have the 'complex solution'. The parsimonious and complex solutions bound the complexity of the Boolean sufficiency conditions. We are aware parsimonious solutions do not give the most nuanced account of the outcome (see Thiem, 2014) but by using them we hope to maintain central focus on how leadership interacts with contextual conditions in CBFM of SSF. Such simplifying assumptions may help identify specific case studies for increased scrutiny in future research.

3.5.3 Condition and outcome selection

Conditions and outcome were organized using Ostrom's (2009) general framework for analyzing social-ecological systems (SESs). Her framework splits components of SES into sub-systems: the resource system (e.g., a small-scale fishery); resource units (fish); users (fishers); and governance systems (organizations and rules that govern fishing within specific communities). Each are identifiable yet interact in complex ways under the umbrella of social, economic, and political settings.

Good QCA practice balances the number of cases and number of conditions used (Schlosser et al., 2009); for research using a medium-*n* approach, between 50 and 100 cases, six or seven conditions are advised. We collected information on 12 conditions that Ostrom (2009) identified as being important to self-organization. Of those 12, we ultimately selected six conditions that both showed high necessity scores and for which there was minimal overlap in the type of information provided. Note that correlation between conditions in QCA analysis does not adversely affect model efficiency and accuracy as in statistical models. However, as each additional condition in a QCA model results in an exponential increase in the number of potential case configurations – and hence more logical remainders and an increasing reliance on assumptions regarding parsimonious or complex solutions – it is still important to try to avoid redundancies among explanatory conditions. Using a total of six conditions resulted in 32 possible SSF configurations and allowed for the consideration of the impact that small differences in the 'make-up' of operational and institutional settings have on causal pathways (i.e., Ostrom, 2005) while not requiring too many assumptions regarding logical remainders.

3.5.4 Conditions

3.5.4.1 Social, economic and political setting conditions

3.5.4.1.1 Macro-level government resource policy

CBFM projects can be implemented regardless of the presence or absence of supportive policy, which can have wide and unpredictable impacts (Pomeroy, 2001). However, in countries that lacked national policy support at the time of the case studies (e.g., Vietnam and Malaysia), the *a priori* expectation is that CBFM would be less likely to be initiated and successful (Pomeroy, 1995). Legitimacy and accountability are created when governments establish macro-level facilitating conditions for CBFM (Pomeroy, 2001). Decentralization or devolution of natural resource management has been implemented in some Southeast Asian countries. Case studies fell into distinct groups that ranged from those where CBFM was developed without supportive government policy to those where CBFM was initiated with legislation. The condition *policy* was assigned a four point fuzzy scale. To be coded 1.00, CBFM had to be initiated when supportive national legislation was in place. To be coded 0.67, CBFM had to be initiated when national legislation was in the final stages of implementation and to be coded 0.33, CBFM had to be initiated then national legislation was in the early stages of implementation. Finally, to be coded as 0.00, CBFM had to have been implemented when there was no supportive legislation.

3.5.4.1.2 Market attributes

For successful CBFM, market demand, resource yield, and fishing capacity within a community have to be in balance (Kuperan and Abdullah, 1994; Peacock and Annand, 2008). Communities that are connected to external markets may experience greater destabilization relative to more isolated communities (Klooster, 2000). Communities that have easy access to markets may experience pressure on higher trophic level species that typically have greater market value (Cinner and McClanahan, 2006; Tsikliras and Polymeros, 2014). In this study, market attributes were defined by either a community's dependence on subsistence or their connections to markets. Coded on a four point fuzzy scale, 1.00 signaled that community fishing was fully subsistence-oriented whereas 0.00 signified that a community was well-connected to important national or international markets. A score of 0.67 signified a community that was largely subsistence oriented but with local market connections and a score of 0.33 signified a community with regional market connections.

3.5.4.2 Resource system conditions

3.5.4.2.1 Number of community users

The number of resource dependent users can influence the success of CBFM. As group size increases, the prospects for successful collective action diminish (Poteete and Ostrom, 2004). Small group sizes increase opportunities for constant interaction and can help strengthen reputations and increase opportunities for mutual monitoring. Through these processes heightened trust can be fostered; trust makes social life predictable, creates a sense of community, and makes it easier for people to work collectively (Folke et al., 2005). Community resource users in this study were situated in small villages, clusters of villages (or communes), larger towns, and coastal cities. A six point fuzzy scale was used to accommodate the substantial differences in numbers of resource users. Coding of 1.00 indicated that the total number of resource users was relatively low (0-200 users), whereas coding of 0.00 signified a high number (over 7000) of resource users.

3.5.4.3 Resource unit conditions

3.5.4.3.1 Resource mobility/predictability

The mobility of target fish species has a significant impact on the ability of communities to manage fisheries. Mobility can be defined as the vertical and horizontal movement of fish stocks (Claudet et al., 2006). Community fisheries or management methods such as Marine Protected Areas (MPAs) often fail to reach their full potential due to migration of fish species which take them outside community protection, where they become vulnerable to fishing pressure (Tupper and Rudd, 2002). A variety of fish stocks were targeted by communities in this study, ranging from stationary shellfish to highly migratory freshwater and marine fish species. To account for fish mobility differences, a four point fuzzy scale was assigned for the condition *sedentary*, where: 1.00 accounted for stocks that were highly sedentary; 0.67 for mostly sedentary stocks; 0.33 for mostly mobile stocks; and 0.00 for highly mobile stocks. Most reef fisheries target multiple species, so these classifications of stock mobility are designed to reflect the mix of species and their mobility rather than, in most cases, single species.

3.5.4.4 Governance system conditions

3.5.4.4.1 Power to craft collective choice rules

Participation of resource users in management processes is key for CBFM (Armitage, 2005; Kuperan and Abdullah, 1994; Ostrom, 1990; Pomerey and Berkes, 1997; Pomeroy, 1995). Increased community participation in decision-making is thought to

provide numerous benefits, including cost effectiveness (Hanna and Munasinghe, 1995), compliance (Eggert and Ellegård, 2003; Gutiérrez et al., 2011; Sutinen et al., 1990), and heightened community ownership (Gutiérrez et al., 2011). Co-management is defined as the sharing of decision-making responsibilities and authority between government units and a community (Pomerey and Berkes, 1997). Co-management can cover various partnerships and degrees of power sharing, from fishers merely being consulted by the government, to those in which fishers have full decision-making powers in regulation design, implementation, and enforcement. The appropriate balance between state and community participation in governance is a primary question in environmental policy and institutional economics (Birner and Wittmer, 2004; Rudd et al., 2003). Our definition of this condition follows Pomeroy et al. (2004), ranging from full decision-making responsibility delegated to stakeholders, to co-management or collaborative systems in which governments and stakeholders jointly make decisions, to consultative systems where government merely informs stakeholders about their decisions. Coded on a four point fuzzy scale, 1.00 signaled community autonomy in decision making, 0.67 signaled a high level of community autonomy (i.e., co-management), 0.33 signaled that most decision making was external to the community (i.e., consultation), and 0.00 signaled no local input in decision making.

3.5.4.4.2 Funding

Financial resources are essential to support CBFM processes that include planning, implementation, coordination, monitoring training and enforcement (Pomeroy et al., 2001). Projects can generate internal funding or receive funding from non-governmental organizations (NGOs), international development organizations, and government bodies. External funding is thought to result in more sustainable resource management (Baland and Platteau, 2000) but some very successful projects have been entirely funded by internal resources (UNDP, 2013). Condition definition ranged from CBFM having secured external funding to no, or limited, funding. Coded on a four point fuzzy scale, 1.00 signaled the community had secure funding from high-level, external organizations while 0.00 indicated that a community had no or very limited funding.

3.5.4.4.3 External support

In communities without prior CBFM experience, knowledge or capabilities, operationalizing CBFM can be challenging without the assistance of change agents (Pomeroy et al., 2003). The establishment of truly community-based projects may come only after several years of community organizing and training (Beger et al., 2004). Beyond funding possibilities, partnerships with external agents (e.g., NGO, development

organizations, government agencies) facilitates access to resources and basic infrastructure (Kiss, 2004), and to external advice, ideas, expertise and technical assistance (Pomeroy et al., 2003). CBFM case studies were defined as having external support if they had access to consistent and formal assistance from high level institutions for a range of CBFM activities including training, community organizing, and technical support. The condition *external support* was coded on a four point fuzzy scale, where 1.00 signified CBFM had continued support from high-level organizations and 0.00 signified that CBFM had virtually no support.

3.5.4.4.4 Implementing agency

CBFM can be initiated by local resource users, community organizations, NGOs, research institutions, and government agencies. Debates exist about the effectiveness of internally versus externally initiated community projects (Beger et al., 2004). Internally created CBFM initiatives may enjoy a close connection with local communities whereas externally initiated projects can help ensure access to resources (Beger et al., 2004). External agents implementing CBFM must allow community partners to recognize themselves as owners and directors of the project (Pomeroy et al., 2003). Case studies were defined as those originating fully from within the community (1.00) to those established by an external organization (0.00) (this condition was defined using a simple dichotomous indicator).

3.5.4.4.5 Supportive legislation

In addition to macro-level policy that recognizes the benefit of community participation in natural resource management, CBFM structures are most effective when they are accompanied by site-specific supportive legislation from governments (Pomeroy et al., 2001). Legislation includes the development of legal, administrative, and institutional arrangements that define legal status, rights and authorities (Pomeroy, 1995). In addition, local political will to share costs, benefits, responsibilities, and authority with local people is crucial (Pomeroy et al., 2001). CBFM projects included in this study possess a range of supportive legislation, from national governmental documentation to legislation assigned from local government bodies. The condition *supportive legislation* was coded on a four point fuzzy scale that signified the level at which legislation or formal rules were designed and implement: 1.00 signified that CBFM was supported by legislation assigned at national the government level; 0.67 signified support at the regional or district level; 0.33 signified support at the local level; and 0.00 signified that there was no legislation or rules in place.

3.5.4.5 Conditions describing resource users

3.5.4.5.1 Local leadership

Local leaders can perform a number of crucial CBFM roles (Sutton and Rudd, 2014). Their responsibilities may include: providing energy and decision-making consistency (Gilmour et al., 2013; Hauck and Sowman, 2001; Pomeroy et al., 2003); ensuring stability and accountability (Njaya, 2007; Pollack et al., 2008); creating links with external agents (Bodin and Crona, 2008); creating visions for change (Olsson et al., 2004); identifying policy opportunities (Klooster, 2000; Olsson et al., 2004); and linking solutions to problems (Font and Subirats, 2010). Relative to external actors, local leaders may catalyze CBFM due to their social connections and existing levels of trust that they enjoy within their communities (Bodin and Crona, 2008). Core leadership groups often arise from committed individuals who consistently participate in CBFM activities and who share a concern for community fisheries (Pomeroy et al., 2003). A caveat exists, however, regarding the 'dark side' of social capital (Putzel, 1997; Rudd, 2000), as there may be a risk of elite capture, further embedding power inequalities and the misuse of CBFM resources (e.g., Hauck and Sowman, 2001; Klooster, 2000; Komarudin et al., 2008; Kull, 2002; Larson and Ribot, 2004; Njaya, 2007). In this research, local leaders included elected locals for CBFM, traditional village leaders, religious leaders, local fisheries officers, and local elites. The condition *local leader* was coded on a four point fuzzy scale and reflected the strength of local leadership. To be coded 1.00, a local individual or individuals had to be elected into leader roles by the community. To be coded 0.67, an informal local leader had to have been in place, while for a coding of 0.33, a local leader was absent but an external leader was present. To be coded as 0.00, there were no CBFM leaders of any type.

3.5.4.6 Interactions (self-organizing activities)

3.5.4.6.1 Community organizations

Community groups provide a space for communication, interaction, dissemination of information, and for community members to voice concerns (Pomeroy et al., 2001). It is important that community groups have the legal rights to organize, autonomy from government, and be recognized as a legitimate user group (Ostrom, 1990). Some of the most successful community organizations are those that grew from projects initiated by the community themselves. Case studies were defined as having a local organization if the community or an implementing agency had established a cooperative or a community group for CBFM purposes. This condition was coded as a dichotomous indicator, where

1.00 signalled a community organization for CBFM had been initiated and 0.00 signaled a community organization had not been initiated.

3.5.4.6.2 Monitoring and patrolling

CBFM requires monitoring, a responsibility that is generally the responsibility of community members (Pomeroy et al., 2001). Monitoring and patrolling of protected areas can maximize protection of resources (Beger et al., 2004). Support in terms of personnel, training and money can increase capacity of local patrol teams' ability to safeguard their resource (Pomeroy et al., 2001). In several Asian countries training and education in monitoring and patrolling activities has increased community confidence and created a sense of empowerment (Pomeroy et al., 2003). Case studies were defined as having formal monitoring and patrolling if they had external support in terms of money, resources, training, or personnel specifically allocated towards monitoring and patrolling. The condition *monitoring* was coded on a four point fuzzy scale and focused specifically on monitoring and patrolling activities. A case was coded as 1.00 if communities were given assistance in terms of hard costs (money and personnel) for monitoring and patrolling, as 0.67 if communities were provided soft costs (equipment and facilities), as 0.33 if communities had unstable *ad hoc* assistance for monitoring and patrolling, or 0.00 if communities had no support for monitoring and patrolling.

3.5.5 Outcomes

What defines successful CBFM? This can be problematic question due to numerous definitions of 'success'. Each project will have specific objectives and may therefore measure success differently (Pollnac et al., 2001). In this research, however, we sought output or outcome indicators that were potentially actionable and defensible. We evaluated outcomes based on two components that covered important social and ecological factors of equity, efficiency, and biological sustainability (Katon et al., 1999; Novaczek et al., 2001; Nuon and Gallardo, 2011; Viner et al., 2006).

3.5.5.1 Ecological performance

Biological sustainability indicators accounted for the condition of fish habitats and fishery landings. A case was considered to have had positive ecological outcome and belong to the set *ecological* if the community had experienced an increase in fish stocks and/or improved fish habitat conditions in the fishing region. Cases demonstrated a wide spectrum of ecological outcomes; to account for these differences and in response to the wealth of information available, ecological performance was measured on a six point fuzzy scale. Cases which experienced flourishing resource stocks and habitats were coded as

1.00, whereas cases exhibiting badly degraded resources and habitats were coded 0.00. Points between 1.00 and 0.00 captured cases with substantial improvements in ecological indicators (0.90), some improvements in habitats and resources (0.60), some degradation in habitats and resources (0.40), and substantially dwindling resources and degrading habitats (0.10).

3.5.5.2 Socio-economic performance

Socio-economic performance was measured by equity and efficiency. Equity is the perceived fairness of the CBFM process (e.g., influence over decision-making and the empowerment of local communities) and distribution of economic project benefits (Hanna and Munasinghe, 1995). Efficiency resulting from increased levels of enforcement and compliance can be viewed as helping a community fishery reduce central government fiscal responsibilities (Nuon and Gallardo, 2011) while managing a fishery, with its local idiosyncrasies, at local scale can reduce the transaction costs of management (Rudd et al., 2003). A case was considered to have had a positive social outcome and belong to the set *social* if the community had mostly experienced increased equity and/or efficiency. Socio-economic performance was measured on a four point fuzzy scale, where 1.00 signaled high levels of social enhancement, 0.67 signified that communities had substantial social enhancement but with some persisting social issues, 0.33 signified cases that had experienced limited level of social benefits, and 0.00 signified that no social benefits were apparent. Table 3-1 summarizes conditions and outputs used in this study.

Table 3-1 - Candidate conditions considered and retained (denoted by subscript a) in the Qualitative Comparative Analysis

Conditions	Measures and anchor points
Community organization[a]	There was a community group involved in community-based fisheries management (CBFM) implementation (1.00 – yes; 0.00 – no).
External support[a]	The community had logistical support from a high-level external organization or government agency. (1.00 – strong government support; 0.67 – high-level of support; 0.33 – mostly local support or at implementing agency level; 0.00 – no or very limited support)
Local decisions[a]	Community had autonomy in decision-making (i.e., ability to engage in local collective action) (1.00 – complete community autonomy; 0.67 – high level of community autonomy (i.e., co-management situation); 0.33 – most decision making was external to the community (i.e., community consultations only); 0.00 – no community involvement in decision-making)
Local leader[a]	The community had a specific local leader(s) for CBFM (1.00 – community had a leader voted in by community members; 0.67 – an informal, influential leader was in place; 0.33 – only an external leader was available; 0 – no leaders were in place)
Subsistence[a]	Community fishing was subsistence in orientation (versus market-oriented) (1.00 – almost exclusively subsistence; 0.67 – largely subsistence but with some access to local markets; 0.33 – some access to regional markets; 0.00 – well-connected to external markets)
Sedentary[a]	Fishery resources were mainly sedentary rather than mobile (1.00 - highly sedentary target species; 0.67 – mostly sedentary species; 0.33 – mostly migratory species; 0.00 – highly migratory species)
Funding	Community had secure funding from high-level, external organizations (1.00 – high

	level of secure, external funding; 0.67 – mostly secure funding; 0.33 – mostly internal funding; 0.00 – no or limited funding)
Monitoring	The community had support for monitoring and patrols (1.00 – high level of support in terms of money and personnel (i.e., hard costs); 0.67 – moderate level of support in terms of equipment and facilities (i.e., soft costs); 0.33 – limited support of any kind; 0.00 – no support of any kind)
Origin	The idea of CBFM originated in the community (1.00 – yes; 0.00 – no)
Policy	Decentralization or devolution of governance responsibilities to communities at the beginning of the CBFM project was supported by national policy (1.00 – fully supportive national legislation in place; 0.67 – supportive legislation was in final stages of implementation; 0.33 – supportive legislation was in early stages of implementation; 0.00 – no supportive legislation)
Supportive legislation	CBFM had formal or recognized legislation in place at the national level (1.00 – legislation formalized and in place at national level; 0.67 – legislation formalized and in place at the provincial or district level; 0.33 – legislation formalized by village/commune government; 0.00 – no legislation was in place)
Community users	Total number of resource users was relatively low (1.00 – 0-200 users; 0.90 – 201-500 users; 0.60 – 501-1000 users; 0.40 – 1001-3000 users,; 0.10 – 3001-7000 users; 0.00 – over 7000 users)
Social	CBFM enhanced social indicators (equity and efficiency) (1.00 – high levels of enhancement; 0.67 – substantial enhancement but some social issues still remaining); 0.33 – limited levels of social benefits have been achieved; 0.00 – no social benefits were apparent)
Ecological	CBFM improved biological indicators (healthy habitats and increased fish stocks/biomass) (1.00 – flourishing resources stocks and habitats; 0.90 – great improvements; 0.60 –some improvements; 0.40 – some degradation of habitats and resources; 0.10 – degradation resources and degrading habitats; 0.00 – badly degraded resources and habitats)

3.6 Results and discussion

3.6.1 Case study summary

Appendix 2 (pg. 189) summarizes the data coding for all case studies. Throughout the balance of the paper we use the tilde (~) to refer to the negation of a condition (e.g., ~subsistence = not subsistence oriented fishing [= fishing for market use]).

3.6.2 Conditions affecting success

3.6.2.1 Necessary conditions

We first tested necessary conditions for our four models (positive ecological outcomes; negative ecological outcomes; positive social outcomes; and negative social outcomes). Consistency measures were <=0.83 for all models. Following Rihoux and Ragin (2009), who advised conditions should only be considered necessary if consistency scores are higher than 0.90, we concluded that there were no conditions that alone were necessary for either positive or negative ecological or socio-economic outcomes. This result is hardly surprising due to the inherent complexities of fishery SESs.

While we found no necessary conditions, necessity scores helped guide condition selection for the subsequent sufficiency analysis. To constrain the number and complexity

of causal pathways to positive SSF outcomes, we focused on six conditions: presence of community organizations (community organization); subsistence fishing (subsistence); local collective choice decision-making powers (local decisions); the presences of a local leader(s) (local leader); resource mobility (sedentary stock); and the presence of external support (external support). Based on the necessity score rankings, these conditions all appeared potentially important for positive ecological and social outcomes, generally important for negative social outcomes, and of mixed importance for negative ecological outcomes.

Beyond the one condition focused on the biological nature of the resource (*sedentary stock)*, the conditions we retained focused on both local level institutions (*community organization, local leaders, local decision)* and the presence of external factors (*external support*, locally-oriented *subsistence* versus market-oriented fisheries) in the case studies. Although other conditions may be important in CBFM, their presence or absence was not found to be highly influential for successful or unsuccessful CBFM in this study. Some conditions were also possibly covered by others. For example, the condition 'funding', which is theoretically and practically important, was covered to some extent by *external support*, the condition retained in the models.

3.6.2.2 Sufficient conditions

Table 3-2 summarizes the parsimonious results for the four models. There was a high degree of causal complexity even in the simplest QCA model outcomes. Such complexity is inherent in SESs and suggests contextuality has important implications for the role of leadership in successful CBFM outcomes. Some causal combinations theoretically 'make sense' while others, at first, appear more ambiguous. It is therefore important to identify the specific empirical cases covered by each combination of sufficient conditions.

Table 3-2 - Summary of models and solution pathways sufficient to achieve successful (positive) and unsuccessful (negative) ecological and social outcomes

	Pathway Diagnostics			Model Diagnostics	
	Raw coverage	Unique coverage	Consistency	Overall coverage	Consistency
Positive ecological outcomes				0.69	0.81
Pathway +E1 [*community organization*] AND [*local decisions*]	0.54	0.31	0.83		
Pathway +E2 ~[*local decisions*] AND ~[*local leader*] AND [*subsistence*]	0.18	0.03	0.86		
Pathway +E3 ~[*external support*] AND ~[*local decisions*] AND [*subsistence*]	0.21	0.00	0.84		

Pathway +E4 ~[*local decisions*] AND [*local leader*] AND ~[*subsistence*]	0.24	0.05	0.85		
Negative ecological outcomes				0.28	0.68
Pathway -E1 ~[*community organization*] AND [*external support*] AND ~[*sedentary*]	0.15	0.10	0.71		
Pathway -E2 ~[*external support*] AND ~[*local leader*] AND ~[*subsistence*]	0.18	0.13	0.73		
Positive social outcomes				0.90	0.70
Pathway +S1 [*community organization*] AND [*local leader*]	0.58	0.06	0.64		
Pathway +S2 [*community organization*] AND [*sedentary*]	0.60	0.07	0.79		
Pathway +S3 ~[*community organization*] AND ~[*local leader*] AND ~[*subsistence*]	0.12	0.04	0.91		
Pathway +S4 [*leader*] AND [*sedentary*] AND [*subsistence*]	0.54	0.08	0.83		
Pathway +S5 [*external support*] AND ~[*local decisions*] AND ~[*subsistence*]	0.32	0.01	0.90		
Negative social outcomes				0.76	0.78
Pathway -S1 ~[*external support*] AND ~[*local decisions*] AND ~[*local leader*]	0.18	0.07	0.80		
Pathway -S2 ~[*community organization*] AND ~[*external support*] AND [*subsistence*]	0.13	0.03	0.90		
Pathway -S3 ~[*community organization*] AND ~[*local leader*] AND [*sedentary*]	0.19	0.09	0.87		
Pathway -S4 ~[*local decisions*] AND [*local leader*] AND [*subsistence*]	0.40	0.07	0.82		
Pathway -S5 [*external support*] AND [*local leader*] AND ~[*sedentary*]	0.43	0.06	0.85		

3.6.2.2.1 Positive ecological outcomes

Four causal pathways, with either two or three conditions each, led to a positive ecological outcome (Table 3-3). The solution resulted in an overall coverage score of 0.69 (relatively high for QCA) and consistency score of 0.81. Both local social conditions and external influences were factors in the solutions, suggesting that socio-economic context plays an important role in promoting positive ecological outcomes among our Southeast Asian small-scale fisheries.

Table 3-3 - Cases covered by pathways sufficient to lead to positive ecological outcomes for Southeast Asian small-scale fisheries

Pathway	Cases Covered	Main points
+E1 [*community organization*] AND [*local decisions*]	Tong Tasae, Gili Indah, Pemutatran Bay, Xuan Tu Minanbonan, Au Svay, Koh Sneng, Stung Hav, Apo, San Salvador, Malilison Island,	Strong local institutions such as community organizations and mechanisms for local decision making can create an effective arena for CBFM. CBFM can be more effectively applied in

	Bolinao, Preito Diaz, Danjugan Bay,Ving Giang	smaller, close-knit communities that have access to alternative livelihoods and rely on a sedentary or mostly sedentary resource.
+E2 ~[*local decisions*] AND ~[*local leader*] AND [*subsistence*]	Panguil Bay, Sumilon Island	Subsistence fishing alone can curtail fishing pressure enough for positive ecological outcomes in some circumstances Islands can offer isolation important for MPA success
+E3 ~[*external support*] AND ~[*local decisions*] AND [*subsistence*]	Sumilon Island	Subsistence fishing alone can curtail fishing pressure Local and external conditions can act as functional substitutes in different pathways to ecological success
+E4 ~[*local decisions*] AND [*local leader*] AND ~[*subsistence*]	Watatoba, Ha Lien, Danao Bay	Having strong local leadership can compensate for lack of local decision-making power even when communities have access to markets

3.6.2.2.1.1 Pathway +E1 [community organization] AND [local decisions]

The combination ‘a community organization and local decision-making’ accounted for positive ecological outcomes among 15 case studies (Table 3-3) and provided the highest proportion (0.58) of coverage of the four solutions. Most cases had sedentary or mostly sedentary resources and used the resource for subsistence fishing or to sell in local markets. Resource use was thus relatively predictable and limited pressure was exerted on local stocks. Many cases had only small numbers of resource users but in areas with larger populations, strong institutions (e.g., at Xuan Tu and Stung Hav) (Newman and LeDrew, 2005; Tran et al., 2013) and alternative livelihood strategies (e.g., at San Salvador and Apo Island) could increase resilience to population-driven fishing pressure (Njaya, 2007; Pollack et al., 2008; Russ and Alcala, 1999). Several communities established MPAs through bottom-up community initiatives (e.g., Apo Island and Minanbonan) (Graham, 1998; Russ and Alcala, 1999) and several experienced great ecological success, increasing yields and enhancing marine environments. Christie (2004) highlighted that although MPAs meet biological goals, they may in fact be ‘failures’ when social evaluation criteria are applied. Indeed Apo Island and Minanbonan, both of which experienced high levels of ecological success, scored low based on social outcomes.

Alternative livelihood strategies can supplement or substitute for fishery income, increase community capabilities and resilience, and take fishing pressure off fish stocks (Allison and Ellis, 2001). Two prerequisites need to be in place to successfully promote alternative livelihoods; community consultations and training for targeted community members are both needed (Pomeroy and Carlos, 1997). Alternative livelihoods for San Salvador fishers included loan assistance programs and swine rearing (Katon et al., 1999; Katon et al., 1997), while in Bolinao, *Euchema* and seaweed fishing was introduced (McManus et al., 1996). A consumer cooperative store, hog roasting facility, and seaweed

fishing was set up on Malilison Island (Agbayani et al., 2000; Amar et al., 1996; Baticados and Agbayani, 2000).

3.6.2.2.1.2 Pathway +E2 ~ [local decisions] AND ~ [local leader] AND [subsistence]

The second causal combination involved subsistence fishing by communities that were relatively isolated from markets but where local decision-making powers and local leadership were lacking (Table 3-3). Overall coverage (0.18) and unique coverage (0.03) was low and this solution accounted for only two cases, Panguil Bay and Sumilon Island (note that a case study can be covered by multiple solution pathways, as is the case for Sumilon Island). Panguil Bay had mostly sedentary resources that were used by thousands of locals, but who sold their catch locally (Gauran, 1996). Despite lacking a local leader, an external community organizer acted as a catalyst for community learning and conservation. The local regulation of fishing practices contributed to the regeneration of bivalve populations and an increase in landed volume and average size of marine products.

Sumilon Island was used by fishers from numerous island communities for subsistence fishing (Russ and Alcala, 1999). Ecological success may be attributed to a flagship MPA being located at Sumilon Island and potentially to the isolation created by the island environment itself. After two decades of community management, there was still a lack of genuine community buy-in and support despite some ecological success. Beger et al. (2004) suggested small coastal islands represent discrete areas that buffer the impact of coastal populations. Edgar et al. (2014) found that ecological isolation was an important determinant of MPA success globally.

The core lesson from this pathway is that communities may see ecological success when fishing pressure is light even if, as in these cases, local leadership and collective choice capacity are limited. The cases illustrate that specific ecological and social conditions may act as substitutes for each other in different contextual conditions.

3.6.2.2.1.3 Pathway +E3 ~ [external support] AND ~ [local decisions] AND [subsistence]

In the third pathway (Table 3-3), lack of external support is substituted for lack of leadership; this solution represents only Sumilon Island (note that unique coverage was 0.00 because Sumilon Island was covered by other solutions as well). Sumilon is an interesting case because the “on-again-off-again” protection of coastal waters had profound impacts on ecological and social outcomes (Russ and Alcala, 1999). Despite some successes regarding impacts on fish stocks and marine environmental quality, there have been limited long-term successes due to the *ad hoc* nature of project implementation. This

case illustrates that two social conditions – local leadership and external support (or the lack thereof) – can act as substitutes along different causal pathways.

3.6.2.2.1.4 Pathway +E4 ~ [local decisions] AND [local leader] AND ~ [subsistence]

The final pathway leading to a positive ecological outcome involved a lack of subsistence fishing (i.e., they had access to markets) and weak local decision making. These three cases (Danao Bay, Ha Lien, Wakatobi National Park) however had a local leader. Despite the potential dangers of having access to external markets, the presence of strong local leadership (and their emphasis on education) helped to ensure positive ecological outcomes. Without the efforts of the local military leader in Danao Bay, the local marine sanctuary would have collapsed under the pressure from local fishers (Heinen and Laranjo, 1996). In Ha Lien, conflicts decreased as more emphasis was placed on education. An agreement in 2004 led to the formation of three management working groups in Wakatobi, one of which concentrated on community outreach and education (Elliott et al., 2001). Typically environmental education was the first step towards community acceptance of and willingness to participate in CBFM (Beger et al., 2004). In addition, the formation of multi-sectoral management boards in Wakatobi and Danao Bay were effective (Elliott et al., 2001; Heinen and Laranjo, 1996). Heterogeneous management committees may bring a diverse set of leader skills, knowledge, expertise and interests to resource management situations. That can increase system resilience and robustness, and allow groups to tackle a wider array of management issues (Olsson et al., 2004).

3.6.2.2.2 Negative ecological outcomes

Two causal pathways with three conditions each led to negative ecological outcomes (Table 3-4). The overall coverage score (0.28) and consistency score of (0.68) were low. This suggests that other contextual conditions influenced negative ecological outcomes (i.e., there are many conditions and pathways to poor ecological performance).

Table 3-4 - Cases covered by pathways sufficient to lead to negative ecological outcomes for Southeast Asian small-scale fisheries

Pathway	Cases Covered	Main points
-E1 ~[*community organization*] AND [*external support*] AND ~[*sedentary*]	Ban Bang Chan	The lack of an effective community group to coordinate management of a mobile stock can be detrimental to CBFM. Complex geographical and political systems can exacerbate management issues of a poorly organized community.
-E2 ~[*external support*] AND ~[*local leader*] AND ~[*subsistence*]	Ch Lao Cham, Pagapas Bay	Some fisheries exhibit negative outcomes due to lack of leadership, isolation and the presence of mobile stocks

3.6.2.2.2.1 Pathway -E1 ~ [community organization] AND [external support] AND ~ [sedentary]

The first causal pathway covered only a single case, Ban Bang Chan, Thailand. Initial CBFM projects were set up by the Andaman Sea Fisheries Development Centre (Pimoljinda and Boonraksa, 2001). The community faced major challenges, including ineffective conflict resolution and the difficulty of managing a highly mobile resource (Nickerson-Tietze, 2000). This was exacerbated by complex political and geographical systems that inhibited the ability of communities to enforce fishing bans.

3.6.2.2.2.2 Pathway –E2 ~ [external support] AND ~ [local leader] AND ~ [subsistence]

This configuration, which erodes local management capacity on all fronts, accounted for two cases of Cu Lao Cham (Vietnam) and Pagapas Bay (Philippines). In Cu Lao Cham, budget constraints hindered enforcement efforts over the large geographical area (Brown, 2011). In addition, there was evidence that non-local fishers regularly ignored local regulations as the benefits of fishing outweighed potentially small fines if they were apprehended and prosecuted. Despite the willingness of locals in Pagapas Bay to participate in CBFM, implementation was regarded as a failure (Melgar and Rodriguez, 1996). This was mainly due to lack of collaboration between local governments and communities, and to the belief from Pagapas Bay's People's Organization (PO), that coastal resource management was still dictated by government agencies.

3.6.2.2.3 Positive social outcomes

Five causal pathways, with either two or three conditions each, led to positive social outcomes (Table 3-5). Overall coverage from these pathways was high (0.90) but the consistency score was somewhat lower (0.70). Both local social conditions and external influences were factors in the solutions, suggesting that socio-economic context played an important role in promoting positive ecological outcomes among our Southeast Asian small-scale fisheries.

Table 3-5 - Cases covered by pathways sufficient to lead to positive social outcomes for Southeast Asian small-scale fisheries

Pathway	Cases Covered	Main points
+S1 [*community organization*] AND [*local leader*]	13 cases: Koh Sneng; Stung Hav; San Salvador; Danao Bay; Bolinao; Xuan Tu; Ha Lien; Hon Mun; Au Tho B; BNP; Pemutaran Bay; Wakatoba; Tong Tasae	Electing individuals into leadership positions can increase trust and community compliance CBFM initiated by communities can be sustainable
+S2 [*community organization*] AND [*sedentary*]	10 cases: Ban Laem; Tong Tasae; Au Tho B; Stung Hav; Xuan Tu; Panguil Bay; Koh	Community groups can be strengthened by formal and/or informal government agencies at multi-levels

	Sneng; San Salvador; Bolinao; Hon Mun	Community groups can also be successful when given autonomy to create their own institutions, especially when they target sedentary species
+S3 ~[*community organization*] AND ~[*local leader*] AND ~[*subsistence*]	2 cases: Ban Saphan Bay; Pasir Lawas	Even in communities with low organizational and leadership capacity, and with market access, it is possible for committed project workers can fill the leadership vacuum Market access can be positive for communities if that access does not lead to overwhelming fishing pressure at the community scale
+S4 [*leader*] AND [*sedentary*] AND [*subsistence*]	9 cases: Koh Sneng; Stung Hav; San Salvador; Bolinao; Blonko; Nolloth; Tong Tasae; Ban Laem; Kuala Teriang	Small, cohesive communities can engage in collective action Customary laws can leave a collective action legacy useful for CBFM Strong working relationships in a co-management structure can lead to positive social outcomes
+S5 [*external support*] AND ~[*local decisions*] AND ~[*subsistence*]	4 cases: Bang Saphan Bay; Wakatobi; KNP; BNP	When areas were previously centrally managed, ongoing external support can lead to successful social outcome even when communities are weak and external markets are accessible

3.6.2.2.3.1 Pathway +S1 [community organization] AND [local leader]

The first pathway relied on the presence of a strong local community organization in combination with a local leader(s). An important consideration across the case sites was the election of a leader(s) by the community. For example, individuals put forward for election in Koh Sneng must not have prior political motivations (Thuon and Vannara, 2005), while the core group in Xuan Tu were elected from trusted community members (Tran et al., 2013). In addition, CBFM was initiated within communities. Community residents took the lead in reef conservation and maintenance in a successful project in Pemutaran Bay (UNDP, 2013). At Pemutaran a previously established village MPA had been restored and was completely protected by community monitoring activities, funding, and the authority derived from traditional Balinese law. This was consistent with theoretical perspectives that suggest successful CBFM often results from bottom-up management approaches (Beger et al., 2004; Pomeroy and Carlos, 1997).

3.6.2.2.3.2 Pathway +S2 [community organization] AND [sedentary]

In the second pathway, local leadership was replaced by the presence of sedentary resources and provided an illustration of how social and ecological conditions can act as direct substitutes in arriving at similar outcomes. Pathway +S2 had the highest overall coverage score (0.60) among the five pathways and a high (0.79) consistency score. The 10 case studies demonstrated the benefits of having strong community organizations that can help overcome other potentially detrimental contextual conditions. Having formal or

informal recognition can provide legitimacy to community groups. For instance, through the efforts of the Haribon Agency, a national Filipino NGO umbrella group, local community groups in San Salvador was strengthened when a Memorandum of Agreement was issued by the Municipal Government (Katon et al., 1997). In Xuan Tu, the MPA was recognized and supported by the local community (Tran et al., 2013). Community groups in Tong Tasae enjoyed even more autonomy, which allowed them to create their own institutions. The participation of the governor and concerned local officials in Ban Laem signaled informal support to the conservation group, helping to reduce conflict over marine resources in the region (Sudtongkong and Webb, 2008).

3.6.2.2.3.3 Pathway +S3 ~ [community organization] AND ~ [local leader] AND ~ [subsistence]

Two case studies, Bang Saphan Bay and Pasir Lawas, were covered by a pathway where community organization and local leadership was lacking, and fishing was market-oriented. Both communities were fairly homogenous with experience of successful local collective action. While CBFM in Bang Saphan Bay was implemented by the Department of Fisheries (DoF) (Macfadyen et al., 2005), in Pasir Lawas CBFM followed customary rules and was self-enforced by the community (Susilowati, 2013). Despite the absence of specific CBFM-oriented local leaders, effective customary institutions were in place in Pasir Lawas and strong external leadership from project staff filled the leadership vacuum in Bang Saphan Bay. Even in communities that initially appear to be unsuited for successful fisheries management, success is possible. Access to markets can help increase social benefits for communities, especially if relatively strong traditional values are still in place.

3.6.2.2.3.4 Pathway +S4 [leader] AND [sedentary] AND [subsistence]

This pathway, which contained three conditions all theoretically associated with positive fishery outcomes, did indeed lead to positive social outcomes with a high level of consistency (0.83). Many of the nine cases covered were small communities that showed strong cohesive traits. Coastal population size is thought to positively correlate to the amount of pressure exerted on fish stocks, so establishing MPAs might be expected to become more difficult as population density increases (Beger et al., 2004; Pollnac et al., 2001). In Blonko and Nolloth (Indonesia), customary institutions and traditional village laws provided a sound basis of community engagement for CBFM (Novaczek et al., 2001; Pollnac et al., 2003). Where larger user groups existed (e.g., Koh Sneng, Stung Hav, San Salvador, Bolinao), close working relationships between communities and implementing agencies, NGOs, and government agencies in co-management structures were effective in

helping to secure socio-economic benefits (Katon et al., 1997; McManus et al., 1996; Sherman et al., 2007; Thuon and Vannara, 2005).

3.6.2.2.3.5 Pathway + S5 [external support] AND ~ [local decisions] AND ~ [subsistence]

A pathway combining access to markets and a lack of local decision making still resulted in positive social outcomes when high levels of external support were also present. This pathway had low raw (0.32) and unique (0.01) coverage. Cases covered by this pathway included four sites: Bang Saphan Bay, Wakatobi National Park, Karimunjawa National Park (KNP), and Bunaken National Park (BNP). Despite contrasting contextual conditions, these case studies showed similarities in the 'make-up' of CBFM. Originally centrally managed to increase marine park effectiveness, the management of Wakatobi, KNP and BNP later focused on increased community engagement (Campbell et al., 2013; Elliott et al., 2001; UNDP, 2012). Areas that have been centrally managed may require additional incentives to change behavior at multiple levels, as well as external assistance in decision making. Additionally, numerous highly geographically dispersed villages were incorporated into community-oriented projects at these sites, which could explain the centrality of external support in attaining positive social outcomes even in the face of market-oriented fisheries and low capacity for local collective action. Rudd et al. (2003) had argued that different combinations of external and local capacity for decision-making would affect the ability of local communities to successfully implement and manage MPAs; our results provide support for multiple contextual combinations of conditions providing pathways to socio-economic success among our cases.

3.6.2.2.4 Negative social outcomes

Five causal pathways with three conditions each led to negative social outcomes (Table 3-6). The overall coverage (0.76) and consistency (0.78) scores from these five were moderate and both local social conditions and external influences were factors in the solutions.

Table 3-6 - Cases covered by pathways sufficient to lead to negative social outcomes for Southeast Asian small-scale fisheries

Pathway	Cases Covered	Main points
-S1 ~[*external support*] AND ~[*local decisions*] AND ~[*local leader*]	3 cases: Cu Lao Cham; Pagapas Bay; Sumilon Island	In the absence of any effective local or higher-level governance organizations or actors, attaining positive social outcomes is difficult
-S2 ~[*community organization*] AND ~[*external support*] AND [*subsistence*]	2 cases: Sumilon Island; Ko Sraloa	CBFM is difficult when mobile resources are shared by numerous fishing villages that are poorly organized Lack of access to markets can limit local

		social benefits
-S3 ~[*community organization*] AND ~[*local leader*] AND [*sedentary*]	9 cases: Desa Haruku and Sameth; Nui Chu National Park; Calabanga; Sumilon Island; Bang Saphan Bay;	Even for fisheries targeting sedentary resources, positive social outcomes are not assured if local communities are weak
-S4 ~[*local decisions*] AND [*local leader*] AND [*subsistence*]	Kuala Teriang; Kilim; Ban Bang Chan; Hon Mun	Lack of awareness and capacity at the community level can hinder positive outcomes in subsistence-oriented fisheries Local leadership cannot always overcome challenges posed by low levels of community capacity
-S5 [*external support*] AND [*local leader*] AND ~[*sedentary*]	7 cases: Ban Bang Chan; Talise; Jemluk; BNP; Vinh Giang, Barili	External support has to be appropriate for the local context for equity and sustainability purposes Support and leadership may not guaranty positive social outcomes when stocks are highly mobile

3.6.2.2.4.1 Pathway –S1 ~ [external support] AND ~ [local decisions] AND ~ [local leader]

The first causal combination involved three negative conditions that were all typically expected to contribute to negative social outcomes. This pathway had low overall coverage (0.18) and covered three case studies, Cu Lao Cham, Pagapas Bay and Sumilon Island. The inability for communities to find balance between government and community involvement in fisheries can be detrimental to CBFM. Despite having a dedicated fieldworker in place, in Cu Lao Cham social benefits were limited in the absence of community or government buy-in for CBFM (Brown, 2011). CBFM implemented by governments should provide communities with incentives and information of expected benefits in order to help secure their support and participation; the MPA authority in Cu Lao Cham expected communities to take responsibilities without offering any benefits (Brown, 2011). Similarly, the expectations of immediate benefits for resource users from the Sumilon Island MPA resulted in skepticism and resentment among residents when benefits where not forthcoming (Russ and Alcala, 1999). Leaders within local government units can also have negative influences on CBFM. For example, local government elections in Pagapas Bay disrupted CBFM procedures (Melgar and Rodriguez, 1996), the selfish and antagonistic motivations of politicians at Sumilon Island exacerbated the already crumbling CBFM (Russ and Alcala, 1999), and government actors managing Cu Lao Cham had no community engagement training due to the hierarchical nature of Vietnam's top-down governance structure (Brown, 2011).

3.6.2.2.4.2 Pathway –S2 ~ [community organization] AND ~ [external support] AND [subsistence]

Sumilon Island (Philippines) and Ko Sralao (Cambodia) were covered by the combination of low levels of community group organizations and external support, and subsistence fishing. Overall coverage was modest (0.13) but the solution was highly consistent (0.91). Ko Sralao had strong local leadership; although the local management committee had some successes, their rules were insufficient to protect mobile resources at the regional scales (Marschke and Berkes, 2005). Local fishers in Ko Sralao became despondent when fishers from other villagers continued using small mesh size nets. Securing community consensus and support for fishers from numerous villages became a barrier to CBFM in Sumilon (Russ and Alcala, 1999; White, 1989). Despite subsistence oriented fisheries, these two communities were unable to successfully manage local fisheries in the absence of strong internal capacity to support fisheries management.

3.6.2.2.4.3 Pathway –S3 ~ [community organization] AND ~ [local leader] AND [sedentary]

Sharing similarities to pathway *–S2*, five case studies (Desa Haruku and Sameth, Nui Chua National Park, Calabanga, and Sumilon Island) shared the combination of sedentary resource stock and weak community-level leaders and organizations. While overall coverage was low (0.19), the consistency for this solution was high (0.87). These cases highlighted two interesting points, the importance of co-ordination and the need for CBFM to compliment local contexts. In Nui Chua, there was a lack of coordination between external agencies (Vu, 2012). Due to the geographical complexity of San Miguel Bay, existing legislation required co-ordination that could not be mustered (Pomerey and Pido, 1995). The formalization of traditional institutions in Desa Haruku and Sameth was accompanied by a rise in violations and conflict, and a decrease in communal action (Novaczek et al., 2001).

3.6.2.2.4.4 Pathway –S4 ~ [local decisions] AND [local leader] AND [subsistence]

This pathway demonstrated that negative social outcomes can arise even when strong local leadership is in place. In this pathway (overall coverage 0.40, unique coverage 0.08, consistency 0.82), two cases – Kilim (Malaysia) and Ban Bang Chan (Thailand) – were covered. Due to limited authority, confidence, and funding resources, the community in Ban Bang Chan lacked the knowledge and resources to successfully secure social benefits from CBFM despite the presence of strong local leadership (Nickerson-Tietze, 2000; Pimoljinda and Boonraksa, 2001). Similarly the main challenge of resource conservation in Kilim was a lack of awareness among local fishermen (Halim et al., 2011).

Additionally, CBFM in Kilim would benefit from extra officers from the DoF Malaysia to create closer rapport with local communities (Halim et al., 2011). While not explicitly mentioned in these cases, there is also a possibility that local leaders exploit their power to pursue selfish interests (Putzel, 1997), thereby jeopardizing ecological and socio-economic success in tropical fisheries management (Rudd et al., 2003).

3.6.2.2.4.5 Pathway –S5 [external support] AND [local leader] AND ~ [sedentary]

Negative social outcomes resulted from this pathway even in the presence of strong leadership and external support. This combination had the highest overall coverage (0.76) of the negative social outcomes, a high consistency (0.78), and covered six cases. These case studies emphasized the importance of inappropriate external assistance. Numerous institutions provided support to Ban Bang Chan but, due to lack of consensus on responsibilities and project activities, these groups became a barrier to effective CBFM (Nickerson-Tietze, 2000; Pimoljinda and Boonraksa, 2001). To design appropriate assistance, organizations offering external support must navigate local contexts such as gender considerations; the withdrawal of a female extension worker, for example, caused a decrease in female participation in Talise (Crawford et al., 2004; Pollnac et al., 2003). Secondly, the distribution of assistance was important as the beneficiaries of aid in Jemluk were mostly members of a large fishing cooperative (Nikijuluw, 1998). Communities must also expect the unexpected. In Barili, for instance, despite external assistance community groups disintegrated (Gutierrez et al., 1996). Kosamu (2015) noted that government support given to communities with weak social capital or local institutions was practically ineffective as that support lands in a vacuum. In the presence of mobile fish stocks that make cooperation more difficult and reduce incentives for cooperation (Rudd et al., 2003) communities can be simply overwhelmed, especially if external support is not aligned with community needs or if local leadership does not have community interests at heart.

3.7 Conclusions

Results from our QCA analysis showed high levels of complexity among our SSF case studies. While pathways to a positive outcome were diverse, it was clear that social, economic and political factors impacted ecological success, and ecological conditions, particularly species mobility, played a role in socio-economic success. Due to the diverse array of contexts displayed by our case studies, it is likely that key conditions identified were quite robust across tropical SSF in Southeast Asia.

The trajectory of a successful CBFM can be quickly reversed in response to changing environmental and social contexts. SSFs can be significantly impacted by social change (e.g., population increase and tourism), changes in political power, and

environmental change. Future assessments of leadership in SSF should examine how local leaders can help communities adapt to change, and in turn, how leaders themselves will also have to adapt. Many of the contextually rich cases upon which we drew were from research in the 1980s and 1990s, and are now quite dated. In the future, it would be useful to design comparative case studies that were designed more explicitly to strategically and systematically compare cases at a sufficient level of contextual depth and across a range of geographic locations and times. This could help provide insights into current CBFM successes and start to help build understanding about how dynamic pathways to and from success vary temporally in the face of changing driving forces, pressures, and disturbances.

Leadership at the local level is an important condition in CBFM. The presence of a committed individual from the community can help CBFM achieve successful ecological and social outcomes. However, the absence of a local leader does not necessarily signal that CBFM will fail. Indeed, having 'strong' local leadership can even be detrimental if 'leadership' involved using power to capture benefits. In addition to a community-oriented outlook, it is evident that to succeed in CBFM it is often beneficial for leaders to have support from high level institutions (NGOs, development organizations and government agencies) and local communities and to have access to resources. In some case studies, there was a degree of substitutability among conditions (e.g., local leaders and a sedentary fish stocks were functional substitutes in some circumstances), implying that there were multiple pathways to success.

SSFs are extremely complicated from an integrated social-ecological systems perspective and thus provide potentially valuable lessons as how to approach the analysis of necessary and sufficient conditions that can support moves towards environmental sustainability. Contextually rich analyses of complex socio-ecological systems will require the integration of research across geographic and temporal scales (Pahl-Wostl and Knieper, 2014) and need to bridge the gap between small-*n* qualitative case studies and large-*n* statistical analyses. Building understanding about context-specific pathways to success should facilitate the development of new models that can be used to design and test interventions and investments that sustain and contribute to successful fisheries governance.

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Chapter 4 Factors influencing fishers' leadership engagement in international small-scale fisheries

4.1 Preface

Local leadership is crucial for successful SSF, especially since the surge in popularity of decentralized and devolved governance structures, which place extra responsibilities on local communities (Armitage, 2005; Rudd et al., 2003). As noted in Chapter Two, while SSF leadership characteristics and functions have been examined in detail (Sutton and Rudd, 2014), the factors affecting an individual's propensity to engage with leadership, the effectiveness of leadership and consequently SSF outcomes, have been under researched. Advances in other fields suggest that a more detailed, sharper focus on leadership could give valuable insights into the role leaders play in SSF.

In Chapter Four, I contribute to increasing understanding about the conditions that influence the capacity of local community members to successfully emerge as leaders and engage with CBFM. Conditions are analyzed at the level of the individual, the community, and high-level governance, and are organized using modified versions of the Institutional Analysis and Development (IAD) framework, Value-Belief Norm (VBN) theory, and Schwartz's theory of cultural values. To facilitate such an analysis, I use detailed information from over 50 semi-structured interviews with international SSF researchers and practitioners.

This paper is written in the style of Frontiers in Marine Science to which it has been submitted and accepted for publication, subject to minor corrections but without changes to the original text. For consistency and ease of reading, figures and tables have been inserted close to their first reference in the text rather than separated as in the publisher's version.

I declare that the work submitted is my own. The contribution by co-authors was as follows:

Dr. Murray Rudd: supervision, review and editing

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Factors influencing community fishers' engagement in international small-scale fisheries

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4.3 Abstract

Local leadership is crucial to the functioning of local organizations in small-scale fishing (SSF) communities. By analyzing local leadership experiences of 54 international SSF researchers and practitioners, we aim in this paper to fill knowledge gaps that recent research has identified regarding our understanding of factors that influence the effectiveness of local leadership. Influencing factors are organized using modified versions of the Institutional Analysis and Development (IAD) framework, the Value-Belief-Norm (VBN) theory, and Schwartz's theory of cultural values. We identified factors that help shape leadership engagement and effectiveness at multiple levels, including: precursors to individual action that relate to potential SSF leaders' perceptions of threats and opportunities; institutional constraints at the individual level and community level; and high level governance issues. Precursors to individual action were numerous and multi-faceted, and individual behaviors were shaped by core values and attitudes, culture, experiences, and education. Motivation to participate in leadership can either be altruistic in nature or oriented towards self-enhancement. A lack of motivation for leadership could be attributed to the individualistic nature of many fishers. The availability of capital assets can facilitate or hinder participation in leadership. Individuals who may be willing to take on leadership roles were often hindered by lack of money and time, low educational attainment, or poor social cohesion among community members. The interactions between leaders and followers were crucial for effective leadership, especially a leader's perceived legitimacy and the ability of a community to groom appropriate successors. At the higher level, constant policy change and the resulting uncertainty were linked to decreasing motivation and apathy regarding SSF management at the local level, and disintegrating relationships between government level and local level actors. Our research highlights how local leadership and context are linked, and suggests potential researchable hypotheses that

would in the future help further advance empirical and theoretical understanding of leadership influences in SSFs.

4.4 Introduction

Uncertainty is pervasive in small-scale fisheries (SSFs) due to complex interactions within and between ecological and socio-political systems. SSFs are, as a result, often perceived to have low governability potential (Jentoft & Bavinck, 2014). This perception is exacerbated by a history of perceived failures by centralized, conventional fisheries management agencies (Imperial & Yandle, 2005; Pero & Smith, 2008). Consequently, decentralized or devolved fisheries management approaches (Plummer & Fitzgibbon, 2004; Rudd *et al.*, 2003) have become increasingly popular since the 1980s (Chuenpagdee *et al.*, 2005; Jentoft, 1989; Pinkerton, 1989). Decentralized governance systems transfer decision-making power to local government managers, while devolved governance involves the transfer of substantive decision-making power to local resource users (Rudd *et al.*, 2003), often through community-based or co-management structures (Jentoft, 1989).

If the devolution of SSFs is to be more than a way for governments to simply download their own management costs on communities (Wiber *et al.*, 2010), engagement of community actors becomes central for success as they are tasked with performing key management functions (Armitage, 2005; Rudd *et al.*, 2003). This is especially the case for the local leaders, who are crucial for successful community-based fisheries management (CBFM) (Al Mamun, 2015; Bodin & Crona, 2008; Evans *et al.*, 2015; Gutierrez *et al.*, 2011; Muehlig-Hofmann, 2007; Sutton & Rudd, 2014; Sutton & Rudd, 2015). While SSF leadership characteristics and functions have been examined at a relatively coarse scale (Sutton & Rudd, 2014), advances in other fields (e.g., Küpers & Weibler, 2008) suggested that detailed sharper focus on leadership concepts and methods could provide valuable insights regarding the role that leaders play in SSF management. In particular, there is a compelling need to also identify the social conditions that influence SSF leaders and leadership capabilities (Al Mamun, 2015; Sutton & Rudd, 2014), as those help shape ecological and socio-economic outcomes.

Here we seek to strengthen our understanding about which conditions – at the level of individuals, communities, and higher-levels of governance – influence the capacity of local community members to successfully develop into leaders and engage in CBFM, thereby enhancing the delivery of positive ecological and socio-economic outcomes arising from the devolution of SSFs to their local communities. To do this, we conducted semi-structured interviews with 54 international SSF researchers and practitioners, focusing on the characteristics of leaders and the challenges that they face in SSF management. Our

results thus provide broad insights into the influences and mechanisms affecting local leadership processes and outcomes in international SSFs.

4.5 Methods

4.5.1 Theoretical background

Local leadership in SSF is influenced by numerous conditions across socio-political scales, at the level of the leader's own household, their community, and the political context within which their community is embedded. To help identify and organize our analysis, we drew on insights from the Institutional Analysis and Development (IAD) framework (Ostrom, 1990; Ostrom, 2005), Value-Belief-Norm (VBN) theory (Stern, 2000; Stern *et al.*, 1999), and Schwartz's theory of cultural value (Schwartz, 1999; Schwartz, 2012). That combination helps to highlight conditions that influence the propensity of individuals to engage in SSF management leadership and to identify ways in which the broader social cultural and political environments might influence local leaders.

4.5.1.1 Institutional Analysis Development (IAD) framework

The IAD framework is a universal policy analysis framework that helps organize and facilitate analyses of how institutions operate and change over time, allowing for greater understanding of the logic, design, and performance of institutional arrangements in a wide variety of settings and scales (Ostrom, 1990; Ostrom, 2005). We use it to organize our analysis and help identify key characteristics of leadership at the individual level and the institutions that catalyze or hinder the development of leaders. When viewed from an IAD perspective, community fisheries become a collection of social actors within an 'action arena', the space where individuals interact, exchange ideas and services, and engage in contestation. The framework lays out how behavior is shaped by various sanctions and rewards associated with particular types of rules or social norms (i.e., about what, where, when, and how activities can be undertaken; by whom; and about permitted, required, or prohibited outputs and outcomes).

In a capital asset-oriented IAD (Rudd, 2004; Rudd, 2010), the state of the world is framed in terms of various capital assets (Figure 4-1), which can be accumulated or depleted. When valued assets and their resource flows are perceived to be threatened (hence linking to VBN theory, below), governments, communities, and leaders themselves have a range of options to alleviate adverse conditions that inhibit them achieving their objectives or adapting to changes in SSF context. Those investments can be in capital assets themselves (e.g., education and training to increase leadership capacity), in changing either the structure of the rules-in-use or their payoffs, and in implementing process-

oriented (rather than structural) changes in the governance system (i.e., designing participatory processes that enhance efficiency, equity, legitimacy, participation, accountability, fiscal equivalence, alignment with moral values, adaptability, resilience, robustness or sustainability – see McGinnis, 2011).

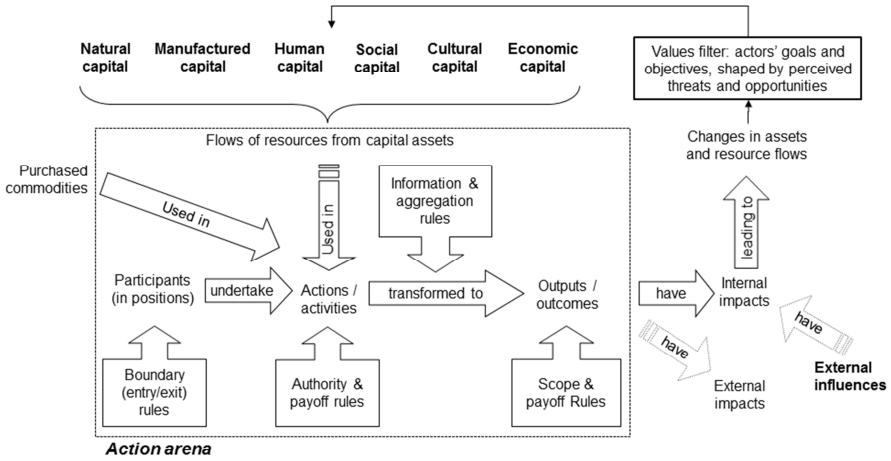


Figure 4-1 – Basic action arena in terms of capital assets and resource flows (adapted from Rudd, 2004)

Action arenas exist at multiple levels from a single household, to regional, national, or international governance organizations (Ostrom, 2005). The IAD framework can be used to structure the feedbacks between action arenas that are linked across different levels. Our primary focus is on the operational level, where individual SSF actors or organizations in their fishing communities make day-to-day decisions. However, outcomes from higher collective choice and political levels also affect them, creating facilitating or restrictive conditions that affect local leaders' capacity to engage and function in SSF leadership roles.

When extending the IAD framework to multiple levels (Figure 4-2) in our SSF context, the lowest level (and that with the quickest cycle time) is that of the individual leader, who makes decisions that help him or her reach their personal objectives (e.g., earning a living and having enough money for educating children) or broader objectives regarding the state of capital assets in their community (e.g., infrastructure, social cohesion) or region (e.g., health of fish stocks). Individuals function within their community, and are influenced directly by actions of the community level (e.g., the aggregated outcomes of local fishers on fish stocks; social norms that influence where, when, and how an individual can fish). All actors at the operational level of households

and communities are influenced by the actions and outcomes of higher level fisheries management and other organizations tasked with governing or supporting the operational level. For example, the formal rules that govern local fisheries are chosen at the higher level, as are choices about enforcement intensity and the allocation of resources to operational level activities like habitat restoration. At an even higher political level, activities and their outcomes shape general policy directions that reflect the desire of governments or other high-level organizations (e.g., donors). In our analysis, we found respondents who addressed issues at all levels and used the multi-level IAD framework to help organize and make sense of those comments.

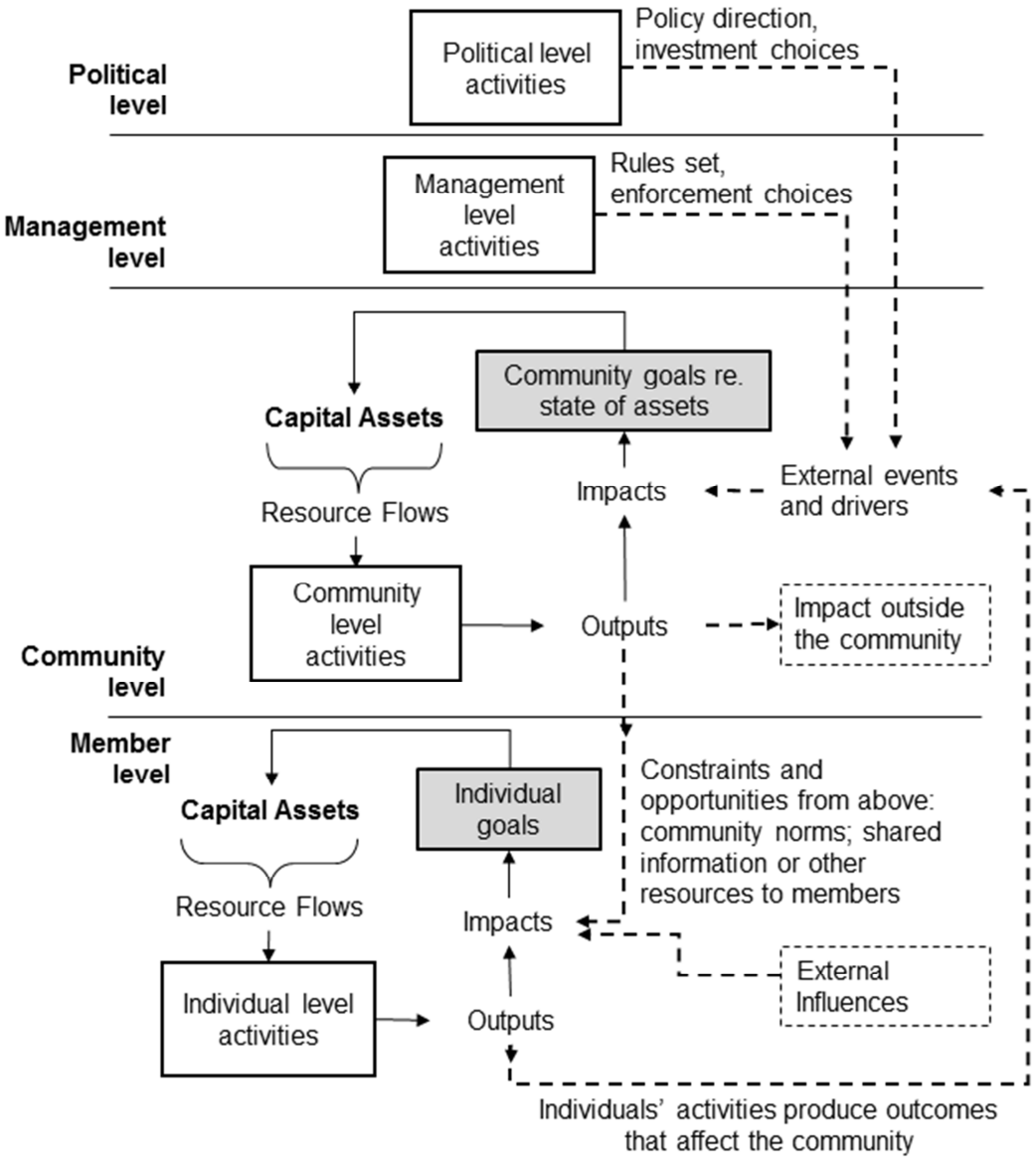


Figure 4-2 – Multi-level IAD schematic

4.5.1.2 Value-Belief (VBN) theory

The VBN theory (Stern, 2000; Stern *et al.*, 1999) seeks to explain environmentally-significant behaviors. While fisheries leadership may not entirely be an environmental behavior per se, we believe that a modified VBN – used as a framework to organize comments about threat perceptions, actor objectives, and propensity to act in certain ways – is useful for framing thinking about SSF fisheries leadership. A key insight from VBN theory is that threat salience is influenced by a number of factors (i.e., cultural context, prior experiences, core values, access to information, and an actor's capabilities – Figure 4-3) that will affect the propensity of that actor to take action and influence the intensity of engagement, subject to institutional constraints. In theory, the more deeply rooted an individual's beliefs are, the more likely an individual is to be aware of the consequences of their behavior (López-Mosquera & Sánchez, 2012). Beyond environmental threat salience research, we believe that the theory can also be applied to perceptions of new opportunities that affect an individual's propensity to engage in behaviors that advance personal goals or become engaged with higher level entities or organizations that have goals reflecting the core values of that individual. For example, an individual fisher would be more likely to engage in a local SSF management if government organizations enforced rules against poaching by community outsiders.

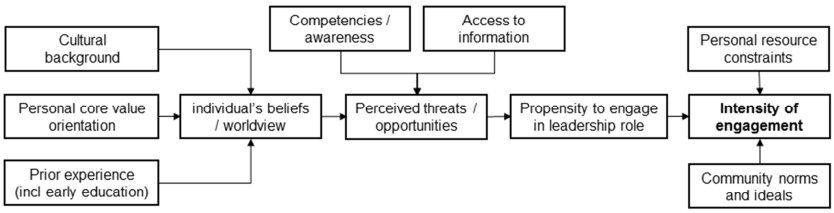


Figure 4-3 – Framing how individuals make choices about leadership engagement

In the context of SSF leadership, individual leaders play a dual role: they act as individuals, making choices about personal actions that fulfill their objectives at the household level; and they also make decisions regarding community-level leadership actions. It is important to distinguish between the two because taking on a leadership role actually means that an individual also formally or informally fills a position at a level higher than the household level. Thus, attention needs to be paid to untangling the actions of individuals and to whether they are acting on behalf of their own household or as an actor with a particular SSF management role to fulfill.

An individual's experience of working in a certain management or leadership context can shape their motivations to participate in future projects. Experiences with successful projects build reputation and credibility that can encourage future participation, while experiences with unsuccessful projects can discourage future participation. Social memory is the mechanism in which information regarding experiences is stored (Adger *et al.*, 2005) and is embedded through community discussions and decision-making (McIntosh, 2000).

4.5.1.3 Cultural values

Cultural values such as freedom, prosperity and security represent shared ideas about what is good, right and desirable in a society (Williams, 1970). Cultural values guide people to understand which behaviors are appropriate in various situations (Schwartz, 1999). Cultural values are numerous and can differ substantially between countries. Schwartz (2012) asserted that some values are congruent with each other while others conflict (Figure 4-4).

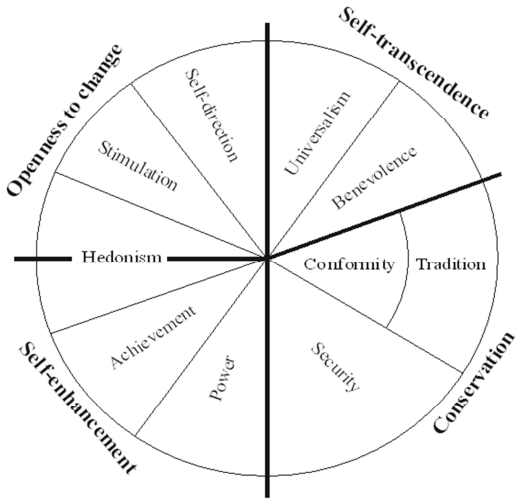


Figure 4-4 – Opposing value types (Schwartz, 2012)

With four quadrants, Schwartz (2012) defines the four major values types: openness to change; self-transcendence; conservation; and self-enhancement. The closer the values are, the more similar their underlying motivations, while the more distant they are, the more antagonist their underlying motivations (Schwartz, 2012). Therefore, conflicts can arise between individuals and groups that hold different values. The value of openness to change relative to the values of conservation captures the tension between independent thought and readiness to change, and values that encourage order,

preservation of the past and resistance to change. Differences of values emphasizing self-enhancement relative to self-transcendence capture potential tensions between the concern for the interests of others (and the environment) and the pursuit of one's own interest.

In synthesis, the IAD framework, and the VBN and cultural value theories facilitate the in-depth analysis of leadership. Individual-level factors we focus on include cultural values, prior experiences, and access to information, all of which influence an individual's propensity to engage in leadership roles. The link between individual-level factors and propensity to engage in leadership is based on the VBN theory (Figure 4-3). The intensity of engagement is constrained by capital assets (e.g., financial and social capital) and community-level activities (Figures 4-1 and 4-2). Higher level factors at the political level directly and indirectly influence local-level leadership through policy direction and regulation setting.

4.5.2 Empirical implementation

4.5.2.1 Interview questions

To collect contextual information on leadership we used semi-structured interviews that offered participants the chance to explore issues they perceived as important (Longhurst, 2010). Interviews started with a general discussion on the fishery to obtain information about the fish stocks targeted, fishing methods used, perceived health of stocks and the environment, and governance arrangements. We then asked four theoretically-guided questions (listed below) to help direct a conversation. Participants thus had the opportunity to develop arguments and engage in open discussions regarding key issues while minimizing interview time (Weiss, 1995).

How do individuals come to be community leaders? The effectiveness of local leadership is related to the legitimacy or credibility of a leader. Theory assumes that individuals who have a connection to the community or who originate from the community are likely to be successful leaders (Ostrom, 2009). Legitimacy can also be enhanced through formal processes of elections and rotations (Hollander & Julian, 1970). In our interviews we sought to explicate the processes by which leaders most commonly emerges, and the conditions and factors that aided or hindered this emergence from an individual role as householder or small business person to an actor that took on a formal or informal leadership role at the community level.

Why do people get involved with leadership roles? Motivations are an important precursor to the performance of certain behaviors (Giberson *et al.*, 2005). The expression of inherent values is shown through motivations to act. Motivations can determine whether an individual will act in self-interest or for the interest of the wider community (Schwartz

& Bilsky, 1987). Deciphering an individual's motivation for becoming involved with SSF leadership roles is therefore crucial.

Are potential leaders prepared for leadership roles? Capacity building is often provided to local communities as part of CBFM projects (Pomeroy & Rivera-Guieb, 2005). Training programs are either directed at the wider community, specific key interest groups, or current leaders. Capacity building increases an individual's knowledge and skills, which can be then utilized in an action arena (Stern, 2000). Our question aimed to explore a range of tools and approaches used to enhance leaders' ability to function in SSF management.

Do individuals receive external assistance to enhance their leadership capacity and meet their responsibilities as a leader? The introduction of CBFM structures often puts additional pressure on community resources. In many instances local organizations do not have the capacity to facilitate CBFM. For those communities, external assistance in terms of leadership, technical assistance, and the facilitation of access to resources is required (Pomeroy *et al.*, 2001).

Do you think there will be any challenges to leadership going on into the future? In addition to four theoretically guided questions, we included one final question that asked respondents to identify key future challenges regarding leadership in SSFs. The aim was to link leadership emergence to broader environmental, economic, political, and social landscapes.

4.5.2.2 Sampling method

We selected cases deliberately to help ensure we covered as broad a range as possible of case study configurations, and to obtain opinions from individuals with diverse expertise. Four contextual variables that were potentially important for SSF success were used to broadly identify 16 general types of case study configurations: development status of the country where the fishery was located; whether fishers regularly participated in CBFM; fishery complexity, defined simply as single-species versus multi-species fisheries; and management status (i.e., how established the SSF management arrangement was) (Table 4-1). Our aim was to include at least one case study from each of those possible combinations. Sampling was therefore theoretically-informed rather than random or representative. Once as many variable combinations as possible were covered with at least one interviewee, we added interviews opportunistically across case types until we reached our target of at least 50 interviews in total (a reasonable number for future Qualitative Comparative Analysis research – see Sutton & Rudd, 2015).

Table 4-1- Number of case studies for each configuration type

Configuration	Development status	Fishery participation	Fishery complexity	Management arrangement	Number of cases
1	1	1	1	1	11
2	1	1	1	0	7
3	1	1	0	1	2
4	1	1	0	0	4
5	1	0	1	1	2
6	1	0	1	0	1
7	1	0	0	1	1
8	1	0	0	0	3
9	0	1	1	1	3
10	0	1	1	0	2
11	0	1	0	1	3
12	0	1	0	0	6
13	0	0	1	1	0
14	0	0	1	0	1
15	0	0	0	1	3
16	0	0	0	0	5

Development status: using Human Development Index (HDI), cases in very high and high HDI nations were ranked 1, and cases in medium and low HDI nations were ranked 0. Fisher participation: if fishers regularly participated in CBFM decision-making the case was ranked 1 and if not, the case was ranked 0. Fishery complexity: if the case SSF was mostly single-species in focus, the case is ranked 1 and if mostly a multi-species focus, the case is ranked 0. Management arrangements: if SSF management techniques were fully established, the case study was ranked 1 and if new or unestablished, the case study was ranked 0.

Potential case studies were identified using academic journals, organization websites, project reports, and the Too Big to Ignore (TBTI) SSF database (toobigtoignore.net/issf/). After case studies were identified, potential interviewees were contacted via email. Our criterion for selecting interviewees was based on their involvement with the SSF. To be involved in this research, the individual had to either be a researcher of, or a practitioner within, a focused SSF. As such, our respondents included academic researchers, government scientists, representatives from NGOs and leaders in community-based organizations. This ensured we covered a range of insights and opinions on SSF leadership from individuals in different regions and with different backgrounds. Of 200 individuals contacted globally, interviews (via Skype or Google Hangouts) were conducted with 54 respondents between January and July 2015.

Kingdon (2003) defined leadership as key individuals who by their skills, experience and personal characteristics are justified in being a central and influential role in social processes. Due to the complexity of leadership, the lack of a common definition for SSF leadership, and the difference in leadership structures between SSF communities, we decided not to have a fixed definition of leadership. Instead we left respondents to define leadership in a manner that was appropriate to their case study; for example, this included a single individual or a group of individuals, external or internal actors, and informal or formal leaders. As we took insights from both academics and practitioners, we had an even mix of respondents who were researchers or advisors to the SSF, and respondents who were themselves leaders.

Interview questions were approved by the Department of Environment research ethics committee at the University of York in November 2014. Confidentiality agreements were signed by all interviewees and transcripts were stored on a private device.

4.5.2.3 Data analysis

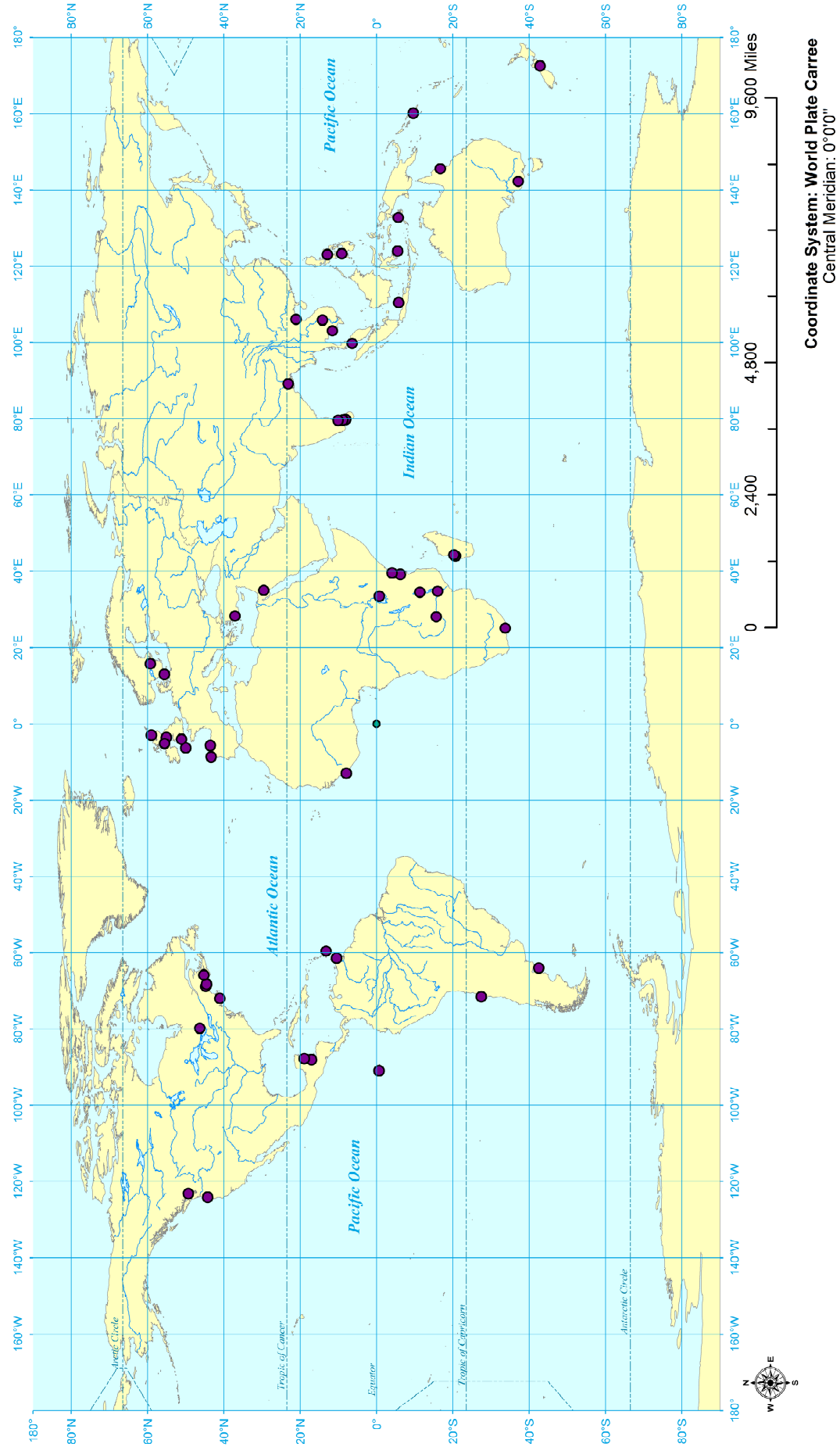
Interviews were transcribed and coded using NVivo software (www.qsrinternational.com). Theme identification is important to show recurrent unifying concepts or statements within data (Boyatzis, 1998). *A priori* themes were defined drawing on terminology likely to be important for theoretically-informed discussions of SSF leadership performance (i.e., terms relating to potential precursors to individual action; individual and community level action choices and constraints; interactions between various social groups; and higher level socio-political influences). As the interview transcripts were analyzed, themes and sub-themes were modified, refined and often combined to improve clarity. Further, theme structure evolved inductively with emergent themes reflecting representation of unanticipated interview responses (Bradley *et al.*, 2007).

4.6 Results and discussion

4.6.1 Interview results

Our 54 interviews covered 52 case studies and 15 of 16 case study configurations (Table 4-1) from 34 countries (Figure 4-5). Conversations lasted between 30 to 120 minutes, resulting in over 46 hours of interview recordings that were subsequently transcribed for textual analysis. In our subsequent reporting of results, we summarize the number of respondents who made reference to particular themes and provide selected interview excerpts. For confidentiality purposes, respondents are numbered R1, R2, etc. This research relied on the opinions and views expressed by our respondents. The potential for biases among our respondents was, we hope, minimized by collecting and reporting on information from a wide range of interviewees across diverse case configurations.

Figure 4-5 – Map showing case study locations



4.6.2 Factors affecting individuals' propensity to engage with leadership

4.6.2.1 Cultural background

Individuals' perceived threats and propensity for taking action are influenced by shared culture and unique personal experiences. Culture influences an individual's behavior by shaping a repertoire of shared habits, skills, and values (Swidler, 1986). Cultural conditions can be either conducive for collective action or act as a barrier (di Falco & Bulte, 2011; Pomeroy *et al.*, 2004), and either can influence leadership potential. We found cases studies in this research that exhibited both possibilities, where cultural context was conducive to collective action and vice versa (Table 4-2).

Table 4-2 – Cultural values facilitate or restrict leadership/collective action in SSF management

Key findings	Comments/tally
Fishing is an important part of cultural identity which incentivizes leadership and community participation in SSF management	7
Culture is not conducive to leadership and community participation in SSF management	4

Seven of our cases studies highlighted cultural contexts that facilitated collective action. For small-scale aquaculture in northern Sri Lanka, collective action was traditionally practiced in cooperatives and associations. R1 emphasized that "if people are used to working collaboratively, its's easier." Fisheries and fish resources were an important part of the community's cultural identity in Velondraike, Madagascar. R2 stated that "it's completely intertwined with who they are as people", so that consequently community members actively participated in activities which focused on protecting those resources. Religion also influenced fishing activity and conservation measures. In Bangladesh, fishing activities ceased in line with Hindu and Muslim festivals. R3 noted that fishers have built a special connection to the fisheries, which has helped place a conservation value on fish stocks. The relative homogeneity of communities in the Khong District, Laos – in terms of ethnicity, language and culture – enabled effective information exchange between community members. R4 reported that this enabled individuals to easily evaluate the actions of others.

For other contexts, collective action was hindered by cultural influences. In many SSFs, fishers had individualistic tendencies, which reduced the likelihood of collective action and of following a leader. R8 described the Bajau fishers of Wakatobi, Indonesia, as "rugged in their individualism" and questioned "why on earth would they accept someone being a leader, when they know everything they need to know." Similarly, fishers in

Scotland preferred to act independently of regional grouping; that independent orientation, which was a valued trait among fishers in the region, hindered the potential of CBFM (R9).

In part, a fisher's individualism is attributed to the characteristics of the resource. Fisheries are a common pool resource, characterized by two defining features, excludability and subtractability. When fish stocks are declining, this can place fishers under pressure to participate in a race to fish (Ostrom, 1990). Independence and individualistic tendencies should not be regarded as undesirable characteristics, as they encourage the propensity to think and behave freely, facilitating the ability to make quick decisions (Poggie, 1980). However, in those cases, what is the likelihood of fishers working collectively, following a leader or becoming a leader themselves? Poggie (1980) recognized that CBFM needs to be compatible with the psycho-cultural characteristics of the fishing community: new management structures should encourage free thought in decision-making, independence, and the creation of community ownership whenever possible.

4.6.2.2 Core values

Our respondents highlighted that individuals have different motivations for leadership (Table 4-3). The motivation of a leader influences his or her behavior and can consequently significantly influence the overall effectiveness of the organization (Giberson *et al.,* 2005). We found that altruistic, self-enhancing, and environmental motivations all played motivating roles for individuals to engage as leaders in differing cases.

Table 4-3- Core values are expressed in motivations for taking on leadership roles

Key findings	**Comments/tally**
Individuals become involved due to altruistic values	9
Individuals become involved due to the opportunities of self enhancement	18
Livelihoods (13 out of 18)	
Connections (3 out of 18)	
Social recognition (2 out of 18)	
Individuals become involved due to environmental values	7

Nine respondents attributed motivation for leadership to altruistic factors. In western Canada, R12 noted that older fishers believed that "it's time to give a little business back to the industry, the industry has been good to me and I'm going to put my time in." Similarly, older fishers in Bangladesh were found to be motivated to, "support their community and ensure the continued livelihoods for future generations" (R3). In Cambodia, R10 recognized that there will always be a member of the community who is committed to improving the life of community members.

Many leaders were motivated for self-enhancement purposes. Simply getting paid was enough encouragement for poorer individuals in Malawi and Tanzania to take on leadership roles. Securing livelihood opportunities was particularly important in western Canada: "I think a lot of it is that this is their livelihood, this is how they and their families survive" (R12). The connections made with external, influential actors through leadership activities are a second motivating factor. One respondent (R17) stated that "individuals [in Argentina] are always trying to get help or trying to connect themselves to other levels, politically". R13 noted that leadership in Spain "brings all sorts of benefits, because you are the linking organization between all the fishers and the government; I think that's a big motivation." Social recognition was also a motivating factor according to two of our respondents. In Australia, R18 highlighted that fishers "are proud of the recognition they receive…they tend to be held in high regard by their communities and this social license is important to them and their families." In Laos, "leaders are people who were more interested in the prestige of the position, in the sense that they wanted to be known in their communities as important people" (R4).

Environmental values were attributed as motivating factors by seven respondents. A member of a local environmental group in Taunton Bay, Maine had little confidence in the State government; his motivation for participating was to represent sound environmental policy (R23). In the Philippines, R29 highlighted that leaders "do not get paid for the work, it is purely a voluntary service, they believe in the cause of resource conservation and protection." Similarly, R30 commented that the leader of a marine protected area (MPA) in Spain was a local university professor; "he was on a mission for sustainability; he was really passionate about it."

Our findings offer insight into the motivations of leaders in SSF and highlight different value structures. In line with the work of Schwartz (2012), it is possible to hypothesize that individuals with altruistic or biospheric tendencies are more likely to serve collective interests for the good of conservation, whilst those who express self-enhancement values are more likely to serve individual interests. However, individuals have multiple values which emerge at different times calling for a temporal component to future leadership research.

4.6.2.3 Prior life experience – early education

Our respondents identified education as a key factor that influenced fishers' behavior. The introduction or re-establishment of participatory approaches often included elements of education, training or capacity building. Education increases awareness and influences perceptions and beliefs that guide human behavior (Hungerford & Volk, 1990;

Stern, 2000). Multiple educational approaches for increasing awareness were practiced in our case studies and targeted both children and adults. As early education is thought to influence threat salience and behavioral choice via its effect on worldviews (as opposed to skills- and awareness-building in adults, which can more directly and immediately affect perceptions regarding threat salience (Stern, 2000)), we deal with each separately.

Marine programs were developed for school children in seven countries including Tanzania and the Philippines. Increasing awareness from a young age embedded the importance of marine ecosystem sustainability (Table 4-4). R7 reported that after two decades of the marine program on Apo Island in the Philippines, local children had a strong sense of place and their marine environment was 'sacred' to them. Similarly, an MPA organized by the Community of Arran Seabed Trust (COAST) in Scotland, UK, has received strong support from the local community. R19 attributed that level of support to "the continued presence of COAST at community events and awareness raising activities for children in local schools."

Table 4-4 - Prior experiences influenced engagement through multiple pathways

Key findings	**Comments/tally**
Early childhood education increased the awareness of local people of all ages	7

4.6.2.4 Human capital – adult education and awareness of SSF threats and opportunities

Human capital refers to the stock of knowledge that individuals possess in an action arena. The ability for individuals to adopt more profitable and secure livelihood strategies from SSF is in part dependent on education (Dercon & Krishnan, 1996). Adult members of the community benefited from awareness building opportunities that were created through the development of workshops, training programs, and community events (Table 4-5). R3 reported that programs in Bangladesh taught local fishers how to brand their fishery products and participate in micro-credit programs. The development of a co-management program in Spain increased local awareness of the importance of local fisheries resources to the local livelihoods. Consequently, R13 noted that fishermen were volunteering more of their time to participate in surveillance and monitoring. R30 reported that local ecological knowledge, a form of knowledge held by local resource users, was incorporated in Spanish MPA proposals, and that this "fostered a sense of ownership and that's what made it succeed."

Table 4-5- Human capital at the local level impacts an individual's ability to lead

Key findings	Comments/tally
Awareness of other opportunities has reduced motivation to remain in the SSF industry	6
Fishers have poor educational levels that can inhibit participation in SSF leadership	8

Many local fishers, however, have minimal formal education, and this can reduce their ability to participate in CBFM (Glaser, 2003; Hollup, 2000; Vedeld, 2000), a point that was reiterated by our respondents. In Sweden, R6 highlighted that language barriers hindered local fishers in their application for a Marine Stewardship Council (MSC) certification, which recognizes the sustainability of a fishery. Similarly, few community members had the level of education required for higher level positions of an MPA authority in Tanzania; R24 reported that "you have to be able to write on the computer and you have to be able to write in English, so that limits the number of people who can apply to the job." Many individuals simply do not have the capacity or disposition to be leaders. Respondents from the UK, Chile, Canada, and Ecuador highlighted that little or no capacity-building was targeted specifically at leadership. Lack of capacity-building for leadership was attributed to poor funding opportunities or leaders having too little time to attend workshops. Capacity building for leadership was provided for Beach Management Units (BMUs) around Lake Malawi and Lake Victoria in East Africa. However, R31 stated that local fisheries officers did not have the capacity to transfer knowledge on to their successors, and R22 added that training was one-off in nature, not followed by successive training that built skills over time.

Several of our interviewees also reported that increased levels of awareness regarding other livelihood and investment opportunities, combined with the uncertain nature of fishing, could deter individuals from remaining in SSFs. In the Philippines, fishers were "less interested in managing the fishery because they don't depend on it anymore" (R32). In Argentina, "the sons and daughters of fishermen don't want to continue in fishing" (R17). Similarly, R31 emphasized that fishers around Lake Victoria were beginning to invest more in their children's education and that, as they did, their motivation to participate in SSF collective action, leadership and management was diminishing.

4.6.2.5 Access to resources

4.6.2.5.1 Financial capital

Many small-scale fishers are extremely poor and live well below the poverty line (Béné, 2003). Financial capital at the individual level is therefore often limited. Our

respondents noted that fishers' poverty levels impacted on their ability to participate in CBFM in Tanzania, Bangladesh, Malawi, and Madagascar. In Vietnam, R15 stated that "the folks on board are also actively engaged in securing a livelihood, so there isn't a huge amount of time to spend doing project activities. This was reiterated by R37 who recognized that "people may be willing (to participate) but not able… an individual, whose livelihood relies on them being out in the industry – that is a constant problem…it's a catch 22." Timing issues were exacerbated by fishers working hours that are highly influenced by tides, and R23 reported, "no matter how carefully we planned, securing 100% attendance was impossible." Fishermen are increasingly being put under greater pressure due to dangerous working conditions, reduced stocks, and stricter regulations. It is inevitable that time will become even more restricted in the future (Salas *et al.*, 2007). Therefore, the need to provide a secure income reduces the time fishers can devote to both leadership roles and collective action (Table 4-6).

Table 4-6 - Financial capital influences leadership potential

Key findings	**Comments/tally**
Many individuals have too little money to be involved in leadership activities	8
Many individuals have too little time to be involved in leadership activities	6
Mechanisms that strengthen social capital	4

Manufactured capital such as fishing boats and technology are the stock of produced assets that people use over time (Rudd, 2004). The importance of manufactured capital was referred to by two of our respondents. Although this is a low level of coverage, we included it as a distinct category to emphasize the importance of further research on the influence of manufactured capital on leadership. In Bangladesh and Indonesia, a fisher's access to boats was the basis of their leadership. For the Bajau in Wakatobi, formal leadership among community members was an uncommon occurrence. However, R8 confirmed that "temporary leadership can emerge if an individual gets a bit more money, who maybe owns three boats and has a crew…this isn't policy-based leadership, it's fisheries-based leadership but not because of the need to manage the fishery, it's just what you do to run your business."

4.6.2.5.2 Social capital

Social capital is an asset built on social networks (Rudd, 2000; Krishna, 2002). It facilitates the transmission of information and reputation, and is a key factor influencing the socio-ecological sustainability of CBFM (Rudd, 2004). While social capital by definition needs multiple actors to function, one can conceptualize that an individual's

access to social capital – their niche in the network – strongly affects their capacity to engage as an effective leader. Social capital is also an important resource from an organizational perspective at higher levels of management and political choice processes.

Social capital was an important influencing factor in our case studies (Table 4-7**)**. Trust and confidence between community members decreased the need for strict enforcement in the tilefish fishery in northeast USA (R42). Limited bonding social capital, or the bonds between likeminded people, was, however, also reported at the individual level. Poor social cohesion between fishers prevented collective action in the Galapagos Islands, Ecuador. R43 attributed this to the prevalence of fishers from mainland Ecuador who had stronger connections to their home communities. In Western Australia, bonding social capital was commonly weak among abalone fishers; R44 argued that this was due to "the historically fractious relationships between fishers." R5 recognized that social bonding between community members around the shore of Lake Malawi needed to be strengthened in order for shared objectives to be developed.

Table 4-7- Human capital at the local level impacts an individual's ability to lead

Key findings	**Comments/tally**
Social capital is apparent in the SSF community	6
Social capital is not apparent in the SSF community	4
Mechanisms that strengthen social capital	4

A potential mechanism for increasing social capital was also highlighted. Experiences of working collectively are stored in the social memory of communities (Adger *et al.*, 2005). Members of SSF organizations in Spain and Malawi who participated in prior CBFM projects had heightened confidence and trust in their collaborations with other fishers. In these communities, leaders used the experience of working collectively and the social memory of the fishing community to participate more effectively in subsequent projects.

4.6.3 Community level leadership issues

4.6.3.1 Leadership legitimacy

At the community level, individuals need to be considered in relation to the formal role that they play as leaders in fisheries management. Legitimacy is a psychological property of leadership that allows followers to perceive appropriate, proper, and just leadership (Tyler, 2005). Legitimacy is the common way of signaling acknowledgement of a leader (Hollander, 2012). By accepting a leader, followers influence the strength of a leader's influence and consequently the performance of the group. Over half of our

respondents identified legitimacy as important and highlighted the numerous pathways individuals can become legitimate leaders (Table 4-8).

Table 4-8 - Leadership legitimacy impacts an individual's ability to lead

Key findings	**Comments/tally**
Leaders can gain legitimacy in numerous different ways • Elections (13 out of 36) • Origins (23 out of 36) • Leadership activities (21 out of 36)	36

Legitimacy can be achieved through formalized mechanisms of nominations, elections, and rotations, processes that define boundary rules and provide clarity regarding the leadership role within which individuals are placed and act. Elections also create a heightened psychological difference between followers and leaders (Hollander, 2012). To become a member of an Inshore Fisheries Group (IFGs) in Scotland, R9 reported that an individual had to meet certain criteria outlined by the organization's guidelines. In western Canada, to gain a place on the Board of Directors, prospective members were required to be nominated and elected by current members (R12). Individuals from regional groupings in New Zealand were nominated to become representatives on the New Zealand Rock Lobster Industry Council (NZRLIC) by other community members (R20). Elections increase legitimacy, but in some circumstances elections can also lead to unrealistic expectations of leaders and consequently they can become the subject of criticism (Hollander & Julian, 1970). Elections can, for instance, be corrupt (Hauck & Sowman, 2001) or poorly executed in the face of community members' low literacy rates (Xu & Ribot, 2004).

Our case studies reiterated that the geographic origin of a leader can be important for leadership legitimacy. Local leaders who have a deep understanding of local processes and cultures are essential for collective action (Beem, 2007; Bodin & Crona, 2008; Gutierrez *et al.*, 2011; Meaton & Low, 2003; Olsson *et al.*, 2004). *Calettas* or fishing federations in Chile have strong social bonds, leading R33 to assert that when someone comes from another area, "he will always be an outsider." Leadership positions were maintained within family units in Quinta Roo, Mexico, and Apo Island (despite formal elections for barangay leadership in the Philippines). SSF leaders were also found to be traditional leaders in Malawi, Canada, Vietnam, Laos, the Philippines, and Malaysia, a factor that helped increase their legitimacy among community members.

A leader's legitimacy can also be enhanced through his or her actions. In our case studies, a leaders' legitimacy was strengthened via their reputation, and the trust, accountability, and transparency that they engendered. In Madagascar, R34 noted that

"community members have seen the benefit (of their leader), so trust had already been developed." Similarly, in the Philippines, R29 highlighted that "although leaders do not possess leadership skills at first, they evolve to be good leaders because of their first-hand knowledge…they gain the trust of the people in the community." The most important criteria of developing leadership in Jordan fisheries were transparency and openness (R25 and R26).

4.6.3.2 Leaderful issues at community level

Creating 'leaderful' organizations can be important for SSFs. A leaderful organization encourages each member of the community to gain experience of being a leader concurrently and collectively (Raelin, 2003). Due to the difficulties of leadership succession, it is important to expand the focus of leadership. The image of 'successful leaders' has to shift from developing individual leaders to developing 'leaderful organizations' of multiple leaders (Al Mamun, 2015), thereby increasing the pool of potential leaders. Succession is a social process determined by the interactions between leaders and their constituents, and the capabilities of local communities to produce new leaders (Hart, 1993). Our respondents identified several concerns about leadership succession (Table 4-9) and techniques to potentially facilitate more successful leadership succession planning.

Table 4-9 - Succession is a beneficial attribute that helps in the longevity of successful leadership

Key findings	**Comments/tally**
Concerns of the ability to produce successors for leadership • Motivation (6 out of 24) • Poor capacity building (13 out of 24) • Lack of up-and-coming leaders (8 out of 24) • Barriers to young people (4 out of 24)	24
Techniques to ensure successful succession planning	20

Motivation was found to be a limiting factor in leadership succession. R5 noted that local chiefs in Malawi had minimal motivation for leadership, as CBFM projects were implemented by the government. Reduced motivation among SSF leaders in Argentina was due to fluctuating support from governmental departments and poor success rates of prior CBFM projects; R17 reported that "the fishers started with a lot of motivation and strength, but the same people who are still in the fisheries are tired of continuing…it's really difficult to maintain the motivation." Similarly, R30 stated that due to reduced effectiveness of an MPA in Spain, the local leader is "totally deflated, he doesn't want to be involved anymore."

Leadership succession was impacted by the lack of up-and-coming leaders. In northern Scotland, R50 reported that "we put an advert in the local press and invited applications from anybody who was interested…we didn't get many people who were interested." A limited pool of potential leaders was also experienced in Taunton Bay, Maine; R23 commented that the "area and the resource were just too small…we were a very limited number of people who were interested and that meant we were an inbred group by the end, we didn't get the fresh blood we were hoping for."

An aging population of fishers contributed to concerns regarding leadership succession. Reporting from Spain, R13 noted that "many of the community leaders in the gooseneck barnacle industry are older, which could be problematic considering the dangerous nature of the fishery." R12 added that with the retirement of older fishers, years of cooperative expertise and local knowledge was likely to be lost. Despite concerns of an aging population, barriers to young, nascent leaders were also highlighted in some cases. In Tanzania, India, and Malaysia, older members of the community often discounted the authority of young members. R24 recognized that "you have an older guy and he doesn't want to listen to the younger guy who was supposed to be a leader, it's very difficult – it's definitely a cultural thing."

To overcome concerns of leadership succession, new approaches should be developed to ensure the longevity of leadership. Capacity building was used in several of our case studies as a method to train individuals for leadership. A non-governmental organization (NGO) called Blue Ventures provided newly elected individuals in Bel Sur Mer, Madagascar, training in leadership and organization management skills (R2). R35 reported that in a regional project in the Caribbean, local fishers were given the opportunity to attend capacity building workshops and conferences on SSF. Similarly, R28 who worked for an NGO in Mexico, stated "over the last three years, we have worked quite heavily on leadership, working on administration and business training, because it's not something they are used to." Succession planning, the process which stabilizes the occupancy of key positions and consequently helps to ensure the continued effective performance of an organization (Rothwell, 2010), is also explicitly needed.

4.6.3.3 Vertical collaborations between communities and agencies

Nesting CBFM organizations in numerous institutional layers is crucial (Dietz *et al.*, 2003). Community-based management has been reported to fail when communities lack linkages to higher levels of government (Cudney-Bueno & Basurto, 2009; Lejano & Ingram, 2007). Our cases studies reiterated the benefits of establishing and strengthening ties to different levels of SSF management organizations (Table 4-10). Linking social

capital is important to this process and refers to the ability of groups to engage with external agencies to either influence policies or resource allocations (Pretty, 2003; Rudd, 2000).

Table 4-10- Interactions between different SSF organizations/agencies at different levels affect leadership

Key findings	Comments/tally
Horizontal and vertical linkages are beneficial for leadership groups	13
Young, educated leaders are crucial in securing and enhancing linking social capital	4

Several of the fishing organizations in our cases studies demonstrated effective linking roles. Fishing federations in Chile's co-management structure played important boundary spanning roles by communicating community issues to state agencies and vice versa (R36). The New Zealand Rock Lobster Industry Council (NZRLIC) provided a method of linking regional groups with the government in New Zealand. Our respondents also noted methods of enhancing linking social capital. In the Caribbean, R35 recommended the use of neutral platforms to facilitate the interaction of different actors including fishermen and government representatives. Similarly, in India, the Palk Bay Fisheries Management Platform was created to bring together key fishing stakeholders (R46).

Local leaders are crucial in establishing and enhancing linking social capital. A key factor in the ability of communities to interact with higher levels of SSF management is the presence of educated, young individuals (Krishna, 2002). These individuals provide a mediating role by dealing with the complex procedures of a state and understanding complicated governmental language. The importance of an educated, younger generation was reiterated by our respondents. In Chile, some younger generations of fishers have been given the opportunity to study technical aspects of fishing and are thus more prepared and educated. R36 stated that these individuals "have a broader perspective on things."

4.6.3.4 Elites and power

Traditional leaders have significant influence over community processes. Traditional leaders include religious or spiritual leaders, caste leaders, and local elites. The potential gains from natural resources such as forestry and fishery products have often enticed local elites to act in self-interest. Consequently, the presence of local elites has been associated with embedded power inequalities and the ineffective use of community resources (Hauck & Sowman, 2001; Kull, 2002; Larson & Ribot, 2004; Njaya, 2007).

Our respondents emphasized that local leadership is not immune from the abuse of elite capture (Table 4-11). R3 noted that formal positions in Bangladeshi co-management were often usurped by rich individuals, who were not members of the fishing community; consequently ethnic fishers (Jalyes) were unable to participate in decision-making. In Indonesia, R45 asserted that CBFM was not the best approach for fisheries management; collaborative or co-management should be implemented to allow for the careful monitoring of community elites by external actors. One respondent also noted that local elites also worked for the interest of the community. R5 commented on a village chief in Malawi who recognized the dangers of elite capture. The chief purposively did not sit on the Beach Village Committee (BVC) but instead orchestrated rotations when committee members became tired or unmotivated to perform leadership responsibilities. R5 referred to this individual as a "benevolent puppet master."

Table 4-11- Elites have a profound influence on CBFM through their leadership

Key findings	Comments/tally
Elites have an influential impact over CBFM for both positive and negative	6

Local elites have a strong influence on CBFM. As our case studies show, the activity of local elites can reduce the legitimacy of local leadership. In addition, the presence of local elites can lead to the dilution of wider community input, corruption, and improper use of community resources (Mahanty *et al.*, 2006). However, elites can also help achieve successful SSF management, for example in Malawi and Mozambique, where traditional leaders have become advisors to SSF committees (Crona & Bodin, 2006).

4.6.3.5 Interaction between leadership groups

Implementing new management structures introduces new institutions, leadership, and potentially new power struggles into SSF communities. As Pinkerton (1989) recognized, key outputs of CBFM to consider are the new relationships that are created between different community organizations. It is especially important to consider how old and new institutions interact, and how power relationships play out (Amy, 1987). The interaction between old and new leadership proved to be an important influencing factor on the effectiveness of local leadership in our case studies (Table 4-12).

Table 4-12 – Harmonious interactions between 'old' and 'new' leadership groups

Key findings	Comments/tally
The interaction between old and new leaders is crucial to the effectiveness of SSF	6

Our case studies highlighted experiences where implementing agencies chose to create new leadership authorities within a community. The Galapagos National Park (GNP) was the main administrator of the Galapagos Marine Reserve. In 2008, the Ecuadorian government approved a new constitution that created a new governing institution called the Galapagos Governing Council (GGC). R43 identified deep uncertainty about the function of the GNP and GGC since the new reforms were implemented in 2008. In Malawi, working relationships between the newly implemented and formalized BVCs and traditional village chiefs continued to influence CBFM effectiveness; R22 emphasized that there is "a blending of management systems where you have the chiefs and the villages on one hand and the government on the other; when there's transparency and accountability it's good and when there's not, it's bad." In the creation of the Gulf of Mannar's Bio-Reserve in India, managing authorities chose not to work through existing leaders but created parallel authorities, although R38 questioned "whether this was an entirely sensible decision." R3 reported that project officials in Bangladeshi co-management arrangements decided to hire new local leaders, as many community members were unhappy with the existing leadership.

Limited research has been conducted on how existing leadership and newly implemented leadership can work together. Our case studies indicated that the transition is often complicated and characterized by uncertainty. Uncertainty is particularly evident in the responsibilities of each leadership group. Community members often questioned the legitimacy of their leaders, which reduced the overall effectiveness of leadership. It is important that agencies implementing CBFM consider the impact new leadership can have on exiting leadership and on the relationships leaders have with SSF communities.

4.6.4 Interactions between local leaders and external actors

CBFM often requires external assistance from organizations such as NGOs, government agencies, and research organizations (Pomeroy *et al.*, 2001). Depending on local leadership capabilities, external actors may need to perform leadership roles. Roles may include identifying management options, providing advice and expertise, and helping in community capacity building. Our respondents outlined a variety of experiences with external leadership (Table 4-13).

Table 4-13- External assistance is important to the effectiveness of SSF leadership

Key findings	Comments/tally
External assistance brings benefits to local SSF groups	10
External assistance is not beneficial to local SSF leadership	9
External leaders are paramount to local groups	12

Several respondents highlighted the positive experiences of working with external leaders. An external leader proved invaluable to local SSF in Argentina; R17 reported that "an outsider from Washington had a lot of experience and knew what was happening in other fisheries and how to manage resources…he organized and invited fishermen, students and researchers to visit communities in Chile, to learn of their experiences." Respondents from Vietnam and the Philippines recognized the work of system thinkers who could leverage important resources from international organizations and link them to communities who required extra help.

Despite the importance of external leaders, barriers were also highlighted that restricted their effectiveness. Reflecting on the work of a governmental representative in Scotland, R50 commented that "does he add anything (to our community)? No, he's not as experienced in businesses as some of us are, he is not experienced in fisheries management, he's not nearly as knowledgeable about the fishery as our fishermen, so what does he add?" Concerns about the capacity of external leaders, in terms of resources and knowledge of local systems, were also highlighted by respondents from Malawi, Bangladesh, Madagascar, and the Solomon Islands.

4.6.5 Higher level political contexts

4.6.5.1 Institutions and management

Institutional design – various management techniques, policy instruments, and other required, permitted, or prohibited activities and outputs – is used to influence SSF resource use at the local level (Ostrom, 1990; Rudd, 2004; Rudd, 2010). Our case studies highlighted how rights-based approaches and direct payments provide economic incentives, which help shape fishers behavior (Table 4-14). If such approaches are designed properly, they provide incentives for fishers to balance resource stewardship, economic efficiency, and social welfare (Castrejón & Charles, 2013).

Table 4-14 - Management techniques influence leadership potential at the local level

Key findings	Comments/tally
Rights based approaches influences behavior at the local level	4
Economic incentives are provided to influence behavior at the local level	3

Rights-based approaches used in our case studies included limited entry, individual transferable quotas (ITQs), individual fishery quota (IFQ) and territorial user rights in fisheries (TURFs). The implementation of rights-based approaches can be contentious due to the exclusion of some community members from the fishery (R12 and R42). R51 recognized that younger members of SSF communities found it difficult to obtain

potentially expensive licenses. In northeast USA, a SSF management plan, which included a limited entry program and an IFQ, was initially met with resentment from excluded fishers. However, after concerns were addressed, R42 reported that the management plan now runs smoothly, has secured rights for local fishers, and has increased cooperation between community members. Similarly, the NZRLIC in New Zealand is made up of nine shares owned by regional groupings and incorporates separate TACs. Through the work of the NZRLIC and the use of TACs, R20 stated that fishers have heightened custodial attitudes resulting in higher levels of environmental stewardship.

Economic incentives can be utilized to motivate fishermen to participate in and comply with CBFM. In a small Jordanian fisheries project, economic opportunities were created for local fishers by project officials who created partnerships with local businesses (R25 and R26). Similarly, in northeast USA, creative marketing ensured local fish was increasingly sold in local restaurants (R42). In Scotland, a major retailer invested in fisheries resources from a remote SSF; R50 noted "if fishermen can see quantifiable advantages of imposed management tools, those tools are more likely to be a hit with them." Payments to cover transport costs and a free lunch were given to participants of co-management projects in East Africa (R31). However, as R5 emphasized, "unfortunately, every time you pay someone for work that is in the collective interest, it reduces their incentive to contribute to anything else in the collective interest without being paid to do so."

Economic incentives are powerful tools used to entice fishers to participate in SSF management. Increased motivation for participation and compliance with regulations was evident in our cases studies for those individuals who have access to rights and/or direct payouts. Those same individuals may be more inclined to follow a leader they perceive will maintain their access to economic incentives or even take on leadership roles themselves to maximize the outputs of their rights. However, as our results allude to, there are limitations to rights-based approaches and direct payouts. Reducing access to fisheries resources has social and economic costs to fishers and their families (Kitts *et al.*, 2007). Poor fishers and younger members of the community are often unable to accces rights, which reduces the likelihood of their participation in CBFM and leadership activities. In addition, the longevity of direct pay-outs influences continued fishers' participation.

4.6.5.2 Influences of political change

An enabling political environment and government support is essential to sustain CBFM (Pomeroy & Berkes, 1997). Changes in government policies can cause knock-on impacts at all levels (Berkes, 2006; Razzaque *et al.*, 2000). Ostrom (1996) found, frequent

top-down changes of national, state, and local authority reduced the motivation of highly effective leaders and fishers to regularly participate in CBFM. Our results support the assertion that policy change creates uncertainty of the longevity of CBFM and is linked to changing attitudes among fishers at the local level (Table 4-15).

Table 4-15- Policy change affects local level leadership capacity/potential

Key findings	Comments/tally
Policy change causes uncertainty in the longevity of SSF organizations	8
Constant policy changes is linked to changing attitudes at the local level (positive and negative)	8

Uncertainty about the longevity of CBFM organizations was evident in several of our case studies. In Argentina, the government went through several structural iterations for fisheries management and a recent change in the head of the Fisheries Department, which resulted in the decline of effective CBFM. R17 reported that "the State no longer supports local initiatives…the constant change and lack of support makes fisheries management difficult." The government of Tanzania leased an island off the coast of Zanzibar to a private company to run a no-take MPA. R24 suggested that the uncertainty surrounding lease renewal was a major concern for the longevity of the MPA. R52 expressed concerns about the uncertainty of continued funding to the English Inshore Fisheries and Conservation Authorities (IFCAs): "at the moment, we are fine; we are fine up until March 2016 when technically the money runs out. And, on paper, there's no more support funding from the government."

Influences of policy uncertainty on individual behavior were reported by our respondents. In New Zealand, the rights-based approach used in the NZRLIC was designed to engender a custodial attitude among fishers. However, R20 recognized that the government has "created so much uncertainty among the continued use of those rights that custodial attitudes and stewardship are being eroded." Reflecting on experiences of working with fishers in a Inshore Fisheries Group, R9 noted that "there's always a bit of suspicion from the fishermen, of anything to do with the government…if you have been in the fishing industry for 20 or 30 years, you will have seen a lot of changes…the fishermen are very wary."

Activity at the government level is important to consider when researching SSF and leadership. Constant policy change and fluctuating government support creates uncertainty about the longevity of CBFM organizations and the flow of government resources available. Importantly, local leaders may be tied to the interests of particular politicians, which can compromise their ability to truly represent SSF communities (Scholtens, 2015).

Our case studies reaffirm that uncertainty is linked to changing attitudes at the local level. Local leaders were found to lose motivation with CBFM in times of constant change due to limited support from government actors, and reduced credibility among community members. Fishers can also become apathetic to management processes, which influences the likelihood of participation.

4.7 Conclusions

"Everything depends on leaders." (R16)

Local leadership is crucial to CBFM and SSF success. Our research explored the factors that influenced the effectiveness of local leadership. Factors that helped shape leadership engagement and effectiveness were evident at multiple levels: the precursors to individual behavior relating to perceptions of threats and opportunities; institutional constraints on behavior at both the individual and community level; and higher level considerations. Interactions between the levels are intricate and complex, and contribute to uncertainty regarding potential leaders' willingness to engage in leadership roles, their balancing of personal versus leadership goals, and the ultimate effectiveness of leadership. Thus, many factors either help or hinder leadership effectiveness, depending on the environmental, social, and political context within which SSFs operate.

Precursors to individual action are numerous and multi-faceted. Our research demonstrated that it can be useful to employ theoretically-derived frameworks to help clarify how individual behaviors are shaped by core values, culture, experiences, and education, and how resource limitations or institutions can constrain leadership engagement. Motivation to participate in leadership can be altruistic in nature (for environment or people) or more narrowly oriented towards self-enhancement. Future CBFM research on how and why individuals decide to become leaders could be useful to help guide interventions that might successfully increase engagement in SSF management. In addition, our respondents highlighted that fishers often display individualistic tendencies. Consideration needs to be given to how likely individuals are to participate in leadership roles or collective action. These fundamental individual characteristics of a SSF community have to be factored in when designing CBFM projects.

Individuals and communities have a stock of capitals that they can use in SSF management. The availability of financial, human, and social capital can hinder or facilitate participation in leadership activities and collective action. At the individual level, we found that financial and human capital often restricted activity to such a point that SSF leadership potential was inhibited. Many fishers do not have the time or money available,

or education level, needed to contribute effectively to SSF management leadership. The need for additional capacity-building aimed at local communities was frequently noted by our respondents. At the community level, the ability to work collectively and to follow a leader is particularly influenced by social capital. Although strong ties between community members were found in many SSF communities, historically fractious relationships between fishers, and between fishers and external actors can significantly reduce the likelihood of collective action.

Interactions between leaders and followers are crucial to the effectiveness of leadership. Our findings suggest that local leadership is strongly influenced by perceptions of legitimacy among the local fishing community. Legitimacy may be achieved or enhanced through elections, by efforts to build reputation and trust, and via the geographic 'credentials' of a leader. We also found, to a lesser degree, that external leaders could also be effective. However, external leaders often have to contend with a lack of trust from communities and limited resources beyond finances, and therefore have a more limited role to play in most SSFs. The ability of a community to produce appropriate leader successors was highlighted as a major concern by our respondents. They recommended developing more 'leaderful organizations' to help facilitate long-term and effective leadership succession.

Finally, our focus was primarily on factors that influenced leadership at the local level. Due to the political nature of leadership, it was also apparent that activities of higher-level actors considerably affected how local leaders could actively engage and be successful in their roles. Thus, there always needs to be consideration of the political environment within which SSFs operate. The uncertainty generated by policy change, in particular, can inhibit effective leadership due to fluctuating government support and access to resources. We found that constant policy change could also lead to the disintegration of relationships and trust between government departments and local actors, reduced motivation among fishers to engage in SSF leadership, and apathy towards SSF management initiatives.

The management and governance of SSFs occurs in complex social environments. Local leadership is extremely important to the functioning of SSFs, and especially in contexts where communities and community organizations are tasked with key management roles in devolved CBFM. Our research outlines a variety of factors that influence the effectiveness of local leadership and that can help inform researchable future hypotheses, which will help further advance empirical and theoretical understanding of the role that local leadership plays in successful SSF management. Further research can build

on this work to further decipher how different social-ecological contexts influence the effectiveness of leadership engagement.

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Chapter 5 Crossing science-policy-societal boundaries to reduce scientific and institutional uncertainty in small-scale fisheries

5.1 Preface

The governance of SSFs is challenging due to the inherent uncertainty, complexity, and interconnectedness of social, ecological, and economical processes. Conventional management of SSFs has frequently been the subject of much criticism. A key issue has been the use of and positioning of science, and the apparent disregard for other knowledge types such as fishers knowledge. This is thought to exacerbate the already low governance potential of SSFs. Integrating scientific knowledge and fisher's knowledge has the potential to reduce the inherent uncertainties of SSFs, and help enhance credibility, legitimacy, and saliency of management efforts. In doing so the boundary between science, policy, and societal processes can potentially become more permeable to knowledge and resource flows.

Chapters Three and Four focused on determining how leadership influences SSF outcomes and identifying the factors that influence effective leadership. Chapter Five is more forward looking and focuses on exploring the positioning of leadership in knowledge integration efforts. I contribute to increasing awareness of the factors that influence knowledge integration and the uptake of new co-produced knowledge into policy making. Data was collected from 54 semi-structured interviews which formed the foundation of my case studies. I frame analysis in terms of scientific credibility, social legitimacy, and policy salience (Cash et al., 2003) and focus on how efforts to increase knowledge integration had been partially or fully successful in reducing uncertainty via push- and pull- boundary crossing initiatives.

This paper is written in the style of Environmental Management to which it was submitted and accepted for publication, subject to minor corrections but without changes to the original text. For consistency and ease of reading, figures and tables have been inserted close to their first reference in the text rather than separated in the publisher's version.

I declare that the work submitted is my own. The contribution by co-authors was as follows:

Dr. Murray Rudd: supervision, review and editing

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Crossing science-policy-societal boundaries to reduce scientific and institutional uncertainty in small-scale fisheries

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5.3 Abstract

The governance of small-scale fisheries (SSF) is challenging due to the uncertainty, complexity and interconnectedness of social, political, ecological and economical processes. Conventional SSF management has focused on a centralized and top-down approach. A major criticism of conventional management is the over-reliance on 'expert science' to guide decision-making and poor consideration of fishers' contextually rich knowledge. That is thought to exacerbate the already low governance potential of SSF. Integrating scientific knowledge with fishers' knowledge is increasingly popular and is often assumed to help reduce levels of biophysical and institutional uncertainties. Many projects aimed at encouraging knowledge integration have, however, been unsuccessful. Our objective in this research was to assess factors that influence knowledge integration and the uptake of integrated knowledge into policy-making. We report results from 54 semi-structured interviews with SSF researchers and practitioners from around the globe. Our analysis is framed in terms of scientific credibility, societal legitimacy and policy saliency, and we discuss cases that have been partially or fully successful in reducing uncertainty via push-and-pull-oriented boundary crossing initiatives. Our findings suggest that two important factors affect the science-policy-societal boundary: a lack of consensus among stakeholders about what constitutes credible knowledge; and institutional uncertainty resulting from shifting policies and leadership change. A lack of training for scientific leaders and an apparent 'shelf-life' for community organizations highlight the importance of ongoing institutional support for knowledge integration projects. Institutional support may be enhanced through such investments such as capacity building and specialized platforms for knowledge integration.

Keywords: small-scale fisheries, institutional uncertainty, leadership, scientific knowledge, fishers' knowledge

5.4 Introduction

The governance of social-ecological systems (SES) such as small-scale fisheries (SSFs) is challenging due to the complexity and interconnectivity of social, ecological, political, and economic processes (Mahon et al., 2008). SSF are assumed to have relatively low governability potential because of these complexities (Jentoft and Bavinck, 2014) as management decisions are frequently made under conditions of uncertainty and unpredictability (Dewulf et al., 2005). Understanding these complexities is crucial due to the contribution of SSFs to local livelihoods and culture (Chuenpagdee et al., 2005), and for the role they play in poverty alleviation and food security globally (Allison and Ellis, 2001; Barnes-Mauthe et al., 2013; Garcia and Rosenberg, 2010).

Conventional SSF management approaches are most often based on a top-down management model with centralized decision-making. A key criticism of these approaches is the positioning and dominance of science as the only important constituent of credible knowledge in the management process. In the conventional management context, an overly narrow use of scientific modeling outputs (e.g., MSY-oriented production models) has implicitly treated fisheries as relatively predictable and controllable (Mahon et al., 2008). Most conventional models have a biological focus (Kolding and van Zwieten, 2011) but neglect key sources of uncertainty arising in ecological systems (Folke et al., 2005) and from the social, economic, cultural, and institutional contextual factors that influence SSF outcomes (Castrejón and Charles, 2013; Garcia and Charles, 2007). The detachment of science from local ecological and social realities has consequently exacerbated the low governability potential of SSF.

There is much evidence of the substantive benefits arising from the integration of fishers' knowledge and mainstream scientific knowledge. Including fisher's knowledge into management decision-making processes is thought to improve the quality and quantity of scientific observations (Johnson and van Densen, 2007), provide new insights, information and knowledge (Edelenbos et al., 2011), and increase fishers trust in decision-making (Kaplan and McCay, 2004). Uncertainty regarding the ecological and social dynamics affecting SSF management can therefore be reduced. However fishers' knowledge still plays a very limited role in SSF management (Johnson, 2010; Johnson and van Densen, 2007; Kaplan and McCay, 2004) The poor integration of fishers' and scientific knowledge has been attributed to intellectual and methodological differences among scientists (Simon and Schiemer, 2015; Rudd, 2015), a lack of consensus regarding

what constitutes credible scientific knowledge (Hind, 2012; Johannes et al, 2000), communication barriers (Dentoni and Klerkx, 2015), and institutional and cultural differences between fishers and scientists (Johnson, 2010).

Many organizations worldwide are thus increasingly advocating for a broadening of conventional management paradigms. Over the past three decades, there has been a noticeable increase in popularity of more community-based, participative, and bottom-up approaches to fishery management (Chuenpagdee et al., 2005; Cinner et al., 2012; Jentoft, 1989). An important aspect of these approaches is the recognition of different knowledge types; bottom-up approaches theoretically facilitate ready integration of local fishers' knowledge into management decision-making processes. Successful knowledge integration often, however, requires a shift in how social actors value different knowledge types and an identification of the barriers that restrict the integration of fishers' knowledge (Soto, 2006). .

Leadership is crucial to SSF management (Gutierrez et al., 2011; Sutton and Rudd, 2014, 2015, 2016). Successful leaders are able to instigate and catalyze management activities (Folke et al., 2005), ensure stability and accountability in times of change (Njaya, 2007), and establish communication channels to external actors (Bodin and Crona, 2008). As Jentoft (2004) recognized, although "knowledge is power", the presence of rich fishers' knowledge does not necessarily ensure effective paradigm broadening and knowledge integration. Therefore local leaders, who have the power to make fishers' knowledge 'heard', have a potentially pivotal role in knowledge integration projects.

Given the ecological and social importance of achieving SSF sustainability in coastal and inland fisheries, it is important to consider how fishers' and scientific knowledge can be more successfully integrated and incorporated into decision-making. In this paper, we report results from 54 semi-structured interviews with SSF researchers and practitioners from around the globe. Our objective was to increase understanding of the factors that influence knowledge integration in SSF management and the uptake of that knowledge into policy-making. We frame our analysis in terms of scientific credibility, societal legitimacy, and policy salience (Cash et al., 2003). Credibility is usually defined in terms of peer-approved methods of evidence production and claims to scientific objectivity, while legitimacy is shaped by perceptions of fairness, appropriateness, and acceptance by multiple audiences, and salience depends on the perceived relevance of evidence to the problems being addressed by societal interventions and discourse. Our focus is on how various participants associated with diverse SSF fisheries have been partially or fully successful in reducing biophysical and institutional uncertainty via push- and pull-oriented boundary crossing initiatives. While our main focus in the broader scope

of our project was on leadership, here we examine both the roles of individual leaders in, and more general issues surrounding, knowledge acquisition and use in the SSF context. This paper helps frame issues regarding the role of evidence and institutional design, and suggests possible solutions that contribute to alleviating the challenges arising from low SSF governability.

5.5 Methodology

5.5.1 Theoretical approach

SSFs typically involve relationships between physical, ecological, and human systems, multi-scale feedback mechanisms, and substantial levels of uncertainty of different types (Berkes et al., 2001; Ostrom, 2009; Sutton and Rudd, 2015). Uncertainty about social and ecological systems can be reduced by formal scientific investigation and by the use of more informal local knowledge applied in specific contexts. Both can help increase our knowledge about how SESs function and the possible ways in which changes in human behavior or governance interventions might affect the system, thereby reducing uncertainty regarding the outcomes of different types of human activity and management actions. In addition, there can be uncertainty about the actual goal of management actions; value-based disagreements can remain even when knowledge about social-ecological dynamics is relatively high (e.g., ongoing political controversy regarding the climate change 'debate' despite a tremendous body of scientific knowledge about the challenge).

One way to conceptualize the problem structuring and knowledge generation challenge is with a 2x2 matrix that considers, on the one hand, clarity regarding the nature of the policy challenge and, on the other hand, the level of knowledge about the problem (Hisschemöller and Hoppe, 1995; Hoppe, 2009; Rudd, 2011). When clarity regarding the relevant policy questions and scientific understanding of the natural and human components of the system are both low, problems are unstructured (i.e., they can be viewed as belonging in a domain of uncertainty). If policy challenges are clear but scientific knowledge is still low, moderately structured problems are in a realm of evidence, where science aligned with problems of importance for policy and society can be directed towards key unknowns in the socio-environmental systems. On the other hand, if knowledge increases but policy challenges remain poorly articulated, unaligned research moves into another moderately structured quadrant, a domain of partisanship, where evidence is used strategically to advance policy solutions aligned with particular values and politics. Only when there is both clarity regarding important policy questions and high levels of knowledge are we dealing with well-structured problems for which we craft institutions, interventions, and investments in a domain of best practices. There are two

main pathways, however, to reach that domain of best practices, either via knowledge-building and value-based contestation, or via policy problem articulation and subsequent knowledge-building activities aligned with policy needs.

The 2x2 clarity–knowledge matrix does not, however, directly incorporate factors relating to societal relevance, which will also affect the feasibility of developing transformative, evidence-based solutions for complex environmental challenges. We believe that it is also advantageous to incorporate a third element, societal legitimacy (Cash et al., 2003), to help frame how different approaches can be used for crossing boundaries between SSF stakeholders, policy-makers, and scientists. Adding a third factor increases the number of boundaries to consider between domains relative to the 2x2 matrix, but we believe that this is a worthwhile trade-off because it helps in the categorization and organization of effective SSF boundary-crossing initiatives and suggests specific hypotheses for future research.

Following Rudd et al.(2014), Figure 5-1 shows a Venn diagram that represents, in set theoretic fashion, the three factors that we consider essential for successful, sustainable SSF fisheries: societal legitimacy; policy salience; and scientific credibility (which we henceforth refer to simply as legitimacy, salience, and credibility in our figures and tables). Our core contention is that to be successful and sustainable, SSF governance must be legitimate, salient, and credible (the overlap at the core of the diagram). We also note that issues must first arise in one of the domains to become relevant to anyone (i.e., issues must arise either through scientific inquiry [e.g., ‘blue skies’ research], emergent policy salience [e.g., horizon scanning processes], or societal legitimacy [e.g., activism]).

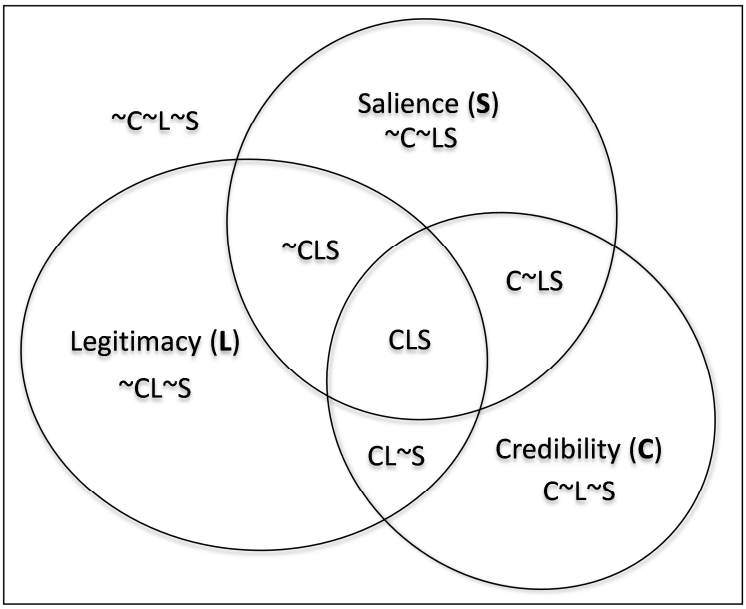

Figure 0-1 - Venn diagram illustrating overlaps between policy salience (S), societal legitimacy (L), and scientific credibility (C) (~ denotes not a member of the set)

The borders between the domains indicate which boundaries exist and need to be crossed in order to reach transformative and sustainable governance solutions (i.e., set CLS), those that are policy salient, socially legitimate, and scientifically credible. The most pressing environmental challenges typically involve complex feedbacks between coupled physical, ecological, and human systems (Liu *et al.*, 2007), and are in need of transformative solutions that span geographical and temporal scales, involve collaborations among researchers from different disciplines, and between those scientists and others from governments, donors and funders, civil society, and the private sector (Hackmann *et al.*, 2014; Weaver *et al.*, 2014).

Each boundary can be fuzzy: the boundary between scientific credibility and societal legitimacy (the dash boundary in Figure 5-2) is particularly important in SSFs as it represents the active debate over what knowledge is viewed as scientifically credible compared to knowledge relegated to the realm of 'pseudo-science' (set ~CLS). The boundary crossing process can be initiated by either a push or pull mechanism. In the case of the science-society boundary, for example, scientists can pull to engage societal stakeholders (e.g., through public awareness building, etc.…), creating societal legitimacy for existing scientific endeavors (i.e., a science pull process to draw the set L closer and increase the overlap with C). Alternatively, they can push to extend the depth and breadth of their scientific activities to expand the scope of societally legitimate knowledge building (e.g., emerging research fields such as environmental justice).

Similarly one could consider the boundary between credible science and policy salience (the dash-dot boundary in Figure 5-2), exploring how different boundary-crossing

processed involved a push (e.g., policies that increased scope for evidence-based decision-making) or pull (e.g., shaping scientific focus by increasing funding for certain topics) by policy-makers or a push (e.g., conducting science more closely aligned with policy needs) or pull (e.g., stimulating demand for science by communicating possibilities for technical or governance innovation) by scientists. A third boundary, which involves societal engagement with science (i.e., pulling science into societally-relevant research topics or expanding the types of issues that scientists feel fall within the bounds of science, is outlined in the dot boundary in Figure 5-2. It is beyond the scope of this paper to categorize each boundary push and pull process; for now we simply note that boundaries exist, they can be fuzzy or disputed, they can potentially be broached via either push or pull mechanisms, and that there are different pathways by which sustainable SSF governance can be achieved. In the material that follows, we introduce and discuss boundaries of particular relevance for our SSF case studies; we refer to boundary crossing in terms that indicates the initial realm, the boundary being crossed, and the direction of the push or pull.

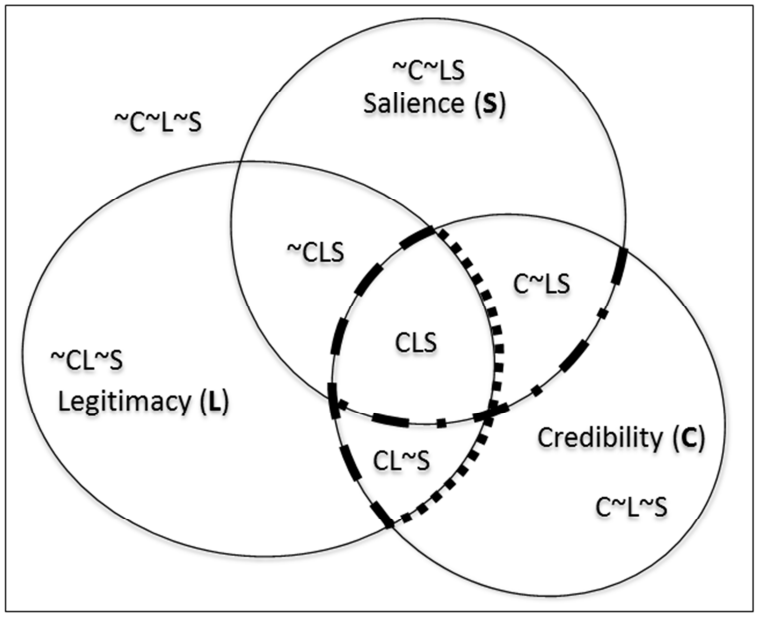

Figure 0-2- Boundaries between scientific credibility and societal legitimacy (dash), policy salience and scientific credibility (dot), and societal legitimacy and scientific credibility (dash-dot)

5.5.2 Empirical implementation

5.5.2.1 Interview question

To conduct our analysis on boundary arrangements and knowledge integration in SSF we required detailed information from particular case studies. Given the diverse contexts within SSFs are undertaken, our strategy was to conduct semi-structured interviews that offered individuals intimately familiar with particular SSFs the opportunity

to explore and develop issues they perceived as important (Longhurst, 2010). The development of interview questions was theoretically guided and designed to facilitate the identification of factors that influence SSF leadership (the primary focus of the larger project within which this paper is situated – Sutton and Rudd, 2015; Sutton and Rudd, 2016). Our list of questions to guide the conversation in semi-structured interviews included:

- How do individuals come to be community leaders?
- Why do people get involved with leadership roles?
- Are potential leaders prepared for leadership roles?
- Do individuals receive external assistance to enhance their leadership capacity and meet their responsibilities as a leader?
- Do you think there will be any challenges to leadership going on into the future?

Within this context, the issues that we examine in this paper – largely surrounding the credibility of knowledge and institutional uncertainty – were emergent themes that arose among many of our interviewees.

5.5.2.2 Sampling and implementation

Case studies were selected systematically to ensure that we covered as broad range of possible case study configurations as possible and diversity in opinions from individuals with diverse experiences and expertise. We organized our sampling strategy around four contextual variables that have been important historically in SSF success: development status of the country where the fishery was located (we used the Human Development Index [HDI] as an indicator); whether fishers regularly participated in fisheries management at the local level; fishery complexity (for clarity, defined as single-species versus mixed-species fisheries); and management arrangement (i.e., how established SSF management was within the broader governance context – less than ten years old indicates the system is relatively new and more than ten years old indicates the system is relatively established). With these four variables, 16 different ‘ideal’ socio-ecological contexts were possible. We aimed to include at least one case study from each of those possible combinations.

Initial contact with potential interview respondents was made via email to ascertain their willingness to participate in semi-structured interviews and, for those who assented, arrange interview times. To be involved in this research, the individual had to either be a researcher of, or practitioner within, a focused SSF. AS such, our respondents included an even spread of academic researchers, government scientists, representatives from NGOs

and leaders in community-based organizations. Interviews were conducted by Skype or Google Hangouts. Once as many combinations from the 16 case types were covered in at least one interview, we conducted interviews opportunistically across case types until we reached our target of at least 50 interviews in total. For a complete breakdown on case study selection and sampling, see Sutton and Rudd (2016).

5.5.2.3 Data analysis

Interviews were fully transcribed and coded in NVivo (www.qsrinternational.com). Themes were identified based on recurring unifying concepts or statements within the data (Boyatzis, 1998). A priori themes were defined drawing on leadership theory and empirical studies which recognized the importance of leadership. For example, we initially focused on themes regarding the origins of a leader (internal versus external candidates), systems of legitimization (e.g. through elections and nominations), motivations of a leader and issues with succession. As additional interview transcripts were analyzed, themes and sub-themes were modified, refined, and combined to improve clarity and new codes were defined to capture emergent themes outside of our a priori expectations.

5.5.2.4 Ethics clearance

Interview questions and procedures were approved by the Environment Department Ethical Review Committee at the University of York in November 2014. Confidentiality agreements were signed by all interviewees and transcripts were stored on a private device. For confidentiality purposes, respondents are numbered R1, R2, etc.

5.6 Results

5.6.1 Interview respondent summary

Of 200 individuals contacted by email, 54 respondents agreed to participate in our interviews between January and July 2015. Interviews lasted between 30 to 120 minutes, resulting in over 46 hours of interview recordings being transcribed for contextual analysis. These represented 52 international SSFs (for two SSFs, we interviewed two individuals) and covered 15 of the 16 idealized case types. The most common case type, with a total of 11 interviewees, was the set [developed country; local fisher participation; single species focus; established fisheries management]. The only case type not represented was the set [developing country; no local fisher participation; single species focus; established fisheries management]. See Sutton and Rudd (2016) for a full sample breakdown. Given our focus on potentially successful and transformative efforts to cross boundaries, we here focus primarily on 18 cases where interviewees specifically raised issues regarding uncertainties of knowledge integration across at least two of three domains (credible

evidence, societal legitimacy, policy salience) and that influenced the effectiveness of SSF management. Those brief case studies are supplemented with comments and insights from some of the other interviews in the Discussion.

5.6.2 Case summaries

5.6.2.1 Nipissing First Nation

Freshwater pickerel or walleye (Sander vitreus) is a main source of nutrition and income for the Nipissing First Nation, who live on the shores of Lake Nipissing in northern Ontario (Bavington, 2015). An agreement on aboriginal and treaty right for fisheries in Canada enabled the Nipissing to sell fresh pickerel commercially starting in 2008. In line with the treaty, the Nipissing First Nation asserted their sovereign rights to manage fisheries within their jurisdiction and refused to accept any externally designed or implemented restrictions. Fisheries decision-making is made at the local level, engages fishers, and draws on local knowledge. Aboriginal fishers are seen as experts who provide credible fishers' knowledge for fisheries management within the First Nations jurisdiction.

Regionally, the declining walleye fishery operates within a broader government management context (https://www.ontario.ca/page/fisheries-management-zone-11-fmz-11). When conventional fisheries science is needed locally, the Nipissing First Nation will employ external scientists or consultants to help them in data collection and analysis. R1 viewed the Nipissing First Nation's relationship with science as "not so much anti-science, but a return to a different way of science, a science of qualities instead of quantities." In terms of positioning within our framework (Figure 5-3), the results from this interview suggest that this SSF may already be operating near the border of zones [CLS] and [~CLS] (societal legitimacy and policy salience are both clearly established in this case). Note that walleye population in Lake Nipissing has been declining and that the Ontario government introduced new management rules in 2014; while Aboriginal consultations were conducted as part of the management review, changes were strongly informed by conventional fisheries stock assessment methods and accounted for diverse user groups active in the area (OMNRF, 2014). Efforts to draw formal scientific information into the local Aboriginal management process (Figure 5-3, solid lines) may help reinforce the perspective that the knowledge of Aboriginal fishers is credible (even if already legitimate from the Nipissing First Nation viewpoint, it may be viewed as pseudo-science [~CLS] by scientists). A heavy focus on quantitative fishery models could, on the other hand, act as a counter force, acting to retract the boundary (Figure 5-3, dashed lines) into a region where fisheries scientists are viewed as the sole providers of credible knowledge. For the Nipissing walleye fishery,

our framework highlights that there is a fundamental tension over what is viewed as credible knowledge for SSF management.

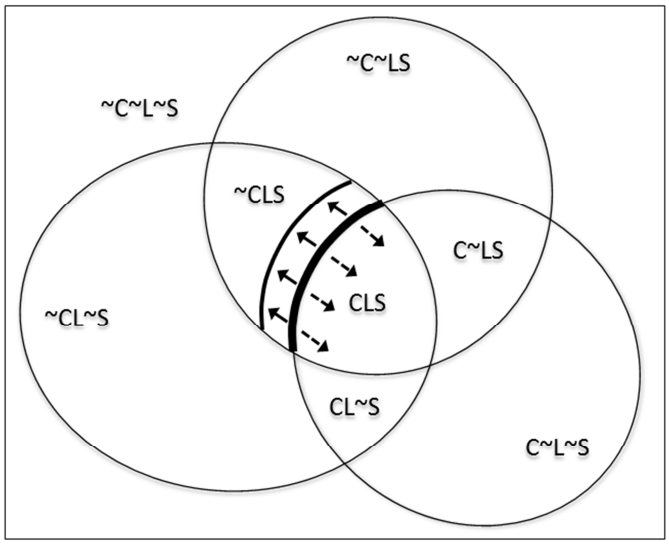

Figure 0-3 - Using science to increase local SSF management capacity

5.6.2.2 Lake Hjälmaren, Sweden

Lake Hjälmaren in Southern Sweden is home to a traditional small-scale pike-perch (*Sander percidae)* fishery. Fishers are organized into a collective that is culturally and socially established within the community. Local individuals are well informed about the status and the biology of the fishery, and collect their own data to generate statistics. In 2006, the fishery was awarded the world's first freshwater fisheries Marine Stewardship Council (MSC) certification in recognition of sustainable fishing processes. The World Wildlife Fund (WWF) was an important player in the initial MSC certification process. In 2013, again encouraged by the WWF, local fishers applied for a second MSC certification.

To help with the second application, the local fishing collective teamed up with a national freshwater fishers' interest organization and WWF helped with technical and administrative aspects of the application. R2, who represented the WWF, noted that the fishers had to overcome substantial barriers in collecting stock data. A major issue was the lack of support from national governing bodies and a local university, who refused to give fishers important data from their archives, perhaps due to opposing motivations. At that point this case study lay near the boundary of [~CLS]. The fishers' organization had attempted to pull science farther into the domain of societal legitimacy albeit with limited success.

The WWF eventually organized a meeting between key stakeholders which enabled more transparent data collection and sharing. For brevity we will not include figures for each of the 18 case studies, but we believe that the efforts helped shift the case so that it was positioned within the [CLS] overlap. This case study shows an example of a pull by fishers (facilitated by an environmental non-governmental organization (NGO)) to encourage governmental and academic input to increase the scope of what was considered credible knowledge. Appendix 3 (pg. 191) summarizes the information for the 18 case studies that are our main focus in this paper.

5.6.2.3 Southwest Inshore Fisheries Group, Scotland

Inshore Fisheries Groups (IFGs) are non-statutory organizations located around the coast of Scotland. IFGs aim to improve the management of inshore fisheries up to six nautical miles and give fishers a voice in management issues. The Southwest IFG is supported in administrative tasks by the Firth of Clyde Forum, in management activities by the Solway Firth Partnership, an independent local charity, and in technical issues by the University of Shetland. The IFG is currently involved with two projects, a trial introduction of creel escape panels and a lobster v-notching scoping study. Creel escape panels are designed to allow juvenile crab and lobsters to escape creels unharmed and v-notching helps to identify and protect breeding females from harvest. Both initiatives are voluntary, enabled by IFG project funding, and aim to conserve valuable commercial stocks. By collecting evidence on the use of traditional fishing grounds and developing a better understanding of lobster stocks, local fishermen may be able to contribute more effectively to management and planning processes.

Despite the IFGs success in instigating local partnerships, R3 expressed concerns of fishers' continued distrust of governmental actors. That was caused by constant policy change: "fishers are wary of any government agency and changes in policy…if you have been in the industry for 20 or 30 years, you will have seen an awful lot of changes." Distrust can hinder participation in management activities and compliance with regulations imposed by the government, and reduces the likelihood of future knowledge integration. The challenge for this case is related to institutional uncertainty arising from shifting policies, presumably due to changing political goals (n.b., policy direction could also shift due to new or evolving government science advice). Recalling Figure 5-2, this case could be positioned at the [CLS]/ [CL~S] boundary. The relatively high level of policy uncertainty, and the symptoms such as distrust that arise due to that uncertainty, imply that the policy salience set in the Venn diagram may be barely overlapping with the societal legitimacy set. R2 flagged capacity building as an approach to alleviate policy uncertainty;

capacity-building through research with external partners increases fishers' levels of awareness and capability of communicating effectively with political actors. R3 noted that as the IFG is relatively new, it has the potential to provide a platform where different stakeholders can interact and learn of opposing perspectives on SSF management.

5.6.2.4 Lamlash Bay MPA, Scotland

The Community of Arran Seabed Trust (COAST) is a community-based marine conservation organizations. COAST works to protect and restore the marine environment around the Isle of Arran and the Clyde in Scotland. COAST has four aims: to improve the local marine environment for the benefit of everyone; help sustain the livelihood of those dependent on fishing and tourism; increase the popularity of the area for diving and tourism; and educate future generations (http://www.arrancoast.com/). They were instrumental in creating a no take zone (NTZ) in Lamlash Bay in 2008 and are now campaigning for legislation to establish an MPA around the south of the island (which is now in place).

In order to lobby for the implementation of the NTZ, COAST established strong links with several universities around the UK. They also collected anecdotal knowledge from local stakeholders and worked closely with Scottish Natural Heritage, a part of Scottish government, in research. This ensured rigorous, independent research of marine life in the Clyde. Engaging in diverse communication methods such as social media (Facebook and Twitter), radio, and newspaper allowed COAST to dissipate important information to a broad audience.

COAST has made significant progress in protecting local ecosystems and livelihoods. Despite this, other local groups have showed a lack of support for the NTZ and MPA, which led to their dropping out of working groups, and a level of distrust in research conducted by Marine Scotland. In addition, R4 recognized government apathy in providing political leadership has placed increased responsibility on COAST. COAST is actively pulling policy to be more socially legitimate and scientifically credible, however due to "government apathy" this case study is positioned in the [CLS]/ [CL~S] boundary. We also note that it may be insufficient to consider 'societal legitimacy' in unitary terms, implying that it may be important to explicitly consider multiple 'publics' in some SSF contexts (e.g., fishers who use different gear types).

5.6.2.5 Galicia, Spain

The Os Miñarzos Marine Reserve of Fishing Interest (OMMRFI) was proposed as a solution to social and environmental concerns (Perez de Oliveira, 2013). Concerns included overfishing and illegal fishing, as well as environmental disasters such as the

Prestige oil spill. The idea of establishing an MPA was envisaged in 2002 and was developed by the local fishers association (*cofradías*) in partnership with biologists, social scientists, environmentalists, and the autonomous government of Galicia. An important component in the successful development of the MPA was the community's capacity for collective action. Capacity had been developed through earlier collaborations between the fishing community and a team of scientists from the local university.

The role played by a local anthropologist based at the local university was crucial. This leader had in-depth knowledge of local idiosyncrasies. With his encouragement and the development of a specialized working group, fishers started participating in management activities. Local fishers were involved in the designing of various aspects of the MPA such as its size, location, regulation, and access. The inclusion of local knowledge on fishing grounds and breeding areas, combined with scientific knowledge, was paramount to building trust between fishers and scientists and promoting mutual respect. After a year and a half of discussions, the Galician Administration gave the MPA its approval and support.

R5 stated that the OMMRFI was "*initially amazing.*" However, in 2011 a government party change which coincided with an economic crisis resulted in a significant reduction of funds for MPA surveillance (Perez de Oliveira, 2013). Despite local protest, R5 reported that the MPA is now functioning only as a 'paper park'. Due to the diminishing success of the MPA and growing distrust among community members, the leader of the local cofradías lost motivation to continue working for the reserve. Legitimacy, saliency and credibility were achieved in the initial stages of the OMMRFI as a result of a pull from the local anthropologist to engage local stakeholders. Institutional uncertainty arising from political leadership change placed this case study in the [CLS]/ [CL~S] boundary. Despite the current status, awareness has been increased as a large extension to the MPA is being planned.

5.6.2.6 Isle of Scilly, England

The Isle of Scilly Inshore Fisheries and Conservation Authority (IFCA) was established by the UK Secretary of State and came into force in 2011. The IFCA is responsible for the regulation and management of all fishing activities within six nautical miles of the coast. Eight individuals make up the IFCA which include elected council members, individuals from the local community, and Natural England and Marine Management Organization officers (which are both a part of the UK government). All members have full voting rights and make decisions on enforcement, bylaws and conservation objectives.

Numerous research projects were organized by the IFCA including lobster and crawfish tagging, and data logging. The goals of the projects were to provide evidence on the viability of shellfish stocks and to ensure that harvesting is sustainably managed. The lobster and crawfish tagging program was initiated as a joint venture between the Isle of Scilly IFCA and the nearby Cornwall IFCA, with input from marine biologists at local universities. Fishers also participated in research which enhanced understanding about local ecological processes. The data logging program was a three year partnership with Plymouth University. Four stations which are scattered around the island digitally record temperature, turbidity and salinity. R6 hoped that additional funding is secured to extend data logging for an additional three years to provide a longer record on environmental processes.

The Isle of Scilly IFCA interviewee highlighted several efforts to increase the formal integration of scientific and local knowledge through the participation of local stakeholders. In doing so, the IFCA is increasing the overlap of the legitimacy and credibility sets in the Venn diagram (Figure 5-2). The IFCA received much of its funding from the government but as R6 noted "at the moment we are fine, we are fine until March 2016 when technically the money runs out, and when on paper there is no more funding support…there are two issues here, one is the general election coming up and second, is that whatever government is in, there's bound to be a comprehensive spending review." Institutional uncertainty positions the case in the [CLS]/ [CL~S] boundary. In the future, the production of credible science might be reduced due to diminishing funding opportunities for research, consequently this case could potentially shift towards [~C~SL].

5.6.2.7 Co-management in Khong District, Champasak Province, Lao PDR

Between 1993 and 1999, 63 villages in the Khong District established co-management regulations to sustainably manage and conserve aquatic resources (Baird, 2007). Co-management was supported by two NGO supported projects, firstly the Lao Community Fisheries and Dolphin Protection Project and, secondly, the Environmental Protection and Community Development in Siphandone Wetland Project (EPCFSWP). The project aimed to enhance management decision-making by building upon the broad local knowledge base and by creating a more standardized approach to monitoring. Extension workers ran workshops in which project officials made short presentations about co-management and facilitated the exchange of fishers' knowledge within and between communities (Baird, 2000; Baird, 2007). At these workshops village leaders also presented draft co-management regulations developed by the community (Baird, 2000). Revisions were made by communities with recommendations made by government and project

representatives. An important aspect of the EPCFSWP was the use of existing local institutions instead of creating parallel authoritative groups.

Co-management in the Khong District was strongly community focused. It appears that this case initially achieved membership in [CLS] as communities designed management plans with the input of government and project representatives. Despite detailed planning and implementation, a misunderstanding between NGO researchers and the local government over long-term funding arrangements led to the early conclusion of project activities. R7 remained optimistic about the impact project activities had on local behavior and reported that "*while some of the practices that were introduced for management purposes have decreased because people have stopped enforcing them, other things have continued…I think the local government has maintained an interest…so I think there are periodic attempts by the government to strengthen things."* Consequently, this case study is operating in the CLS/CL~S boundary due to the influence of institutional uncertainty.

5.6.2.8 New Zealand Rock Lobster Industry Council

The rock lobster (*Palinuridae achelata)* industry in New Zealand is represented by the New Zealand Rock Lobster Industry Council (NZRLIC). It is made up nine regional commercial stakeholder groups known as CRAMACs which derives from rock lobster (CRA) and Management Area Councils (MAC). Each CRAMAC is allocated a share of the total allowable catch and appoints a director to NZRLIC, which itself is managed by an Executive Director who coordinates research and management activities, represents the industry, and provides advocacy regionally and nationally. Through the NZRLIC there is a well-defined set of property rights which allows fishers to access and utilize the resource, and were designed to encourage custodial attitudes and stewardship among resource users.

In 1997, the NZRLIC became the accredited research provider to the Minister of Fisheries. Since then the NZRLICs contribution to research has been extensive and positive. Research programs include catch sampling, vessel logbooks, and lobster tag, release and recapture projects. Some CRAMACs are more active in industry generated data collection, which R8 attributed to incentive structures and personal motivations of regional leaders. For example, the potential profits from running a sustainable fishery have provided an incentive for the Southern CRAMAC, the largest and most valuable regional grouping, to participate in data collection programs.

Decreasing access to space is an emerging concern for New Zealand's fisheries. The government in 2014 announced plans to introduce recreational fishing reserves. R8 reported this is causing much uncertainty and concern for the NZRLIC: "*there is a reserve*

that will impact on my rock lobster fisheries, and there are currently no proposals for any redundancy agreement or opportunity adjustment, you basically get locked out." The key issue here was the impact institutional uncertainty could have on the behavior of local fishers. R8 noted that the rights of fishers *"are rights of access and utilization rather than rights of ownership…you don't own the fish…those rights are meant engender a custodial attitude and stewardship of the resource, when you create so much uncertainty about the continued use of those rights, you start to erode the custodial attitude and stewardship, and that defeats the real positive side of the property rights based management system."* The NZRLIC case study is operating in the [CLS]/ [C~LS] boundary, due to the impact of institutional uncertainty on social legitimacy.

5.6.2.9 Negombo Lagoon, Sri Lanka

Sri Lanka has a long history of collective action (Galappaththi and Berkes, 2014). Small-scale shrimp fisheries in Negombo, northwest Sri Lanka are managed by rural fishing cooperatives (Galappaththi and Berkes, 2015b). Fishers gained technical knowledge working for large-scale aquaculture companies in the boom years before the bust in the mid-1990s. Community cooperatives currently manage aquaculture through a zonal crop calendar with government oversight and collaboration. Fishers are represented by their associations, which are then organized into zonal associations with Sri Lanka Aquaculture Development Alliance (SLADA) at the apex of vertical linkages (Galappaththi and Berkes, 2015a). SLADA in turn works in a horizontal partnership with the National Aquaculture Development Authority, a department of central government which provides technical expertise, coordination, and oversight.

R9 reported that community associations meet during and after each crop season to discuss, evaluate, and adjust the calendar. These feedbacks and suggestions are relayed via community leaders and zonal representatives to decision-makers at the national level. The zonal calendar is a continuous learning process and is therefore highly adaptable. R9 believed that the management system is self-sustaining and that, although final decision-making resides at the government level, the community plays a significant role in data collection and design of the crop calendar.

Although the system is effective, R9 recognized issues of corruption and discrimination. Rich local actors often bribed leaders within SLADA, thereby influencing their decisions. Here the challenge is ensuring social legitimacy remains intact despite the influence of local elites. Consequently, this case can be positioned within the [CSL]/ [CS~L] boundary. The presence of corruption implies that the legitimacy set in the Venn diagram (Figure 5-2) is offset against the sets of credibility and saliency.

5.6.2.10 Benthic resources in Chile

In the late-1980s, the SSF industry in Chile experienced extensive over-exploitation (Marín and Berkes, 2010). Exploitation was attributed to social and economic instability, and the emergence of a black market. In response to the crisis, the government imposed a four year ban on catching fish and in 1991 established the Management of Exploitation Area for Benthic Resources (MEABR). The MEABR recognized the rights of organized artisanal fishers to regulate territorial user rights in their management areas. Under the co-management system formal fisher organizations sign a four-year agreement with the state. The contract is grounded on baseline resource assessments and a management plan which is prepared by biological consultants hired by fishers (Marín and Berkes, 2010).

Pilot studies for co-management agreements were designed to be highly collaborative. Since the pilot studies there were, however, numerous user complaints about the continued top-down nature of management and the lack of horizontal linkages between fisheries associations. The combination of bureaucracy and the rigidity of the law which defines the state-drive management system have hindered bottom-up learning and innovation (Marín and Berkes, 2010). The Chile case study shows an original pull from government to improve legitimacy and credibility of SSF. However, the continuation of a top-down management style has eroded social legitimacy and moved the case study into the [CLS]/ [C~LS] boundary. To improve legitimacy, R10 recommended that local leaders should "*negotiate with high level actors but also establish alliances with similar local groups.*"

5.6.2.11 Taunton Bay, USA

In Taunton Bay, Maine, a local ecosystem-based management project was initiated by the Maine Department of Marine Resources. The project aimed to increase knowledge on how to balance resource use with long-term protection of the environment (Sowles, 2011). Initial project activities were deliberate and time consuming, and included an iterative round of assessment, feedback, and adjustment involving the government representative and the local community. The engagement of community stakeholders was imperative to the project. Through the Taunton Bay Advisory Group, citizens provided local knowledge, expertise, perspectives, and advice to the State of Maine. R11 attributed successes to the inclusion of fishermen in survey design and data collection, which assured them of credible and trust-worthy science, and of the unwavering support of the State Commissioner. Once the final report had been published, the management plan received facilitating legislation.

Due to push from a particular government representative and initial project successes, the Taunton Bay case study initially achieved full membership in the set [CLS]. However a budget cut coinciding with the government representative's retirement resulted in reduced project activity cumulating in a 'passive management plan'. Consequently the case is currently operating in the [CSL]/ [C~LS] boundary region due to apathy among community members to engage in the management process. R11 remained positive and reported that "*the foundation had been laid and so the story isn't over…at some point in the future, if there is enough interest locally, somebody can reinvigorate it and bring new life to it, so it's a starting point.*"

5.6.2.12 Aqaba, Jordan

Compared to some other cases in our study, Jordanian SSFs have received little research attention. As such, there was limited information available in Aqaba, Jordan regarding the size of fish stocks, catch composition, and the number and behavior of fishers. The German organization, Gesellschaft für Internationale Zusammenarbeit (GIZ), in partnership with the Jordan Royal Ecological Diving Society (JREDS), has been working to support the Jordanian government in fisheries research since 2013. By using new approaches, the aim of the Jordan Fisheries Project was to raise awareness among Jordanian people about the environment, foster environmentally sustainable behavior, strengthen data collection, and increase the availability of credible science in Jordanian fisheries.

GIZ facilitated numerous Project activities in Jordan and supported capacity-building at JREDS and other NGOs. An initial step of the Project was to build partnerships between Project assistants at JREDs and local fishers. Fishers in Jordan were naturally distrustful of science and scientists; R12 recognized that local fishers believed, "*if I don't say anything, they can't use that information against me."* Consequently, a primary project objective was to build strong relationships on knowledge rather than rumors.

The Project is still in the beginning stages but successes have already been noted. The Jordan case shows that a strong push from science for saliency and legitimacy can be facilitated by extensive trust building efforts. R13 recognized that trust was enhanced after JREDS ensured fishers were the first to hear of project results and that results were made freely available to all participants. The legitimacy may be questioned as the participation of local fishers was confined to data collection rather than decision-making, therefore this case study is positioned in the [C~L~S]/ [C~LS] boundary. Increased overlap with the legitimacy set may be achieved as the project becomes more established, and levels of local awareness and capabilities increase.

5.6.2.13 Gazi Bay, Kenya

The Whole Decision-Network Analysis of Coastal Ecosystems (WD-NACE) project, which was funded by a UK research grant and led by academics, developed fishery models for a small artisanal fishery in Kenya. Project aims were to generate generic and comparable studies about how decisions for policy and action were made at the local level. The first step in developing the models was to find out how people used information to make their decisions, the state of local environments, the current financial situation, and local people's social standing in the community. To address these questions the project built upon existing information in the Gazi Bay by working with local teams and connecting them with policy-makers, practitioners, and local people who depend directly on fishery resources.

WD-NACE intended to provide decision-makers at multiple levels with useful models to facilitate understanding about critical social-environmental relationships. R14 recognized that models are important as they ease understanding and potentially secure the attention of governments. Due to a push from scientists in an attempt to extend scientific knowledge, science became more credible. However it is unclear if and how local people participated in decision-making, and the longevity of project results are uncertain. This case study is therefore situated in the [C~L~S]/ [C~LS] boundary.

5.6.2.14 Galapagos, Ecuador

An ecosystem-based spatial management approach was adopted by the Galapagos Marine Reserve. This approach was developed to help with ecological, socioeconomic, and political challenges related to fishing and tourism (Castrejón and Charles, 2013). Increasing conflicts and ecological degradation led to the creation of the Galapagos Special Law (GSL) and the Galapagos Marine Reserve Management Plan at the end of the 1990s. Under the GSL, two authoritative institutions were created, the Participatory Management Board (PMB) and the Institutional Management Authority (IMA) who respond to the Minister of Environment within national government. The PMB was composed of local stakeholders including fishers, members of the tourism sector, conservationists, and the Galapagos National Park. R15 highlighted that decision-making was made by consensus within the PMB, and if consensus was not reached the IMA took over. Scientific input was provided by a local NGO, the Charles Darwin Foundation (CDF)

In 2008, the government approved a new constitution that created a new authority called the Galapagos Governing Council (GGC), which aims to govern Galapagos as a whole. The GGC has caused uncertainty about the function of lead institutions and increased conflict. To overcome conflicts and uncertainties a reform was made in 2015.

However, R15 voiced concerns that these reforms may reduce the number of fishing representatives involved in decision-making due to the status of the PMB being changed from a cooperative to a consultative form of co-management. The CDF has also contented with economic and political disruption and will conclude in 2016.With the new reforms, this case has shifted from [CLS] to [~C~LS] due to the conclusion of the PMB and CDF.

5.6.2.15 Puerto Madryn, Argentina

The Argentine hake (*Merluccius hubbsi)* is the backbone of the Argentinian fishing industry. The Association of Artisanal Fishers of Puerto Madryn (APAPM) was initiated in 1993 when Argentina experienced severe reductions in the numbers of hake. By 2000 APAPM had secured formal legal status, had membership of 60% of local fishers, and played a proactive role in fisheries management (Orensanz et al., 2007). APAPM was involved in lobbying to reduce unrealistically high catch allocations for the 2000 fishing season. Fishery managers approached the provincial government looking for scientific advice but there was a lack of data and high uncertainty regarding fish stock population dynamics. Due to the uncertainties of ecological SSF process, it became apparent that extensive discussions between scientists, managers and stakeholders were required. In response, the provincial government created a technical advisory board comprising of technical staff, scientists and representatives from APAPM in 2001. This facilitated scientist-fisher collaborations in data collection which informed catch quota recommendations. In 2005, the advisory group was expanded to incorporate representatives from the Natural Protected Area Peninsula Valdes and the provincial authority of tourism.

Despite the achievements of the co-management structure at developing partnerships between stakeholders, relationships have disintegrated. R16 raised concerns about the legitimacy and transparency of collaborations, and the adaptability of quotas to reflect stock activity. In addition, there were legal constraints, a weak judiciary system, and a lack of coordination between agencies (Orensanz et al., 2007). The preceived lack of scientific credibility and institutional support influenced behavior at the local level. R16 reported: "*the most frustrating factor is the lack of support from the state…because fishers started with a lot of motivation and strength, but those same people who are still in the fishery are really tired…it's really difficult to maintain the motivation if you don't have responses from the agencies*." The initial pull on science from fishers, who had lobbied for more credible science, moved this case study into [CLS] but the case since shifted to occupy [~C~L~S] due to poor integration and fluctuating support from the state. Recalling

Figure 5-2, one could envision this case as having the three sets not overlapping at all, with the case positioned in a gap between the sets.

5.6.2.16 Belo Sur Mer, Madagascar

A non-governmental organization (NGO) called Blue Ventures (BV) started work in Belo Sur Mer in 2009. To increase scientific knowledge and to engage local communities, BV has evaluated and established community-based mangrove conservation through both push and pull mechanism. BV supported locally-led initiatives and partnerships by offering advice, organizing meetings, and facilitating the legislation of customary laws. Partnerships have been created between resource users from Belo sur Mer and neighboring villages.

Several mangrove fishery closures located and designed by the community have been implemented since 2011. Research was conducted to determine the appropriate minimum landing size for mangrove crabs, with the aim of eventually informing national fisheries policy. Over the past five years, nine reserves have been established and are now flourishing. In addition, BV established community-based health activities and alternative livelihood possibilities such as sea cucumber aquaculture.

Our Belo sur Mer case highlights an example of a case study in the [CL~S]. At the time of our interview, BV was operating without the input of government and was focused on encouraging behavioral change through increasing community awareness and capacity. R17 reported *"I can't tell communities "here is the magic number", I don't have it…it's more of a mentality or behavior change.*" It is possible that once project activities become more established, BV will be able to work to encourage policy saliency by creating partnerships with government agencies.

5.6.2.17 Victoria, Australia

Abalone (*Haliotis)* is a primary commercial species in Australia. Since the 1960s there has been an increasing use of private-property rights to regionally manage Australian abalone fisheries (Gilmour et al., 2013). In the Victoria Western Zone (VicWZ) fishers' organization, three quarters of abalone license holders belong to a divers' association. An executive officer was hired externally and R18 noted that that this individual had helped the group to become more professional and facilitated improved interactions with the State government.

Due to declining levels of abalone abundance, VicWZ members sought the advice of an external consultant in 2001. Working with local divers through a series of workshops, the consultant facilitated industry-based stock assessment and bottom-up management changes. Outcomes from those workshops included an agreement to increase abalone size

limits across the fishery, implement reef codes (sub-zonal partitions for recording catch and effort), and impose a cap on abalone landings. R18 reported that the VicWZ also worked closely with local universities but received little research support from the government. R18 emphasized that abalone fishermen gained much experience in data collection over the last ten years: "*they have learned a lot of lessons and they have come a long way."*

The VicWZ abalone fishery has a strong property rights system in place and enjoys the participation of industry members and scientists in research. Although there is limited engagement from the government, fishers are capable of conducting research with the help of scientists and consultants. Strong leadership in the Abalone Divers Association allows the group to participate with government counterparts and for industry members "*to get their voices heard*." As such, this case study is operating in the [CLS] boundary, with a push from industry members for social legitimacy and scientific credibility. This case provides an example of how the use of consultants can be used to increase the credibility of knowledge in a science-pull boundary crossing effort.

5.6.2.18 Asturias, Spain

The gooseneck barnacle (*Pollicipes pollicipes)* fishery in Asturias is important to the artisanal fleet. In 1994, a co-management system between the government agency and local cofradías was implemented. By 2001, seven co-management agreements had been established along the Asturian coast. Each region had its own specific management plan, each of which was developed in conjunction with the fishery association. Under the arrangement only licensed fishermen can exploit the resource, which has led to a sense of entitlement and a perceived need by fishers to protect their resource (Rivera et al., 2014). Co-management has allowed for an adaptive learning-approach and fine-scale management of the fishery.

Local users regularly participate in data collection and management decision-making. Cofradías regularly report daily landings and effort data, which provide scientists with fine-scale data to use in modeling. R19 noted that fishers have the responsibility of deciding the location of fishing activity and of reporting the quality of the resource. The government partner checks over proposed activity for the following year with the help of scientists. In the gooseneck barnacle co-management system, fishers' knowledge has been considered from the onset and there were high levels of resource user participation in SSF management (Rivera et al., 2014). Consequently this case study is positioned firmly in [CLS]. The flexibility of co- management policies and adaptive strategies adopted by the

fishers has enhanced resilience in times of changing management measures and during an economic crisis (Rivera et al., 2016).

5.6.3 Other opinions of relevance for SSF management

From among and beyond (i.e., from our analysis of interview transcripts for interviewees from the 36 other cases not specifically outlined above) the cases on which we have so far focused, our respondents highlighted additional themes: knowledge and valuation of SSFs; the credibility of science; and the uncertainty of institutional processes (Table 5-1).

Table 5-1 - Summary of other themes important for SSF management

Findings	Tally
Knowledge and the value of SSFs	
The merits of different knowledge types are recognized	4
Tensions between knowledge types	11
Difference in valuation of SSF resources	5
Ecological and social knowledge limits	
Limited amount of scientific data (including effects of poaching)	6
Issue of complexity and uncertainty	4
Disconnect from social realities	5
Concerns about governance effectiveness	
The impact of migratory fishing	5
The paradigms that governments hold	9

5.6.3.1 Knowledge and the value SSFs

Our respondents reiterated the importance of scientific and local knowledge for effective SSF management (Table 5-1). R11 highlighted the importance of scientific knowledge. *"I want to emphasize that science is the underpinning of all of this…for stewardship and adaptability, science is an integral part and it has to be credible."* He also recognized the attributes of local knowledge: *"fishermen are very astute; they are out there in all kinds of weather that scientists aren't in…their anecdotal knowledge or local knowledge is very strong, profound…these guys are curious, excited about their resource…they understand biology far better than we give the credit for."* Similarly R9 who worked with small-scale aquaculture fisheries in northwest Sri Lanka stated "*local people are resilient…they are confident in their knowledge, local knowledge about their environment, specifically unique to their community."*

The tension between scientific and local knowledge was also evident. In her work on Canadian fisheries, R20 experienced little interest in local knowledge among the scientific community. R21 attributed scientists' apathy towards local knowledge to the training scientists are provided in universities; "*they're not taught to appreciate local knowledge, and in fact, when they come out of university they can be suspect of it…and*

suspect of the ability of locals to perform tasks they consider as their own domain." Fishers were also found to be suspect of scientific knowledge. R4 highlighted that fishing communities on the west coast of Scotland lack the understanding or willingness to accept scientific results; "*there seems to be a dearth or lack of understanding of actual science…certain people don't seem to trust the science or the implication of it."* A lack of trust in science and scientific methods was also experienced in Jordan.

SSF stakeholders have different priorities and beliefs which shape how they value SSF. There was consensus among our respondents that current valuations hinder attempts for sustainable SSF management. In Patagonia, Argentina R16 noted that "*not many people appreciate the value of having fish…in a busy area, with lots of people, fishermen are not well seen"*. R16 added, "*People are just there to catch as much fish as possible, so they don't care about conservation measures."* R22 highlighted that Bajau fishers in Indonesia purely value fish as a food sauce and often question why tourists "*would want to come and see something that is just food?"* In contrast, fish stocks are a culturally valuable resource for communities in Madagascar, which has helped facilitate the implementation of an MPA (R23). R1 reported that for many fishing communities "*fish are more than just money, they are thing to eat, and they are culture, these intangible things"*. To improve SSF management, R1 went on to recommend an inversion of current valuations of fish, from a system that places the most value on the exchange rate to one that places the most values on the existence of fish.

5.6.3.2 Ecological and social knowledge limits

The credibility of science that currently guides SSF decision-making was called into question (Table 5-1). Especially important was the impact uncertainty had on the production of credible knowledge. Limited scientific data in many SSF contributed to uncertainty. In the Elephant Marsh SSF, Malawi, R24 reported "*as we are, it is like managing in the dark, we don't know much about the fishery, what the issues are, what's the maximum harvest, how many fishermen can really be in the fishery to exploit the resources from it."* In South Africa and along the coast of many West African countries, poaching has reduced the ability to calculate credible stock assessments due to the lack of accurate catch and effort data (R25 and R26). R25 stated that "*scientific processes are definitely flawed, but we don't have any other way of managing the stock."*

Complexity of ecological processes adds to the uncertainty of credible science. R21 highlighted that obtaining an annual quota for complex multi-species fisheries remains difficult and results in measurement errors. In addition, R21 recognized that lack of consideration for natural fluctuations can add to uncertainty; *"I think the important*

decisions are the decisions tied to the biology of the species…it goes back to the problem of governing fisheries, whether you see fluctuations as a problem to be fixed or something you can adapt to." R27 reported that in the Caribbean context, while fishers are accustomed to uncertainty, fisheries science is based on assumptions guided by predictability and certainty, and that this fundamental difference has been a cause of tension between fishermen and scientists.

Concerns about the credibility of science are also attributed to the separation of SSF decision-making from local users and social realities. R1 highlighted that a major issue with SSF management is that science "*tends to be technically oriented…which often doesn't have a good knowledge of its history."* Similarly, R21 reporting on salmon fishing in West USA noted that "*our current management is not strongly tied to place; it is not tied to specific populations and watersheds; conventional management is too divorced from local realities."*

5.6.3.3 Concerns about governance effectiveness

Uncertainty generated by the activity of institutions at all levels pose difficulties for effective collaborative research (Table 5-1). The impact of migratory fishers was reported as a limiting factor by our respondents. Migratory fishers who operate along the coast of West Africa are able to travel great distances, utilize efficient technology, and exploit new fish stocks. R26 reported that fish caught can equal up to 30% of the overall catch which is problematic: "*it doesn't appear anywhere in the statistics or records…it's a big issue for management because you are managing ghost fishermen, you don't know who they are or where they came from."* Consequently, management approaches based on maximum sustainable yield (MSY) can be problematic.

Our respondents also commented on the effects of high-level institutional uncertainty and the paradigms under which government departments operate. Governments can be unwilling or unable to facilitate effective collaborations, lack will to devolve power to lower levels, and overly depend on single stock assessments. For example, R20 believed that "*the institutional rationalities that governments operate under inhibit many effective policies and leadership."* Similarly, R25 asserted that "*being stuck in a particular paradigm and not being able to get out of it, is probably the root cause of failed governance in this fishery."*

5.7 Discussion

Reducing biophysical and institutional uncertainty is crucial if SSFs are to contribute to positive social outcomes such as poverty alleviation and coastal sustainability. Key to reducing uncertainties is the integration of scientific knowledge and

local knowledge, and the uptake of integrated knowledge by policy-makers in decision-making. We found SSFs that were successful or partially successful in reducing biophysical and social uncertainty through knowledge integration. However, our analysis also highlighted the dynamic nature of SSF governance systems and we found numerous instances where successful SSF governance processes and structures degraded over time. Recurring issues expressed by our respondents involved the framing of knowledge and the credibility of science, and the factors that influenced institutional uncertainty.

5.7.1 Key issues

5.7.1.1 Blurred boundary on scientific credibility

The way in which SSF stakeholders frame different knowledges influences knowledge integration. Framing refers to an individual's ideas, beliefs, and discourses (Fisher, 2003), which determines their valuation of knowledge. Frames bind like-minded actors together in social groups (Parry and Murphy, 2013), for example fishing communities who share common knowledge, and academic research clusters who agree on specific scientific methodologies. Within SSF management systems the dominant frame has largely been scientific knowledge, which has reduced the credibility of fishers' knowledge. In some cases, scientists can be actively hostile to the idea of incorporating fishers' knowledge into policy advice (Soto, 2006). Despite increased efforts to encourage knowledge integration, our results highlighted that a blurred boundary on what constitutes credible knowledge still exists.

How stakeholder groups can come to agree on a common definition of credible knowledge is therefore an important research question. Leadership, which is crucial to SSF plays an important role in knowledge integration. We found leaders who are outward looking, and forward thinking had the potential to push boundaries on restrictive frames in order to encourage new ways of valuing knowledge. In our case studies, leaders who were able to break conventional frames and facilitate knowledge integration came from community organizations (Lamlash Bay, Lake Hjälmaren and Southwest IFG), NGOs (Bel Sur Mer), research institutions (Galicia, Aqaba), and government departments (Taunton Bay).

Leadership from scientists and research institutions is especially important to knowledge integration. Our results suggest that the success of knowledge integration can depend on a scientist's willingness to engage in transdisciplinary research that engages community stakeholders and government officials. In Taunton Bay, for example, a government scientist pushed to increase credibility and legitimacy by engaging local stakeholders in survey design, data collection, and decision-making, which had an impact

on the final management plan. In other cases however, it was ‘business as usual’ as scientists continued to use well-practiced scientific methods and pre-defined research questions, with local communities only being engaged in data collection stages.

A key issue affecting the effectiveness of scientific leadership is the training young scientists receive in universities and research institutions. Our respondents recognized that current training practices often produce scientists who are suspicious of local fishers’ knowledge and are thus less inclined to push for a broadening of management paradigms. . Encouragingly, Rudd (2015) noted that in other cases there is evidence of changing attitudes among young ocean scientists regarding engagement in policy-salient research.). This points to the possibility of enhancing knowledge integration through interdisciplinary research and partnerships. Broadening paradigms in order to achieve greater consensus in what constitutes credible knowledge will require greater alignment in how people frame knowledge. In many cases this will entail revising assumptions and worldviews through increased awareness, respect, and understanding of opposing values and beliefs. Obviously there is no simple prescription for changing individuals’ framing of knowledge generation and enhancing integration, given often entrenched discourse and advocacy coalitions (e.g., Weible and Sabatier, 2005; Caveen et al., 2013; Nursey-Bray et al. 2014; Rudd, 2015). However, long lasting and adaptable capacity-building projects, especially within research and governmental agencies where it is often severely lacking is crucial. In addition, several of our respondents noted the benefit of creating specialized platforms for collaboration and partnership building. For example, the WWF organized a meeting which ended tension between fishers, scientists, and policy-makers in Sweden. Such platforms need to be unique for each context and take into account environmental issues, policy landscapes, physical locations, and characteristics of stakeholders involved (Bracken and Oughton, 2013). An important characteristic of platforms is adaptability, especially given the speed at which successful integration projects can become unsuccessful integration projects.

5.7.1.2 Institutional uncertainty

Institutional uncertainty was a limiting factor to knowledge integration projects in our case studies. Uncertainty resulting from shifting policy objectives, fluctuating leadership and support for devolved SSF management, and funding opportunities were found to considerably influence the sustainability of community-based organizations and behavior of actors at the local level. A major concern is the potential for institutional uncertainty to reduce the credibility, legitimacy, and saliency of knowledge integration projects even if full overlap in [CLS] has been achieved. This could involve efforts to increase the coherence of policies and regulations across agencies, and integrate coastal

and marine ecological research within the emerging nexus of social, human health, and environmental research (i.e., as laid out in new the Sustainable Development Goals – Gaffney, 2014).

Many SSF knowledge integration projects rely on government funding. Uncertainty in the longevity of those funding channels reduces credibility, legitimacy, and saliency. In Galicia and Taunton Bay, membership in [CLS] was attributed to the engagement of local communities and the inclusion of fishers' knowledge in decision-making. However in both cases, legitimacy and saliency were reduced due to the combination of an economic crisis and the loss of a strong leader. In the Isles of Scilly, for instance, uncertainty in the continuation of funding for research projects, after national elections has the potential to reduce the credibility of knowledge used in decision-making.

Policy change was found to adversely affect the ability of leaders to retain community followers. Government representatives in Scotland were required to change regulations in line with changing policy objectives, which caused distrust among local fishing communities. In Galicia, suspicion of the local leader grew due to diminishing MPA successes after a cut in funding was made for surveillance. Others have also found that a leader's legitimacy is lost if they are perceived to be too close to regulatory processes and are therefore unable to fully serve community interests (Johnson, 2011; Schut et al., 2013). Consequently, it is imperative that leaders remain accountable to all those they represent (Hoppe, 2010).

In turn, institutional uncertainty influences the behavior of local level actors. Like Ostrom (1996), we found that frequent policy change reduces the motivation of highly effective leaders. Maintaining the motivation of a leader is particularly important given the influence they have on the overall sustainability of an organization (Giberson et al., 2005). In Argentina, the motivation of local leaders decreased due to fluctuating support from government partners. Institutional activity also determines the likelihood of fishers participating in SSF management activities (Sutton and Rudd, 2016). Case studies from Sri Lanka and Galicia highlighted that fishers are more likely to participate if they have had positive experiences of working in collaboration. Unsurprisingly, Scottish fishers who participated in unsuccessful projects are less inclined to participate further due to their distrust of governmental leaders and apathy towards management activities.

5.7.2 Relation to boundary spanning research

Our findings mirror some core findings from broader boundary spanning research. Science-policy-societal boundary arrangements determine the effectiveness of knowledge integration. As our case studies demonstrated, boundary arrangements are embedded

within social, economic, and political contexts. Changing contexts cause boundaries to be negotiated and renegotiated over time (Schut et al., 2013; van Paassen et al., 2011). Several case studies highlighted projects that succeeded in gaining credibility, legitimacy, and saliency [CLS], however due to changing contexts the boundary dissolved. Our respondents remained positive that [CLS] could be renegotiated if circumstances became more favorable.

Integrating science and local knowledge requires the involvement of different stakeholder groups. Partnerships between local communities and research institutions were paramount to knowledge integration in our case studies. The degree of scientist involvement in those partnerships depends on the capabilities of local actors and the stage of the research project (van Paassen et al., 2011). Communities from Madagascar and Jordan, which have little experience of SSF management projects, required assistance from external organizations in research and management activities. In contrast, abalone fishers in New Zealand and shrimp aquaculture fishers in Sri Lanka have many years of experience in data collection and are thus able to conduct independent research. Scientists play many roles in fisheries policy and management, ranging from conventional information providers (Rudd, 2015) to collaborative policy actors, to public intellectuals.

Path dependence determines the success of boundary arrangements. Path dependence assumes that boundary arrangements are influenced (either enable or constrained) by past collaborations between stakeholders and researchers (Leuuwis, 2004). Perceptions, which are stored in the social memories of community members, change in response to experiences of previous projects and outcomes (Schut et al., 2013), and direct behavior in future projects. Apathy towards management processes was evident in case studies from Scotland and Argentina which deterred further participation and compliance. Therefore, the outcomes from past projects should be analyzed before new projects are implemented to gauge local perceptions.

5.8 Conclusions

The objective of this contribution was to increase understanding of factors that influence the integration of scientific knowledge and fishers' knowledge LEK, and how this can be incorporated into SSF decision-making. In the context of our broader research project on SSF leadership, we collected information from 54 interviews from around the globe, and featured in this paper 18 case studies that specifically raised issues regarding the uncertainties associated with knowledge integration. We recognize that this study relied on the experiences and opinions of our interview respondents, which may have introduced potential biases (i.e., there is certainly a degree of self-selection arising because we could

only interview respondents still active in SSF research or management). To minimize biases, we ensured data was collected from a broad range of case studies and was backed up by peer-reviewed literature. We also note the importance of conducting further analysis on how the characteristics of respondents (e.g., developed versus developing country) affects views on the credibility of science. Whilst this is beyond the scope of this paper, we encourage further work to decipher those relationships, using medium-*n* set theoretic methodologies (e.g. Sutton and Rudd, 2015).

Our results emphasized the complexity, uncertainty, and dynamic nature of science-policy-societal systems. By focusing on the dimensions of credibility [C], legitimacy [L], and saliency [S], we were able to identify the evolution of systems in their efforts to achieve full overlap in [CLS]. Several systems achieved membership in the [CLS] overlap; however it was evident that staying in [CLS] was more difficult. Credibility, legitimacy, and saliency were lost due to changing economic, political, and social contexts. Our work suggests that community-based organizations may have a 'shelf-life' but can have the potential to perpetuate if new ideas, resources and energy become available, and if the experiences of past projects remain in mind. Capacity building and the creation of specialized platforms for knowledge integration are potential mechanisms to enhance institutional support.

Major issues affecting knowledge integration are a blurred boundary on what constitutes credible knowledge and institutional uncertainty. To improve knowledge integration, capacity building for actors within research organizations and governmental departments, is important to break down pre-conceived ideas and encourage actors to consider the merits of different knowledge types. As complicated socio-ecological systems, SSFs are dynamic and will need constant attention from both ecological and social perspectives, and a constant upgrading of integrated scientific and contextual local knowledge. Managers must not expect that a set of interventions will permanently 'fix' SSFs. Given their immense importance globally as a source of food and livelihood – and the constant pressure for 'successful' SSFs not to stray out of the intersection of credibility, salience and relevance – it is crucial that effective efforts are taken to create the enabling conditions that can provide multiple benefits from SSFs.

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Chapter 6 Conclusions

6.1 Summary of thesis aims and results

In this study I critically assessed local leadership in SSF. My first aim was to identify important knowledge gaps in SSF leadership by conducting an extensive literature review. My literature review (Chapter Two) gave direction for the following chapters. I sought to determine how local leadership interacts with other contextual conditions to influence SSF outcomes, and explore factors that influence an individual's propensity to engage with leadership and participation in management activities. I also aimed to identify the role of leadership in helping to reduce the uncertainties common in SSF management. My focus has advanced the field of leadership in SSF, used novel techniques such as QCA, and provided the basis for recommendations for future SSFs leadership research.

In Chapter Two, I reviewed the literature on leadership in SSF, natural resources, and further afield. Findings were split into three categories or the "3C's" of leadership: the characteristics of leaders, the connections of leaders, and the context within which leaders function. This paper found that previous research on leadership in fisheries management generally focused on deciphering the coarse-scale characteristics of leaders and the functions they perform. Future research should build on the foundations of current research to better understand how contextual differences influence leadership and the effectiveness of CBFM. This chapter was published in Marine Policy in 2014 and gave direction for the following chapters.

In direct response to Chapter Two, Chapter Three aimed to explore how SSF leadership and other important contextual conditions act alone or in combination to influence SSF outcomes. 50 case studies from Southeast Asia were analyzed using QCA, which facilitated the identification of necessary and sufficient contextual conditions. QCA is a novel methodology in the field and advances thinking of causality and complexity, which is inherent in SESs. My results highlighted high levels of complexity in the case studies. Ecological successes were particularly impacted by social, economic, and political factors, whilst species mobility played an important role in socio-economic success. Local leadership was found to be an important condition in achieving successful ecological and social outcomes. However, the absence of local leaders from SSF communities did not signal a definite failure, and indeed in some cases, strong local leadership was found to be detrimental to SSF outcomes. This study highlighted the importance of research that considers social systems and how they interact with environmental processes to influence overall outcomes. Chapter Three was published in Ocean and Coastal Management in 2015.

Chapter Four aimed to increase understanding of the factors that influence the propensity of individuals to engage with leadership. Experiences of leadership were collected from 54 interviews with international SSF researchers and practitioners. Major themes collected from the interviews were organized using modified versions of the IAD framework, VBN theory, and Schwartz's theory of cultural values. I identified factors that shape an actors propensity to engage with leadership at multiple levels which included worldviews (shaped by core values, education, and experiences), and capital restraints at the individual and community level. I also outlined the influences of effective leadership which included interactions between communities and leaders, communities and external actors, and different leadership groups. Of particular importance to successful leadership is the ability of communities to produce leader successors, leadership legitimacy, and the role of governmental counterparts. Chapter Four was published in Frontiers of Marine Science.

A major theme collected from my interviews (used in Chapter Four) was the difficulty of managing SSFs under conditions of uncertainty. My objective for Chapter Five was to identify the role of leaders in efforts to reduce uncertainty, by knowledge integration projects. I aimed to understand factors that influence knowledge integration in SSF management and the uptake of that knowledge into policy-making. Analysis was framed in terms of scientific credibility, societal legitimacy, and policy salience, and focused on how 18 case studies had been partially or fully successful in reducing uncertainty via push- and pull-oriented boundary crossing initiatives. Findings suggested the way in which stakeholders frame knowledge, the credibility of science, and institutional uncertainty influence the success of knowledge integration projects. Analysis also highlighted the dynamic nature of societal-policy-societal processes, and instances where successful case studies had degraded over time due to changing economic, political, and social contexts. I determined that community-based organizations can become 'exhausted' but have the potential to reform if new ideas, resources, and energy become available. To improve knowledge integration, capacity building should be given to all stakeholders, especially actors in high-level organizations, which increases the potential for creating leaderful organizations. Chapter Five was published in Environmental Management.

This thesis has contributed to the emerging research field of leadership in SSF. As indicated by Chapter Two, although local leadership has long been recognized as an important condition for successful CBFM and co-management, there has been little consideration about how leadership plays out in different community contexts. Chapters Three and Four are a direct response to Chapter Two, and aimed at initiating greater understanding of the complexities of leadership. Chapter five expands the focus of local

leadership to decipher the position and role of key actors in efforts to reduce uncertainty in SSFs management.

6.2 Future research

As highlighted throughout this thesis, local SSF leadership is a relatively new research field. As such, it is an exciting time to generate interest in the field and develop future research opportunities. Work that considers the necessity of increasing leadership knowledge through in-depth, comparative, and systematic research is crucial. I now go onto outline recommendations for future research, which were identified by my own reflections and the insights of my interview respondents from Chapters Four and Five. This list is by no means exhaustive, as much additional research is required to enhance our understanding of leadership in SSF.

6.2.1 How do we increase leadership succession capabilities within SSF communities?

In Chapter Four leadership succession was found to be an important influencing factor on local leadership, and a concern for many of my interview respondents. There are many barriers to effective succession which include: low education and awareness levels, limited access to resources, negative perceptions of leadership resulting in reduced motivation to become a leader, a lack of local passion, poor commitment to remain in leadership roles, over-reliance on a small pool of potential leaders, and cultural and social barriers. An important research question is therefore: how can we overcome these barriers to increase leadership succession capabilities within SSF communities?

Several recommendations were given to improve leadership succession by my interview respondents in Chapter 4. The importance of expanding the focus of leadership, from building successful leaders to building 'leaderful' organizations was emphasized. A leaderful organization encourages each member of a community to gain experience of being a leader concurrently and collectively (Raelin, 2003). This allows leadership to be collaborative and develops the capacity of each community member, thereby increasing the pool of potential leaders.

Crucial in developing leaderful organizations is capacity building. As Pomeroy et al (2001) iterated training and education must strive to build leadership skills among a variety of individuals in the community so management doesn't become dependent on a single individual. Future research should be conducted to decipher how capacity building can become more effective. It is important that capacity building is well thought out, culturally appropriate, and designed with the target audience in mind.

6.2.2 How do high level leaders influence local level SSF leadership?

This thesis has focused on local leaders in SSF. However it is also important to consider the impact of leader activity within higher level organizations, such as governments, NGOs, and research institutions. High level leaders are particularly important in setting policy conditions and allocating resources for CBFM. In Chapter Four and Five, I found that the activity of political leaders and government departments greatly influences behaviors at the local level. For example policy change, fluctuating political support, and leadership change influenced motivations and perceptions and in some cases, deterred fishers from participating in further leadership activities. Ratner (2012) reiterated that political leaders who withdraw their support for local initiatives can potentially destroy the gains made at the local level. Therefore the link between the activity of high-level actors and the impact they have on local level behavior should be investigated further.

Chapter Five focused on the difficulties of managing SSF in conditions of uncertainty. Integrating scientific knowledge with fishers knowledge is assumed to reduce uncertainties, as more context-rich information is used in decision-making, It was highlighted that the way stakeholders, especially scientists and governmental actors, frame knowledge limits the degree of knowledge integration. To overcome this considerable barrier, capacity building within high lever organizations to encourage new ways of viewing and valuing knowledge should be explored.

6.2.3 Is it possible to develop a framework to critically analyze local leadership in SSF?

Due to the novelty of SSF leadership research, an analytical tool to assess the likelihood of effective local leadership is unavailable. The development of such a tool or framework would help answer important leadership questions, and assess the likelihood of effective leadership within SSF communities. Key insights from my research could be used to find a common definition of “successful leadership” and form the foundations of an analytical framework. Table 6-1 shows an overview of initial ideas for potential questions and categories that could be included.

Table 6-1- Potential factors influencing leadership

Leadership questions of interest	Potential determinants
The likelihood of securing leadership	
What is the propensity of an individual to engage with leadership?	• Worldviews Culture (e.g. gender issues, power structures) Core values and motivations Experiences (e.g. education, past experiences of working with SSF projects and leadership) • Resources Financial capital Social capital Technical and manufactured capital Human capital • Incentive structures Livelihood options Dependency on fishery Value of fishery to the individual
What is the capacity of a community to produce successors?	• Education and awareness levels of the community • The pool of potential leaders available • Motivations for leadership present within in the community • Barriers to individuals becoming leaders (cultural, gender) • Capacity building opportunities
The influences on successful leadership once a leader is appointed	
What are the external contextual influences on community processes such as leadership?	• Economic (market tools, regulations, funding) • Environmental (disasters, natural fluctuations, uncertainty) • Political (support, capacity, resources, enabling legislation)
What is the likelihood of successful leadership?	• Personal characteristics Innovative (able to use new technologies and communication devices) Knowledgeable about local and external,

social and natural processes

Connected to the community but also outward looking

- The likelihood of communities accepting leaders

  Legitimacy of a leader

  Reputation of a leader

  Trust in the leader

- The interactions a SSF leader has with other leaders within the community

  The number of other leaders

  Past interactions of leaders

  Clear division of responsibility and authority

- Interactions with external actors

  Links to research institutions

  Links to NGO and governmental organisation at the local, national and regional levels

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6.3 Conclusions

Leadership is crucial to participative SSF management approaches such as co-management and CBFM (Gutierrez et al., 2011). Despite its importance there has been a lack of focused leadership research in SSF and in other natural resource management. Enhancing our understanding of leadership functions and processes is key to ensuring effective and long-lasting SSF organizations and management. Encouragingly since starting my research, I have noticed an increasing amount of interest in leadership work which is highlighted by several recent publications (Al Mamun, 2015; Case et al., 2015; Evans et al., 2015) and a focus on leadership at conferences, workshops, and within international organizations.

Leadership responsibilities and characteristics are often assumed to be held and practiced by a single individual, at a single point in time. This portrayal of leadership is too simplistic; throughout my research I have found leadership to be complex, uncertain, and dynamic. Leadership traits are not confined to a single actor within a community but within multiple individuals and different groups concurrently. Formal and informal leadership can be passed around members of a community in response to fluctuating motivations and changing policy directions, which may require different competencies. Due to the dynamic nature of leadership future research should have a temporal element,

which would help track the evolution of leadership within a community. This will enable practitioners to assess the likelihood of successful leadership, thus organizations in SSFs management.

This thesis primarily focused on researching leadership processes at the local level. However, it is frequently highlighted that the effectiveness of local leadership is affected by the activities of high-level leadership. Leaders from NGOs, academic institutions, and government departments regularly work in SSFs and can influence resource allocation, policy direction, and overall SSFs success. Therefore it is important to analyze the influences of high level activities on local processes. My research suggests that the impact of limited government capacity, disregard for social processes and fishers' knowledge, fluctuating support, and constant policy change considerably reduces the success of community SSF organizations, especially in knowledge integration projects.

SSFs decision-making is frequently conducted in conditions of scientific and institutional uncertainty. Integrating scientific and fisher's knowledge can reduce inherent uncertainties and help enhance credibility, legitimacy, and saliency. A key finding from my research is that local organizations used in knowledge integration may have a 'shelf life'; organizations are only able to withstand a certain degree of social, political, and economic change before they become exhausted. I hypothesize that expanding the focus of local leadership has the potential to increase the lifespan of community-based SSF organizations. For example, the creation of leaderful organizations is crucial as it increases the likelihood of successful leadership succession, which was a key concern highlighted in Chapter Four. This can be achieved through capacity building for all stakeholders, especially high-level leaders, to encourage new ways of framing knowledge and to ease future knowledge integration projects.

My work has identified important researchable hypotheses. Chapter Four in particular, which assessed factors that influence leadership, has the potential to form the basis of further analysis. Research is required to understand the key themes highlighted by Chapter Four and how they interact, for example, is there a relationship between the characteristic of the interviewee and their views on what affects leadership? Or is there a correlation between the development status of a SSF and the likelihood of successful leadership? These research questions could be answered with additional applications of QCA, which I am currently exploring.

Given the fact that SSF leadership is a relatively new research field; this contribution is of an explorative nature in terms of the subject matter and the analytical techniques, for example QCA. My contribution has provided key insights into how leadership influences SSF outcomes, the factors that influence the likelihood of successful

leadership, and the role of leaders in ensuring more sustainable SSFs organizations under conditions of uncertainty. My results have also pinpointed crucial recommendations for further work. I encourage inter-disciplinary research that builds on the lessons highlighted by my research to further develop knowledge and understanding of leadership processes.

6.4 References

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Appendix 1 – Key findings from 32 case studies highlighting the "3C's" of leadership

The "3 C's" of Leadership	Fisheries	Natural resource management	Other industries
Characteristics	**Resources** • Understanding community members (Gilmour et al., 2013) • Most trusted and influential leaders are local people with similar backgrounds to the rest of the community (Bodin and Crona 2008) • Lack of financial links can limit a leaders ability to support the community financially (Bodin and Crona, 2008)	**Resources** • Educated background, part of the community (Olsson et al., 2004b) • Extensive social networks, knowledge, organisational design, conflict management competencies, writing skills, communication and negotiation skills, authority, and how to create a vision of desired goals and activities (Cheng and Sturtevant, 2011)	**Resources** • Respect and status (Krishna, 2002) • Trust (Nakagawa and Shaw, 2004) • Money, social status, sustained period of time in community or family history within the community (Kahl, 2000)
	Functions • Provide consistency (Hauck and Sowman, 2001) • Act as energy centres and motivators (Gilmour et al., 2013;Huack and Sowman, 2001) • Dissipate responsibility (Gilmour et al., 2013) • Continuously accountable and transparent (Njaya, 2007) • Provide stability in times of political change (Pollack et al, 2008)	**Functions** • Develop social networks, organize community training, provide goals and visions, identify policy windows, conduct press releases and secure funding and create incentives (Olsson et al., 2004b) • Maintain regular meetings, gather local information (Cheng and Sturtevant, 2011) • Identify key policy windows Klooster, 2000) • Mobilise resources, connect	**Functions** • Encourage participation in collective action (Minnery et al., 2013) • Organise movements, mobilise residents to act, and introduce an election and voting system (Nakagawa and Shaw, 2004) • Generate social capital (Krishna, 2007) • Recognise winning ideas and adaption of selling approaches (Howell, 2005) • Emphasize benefits of collective

• Lobbying, negotiating, liaising with external stakeholders, empowering, and promoting benefits of projects (Gilmour et al., 2013) • Provide links to external agents so they can assist with education and training (Bodin and Crona, 2008)	problem with solution (Font and Subirats, 2010)	action (Meaton and Low, 2003)
Motivations • Without the appropriate incentives and knowledge favourably placed actors will not exploit their positions to initiate collective action; in Mombasa, Kenya centrally placed deep-sea fishermen have not taken any steps forward to influence management. As such they may in fact become barriers to less central but highly motivated individuals (Crona and Bodin, 2006).	**Motivation** • The leader of a village common pool resource, whose role it is to act on behalf of the community, is faced with personal dilemmas. S/he has to balance personal vested and community interests (Vedeld, 2000).	**Motivations** • Leaders' incentives are often quite political in nature. Quite often leaders use their work in a community as a launch pad into careers in state and national politics (Krishna, 2007) • There is a worry for community leaders involved with community development schemes about the lack of interest of potential new leaders. Without anyone willing to take active leadership roles, current leaders fear the demise of the community, in which they have invested so much to sustain Kahl, 2000)
Training • Officials may need training in	**Training** • Leader training is paramount to	**Training** • Training for potential

	participatory approaches, conflict resolution, and an understanding of traditional structures and processes (Hauck and Sowman, 2001)	increasing social capital (Leach et al., 1999)	(sometimes reluctant) leaders (Boggs, 2003)
Connectivity	• Centrality in a network was linked to more influence, through connections. In Mombasa, Kenya – local leaders are more centrally positioned compared to the other villagers, key individuals have direct social ties to 49% of the other villagers in the combined support and knowledge networks. Between 50% and 75% of key individuals reported contacts with government agencies, with the highest proportions of links directed at fisheries officials at the local level and fewer to representatives of the forestry commission and other administrative bodies. The formally appointed representatives in Mombasa are not among the most centrally placed actors. However the unauthorised chairman is fully embedded in the network and	• Steward of the Lower Helgea River's first accomplishment was to gather support for the project by focusing on "strong individuals in key organisations" including academics, an official at WWF, a hotel director former president of Kristianstad Tourism Board, the director of the National Museum of Natural History and a national research council, to gain trust and a close working relationship. This network was an important factor for the organizational flexibility and dynamics for managing the socio-ecosystem. The capacity to address the range of issues involved in the project was dispersed over a range of actors at different levels in society, rather than spreading his own personal resources too thinly (Olsson, 2004b) • Connectivity can be detrimental	• Leaders play a crucial role in activating social capital for the benefit of the community. Therefore they know how to work bureaucracy in order to gain benefits from government programs, and by facilitating collective action and conflict resolution. Young and educated leaders consolidate their positions by building large cross-caste networks to increase their bargaining power. On the other hand party officials use and reward new leaders according to the number of voters they can influence. (Krishna, 2002) • The village of Balesariya in North India, social capital has an almost ambient quality; people trust each other and meet often to deal with community issues and common problems. However, this collective action does not translate into superior

		therefore holds an extremely powerful position. The chairman can either be a barrier for collective action or a facilitator depending on his motivations (Bodin and Crona, 2006). • Having a centralised, cross boundary network proved beneficial in Swedish inshore fisheries as it allowed for adaptive management, greater rule compliance and sharing of management objectives (Sandström and Rova, 2010)	to collective action; Dialloube, Mali experienced issues of opportunistic leaders who by having connections to local state officials to resolve internal disputes actually undermine legitimacy and autonomy (Vedeld, 2000) • Once a community organizer accepts the idea, information they obtain can then be diffused through community communication networks (Crawford et al., 2006).	economic development; low agency capital is thought to be a limiting factor. The chief of Balesariya is not well-liked, yet is the only person in the village to have outside links to state and market contacts. Due to his inability to influence political decision making and his lack of leadership skills, he acts as a barrier to villagers ability to tap into funding resources (Krishna, 2002) • Work on political social capital found that social capital is highly dependent on tangible components such as styles and forms of leadership. As far back as the 1870s politician Joseph Chamberlain, Major of Birmingham recognised the importance of social networks. Chamberlain's social networks were wide ranging and multi-faceted covering numerous social classes and religious divides, and he was thoroughly embedded within those networks (Szreter and Woolcock, 2004) • In 5 organizations, individuals who were central to their work

			groups' advice networks had higher levels of in-role and extra-role performance than individuals who were not central players in the network. Individuals who were central to hindrance networks had lower levels of both in-role and extra-role performance (Keegan and Den Hartog, 2004) • In student group performance, social networks clearly mattered to important educational outcomes (student satisfaction, team project performance and individual grades). Both individual centrality and within- and between-team relationship were important to outcomes (Boggs, 2003)
Context	**Leader origin** • A project champion regardless of whether they originate from the community, a local agency, an external NGO or an academic institution, are key to co-management (Hauck and Sowman, 2001) • Despite contextual similarities, fisheries in Maine and Chesapeake had different	**Leader origin** • Influential leader of the Lower Helgea Project was originally a curator at the local museum, therefore part of society (Olsson et al., 2004b) • The board members of the Little Miami River Partnership, showed concern that the professionalism and lack of confrontation between board	**Leader origin** • For villages in rural areas, an increase in state expenditures for activities in rural areas, lower caste and other marginalized groups now have the ability to negotiate independently with state bureaucrats and state officials. A new wave of young, educated leaders has arisen, who are able

experiences in comanagement. Co-management in Maine was successful because of a local leader whereas Chesapeake Bay lacked a leader from within the community (Beem, 2007)

- In Cape Horn, Chile, complimentary leadership of a Chilean researcher and a civil administrator was very effective (Pollack et al., 2008).

members was actually a disadvantage. They were worried that, as professionals participating in the partnership as representatives of their employers, they lacked the passion of citizens and landowners. (Boonell and Koontz, 2007)

- In a Marine Protected Area (MPA) in Indonesia, the community selects the Community Organisers; therefore they are likely to be respected opinion leaders within the community (Crawford et al., 2006)

to gain benefits for their communities (Krishna, 2002)

- Krishna's later work in 61 villages in Rajasthan state, India, showed that out of 3 groups of local leaders, local government leaders, caste leaders and new leaders, villagers only had constant contact with new leaders (Krishna, 2007)
- Under the training of influential community leaders in Manu, Japan, a new wave of leaders has emerged, many of whom have been members of several community based groups and are actively involved in their activities (Nakagawa and Shaw, 2004)
- In the Colne Valley, UK, the initiator of a car club was a resident of the community who worked full time for a community organisation located in the village. The champion appears to have been well placed to develop the initiative due to her close connections within the community and secondly because of her profession within the

		community which allowed her to develop bridging links (Meaton and Low, 2003)
Legitimacy • In Bangladesh, local leaders were identified and elected by the fishers (Pomeroy et al., 2001) • An NGO working with community fisheries for floodplain management in Bangladesh nominated new leaders who rose to executive posts. However, this resulted in two sets of leaders, the newly elected leaders who saw the NGO as their source of help and power and an old set of leaders who saw NGO as a threat (Thompson et al, 2003)	**Legitimacy** • Elections for community forest management organizations in China were often poorly executed due to illiteracy and/or cultural barriers leading to a process riddled with errors Xu and Ribot, 2004) • Despite established systems for elections, leaders in Cameroon community forest programs did not represent local peoples' interests but were instead establishing themselves as a new local elite (Larson and Ribot, 2004)	**Legitimacy** • In Manu, Japan, the success of community was influenced by the democratic nature of groups. Selection of leaders was by a direct voting system and the election of a group chairman was conducted every two years at a community meeting (Nakagawa and Shaw, 2004)
Leadership • In Malawi and Mozambique, traditional leaders have been effective by becoming advisors or included in committees. In other instances chiefs form associations in which fishers have little influence. In Lake Chilwa, Malawi, sub-committee leaders are selected by traditional leaders; this can lead	**Leadership** • In San Martin, Mexico, the forestry elite (including the majority of the traditional authoritative body, Council of Distinguished Men) dominated through intimidation, manipulations, elections, dodging oversight and discouraging participation in community assemblies	**Leadership** • In the village of Ghodach, Northern India, numerous new leaders strive to maximize their influence over the community. From a population of only 2003, 7 capable new leaders have emerged. Ghodach has experienced lack of coherence and consensus building. The combination of leaders who

to the sub-committee becoming more accountable to the traditional leaders rather than the community (Njaya, 2007)
- In Kleinmond, South Africa, elected representatives from influential traditional elites failed to account for the interests of the fishermen, resulting in distrust and suspicion (Hauck and Sowman, 2001)
- A management liaison committee (group of leaders) can help facilitate information sharing between industry and management (Hauck and Sowman, 2001)
- Although many villagers in Mombasa were not aware of declining fish stocks, interviews with key individuals did not perceive the problem to be serious. This can be traced back to leader occupational homogeneity; all leaders were deep sea fishermen who fish further away, and were therefore not aware of issues near shore (Bodin and Crona, 2008)
- In Bangladesh, a leader served a certain time in office to gain (Klooster, 2000)
- In Madagascar unsuccessful CBNRM, was due to (in part) to corrupt local leadership (Kull, 2002)
- The failure of new local leadership in Cameroon community based forestry was related to the marginalization of traditional leaders, who had greater legitimacy but were left out of the process (Larson and Ribot, 2004)
- Problematic situations arose for the US Forestry Service, even if a forest supervisor was a key informant, as s/he may have been constrained by administrative or budget direction from higher-up authority (Cheng and Sturtevant, 2011)
- The leader of the Lower Helgea re-organizational project joined forces with members of Bird Society of North-Eastern Scania (BSNES), pooling their experiences and knowledge they were able to map local land use practices for the wetlands of the river (Olsson et al., 2004b)

acted for their own benefit rather than for the collective, and poor service quality led to distrust and scepticism among community members and leaders (Krishna, 2002)
- Community leaders in Manu, Kobe have strong ties, strengthened through social events such as recreational activities and festivals (Nakagawa and Shaw, 2004)
- In civic leadership in rural communities in Kansas, USA, to be involved in a leader group, individuals need to fall in line with the groups rules but, whose rules are they? What are the hidden realities of civic leadership? Some marginalized individuals within the community have been referred to as unusual voices, whom may feel unwelcome to participate in leader activities Kahl, 2012)

leadership skills and to reduce the possibility of corruption (Pomeroy et al., 2001) • In the Philippines, projects failed when the leader died, left political office or left the area, as there was no back up to take the leader's place (Pomeroy et al, 2001) • Communication between groups of leaders from different sites was key for successful management, especially for migratory fish species. Community initiated co-management in Lake Chiuta in Malawi, was undermined by lack of coherence between projects across the border in Mozambique (Njaya, 2007)	• Heterogeneity in leadership groups proved to be detrimental to collective action in Dialloube, Mali. The two leadership groups, the traders and the pastoralists, had strikingly different economic interests which ultimately led to intensified conflict [48] • Homogeneous characteristics of community organizers including ethnicity, religion, and educational attainment were important at the intracommunity level (Vedeld, 2000) • In a two decade water policy transition in Spain, policy entrepreneurs were clustered in a coalition of social, scientific and political organisations (Font and Subirats, 201)	

Appendix 2 – Summary of coding assignments for conditions and outcomes selected for inclusion in the final models

	Case	Country	Subsistence	Sedentary	Local decisions	External support	Leader	Community organization	Ecological	Social
1	Kuala Teriang	Malaysia	1.00	0.67	0.33	1.00	1.00	1.00	0.10	0.67
2	Kilim	Malaysia	1.00	1.00	0.33	1.00	0.67	1.00	0.40	0.33
3	Ban Laem	Thailand	0.67	1.00	0.67	0.33	0.67	1.00	1.00	1.00
4	Tong Tasae	Thailand	0.67	1.00	1.00	0.33	1.00	1.00	0.90	1.00
5	Ban Bang Chan	Thailand	0.67	0.33	0.33	1.00	1.00	0.00	0.10	0.33
6	Bang Saphan Bay	Thailand	0.00	0.67	0.33	0.67	0.33	0.00	0.10	0.67
7	Nolloth	Indonesia	0.67	0.67	1.00	0.67	0.67	0.00	0.00	0.67
8	Blonko	Indonesia	0.67	1.00	0.67	1.00	1.00	0.00	0.90	1.00
9	Talise	Indonesia	0.67	0.33	0.67	1.00	0.67	0.00	0.60	0.33
10	Wakatoba	Indonesia	0.33	0.67	0.33	0.67	1.00	1.00	0.90	0.67
11	Pasir Lawas	Indonesia	0.33	0.00	1.00	0.00	0.00	0.00	0.60	1.00
12	Gili Indah	Indonesia	0.67	0.00	1.00	1.00	0.00	1.00	0.60	0.33
13	KNP	Indonesia	0.33	0.33	0.33	0.67	0.00	1.00	0.40	0.67
14	Senayang Island	Indonesia	0.67	0.00	0.67	0.67	0.33	1.00	0.60	0.67
15	Jemluk Village	Indonesia	0.67	0.33	0.67	1.00	1.00	1.00	1.00	0.33
16	Pemutaran Bay	Indonesia	1.00	0.67	1.00	1.00	1.00	1.00	1.00	1.00
17	BNP	Indonesia	0.00	0.33	0.33	0.67	1.00	1.00	0.40	1.00
18	Desa and Sameth	Indonesia	0.67	1.00	1.00	1.00	0.00	0.00	0.10	0.33
19	Au Tho B	Vietnam	0.33	1.00	0.67	1.00	1.00	1.00	0.90	1.00
20	Hon Mun MPA	Vietnam	1.00	0.67	0.33	0.33	1.00	1.00	0.40	0.67
21	Ving Giang	Vietnam	0.33	0.33	0.67	0.67	0.67	1.00	1.00	0.67
22	Cu Lao Cham	Vietnam	0.33	0.00	0.33	0.00	0.00	1.00	0.10	0.00
23	Ha Lien	Vietnam	0.33	0.33	0.00	0.00	1.00	1.00	0.60	0.67
24	Nui Chu National MP	Vietnam	0.67	0.67	0.67	1.00	0.00	0.00	1.00	0.33
25	Xuan Tu	Vietnam	0.67	1.00	1.00	0.00	1.00	1.00	0.90	1.00
26	Danjugan Island	Philippines	1.00	0.33	0.67	0.67	0.33	1.00	1.00	1.00
27	Twin Rocks	Philippines	0.67	1.00	0.67	0.67	1.00	1.00	0.40	0.00
28	Olango Island	Philippines	0.33	1.00	0.67	0.67	1.00	0.00	0.60	0.33
29	Balicasag Island	Philippines	0.33	0.67	0.67	1.00	0.67	0.00	0.10	0.00
30	Panguil Island	Philippines	0.67	1.00	0.00	0.67	0.33	1.00	1.00	0.67

31	Preito Diaz	Philippines	1.00	0.67	0.67	1.00	0.67	1.00	1.00	0.00
32	Minanbonan	Philippines	1.00	0.67	1.00	0.33	1.00	1.00	1.00	0.33
33	Calabanga	Philippines	0.67	0.67	0.67	1.00	0.00	0.00	1.00	0.33
34	Pagapas Bay	Philippines	0.33	0.00	0.00	0.33	0.00	1.00	0.10	0.00
35	Cogtong Bay	Philippines	1.00	0.33	0.67	0.67	0.33	1.00	0.10	0.33
36	Bolinao	Philippines	0.67	0.67	0.67	0.33	1.00	1.00	0.90	0.67
37	Peurto Princesa	Philippines	0.33	0.67	0.67	0.67	1.00	1.00	0.40	0.33
38	Danao Bay	Philippines	0.33	0.67	0.33	0.33	1.00	1.00	1.00	0.67
39	Malilison Island	Philippines	0.67	1.00	0.67	1.00	0.00	1.00	0.60	1.00
40	San Salvador	Philippines	0.67	0.67	0.67	1.00	1.00	1.00	1.00	0.67
41	Apo Island	Philippines	1.00	0.67	0.67	1.00	1.00	1.00	1.00	0.33
42	Sumilon Island	Philippines	1.00	0.67	0.33	0.00	0.00	0.00	0.90	0.00
43	Barili	Philippines	0.33	0.33	0.67	1.00	1.00	1.00	0.10	0.33
44	Krala Peah	Cambodia	0.33	0.67	1.00	0.67	0.67	0.00	0.00	0.67
45	Stung Hav	Cambodia	0.67	1.00	0.67	0.67	1.00	1.00	1.00	0.67
46	Kompong Phluk	Cambodia	0.33	0.67	1.00	0.67	1.00	0.00	0.90	0.67
47	Ko Sralao	Cambodia	1.00	0.33	1.00	0.33	1.00	0.00	0.60	0.33
48	Tblong Kla	Cambodia	1.00	0.67	0.67	0.33	1.00	1.00	0.00	0.33
49	Koh Sneng	Cambodia	1.00	0.67	0.67	0.67	1.00	1.00	0.90	0.67
50	Au Svay	Cambodia	1.00	0.67	0.67	0.00	0.00	1.00	0.90	1.00

Appendix 3 – Summary of case study configurations and boundary crossing conditions for 18 cases

Case	Country	Contextual conditions				Boundaries of interest	Comments
		Development status (in HDI)	Local participation	Fishery complexity	Management arrangements		
Nipissing First Nation	Canada	Very high	Yes	Single species	Relatively new (2008)	CLS / ~CLS (some pull on science)	Nipissing First Nation employs external advisors to assist them in data collection and analysis. Questions as to what defines credible knowledge in a regional context
Lake Hjälmaren	Sweden	Very high	Yes	Single species	New (2013)	~CLS/CLS	Pull by fishers to get governmental and academic input to build credible knowledge, facilitated by a NGO.
Southwest IFG	Scotland	Very high	Yes	Multi species	New (2013)	CLS / CL~S (needs either policy pull or legitimacy push)	IFG supported in research by the Solway Firth Partnership and the University of Shetland. Salience uncertain due to frequent changes in policy direction
Lamlash Bay MPA	Scotland	Very high	Yes	Multi species	Relatively new (2008)	CLS/CL~S (social pull on saliency and credibility)	COAST is actively pulling policy into a situation where scientific credibility and social legitimacy are strong. Despite a degree of support, the government shows a lack of political leadership. Other local stakeholders distrust research conducted by Marine Scotland
OMMRFI marine reserve	Spain	Very high	Yes but the reserve is currently	Multi species	Established (early-mid 2000s)	CLS / CL~S	Leadership of a local actor was paramount to initial discussions; he pushed to expand the focus of

			operating as a 'paper park'				scientific knowledge to include local knowledge. OMMRFI achieved CSL, however broader political and economic contexts degraded the boundary to C~SL
Isle of Scilly IFCA	England	Very high	Yes	Multi species	New (2011)	CLS / CL~S	Partnerships with universities and local participation increases legitimacy and credibility. Institutional uncertainty in the funding stream will potential reduce saliency and credibility into the future
Khong District co-management	Lao PDR	Medium	Yes (but project on hold)	Multi-species	The project is now over – at the time it was relatively un-established (1993-1999)	CLS / CL~S	With the support and push of NGOs, CLS was achieved. Using existing local leadership was crucial. Institutional uncertainty reduced saliency. However, lessons learnt through project activities are still being practiced to a certain extent.
NZRLIC	New Zealand	Very high	Yes	Single species	Established (1996)	CLS / C~LS	Incentive structures of regional leaders impact the level of research conducted. Institutional uncertainty which impacts property rights reduces policy saliency and influences local level behavior.
Negombo Lagoon aquaculture	Sri Lanka	High	Yes	Single species	Established (early 2000s)	CLS / C~LS	Although final decision-making resides at the government level, the community plays a significant role in data collection and design of the crop calendar. Corruption and discrimination reduces social legitimacy

MEABR loco fishery	Chile	Very high	Some (but decreasing)	Single species	Established (1991)	CLS / C~LS	The continuation of an overly top-down approach has reduced social legitimacy. Leadership that can operate across boundaries (vertically and horizontally) is crucial.
Taunton Bay lobster fishery	USA	Very high	Yes (but project on hold)	Multi-species	Relatively new (2007-2010)	CLS / C~LS	Government effort to pull fishers into management system to improve credible science. Taunton Bay achieved CSL, however economic contexts and the loss of a leader degraded the boundary to CS~L
Aqaba commercial fishery	Jordan	Medium	Yes (Increasing)	Multi-species	New (2013-2014)	C~L~S / C~LS	Strong push by a science to improve saliency and legitimacy. Trust was built through project activities and feedback. Legitimacy is still uncertain due to the lack of participation of fishers in decision making which reflects limited capacity and awareness.
WD-DACE project	Kenya	Low	Yes	Multi-species	New (2010)	C~L~S / C~LS	Strong push by science to improve saliency and legitimacy. Credibility was enhanced through the use of models, however legitimacy and saliency are disputed
Galapagos National Park	Ecuador	High	Yes (but potentially decreasing)	Multi-species	New (new management structure came into force in 2015)	CLS / ~C~LS	Fractious relationships between leadership groups caused by uncertainty in mandate. Concerns about legitimacy and credibility due to the dissolve of the CDF and PMB
APAPM artisanal fishers	Argentina	Very high	Some (but decreasing)	Multi-species	Established (1993)	~C~L~S	Original pull from fishers to facilitate more credible policy. Legitimacy, saliency and credibility dissolved due to poor transparency, poor integration and fluctuating support from the state.

Community fisheries of Belo Sur Mer	Madagascar	Low	Yes	Multi-species	Relatively new (2009)	CL~S	Science-oriented NGO pushing to expand social legitimacy and scientific credibility. There is currently a lack of government involvement, therefore poor policy saliency.
VicWZ abalone fishery	Australia	Very high	Yes	Single species	Established (2001)	CLS (industry members pushing for legitimacy)	Limited engagement with government but strong property rights in place (therefore saliency) and fishers are experienced in research. Strong local leadership facilitates discussions with the government.
Gooseneck barnacle fishery	Spain	Very high	Yes (but decreasing)	Single species	Established (1994)	CLS	The implementation of co-management and property rights has increased credibility, saliency and legitimacy. The participation of local users and their knowledge has increased flexibility, resilience and adaptability.

List of abbreviations

APAPM – Association of Artisanal Fishers of Puerto Madryn

BMU – Beach Management Units

BNP – Bunaken National Park

BV – Blue Ventures

BVC – Beach Village Committee

CBFM – Community-Based Fisheries Management

CDF – Charles Darwin Foundation

COAST – Community of Arran Seabed Trust

DoF – Department of Fisheries

EPCFSWP – Environmental Protection and Community Development in Siphandone Wetland Project

FAO – Food and Agriculture Organization

fSQCA – Fussy Set Qualitative Comparative Analysis

GGC -Galapagos Governing Council

GIZ - Gesellschaft für Internationale Zusammenarbeit

GNP – Galapagos National Park

GSL – Galapagos Special Law

HDI – Human Development Index

IAD – Institutional Analysis and Development (framework)

ICM – Integrated coastal management

IFCA – Inshore Fisheries and Conservation Authorities

IFG – Inshore Fisheries Group

IFQ – Individual Fishery Quota

IMA – Institutional Management Authority

ITQ – Individual Tradeable Quota

JREDS – Jordan Royal Ecological Diving Society

KNP – Karimunjawa National Park

LEK – Local Ecological Knowledge

MEABR – Management of Exploitation Area for Benthic Resources

MPA – Marine Protected Area

MSC – Marine Stewardship Council

MSY – Maximum Sustainable Yield

NGO – Non-Government Organization

NTZ – No Take Zone

NZRLIC – New Zealand Rock Lobster Industry Council

OMMRFI - Os Miñarzos Marine Reserve of Fishing Interest

PMB – Participatory Management Board

PO – People's Organization

QCA – Qualitative Comparative Analysis

SES – Social-Ecological Systems

SLADA – Sri Lanka Aquaculture Development Alliance

SSF – Small-Scale Fisheries

TAC – Total Allowable Catch

TBTI – Too Big To Ignore

TURF – Territorial User Rights in Fisheries

VBN – Value-Belief Norm Theory

VicWiz – Victoria Western Zone

WD-NACE – Whole Decision-Network Analysis of Coastal Ecosystems

WWF – World Wildlife Fund