

Transitioning from Vulnerability to Viability: Small-Scale Fisheries in Marine Protected Areas of Sri Lanka

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Small-scale fisheries (SSF) play a vital role in poverty reduction and food security in developing countries, providing livelihoods for millions while supplying essential nutrition to billions and contributing to local and national economies. However, small-scale and traditional fishing and coastal communities face increasing challenges due to the establishment of conservation measures, such as marine protected areas (MPAs), which directly affect their livelihoods, food security, culture, and survival. Highly protected MPAs, which ban extractive and destructive maritime activities, are effective in protecting and restoring marine biodiversity. MPA governance, however, often results in nearby coastal communities losing their rights and access to resources. While setting science-based limits on fish catch is an effective management practice, fisheries' biological, socioeconomic, cultural, and governance contexts need to be concerned for the most appropriate conservation interventions. This research aims to examine the effects of the governance of marine protected areas that exacerbate the vulnerability of small-scale fisheries. The study's objectives are, 1) to characterize MPAs, SSF, and their interactions, 2) to examine the key drivers that exacerbate the vulnerability of SSF in MPAs, 3) to examine the key drivers that facilitate the viability of SSF in MPAs, and 4) to examine the key attributes of an appropriate MPA governance arrangement that is effective to facilitate the transition of SSF from vulnerability to viability. The study is focused on the Bar Reef Marine Sanctuary (BRMS), the largest MPA in Sri Lanka. The study was conducted in four purposefully selected study sites, Kudawa, Kandakuliya, Kalpitiya, and Uchchimunei. Following a qualitative case study approach, the study collected data through semi-structured interviews (n=51), two focus group interviews (n=2), observations, and literature review. The key research findings identified Kalpitiya SSF as a low-tech, labor-intensive occupation inherited from previous generations, mainly focusing on the domestic market. Further, the BRMS in Kalpitiya is significant in terms of biodiversity, ecosystem, and economic benefits. However, it has encountered challenges from past natural disasters and unsustainable fishing practices. These two social and natural systems are highly interconnected and complex regarding ecosystem dynamics and human interventions. Moreover, the major domains affecting the vulnerability of Kalpitiya SSF are governance and management, while the ecological and environmental domain have more viable impacts. However, the economic and development domain has both vulnerable and viable effects on SSF. The key recommendations for future governance implications to facilitate the transition from SSF vulnerability to viability include

incorporating SES characteristics in policy developments, enhancing community involvement in governance, and the improvements in governance institutions.

Key terms: Small-scale fisheries, MPA governance, Social-ecological systems, Vulnerability and Viability

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Dedication

I dedicate this thesis to my dear family for their unwavering love, support, and belief in me,
&
to the kind and hardworking fisher community in Kalpitiya, who daily struggle at sea.

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List of Abbreviations

BRMS	Bar Reef Marine Sanctuary
CCD	Department of Coast Conservation and Coastal Resource Management
DFAR	Department of Fisheries and Aquatic Resources
DS	Divisional Secretariat
DWC	Department of Wildlife Conservation
FA	Fisheries Association
FAO	Food and Agriculture Organization
FARA	Fisheries and Aquatic Resources Act
FFPO	Fauna and Flora Protection Ordinance
FGD	Focus group discussions
GEF	Global Environment Facility
GND	Grama Niladhari Division
IG	Interactive Governance
IUCN	International Union for Conservation of Nature
IUU	Illegal, Unreported and Unregulated fishing
MPA	Marine Protected Area
NAQDA	National Aquaculture Development Authority of Sri Lanka
NARA	National Aquatic Resources Research and Development Agency
NGOs	Non-governmental organizations
SDG	Sustainable Development Goals
SES	Social-ecological systems
SLCG	Sri Lanka Coast Guard
SLTDA	Sri Lanka Tourism Development Authority
SSF	Scall-scale fisheries
TBA	Tourist boat association
UNDP	United Nations Development Programme

V2V	Vulnerability to Viability
WFA	Women Fisheries Association

Chapter 1

Introduction

1.1. Research context and problem rationale

Small-scale fisheries (SSF) are often marginalized across cultural, social, economical, geographical, legal, and political dimensions, despite their significant contributions to poverty eradication, livelihoods, food security, and community well-being (Chuenpagdee & Jentoft, 2018). Over the past few decades, the marginalization and vulnerability of SSF have been intensified by range of drivers such as climate change, overfishing, industrial fleets, unsustainable industrial and urban development, and habitat destruction (Islam & Chuenpagdee, 2022). Moreover, access to marine resources and coastal areas has increasingly been restricted by conservation measures, such as marine protected areas (MPAs), which significantly affect the livelihoods and the survival of fisheries communities that rely on these coastal resources for their day-to-day sustenance (FAO, 2020). Protected areas, including MPAs, are a socially constructed set of rules that collectively govern human interactions within marine reserve boundaries (Mascia, 2004).

Marine protected areas (MPAs) are complex and dynamic ecological and social systems, deeply intertwined with many local and indigenous communities whose cultural identities- lives and traditions- are closely linked to their natural environments. However, the abrupt and forceful establishment of conservation rules and property rights over coastal resources can severely disrupt these communities, undermining their livelihoods and the delicate balance of social-ecological systems (Sowman et al., 2021; Bavinck et al., 2017). This phenomenon, known as “*coastal grabbing*”, often fails to consider the interests of the local communities that are dependent on these natural resources, leading to displacement, impoverishment, outmigration, and a loss of cultural identity among SSF communities (Bavinck et al., 2017). The reallocation of access rights from MPAs determines who can enter a specific spatially defined area and who can exploit certain resources (Mascia & Claus, 2009). The displacement and reallocation of these access rights make local communities economically and socially vulnerable by disrupting their livelihoods, weakening community relationships, and diminishing their sense of place (Mascia & Claus, 2009). Inevitably, fishing restrictions threaten local fishers' livelihoods and negatively impact food security within SSF communities, many of whom depends on fishing for both economic subsistence and daily consumption (Nurhidayah & Alam, 2017).

Inappropriate conservation practices adversely affect the relationship between social and ecological systems. When communities are entirely or partially prohibited from accessing, using, and managing local resources, it leads to a gradual loss of responsibility for the natural environment among the local community (Bavinck et al., 2017). Additionally, the establishment of MPAs may push the resource users who lose access rights to migrate elsewhere in search of opportunities. This displacement, in turn, can create new resource conflicts within the broader society (Mascia & Claus, 2009).

Most studies on MPAs tend to focus on ecological aspects, often lacking social data (Ban et al., 2017a). To establish effective reserves, it is essential to assess direct and indirect use values, wealth distribution, social relations, and perceptions of well-being in addition to factors such as fish abundance or species richness (Mascia, 2014). Lubchenco *et al.* (2003) in their study highlighted the need to consider the interaction between human stakeholders and the success of marine reserves from a socio-economic perspective during the design phases of these reserves. Although setting science-based limits on fish catch is an effective management practice, it is crucial to account for the biological, socio-economic, cultural, and governance context of fisheries to ensure appropriate interventions (Costello *et al.*, 2020). According to Pitcher and Lam (2010), multiple variables- including economic, ecological, social viability, ethical status, and institutional implementation- need to be evaluated for achievable and restorative policy goals for fisheries management. Moreover, Eales *et al.*, (2021) in their research has highlighted that identifying knowledge gaps related to human health and well-being- such as freedom of choice and action, security and safety, subjective well-being, health, culture and spirituality, education, and awareness- are crucial for effective marine conservation. Research in coastal and marine protected areas in Mexico suggests a pressing need to understand local and global social, economic, and ecological processes within the context of protected area management issues (Jesus & Fraga, 2008). Consequently, there is a need for a robust dataset to evaluate the effectiveness of MPAs in both biological and socio-economic dimensions, which can help design, classify, and implement MPA policies and goals (Horta e Costa et al., 2016). States should prioritize the needs of marginalized and vulnerable SSF communities during the design, planning, and implementation of management practices such as protected areas (Chuenpagdee & Jentoft, 2018).

1.2. Purpose statement

This research aims to explore how small-scale fisheries (SSF) can transition from vulnerability to viability within marine protected areas (MPAs) by implementing effective governance practices. By addressing gaps in the existing literature, this study will go beyond ecological and environmental considerations. It aims to explore economic development, social and cultural factors, and governance challenges that exacerbate SSF vulnerabilities and hinder their viability within the context of MPA governance (Costello et al., 2020; Dirhamsyah, 2016; Eales et al., 2021; Jesus & Fraga, Julia, 2008; Lubchenco et al., 2003; Pitcher & Lam, 2010).

1.3. Research objectives

This study examines the social-ecological system of SSF and MPAs and the impacts of MPA governance on small-scale fisheries. Ultimately, it aims to address gaps in MPA governance for a successful transition from vulnerability to the viability of SSF in MPAs through appropriate MPA governance practices. The research is guided by the following four objectives and research questions.

- 1) To characterize the MPAs, SSF, and their interactions
 - I. What are the characteristics of SSF and MPA and their interactions?
 - II. What are the current practices of MPA governance in BRMS, Kalpitiya?
 - III. How has the governance of the MPA impacted its local SSF industry?
- 2) To examine the key drivers that exacerbate the vulnerability of SSF in MPAs
 - IV. What are the key drivers that exacerbate the vulnerability of SSF in BRMS, Kalpitiya?
- 3) To examine the key drivers that facilitate the viability of SSF in MPAs
 - V. What are the key drivers that facilitate the viability of SSF in BRMS, Kalpitiya?
- 4) To examine the key attributes of an appropriate MPA governance arrangement effective to facilitate the transition of SSF from vulnerability to viability
 - VI. What are the appropriate MPA governance practices for making small-scale fisheries viable?

1.4. Literature review

The literature review of this study aims to establish a comprehensive understanding of theories and concepts related to MPA governance, as well as the vulnerability and viability of SSF. The study synthesizes current knowledge about MPA governance and its impacts on SSF by examining a wide range of literature. Additionally, the literature reviews of this research also identify gaps in current research and highlight areas that need further investigation to address challenges in MPA governance and enhance the viability of SSF.

1.5. Research methodology

This study employed a qualitative case study approach to gain an in-depth understanding of the lived experiences of fisher communities in the context of MPA governance. The research methods began with a comprehensive literature review on MPA governance and the vulnerability and viability of SSF. This review included peer-reviewed journal articles, government publications, and other relevant documents to establish a solid theoretical foundation. Next, field data collection involved 51 in-person, semi-structured interviews with a diverse range of participants, including fishers of various scales, community leaders, tourist boat operators, other community members, and government officials. These interviews aimed to capture diverse perspectives on the research context. To complement the interviews, the final stage of field data collection included two focus group discussions with total 12 participants. These discussions were conducted to deepen the understanding of data gathered from semi-structured interviews, which allowed community members to interact with one another and refine the emerging themes. This approach enhanced the validity of the data collected for the research. By conducting both interviews and focus groups on-site, I was able to engage directly with participants and observe the social-ecological system in real-time, which provided valuable context and insights that enriched the data. Finally, the data analysis involved inductively analyzing the themes that emerged from the collected data.

1.6. Significance of problem and contributions

The primary aim of this research was to identify and reshape the vulnerabilities faced by SSF within the context of MPA governance, proposing viable options in governance practices. Thus, this study contributes to a systematic understanding of key domains and drivers influencing the vulnerabilities and viabilities of SSF communities in MPAs. In addition, this study will enhance the existing literature by

exploring the socioeconomic, cultural, and governance context of MPAs in the SSF communities, extending beyond ecological focus.

The findings of this study will provide a comprehensive understanding of the impacts of current MPA governance practices on the small-scale fisheries sector and expectations regarding future governance strategies from the perspectives of SSF communities. Consequently, this study will provide a systematic understanding of MPA governance practices and their implications for future policy development. This information will be helpful for policymakers, governmental bodies, practitioners, and non-governmental organizations to support sustainable small-scale fisheries. Lastly, the outcomes of this study will be instrumental in setting up coastal conservation practices in the future by considering the needs and perceptions of coastal resource users. It will further provide generalizable insights applicable to natural resource-dependent communities that may experience vulnerability during the establishment of ecological conservation measures.

1.7. Thesis structure

The thesis consists of a total of seven chapters. Chapter 1- introduces and explains the research problem and outlines the purpose of the study, along with research objectives, questions, significance, and contributions. Additionally, chapter 1 also briefly explains the methodology that guided the research. Chapter 2 expands into the literature relevant to the study, discussing key concepts such as small-scale fisheries (SSF), marine protected areas (MPA), and vulnerability and viability. This chapter also describes the conceptual frameworks – social-ecological systems and interactive governance adopted by this study. Chapter 3 of this research focuses on the research methods employed in the data collection for this study, study location, and the data analysis process. Further, it outlines the study limitations, the researcher's positionality, and research ethics. Chapters 4, 5, and 6 highlight the research findings that directly address the research objectives outlined in Chapter 1. Chapter 4, specifically, characterizes the social-ecological system of SSF and MPA by examining the resource system, resource units, users, and their interactions. Chapter 5 delves into the current MPA governance structure of the case study location, highlighting the role of institutes and orders of governance. Chapter 6 analyzes the vulnerabilities and viabilities of SSF in MPAs. The first half of chapter 6 highlights the major domains and drivers of vulnerability and viabilities identified by the participants. The second half of this chapter synthesizes vulnerabilities and viabilities stemming from SES characteristics discussed in Chapter 4 and governance aspects covered in Chapter 5.

Finally, Chapter 7 concludes by summarizing the key findings, and providing recommendations for future governance implications.

Chapter 2

Literature Review

2.1 Introduction

This chapter explores the key concepts that are used in this research. Section 2.2 focuses on small-scale fisheries, while section 2.3 examines marine protected areas (MPA), including their critiques and trends in MPA governance. Section 2.4 discusses the vulnerability and viability of SSF. Finally, section 2.5 explores the conceptual frameworks employed in this study: the social-ecological systems framework and interactive governance. This chapter concludes by identifying gaps in the literature and suggesting potential directions for further research.

2.2 Small-scale fisheries

Small-scale fisheries (SSF) are a vital component of the global economy that provides livelihoods and food security to millions, particularly in developing countries. SSF represents the largest employer in the ocean economy, surpassing industrial fisheries, oil and gas, shipping, and tourism combined (World Bank, 2012; OECD, 2016). According to FAO (2020), an estimated 39 million people were engaged either on a full-time, part-time, or occasional basis in the primary sector of capture fisheries in 2018, of which the majority are in small-scale fisheries, artisanal fisheries, and aquaculture in developing countries. SSF involves labor-intensive harvesting and processing of marine and inland fish using low-technology gear and vessels with small capital investment (FAO, 2004). Asia has the highest number of fisheries workers, accounting for 85% of the global total and the sector continues to grow in terms of employment (FAO, 2020). SSF contribute to approximately half of the global fish catch and employ more than 90% of the people working in fisheries, with women making up nearly 50% of the workforce. Additionally, 97% of these fish workers are from developing countries, contributing to half of the global fish catch, 90-95% of which is consumed locally (FAO, 2020). Around half of the global fish catch intended for direct human consumption is provided by these SSFs (FAO, 2015). Despite their significance, many SSF communities, even in the developing countries, experience high levels of poverty and are deprived of food nutrition (Allison, 2011, Kawarazuka & Béné, 2010, FAO, 2020, World Bank, 2012). Hence, SSF and small and medium scale aquaculture enterprises play a vital role in the context of poverty reduction and food and nutrition security in developing countries. They provide livelihoods to millions and essential nutrition to billions while substantially contributing to household economies, as well as local and national economic growth (Allison, 2011, FAO, 2020, Kelleher, 1999, Sala et al., 2021).

Fish is an affordable and accessible source of animal protein, rich in micronutrients and essential fatty acids, particularly for poor households in developing regions (Kawarazuka & Béné, 2010). SSF is recognized as an irreplaceable segment of society due to its immense role in food security, poverty alleviation, and ecosystem health (Chuenpagdee & Jentoft, 2013). SSF is not only limited to providing livelihoods and food, but it also plays a major role in the deep-rooted social and cultural value systems of communities worldwide. Hence, the sustainability of SSF is critical for preserving cultural identities and promoting social cohesion within communities.

As the demand for global food consumption increases, adding more stress on terrestrial food production, food from the sea can provide highly nutritional food to ensure food provision and food and nutrition security while reducing land-based environmental and health issues (Costello et al., 2020). Thus, low-income food-deficit countries should inevitably integrate the sustainability of small-scale fisheries and aquaculture expansion into their national-level strategies (Kawarazuka & Béné, 2010). Yet, various factors such as ecological, economic, policy, and technology will influence the future contribution of seafood to global food supply in the future (Costello et al., 2020). Jentoft & Chuenpagdee (2009), argue that SSF is highly complex and involves various actors and institutions that govern how resources are accessed and managed. Moreover, governance is highlighted as one key challenge to SSF, where effective governance needs a combination of strong, coordinated institutions with enhanced community engagement to benefit the vital SSF industry (Jentoft, 2014).

Despite their immense contribution to the economy, household income generation, and food sourcing, SSF is often marginalized in social, economic, and political processes and is frequently overlooked in the policy development (FAO, 2020, Johnson et al., 2018). SSF communities face numerous challenges, including pollution, environmental degradation, climate change impacts, and natural and human-induced disasters (FAO, 2015).

SSF also often faces issues related to access, property rights, governance, trade and globalization, and international agreements (FAO, 2004). Access to marine resources and space is increasingly challenged by growing competition from marine aquaculture, climate change impacts, different fleet segments targeting the same stocks and operating in the same space, and conservation measures such as MPAs (FAO, 2020). MPAs, particularly no-take zones in traditional fishing areas, can increase the SSF's vulnerability. Spatial closure through setting up no-take zones reduces the economic viability of fishers by limiting fishing activities (Boubekri et al., 2022). Such restrictive regulations can lead to loss of

income, decrease food security and displacement from traditional fishing grounds. Additionally, these also increases social tension and political struggles among the SSFs. As a result, these vulnerabilities often outweigh the perceived benefit of MPAs, undermining fishers' cultural values, way of life, and sense of place. These factors eventually contributing to the failures in ecological conservation (Kriegl et al., 2021).

Moreover, higher-priority economic sectors such as tourism, energy exploitation, and marine transport are increasingly invading the space where small-scale fisheries operate (FAO, 2020). The establishment of MPAs directly impacts the livelihoods, culture, and survival of small-scale, and traditional fishing and coastal communities. SSF play a crucial role in supporting livelihoods, ensuring food and nutrition security, and enhancing the overall well-being of coastal populations worldwide (Costello et al., 2020, Stacey et al., 2021).

2.3 Marine protected areas

Marine protected areas have become an emerging tool for marine biodiversity conservation that avoids disturbances occurring to both living and non-living marine resources by overfishing, destructive fishing practices, land-based marine pollution, climate change, etc. (Dudley, 2008; Nurhidayah & Alam, 2017; WWF, n.d). Marine protected areas are defined as an area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, and historical and cultural features, which have been reserved by law or other effective means to protect part or all of the enclosed environment (IUCN, 1999).

According to IUCN, nearly 5,000 marine protected areas are established worldwide (Dudley, 2008).

There are different types of protected areas classified by the IUCN. These protected areas are divided into six types based on their objectives: (i) strict nature reserve- mainly for science or wilderness protection; (ii) national park- mainly for ecosystem protection and recreation; (iii) natural monument- mainly for conservation of specific natural features; (iv) habitat/species management area- mainly for conservation through management intervention; (v) protected landscape/seascape- mainly for landscape/seascape conservation and recreation; (vi) managed resource protected area- mainly for sustainable use of natural ecosystems (IUCN, 1994). Furthermore, marine protected areas can be categorized into four types based on the level of protection of its biodiversity from permissible activities (e.g. mining, dredging and dumping, anchoring, infrastructure, aquaculture, fishing, and non-extractive activities) within an MPA as (i) fully protected -no extractive or destructive activities allowed, (ii) highly protected – only light extractive activities with minimal impact are allowed, (iii) lightly protected – moderate and substantial

extraction and other impacts are allowed and (iv) minimally protected –extensive extraction and other impacts are allowed (Gorud-Colvert et al., 2021). This categorization comes with a zoning plan in action to manage MPAs, which defines the purposes for which each part of the protected area can be utilized. Therefore, a thorough understanding of these zoning practices is essential as the level of restriction on access to marine resources varies among each of these zones. The two primary principles for establishing MPAs are to protect declining fish stock and restore the proportion of fish stocks within biologically sustainable levels for a viable fishery (Kelleher, 1999; Sala et al., 2021). Fish stocks are classified into three categories, namely underfished, maximally sustainably fished, and overfished. In this regard, the underfished and maximally sustainably fished levels are considered biologically sustainable fish stocks, and the overfished are considered biologically unsustainable (FAO, 2020). The percentage of biologically sustainable stocks is used to indicate the sustainable development goal (SDG), which is 14.4.1. and the Convention on Biological Diversity’s Aichi Target 6 (FAO, 2020).

From an ecological perspective, marine protected areas are highly recognized as effective in conserving the complex marine biodiversity that encompasses various marine taxonomies and ecosystems to protect species from extinction. It also maintains diversity in species and preserve evolutionary marine life history, and ensure the representation of biogeographical features (Sala et al., 2021). Highly protected MPAs that ban extractive and destructive activities are considered effective to mitigate climate change and safeguard conventional fisheries by increasing the biomass of commercially targeted fish through adult and larval spillover (Sala et al., 2021). In addition, MPAs protect water quality and the movement of nutrients, maintain food chains, increase biological productivity, and help nature-based tourism (Kelleher, 1999).

2.3.1. Critiques of MPA governance

Marine areas are usually considered as “the commons” that all users can access (Dudley, 2008). Since it is a common space, it becomes a major challenge to governance in these areas, since the coastal communities are dependent on the common resources of these marine areas for their livelihoods (Armitage et al., 2017). Moreover, it becomes extremely difficult to enforce boundaries or restrictions, and control or regulate the entry and activities of external influences in these areas. Therefore, it is often under the influence of the surrounding factors, making it unmanageable as separate single units where the scale of marine connectivity is much larger than the land (Dudley, 2008). Further, it is often questionable whether full protection is required throughout a range of time periods, which is only possible when fish

and other marine mammals are at their breeding stage (Dudley, 2008). Moreover, even though fisher communities have improved their knowledge about marine parks over time, the acceptance rate and support towards MPAs may decrease due to the disagreements with regulations enforced through top-down decision-making without encompassing participation, recognition, and legitimacy to fishers (Pita et al., 2020). Protecting threatened species, preventing illegal, unreported, and unregulated fishing (IUU), sustaining MPAs, and ensuring social sustainability in the value chain are some of the other challenges in marine conservation (Costello et al., 2020; FAO, 2020). In addition to these attributes, the lack of proper institutions and legal frameworks has contributed to the ineffectiveness of MPAs (Dirhamsyah, 2016). Legislative framework and institutional arrangements such as coordination problems, functional overlap, and unclear mandates set by government agencies become setbacks in the development of marine protected areas (Dirhamsyah, 2016). Most importantly, marine protected areas are successful when multi-stakeholders are involved during the planning, implementation, monitoring, and enforcement stages of MPAs, further considering the foundations of good governance and management, such as accountability, transparency, and inclusiveness (Nurhidayah and Alam, 2017). FAO (2020) highlights the importance of the direct participation of SSF communities in fisheries management by enhancing co-management practices while allowing access to marine resources in the paradigm of the blue economy.

2.3.2. Trends in MPA management practices

The success of MPAs depends on government involvement as well as the support and involvement of local people, where the balance of both government-driven “top-down” and local people involved “bottom-up” management approaches are an integral part of it (Kelleher, 1999). As defined by the IUCN, the ownership or management authority of protected areas remains ‘neutral’, which in turn means government agencies, private parties, non-government organizations, communities, and Indigenous people can own or directly manage the natural resources alone or collaboratively (Dudley, 2008). Currently, the design of MPAs is evolving in a way that engages both community and governing bodies in the process. Further, increasing consideration is on social and ecological systems in the planning and management process, incorporating human dimensions (Ban *et al.*, 2011). Recent research highlights a shift towards inclusive governance concerning the well-being of stakeholders, particularly in large-scale MPAs (Ban et al., 2017b). In addition to that, an emerging trend of adaptive management practices is also being considered when planning MPAs (Ban *et al.*, 2011). According to Weeks & Jupiter (2013), adaptive management of natural resources is an iterative process of decision-making whereby

management strategies are progressively changed or adjusted in response to new information. Adaptive management is also applied as a concept to understand the effectiveness and efficiency of management inside MPAs nowadays. The evolving trends in MPA demonstrate improvements in considering social and ecological systems through adaptive management and collaborative approaches.

2.4. Vulnerability and viability

Vulnerability is known to be a highly inter- and trans-disciplinary study with a multi-dimensional, complex, and highly dynamic nature (Nayak & Berkes, 2019a). Vulnerability can be viewed either as a property of a system or an indication of potential problems (Nayak & Berkes, 2019a). Vulnerability is also defined as a property (degree) of an entity in some state (characteristics, state, human condition, or process) (Wolf et al., 2013). Wisner et al. (2004) defined vulnerability as the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist, and recover from the impact of a natural hazard. Adger (2006) defines vulnerability in a broader perspective as the state of susceptibility to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt. The vulnerability concept consists of three components: exposure, sensitivity to external stresses, and the capacity to adapt (Adger, 2006). Exposure refers to the nature and degree to which a system undergoes environmental or socio-political stress, while sensitivity refers to the degree to which a system is modified or affected by stressors (Adger, 2006). The ability of a system to evolve to accommodate environmental hazards or policy changes and to expand the range of variability to cope possibly is defined as adaptive capacity (Adger, 2006). In the context of SSF, vulnerability can be the absence of well-being- material, relational, and subjective; less capital or resources to navigate through vulnerability; and loss of resilience to absorb disturbances and reorganize systems to deal with vulnerability (Nayak & Berkes, 2019a). The development of robust credible measures, incorporating diverse methods with perceptions of risk and vulnerability, is needed to mediate vulnerability while promoting adaptive action and resilience (Adger, 2006).

The term ‘viability’ refers to the long-term survival of an entity, a sector, a social structure, or a population of a given species (Schuhbauer & Sumaila, 2015). SSF viability refers to the capacity of the system to navigate disturbances, adapt and transform, and build resilience in unexpected circumstances (Dias et al., 2023). The transition from vulnerability to viability is a multidimensional, dynamic, complex, and context-specific process. Dias et al. (2023) highlight that ‘transition’ is neither a uni-directional nor an end goal but reflects a dynamic process that involves linkages between vulnerability and viability.

Thus, SSF viability involves economic, social, political, and ecological concerns (Dias et al., 2023). A way to enhance viability is to reduce vulnerability. A reduction in multi-dimensional, complex, and highly dynamic vulnerabilities needs to focus on all the above three dimensions of vulnerability-increasing well-being, better access to capital, and building resilience (Nayak & Berkes, 2019a). Capitals of human, physical, natural, social, and financial are the basis of viability that help people navigate through the face of vulnerabilities. Resilience is the capacity of a system to absorb disturbance and reorganize while changing to retain essentially still the same function, structure, identity, and feedback (Walker et al., 2004). A combination of knowledge, skills and learning, community networks, people-place connections, community infrastructure, a diverse and innovative economy, and engaged governance is beneficial for resilience when a social-ecological system undergoes significant changes (Maclean et al., 2014). These social resilience attributes enhance the ability to adapt, transform, and strengthen in the face of environmental, social, economic, and political challenges (Maclean et al., 2014). Moreover, Berkes and Nayak (2018) suggest three ways to consider to overcome community vulnerability: (i) the degree to which SSF communities are aware and perceive vulnerabilities and their strengths; (ii) the key motivations of SSF communities that drive viability; and (iii) governance implications that strengthen local institutions and their capacities. Understanding and addressing these three areas facilitates achieving the viability of SSF communities (Berkes & Nayak, 2018a).

A *driver* refers to any natural or human-induced factor that directly or indirectly causes a change in an ecosystem (Nelson et al., 2006). Dias et al. (2023) identify five major overlapping domains, including ecological and environmental, economic and development process, governance and management, social and cultural influences, and other emerging issues (e.g., pandemic conditions) that either exacerbate SSF vulnerability and/or viability. These drivers are often intertwined, emphasizing the complex nature of the SSF transition from vulnerability to viability (Dias et al., 2023). The ecological and environmental domain refers to the natural system that includes system changes and characteristics, ecosystem cycles, and biodiversity. The economic and development domain contains issues and opportunities arising from drivers such as urbanization, fisheries modernization, technological advancements, and tourism (Dias et al., 2023). Societal dynamics -issues and opportunities that stem from interaction, and characteristics of various actors are considered under the social and cultural domain, impacting SSF vulnerability and viability (Dias et al., 2023). Additionally, interactions between actors and institutions representing different levels in fisheries and environmental management (e.g., MPA) are considered under the governance and management domain. Moreover, Dias et al. (2023) in their study has emphasized the importance of addressing emerging issues as a domain affecting SSF vulnerability and viability, reflecting

recent events and issues in SSF. Their paper further emphasizes the most common ways of facilitating the transition from vulnerability and viability of SSF as community-centred approaches in governance and decision-making, governing IUU and industrial fleets, enabling better markets for SSF, and gender-inclusive initiatives (Dias et al., 2022). Further, legal, political, and socio-economic problems regarding marine resource use can be addressed through an inclusive fisheries governance approach (Okafor-Yarwood et al., 2022). However, the studies carried out in six Asian countries and six African countries by Dias et al. (2022) highlight the need for further research and attention in the transition from vulnerability to viability of small-scale fisheries.

2.5. Conceptual Framework

2.5.1. Social-Ecological Systems (SES)

The theory of social-ecological systems (SES) is used in this research to assess the transition of small-scale fisheries from vulnerability to viability in marine protected areas. The term ‘Social-ecological systems’ implies that social and ecological systems are interlinked while there is an artificial and arbitrary delineation between these two systems (Berkes, 2021). Biological, economic, and social nature are closely interlinked with fisheries and coastal governance (Jentoft & Chuenpagdee, 2009). Social and natural systems have threshold levels that, if not maintained, could lead to either biodiversity loss or the end of a fishing community (Jentoft & Chuenpagdee, 2009). Hence, a healthy balance between the ecosystem and its social system has become an issue that needs constant attention and action (Jentoft & Chuenpagdee, 2009). The interlinked human and biophysical subsystems, their condition, functions, and linkages need to be analyzed in order to improve the understanding of vulnerability (Turner et al., 2003). The SES theory has been evolving over the last two decades into a mainstream research field that studies the interdependency of social and environmental change throughout the journey to achieve sustainability goals (Berkes and Folke, 1998; Liu et al., 2007; Pacheco-Romero et al., 2020). The three major concepts utilized to understand better SES theory are resilience, vulnerability, and adaptive capacity (Gallopini, 2006). Adaptive capacity simply refers to the ability to adapt (Engle, 2011). Adaptive capacity is a critical characteristic of a vulnerable and marginalized community in reducing vulnerability (Engle, 2011).

Scholars like Fikret Berkes and Elinor Ostrom significantly contributed to the SES theory to further evolve following the blueprint of the Brundtland Report (WCED, 1987) that emphasized human activities and their effects and environmental, economic and social concerns should be taken into account

as one phenomenon during policy development. This led to the development of the social-ecological systems framework (SES) as a conceptual framework providing a list of variables that may be interacting and affecting outcomes in social-ecological systems (SES) (Partelow, 2018). The framework proposes a list of generalizable variables that can be used as a diagnostic tool to help solve challenges with the governance of environmental problems (Figure 2.1.) (Ostrom, 2007). The SES framework is used to study specific resource-use sectors such as forestry, fisheries, food production, irrigation systems, etc. (Partelow, 2018). Studies by de Vos et al. (2019) emphasize SES employability in most pressing issues such as biodiversity loss, poverty, livelihoods, climate change, land use change, conservation, trade, governance and institutions, and social and environmental justice. Additionally, this approach is useful in order to understand the integrated nature and the interplay of economic, social, political and ecological components of a human-environment system (Nayak, 2014). Thus in a broader aspect, the SES framework provides cross-disciplinary insight into complex environmental problems such as coastal and marine environments (Refulio-Coronado et al., 2021).

The SES is a multitier framework in which a set of variables are nested to diagnose problems and potentialities of linked social-ecological systems. This diagnostic framework has adopted many variables affecting patterns of interactions and outcomes identified by other scholars (Ostrom, 2007a). The broad primary high-tier variables include (i) resource system (RS), (ii) resource units (RU), (iii) users (U), and governance structures (GS) influencing each other (Ostrom, 2007a). The resource system of the SES framework refers to the environmental and ecological system that provides resources that are being utilized by users and under governance (e.g., fishery, lake, grazing area). Resource units refer to the individual units or components that comprise a resource system, such as fish, water, fodder, etc. In the SES framework, ‘users’ refer to individuals or groups that depend on or interact with the resource system, extracting and gaining various benefits from and managing RS and RU. The governance system influence and is influenced by the interactions and outcomes that occur in a specific context over time. These RS, RU, U, and GS are further affected and influenced by interactions and outcomes. Interactions of the SES framework are the actions between various components of the systems -RS, RU, U, and GS. This framework further enables us to analyze how each of the above effects and is affected by socio-economic, political, and ecological settings (Ostrom, 2007a). Figure 2.1. illustrates how each of these eight broad higher-level variables is interlinked with each other.

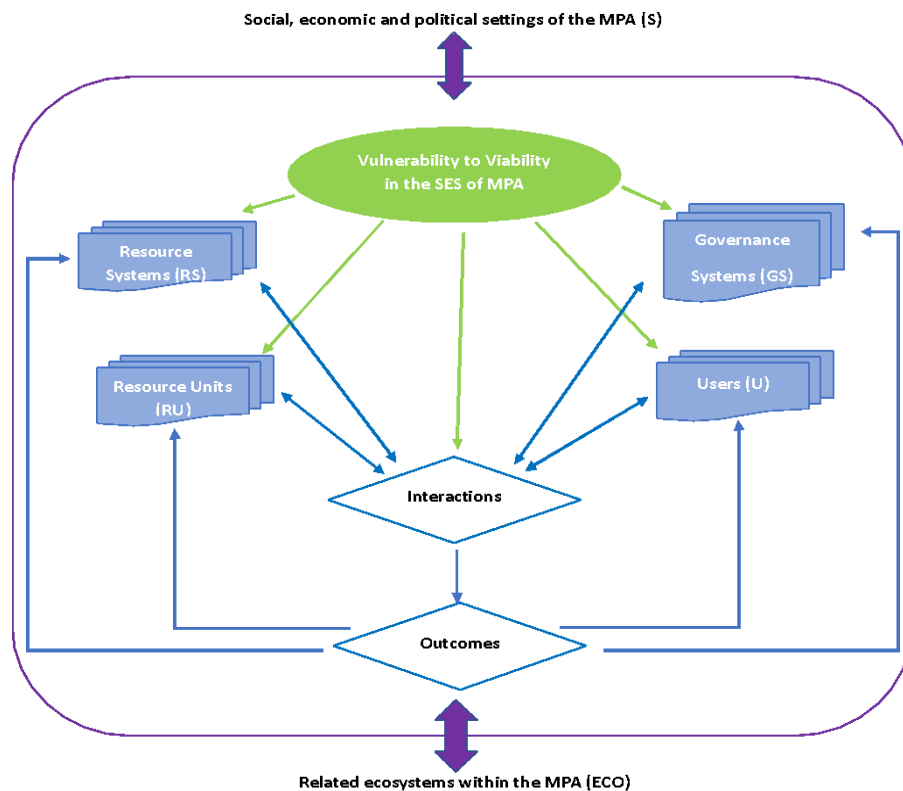


Figure 2.1. The conceptual framework highlighting the broad higher level variable of SES framework (Adopted from Ostrom, 2007).

Additionally, these eight broad variables can be further unpacked into deeper multiple tiers, such as second-tier, third-tier, and so on, expanding and depending on the study under consideration. Table 2.1 depicts the broad second-tier variables under each of the above higher-level variables.

Table 2.1. Second-tier variables of the SES framework (Adopted from Ostrom, 2007)

Social, Economic, and Political Settings (S)			
S1- Economic development. S2- Demographic trends. S3- Political stability. S4- Government settlement policies. S5- Market incentives. S6- Media organization			
Resource System (RS)		Governance System (GS)	
RS1	Sector	GS1	Government organizations
RS2	Clarity of resource System Boundaries	GS2	Nongovernment organizations
		GS3	Network structure

RS3	Size of resource system	GS4	Property-rights systems
RS4	Human-constructed facilities	GS5	Operational-choice rules
RS5	Productivity of system	GS6	Collective-choice rules
RS6	Equilibrium properties	GS7	Constitutional-choice rules
RS7	Predictability of system dynamics	GS8	Monitoring and sanctioning rules
RS8	Storage characteristics		
RS9	Location		
Resource units (RU)		Users (U)	
RU1	Resource Unit Mobility	U1	Number of users
RU2	Growth and replacement rate	U2	Socioeconomic attributes of users
RU3	interaction among resource units	U3	History of use
RU4	Economic Value	U4	Location
RU5	Number of units	U5	Leadership/entrepreneurship
RU6	Distinctive characteristics	U6	Norms/social capital
RU7	Spatial and temporal distribution	U7	Knowledge of SES/mental models
		U8	Dependence on resource
		U9	Technology used
Interactions (I)		Outcomes (O)	
I1	Harvesting levels of diverse users	O1	Social performance measures (e.g., efficiency, equity, accountability)
I2	Information sharing among users	O2	Ecological performance measures (e.g., overharvested, resilience, diversity)
I3	Deliberation processes		
I4	Conflicts among users	O3	Externalities to other SESs
I5	Investment activities		
I6	Lobbying activities		
Related Ecosystems (ECO)			
ECO1- Climate patterns. ECO2- Pollution patterns. ECO3- Flows into and out of focal SES			

The study analyzes the resource system, resource units, users, and interactions of the social-ecological system of SSF and BRMS, Kalpitiya, to characterize each of the two social and natural subsystems in Chapter 04.

2.5.2. Interactive Governance (IG)

Governance is defined as the whole of public and private interactions taken to solve societal problems and create societal opportunities, including formulating and applying principles guiding those interactions and caring for institutions that enable them (Kooiman et al., 2005). Thus, given the definition, interactions, institutions, and principles are major components of a governance approach in a society of numerous actors (Kooiman et al., 2005). Institutions provide frameworks or structures for these social actors with structure, order, and predictability in human relations in responding to and interacting with problems or opportunities, either constraining or enabling (Kooiman et al., 2005). These structures are recognized as culture, law, agreements, material and technical possibilities, and other inherited dimensions at birth. Similarly, principles bring fundamental assumptions, worldviews, and ethical values to human interactions (Kooiman et al., 2005).

Interactive governance is becoming another trend in small-scale fisheries and coastal governance (Jentoft & Chuenpagdee, 2015). Kooiman and Bavinck (2005) defined interactive governance as “the whole of interactions taken to solve societal problems and to create societal opportunities, including the formulation and application of principles guiding those interactions and care for institutions that enable them.” Interactive governance thus comprises three major components: (i) system-to-be-governed, (ii) governing system, and (iii) governing interactions.

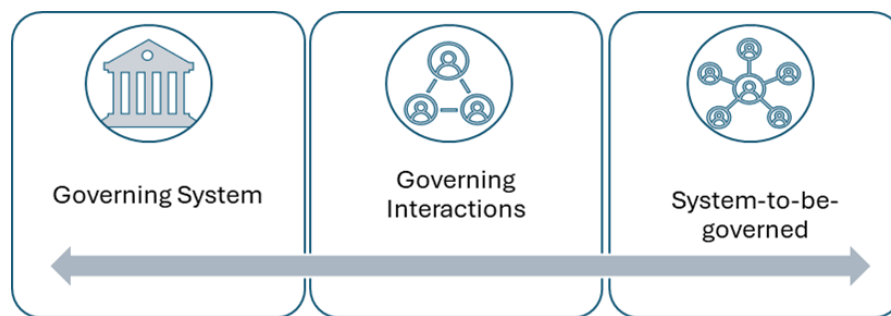


Figure 2.2. Interactive Governance Framework (Adopted from Bavinck et al., 2013)

According to Kooiman and Bavinck (2013), a governing system is defined as a set of mechanisms and processes used to guide, control, and direct the system to be governed in question. The governing system comprises three realms of governing -state, market, and civil society (Kooiman and Bavinck, 2013). The ‘State’ refers to government entities encompassing all administrative levels, such as local, regional, and

national, that formulate policies and legal frameworks. ‘Market’ often refers to the chain and mechanisms of production, supply and demand, and distribution channels that facilitate and regulate trade. The market comprises a number of actors, from fishers and buyers (individuals and businesses) to end users. ‘Civil society’ comprises NGOs, community associations, and individuals involved in shaping governance arrangements.

Moreover, the governing system involves law and legal aspects, which includes three levels of orders namely first order, second order, and meta order (Jentoft & Bavinck, 2014). Meta-order governance involves underlying values, norms, and principles. These ethical perspectives are often fundamental for governance at any level and equally important in both social and economic development (Kooiman et al., 2008). Second-order governance relates to institutions or organizations that are involved in governance and that have legal rules or mandates ‘to care for them’ (Kooiman et al., 2008). With regard to fisheries and conservation, access to resources is often brought to discussion. This focuses on the institutional arrangements, both formal (policies, laws, and regulations) and informal (traditions, norms, and customary rights) within which first-order governing takes place (Kooiman & Jentoft, 2009). First-order governance refers to the day-to-day affairs and decision-making often performed at the operational level (Kooiman et al., 2008). Simply put, interactive governance emphasizes solving societal problems and creating societal opportunities through interactions among the civil, public, and private sectors. In the context of the governing system, the study examines institutions, rules and regulations, and rights that are in action to govern the social-ecological system of the marine sanctuary.

System-to-be-governed is a foundational element to understanding the governability of societal entities, particularly regarding their natural resources (Kooiman et al., 2005b, 2008). Thus, the system-to-be-governed becomes the object of being governed. This underscores the need to consider dynamics, complexities, and specific attributes of the system for effective governance to happen (Kooiman et al., 2005b, 2008). Examining the system's qualities, such as structure, function, and resilience, allows us to identify its challenges and opportunities. Thus, it helps build a comprehensive understanding of design governance that responds to the system's needs.

Interaction, a mutually influencing relation among actors with an intention and structure, is the key to the interactive governance approach (Kooiman et al., 2005). Governance interactions include linkages, networks, tensions, and relationships between the system-to-be-governed and the governing systems being examined. In terms of the governing interactions, the relationships, interplay, and mechanisms

between the SES system to be governed and the governing system will be considered (Kooiman et al., 2005). Kooiman and Bavinck (2013) stated in their research that societal and natural systems – systems-to-be-governed- can also be examined with SES.

Chapters 4 and 5 employ the above two conceptual frameworks -SES and IG, respectively, to guide this research study. Chapter 4 examines the SSF and MPA subsystems, characterizing each of these subsystems and their interactions with using SES. Chapter 5 examines the current MPA governing system of the study location to build an understanding of current governance and identify future MPA governance arrangements effectively to facilitate the transition of SSF from vulnerability to viability. Chapter 5 expands to the specific roles of institutions, markets, and civil society, encompassing legal frameworks in action, law enforcement, and governance orders. These two conceptual frameworks support contextualizing this study and structuring the analysis.

This research adopts several frameworks to interpret the data collected. The purpose of using multiple theoretical frameworks is to conduct a comprehensive analysis of my research. The integration of these frameworks enables a holistic approach to understanding the complexities of SSF in MPAs.

2.6. Gaps

Despite the growing body of literature regarding marine protected areas, there remains a significant lack of attention to social dimensions in governance. Most studies primarily focus on ecological and science-based facts, with less concern for human perspectives. These science-based evaluations often overlook how governance can exacerbate existing vulnerabilities or create new challenges for local communities dependent on the marine ecosystems under governance. Additionally, current studies have paid less attention to generating comprehensive understandings of complex, interconnected natural and social systems, such as SSF and MPAs. Understanding how these systems, alongside the governance structures, contribute to vulnerability and viability is essential in achieving realistic policy goals in both fisheries management and MPA governance.

2.7. Conclusions

Small-scale fisheries worldwide are vital in many aspects for developing local economies, providing livelihoods, ensuring food security, and protecting ecosystems. While the establishment of marine

protected areas is vital for ecological conservation, the design of MPAs needs to take into consideration the coastal resource users who are dependent on the ecosystem for their survival. Although there is a trend towards considering community perspectives in the management process in some parts of the world, many other existing MPAs are controlled under conventional top-down management strategies. These management strategies often restrict access to marine resources, which exerts much pressure on the small-scale fisher communities, making them vulnerable in terms of social well-being and financial perspectives. Accordingly, vulnerabilities of SSF under the governance of MPAs need to be evaluated in order to ensure the survival of SSF communities by enhancing its viability.

Chapter 3

Research Methods and Design

3.1 Introduction

This chapter discusses the study location and research methods. The chapter first starts with providing the context of the case study location in section 3.2. Sections 3.3 and 3.4 provide the broad plan to conduct research approach or methodology describing the philosophical foundation, research designs, and methods employed to achieve study objectives outlined in Chapter 1. Section 3.5 discusses the data analysis process adopted by the research. Section 3.6 and 3.7 discuss the limitations of the case study and the positionality of the researcher, respectively. Finally, section 3.8 outlines the background of ethics that guides the research.

3.2. Case study location

The South Asian region is home to 15.5% and 12% of the world's flora and fauna, respectively. Particularly, the Indian Ocean is a hot spot of coral reefs and biodiversity, underscoring the critical importance of protected areas to safeguard the South Asian region's biodiversity from anthropogenic challenges (Chowdhury et al., 2022). Over the past few decades, protected areas (PA) have become a popular conservation tool. However, the majority of the PAs remain relatively small, and none of the South Asian countries have yet achieved the goal of 10% marine representation target (Chowdhury et al., 2022). Sri Lanka stands out as an exception in the South Asian region, having achieved the terrestrial protected areas (TPA) representation target of 17%.

The case study was based in Sri Lanka for several reasons. First, as a country, it provides livelihoods and food to thousands of marginalized communities. As an island located in the Indian Ocean, Sri Lanka is part of the South Asian region, which includes Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, and Pakistan. Similar to other South Asian countries, Sri Lanka has a deeply-rooted fisheries sector. Fishing has been a primary economic activity for coastal communities for thousands of years. The Fisheries sector provides fish, a low-cost protein source, to millions of low-income communities across Sri Lanka. Located around 100 km off the Southeastern coast of India, Sri Lanka comprises an exclusive

economic zone (EEZ) of 517,000 km² with a 1,585 km long coastline (Athauda & Chandraratna, 2020; MFRAD, 2022; Galappaththi et al., 2023) (Figure 3.1.). The island is rich in a wide array of coastal habitats, including coral reefs, beaches, estuaries, lagoons, mangroves, sea grass beds, and salt marshes, highlighting the coastal biodiversity (Athauda & Chandraratna, 2020). Approximately 610 coastal fish species have been reported in Sri Lankan waters, of which 40% of the coastal fish catch accounts for small pelagic species (Athauda & Chandraratna, 2020). The fisheries sector generates nearly 2.4 million direct and indirect employment to various stakeholders such as fishermen, breeders, processors and logistics, cold chain, packing, and other service providers (Athauda & Chandraratna, 2020). Sri Lanka's key export markets include the United States, Germany, Hong Kong, France, Italy, the Netherlands, the United Kingdom, China, Japan, and Canada (Sri Lanka Export Development Board, n.d.). In 2021, Sri Lanka's marine fisheries sector provided livelihood to 185,810 coastal households while employing 224,190 both male and female (MFRAD, 2022). In 2021, the fisheries sector contributed 1.1% of the country's gross domestic product (GDP), with marine fishing contributing 0.9 % (MFRAD, 2022). Sri Lanka's marine fish production is divided into coastal, offshore and inland and aquaculture, with 149,440 MT, 131,170 MT, and 116,620 MT of total fish production in 2022, respectively (Department of Census and Statistics, 2023). Further, Sri Lanka exported fish and fishery products of 25,730 MT, earning LKR 97,243 million in 2022. The export of fish and fishery products included prawns, lobsters, crabs, sea cucumber, ornamental fish, chank and shells, shark fins, mollusks, fish maws, fish, and others (e.g., fish oil and fats) (Department of Census and Statistics, 2023).

In addition to the socio-economic significance of the fisheries sector, Sri Lanka is renowned for its rich marine biodiversity. Several marine and coastal habitats are protected along terrestrial protected areas (TPAs) boundaries and in Sri Lanka's marine landscapes as MPAs. As a relatively small island of 65,525 km² total extent, Sri Lanka operates marine protected areas covering a total of 774.52 km² of marine areas (Tisdell & Hazra, 2022). There are 6 national parks, 13 marine sanctuaries, and 12 fishery management areas in Sri Lanka (BOBLME, 2014).

Bar Reef Marine Sanctuary (BRMS), Kalpitiya

The Bar Reef Marine Sanctuary (BRMS), declared in 1992, is the largest MPA in Sri Lanka, with an extent of 30,670 ha. BRMS is located 80° 32' 0" N and 79° 40' 0" E to 80° 8' 0" N and 79° 48' 0" E; 94° 35' 13" N and 35° 32' 52" E to 8° 99' 234" N and 36° 77' 95" E; offshore of Kalpitiya in North-Western Province of Sri Lanka (Figure 3.2.). The BRMS patch reefs comprise the largest coral reef system in Sri Lanka (Bar Reef Marine Sanctuary Management Plan, n.d.). This ecosystem in a shallow coastal zone includes two types

of corals: shallow coral reefs and sandstone reefs with reef-bed patches larger than a hectare. The closest coral patches are located 2 km west of the north point of the Kalpitiya peninsula (Öhman et al., 1997). The reef was primarily composed of *Acropora spp*, with corals over 80%. The reef was then severely damaged, with more than 90% coral mortality due to the bleaching by the 1998 and 2016 *El Nino* (Perera, N. & Arachchige, G., 2017). BRMS is prone to southwest monsoons from May to October and is adversely affected by strong winds and currents (Bar Reef Marine Sanctuary Management Plan, n.d.). Geographically, this belongs to Sri Lanka's Northwestern dry zone with intense sunlight at 28.2°C and an annual rainfall between 1,000 – 1,200 mm. Moreover, BRMS is connected to the adjacent Puttalam estuarine system, which includes Dutch Bay and Portugal Bay. The estuarine waters and nearby river outlets (e.g., Kala Oya, Modaragam Aru) influence the ecosystem, bringing nutrient-rich waters to the reef area. Nevertheless, the continental shelf on Sri Lanka's west coast near Kalpitiya connects with the Indian shelf. This unique geographical formation, with narrow continental shelves and steep slopes, brings marine mammals to the area, making Kalpitiya ecologically significant (Bar Reef Marine Sanctuary Management Plan, n.d.). BRMS is a vital hotspot of marine biodiversity, with numerous species. It is home to over 120 coral and 300 fish species (Jayaratne et al., 2024). It is recognized as a Cetacean hotspot, with 20 marine mammal species, such as killer whales, sperm whales, Indo-Pacific Hump-backed dolphins, and dugongs, being regularly observed (Bar Reef Marine Sanctuary Management Plan, n.d.). In addition, the adjacent island ecosystem is home to both sea birds and migratory birds.

BRMS not only has ecological significance but also socio-economic importance. Further, BRMS and its connectedness to the Puttalam lagoon system with sub and intertidal mudflats and seagrass beds are crucial for the lagoon and near-shore fishing. Even though the BRMS was declared in 1992, it gained global recognition due to tourism activities that emerged after the Sri Lankan civil war ended in 2009. Kalpitiya became a popular destination for tourism activities such as whale watching, kite surfing, and diving, opening pathways for community members to gain from alternative livelihoods (Bar Reef Marine Sanctuary Management Plan, n.d.). However, the BRMS had been challenged by increasing fisher population, destructive fisheries (e.g. bottom set gill nets, coral damage, spearfishing, night diving, ghost nets), unregulated tourism activities, and poor management (Öhman et al., 1997; Tamelander & Rajasuriya, 2008; BOBLME, 2015; Perera, N. & Arachchige, G., 2017; Jayaratne et al., 2024).

Given the ecological and socio-economic significance of BRMS, the largest MPA in Sri Lanka, and the complexities and tensions of the interconnected social and natural systems, I chose to focus my research on BRMS to build insights on MPA governance and its influence on SSF vulnerabilities and viabilities. Lastly, as a native of Sri Lanka, I, as the researcher, have a good knowledge of the ecosystem and the

[illegible]

3.3. Research methodology

Research methodology provides the broad plan to conduct research, which is often referred to as research approach or methodology. It intersects three major components: philosophy, research designs, and methods (Creswell and Creswell, 2018), which is employed in this research to achieve the study objectives mentioned in Chapter 1.

A qualitative research approach has been used to guide this study, as qualitative research approach allows researchers to study individuals, explore processes, activities, and events, or explore the broad culture-sharing behavior of individuals or groups (Creswell and Creswell, 2018). The inductive nature is beneficial in focusing on individual meaning and the importance of reporting the complexity of situations in social-ecological systems. A major reason for conducting qualitative research is its exploratory nature to study a topic or a population that has been less studied. In qualitative study the researcher aims to listen to participants and build understanding based on what is heard (Creswell and Creswell, 2018). More often, data is organized into more abstract units of information to build into patterns, categories, and themes inductively from the bottom up. Inductive thinking is also important as researchers examine the themes to determine if more evidence can support to themes or if there is a need to gather additional information (Creswell and Creswell, 2018). The major focus of the qualitative study is exploring the meaning of the problem or issue held by the participant (Creswell and Creswell, 2018). Keeping all these in mind, this study follows a qualitative research approach to examine MPA governance's impacts on small-scale fisheries' vulnerability and viability. The flexibility of the design enables the exploration of the small-scale fishers' and other relevant stakeholders' perspectives or the meaning of the ongoing MPA governance of the SSF industry's vulnerability and viability and its future viable implications.

The knowledge generated from this study contributes to developing the understanding of small-scale fisheries and protected area governance through multiple perspectives and lived experiences of stakeholders. This aligns with a constructivist worldview that focuses on the construction of knowledge through understanding that emerges from an individual's experience. This philosophy relies primarily on the participant's view of the situation being studied (Creswell and Creswell, 2018). Thus, the study follows a constructivist worldview to explore various perspectives of different stakeholders to identify gaps in MPA governance and its impact on the vulnerability and viability of SSF.

The research is conducted under a case study design. Case studies are particularly used to employ where an in-depth appreciation of an issue, event, or phenomenon of interest is required to be explored within its natural, real-life context (Crowe et al., 2011). A case study approach allows critical events, interventions, policy developments, and program-based service reforms to be studied in detail in a real-life context (Crowe et al., 2011). According to Creswell and Creswell (2018), a case study is a special evaluation or an in-depth analysis of a case, often a program, event, activity, process, or one or more individuals. Thus, the case study approach will be used for this study to examine how and in which ways the current MPA governance practices have impacted the lives of SSF communities of the study area of interest.

As a qualitative case study research design, this study employed qualitative data collection instruments incorporating both inductive and deductive approaches. This will enable both a bottom-up approach for insights and propositions to emerge from the data collection and the use of predetermined theories and concepts identified from the literature review (Creswell & Creswell, 2018).

3.4. Research methods

Research studies employ methods to collect, analyze, and interpret the study's data (Creswell & Creswell, 2018). A key aspect of qualitative data collection is to collect data from various sources (Creswell & Creswell, 2018). Data collection for this research was carried out using several methods, such as semi-structured interviews, focus-group discussions, observations, and a systematic literature review to contextualize the case study.

This research used purposefully selected sites for the case study to understand the research context better. Table 3.1 shows the criteria considered when choosing study sites to recruit participants. Snowball sampling was employed to select participants where an interviewee was asked to provide names of at least one or more potential participants who might be interested and contribute to the context of the study, and in this way the sample size for this study grew larger as a rolling snowball (Kirchherr & Charles, 2018). Therefore, the selected sampling technique enabled to reach out to the most suitable actors or the respondents of the area of interest.

The case study sites are located in the Puttalam District of the North-Western Province of Sri Lanka. The BRMS is managed under the Kalpitiya Divisional Secretariat (third-level public administrative units in Sri Lanka). Kalpitiya DS is one of the 16 Divisional Secretariats in the Puttalam District. Grama Niladhari Divisions (GNDs) are the smallest and the fourth-level administrative units in Sri Lanka, serving as sub-units of the Divisional Secretariat. Currently, there are 31 GNDs in the Kalpitiya Divisional Secretariat, of

which 12 are coastal GNDs. Additionally, there are 14 islands in the Kalpitiya DS, but only four are inhabited- Uchchimunei, Baththalangunduwa, Rodapaduwa, and Palliyawatta.

For my field data collection on BRMS governance, I have selected four villages and islands from 5 different coastal GNDs within the Kalpitiya Divisional Secretariat. These locations include Kandakuliya, Kandakuliya Kudawa (often referred to as Kudawa), Kalpitiya town area (comprising Sinnakudirippuwa and Anawasala GNDs) from the mainland, and Uchchimunei as the island. Here, I have combined data from Sinnakudirippuwa and Anawasala GNDs as Kalpitiya town area for the ease of data collection.

Table 3.1. Selection criteria for study sites

Study sites	Selection criteria of study sites
Mainland villages/town	
Kudawa	• Kudawa fisheries include SSF, medium, large scale, and ornamental fish collectors. • Prominent tourism industry is there with tourist boats, recreational activities, hotels, homestays, cabanas • Markets – fishmongers at landing sites
Kandakuliya	• Kandakuliya fisheries include SSF and medium-scale fishers. Further, this area is mainly into sardinella harvesting. • Tourism operations include tourist boats, recreational activities, hotels, homestays, etc. • Markets – fishmongers at landing sites
Kalpitiya	• Kalpitiya town has a diverse fishing scale- SSF, medium, large scale, trawling, multiday boats, and ornamental fish collectors in both coastal and lagoon systems • Tourism includes tourist boats, recreational activities, and hotels • Markets – a variety of local and export-oriented fresh fish businesses and dried fish, fishmongers at landing sites
Islands	
Uchchimunei	• Fisheries include SSF (coastal, lagoon) and majorly purse seiners, beach seine • Tourism limited to church visits

	● Markets- markets not present at the village, but a separate landing site at Kalpitiya
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3.4.1. Literature and document review

A literature review is instrumental in a research study to determine if the selected topic is worth studying simultaneously limiting the scope of the required area of interest (Creswell & Creswell, 2018). In qualitative research, the purpose of using a literature review varies depending on the design. In case studies, a limited amount of literature is often used to set the stage for the study (Creswell and Creswell, 2018). The study involved a six-step comprehensive literature review (Creswell and Creswell, 2018). The overall goal of the literature review was to understand and analyze the situation at a broader level regarding its present and historical context. The literature review was initiated by identifying keywords that emerged from the research topic, such as small-scale fisheries, vulnerability, viability, and governance of marine protected areas, to situate the research within the existing body of literature. In the second step, the identified keywords were searched in online databases, namely Scopus, Web of Science, and Google Scholar, for peer-reviewed research articles, reports, books, university websites and other scholarly organizations. Additionally, existing and oncoming ocean policy studies and social sciences literature was accessed through ‘Marine Policy’, an interdisciplinary peer-reviewed academic journal published by Elsevier. In addition to peer-reviewed journal articles, a comprehensive document review was carried out by exploring grey literature to understand the fisheries sector and the ecological and economic significance of the selected study location. This process included reviewing technical reports, information flyers, booklets issued by the government of Sri Lanka and its affiliated research institutes (e.g. NARA, NAQDA), project reports, and websites of NGOs and other relevant institutes such as United Nations and IUCN, ministry websites of Sri Lanka, books and unpublished demographic census data accessed from Government institutes. As the third step, the most useful articles to lay the study's foundations were identified at the proposal development stage. However, the literature review continued throughout the entire data collection process till the end of the thesis writing. In the fourth step, research topic-specific articles and chapters were skimmed for the most useful literature for the study. At the beginning of the fifth stage, a reference management application -Zotero- was used to manage literature by storing and keeping track of literature more efficiently under different folders of keywords, concepts, and themes. The sixth step involved writing up the summarized literature review in the proposal, which

later expanded to the thesis. This paper employed the American Psychological Association (APA) referencing style.

3.4.2. Semi-structured interviews

Semi-structured interviews are often used in qualitative research, enabling dialogue between researcher and participant that involves a flexible interview protocol and supplemented by follow-up questions, probes, and comments (DeJonckheere & Vaughn, 2019). Participant's thoughts, feelings, and beliefs on a particular topic can be explored through semi-structured interviews. In contrast to rigid structured questionnaires, semi-structured interviews are more fluid and flexible and enhance validity, and sensitivity of a concern (Mason, J., 2002).

This study employed a total of 51 (n=51) in-person field interviews in relatively informal and interactional exchange of one-to-one dialogues with participants in person. In addition to small-scale fishers, various stakeholders such as medium- and large-scale fishers, presidents of fish associations at the village level, fishmongers, fishers and/or tourist boat operators, housewives, and government officials were interviewed as key informants due to the complex and interconnected nature of the fishing jobs in the case study location (Table 3.2.). Participants were recruited following the snowball sampling technique. The interviewees were allowed to freely express their perceptions, insights, experiences, gains, and losses regarding the local MPA governance practices guided by a semi-structured interview protocol comprising open-ended questions. The interview protocol, initially created in English, was then translated into the local language -Sinhala- for convenience of the data collection process. The interviews were recorded as audiotapes with the consent of the participants. Individuals, specifically small-scale fishers, were interviewed where they usually carry out their fisheries activities (e.g., landing sites, markets) or in households from 8 am to 6 pm, depending on participant availability.

Table 3.2 provides a detailed view of the case study participants, particularly highlighting the variety of livelihood operations that represent each of the four villages. The case study respondent pool consisted of fishers and community members of varying scales, including small, medium, and large-scale fishers and tourist persons from these four villages. There were 21 small-scale fishers (n=21), 16 exclusively engaged in small-scale, and 5 working as SSF and medium-scale laborers. In addition to SSF, individuals representing medium-scale and large-scale tourism were also interviewed in this case study to develop a

thorough understanding of the SES being studied. Eight (n=8) medium-scale fishers were interviewed, with 5 solely into medium-scale fishing, 2 of them were into both medium-scale fishing and tourism, and one both a medium-scale fisher and a fishmonger. Another eight (n=8) fishers from large-scale fisheries were interviewed, with 5 exclusively into large-scale fishing, one doing both large-scale and tourism, another person doing both large-scale and ornamental fishing, and another being a large-scale fisher and a fish monger. Moreover, a total of 8 people representing the tourism industry were included, where 5 are only involved in tourism-related jobs, 2 are in tourism and ornamental fisheries, and 1 person is in the tourism industry and a fishmonger. The participants' variety effectively highlights the complex nature of fishing and tourism activities ongoing in the case study location. However, in addition to this total of 45 respondents, the entire respondent pool included 5 officials representing government institutions and one female community member who served as a key informant. Moreover, the following respondent pool included 5 FA Presidents representing SSF, medium and large-scale.

Table 3.2. Number of community member interviews conducted from each village based on the scale of fishing, sale, and tourism

Main livelihood	Alternative livelihoods	Kalpitiya	Kudawa	Kandakuliya	Uchchimunei	Total interviews by the main livelihood
Small-scale	Small-scale only	3	1		12	21
	Medium scale labour		3		2	
Medium-scale	Medium-scale only	1	2	2		8
	Tourism	1	1			
	Fishmonger		1			
Large-scale	Large-scale only	1			4	8
	Tourism	1				
	Ornamental fisher	1				
	Fishmonger	1				
Tourism	Tourism only	1		2	2	8
	Ornamental fisher		2			
	Fishmonger		1			
Total interviews by village		10	11	4	20	45

In addition to the above participants, the study included six more key informants consisting of the following participants in Table 3.3.

Table 3.3. Key informants of the study

Key informant	Number of participants
Secretary (former president) Women Fisher Association	1
Wildlife Ranger - DWC	1
Officer-in charge - Coastal Conservation Department	1
Assistant Director - DFAR	1
Fisheries officers – DFAR	2

3.4.3. Focus group discussions (FGD)

Focus group discussions are commonly used in conservation research for the last two decades (Nyumba, O. *et al.*, 2018). Focus group discussions stimulate interactions among participants by enabling one to observe how situational interactions take place, how issues are conceptualized and how negotiations arise in different contexts (Mason, J., 2002). Following the semi-structured interviews, a total of 2 focus group discussions with nearly 12 participants were carried out with the aim of reducing biases that potentially arise from individual interviews and helping improve the validity of data. The first FGD was conducted in Uchchimunei with the participation of both males (SSF) and females a total of 5, while the second FGD took place in Kudawa, with the participation of a total of 7 fishers (Table 3.4.). When planning groups, geographic proximity and the nature of the job of the interviewees were considered to make sure that all target participants were available in the selected location at the same time (Nyumba, O. *et al.*, 2018). Since fishers are a major part of the study, the nature of their occupation was considered when selecting the location and time for group discussions. Both men and women who reside close by the MPA were considered equally in recruiting. Participants were recruited using snowball sampling techniques. Focus group discussions were carried out in common places- landing sites in both FGDs- that were familiar to participants. Data was mainly recorded using both observation and interview protocols, which were specifically developed to ask questions. Handwritten notes and audiotaping were used for recording purposes.

Table 3.4. Details of focus group discussions (FGD) by location and participant profile

Key informant	Number of participants
FGD 01: Location- Uchchimunei	
SSF fishers	2
Fisherwomen	3
FGD 02: Location- Kudawa	
SSF fishers	4
Medium-scale fishers	2
Fishmonger	1

3.4.4. Observations

The early stage of the data collection involved scoping and observing various stakeholders and their day-to-day interactions with a social-ecological system of the MPA with the intention of identifying possible respondents and familiarizing myself with the social and cultural setting of the study location. This initial period was used to reflect on the suitability of the study to the local setting and thereby fine-tune data collection methods where necessary. Moreover, informal conversations were conducted with stakeholders by visiting local institutions, knowledge centers, coastal fishing centers, and markets to build trust and gain a better understanding as a researcher. Observations included living conditions of SSF communities, interactions and relationships with various stakeholders, MPA governance-related laws and regulations in practice, SSF interactions with the ecosystem protected by the MPA, and the role of local institutions. Observations continued throughout the entire data collection process, and each observation was recorded as journal notes, photographs, videos, and voice recordings to be used in data analysis and validation. Videos and voice tapes were recorded with the consent of the respondents only.

3.5. Data analysis

Interview transcripts were coded using the qualitative analysis software -NVivo 14 to manage primary data. Further, the interviews were also personally analyzed by me to better integrate the data collected. The demographic data collected through questionnaires was recorded and descriptively analyzed using Microsoft Office Excel spreadsheets. The data analysis process was comprised of six steps, namely, (i) Preparation of data, (ii) Familiarizing of data, (iii) Coding data, (iv) Analyzing data, (v) Visualizing data,

and (vi) Reporting findings. At the data preparation step, semi-structured interviews and focus group discussions were manually transcribed to English since the interviews were conducted in Sinhala, which is the native language of the case study location. Next, interview transcriptions (MS Word documents) were imported to NVivo 14 software, and documents were organized to create relevant folders in the software Figure 3.3. The second step involved familiarizing with transcribed data by reading and annotating the 51 individual participants and two focus groups. Data coding was carried out by developing a coding scheme, coding data, and refining data. The coding scheme was developed by preliminary outlining the codes with reference to research questions and inductively prioritizing the emerging themes from the qualitative data. Next, data was coded into categories and concepts, and nodes were created for each relevant segment using NVivo 14. As the final step, codes were refined to obtain clear data connections by merging and renaming codes. Data was visualized using MS Excel by exporting codes and frequencies from NVivo 14. Charts and graphs were created using MS Excel and MS Word to depict research findings clearly. The final step included the writing up of the thesis based on the study findings.

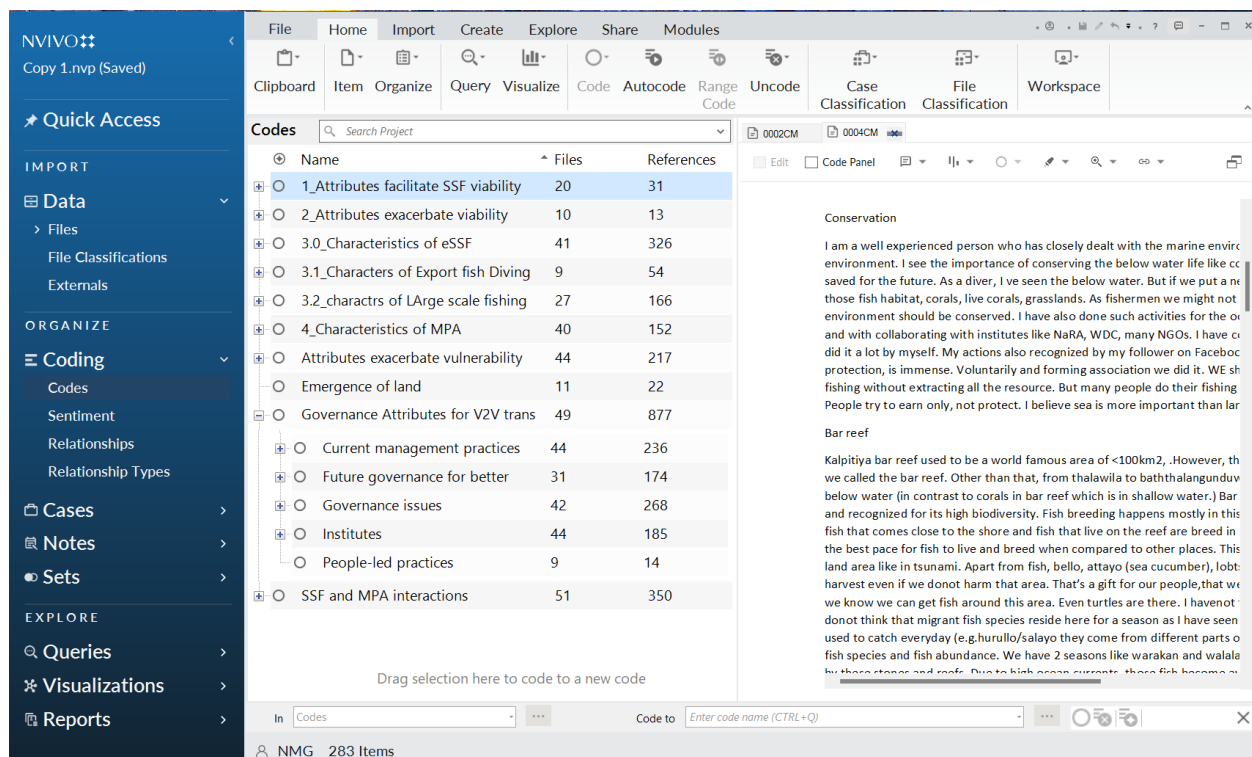


Figure 3.3. Coding done using NVivo 14

3.5.1. Validity and reliability

The validity of the study was determined through triangulate validation, where evidence from multiple sources was examined and then used to build a coherent justification for themes (Creswell & Creswell, 2018). The reliability of the study was checked and enhanced by checking transcripts for mistakes and accurately assigning codes throughout the coding process (Creswell & Creswell, 2018).

3.6. Limitations

Although I am originally from Sri Lanka, as a researcher, I had no prior experience in the case study location. Therefore, it was necessary to first establish contacts with community leaders in order to familiarize myself with the area and gain access to the community. As the study employed snowball sampling, I initiated data collection through these community leaders, particularly the presidents of fisheries associations. Given their knowledge of BRMS governance, they directed me to individuals who were considered most knowledgeable -particularly those involved in the initial voluntary work during the BRMS implementation such as tourist boat operators, divers, and active community members. As I spent the first couple of weeks in the field, I identified the need to broaden my participant pool to avoid potential biases from these participants. Therefore, I started asking for diverse stakeholders who could provide broader insights into the research context, mostly fishers encompassing different fishing scales. Thus, it resulted in the recruitment of fishers from different scales and fishmongers, allowing more inclusive participant representation. Further, although the initial plan was to explore two islands- Uchchimunei and Baththalangunduwa, data collection was limited to Uchchimunei due to logistical challenges and difficulties in securing accommodation. Another limitation was the absence of direct NGO representation. While UNDP had an operational unit regarding BRMS previously, it no longer existed since the five-year BRMS project was concluded by the time my research was conducted. However, the data regarding NGOs and their role was derived from document references and respondent discussions. The study encountered challenges due to limited female participants. Initial informal discussions with fisherwomen revealed they lacked sufficient information regarding BRMS governance and impacts. Their conversations primarily revolved around household struggles, such as increasing fuel and grocery expenses, rather than MPA governance impacts. As a result, female representation was limited to a key informant representing a women's fisher association. Due to these challenges, the research focused on recruiting more relevant participants to align the study within its scope through screening initial informal discussions. Another limitation was that the majority of the Uchchimunei community speak Tamil, with some handling Sinhala. Even if I did not plan to recruit a translator during the initial stages, as I built trust

with the community, I received translation assistance from voluntary community members where necessary. Moreover, the original plan included providing a thorough understanding of the fisheries industry by targeting fish species by different fishing jobs and villages and identifying their interactions with MPA. This was not executed as local terms used by different communities for fish species were unclear due to the language barrier (Tamil), my lack of knowledge of the species, and concerns on the time consumption. Further, as a case study research approach, one of the major limitations of this study was the extent of the generalizing findings to other social-ecological systems. Regions or countries highly vary in social and cultural aspects and adopt different management practices in terms of protected areas, including MPAs. Even in the same country, the management or governance practices may vary based on the socio-cultural context of the local communities. Therefore, it is evident that the impacts of such governance or management practices on coastal and fisheries communities can be varied and merely dependent on the context. Moreover, the study researched the coastal SSF fishing communities in the locality, where the assessment of MPA impacts on the rest of the coastal resource users, such as tourism people and other community members, such as households, need further research.

3.7. Positionality

As the researcher of the study, my position significantly impacts and shapes how I approach the study and interpret findings. As born and raised in Sri Lanka, I possess a broader understanding of the socio-cultural and environmental context of coastal areas in the country. However, my background may also have limitations and opportunities contributing to the research. While I have certain common aspects (e.g., language) and an understanding of the socioeconomics of the local community, I have no prior experience with the Kalpitiya fisher population or its local dynamics. While this enabled me to examine the study location from a fresher's open-minded perspective, difficulties existed in building trust with the local community as an outsider, particularly in researching governance, which some community members perceived as a threat. As mentioned in 3.6 (limitations), I initially relied upon FA leaders, which helped me to penetrate the community while building trust. Moreover, since the study included a diverse respondent pool to obtain insights on the vulnerability and viability of the SSF community, I made conscious efforts to maintain open discussions to facilitate different perspectives to emerge as SSF was identified to be impacted by actions of other fishing scales. Further, due to my limited knowledge of the fisheries industry, I tried to remain aware of my biases and perceptions while trying to grasp as much information as I could. I adopted a reporting style throughout my thesis to reflect participant perspectives, particularly when discussing research findings.

3.8. Ethics

This research study complies with the standard guidelines of the latest edition of the Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans (TCPS2) under the certificate number ORE # 45677, which was obtained through the University of Waterloo's Office of Research Ethics (ORE) clearance process (see Appendix D). Further, I, the researcher, have completed TCPS 2: CORE 2022. When carrying out my master's research thesis, I was obliged to respect every participant and actor for their consent, volunteerism, and social and cultural values, even though the research was intended to take place outside of Canada. Moreover, I am obliged to safeguard the participants' identities and confidentiality of sensitive information. Participants' consent was considered during the data collection process through recording voices and videos, taking photographs, and handling and reporting confidential and sensitive data.

Chapter 4

Characterization of Small-scale fisheries, marine protected areas, and their interactions through social-ecological perspective

4.1. Introduction

Small-scale fisheries (SSF) and marine protected areas (MPAs) are interconnected subsystems in the marine landscape. Developing a systematic understanding of the inherent characteristics of both the social and ecological subsystems is crucial for managing their vulnerabilities and enhancing viability. By analyzing these characteristics through the social-ecological systems framework (SES), we can recognize how specific features and interactions of these subsystems exacerbate vulnerabilities or promote resilience and viability. Further, this understanding can help pinpoint specific areas that need attention in the decision-making of governance without increasing the systems' vulnerabilities. Thus, this chapter aims to identify and analyze the key characteristics of SSF and MPA subsystems in Kalpitiya, utilizing the SES framework to build a comprehensive understanding of the social-ecological system and their interactions in Kalpitiya. This analysis highlights the ways in which these characteristics contribute to either vulnerability to the transition towards viability in MPA governance, addressing the following research objective and research question.

Objective: To characterize the MPAs, SSF, and their interactions

Research Questions: What are the characteristics of SSF, MPA and their interactions?

This chapter discusses the characteristics of SSF, MPA, and interactions. Section 4.1. starts with an introduction to the chapter. Section 4.2. expands into the characterization of small-scale fisheries and bar reef marine sanctuary, Kalpitiya Sri Lanka, under four subsections, namely resource system, resource unit, users, and interactions. First, the resource systems of both SSF and MPA are discussed in subsection 4.2.1. Next, section 4.2.2. discusses resource units of both the natural and social subsystems of MPA and SSF. Then, the users and their characteristics are discussed under SSF and MPA in section 4.2.3. Finally, the interactions between SSF and MPA are discussed in section 4.2.4. The identified characteristics and the way they are impacting the vulnerability and viability of SSF are discussed in section 4.3. In the end, the chapter concludes by summarizing chapter findings on the characterization of SSF, MPA, and interactions.

4.2. Characterization of Small-scale fisheries and Bar Reef Marine Sanctuary, Kalpitiya Sri Lanka

This chapter utilizes the social-ecological systems (SES) framework to identify the characteristics of the social and ecological systems under consideration in this case study. SES comprises four core subsystems: resource system (RS), resource unit (RU), users (U), and governance system (GS) (Figure 4.1). SES framework allows the analysis of complex interconnected social and natural subsystems using a multi-tier hierarchical layout to define each of the core subsystems. The framework presents second-tier variables under each of these core systems allowing for further expansion into third-tier, fourth-tier variables defining the system's intrinsic features.

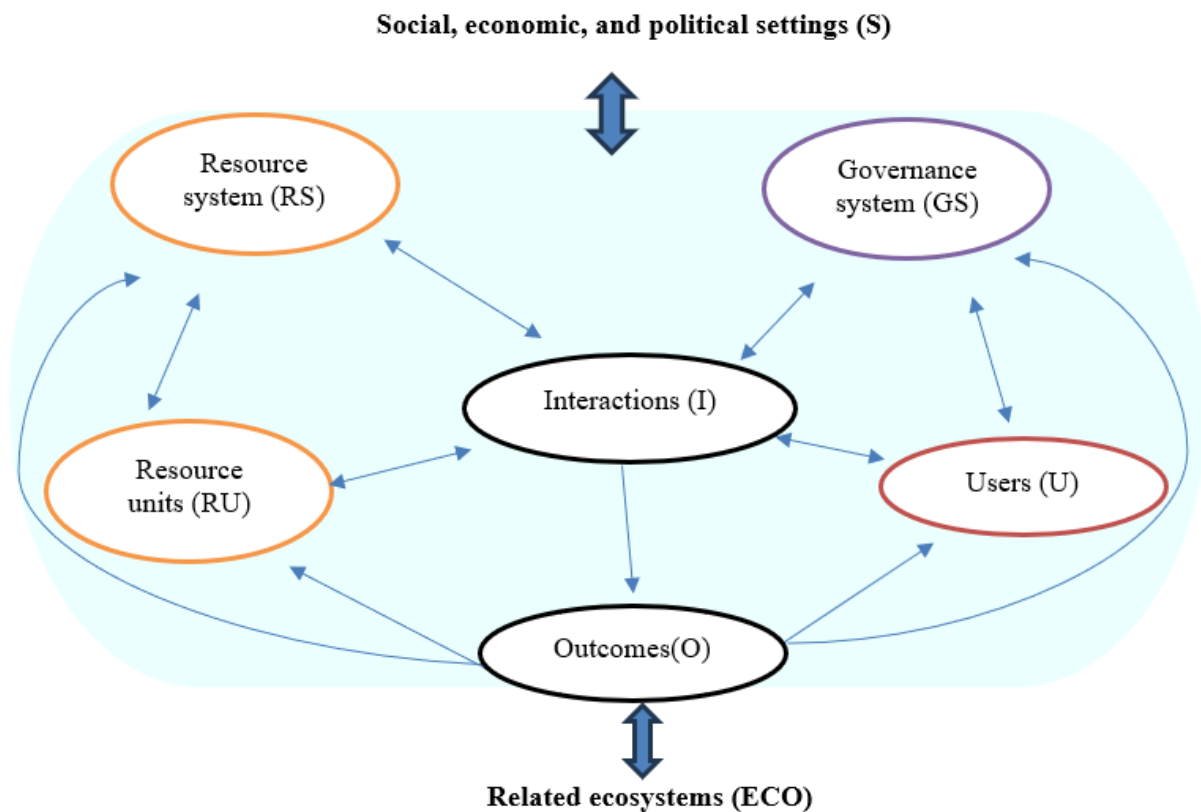


Figure 4.1. Core subsystems of the social-ecological systems framework (Adopted from Ostrom, 2009)

This chapter delves into the characteristics of SSF and BRMS within the context of three of the above subsections: resource system, resource unit, and users along with their interactions (the governance system will be discussed in Chapter 5, using the interactive governance framework). This chapter expands into second-tier and third-tier variables that exist in the social-ecological system of SSF and BRMS.

The study examined the SES by considering perspectives from various stakeholders, including the fisheries and the tourism industry. The fisheries industry in Kalpitiya Divisional Secretariat Division (Kalpitiya DS) comprises a variety of fishing scales and aquaculture. Fishing practices range from small-scale, medium-scale, large-scale, and export-oriented fishing in both marine and lagoon ecosystems. Fishing practices further vary depending on the village; for example, in certain villages such as Uchchimunei, the predominant fishing practice is fishing by purse seine nets, which can be categorized into medium and large-scale fisheries. The tourism industry includes tourist boat operators, hospitality service providers (accommodation, transportation, and food services), and recreational activities. Thus, the analysis was based on the qualitative data collected from in-person interviews, focus group discussions, and observations in four villages, Kalpitiya, Kudawa, Kandakuliya, and Uchchimunei, to identify the complexities and interactions in the social-ecological system of interest.

4.2.1. Resource System (RS)

The resource system of the SES framework refers to the environmental and ecological system that provides resources that are utilized by users and under governance. The RS comprises nine second-tier variables followed by third-tier variables inherent to the SSF and MPA resource systems in Kalpitiya. The two resource systems of SSF and MPA are examined in Table 4.1 and Table 4.2, respectively.

4.2.1.1. Resource System of SSF, Kalpitiya

The resource system type (RS1) of the SSF involves a generational, low-tech, labor-intensive SSF industry (Table 4.1). The SSF resource system type in Kalpitiya represents a generational livelihood, with the occupation traditionally passed from fathers to sons (n=17). Many young men, after completing primary or secondary education, choose to engage in fishing as their primary occupation. Hence, SSF is an early-learned life skill for the majority of the young males in this area (n=7). The type of RS varies depending on the geographical location and seasonal effects. SSF activities are carried out in both coastal waters near the shoreline and Puttalam lagoon. During initial observations and consultations with the community, the study focused on screening SSF in coastal waters to align with the research aim of

analyzing SSF and MPA interactions. Historically, Kalpitiya had been a major SSF hub, with fishers utilizing non-motorized wooden boats called ‘oru’ ‘wallam’ or ‘theppam’ with paddles and/or sails and low-tech gears such as different types of fishing nets, rods, hooks and baits (n=21). Gradually, fishers expanded their operations further offshore, adopting more extractive and destructive practices, such as dynamite and purse seine fishing shifting to medium and large-scale fisheries. Nowadays, nearshore and lagoon SSF fishing continue using ‘wallam’ or ‘theppam’ which are now made from fiberglass material and low-tech gears. Many SSF now use small motorboats with engines ranging from 8 – 25 horsepower (n=20). The seasonal availability of fish influences the types of nets and gear used. Generally, the SSF industry in the area is a low-income level livelihood. Usually, SSF is labor-intensive and involves 1-3 people involved in SSF depending on the fishing method. Moreover, fishing duration or time of the day varies upon the type of fish each of the fisher harvest. The time of the day varies from early morning to evening.

“My father, relatives, cousins, and brothers all are fishermen. That made me go fishing. It is common in this fisher village that after finishing schooling boys go to sea with their relatives or as laborers” – A fisherman, Uchchimunei

“SSF also use different types of gear based on the fish species, size, and season. Some have only one set of nets, so they have to wait for the suitable season and species, making it very hard for them to survive.”
-A fisherman, Kudawa

Resource System Boundaries (RS2) of SSF in Kalpitiya are limited to the shallow coastal waters (n=20) (Table 4.1). Historically, SSF was limited to nearshore and lagoon, with informal geographical markers used to identify fishing lands and boundaries. Some respondents mentioned that the unclear boundaries had led to conflicts among villages over marine resources. To avoid such conflicts, at present, medium to large-scale fishers are obliged by the DFAR to carry out offshore fishing beyond 10km from the coastline, thereby reserving the nearshore zone for SSF fishers.

“We normally go fishing up to 4-10km from the shore to sea according to the availability of fish.” – A SSF fisherman, Uchchimunei

The size of the resource system (RS3) is typically limited to coastal and lagoon water bodies (Table 4.1). As discussed in RS1, the limited size of the RS has become a significant pressure point, especially as younger men join the SSF sector after completing their education. This increase in fishermen has resulted in either expanding their activities or intensifying their operations within the same fishing grounds.

Kalpitiya has benefitted from several human-constructed facilities (RS4). Recent developments in the fishing industry have improved fishing infrastructure in Kalpitiya (Table 4.1). Most landing sites now have on-site fishmongers who purchase fresh harvest from fishers, some equipped with cold or ice storage. Fishers in Kudawa and Kandakuliya villages sell their fish to mongers onshore. Those in Kalpitiya and Uchchimunei sell their catches to ice boats that collect fish. Fishmongers operationalize these ice boats to reach fishers by the lagoon side and load the harvest into the sea to bring the fresh harvest to landing sites. This system has reduced dried fish production, which was once dominant in Kalpitiya. At present their dried fish production is mostly limited to household consumption. In addition to the local market, the recent development in fish export businesses targeting high-value species (e.g., parrot fish, cods, sea cucumber, lobster, crabs, prawns, and ornamental fish) for international markets has created new opportunities for various fishing jobs, while intensifying the resource extraction pressures. Moreover, Kalpitiya has a few fish processing factories for crabs for export purposes. These human-made facilities (RS4), however, have created considerable pressure on resource extraction activities in both the sea and lagoon, leading to the exploitation of resources.

Many SSF fishers expressed that the productivity of the system (RS5) has decreased over the years due to the loss of fish habitat, overfishing by other fishing jobs, climate change, and impacts from Norochcholei power plant heat water emission (Table 4.1). In the past, several natural disasters such as *El Nino* 2016, and the Tsunami 2004, high tides, increasing water temperature, and fishing destruction from medium-large-scale jobs and trawlers have led to the destruction of fish habitats and reduced stocks. As a result, the system's regenerative capacity had declined exacerbating low productivity experienced by SSF today.

Although respondents discussed limited information about equilibrium properties (RS6), some fishers emphasized the importance of preserving marine biodiversity to maintain ecological balance. Some fishers stated they try to avoid juvenile fishing and reduce bycatch of marine species such as turtles and dugongs. However, some respondents stated that due to unfavorable economic conditions, fishers try to maximize their harvest without considering the system's natural balance.

Fisher communities in Kalpitiya are highly attached and in tune with their marine ecosystem, possessing a deep knowledge of the predictability of system dynamics (RS7) in terms of seasonal and ecological changes (Table 4.1). They often are very skilled at predicting climatic conditions (e.g., Monsoon rains) and seasonal fish behavior, movement patterns, and availability. The ability to predict system dynamics enables them to adapt their fishing practices accordingly to seasonal changes. For example, SSF fishers take advantage of the monsoon season, when crabs are more abundant nearshore. They are well-prepared for these seasonal changes as their gears are well equipped with different sets of gears and fishing nets to fit the available species in different seasons.

The storage characteristics (RS8) of SSF in Kalpitiya are mostly facilitated by the human-constructed facilities we discussed in RS4. SSF fishers either sell their catch to fish mongers or dry excess or damaged fish (Table 4.1). While, some individual fishers use their own small ice boxes, some sell to ice boat service facilitated by fishmongers. Buyers (business owners, individuals) from various parts of the country buy fish from fishmongers at landing sites daily. Therefore, the storage capacity does not exist for prolonged periods. Furthermore, post-harvest losses are considerably minimal as the damaged or non-economic value species are being dried for household consumption or local selling.

The RS location (RS9) spans Kalpitiya mainland and its 14 islands, with only a few islands as residential areas (e.g., Uchchimunei, Baththalangunduwa, Rodapaduwa, and Palliyawatte). As per the case study's target locations, Kandakuliya, Kudawa, and Kalpitiya villages are in the mainland of Puttalam District, while Uchchimunei (identified as an island) is located on the topmost part of the Kalpitiya peninsula. The remote location of these islands results in logistical challenges, limiting infrastructure and access to markets (Table 4.1). Thus, the remote location often makes the islanders economically disadvantaged compared to mainland communities. The tourism industry is further concentrated in the mainland due to its easy accessibility and infrastructure. Despite the challenges, some respondents stated that the unique geographical location of the Kalpitiya peninsula and the adjacent Puttalam lagoon and reef system had been a shield for the local communities in natural disasters such as Tsunami 2004.

Table 4.1 provides a detailed overview of the SSF resource system by its characteristics as we discussed above.

Table 4.1. Resource systems characteristics of SSF, Kalpitiya

First-tier variable	Second-tier variables		Third-tier variables	Characteristics
Resource system	RS1	Sector	Tradition	Inherited by previous generations
			Type of gears	Low-tech gears
			Type of boats	Nonmotorized/motorized
			Labour usage	Labor intensive; 1-2 people
			Socioeconomic condition of SSF	Low income level, low formal education

			Duration/Time of the day	A couple of hours/early morning to evening, increasing population
	RS2	Clarity of resource System Boundaries	Marine spatial distance	Nearshore fishing
	RS3	Size of resource system		Limited to coastal and lagoon waters
	RS4	Human-constructed facilities	Services	Ice-boat service Cold storage
			Markets	Export market- for consumption, ornamental fish
			Fish processing	Crab export factories
	RS5	Productivity of system		Lower productivity/ regeneration rate
	RS6	Equilibrium properties		
	RS7	Predictability of system dynamics	Seasons Climate conditions Fish behaviour Fish navigation patterns Fish availability	Fishers are skilled at predicting the occurrences and changes in these resource system dynamics
	RS8	Storage characteristics	Post-harvest practices	Fishers sell fish to buyers right away or do dry fish production
	RS9	Location	Transportation Less infrastructure Access to markets Alternative livelihoods	Economically disadvantaged fisher communities in islands

4.2.1.2. Resource System of BRMS, Kalpitiya

The BRMS resource system type (RS1) is recognized for its biological and physical components and aesthetic and economic value by the majority of the respondents (Table 4.2). Sixteen respondents (n=16) listed the abundance of fish (cods, rays, parrotfish, reef shark, ornamental fish) and other species (chank shells, sea cucumber, lobster) that are in demand in both domestic and foreign markets. Additionally, some mentioned that this area is a habitat for marine mammals such as turtle species, dolphins, and dugongs. Most highlighted physical components of BRMS (n=6) included the sandstone reef coral system in a shallow water body. Additionally, due to the availability of numerous fish and coral species, BRMS was recognized to be the most aesthetic marine space in Kalpitiya (n=20). Some respondents (particularly divers) explained the area as a 'heaven underwater,' 'treasure.' Some tourist boat operators mentioned that they felt proud of their ecosystem as BRMS is often being admired for its high aesthetic value by foreign tourists. Moreover, 11 respondents discussed its economic importance as the reef area is home to high-value species (cod, parrotfish, lobster, sea cucumber).

BRMS is not administered under an extensive zonation (RS2). Despite this, sensitive areas of the system have been demarcated with the use of buoys as a no-take zone where fisheries and other recreational activities are prohibited (Table 4.2). Some respondents mentioned that these buoys were damaged by high tides, and thus, it is difficult to locate the sensitive area. However, some of them stated that they are well aware of the special geographical features, such as corals, that enable them to identify the boundaries of the sensitive area.

The BRMS extends up to 30,670 ha (RS3) (Table 4.2), making it the largest MPA in Sri Lanka. However, only a few respondents were aware of its actual size, whereas many lack clear ideas of its extent. The highly protected zone, as discussed in RS2, is limited to the biologically sensitive area. Some respondents expressed that the reef area, being smaller in size, could have been more effectively monitored and protected.

BRMS is equipped with human-constructed facilities (RS4) such as concrete domes and buoys on-site, which were immersed in the 5-year BRMS management plan in 2019 (Table 4.2). However, many respondents stated that it required a nearby monitoring point rather than patrolling services run by DWC and SL Navy. Additionally, some respondents mentioned the presence of an off-site facility- a ticket-issuing unit for tourists, along with a small marine museum. Moreover, NARA, Kalpitiya, is overseeing the research related to fisheries in Kalpitiya and aquatic ecosystems, including BRMS.

Respondents rated the productivity of BRMS (RS5) higher than other areas in Kalpitiya. Thirteen respondents (n=13) identified it as a rich fish habitat, while 16 mentioned (n=16) its role as a breeding

ground for various fish species. Further, 14 respondents emphasized the abundance of fish stocks in BRMS. The reef area is identified as full of smaller fish species that are the prey for high-economic value fish species. However, some fishermen reported that productivity levels of BRMS have declined over time due to overfishing and natural disasters.

In line with RS5, the majority of the respondents stated that the equilibrium of BRMS (RS6) has declined over time due to destructive fishing, overfishing, and natural disasters (*El Nino*) (Table 4.2). Although governance measures restricted human extraction activities within the area, the ecosystem has yet to recover fully due to the prevalence of increasing pressure from fisheries in the surrounding areas, climate change, and Norochcholei power plant emissions.

“Due to the El Nino, bar reef died completely. Earlier, the reef was like a heaven. With the El Nino, the corals turned to rubble. We are helpless at natural disasters. Fish that cleaned and survived on algae left the coral reef after full destruction. Fish habitats were lost. After that, algae began to grow.” – A tourist boat operator, Kudawa

Aligning with the SSF (RS7), it was noted that fishers in the region are highly skilled in predicting fish breeding seasons, seasonal migration patterns, and species availability in BRMS, which are closely tied to monsoon patterns (Table 4.2). Moreover, fishers often can predict resource system dynamics that are highly correlated with overfishing and destructive fishing. For example, overfishing significantly reduced lobster stocks, making the government ban lobster harvesting during its breeding periods (February and September).

“In the Northwest monsoon period, reef fish species breed and stay near coral areas. When there are high tide seasons, the marine environment begins to agitate. During those periods, there is a surplus of fish species that live near coral areas as fish species that used to calm environments can’t withstand the agitated environment.” – A fisherman, Uchchimunei

As mentioned in RS5, respondents highlighted the storage capacity (RS8) of the BRMS with its higher fish stock. They perceived that the abundance of corals leads to more habitat and breeding grounds, resulting in higher fish stock. However, it was highlighted that the ecosystem's capacity to generate and store marine life has been declining due to prolonged damage. They expected more effective rules and regulations in action to bring the BRMS back to its productive capacity levels.

BRMS is located 2 km offshore from the Kalpitiya peninsula, which is being administered under the Kalpitiya Divisional Secretariat (RS9). The reef is closer to fishing islands such as Uchchimunei and Baththalangunduwa than to mainland fishing communities (Kudawa, Kandakuliya, Kalpitiya). There is no

beach area administered under the BRMS governance. Due to this isolated offshore location, logistical challenges are there for governance activities such as monitoring and maintenance. Table 4.2. below provides an overview of the resource system of BRMS.

Table 4.2. Resource system characteristics of BRMS, Kalpitiya

First-tier variable	Second-tier variables		Third-tier variables	Characteristics
Resource system	RS1	Resource System Type	Biological components	Fish and other marine species, corals
			Physical components	Sandstone reef, shallow water body
			Aesthetic value	Combination of corals and marine species
			Economical value	Availability of highly demanding fish species; tourist attraction
	RS2	Clarity of resource System Boundaries	Zones & demarcation	Zoning is limited to the biologically sensitive area; Demarcated by buoys
	RS3	Size of resource system	Area of the MPA	30,670 ha
	RS4	Human-constructed facilities	On-site	Buoys, concrete structures
			Off-site	Tourism unit and museum, NARA operational research unit
	RS5	Productivity of system	Number of marine species	200+ fish species
			Fish breeding place	
			Fish habitat	
			Productivity rate	Declining productivity
	RS6		Natural disasters	El Nino, Tsunami

		Equilibrium properties	Man-made destructions	Destructive and overfishing; Norochcholei power plant emissions
			Status of equilibrium	Disturbed natural equilibrium of the system
	RS7	Predictability of system dynamics	Seasons Fish navigation patterns Fish availability Impact of fishing practices	Highly predictable of seasonal changes; impacts of large-scale fishing and destructive fishing on the system dynamics
	RS8	Storage characteristics	Status	Declining capacity
	RS9	Location	Administration zone	Kalpitiya Divisional Secretariat
			Geographical location	Offshore, close to islands

4.2.2. Resource Unit (RU)

The SES framework's resource units refer to the individual units or components that comprise a resource system—in this case study, SSF and MPA. The resource units of SSF and BRMS are examined separately in sections 4.2.2.1 and 4.2.2.2 under seven second-tier variables, followed by third-tier variables, as summarized in Tables 4.3 and 4.4.

4.2.2.1. Resource Unit of SSF, Kalpitiya

Most highlighted variables under RU mobility (RU1) included fish migratory patterns and spatial distribution. Fishing activities in Kalpitiya vary from small-scale to large-scale depending on the fish migratory patterns and distribution of fish species. Migratory patterns are mainly dependent on the monsoon season, which further affects the availability of marine species. The majority of the fishers expressed they are entirely dependent on fishing as a livelihood. Thus, they try to maximize their catch when fish migrate to the area. Additionally, fish mobility patterns vary depending on the time of the day,

affecting fishing practices. For example, divers preferred to harvest parrotfish at night when the fish was more abundant. Moreover, fish mobility patterns have an impact on the overlapping of fishing grounds of SSF and other fisheries activities and tourism. While SSF primarily targets smaller to medium-sized fish, medium and large-scale fishers target species that grow larger in size. Overlapping of fishing grounds resulted in larger fish species hunting smaller species for food. Despite migratory patterns, the spatial distribution of marine species influences the scale of fishing in Kalpitiya. SSF primarily targets coastal areas (intertidal and subtidal zones) and upper layers of the ocean, whereas medium to larger-scale fishers target deeper ocean layers and deep seas.

SSF expressed that overfishing of large-scale purse seine net fishers and the increasing number of fishers have contributed to lower fish growth and replacement rates (RU2). Although some fishers stated there was no change in fish growth rate, the majority believed that increased fishing pressure has reduced both growth rates and harvest rates compared to the past (Table 4.3).

As highlighted in RU1, fishing activities are closely linked to biological interactions (RU3) of underwater food chains, where larger species depend on smaller prey (Table 4.3). The food chain dynamics create competition among different scales of fishing jobs, exacerbated by unclear fishing ground boundaries. In contrast, some fishers shared experiences of collaboration between fishing and tourism. For example, when a pod of dolphins is sighted by tourist boats, they would signal fishers to indicate the fish available location and vice versa.

SSF in Kalpitiya primarily targets species for the domestic market except crabs, which are exported (Table 4.3). The economic value (RU4) of SSF species at markets is relatively low, ranging from LKR 400-2,000 per kilogram, in contrast to high-demand species foreign market-oriented species such as lobster (price ranging from LKR 10,000-20,000 per kilogram). These high-demanding species are typically found near reef areas. The harvest levels of SSF are generally less than 100 kg per day (n=14), whereas large-scale fisheries harvest between 1,000-15,000 kg daily depending on the fish availability (n=12). However, this disparity in harvest levels has led to lower market prices for SSF, limiting their price negotiation power with fishmongers.

Kalpitiya fishing industry benefits from its unique geographical location, surrounded by both a lagoon and the sea. Although every respondent stated that Kalpitiya fish stock (RU5) has been reduced over the years, it has remained sufficient to support the livelihoods of hundreds of fishers (Table 4.3). Some medium- to large-scale fishers perceived that current extraction rates are not limiting future generations' needs whereas SSF mostly had negative to neutral perceptions. Some respondents expressed their

opinions and anticipation regarding the potential for increasing fish extraction through the introduction of new technology, as supported by the government.

Distinctive characteristics (RU6) of SSF primarily involved nearshore fish species in smaller-medium size, and crustaceans like crabs and prawns (Table 4.3). Additionally, island fishers (both male and female) harvest oysters from the lagoon for both consumption and sale. The taste of fish is a critical factor in determining domestic market demand. For instance, parrotfish are rarely popular cuisine in Sri Lanka. However, as pathways opened for global markets, fisheries targeting reef species such as parrotfish, cucumber, lobster, and chank shells have increased, offering higher prices and attracting more fishers.

The spatial and temporal distribution of species (RU7) is a major factor distinguishing the fishing grounds of different fishing scales in Kalpitiya. The distribution and quantity of fish species are heavily influenced by seasonal effects (Table 4.3). SSF is typically concentrated in nearshore and lagoon waters, shifting between these locations based on the monsoon seasons.

The diverse RU characteristics of SSF are summarized in Table 4.3 below.

Table 4.3. Resource unit characteristics of SSF, Kalpitiya

First-tier variable	Second-tier variables		Third-tier variables	Characteristics
Resource unit	RU1	Resource Unit Mobility	Fish migratory patterns	Depends on seasonality, overlapping of fishing grounds
			Spatial distribution	Coastal areas, uppermost area of the ocean
	RU2	Growth and replacement rate		Mixed perceptions- no change / lower rate; but no higher rates
	RU3	Interaction among resource units	Underwater food chain	Competition over fishing grounds, to locate fish
	RU4	Economic Value	Market value	SSF is mostly domestic market-oriented with lower market rates

			Harvest level	Lower harvest levels <100kg per day
			Price negotiation	Lower negotiation power
	RU5	Number of units	Fish stock	Reduced over time, still productive, potential for further extraction
	RU6	Distinctive characteristics	Fish Species	SSF catch smaller-medium size fish
			Other species	SSF catch mainly prawns and crabs, oyster
			distinct taste of fish	Changes in market demands, dry fish production
	RU7	Spatial and temporal distribution	Location	Nearshore and lagoon
			Seasonal effect	SSF shifted their fishing ground between coastal areas and the lagoon

4.2.2.2. Resource Unit of BRMS, Kalpitiya

Many respondents stated that the BRMS serves as a fish habitat for both migratory fish and reef species, each having different mobility rates (RU1) (Table 4.4). While reef species such as cods, lobster, and sea cucumber are less mobile, migratory fish have a higher rate of mobility. This variation in mobility influences the intensity of human activities affecting the BRMS. The spillover effect of the MPA was identified as a significant source of fish availability beyond its boundaries. Respondents discussed that after the MPA implementation, some marine species started increasing in the rest of the oceanic layers. They perceived that the spillover effect took a longer period to happen. Further, some stated that even if the MPA had been productive at such a lower rate, it would not have been able to provide a rate of constant resource extraction by fisheries.

“I think fish retain in that area as that place is a very good environment for them in seasons. And fish migrate around the country in seasons.” – A fisherman cum tourist boat operator, Kudawa

The growth rates of marine life (RU2) in BRMS were observed to decline compared to the past. The depletion rates were primarily due to *El Nino* 2016 and destructive fishing practices (Table 4.4).

The interaction (RU3) most discussed regarding the resource units in the BRMS was the role of certain reef fish species, such as parrot fish, in cleaning the reef when feeding on coral algae. Fishers and divers expressed the importance of maintaining adequate numbers of these species to ensure the long-term health of the reef for fisheries and future generations (Table 4.4).

The most widely recognized economic value (RU4) of the MPA was its influence on the development of tourism which has attracted both local and foreign tourists. This publicity had also opened pathways for Kalpitiya fisheries sector expansion. Some fishermen (n=4) stated that infrastructure development due to tourism projects has made Kalpitiya more accessible to buyers from different parts. Eighteen participants of the study, who were former fishers, have transitioned to the tourism industry either full-time or part-time as small hoteliers, ornamental fish collectors, divers, recreational activity businesses (camping, snorkeling, scuba diving), and/or tourist boat operators. Some respondents from Kudawa and Kandakuliya expressed that women and the young generation were earning income while working as labor in hotels. Some of them were content that their children could secure white-collar jobs at these hotels after completing secondary education. In contrast, some remote communities, such as Uchchimunei, have not fully benefitted from these economic benefits of MPA due to limited infrastructure facilities and cultural resistance to tourism's potential social impacts. Older generations in Uchchimunei (who are now in their 70s -80s) were afraid of the societal and cultural influence that could arise from tourism and, in turn, damage the harmony of their smaller community. However, their children who are in their late 30s – 40s expressed that they could benefit from tourism as an alternative income source from the opportunities created by the MPA.

“To be honest, Tourism is an alternative livelihood for us. Our children and women work at hotels. So, in that way, poor fisher families can earn more money, as fisher income is decreasing due to higher operating costs of fishing activities. Also, young generation who are educated more than our generation gets jobs in the hotel industry.” – A fisherman, Kudawa

Respondents stated that the number of units (RU5) of fish and other reef species had declined over time, while some fishermen and tourism persons expressed there is a higher opportunity to preserve the stock levels by imposing effective conservation strategies (n=16) and fisheries management (n=8). Contrasting perceptions (n=3) were that the MPA had depleted its marine life stock and thus, it would be in vain to regenerate the BRMS through millions worth of projects (Table 4.4).

BRMS is instrumental in protecting various species, both flora and fauna (fish and non-fish species), with distinct characteristics (RU6), such as corals, lobster, parrotfish, and turtles in Kalpitiya (Table 4.4). As discussed in RU3, these species interact with each other to maintain a healthy balanced underwater ecosystem. In addition, the geological characteristics such as reef structure, rocks, and their spatial distribution facilitate fish breeding places.

The BRMS's spatial extent is 307 km², located offshore in Kalpitiya, including a coral reef system in shallow waters. Many respondents expressed that the spatial distribution (RU7) of coral reefs had particularly been beneficial in locating the BRMS.

The following table 4.4 summarizes the various resource unit characteristics of BRMS.

Table 4.4. Resource unit characteristics of BRMS, Kalpitiya

First-tier variable	Second-tier variables		Third-tier variables	Characteristics
Resource unit	RU1	Resource Unit Mobility	Mobility rate	Higher- migratory species Lower-reef species
			Spillover effect	MPA's spillover affects the fish availability in other areas
	RU2	Growth and replacement rate		Lower growth rates
	RU3	Interaction among resource units	Biological effects	Fish species cleaning the reef algae
	RU4	Economic Value	Alternative livelihoods	A set of alternative livelihoods generates from MPA
			Disparity of opportunities	Less advantaged island communities, landside communities more advantaged

	RU5	Number of units	Stocks of marine life	Reduced stocks, mixed perceptions regarding stock regeneration
	RU6	Distinctive characteristics	Ecosystem functions of flora	Breeding places and fish habitat
			Ecosystem functions of fauna	Reef cleaning, maintaining the balance of stocks
	RU7	Spatial and temporal distribution	Extent, Components	Extent of 307 km ² , Coral distribution

4.2.3. Users (U)

The term ‘Users’ in the SES framework refers to individuals or groups that depend on or interact with the resource system. Users extract, gain various benefits from, and manage RS and RU. This subsection describes the user characteristics of SSF and BRMS separately, focusing on their second-tier and third-tier variables and highlighting intrinsic characteristics in Tables 4.6 and 4.7.

4.2.3.1. Users of small-scale fisheries, Kalpitiya

The number of small-scale fishers (U1) is indefinite (Table 4.6). SSF shifts between different fisher jobs depending on the season and economic needs. For instance, during monsoon season, some coastal fishers, including SSF and medium-scale fishers, shift to the lagoon ecosystem, adapting their fishing practices. Additionally, some fishers work as laborers on boats owned by fishmongers and wealthier fishermen. Most of these labor fishers had no engine boats or could not afford gears of their own. Some of them engaged in SSF activities with their non-motorized- wallam and theppam while working under purse-seiners or divers. Further, the majority of the respondents stated that the total number of active fishers and fisher households is increasing as the population grows over time. During monsoon season, the number of fishers declined as some fishers avoided the sea due to safety concerns. The number of total fisher families in the Kalpitiya division is recorded as follows (Table 4.5), though the exact count of the islands remains uncertain due to a lack of reliable data according to the resource profile of Kalpitiya Division as created by the Kalpitiya DS Office. Further, the case study respondents revealed that the majority of the

inland-Uchchimunei fisher families now have moved to Kalpitiya landside for children's education and improved infrastructure facilities.

“Earlier fishers did not want to go very far. Fish were abundant close to the shore. Now resources are declining as the number of fishermen increased. Now that makes even an SSF fisher to use a motorboat. Earlier they used sails in oru, theppam, wallam (non-motorized). But today, we need higher horsepower boats and consume a lot of fuel” – A fisherman, Kalpitiya

Table 4.5. Total number of fisher families by area (adopted from Resource profile Kalpitiya, 2021)

Area	Number of fisher households
Kandakuliya	768
Kudawa	79
Kalpitiya-landside	1437
Islands	uncertain

The users' socio-economic attributes (U2) in Kalpitiya can be discussed under population, gender, race, population density, livelihoods, household income, and education levels. According to the Resource Profile of Kalpitiya Divisional Secretariat (2021), the population consisted of 27,849 households and 103,381 people, with 52% females and 48% males. The average household size was 4 family members. The population is ethnically diverse with race, where Muslims comprise the largest group (46.34%), followed by Sinhalese (35.41%), Tamils (18.25%), and Burgher (0.01%) (Figure 4.2). Moreover, population density has been increasing, as shown in Figure 4.3 over the five-year period of 2017-2021, as per the statistics of the Kalpitiya Divisional Secretariat. Figure 4.4 highlights the education level of the research participants, where many community members had low levels of formal education, with the majority, 56.9%, having completed up to primary education, 27.5% up to secondary education, 2% up to elementary school, and 3.9% with no schooling. The 9.8% of respondents who completed tertiary education were the government officials (Figure 4.4).

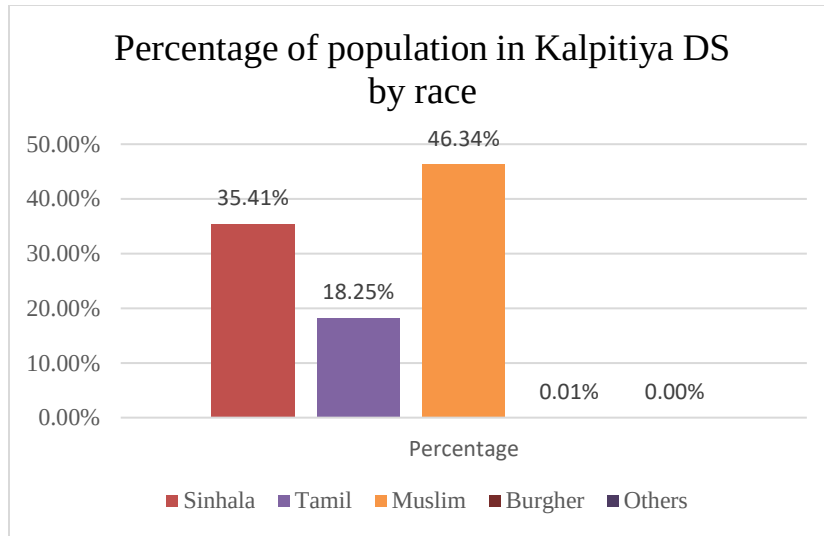


Figure 4.2. Kalpitiya Division Population percentage by race (data from Resource profile Kalpitiya 2021)

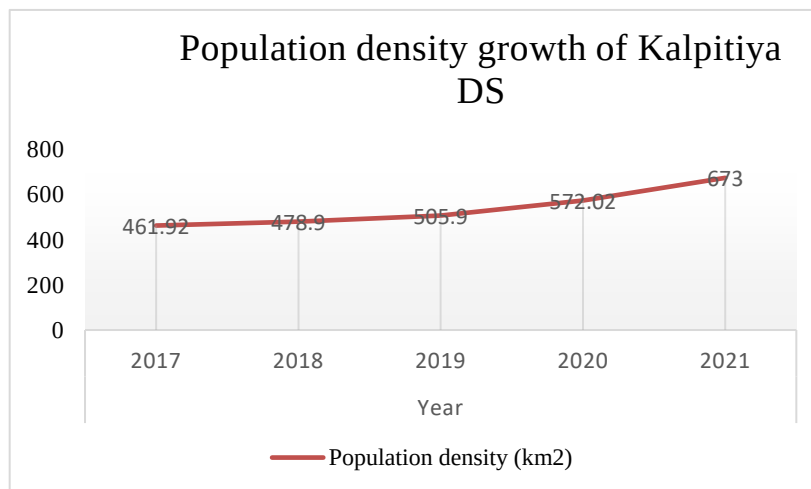


Figure 4.3. Kalpitiya DS population density growth 2017-2021 (data from Resource profile Kalpitiya 2021)

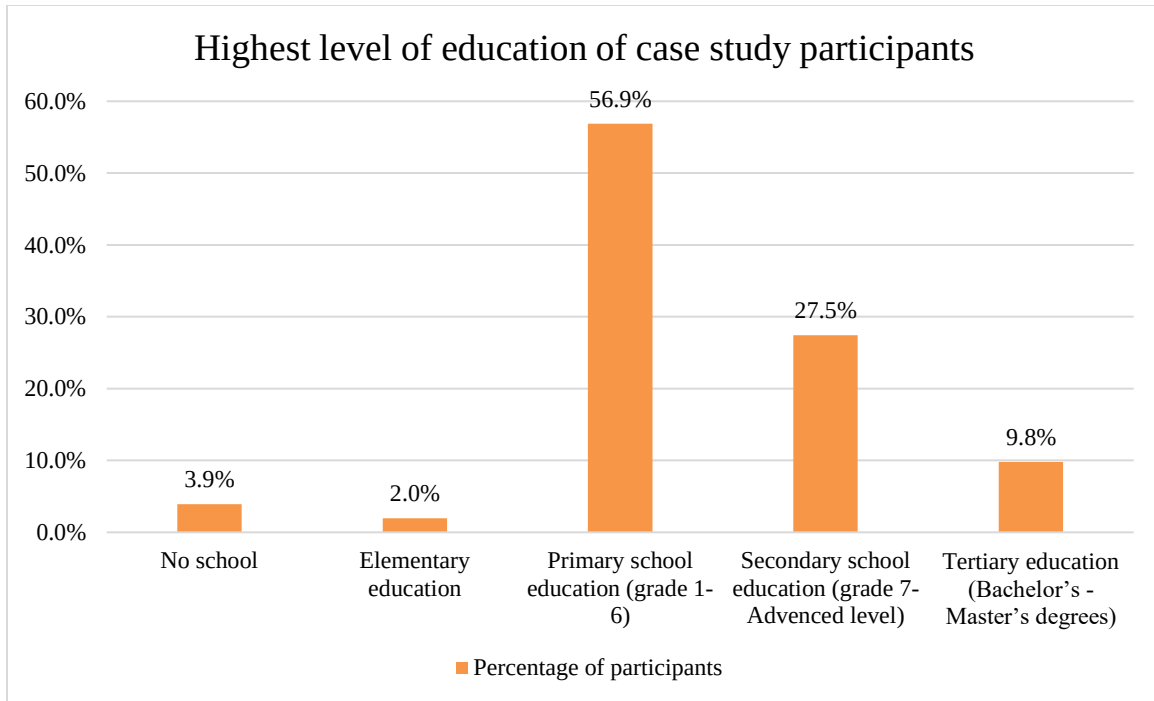


Figure 4.4. Highest education level of case study participants

According to the resource profile (2021) of Kalpitiya DS, the occupations among the Kalpitiya community can be categorized into the following categories as shown in Figure 4.5. The highest percentage of the community is involved in self-employment (35.7%), followed by labor and mechanical jobs (24.3%) (Figure 4.5). The third largest group consisted of other unidentified jobs, with 12.5%, while 10.3% were involved in the agriculture and plantation sector (Figure 4.5). Further, community members are occupied as merchants (7.9%), foreign workers (5.7%), professionals (2.4%), executives and managers (1%), and in the security sector with 0.3% (Figure 4.5). Figure 4.6 provides a detailed breakdown of the jobs in the highest occupation category- self-employment- in Kalpitiya DS (Resource profile, 2021). It depicts the fisheries sector providing the highest number of employments in self-employment for 35.7% of the community, followed by 26% in agriculture (Figure 4.6). Thirdly, community members are involved in masonry, carpentry, and mechanical jobs, with 12.7%, while 9.3% own shops. Animal husbandry and apparel jobs accounted for 6.7% and 3.4% respectively (Figure 4.6). Moreover, 3%, 1.6%, and 0.1% occupied in food manufacturing, house renting, and cement production, respectively (Figure 4.6).

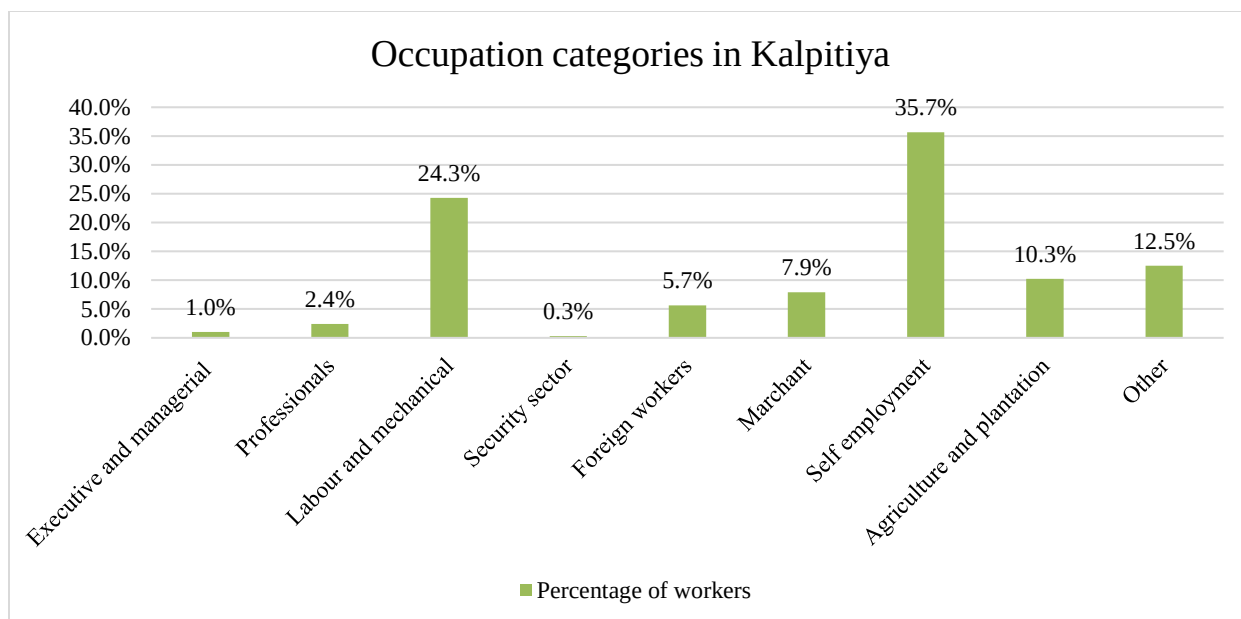


Figure 4.5. Occupation categories in Kalpitiya (data from Resource Profile, Kalpitiya, 2021)

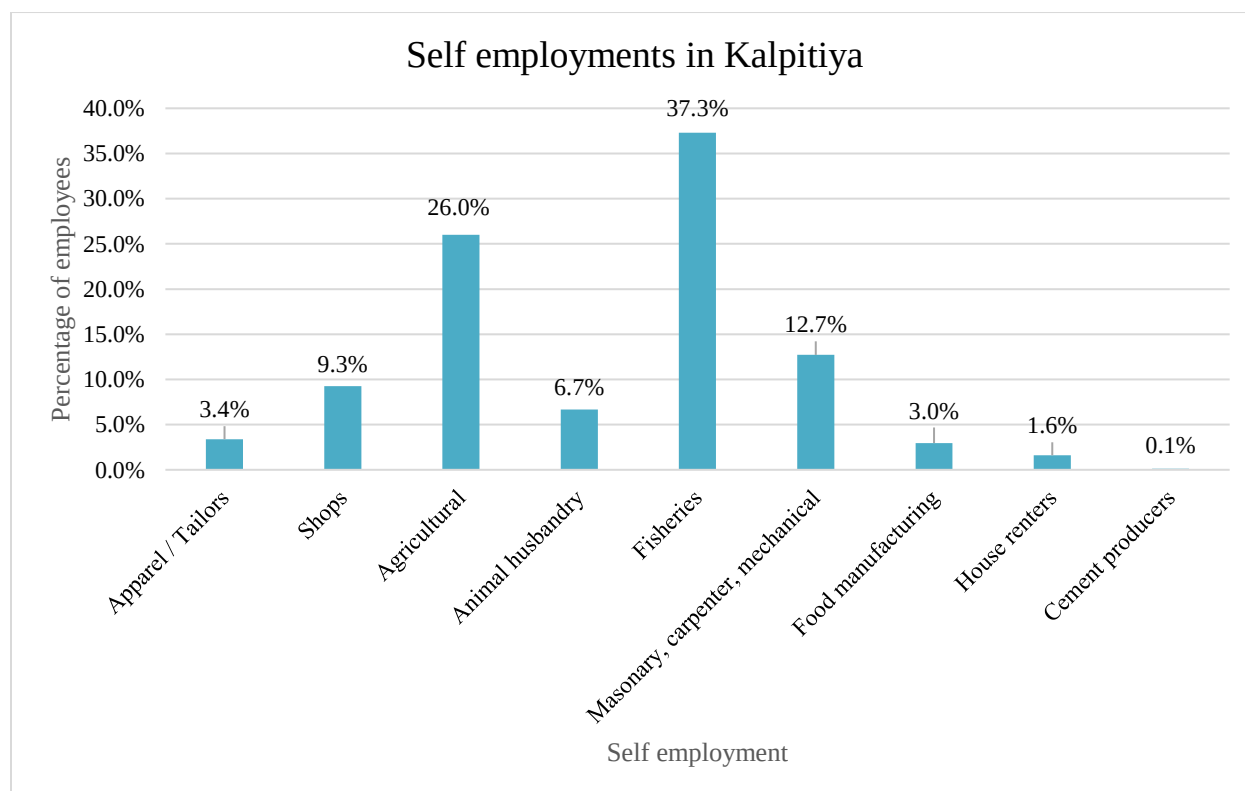


Figure 4.6. Self-employment types in Kalpitiya (data from Resource Profile, Kalpitiya, 2021)

Users can be further characterized by their household income levels (Figure 4.7). As per data in the resource profile of Kalpitiya (2021), the majority (89%) of the community members earned monthly per capita below LKR 32,000, while only 11% earned above LKR 32,000 monthly (Figure 4.7).

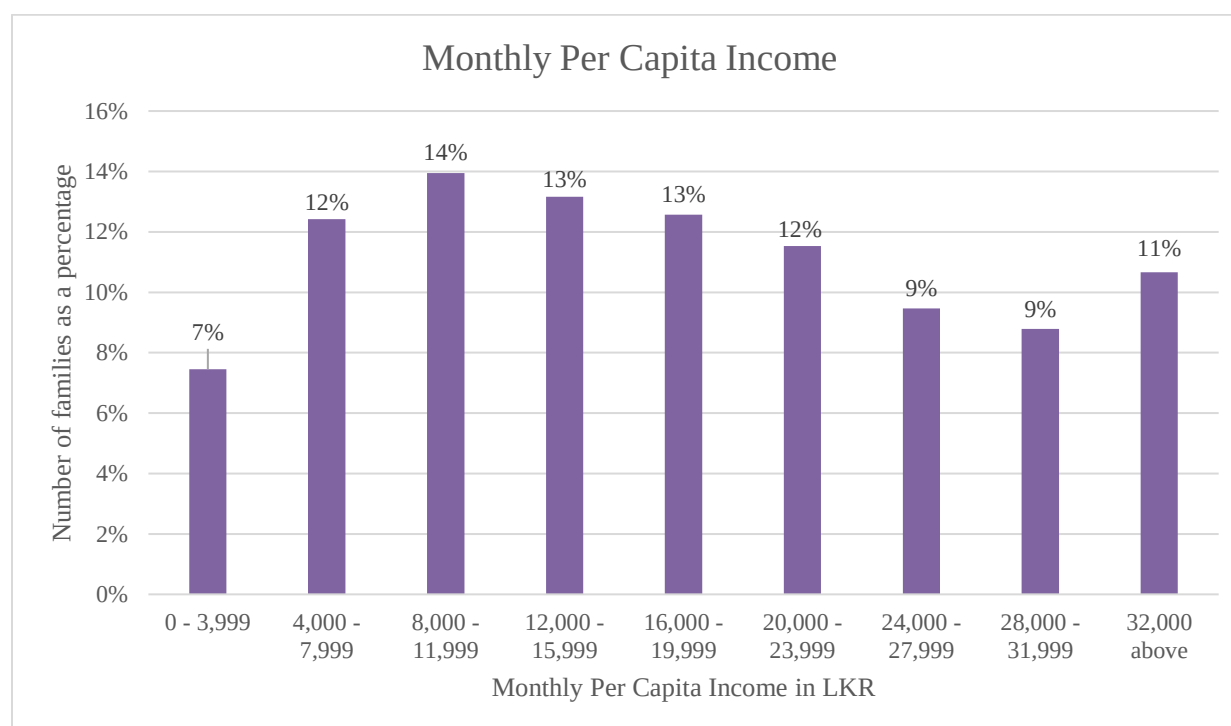


Figure 4.7. Household income as monthly per capita (LKR) (data from Resource Profile, Kalpitiya, 2021)

The history of use of (U3) of the SSF subsystem in Kalpitiya shows transition among various fishing jobs (Table 4.6) As per the interviews conducted with the community members and state officials, it was identified historically Kalpitiya has been a major hub for SSF, primarily utilizing traditional non-motorized small vessels (oru, theppam, wallam) and beach seine. Additionally, in the past, fishing using explosives such as dynamite was common, which was later banned under the Fisheries and Aquatic Resource Act No. 2 of 1996. Later, with the introduction of motorized vessels, fishing practices expanded, increasing pressure on marine resources. Many fishers transitioned from traditional methods to modern practices, such as purse seine and ornamental fish collection, driven by market expansion (Table 4.6).

“My grandfather did small-scale fishing. My father did a diving job. My father used dynamite to catch fish and then dive and collect fish. Diving job is profitable one.” – A SSF, Kalpitiya

“In the past, I did all sorts of jobs. I used 15 different net types to catch different fish species. Then, from time to time, the renewal and repair of nets made it difficult to continue the job because of the high cost.

A huge amount of the income had to be spent on purchasing nets. This high cost made me shift to the diving job. Equipment used for diving jobs does not damage more frequently compared to fishing nets.

Fishing net normally damaged within 6 months or one year.”- A diver, Uchchimunei

Location-wise (U4), the SSF users are dispersed along the Kalpitiya peninsula, utilizing both lagoon and sea ecosystems (Table 4.6). Marine fishers on the mainland typically reside near coastal landing sites, while lagoon fishers reside closer to the lagoon. In Uchchimunei, fishers (SSF to purse seine fishers and lagoon fishers) are concentrated in the same area of the peninsula.

Leadership (U5) within the fishing communities is often held by the Presidents and Secretariats of the Fisher Association (FA), Tourist Boat Association, and the Catholic Church. Community leaders are influential in fisheries management and decision-making. The Church plays a significant role in resolving conflicts and advocating fishers’ day-to-day lives. These figures form village-level agreements and negotiate fishing practices, share information, and facilitate communication with government authorities (Table 4.6).

The norms (U6) followed by the fisher community were not clearly highlighted in the research interviews. Some respondents mentioned that in the past, there were periods of resource recovery without continuous resource extraction. In contrast, nowadays, modern gears and motorized boats have enabled continuous resource extraction. However, Sundays and religious holidays are typically considered non-fishing days by the Catholic fisher community (Table 4.6). Some respondents perceived that one day per week was insufficient to regenerate the resource system. In addition, the social capital (U6) of these communities was shaped by a cohesive social structure at the village level influenced by the Church (Table 4.6). The majority of the fisher community fostered social relationships during daily fishing activities at landing sites, such as working together to mend fishing nets. The majority of the Uchchimunei community was related by blood since their generations grew over time. However, certain disagreements existed among different scales of fishers over resource extraction, and marine and lagoon spatial use. Despite close social ties, these conflicts led to inconsistencies in users’ involvement in sustainable fisheries management and conservation.

Through the interviews, fishers in Kalpitiya demonstrated extensive knowledge of the SES (U7) in seasonal patterns, fish availability and migration patterns, and underwater ecosystem functioning. While they showed an understanding of the environmental impacts of unfavorable fisheries activities, many

prioritize maximizing their harvests over sustainable fishing practices. Although the SES knowledge is integral to their livelihoods, it is often used to intensify resource extraction (Table 4.6).

Kalpitiya fisher communities demonstrated a huge dependence on marine resources (U8), fishing being a traditional livelihood passed down through generations (Table 4.6). Many young men begin fishing at an early age, viewing it as their only viable employment option. This is still a very prominent situation, particularly in islands with limited access to secondary education. Many fishers expressed that they had no additional skills other than fishing. Further, many respondents perceived fishing as a job with high earnings and full freedom. Not any other jobs on the landside were perceived as a high-income generation when compared to fishing due to adverse economic conditions (e.g., higher fuel prices, labor costs, lower market prices).

“Since I was born in this area and my father was a fisher, I went fishing. I like fishing, and my village is also a fishing village. We have only that industry in our area, and we know no other job” - A fisherman,

Kudawa

The use of technology (U9) by Kalpitiya fishermen is mostly limited to boats and gear, GPS devices for navigating the sea and locating fish flocks, and fishing nets. Additionally, mobile applications provided by mobile service providers for weather forecasts were also used by many fishermen (Table 4.6).

Table 4.6. User characteristics of SSF, Kalpitiya

First-tier variable	Second-tier variables		Third-tier variables	Characteristics
Users (U)	U1	Number of users		Uncertain
	U2	Socioeconomic attributes of users	Gender	
			Race	Muslim, Sinhala, Tamil, Burgher,
			Population and density	Increasing over time
			Livelihoods	Highest self-employed
			Household income	Majority below LKR 32,000

			Education levels	Low formal education
	U3	History of use	The transition among fishing jobs	SSF to purse seine fishing, fish collectors
	U4	Location	Dispersal of different fishing jobs	Marine fishers, lagoon fishers
			Proximity to landing sites and markets	
			Migration	Uchchimunei purse seine fishers moved to landside
	U5	Leadership/entrepreneurship	Institutions Community members	Role of authorities of village level FAs, active members, and the Church is significant
	U6	Norms/social capital	Social connectivity	Highly connected communities
			Norms	Influenced by religion
			Conflicts	Prevalence within and among communities
	U7	Knowledge of SES/mental models		Highly knowledgeable about seasons, fish migration, weather, etc.
	U8	Dependence on resource	Livelihoods	Fisheries have been a predominant livelihood from the past
			Skills	Most are skilled only at fishing from a younger age
	U9	Technology used		Boats, gears, GPS, mobile phone applications

4.2.3.2. Users of BRMS, Kalpitiya

Historically, the reef area was utilized by a number of fishing jobs (U1) prior to the MPA implementation. With the establishment of the MPA, fishers shifted to other marine spaces. The exact number of fishers affected by the BRMS remains unclear. However, the impact of exclusion was neutral as they got used to other spaces over time. As per the case study responses, nowadays, the BRMS adjacent reef area is mainly utilized for tourism activities, with 118 tourist boats engaged in whale and dolphin watching and ecotourism activities (Table 4.7).

The socioeconomic attributes (U2) of these resource users were primarily impacted by the BRMS, which is visible in income levels and access to infrastructure (Table 4.7). The mainland fisher communities have benefitted significantly from the BRMS due to tourism development. November to April period is considered the peak for tourism activities given the favorable weather conditions (dry weather, wind patterns, ocean currents) enabling the mainland community to earn additional income through tourist boats, recreational sports, and providing accommodation, food, and transport facilities to both domestic and foreign tourists. However, island communities such as Uchchimunei have minimal economic gains from BRMS-related tourism development. Further, access to infrastructure such as proper road systems and electricity, permanent housing, and access to markets is minimal in island communities.

“I think the roads were quite built and electricity too due to tourism. Tourism from bar reef sightseeing is popular, so it’s a good thing. It’s an alternative income. Around 10-25 boats from this area go daily with tourists to that area and dolphin watching. Because of tourism some infrastructure developed in the village. Electricity was given to Keeramundal, where there are a couple of hotels, too.” – A tourist boat operator, Kudawa

“This area does not benefit from tourism. Even if there are a couple of hotels in Dutchbay and Keeramundal, no proper road is built in that area. Kalpitiya and the landside area are benefitted from tourism.” – A fisherman, Uchchimunei

Historical use (U3) of the BRMS includes its serving as a vital fishing ground for SSF and other fishing activities (Table 4.7). However, the reef was reported to be adversely impacted by the fishing nets entangled in the corals. Some respondents mentioned that fishers used to pull or break corals to free nets. Furthermore, purse seine fishers and divers were believed to have used their oxygen tanks to break and detangle their nets. Some divers who volunteered in reef cleaning activities mentioned that they had

removed ghost nets from the reef. Some tourist boat operators also reported instances where they had warned fishers who extracted corals and fished in the reef.

“Before the civil war, all of us did dynamite fishing. Then we shifted to fishing net jobs. We used to go to coral area and fish.” – A fisherman, Uchchimunei

The offshore location (U4) of the BRMS is in close proximity to fisher islands such as Uchchimunei and Baththalangunduwa (Table 4.7). Islands fishing jobs mainly involve purse seine fishing (medium-large scale), SSF (coastal and lagoon), and beach seine. Some respondents discussed how the intensity of island fishing had impacted the overall health of the reef area, depleting the economic value for tourism, and thus, BRMS implementation is beneficial to protect the ecosystem for long-term sustainability. However, the majority of the island fishers expressed their fishing activities had not been significantly impacted by the BRMS, as other fishing grounds are available for them to continue extracting at a satisfactory level.

The leadership of BRMS users (U5) primarily involved tourist boat operators and FA authorities, particularly in tourism-dominant villages such as Kandakuliya and Kudawa (Table 4.7). Additionally, a considerable portion of villagers in these areas have become entrepreneurs (U5) engaging in recreational activities and hospitality providers (Table 4.7). Further, many of these leaders and tourism stakeholders had played an active role in initial discussions and establishment of the BRMS, collaborating with officials of government, donor agencies and NGOs. Among the case study respondents pool, tourism operators and leaders showcased a higher level of knowledge encompassing traditional fishing, ecosystem functions, biodiversity, and sustainable use of marine resources, often using technical terminology. Hence, the active involvement of these members in both advocating for community engagement and supporting has been pivotal in BRMS implementation.

In terms of social capital (U6) in BRMS, FAs have been the focal point in engaging communities in MPA discussions and implementation. However, though fisher communities are closely knitted, as we discussed in section 4.2.3.1 (U6), the level of social connectivity among villages has not been sufficient to foster conservation awareness. However, their community networks have facilitated the dissemination of information about new rules and regulations allowing fishers to adjust their fishing practices in accordance with the MPA legal framework (Table 4.7).

The majority of the respondents perceived a considerable knowledge of SES, particularly the ecological benefits provided by the MPA such as replenishing stock levels. Many respondents claimed this positive understanding has led to compliance with MPA regulations. Further, some stated that, although they were familiar with the ecosystem, the MPA establishment enhanced their awareness of the reef's ecological significance (Table 4.7).

Fishers nowadays no longer demonstrate a strong dependence (U8) on the MPA. Even those who had previously been reliant on this reef area expressed that they had not been significantly influenced by the MPA restrictions. However, the tourism industry was observed as the primary user group dependent on the benefits associated with the MPA (Table 4.7).

Regarding technology (U9) usage in MPA, the DWC, the responsible BRMS authority, was not reported to utilize any specialized technological devices to monitor or maintain routine BRMS tasks (Table 4.7). However, the use of technology in patrolling and monitoring services by the SL Navy was not thoroughly researched in this case study.

Table 4.7. User characteristics of BRMS, Kalpitiya

First-tier variable	Second-tier variables		Third-tier variables	Characteristics
Users (U)	U1	Number of users		Fishers -zero to minimal Tourist boat operators - 118
	U2	Socioeconomic attributes of users	Alternative income sources	Landside villages benefit from tourism
			Income levels	Income changes as season's effect on tourism, disparity among villages
			Access to infrastructure	Disparity among villages
	U3	History of use	Extractive activities	Fishing, coral extracting
			Unintentional impacts by humans	Ghost nets
	U4	Location	Proximity to MPA	Islands are closer to the MPA

	U5	Leadership/entrepreneurship	Conservation	The influence of tourist boat operators is significant
			Small businesses	Recreational and hospitality
	U6	Norms/social capital	Social connectivity	Higher connectivity to disseminate information
	U7	Knowledge of SES/mental models		Positive understanding of MPA benefits
	U8	Dependence on resource	Livelihoods	The tourism industry is primarily dependent on the MPA
	U9	Technology used		Not identified

4.2.4. Interactions (I)

Interactions of the SES framework refer to the actions between various components of the systems -RS, RU, U, and GS. These interactions include harvesting levels by users, the information sharing process, the deliberation process, conflicts, investments, and lobbying activities. This subsection describes the characteristics of interactions in the social-ecological system of SSF and BRMS by their second-tier and third-tier variables highlighting intrinsic characteristics (Table 4.8). Harvesting levels (I1) in Kalpitiya fisheries were observed to be varied across different fishing scales (n=40). SSF harvest was typically less than 100 kg, while large-scale harvest exceeded 15,000 kg per day. Techniques used in fishing also influenced harvest levels across scales (n=40). Purse seine fishing was mostly highlighted for its over-extractive activities, contributing to considerable discrepancies in harvest levels, which in turn affected the price of SSF and diminished their negotiation power at markets. In addition, fishing techniques employed significantly impacted extraction rates. Purse seine fishers utilized oxygen tanks to collect fish stock underwater, while export-oriented divers were reported to use high beam lights to catch reef species like parrot fish at nighttime. However, nighttime government regulations have prohibited night diving due to concerns over stock depletion of these highly demanded target species. Market demands (n=27) further exacerbated these challenges by offering higher prices for export-oriented fishing. Additionally, season

effects influenced harvest levels across different fishing scales (n=23), making fisher adjust their gear types and locations based on the species availability (Table 4.8).

In terms of information sharing among users (I2), organizations played a central role in facilitating information dissemination within communities (Table 4.8.). Key organizations such as FAs, Church, DFAR and Navy were considered closely connected with fisher communities in this regard. However, most strong and effective form of information sharing was identified as informal connectivity among fisher communities.

In deliberation processes (I3) of BRMS, twenty respondents (n=20) shared their experience about the deficiency in existing communication channels, highlighting a disconnect between communities, FAs and authorities (Table 4.8). Factors such as the timing of fishing activities, remote locations, inadequate infrastructure, and limited number of staff contributed to the disconnection of remote fisher communities from the deliberation processes. Additionally, the lack of formal education and limited knowledge of organizational services further discouraged the active engagement of fishers, while the majority of the fishers relied upon FA Presidents to represent them at discussions. However, the deliberation processes had also been weakened as fisher participation in regular FA meetings had been inadequate due to reasons such as the nature of the job, lack of interest, lack of benefit from FAs, and ineffective functioning of FAs after the COVID-19 outbreak. Authorities of FAs, active members of the community, and fish mongers excelled more power in power dynamics of deliberation while political influence also significantly impacted fisheries decision-making (n=3). Apart from that, it was revealed that certain communities (islands) had often been excluded from the decision-making (n=23). Even though they showed dissatisfaction with being excluded, many fishers were dedicated to their fishing activities with a lack of interest in these community affairs. In contrast, volunteers associated with the tourism industry and FA authorization had been prominent in deliberations driven by their interest in alternative livelihoods.

Conflicts (I4) were prevalent among villages, across different fishing scales, within communities, and between tourism (n=24) (Table 4.8). Some villages had conflicts over resource units. For example, the majority of Kandakuliya fishers primarily targeted sardinella and had conflicts with the adjacent villages (Kudawa) regarding harvesting sardinella, where informal agreements mutually agreed upon by both communities were formed. Similarly, in Uchchimunei, disagreements could be seen within its community between SSF and purse seine fishers over resource extraction. Additionally, conflicts occurred between fishers and hoteliers over landing sites in both Kalpitiya's mainland and island villages.

“We can see a huge conflict coming in the future. This is because while fishers use their coast freely for their landing purpose, external persons who are involved in tourism try to repel fishers. They find fishing

makes their view unpleasant and a threat to their security. Now, we face problems like getting land ownership legally or leaving lands. That has affected the fishers' freedom.” – A fisherman cum tourist boat owner, Kudawa

There were no reported investments (I5) provided by the state supporting fishers at present (Table 4.8). However, NGOs such as World Vision have assisted women and children through various programs to improve living standards. Particularly, NGOs and individual donors, along with the Catholic Church, had provided less developed island communities (such as Uchchimunei) with sanitary facilities, solar panels, vegetable plots, and animal farms for households. Further, some women had received theppam and gear from these NGO projects to facilitate their SSF activities in the lagoon.

Kalpitiya fisher communities' involvement in lobbying activities (I6), such as formulating and amending rules, regulations, and policies, was limited (Table 4.8). Thirteen respondents (n=13) stated the governance of both fisheries and conservation has been a top-down system. Further, the feedback from fisher communities was also less regarded at decision-making levels. However, there have been instances where fishers have united through FAs to challenge certain government decisions. Political influence has been influential in policy changes, where it has been advantageous to some fisher jobs while others have been disadvantaged.

Table 4.8. Interactions of SSF and BRMS, Kalpitiya

First-tier variable	Second-tier variables		Third-tier variables	Characteristics
Interactions	I1	Harvesting levels of diverse users	Intensity	Harvest levels and intensity depends on job type
			Techniques	Usage of different gears and techniques by different job types
			Markets	Impact on high demand species extraction
			Seasonality	Harvest levels vary
	I2		Organizations	FAs, DFAR, Navy, Church

		Information sharing among users	Civil	Community connections
	I3	Deliberation processes	Communication channels	Inefficient communication channels
			Power dynamics	FAs' and political influence
			Exclusion/Inclusion	Exclusion of majority of fishers, fisher perceptions, active roles
	I4	Conflicts among users	Resource unit wise	Among villages, within communities
			Scale/ industry wise	SSF and others, and tourism
	I5	Investment activities	State	Not prominent
			Donors	NGOs, Church, and individuals support was prominent
	I6	Lobbying activities		Less influence of fishers

4.3. Characteristics and dynamics of SSF, MPAs, and their interactions impacting vulnerability and viability of SSF

The social-ecological systems framework enabled a comprehensive analysis of the characteristics of the social and natural subsystem of SSF and BRMS in Kalpitiya. The analysis was based on data collected from interviews, focused group discussions, and observations and encompasses four major components: resource system (RS), resource units (RU), users (U), and interactions among these elements (I). Additionally, it examined second-tier and third-tier variables to provide a more nuanced understanding of these subsystems.

Resource system dynamics

SSF in Kalpitiya is characterized by low-income and highly labour-intensive, low-tech gears and utilizes non-motorized boats or low horsepower engine boats. However, the traditional SSF has been challenged by the diversification of fishing jobs that employ more intensive fishing practices. This has led to higher extraction levels exacerbating the vulnerability of SSF and adversely impacting the marine ecosystem. While SSF is limited to nearshore fishing, unclear resource system boundaries impact exacerbating SSF vulnerability to increased conflicts. Further, the limited resource system (e.g. nearshore and lagoon water bodies) decreases the resilience of SSF in the face of seasonal fluctuations, natural disasters, and conservation efforts. Additionally, the limited ecosystem is insufficient to provide for the increasing number of fishers making SSF more vulnerable in fish harvest levels and income generation. Human-constructed facilities, such as markets and ice-boat service in Kalpitiya, facilitate post-harvest practices. In contrast, these developments gradually led to the decay of traditional dried fish production in Kalpitiya. Even though the ice facility and manufacturing facility have considerably reduced post-harvest losses, the reliance on third-party facility providers has been challenging in price negotiations at vending. Market expansions such as export-oriented seafood manufacturing have resulted in over-exploitation of marine resources, exacerbating SSF vulnerabilities while on the other hand, providing income sources. Fishers' knowledge acquired through lived experiences in predicting resource system dynamics plays a crucial role in enhancing the viability of SSF. It increases their resilience and adaptability to seasonal effects, and enabling them to adapt to seasonal changes by equipping proper fishing gears and being financially prepared. Geographically, island SSF communities are more vulnerable due to limited market access, inadequate infrastructure, and poor socio-economic conditions compared to mainland communities. Furthermore, geographical location is a factor in determining vulnerability or viability, particularly in terms of protection from natural disasters such as cyclones and tsunamis from past incidents.

The MPA resource system, once rich in biological, physical features, and aesthetic value and known for its higher productivity, is now in declining rates due to intensive fishing practices. Thus, effective enforcement of MPA size and boundary demarcation is critical for achieving MPA goals that support replenishing deteriorated marine life and enhance SSF viability. The existing human-constructed facilities for BRMS have a minimal impact on SSF vulnerability or viability, despite the research facilities that supplement industrial production. The predictable dynamics of BRMS can be used in the decision-making process that facilitates more engaging and effective MPA governance concerning seasonal fish production and seasonal species availability. The coral reef system serves as a vital factor for fish breeding. However, the offshore location of BRMS has been a challenge for regular monitoring, and law enforcement is making the reef area vulnerable without proper management.

Both SSF and BRMS resource systems face challenges related to productivity levels, which have been adversely affected by stock depletion due to factors such as natural disasters and development projects like the Norochcholei power plant. These factors have further disrupted the ecosystem equilibrium, impacting SSF's vulnerability.

Resource unit dynamics

The mobility patterns of resource units, particularly seasonal fish migration and spatial distribution, significantly impact SSF vulnerability. Accordingly, fishers are urged to change their gears and fishing nets to align with the seasonal availability of species. These changes further exacerbate SSF vulnerability due to increasing competition from other fishing jobs over resources. As discussed in the resource system (section 4.2.1), SSF vulnerabilities have been exacerbated by the pressure from overfishing and constant extraction by other jobs. These factors have led to a negative impact on the growth and replacement rates of the SSF resource units, resulting in vulnerabilities in low harvest and income levels. Interaction among resource units showed mixed effects on SSF vulnerability and viability. Overlapping of fishing grounds due to biological interactions under water such as food webs, excels competition among fisher jobs for extraction. In contrast, tourism and fishing in the sea have been complementary to each other to mutually benefit from sharing information, increasing fishers' viability. Thus, the interactions between the resource units result in either exacerbating SSF vulnerability or viability. In terms of economic value, SSF has been disadvantaged from lower market prices, and price fluctuations. As SSF targets domestic markets with smaller species, the prices often are considerably lower compared to high-demand species in large-scale and export-oriented fishing. Price fluctuations are further a result of the higher production levels of other fishing scales. The income disparity and price volatility often exacerbate the vulnerabilities of SSF. Further, diversification of livelihoods through tourism seemingly increases the economic resilience of certain communities. However, the disparity in the distribution of tourism benefits among villages makes remote island communities less disadvantaged from the economic gain from these alternative livelihoods.

On the other hand, BRMS positively influences resource unit mobility through the spillover effect to increase fish availability in areas beyond the reef, which can enhance SSF viability. However, the spillover effect takes much longer periods to significantly benefit the fisher communities. As discussed, overfishing and natural disasters adversely affect the growth rates of BRMS, making the ecosystem more vulnerable. The longer periods of spillover effect are impacted by these lower growth and replacement rates of resource units. Moreover, the ecological symbiotic functions within the BRMS contribute to the

balanced and healthy ecosystem maintenance. BRMS and tourism development plans play a key role in promoting the economic value of both social and natural systems. BRMS has a huge impact on creating market opportunities and diversification of livelihoods in Kalpitiya. However, as discussed previously, the disparity in benefit distribution among villages persists. Further, the impacts of tourism on the societal norms of fishing communities raise concerns about the overall effects on the community.

In summary, the economic value of an MPA resource unit has both vulnerable and viable effects on communities. Further, distinct ecological and biological characteristics (abiotic and biotic) of BRMS aid in maintaining ecosystem balance and preserving marine life, impacting SSF viability. However, both the SSF resource system and BRMS reflect the declining number of resource units, which in turn exacerbates SSF vulnerability. The depletion of resource units raises concerns about prevailing management practices.

User dynamics

The uncertain and fluctuating number of SSF fishers who shift accordingly with seasonal changes among various jobs increases the complexities of resource usage and governing resources. However, this shifting enhances the resilience and adaptive capacities of fishers to navigate through seasonal vulnerabilities. In addition, certain socio-economic attributes such as increasing population, and low formal education further increase the vulnerabilities faced by fishers. Increasing population leads to overexploitation of resources making the overall fisheries industry vulnerable, with a particularly severe impact on SSF. Additionally, the heavy reliance of fishers on fishing as a primary livelihood due to a lack of diversified skills and low levels of education are other factors that limit SSF's capacities to be resilient. Moreover, the leaderships within the fisher community are mostly limited to a certain segment while not effectively representing most of the fisher community. The inadequate representation further influences the vulnerability of the SSF community, whereas the Catholic church has been a viable factor for underprivileged, under-represented communities to navigate through conflicts and ensure compliance of fishers in conservation.

Dynamics of interactions

The techniques, intensities, and harvest levels of medium to large-scale fishing, export-oriented fishing, and seasonality are impacting the vulnerability of SSF in terms of harvest levels. Thus, conflicts often arise over resources between and within communities making operationalization of governance difficult. Additionally, poor communication channels, power dynamics, and the exclusion of certain communities

further marginalize the SSF communities. Moreover, SSFs are often limited in access to investments, particularly as there is less state support. Even if the role of NGOs and individual donors is admired, SSF cannot rely on their consistent support over a longer period. Additionally, the SSF influence in lobbying activities is reported to be less where the voices of fishers are often unheard in governance making them more vulnerable.

The characterization of SSF, MPA and Interactions reflects critical factors contributing to the exacerbation of vulnerabilities and undermining of SSF viability.

4.4. Conclusions and Chapter Summary

The systematic characterization of SSF and BRMS provided a comprehensive understanding of the SES under consideration to identify the drivers of vulnerability and viability of SSF under resource system, resource unit, users of both SSF and MPA, and their interactions. Section 4.2.1 highlighted characteristics of a resource system (RS) covering the sector, system boundaries, size, availability of human-constructed facilities, productivity, equilibrium, predictability of system dynamics, storage characteristics, and location under both the SSF social system and MPA ecological system. Next, section 4.2.2 discussed the characteristics of resource units (RU) such as resource unit mobility, growth and replacement rate, interaction among resource units, economic value, number of units, distinctive characteristics, and spatial and temporal distribution of SSF and MPA. Section 4.2.3 expanded on the user (u) characteristics of these two sub-systems, such as the number of users, socioeconomic attributes of users, history of use, location, leadership/entrepreneurship, norms/social capital, knowledge of SES, and dependence on resources and technology used. Section 4.2.4 characterized the interactions prevailing in the SES of SSF and MPA under harvesting levels of diverse users, information sharing among users, deliberation processes, conflicts among users, investment activities, and lobbying activities. Each of the above sections expanded on second-tier variables derived from the SES framework, leading to the identification of third-tier variables. Finally, section 4.3 discussed how these characteristics impact either exacerbate/ undermine the vulnerability of SSF or facilitating viability. These findings will be utilized to propose appropriate governance arrangements in the final chapter of this research paper. Additionally, the governance system will be comprehensively analyzed in Chapter 5 under MPA governance utilizing an interactive governance framework.

Chapter 5

Current MPA governance in BRMS, Kalpitiya

5.1. Introduction

The previous chapter addressed a part of the objective 1 by examining the social-ecological system of SSF and MPA through the lens of the SES framework, building a comprehensive understanding of the systems' intrinsic characteristics. This chapter is intended to expand on objective one by providing an in-depth analysis of the current governance arrangements while exploring fishers' perspectives on future governance structures. Hence, this chapter addresses the second part of objective 1 to develop a holistic understanding of existing governance frameworks and stakeholder views evaluating them.

Objective

- 1) To characterize the MPAs, SSF, and their interactions

Research Questions:

- What are the current practices of MPA governance in BRMS, Kalpitiya?
- How has the governance of the MPA impacted its local SSF industry?

The empirical knowledge based on the fisher's lived experiences, perspectives, and how they have been impacted by the current MPA governance arrangements are critically analyzed using an interactive governance framework. First, 5.2 The section critically examines the current BRMS governance under the realm of governance (roles of state, market, and civil society) and then by governance order (first, second, and meta). Next, section 5.3 discusses the future governance arrangements as perceived by the case study participants. Finally, the chapter summarizes key findings and implications regarding the governance of the case study. The knowledge generated from this chapter contributes to rethinking the governance of marine protected areas in the context of facilitating the viability of small-scale fishers.

5.2. Assessment of Current BRMS Governance

Governance involves the interaction of various actors encompassing governmental, and non-governmental across various levels. In the context of MPAs, governance expands to formal and informal arrangements established by various stakeholders. Therefore, to analyze a governance system, several focal areas are recommended, including the governance realms of state, markets, civil society, and their combinations (Jentoft, 2007; Bavinck et al., 2013). Understanding each of these component's role and influence is instrumental in assessing the current MPA governance to identify areas of improvement.

5.2.1. Assessment of Current Governance by Realm of Governance

5.2.1.1. Role and influence of State

States or governments still play the central role in most of the countries as the governing body. This holds truth for Sri Lanka as a country situated in the global south. In this case study, the Government of Sri Lanka and its agencies are the major governing bodies of the BRMS in creating and enforcing laws and policies. This subsection specifically examines the most highlighted state institutes involved in BRMS governance as identified by the interviews conducted in the study (Table 5.1).

Table 5.1. The main governing bodies involved in BRMS

Governing Body	No of respondents
Sri Lanka Navy	21
Department of Wildlife Conservation (DWC)	18
National Aquatic Resources Research and Development Agency (NARA)	18
Tourism Development Authority (SLTDA)	8
Department of Fisheries and Aquatic Resources (DFAR)	6
NGOs	4
Department of Coast Conservation and Coastal Resource Management (CCD)	3
Divisional Secretariat (DS) Office Kalpitiya	3
Sri Lanka Coast Guard (SLCG)	1

As discussed in the methods (Chapter 3), the data on the governing bodies involved in BRMS was collected through 51 semi-structured interviews with participants, including fishers, community members, and officials. According to the respondents' data in Table 5.1, 21 respondents (n=21) reported that the Sri Lanka Navy as the topmost state governing body that is involved in BRMS governance, while the Department of Wildlife Conservation (DWC) and National Aquatic Resources Research and Development Agency (NARA) in the second place with 18 respondents each (n=18). In addition to these state institutes, Sri Lanka Tourism Development Authority (SLTDA), Department of Fisheries and Aquatic Resources (DFAR), Department of Coast Conservation and Coastal Resource Management (CCD), Divisional Secretariat (DS) Office Kalpitiya and Sri Lanka Coast Guard (SLCG) were reported to be involved in the BRMS governance according to 8, 6, 3, 3, and 1 respondents respectively (Table 5.1). Four respondents (n=4) reported that NGOs are involved in BRMS governance (Table 5.1). The role of NGOs in the case study location will be discussed in the next section.

As depicted in the above table (Table 5.1), the majority of the respondents expressed SL Navy as the first governing body involved in BRMS management than the DWC, while the DWC is the major institute for MPA governance officially. In Kalpitiya where a Naval base is located, SL Navy's role in monitoring the sea is highly prominent. In addition to DWC, the SL Navy also holds the power to monitor the marine environment along the coastal belt of Kalpitiya. SL Navy- Naval Base, Kalpitiya performs marine duties related to BRMS, including monitoring illegal fishing, checking the licenses of fishing boats and tourist boats, and monitoring BRMS. The Navy has the legal power to arrest wrongdoers and take their equipment and boats under custody. DWC and SL Navy jointly monitor BRMS by patrolling daily along the coastal belt. Additionally, the Navy contributed to BRMS implementation by providing their boats, equipment, tools, technology and labor, marine expertise, and ongoing monitoring. Further, respondents revealed that they were very often in contact with the Navy and that the Navy officers disseminated essential information regarding severe weather conditions before fishers sailed to the sea and assisted them when they were in need in the sea.

Some of the respondents revealed that they were aware that DWC is the major governing body of BRMS and the active engagement of DWC, while some were aware that DWC is the major governing body, though not very clear about the institute's active role in BRMS governance. At present, the Department of Wildlife Conservation (DWC) is the responsible state agency for protecting flora and fauna while maintaining national parks and nature reserves in Sri Lanka. DWC performs both landside and marine

duties adhering to the Act of Fauna and Flora Protection Ordinance (FFPO) of 1993 and its subsequent amendments. While the director of General of DWC has the power of the FFPO, Wildlife Ranger has the legal power of the FFPO 1993 at an operational level. However, park wardens are not appointed for sanctuaries; instead, the Assistant Director of the DWC, Puttalam district, directly manages BRMS with the help of a wildlife ranger officer located in the Kudawa DWC unit.

In terms of BRMS, DWC is responsible and not limited to the following duties that come under the above Act.

- Coral replanting
- Monitoring of the BRMS
- Tourism management by issuing tickets for tourist boats
- Issuing and renewal of tourist boat license- (118 licensed tourist boats)
- Removal of invasive species
- Law enforcement and legal activities with regard to BRMS
- Awareness programs and capacity building of the community, and tourist boat operators
- Carrying out and assisting NGO projects
- Assisting research purpose

Moreover, DWC has established a range unit at Kudawa with a Kiosk to facilitate tourist boat operations and issue tickets for both domestic and foreign tourists. This unit further acts as a small marine museum to attract and educate tourists.



Figure 5.1. Exhibits at maritime museum run by DWC, Kudawa (captured by Nilushika Gamage, 2023)

Despite the role of the Navy and DWC, respondents identified NARA's role as significant as DWC in BRMS management. NARA is the principal National Institute charged with the responsibility of carrying out and coordinating research, development and management activities about Aquatic Resources in Sri Lanka. The institute promotes and conducts research activities directed towards the identification, assessment, management, conservation, and development of aquatic resources. NARA Regional Research Centre at Kalpitiya involves research, capacity building, and awareness programs in the Kalpitiya DS.

The respondents revealed that NARA was the major state institute that engaged in research regarding BRMS, and their past efforts were recognized in terms of making fisher communities aware of the importance of marine life in Kalpitiya. According to National Aquatic Resources Research and Development Agency (NARA) (n.d.), its duties involve:

- Improvement and development of fishing craft, fishing gear and equipment, and fishing methods
- The social and economic aspects of the fishing industry, including the welfare of fishermen and their dependents
- The processing, preservation, and marketing of fish and aquatic products
- The development, management, and conservation of aquatic resources in inland waters, coastal wetlands, and off-shore areas
- Provide advisory and consultancy services on scientific, technological, and legal matters relating to the exploitation, management, conservation, and development of aquatic resources.
- Co-ordinate the activities of institutions engaged in the exploitation, planning, research, development, conservation, control and management of aquatic resources
- Collect, disseminate, and publish information and data useful for the management, conservation, and development of aquatic resources and the fishing industry in Sri Lanka.
- Provide training for the people required to carry out or assist in the work of the Agency
- Exercise, discharge, and perform all the powers, functions, and duties conferred or imposed on the Agency under the National Aquatic Resources Research and Development Agency Act No. 54 of 1981 as amended by Act No. 32 of 1996 (National Aquatic Resources Research and Development Agency (NARA) (n.d.)

Tourism Development Authority (SLTDA) was identified as the third state institute that is involved in BRMS management. However, SLTDA is not engaged in BRMS governance and monitoring. SLTDA works with the BRMS since it is attached to the Kalpitiya tourism development plan. SLTDA's engagement was prominent in the initial BRMS project implementation and for the ongoing tourism activities and developments. SLTDA is involved in the tourism industry in the region, contributing to alternative livelihoods such as safari boat operators, recreational divers, small-scale hoteliers, kite surfing venture operators, and vehicle renters. Several key duties of SLTDA involves:

- Development of islands for tourism in Kalpitiya
- Promotion of tourism and recreational activities in the region
- Licensing tourism businesses and service providers
- Providing operational guidelines for boating tourism, camping tourism, kitesurfing

- Providing sustainable operations guidelines to guesthouses, hotels, homestays, and restaurants

The Department of Fisheries and Aquatic Resources (DFAR) was identified as the fourth state institute in BRMS management. DFAR is responsible for the management and regulation of the marine fisheries sector in Sri Lanka. An operational unit of the DFAR is located at Fisheries Harbour, Kalpitiya. Additionally, fisheries inspectors are assigned to several operational divisions of the region to successfully carry out daily fisheries-related tasks. The role of DFAR is instrumental in promoting sustainable fishing practices, supporting the livelihoods of fishing communities, and conserving marine resources. According to the Department of Fisheries & Aquatic Resources (n.d.), at the operational level DFAR performs duties such as:

- Law enforcement such as enacting rules and regulations, patrolling coastal waters, inspecting fishing vessels and other related facilities, monitoring fisheries activities, regulating the inputs of the industry, enforcing legal limits and restrictions set out for the effective management of the fisheries sector
- Issuance of fishing licenses to boats, and gears
- Implemented various initiatives to modernize the fisheries sector to increase productivity
- Issuance of weather reports to the community, warnings, and announcements to the community
- Co-ordination of salvage of seafarers and seafarers in distress at sea
- Regulating quality control measures for fishery product exports and capacity building of the industry
- Conducts awareness campaigns and educational programs to promote compliance with fisheries regulations among fishers and local communities (Department of Fisheries & Aquatic Resources (DFAR, n.d.)

As mentioned above, DFAR plays an instrumental role in the Kalpitiya fisheries industry and is the first state institute that is in contact with fishers regularly, assisting fisher's activities, capacity building in fishing, and disseminating information to the fishing community. The Kalpitiya fisher community is closely attached to DFAR's Kalpitiya harbor unit, and its officers are the first point of contact regarding advocating and regulating fishing activities. Even though DFAR does not perform direct BRMS management, it holds the power to regulate destructive fishing practices and illegal fishing through fines and civil arrests. Therefore, DFAR excels the power to control fishing activities in this area. Further, DFAR's initiatives in making fisher communities aware of marine life conservation are crucial to safeguard BRMS.



Legislation and Policies

BRMS was declared a marine sanctuary in 1992 and is the largest marine protected area, expanding over 30,670 ha. BRMS is administered in accordance with the Fauna and Flora Protection Ordinance (FFPO) of 1993 and its subsequent amendments, including Act No 07 of 2009, which gives power of the Act to the DWC acting as the principal legislation to manage protected areas. However, the initial purpose of creating this legislation is to protect terrestrial biodiversity and declare protected areas (Perera & De Vos, 2007). There are two types of MPAs- marine parks and marine sanctuaries in Sri Lanka (Table 5.2). In marine parks, all sorts of resource extraction are prohibited, assuring the highest protection, whereas in marine sanctuaries, non-extractive resource use and artisanal fisheries are permitted.

Table 5.2. Marine Sanctuaries and Parks in Sri Lanka (adopted from Perera & De Vos, 2007)

Name of the sanctuary/ park	Year of declaration	Area/Ha	Responsible agency	Governing legislation	Permitted activities	Prohibited activities	Major Habitat
Hikkaduwa National Park	1979	104	DWC	FFPO	Recreational activities	Fishing and extraction of other natural resources	Coral reef
Pigeon Island National Park	2003	471.4	DWC	FFPO	As above	As above	Coral reef
Bar Reef Marine Sanctuary	1992	30,670	DWC	FFPO	As above & artisanal fisheries	Commercial fishing and other resource extraction	Coral reef, sandstone reef
Rumassala Marine Sanctuary	2003	1707	DWC	FFPO	As above	As above	Coral reef
Great and Little Basses FMA	2001	Unclear	DFAR	FARA	Recreational activities, fishing with a permit	Fishing without a license from the DFAR	Rocky reef

Polhena FMA	2001	Unclear	DFAR	FARA	As above	As above	Coral reef
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Moreover, DFAR has the power to protect Sri Lanka's water bodies and adjacent land as 'fisheries management areas' under the Fisheries and Aquatic Resources Act No. 02 of 1996 (FARA) (Samarasinghe, 2019).

Prior to the current BRMS management plan in 2019, the Bar Reef and Kalpitiya ecosystem had been managed under the Special Area Management (SAM) plan from 2000 to 2005 under the coastal zone management plan of Sri Lanka. However, it was highlighted in the current BRMS management plan that proper implementation of SAM was not observed. Moreover, it stated that the recent construction of the Norochcholai (Lakvijaya) coal power plant was one major concern for BRMS's present management plan. Lakvijaya power plant, which is located at a distance of 15 km to the west of the reef, is said to release warm water, ash, and coal after operations.

Present bar reef management plan

The current management was a five-year plan implemented from 2019 to 2023 with a vision of;

“Bar Reef Marine Sanctuary serves the nation with a rich biodiversity and healthy ecosystems with optimal social wellbeing.”

The plan included the direct, impactful adjacent land areas such as the Kalpitiya divisional secretariat and the Gange Vadiya area of the Kala Oya estuary. The management plan had been designed following the Ecosystem Approach to Management (EAM) model suggested by Staples & Funge-Smith (2009). It comprised a thorough stakeholder analysis from the grassroots level to policymakers. The above model was employed to identify the appropriate management structure and key stakeholders who can assist the process of implementation of the management plan by DWC (Bar Reef Marine Sanctuary Management Plan 2019-2023). The management plan involved four long-term goals, which were divided into objectives and strategic actions for operationalizing the plan as follows.

- Operational goal - to operationalize an enabling BRMS management environment to effectively serve ecological and human needs

- Environment goal - to ensure a thriving ecosystem rich in biodiversity with long-term integrity and resilience
- Socioeconomic goal - to safeguard optimum living conditions for the community and satisfaction from services derived by BRMS to all
- Governance goal - to warrant an enabling governance framework strengthened to manage BRMS and beyond with committed participation from stakeholder

Further, with preliminary consultations at the field with various stakeholders encompassing the grassroots level to the decision-making level, the above plan executed a threat analysis for BRMS. It was identified that illegal fishing gear and fishing emerged as the most important threat to the system. In addition to fishing, the other threats included climatic conditions such as bleaching, water/solid debris pollution, tourism activities, invasive species, and certain governance issues (transboundary fishing and inactive policy implementation at the operational level, etc.)

While FFPO 1993 and its subsequent amendments till 2009 guided the BRMS management plan as a protected area, the following policies and legislations were also considered in the five-year Bar Reef Marine Management Plan from 2019-2023 (Table 5.3). Since BRMS is located in the Kala Oya basin - right outside the mouth of the Kala Oya River and adjacent to the Wilpattu protected area on the landside, the current management plan has integrated the relevant landscape and seascape policies, legislations, and management plans that govern the Kala Oya basin.

Table 5.3. Summary of policies, legislations, and conventions related to BRMS management plan (Adopted from Bar Reef Marine Sanctuary Management Plan 2019-2023).

Name	Year	Major Area
Policies		
National Wildlife Policy	2000	Wildlife
National Forest Policy	1995	Forest resources
National Physical Planning Policy and Plan	2007	Land resources
National Environment Policy	2003	Environment
National Policy on Solid Waste Management	2003	Solid waste management
National Air Quality Management Policy	2000	Air pollution

National Watershed Management Policy	2004	Water pollution
National Policy on Wetlands	2006	Wetlands
National Fisheries Policy	2006	Fisheries resources
National Soil and Mineral Policy	2007	Minerals and sand
National Sand Policy	2005	Sand use
National Policy on Elephant Conservation	2006	Elephant management
Alien Invasive Species Policy	2017	Invasive species
Legislations and regulations		
National Environment Act No 47 of 1980	1980	Environment
Irrigation Ordinance No 32 of 1946 and Act No 1 of 1951	1951	Water resources
Fauna and Flora Protection Ordinance (Amended) Act No 32 of 2009	1937	Wildlife and protected areas
Plant Protection Act No 35 of 1999	1999	Plant protection
National Aquatic and Development Agency Act No 54 of 1981	1981	Aquatic resources
Fisheries and Aquatic Resources Act No 2 of 1996	1996	Fisheries and aquatic resources
Control of Pesticide Act No 33 of 1980	1980	Environmental protection
Felling of Trees Control Act No 9 of 1951	1951	Environment
Water Hyacinth Ordinance No 9 1909	1909	Aquatic resources
Mines and Minerals Act No. 33 of 1992	1992	Mineral extraction
Soil Conservation Act No. 25 of 1951 and No. 29 of 1953 and amended by Act No. 24 of 1996	1996	Soil
Irrigation Ordinance No. 32 of 1946, Act No.1 of 1951 and No. 48 of 1968, Law No. 37 of 1973	1973	Irrigation development
National Environment Act (NEA) No 47 of 1980 as amended by Act No 56 of 1988 and Act No 53 of 2000	2000	Environment
Land Acquisition Act No. 9 of 1950 and subsequent regulations (1596/12) in 2009	2009	Land acquisition
The Urban Development Authority Act No. 41 of 1978	1978	Urban area management

Urban Council (UC) Act No. 18 of 1987	1987	
The Antiquities Ordinance, No.9 of 1940 (now Act) and the subsequent amendments, particularly the Antiquities (Amendment) Act No. 24 of 1998	1998	Preservation of artefacts
Provincial Environmental Statue No 12 of 1990 of the North-western Province Forest Ordinance of 1907 and subsequent amendments	1907	Forest governance
Conventions		
Ramsar Convention	1971	Wetlands
Convention on Migratory Species	1979	Migratory species
International Plant Protection convention	1951	Plant protection
United Nations Framework Convention on Climate Change (UNFCCC 1992)	1993	Atmosphere
Kyoto Protocol (1997)	2002	Atmosphere
International Plant Protection Convention (1951)	1956	Biodiversity
Plant Protection Agreement for Asia and Pacific Region (1956)	1956	Biodiversity
Convention on the conservation of Migratory Species (CMS-1979)	1990	Biodiversity
Convention on Biological Diversity (CBD-1992)	1992	Biodiversity
United Nations Convention to Combat Desertification (UNCCD-1994)	1994	Land
Management Plans/Strategies and other Documents		
Wilpattu Protected Area Strategic Management Framework	2017	Department of Wildlife Conservation (2017)
Education, capacity development and monitoring in support of Bar Reef Marine Sanctuary (BRMS) Management	2015	National Aquatic Resources, Research and Development Agency (2015)
Report on the Systematic Surveying of Bar Reef Sanctuary 2017	2017	Department of Wildlife Conservation (2017)
Enhancing Biodiversity Conservation and Sustenance of Ecosystem Services in Environmentally Sensitive Areas (ESA project)	2017	Department of Wildlife Conservation (2017)

Gazette Notifications		
Gazette Extraordinary No. 1533/16 dated 25 January 2008) Environmental Protection License (EPL) regulations gazetted under NEA (Government)	2008	Pollution control
Wastewater Discharge Standards-Gazette Notification No. 1534/18 dated 01/02/2008	2008	
EIA regulations gazetted under NEA (Government Gazette Extraordinary No.772/72 dated 24 June 1993 and in several subsequent amendments)	1993	Sustainable development

Despite Key informants such as representative officials of the governing institutes (e.g., DWC, DFAR, CCD), it was observed that none of the interviewees from the fisher community mentioned the above policies and legislations. However, many respondents stated that they obeyed certain rules and regulations as they carried out their day-to-day fishing activities as being informed by the DWC, DFAR, Navy and fisher associations (FA). These rules and regulations are administered at the operational level of the BRMS and fisheries management in the area and will be further discussed in the forthcoming Second Order Governance (Section 5.2.2.2)

Implementation and Enforcement

At the implementation stage, a regional implementation committee was formerly headed by the Assistant Director of the region and Head Ranger of BRMS. The committee consisted of identified key stakeholders such as Department of Forest, Divisional Secretaries of the region, Department of Fisheries (DFAR), Coast Conservation Department (CCD), SL Navy, Police, Coast Guard, Central Environmental Authority, Provincial Environmental Authority, Department of Agriculture, Tourist Board, National Aquaculture Development Authority of Sri Lanka (NAQDA), National Aquatic Resources Research and Development Agency (NARA), and civil society representatives from fisheries, safari boat operators, tour operators and aquaculture (Bar Reef Marine Sanctuary Management Plan 2019-2023). However, Perera and De Vos (2007), in their paper reviewing marine protected areas in Sri Lanka, highlighted that the practical application in reality is far less than making policy decisions and developing management plans. They further revealed that the management of BRMS is not ongoing, and thus, it had been challenged by destructive regular fishing practices such as explosives and bottom-set nets.

At present, DWC and SL Navy jointly monitor BRMS by patrolling daily along the coastal belt of Kalpitiya. As mentioned above in section 5.2.1.1, Bar Reef is a marine sanctuary, and there is no park warden assigned to monitor the reef at its location. Further, no unit is established close to the BRMS to locate officers for routine monitoring purposes by DWC or any other governing institute. The only unit that is established with regard to BRMS is the range unit with a small museum at Kudawa that has a Kiosk to issue tickets for tourists. Tourist boat operations are thereby regulated by the Kudawa range office. Any boat transporting both domestic and foreign tourists is required to pass through this unit to purchase tickets prior to starting their journey. SL Navy, DWC, or DFAR have the power to arrest, take illegal gear and other tools under custody, and fine illegal fishing and destructive fishing activities in BRMS and Kalpitiya seas.

However, many respondents expressed negative perceptions in terms of the ongoing enforcement of BRMS management Table 5.4.

Table 5.4. Issues of law enforcement

Issues of law enforcement	Percentage of respondents (%)	Ranking of the issue
No ongoing monitoring	35 %	1
Poor communication channels	33 %	2
Not considering people's perceptions	33 %	2
No clarity of the roles of institutes	31 %	4
Top-down management	25 %	5
No strict rules	24 %	6
No clear idea of why certain rules/regulations are made or not knowing rules	24 %	6
Poor fisheries management	22 %	8
Illegal transboundary fishing	20 %	9
High cost of management and no ongoing management	18 %	10
No alternatives introduced for bans	14 %	11
No new technology introduced	10 %	12
No proper connection among institutes in governing	10 %	12

Not enough/skilled staff and less facilities in management	4 %	14
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As shown in Table 5.4, the most significant issue identified by most of the respondents (35 % of respondents) regarding law enforcement in the BRMS is a lack of monitoring . This gap in monitoring has created challenges for enforcement as illegal fishery activities exploit the sensitive area. The second most pressing issue, with 33% of respondents, is poor communication channels. Respondents mentioned that there had been fewer meetings to educate the community post-BRMS implementation. This resulted in reduced direct contact between government officials and fishers on a regular basis. Since there is no government office or an operational unit established in remote areas such as Uchchimunei, Baththalangunduwa, or Dutch Bay, it is often difficult to connect with officials who visit these areas less frequently. Hence, fishers are typically informed of updates through their FAs or by word of mouth. However, many island fishers are unable to attend these meetings in Kalpitiya town due to the inconvenience and costs associated with travel and the nature of the job as they spend their whole day in the sea. Further, some fishers stated that FA meetings are held only if there is an urgent matter to discuss and that, especially after the COVID-19 pandemic, most of the FAs have not been functioning as actively as before. Despite the above reasons, some fishermen had no interest in attending any kind of meetings, while some were not comfortable expressing their ideas even if they attended meetings. Additionally, another 33% of respondents highlighted the issue of not considering people’s perceptions. They revealed that their perceptions, opinions, or traditional knowledge have not been sufficiently considered in current governance practices.

“During the awareness programs conducted by respective authorities, they never consider about our concerns. They pretend like they are concerned about it. But actually, they are not. Now fishermen know about that. Therefore, they go to meetings or awareness programs but do not express their ideas because they know that it is useless. Therefore, sometimes fishermen do not attend those meetings.” – A tourist

boat operator cum former fisherman, Kudawa

“At bar reef implementation they have taken our labour for replanting corals, but not our knowledge that much.” - A fisherman, Uchchimunei

“When the respective authorities of the government formulating policies related to marine protected areas or any kind of ban associated with fishing, they are not asking our opinions.” - A fisherman,

Kalpitiya

The fourth issue identified by 31% of respondents is a lack of clarity regarding the roles of different institutes involved in BRMS governance. Some fishermen were unaware or were not clear about DWC's role in BRMS governance. Some tourist boat operators, even if they were aware of DWC's role, did not believe that DWC was the best institute to look after the marine life than on the landside, even if DWC has the right of the Act to protect MPAs in Sri Lanka. Many of the respondents perceived that NARA and Navy have more responsibility than DWC in terms of research and marine protection of the area, respectively. Hence, the majority of the fishermen do not have a clear idea of which institute or representative official to consult whenever needed.

“DWC, is the environment protection authority, while different environmental organizations have the responsibility to protect this bar reef area. NARA and NGOs also provide their contribution. All fishermen do not have an understanding about the services rendered by these organizations, but people who have a general understanding are aware of the roles of these institutes” – A fisherman, Kandakuliya

The fifth issue identified by 25% of respondents is related to top-down management. Respondents indicated that rules and regulations are often imposed without adequate consultation with the fishing community. The decision-making involves respective authorities or Ministries. Many fishermen feel they have no choice but to comply to avoid being arrested or fined. However, some stated that certain rules or regulations were made without having a thorough understanding of the nature of their fishing jobs. In the sixth place, 24% of respondents identified the absence of strict rules and punishments as an issue of law enforcement. It was stated that rules were mostly limited to a paper document without effective enforcement. For example, fishermen experienced fish habitat and fish stocks were protected from destructive fishing activities such as dynamite fishing in the past, and thus, there is a preference for stricter enforcement of protective measures. Another 24% of respondents stated that they had no clear idea of why certain rules and regulations were made. Some fishermen mentioned that they did not know why certain nets and gears were prohibited. It was further observed that some fishermen were not aware of certain BRMS rules and regulations.

Additionally, the eighth and ninth issues are poor fisheries management (22%) and illegal transboundary fishing (20%), respectively, with both issues contributing to overfishing and depletion of marine resources in the region. Both the sea and lagoon are experiencing overfishing, leading to a decline in the marine biodiversity of the area. This problem is caused by both local and illegal transboundary fishers.

In the Kalpitiya region, a diverse range of fishing occupations exist, varying in scale from small (in both lagoon and sea) to large-scale (trawling and multi-day fishing). While multi-day fishing typically occurs in deeper waters, most other fishing activities happen in commonly accessed fishing grounds. Small-scale fishers reported being affected by medium to large-scale fishing that harvests significant quantities of fish. Additionally, it was further revealed that trawling boat operations which primarily targeted lagoon prawns 24/7, were halted by a gazette order issued a few years ago. Moreover, many fishermen revealed that bottom-trawling operations conducted by transboundary fishing boats deplete Kalpitiya fish resources and are believed to have an adverse impact on the BRMS and to damaging rocks and corals.

The tenth issue highlighted is high operational costs, with 18% of respondents. High operational costs hinder ongoing management of the BRMS, as initial funding from donor agencies like GEF and UNDP has not sustained ongoing efforts, such as buoy maintenance. This has resulted in inadequate protection for sensitive areas.

“Buoys were broken down due to ocean currents. Based on our knowledge and GPS, we can locate the reef demarcation even without buoys. Now there are no buoys. But if an unknown person comes here, they do not know that this is a sensitive area as no demarcation is left now.” – A tourist boat operator,

Kudawa

In the eleventh place, 14% of respondents mentioned that no alternatives for fishing bans have been introduced. Ten percent of the respondents stated that there has been no introduction of new technology to improve fishing practices. Furthermore, another 10% also reported a lack of proper connections among governing bodies, complicating effective governance. It was mentioned that certain institutes' roles and responsibilities are further apart from each other such as DWC and SLTDA (tourism) and DFAR (fisheries). Thus, the misalignment of institutional goals had led the institutes to work more independently focused on their own goals, rather than collaborating effectively with other agencies in governance. Consequently, this scenario created challenging conditions for fishers.

Finally, a small percentage of respondents (approximately 4%) highlighted the issue of insufficient skilled staff and resources within management institutions to carry out field operations, which further challenges effective governance. Regional units in governance (e.g., DWC) are reported to have inadequate staffing and limited facilities, adversely affecting their ability to conduct routine management activities.

In summary, addressing the pressing law enforcement issues identified by the respondents is vital for sustainable fisheries and protecting marine ecosystems. Next, the role and influence of the market on MPA governance are explored.

5.2.1.2. Role and Influence of Local and Foreign Markets

Fisheries represent the primary economic activity in Kalpitiya, and both local and foreign market forces significantly impact fishing and other extractive activities in the area. This has some impacts on the BRMS as well in terms of resource extraction. Local market demands primarily cater to consumption, while foreign market demands for both consumption and ornamental purposes. Kalpitiya town hosts several private-owned or privately partnered export fish businesses that supply products for international markets. The majority of the rest of the villages in Kalpitiya (i.e., Kudawa, Kandakuliya, Uchchimunei) are mostly into providing fish for local consumption, while a few private enterprises are involved in exporting fish for ornamental use. The foreign market highly demands certain marine species, including reef cod, lobster, parrotfish, and sea cucumber, which were once abundant in the BRMS reef area. Export companies typically offer higher prices for these species, driving local fishermen to target them.



Figure 5.4. A collection of Chank shell (*Xancus pyrum*) at a landing site, Kalpitiya (captured by Nilushika Gamage, 2023)



Figure 5.5. A box of parrot fish at a landing site, Kalpitiya (captured by Nilushika Gamage, 2023)

In addition, both the local and foreign markets also play a crucial role in regulating and maintaining the quality of fish harvest. Historically, fishermen employed destructive harvesting techniques that adversely

affected fish market quality. In response to both local and international consumer demand for high-quality, fresh fish, buyers required fishermen to deliver quality harvests. Furthermore, market dynamics reinforce rules and regulations governing fishing practices. For instance, the harvesting of lobster is prohibited during their breeding season. If fishermen attempt to sell lobsters during this restricted period, many buyers refuse to purchase them, which may lead to legal repercussions for the fishermen such as arrests or fines. Some buyers may still offer to buy lobster at significantly reduced prices. One ornamental business owner mentioned that he would not accept small chank shells that are still in the development stages. In this way, the market plays a major role in regulating fishing and extractive activities.

Moreover, there is a huge demand for sea cucumbers for foreign export markets, which exerts huge pressure on the marine life in reefs in the area, including BRMS. Fishers tend to dive in search of sea cucumbers. While many divers usually harvest sea cucumbers from reef areas, there are a few privately-owned sea cucumber farms ongoing in the lagoon area, funded by private partnerships. Farm operations are carried out under the supervision of government institutes such as DFAR, NAQDA, and NARA.

Recognizing the critical role of prevailing markets in shaping sustainable fishing activities, is instrumental in MPA governance. Additionally, the next section discusses the equally significant role of civil society organizations and communities in MPA governance in Kalpitiya.

5.2.1.3. Role and influence of Civil Society

Civil society in the Kalpitiya region consists of various community groups, including fisher associations, tourist boat operator associations, NGOs, the Catholic Church, and women's associations.

Role of NGOs

NGOs and donor agencies play an instrumental role in providing funding and consultations. The current BRMS management plan is a GEF-funded project implemented by the Ministry of Mahaweli Development and Environment Sri Lanka, supported by UNDP. This project aims to operationalize Environmentally Sensitive Areas (ESA) as a mechanism for mainstreaming biodiversity management into development in areas of high conservation significance (Bar Reef Marine Sanctuary Management Plan 2019-2023). Despite the BRMS management plan, several smaller environmental protection projects have

been funded by both local and international NGOs. Some respondents mentioned that they had been involved in those environmental projects as labor.

“We have removed polythene bags, anchors, and ropes with the help of NGOs in the reef area. NGOs spent money and we helped them to carry out such conservation activities in the past.” – A tourist boat operator cum former fisher, Kudawa

Other than that, many community members highlighted the contributions of organizations such as World Vision, which helped them improve household conditions and living standards, particularly on islands like Uchchimunei. Their efforts included building sanitary facilities, providing livestock, and supporting vegetable cultivation (vegetable plots). World Vision alongside the local Catholic Church, had created self-employment opportunities for fisherwomen. Moreover, fisher families received small boats, fishing gear, engines for fishing, and equipment for dried fish production (metal nets), highlighting the broader support provided by NGOs.

Role of Fisher Associations (FA) and Women Fisher Associations (WFA)

Despite the presence of NGOs, local fisher associations (FAs) play a vital role in the Kalpitiya fishing community. A total of 32 respondents (n=32) shared their experiences regarding their local FAs. As per their description, each fisherman is required to join their respective local FA and adhere to the rules and regulations agreed upon. Thus, FAs hold considerable power, enforcing sanctions on those who violate community agreements. Moreover, FAs are also the primary point to disseminate knowledge and news related to fishing within the fisher community. Despite information sharing, FAs play a critical role in resolving issues such as land ownership and resource conflicts among fisher villagers over marine space. Presidents and Secretaries of FAs are key figures who maintain contact with governing bodies such as DWC, DFAR, DS Office, and NGOs. In Kalpitiya, the FA President's influence is particularly significant in decision-making and controlling their fisher community. However, it was noticed that some FAs were less active after the COVID-19 pandemic in 2020.

Apart from FAs, the tourist boat association (TBA) represents 118 tourist boats in the entire Kalpitiya DS area, regulating tourism activities. The tourist boat association further engages in resolving conflicts to maintain fair opportunities that benefit each tourist boat operator, etc. However, no significant active and

direct involvement was seen in these community-based associations (FA and TBA) in BRMS governance. However, their contributions to educating and engaging the community are crucial for MPA governance. Moreover, each village in the Kalpitiya region exhibits unique cultural and societal traits, influenced by demographics and the nature of their local jobs. Thus, FAs play a critical role in representing the interests of these community segments and uniting them under their own bylaws.

“Nowadays, we receive information, especially about new rules and bans imposed by the government through village fishing societies. Earlier there was no such system to inform the fishermen when there were no FAs in the past. We normally communicate our ideas to the respective governing authorities through the president of our village fishing society.” – A fisherman, Kalpitiya

“Some FAs are not very active. Only if a huge crisis is there, FA would call for a meeting. Some fishers attend those meetings. Some fishers from Uchchimunei do not attend meetings as meetings are held in Kalpitiya.” – A tourist boat operator cum former fisher, Uchchimunei

I formed a small FA with a smaller number of fishers apart from our main FA, in which the majority of fishers are medium to large-scale, where small-scale fishers are often neglected. Through our small FA, I managed to partner with World Vision and get funds/equipment for our fishers like several theppam, boat engines, and gears.” – A small-scale fisher, Uchchimunei

However, the role of women's fisher associations (WFA) was less prominent in governance. These WFAs mainly supported women by providing credit loans for household needs, children's education, and their husbands' fishing activities. Additionally, some WFAs were also involved in conservation projects, such as lagoon mangrove regeneration funded by NGOs. One WFA president mentioned that their WFA members participated in the initial BRMS conservation awareness programs.

Furthermore, historically, Kalpitiya has been a significant center for dried fish production in Sri Lanka, where women played a major role in the industry. Although some women continue dried fish production at present, many now sell fresh fish to ice-boat buyers instead of daily. However, still women dry fish for household consumption. In the past, WFAs had provided training for dried fish production, but their activity has since declined. Women today are more involved in household management and supporting their spouses' fishing activities such as sorting out fish nets and selling fish. Some women, particularly from islands, also engage in fishing in small, close by islands and the lagoon using their theppam.

Role of the Catholic Church

In addition to the above-mentioned community associations, the Catholic Church plays a significant role in the Kalpitiya region, particularly in the islands where each village has at least one Church. Ten respondents (n=10) shared how the Church had been involved in resolving conflicts, facilitating communications with governing authorities, and supporting the households of fisher communities.

“Fishers’ suggestions are very rarely taken to the top-level authorities. Usually, this communication is done by the intervening of either FA presidents and/or priests of the Church.” - A Fisher cum FA Secretary, Uchchimunei

“Uchchimunei shoreline is under the control of the Tourism board meant for hotel projects and tourism. We, villagers, do not even own a deed for our lands. There were conflicts with these tourism decisions which villagers were against. And priests of the Church had to involve in conflict resolution.” – A tourist boat operator cum former fisher, Uchchimunei

“One reason is that there should be a knowledgeable person to disseminate the information, the problem is that islanders are not that knowledgeable about conservation. Further, islanders' perceptions, views, and language are different than ours. That’s why we need a person like a Church priest to communicate with them as they have trust in the Church. The Catholic Church and priests are closer to the island communities than officials. Officers might be knowledgeable, but they are not accepted by the community. When communicating with the islanders, a different approach should be taken to effectively deliver information and improve awareness. Therefore, the Church has a big role to play here.” – A tourist boat operator, Kudawa

In summary, civil society in Kalpitiya, through the efforts of NGOs, FAs, TBAs, WFAs, and the Catholic Church, plays a critical role in supporting community livelihoods, facilitating communication, and promoting conservation initiatives, although its direct involvement in BRMS governance remains limited.

5.2.2. Assessment of Current Governance by Order

This subsection assesses the current governance mechanisms of the BRMS through the governance orders outlined in interactive governance theory, as discussed in the theoretical framework in Chapter 2. By examining the governance by first, second, and meta-order, the governance framework can be better evaluated for its institutional and societal influence in decision-making and resource management. The subsequent subsections first outline first-order governance focusing on daily management tasks and enforcement of rules. Next, second-order governance explores the institutional context and community engagement in decision-making in governance. Then, meta-order governance discusses societal values that shape MPA governance in Kalpitiya. Lastly, the discussion expands into future governance insights by order.

5.2.2.1 First Order

First-order governance involves day-to-day management tasks and activities such as enforcing rules and monitoring resource use (Kooiman et al., 2008). This order focuses on the practical implications of governance operations and decision-making.

Monitoring

As previously mentioned under the role of State (section 5.3.1), daily operations involve the monitoring of BRMS through patrols conducted by DWC and the SL Navy. This collaborative patrolling service along the shoreline helps to monitor fishing activities and enables authorities to take legal action against illegal activities. However, despite these efforts, as a marine sanctuary, BRMS has no assigned park warden to look after it on the site. As per the DWC ranger in Kudawa, monitoring is done from two points: (i) Puttalam lagoon side and (ii) seaside – ‘Welle Wadiya’ and ‘Maadel Wadiya’ landing sites. DWC uses two boats for patrols in the early mornings and evenings. Additionally, DWC responds immediately to reports of illegal activity. Apart from that, DWC's daily tasks include issuing tickets for tourists who visit the lagoon and marine ecosystem via local boat tours.

Implementation and maintenance of the BRMS

Twelve respondents (n=12) mentioned that they were involved in the initial stages of the current BRMS project implementation. A group of fishermen, particularly divers, contributed by collecting growing tips from the rubble, replanting coral, restoring fish habitats using artificial concrete structures, and implementing buoys around the sensitive area underwater. Further, FAs, WFA, and community members, including fishers, divers, and tourist boat operators, attended the meetings and awareness programs conducted by the government institutes (particularly DWC, NARA, DFAR, DS) along with the donor agencies such as UNDP. Some community members had also performed beach and reef cleaning supported by NGOs or other donors who covered their operational costs, such as fuel expenses. However, these activities were mostly limited to the initial stages of the BRMS management plan and not continuing on a regular basis.

Decision-making

Furthermore, it was observed that there have been new rules or regulation changes from time to time to manage fisheries activities, which will be further discussed in the next section— second-order governance. Since fisheries activities had been identified as the most influential challenge to marine resources, the current management plan considered these fisheries management bans and regulations in its implementation. Thus, institutional involvement was the most prominent force identified in BRMS's day-to-day governance. Community member involvement in governance was only limited to participating in awareness programs, attending decision-making meetings, and providing labor in certain conservation projects so far. It is evident that the community has no significant role in ongoing management, decision-making, or law enforcement.

Practical Challenges of First-Order Governance

The majority of the respondents raised concerns about the current MPA governance, particularly the lack of equal community representation in activities such as coral and fish habitat restoration. Those who participated in those activities were mostly skilled divers, FA leaders, and other community members. This group of volunteer community members was also related to fishing, ornamental fishing, and tourism from the Kudawa, Kandakuliya, and Kalpitiya town. These divers and their boats were hired as labor in

the initial implementation activities. Fishers from the more remote islands, such as Uchchimunei, were less involved due to the logistical challenges of attending meetings and conservation tasks. Meetings were usually held on the mainland, making it difficult for islanders to attend due to travel costs and geographical isolation. Another reason why the majority of the fishers had not been involved in such activities was that the nature of their fishing job as fishers spent most of their time in the sea, and their limited time availability restricted them from participating in these activities. Even though the group of volunteer community members was involved in the initial stages, they were not engaged in the ongoing monitoring, or maintenance of the reef. The responsibility for the routine monitoring of the BRMS is assigned to DWC and SL Navy.

As already discussed in Table 5.4, some respondents stated that ongoing BRMS monitoring or routine maintenance has been insufficient due to high management costs, shortage of skilled staff, and limited facilities. Since the BRMS management plan was funded by donor agencies, routine maintenance has been a challenge for government institutions following its initial implementation.

5.2.2.2 Second Order

Second-order governance focuses on the institutional context that supports first-order governance, including formal rules such as policies and regulations and informal rules such as norms, traditions, and customary rights (Kooiman et al., 2008). Institutions form the framework for first-order governance. Earlier we discussed the institutions involved in BRMS governance, their specific roles, legislation, and policies within the governing system in section 5.2.1 in detail. Hence, this section expands on how community members were involved in the decision-making process, the play of traditions, norms, and customary rights in BRMS governance.

Community participation in decision-making

Respondents indicated that community involvement in decision-making was minimal, with most decisions (e.g., policy making, and rules and regulations implementation) made by state authorities and policymakers. The governance of the MPA follows a top-down management approach, with little

opportunity for community members to influence policy development and rule and regulation implementation.

Informal Rules

As Kalpitiya DS developed as a tourism hub alongside the establishment of the BRMS, tensions arose between the tourism and fisheries sectors. The villages of Kandakuliya, Kudawa, Kalpitiya town, and Dutch Bay are more oriented toward the tourism industry. However, it is important to note that the ownership of coastal lands and islands is held by the state. These coastal areas and small islands have been leased for multi-year tenures to hotels and tourism projects under the tourism development plans of SLTDA. Most large-scale hotels are owned by external investors, while small-scale hotels, cabanas, and homestays are owned by local villagers. Tourism in Kalpitiya DS utilizes both marine and lagoon spaces for various ecotourism and recreational activities such as water skiing, kite surfing, snorkeling, whale and dolphin watching, and eco-tourism boat trips. Consequently, there have been several instances where these hospitality and tourism activities have been a threat to the local fisheries industry. In such cases conflicts had been resolved through mutually agreed-upon arrangements among the relevant parties, with the help of FAs, active community members, and government authorities.

“Our village-level associations are important to navigate the issues we face from the influence of outsiders’ actions. For example, once there was a conflict over kite surfers and SSF over utilizing an SSF landing site. At this time, kite surfers, and FAs came to an agreement that the particular coastal area would be reserved for a specific period of time for surfing without disturbing fisher’s activities. Surfers also agreed to offer some compensation for that dedicated time for FAs to distribute among fishers. Conflicts over resources are there. In such conflicts, the fisheries Department, Pradeshiya Sabha (a local legislative governing body overseeing the country’s third-level municipalities), the Divisional Secretariat, and Police authorities help resolve conflicts. Leaders in the village are the ones who help control fishers’ reactive behaviors over these kinds of conflicts. Leaders of FAs have people power and trust of people”–

An FA President (tourist boat owner cum former fisher), Kudawa

Other than that, fishers from each village demonstrated a strong attachment to their fishing grounds and landing sites. Some respondents stated that they would not permit outsiders-whether from other villages or different parts of the country- to fish in their designated fishing grounds. This practice has also enabled

them to identify wrongdoers and safeguard their marine resources. In this context, FAs have been identified to play a major role in establishing rules and regulations within the respective communities. There had been some instances in which violators were suspended from fishing for a couple of days or weeks. Further, it was observed that the role of FA presidents and active community members play an instrumental role in formulating and enforcing these informal rules and agreements.

Additionally, some respondents mentioned their commitment to sustainable fishing practices to protect fish resources. They reported releasing marine species such as turtles and dugongs in accordance with guidance from the DWC. Further, they also consciously refrain from fishing juvenile fish. Notably, the villages of Kudawa and Kalpitiya are renowned for ornamental fishing, which relies on the reef species. Some informal actions and rules adopted by ornamental fish collectors have a significant impact on resource extraction.

“I do not encourage my ornamental fishers to collect chank shells in the development stage. Once, I bought a huge sack of small chank shells from a person and asked the same person to throw those back to the ocean”. – An ornamental fish businessman, Kudawa

Access Rights

While the BRMS does not implement extensive zoning, a no-take zone has been established within the highly sensitive biological area (modified final area: 0.51 km² and perimeter: 2.97 km) demarcated by buoys. Fishing, diving, and tourism activities are prohibited within this zone, and violations result in legal actions under the formal legislation of FFPO No. 2 of 1937 and its amendments. Fishing of any kind is strictly prohibited within the boundaries of the MPA. Tourism and recreational activities such as diving and snorkeling are allowed under a certain set of guidelines that safeguard the coral reef and only expert divers are allowed within the sensitive area. No one is allowed to walk on the coral reef since this coral reef is located in shallow water. Sailing boats or windsurfing over the boundaries, or anchoring boats within the boundaries of the BRMS are strictly prohibited. Research activities in the sensitive area are permitted with formal approval from the Director General of DWC as declared in FFPO No. 2 of 1937 and its subsequent amendments as mentioned above in the institutional context.

“Buoys are there restricting enter to that coral area.”-A fisherman, Kalpitiya

“If any fisherman breaks the rule by entering the sensitive area, they will be arrested by the NAVY or the DWC. That was the only challenge we faced from the protected area. Other than that, no such big effect on our industry.”-A fisherman, Kudawa village

“The reason for implementing an MPA is because fishers break corals when they try to detangle the fishing nets from corals. If we bring those broken corals to land, we will be arrested.”- A fisherman, Uchchimunei village

“We have rules in showing the reef to tourists. They cannot walk or dive in that area. We cannot anchor our boats near there. There are anchoring points assigned (in the sand belt) to anchor. So, we are being informed about these rules. If we breach the rule, DWC can act legally against us. We have given guidelines for snorkeling tourists; those are good things.”- A diver cum tourist boat operator, Kudawa village

Despite the BRMS's impact on the access rights of marine resource users, other circumstances arise from the MPA as it aligns with the tourism development plan in Kalpitiya. The BRMS plays a significant role in attracting local and foreign visitors to this area. However, certain hotel projects in Kudawa and the islands have resulted in the loss of access to long-established landing sites of local fishers.

“There was once a huge problem with selling land ownership to large-scale hotels of private owners with the tourism plan. Due to that, our fishers got repelled from the coastal area. Our people should stay where they used to fish on the shore. From Uchchimunei to Mohoththuwarema there are around 11 landing sites along the beach side, each located nearly 200m apart. So, if the land is owned by the tourism industry, how can our fishers access their landing sites? There was a suggestion to build a fence along the seaside, allowing fishers to access the sea by only one route. That solution was not feasible for us. Then it stopped. We do not like that kind of tourism or development. If fishers are excluded, they lose their jobs, freedom, and their houses.”- A fisherman, Uchchimunei

5.2.2.3. Meta Order

Meta-order governance refers to deliberations that are guided by fundamental societal values, principles, and meanings, which are instrumental to the effective functioning of first and second-order governance

arrangements (Kooiman & Jentoft, 2009). While interactive governance emphasizes the importance of societal values and principles, limited information was found regarding how these societal values and principles influence the BRMS governance in Kalpitiya. According to the BRMS management plan, stakeholder analysis and consultations demonstrated a clear application of meta-order governance principles. Various stakeholders, including local fishers, tourism operators, and community associations such as FAs and WFAs, were engaged in awareness programs and meetings held by government authorities in collaboration with NGOs (Bar Reef Marine Sanctuary Management Plan 2019-2023, n.d.). The inclusion of stakeholders, ranging from grassroots-level communities to policymakers, aligns with the core values of participation, transparency, and inclusivity. However, despite the initial engagement through consultations and awareness initiatives, many respondents expressed that their perspectives were not sufficiently integrated into the governance processes, highlighting a gap in the successful application of meta-order governance principles.

Historically, the fishing community had a limited understanding of the ecological significance of coral reefs. Many fishers viewed the reef area as a reliable fishing ground, with little regard for its environmental value. Destructive fishing practices, such as dynamite fishing and coral breaking for limestone production were common in past generations. Additionally, population growth and increased pressure on marine resources have led to resource depletion, causing income levels to drop. Given the background, the declaration of BRMS in Kalpitiya and the conservation projects that happened thereafter served as a wake-up call for the fishing community. The study identified that the majority of the fishers and other community members now recognize the need to protect marine resources for future generations. Some stated that the implementation of BRMS helped preserve depleting fish stocks and marine ecosystems, ensuring the sustenance of both fishing and tourism jobs. Some respondents described the BRMS and the coral reef area as a treasure to Kalpitiya.

It was observed that nowadays the fisher community is compelled to value and utilize the marine ecosystem in a more sustainable way than before. Particularly, community members who were involved in tourism activities and heads of FAs had more active initiatives towards sustainable resource use. Some had performed reef cleaning such as ghost net, plastic debris removal and beach cleaning. The FAs had implemented rules and regulations for resource extraction. Hence, this change of community perception is sought to be a positive impact that occurred from BRMS governance.

The changes in community perception and behavior reflect meta-order governance, which in turn enhances the effectiveness of first—and second-order governance. Active members of the fishing community, including individuals, teams, and FAs, acted as catalysts in promoting sustainable resource use. Many fishermen expressed a willingness to participate in deliberations regarding MPA governance and decision-making. They further emphasized the need for more efficient and impactful governance from authorities regarding both MPA and fisheries governance.

The study, as summarized in Table 5.5 reveals that state involvement is dominant, particularly in the first and second orders of governance, compared to community participation. This indicates a top-down approach, with state institutes playing a central role in daily monitoring, maintenance, and decision-making. However, as above, the assessment of governance orders highlights the limited opportunity for the community to be involved in MPA governance in the case study location.

Table 5.5. Current management practices by order of governance

Management practices/ Activities involved in governance	Responsibility held by
First order governance	
Daily monitoring	State institutes (DWC, Navy)
Routine maintenance and research	State institutes (DWC, NARA)
Ongoing decision-making and law enforcement	State institutes
Carrying out tasks such as: Collecting growing tips from the rubble to replant, coral replanting, immersing artificial concrete structures under water, attending meetings for the BRMS management plan	State institutes, donor agencies, NGOs, FA, WFA, community members (fishers, divers, tourist boat operators)
Beech/reef cleaning	State institutes, donor agencies, NGOS, community members (fishers, divers, tourist boat operators)
Second order governance	
Participation in decision-making	State institutes
Informal rules/ governance arrangements	FAs, and active community members
Meta order governance	

Value-based deliberations	FAs, tourist boat operators, and active community members
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5.3. Assessment of Future MPA Governance Arrangements by Order

Moreover, respondents expressed their perceptions on key criteria for future MPA governance arrangements, as summarized in Table 5.6. Approximately 12 % of the respondents focused on first-order governance, particularly emphasizing the involvement of fishers in conservation efforts. In contrast, 88% of the respondents prioritized second-order governance, highlighting the need for stronger rules and institutional arrangements.

5.3.1. First Order

Twenty-five percent (25%) of the respondents suggested that fishers should be more active in conservation, proposing community-centred monitoring and increased engagement in ongoing conservation tasks and awareness programs/meetings (Table 5.6). Further, some suggest strengthening village-level decision-making to enhance community participation in governance. Community-led monitoring has been recognized as an effective tool for sustainable resource management, particularly in MPAs. Local fisher involvement in management tasks such as monitoring enhances the sense of responsibility and accountability improving compliance with conservation regulations (Danielsen et al., 2005; Govan et al., 2009). Pomeroy and Rivera-Guieb (2007) suggest that such regular monitoring by fishers develops their understanding of ecological processes to sustain their livelihoods and thereby can integrate conservation practices into daily activities.

Additionally, involving fishers in awareness programs that focus on local ecological knowledge has been effective in marine conservation, where the input of local communities provides meaningful insights into ecosystem dynamics (Aswani et al., 2012). Moreover, strengthening village-level decision-making increases the opportunity for local communities to participate in MPA governance. Respondents highlighted that empowering village-level governance structures could enhance more inclusive decision-making that allows fisher voices, perspectives, and needs to be considered in policy developments. The decentralized governance structures have been identified to improve governance outcomes while providing solutions that focus the local community needs (Béné & Neiland, 2006).

5.3.2. Second Order

Respondents identified rules and regulations as the most critical criteria under second-order governance, with 43% of participants reflecting the need for stricter enforcement and immediate conservation actions (Table 5.6). It was suggested that regulations or bans need to be designed according to the scale of fishing activities, while also accounting for seasonal ecosystem changes. Moreover, clear demarcation of the sensitive area with proper maintenance and ongoing active monitoring was suggested to safeguard the reef area. Most importantly, respondents stressed the importance of incorporating fishers' experiences and perspectives in rules and regulations. Nevertheless, banning destructive fishing practices and gear was also suggested by the community to protect marine resources.

Secondly, the role of institutions was identified by 37% of respondents stressing the importance of institutional functions in formulating policies, rules, regulations, and research (Table 5.6). Strong institutional arrangements need to be fostered. Nevertheless, the need for improved collaborations among relevant State authorities, NGOs, churches, fisher associations, and community members was also pointed out by the respondents. Strong institutional arrangements to coordinate among stakeholders are key to effective MPA governance (Pomeroy et al., 2001).

Thirdly, the introduction of new technology and alternative fishing methods was another notable suggestion, supported by 31% of respondents (Table 5.6). Rather than simply banning fishing gear, respondents were looking forward to developing skills in sustainable and efficient fishing practices introduced by DFAR, NARA, or relevant authorities. This is consistent with the need to empower communities' adaptive capacity to navigate environmental and conservation strategies as highlighted by McClanahan et al. (2008).

As the fourth criterion under second-order governance, improved communication channels that encompass every level of the community were highlighted by 27% of respondents (Table 5.6). Transparent and open communication between authorities and fishers was stressed as essential prior to policy implementation. The need for more negotiations to happen between authorities and communities was also highlighted at the decision-making stages. These suggestions to improve dialogue between resource users and authorities, policymakers, and academics lead to better outcomes in resource management (Gelcich et al., 2010).

Respondents further highlighted the need for building community capacities (14%) and formulating proper fishery and conservation management practices (14%) as crucial strategies for mitigating human-conservation conflicts (Table 5.6). They noted that a more informed and educated community would be more effective in participating in conservation efforts. Additionally, some respondents stated that fishers should develop other skills in alternative livelihoods such as tourism, rather than solely dependent on fishing. They observed tourism attracts more attention to Kalpitiya, resulting in improved infrastructure including electricity, roads, and public transportation that enhances the living standards of villagers. Moreover, respondents suggested implementing a comprehensive fisheries management and conservation framework in place. They emphasized the need to regulate overfishing and transboundary fishing, as these practices exert significant pressure on marine ecosystems while challenging the SSF industry in depleting fish harvest and lower income generation.

Further, 6% of respondents highlighted that future governance should consider subsidies to compensate for income loss due to conservation efforts (Table 5.6). Additionally, 4% of the respondents emphasized safeguarding fishers' access rights to their landing sites without impacting SSF from tourism or conservation activities. Finally, 2% of the respondents suggested the creation of an artificial underwater reef area as a way to restore marine habitats, as the bar reef was mostly destroyed by now. Another 2% of respondents highlighted the need for adequate expertise staff, operational units, and infrastructure to successfully operationalize governance (Table 5.6).

5.3.3. Meta Order

As depicted in Table 5.6, the majority of proposed future governance arrangements emphasized second-order and, secondly, first-order governance. None of the respondents suggested any specific criteria to consider under meta-order governance. This highlights that the respondent pool was more focused on practical and operational criteria of governance rather than norms, values, or principles that guide governance frameworks. Thus, the absence of meta-order governance within communities highlights a gap in strong foundations of governance to address.

Table 5.6. Criteria to consider in future implications by order of governance

Criteria to consider in future implications	Percentage of respondents
First order governance	
Involve fishers in conservation	25%
Second order governance	
Rule implementation	43%
Role of institutes	37%
Introduction of new tech and proper alternative	31%
Improved communication channels	27%
Capacity building	14%
Proper fishery/conservation management	14%
Subsidy	6%
Land ownership	4%
Artificial reef	2%
Staff requirement	2%
Meta order governance	
None	-

5.4. Conclusions and Chapter Summary

This chapter aimed to critically examine the current governance of MPA to identify future implications that facilitate the V2V transition of SSF communities utilizing an interactive governance framework. First, section 5.2 examined the current MPA governance by role and influence of the institutions in governance and categorizing governance by order while section 5.3 explored future governance by order. In section 5.2.1, the role of institutions was analyzed encompassing state, market, and civil society. The state's involvement was discussed in terms of governance, legislation, and policies, the current BRMS management plan, and issues of law and enforcement. Under the role of the market, particular attention was given to the export-oriented market, which subsequently pressured the extraction of reef marine species. Civil society's role was explored through the involvement of NGOs, Fisher Associations (FA) Women Fisher Associations (WFA), and the Catholic Church. Moreover, 5.2.2 analyzed current MPA governance according to the three orders of governance: first, second, and meta order. The first-order

governance focused on monitoring, implementation and maintenance, and day-to-day decision-making. Additionally, practical challenges of first-order governance were also discussed. Next, second-order governance explored community participation in decision-making, informal rules, and access rights concerning BRMS. Then, the chapter discussed meta-order governance, highlighting the limited integration of norms, principles, and values of local communities in governance arrangements. The findings of the above sections emphasized the strong presence of the state primarily in decision-making and law enforcement while revealing limited community involvement in current MPA governance arrangements. Additionally, the chapter discussed the most pressing issues in current governance. Section 5.3 assessed the future implications for MPA governance by order based on the perspectives of the case study participants. The respondents emphasized the need for improvements primarily in second-order and first-order governance with a limited emphasis on meta-order. This suggests a significant gap in value-based governance to address in the future.

Chapter 6

Vulnerability and Viability of SSF in BRMS, Kalpitiya

6.1. Introduction

Chapters 4 and 5 delved into the characteristics of the social-ecological system and examined the current MPA governance respectively. As mentioned in Chapter 1, the study aims to explore how the transition from vulnerability to the viability of SSF can be achieved through the most appropriate MPA governance practices. SSF communities encounter challenges such as climate change, habitat destruction, and overfishing, which emerge from both natural and human systems. Furthermore, these SSF communities are negatively impacted by conservation measures like MPA governance through limited access rights, disrupting livelihoods, and impacting cultural identity. However, the very system characteristics or governance practices can also improve the viability of SSF. Therefore, understanding these vulnerabilities and viabilities is crucial in developing transitional strategies for SSF to navigate from vulnerability to viability. Hence, this chapter is aimed at identifying the most impactful drivers and attributes of SSF vulnerability and viability in an MPA setting addressing objectives 2 and 3. Further, this chapter serves as a synthesis of the case study findings in the previous two chapters (Chapters 4 and 5) and proposes future MPA governance implications for ensuring SSF viability addressing objective 4. Thus, the chapter addresses the following objectives and research questions.

Objective 02: To examine the key drivers that exacerbate the vulnerability of SSF in MPAs

- What are the key drivers that exacerbate the vulnerability of SSF in BRMS, Kalpitiya?

Objective 03: To examine the key drivers that facilitate the viability of SSF in MPAs

- What are the key drivers that facilitate the viability of SSF in BRMS, Kalpitiya?

Objective 04: To examine the key attributes of an appropriate MPA governance arrangement effective to facilitate the transition of SSF from vulnerability to viability

- What are the appropriate MPA governance practices for making small-scale fisheries viable?

This chapter adopts Dias et al. (2023) study findings in Asia and Africa on vulnerability and viability of SSF that highlight five major domains that exacerbate vulnerability and undermine SSF viability to

discuss research findings. As per Dias et al. (2023), the five major domains of SSF vulnerability and viability include ecological/ environmental, socio-cultural attributes, economic and development, governance and management, and emerging issues and challenges. As per the case study findings, the most highlighted drivers and attributes leading to exacerbating SSF vulnerability and undermining viability are discussed across the above domains. First, section 6.2 assesses the drivers and attributes that exacerbate vulnerabilities or facilitate viabilities of small-scale fisher communities in Kalpitiya DS, with regard to BRMS as deductively derived from interviews (n=51) and focus group discussions as mentioned in chapter 3. Section 6.3 synthesizes how the SES characteristics (chapter 4) and MPA governance (chapter 5) cause vulnerabilities and viabilities of SSF under each of the above major domains. Finally, the chapter proposes future MPA governance implications for a viable small-scale fishery to facilitate transitioning from vulnerability. Chapter 6 ends by summarizing the chapter's content.

6.2. Assessment of drivers of vulnerabilities and viabilities

This section examines the most highlighted drivers and attributes impacting both the vulnerability and viability of SSF based on the semi-structured interviews and focus group discussions. The viability of SSF is essential due to their contribution to the economy, environment and society. However, SSFs often face a variety of vulnerabilities that emerge from multiple drivers of change and disturbances, coupled with limited capacities to cope with them (Berkes & Nayak, 2018b; Nayak & Berkes, 2019b). These vulnerabilities mainly include economic, environmental, social, and governance issues. Many SSFs lack access to financial resources to invest in their livelihood and are less economically resilient in market access, bargaining power, and fair prices (Nayak & Berkes, 2019b). These SSF economic vulnerabilities lead to socio-economic difficulties and declined life standards. Moreover, changes in ecosystems, environmental cycles, and biodiversity make these SSF communities more environmentally vulnerable with depleting stocks, low harvest rates, and food insecurity (Dias et al., 2023). SSFs are socially vulnerable due to dynamics within fishing communities, issues, and interactions of other actors in the community (e.g., conflicts over resource use, gender inequalities, displacement, unequal benefit distribution, low education levels, and power imbalances) (Dias et al., 2023). Moreover, ineffective governance structures and institutions significantly contribute to SSF vulnerability with poorly formulated policies, a lack of inclusive governance structures, a lack of coordination, top-down management, and many more (Dias et al., 2023). Hence, assessing drivers and attributes that exacerbate vulnerabilities is crucial for identifying gaps in MPA governance. Understanding these drivers will facilitate the

development of governance strategies in the process of transitioning SSF from vulnerability to viability, by addressing root causes.

6.2.1. Drivers that exacerbate the vulnerability of SSF

Out of the above five major domains identified in the literature, the case study findings narrowed down to two major domains exacerbating SSF vulnerability in Kalpitiya as a result of BRMS. This conclusion was based on the consistent emphasis given to these two domains in the interviews and focus group discussions. The domains, (i) governance and management and (ii) economics and development emerged as the most impacting vulnerabilities, reflecting the perceptions and lived experiences of fishers and other community members (Table 6.1).

The most discussed domain exacerbating SSF vulnerability was governance and management (n=41), with drivers including ineffective management and limited community involvement in conservation efforts (Table 6.1). Poor fisheries management and ineffective conservation management were identified as directly impacting SSF vulnerability. SSF perceived that overfishing and destructive fishing activities required strict regulations and highlighted the policy implementation need to consider the nature of fishing jobs since not every job negatively affects the environment. Further, fishers stated that the prevailing BRMS management is inadequate to preserve marine life, making fishers vulnerable in reduced stocks. Moreover, it was highlighted that community/fisher involvement is limited in decision-making, routine conservation management, and law enforcement, thus making fishers' needs and perspectives less visible in decision-making.

“Bar reef is in the sea, so it needs to be a practical program to preserve it. It has been unsuccessful all this time. Nobody can regulate it in the offshore. If so, they should make an office and appoint someone there to monitor it. An effective way to do so is to make fishers aware and get them involved. Rules are only restricting people, and they try to act against rules.” -A tourist boat operator cum former fisher,

Kudawa

The second major domain, economic and development, was identified by respondents (n=11) as exacerbating SSF vulnerability, particularly through drivers such as tourism development plans targeted at the Kalpitiya region. Some landing sites were challenged by large-scale hotels, as coastal lands had been leased to outsiders to build permanent buildings for tourist accommodations. In addition, some community members expressed concerns about the multi-year leasing of islands to millionaires and

foreign investors, who prioritize economic benefits over community well-being. Additionally, some discuss the fear of adverse socio-cultural effects of tourism (e.g., drug addictions, deterioration of social norms) that could threaten their culture, family lives, and the future of younger generations.

“Landing sites are challenged. Hotel owners (external) are a threat to this generational fisher industry. They have political and monetary power. From my experience, there are three instances in which fishers were removed. E.g. 10 boats were removed in Kudawa saying fishers distracted the hotel view, and 10 innocent theppam fishers in the lagoon (‘Seethawadiya’ landing site) were removed. Hotels leased state-owned lands. One hotel has illegally established a fence covering the most beautiful area which is home to migration birds of the lagoon.” – A fisherman, Kalpitiya

“Our villagers were afraid of tourism as a challenge to our culture and societal values.” - A fisherman, Uchchimunei

While tourism development demonstrated significant challenges, some fishers also identified it as a viable option for fishers as discussed in section 6.2.2.

Table 6.1. Drivers and attributes that exacerbate the vulnerability of SSF

Domain of vulnerability	Drivers of vulnerability	Attributes of vulnerability	Impact (positive/negative/mixed)	Total number of respondents
Governance and management	Ineffective/poor management	No ongoing monitoring, law enforcement, unregulated markets, poor fisheries management	Negative	41
	Less community involvement	Decision-making, management	Negative	
Economic and development	Tourism development plans	Exclusion from landing sites Socio-cultural effects	Mixed	11

6.2.2 Drivers and attributes that facilitate viability of SSF

This section examines the drivers and attributes that facilitate SSF viability in BRMS based on the case study data (Table 6.2). Two major domains that facilitate SSF viability in MPAs were identified: (i) ecological or environmental development and (ii) economic development (Table 6.2).

The ecological or environmental effects of MPA emerged as the most significant domain facilitating SSF viability (n=33). The majority of the respondents identified the MPA's role in preserving fish habitats, functioning as a breeding place for various fish and other marine species due to its diverse ecological features, including corals, rocks, sandbeds and seagrass beds, as drivers of SSF viability. Nevertheless, they mentioned that the sensitive area serves as a home to migratory species during seasons throughout the year. Further, the BRMS was recognized as the only area in the region rich in biodiversity, with an abundance of fish stocks around the reef. Particularly, the reef area is home to smaller to medium-sized fish species, which are the prey for larger species. Hence, this area has been highly resourceful for fisheries activities. In addition, ecosystem resilience was recognized by some respondents who mentioned that the existence of corals acted as barriers to high tides from natural disasters like the Tsunami in 2004, protecting the fisher villagers. Overall, the MPA was identified as an ecologically and environmentally valuable area for fishers to sustain fish stocks, ensure fish availability, and provide protection for local fishers, thus promoting SSF viability (Table 6.2).

The second most highlighted domain that facilitates SSF viability is economic and development attributes (n=27) (Table 6.2). A key driver of this domain was the diversification of livelihoods through tourism. The declaration of MPA and subsequent tourism development plans have attracted tourists to the Kalpitiya region, creating numerous tourism-related job opportunities in recent decades. These opportunities have created income sources for both villagers (and external stakeholders to generate income from operating tourist boats, providing food and accommodations, transport facilities (renting out bicycles, motorbikes, three-wheelers, vehicles, etc.), and recreational activities (snorkelling, windsurfing). However, as discussed in previous chapters (Chapter 4), these tourism-related livelihood options are mostly concentrated in mainland villages such as Kudawa, Kandakuliya, and Kalpitiya.

“To be honest, Tourism is an alternative livelihood for us. Our children and women work at hotels. So, in that way, poor fisher families can earn more income. Nowadays, income from fishing is decreasing due to higher operating costs. Also, the young generation who are educated more than our generation, get jobs in the hotel industry.” – A tourist boat operator, Kudawa

As discussed in subsections 4.2.1 and 4.2.2, tourism development was perceived to have both positive and negative impacts on the social and cultural dimensions of fishing communities. However, the economic advantages of tourism were unequally distributed among fisher communities, with remote villages being less advantageous than coastal areas.

Table 6.2. Drivers and attributes that facilitate the viability of SSF

Domains of viability	Drivers of viability	Attributes of viability	Impact (positive/negative/mixed)	Total number of respondents
Ecological/ environmental	Restoration of marine ecosystem	Habitat restoration, coral replanting	positive	33
	Higher fish stock/biodiversity	Fish habitat and breeding place	positive	
	Regeneration fish stock	Spill-over effect	positive	
	Ecosystem resilience	Protection natural disasters	positive	
Economic and development	Diversification of livelihoods	More tourism jobs	mixed	27

As discussed above, MPA governance has both positively and negatively impacted the viability of Kalpitiya SSF. While governance and management were identified as a major domain exacerbating SSF vulnerability, ecological or environmental resulting from MPA contributed to SSF viability. Economic and development was perceived to have both vulnerable and viable effects on SSF, particularly regarding tourism development.

Moreover, twenty-one respondents highlighted that MPA had no significant impact on SSF (n=21), as the no-entry sensitive area is only limited to a considerably smaller marine space. No fishermen were recorded to leave their jobs due to conservation practices or affected by rules and regulations, seasonal bans/closures due to MPA. Some expressed that they had no food insecurity as a result of MPA implementation, as they still have a good harvest for their household consumption and sales. In contrast to vulnerabilities, most of them had positive anticipations about the ecological effects of MPA on fisheries, as discussed in section 6.2.2.

This chapter further synthesizes the vulnerabilities and viabilities identified in previous chapters. The next section integrates Chapter 4 and 5 findings on SES characteristics and MPA governance structure, respectively. The synthesis categorizes these vulnerabilities and viabilities under the major drivers outlined in sections 6.1 and 6.2.

6.3 Categorization of SES characteristics and governance attributes under major domains of SSF vulnerability and viability

In addition to the above research findings on vulnerability and viability attributes, this section further analyzes the findings from Chapter 4 (Characterization of SES) and Chapter 5 (MPA governance) by categorizing the SES characteristics and current governance attributes under the major domains of vulnerability and viability of SSF discussed above. The systematic analysis deepens the understanding of factors exacerbating vulnerability and undermining viability and factors facilitating the viability of SSF in an MPA governance setting based on the characteristics of social-ecological systems and governance systems. The categorization matrices of SES characteristics (Figure 6.1) and governance attributes (Figure 6.2) can be utilized in decision-making to address existing governance gaps and improve future MPA governance. As discussed in Chapter 4, certain intrinsic characteristics of the core subsystems, such as the resource system, resource units, users, and interactions of the social-ecological system, play a significant role in shaping SSF vulnerability and viability.

6.3.1. Ecological/environmental domain attributes

Variables associated with the resource system and resource units of SSF and MPA can be categorized under the ecological/environmental domain.

Resource system variables/attributes

Resource system variables such as unclear system boundaries, limited size, low SSF productivity levels, and disturbed ecosystem equilibrium contribute to vulnerabilities of SSF (Figure 6.1). In contrast, fisher's knowledge and experience of resource system predictability (e.g., seasonal effects, weather changes, fish behavior, navigation patterns, fish availability) enhances their adaptive capacity, ensuring

the viability of SSF in response to ecological dynamics. The diverse biological and physical components of MPA and its aesthetic, economic, and biological values further positively impact SSF, other community members, and tourism industries. The MPA productivity level fosters SSF viability by serving as a habitat and breeding place for various marine species, thereby increasing fish stocks. However, the geographical location of fishing villages creates both vulnerable and viable effects on fishers in terms of infrastructure facilities, access to markets, and availability of alternative livelihood opportunities. Thus, the geographical location of the fishery social system is a major determinant of fisher vulnerability and viability, impacting income levels and life standards.

Resource unit variables/attributes

Resource unit variables such as low growth and replacement rates, spatial and temporal distribution of units depending on the seasons, and decreasing number of resource units within the MPA exacerbate SSF vulnerability (Figure 6.1). In contrast, resource unit mobility, particularly regarding the spillover effect and higher migratory fish mobility, positively influences SSF viability. Further, resource unit interactions, particularly in maintaining underwater food webs, contribute to viable effects of SSF, creating a healthy marine ecosystem favorable for fisheries. However, resource unit mobility (fish migratory patterns and spatial distribution) and interactions can also create vulnerabilities due to overlapping fishing grounds, leading to user conflicts. Nonetheless, mobility and interactions can help locate fish pods while collaborating with tourist boats.

6.3.2 Socio-cultural domain attributes

Resource unit and user variables can be categorized under the socio-cultural domain of vulnerability and viability of SSF in an MPA setting.

Resource unit variables/attributes

The economic value generated by SSF is highly vulnerable due to factors such as lower market prices, price fluctuations, and lower harvest levels compared to other types of fishing jobs (Figure 6.1). These factors exacerbate income disparities among SSF fishers. In contrast, the MPA generates mixed effects on SSF, providing alternative income sources such as tourism.

User variables/attributes

RU socio-economic attributes such as increasing population density and heavy dependence on fishing contribute to SSF vulnerability. Increasing population pressure leads to overdependence on fishing as the primary livelihood, putting much pressure on marine resources (Figure 6.1). However, the knowledge and experience held by the fisher communities regarding the natural (MPA and the marine ecosystem) and social system result in viable fisher communities. Furthermore, the geographical dispersal of the fisher communities creates different fisher communities that are vulnerable or viable in different ways. Further, social norms fishers hold regarding MPA and fisheries have both vulnerable and viable effects on SSF. While local fisher communities demonstrate strong social support networks, conflicts within or between communities can exacerbate vulnerabilities related to resource extraction.

6.3.3 Economic and development domain attributes

Economic and development domain attributes include both user and resource system variables.

User variables/attributes

The historical usage of fisheries and MPA in the study location highlights a key vulnerability, SSF (Figure 6.1). The transition from traditional fishing practices to destructive and extensive overfishing methods has led to stock depletion, lower harvest levels, lower income levels, and resource conflicts. Further, the health of the MPA has deteriorated due to past destructive fishing methods, resulting in habitat loss and species reduction. The technology used, such as GPS devices, has facilitated fishers to locate fish flocks and convenience in navigation. However, limited access to technology still constrains harvest levels. Additionally, the socioeconomic attributes created by the MPA to generate alternative income (e.g., tourism) and improved infrastructure benefit villages varying across locations.

Resource system variables/attributes

Resource system characteristics, such as human-constructed facilities such as storage facilities, ice-boat services, and fish processing factories, positively impact SSF by facilitating post-harvest preservation

(Figure 6.1). On the other hand, the expanded markets created a high demand for several marine species, leading to higher and constant resource extraction.

6.3.4 Governance and management domain attributes

Variables related to resource systems, users, and interactions identified in Chapter 4 can be categorized under the governance and management domain, significantly influencing the vulnerability and viability of SSF.

Resource system variables/attributes

The degradation of MPA's ecological equilibrium due to anthropogenic impacts such as destructive and overfishing practices highlights the need for stronger governance implications in conservation (Figure 6.1). Development projects such as the Norochcholei power plant further disrupt ecosystem equilibrium and draw attention to careful considerations of impact assessment of development projects. Additionally, the remote offshore location of the MPA poses logistical challenges to routine governance, increasing the ecosystem vulnerability. However, the predictability of the MPA's ecological dynamics could be used to formulate more adaptive governance practices.

User variables/attributes

The indefinite number of SSF fishers and their seasonal job transitions often complicate decision-making (Figure 6.1.). Further, careful evaluation of the impacts of the diverse user activities (e.g., fishing, tourism, and other activities) is needed as it contributes to the collective utilization of marine space. Additionally, limited technology usage in MPA governance by the authorities weakens the effectiveness of MPA management, thus increasing the vulnerability of the resource system (Figure 6.1). Leadership of FAs, TBA, and Church play a critical role in fostering communication channels and educating communities and thus enhancing SSF viability.

Interaction variables/attributes

Interaction variables such as different harvesting levels of diverse marine users, deliberation processes, lobbying activities, investment activities, and user conflicts contribute to SSF vulnerability (Figure 6.1). High harvest levels by non-SSF jobs result in market volatility, negatively impacting SSF income levels and limiting price negotiation at markets. Seasonal fluctuations of species further contribute to economic instability during monsoon periods. Thus, the governance implications may consider these attributes and interactions in facilitating viable SSF. Additionally, poor communication channels, lack of involvement in the deliberation process and limited lobbying activities, and political influences exacerbate SSF vulnerability. Further, less access to investments such as financial, physical, and human capital development also contributes to SSF vulnerability, limiting their adaptability and resilience in facing challenges. However, social connections and information sharing within local communities can have positive and negative effects, depending on the effectiveness of FAs and other community institutions. The inconsistencies in communication channels, either formal or informal, often weaken the two-way information flow, limiting feedback channels.

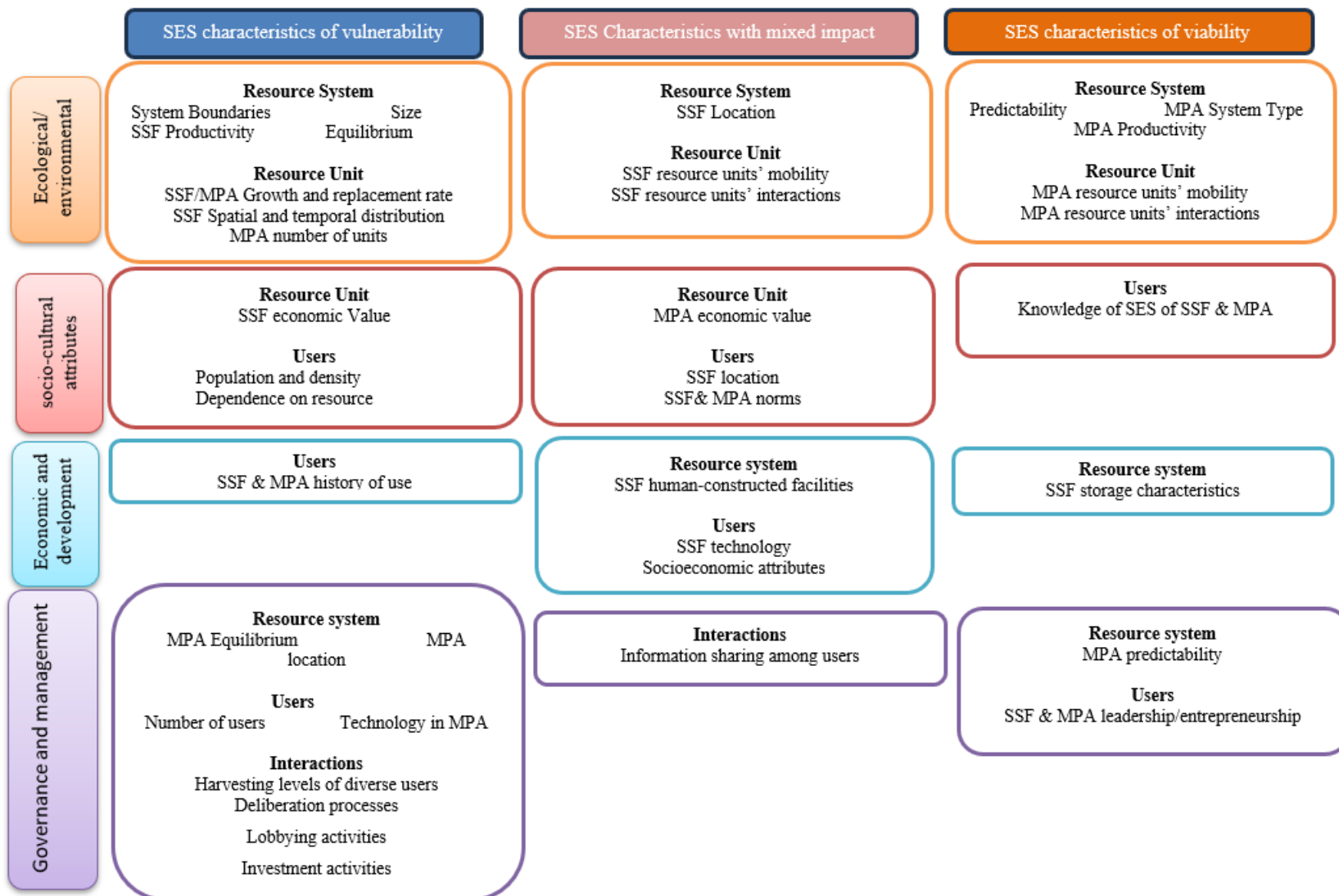


Figure 6.1. Categorization of SES characteristics under major domains of SSF vulnerability and viability

Governance attributes by actors and order of governance

In addition to the SES characteristics discussed above, the governance attributes identified in current MPA governance (Chapter 5) regarding the role and influence of the State, NGOs and civil society, and the order of governance can further be categorized to impact SSF under the governance and management domain (Figure 6.2).

Vulnerable and viable outcomes resulting from the order of governance—first, second, and meta-order—emphasize the gaps in governance. In first-order governance, tasks such as monitoring the MPA, implementing and maintaining the MPA, and day-to-day decision-making at the operational level highlight negative attributes due to the limited involvement of fisher communities.

Similarly, in second-order governance, the dominant top-down decision-making process and access rights present significant challenges to SSF (Figure 6.2). However, the informal rules practised by fisher communities and FAs offer some viable impacts on SSF in problem-solving, negotiations, and facilitating communications with authorities. Further, the limited entry to MPA was highlighted as a positive measure to preserve marine life and fish stocks, thus promoting SSF viability (Figure 6.2).

Meta-order governance also plays a significant role, particularly concerning fishers' principle/norms of resource extraction, which lead to both vulnerable and viable impacts on SSF (Figure 6.2). Historically, perceptions of destruction and overfishing to maximize profits have made SSF vulnerable in terms of reduced marine stock at present. However, MPA governance initiatives such as awareness programs have fostered the understanding of sustainable practices to avoid the deterioration of stocks.

Moreover, the roles of state, market, and civil society further highlight their complex impact on SSF vulnerability and viability (Figure 6.2). The dominant top-down state approach is identified as a negative influence where fishers are not essentially represented in the decision-making of conservation management, as discussed in the first- and second-order governance above. This scenario has led to fishers' perspectives and needs being hidden at decision-making tables, often disadvantaged by policy impacts. In contrast, the state's role in formulating rules and regulations and conservation efforts positively affects fisheries management and preserving ecosystems for viable SSF. However, ineffective law enforcement at the operational level leads to unregulated resource extraction by various groups, contributing to SSF vulnerability (Figure 6.2). Even though collaborations among State institutes, NGOs, and community-level institutes are happening in the case study locations, it is not effectively occurring and continuing for the long term.

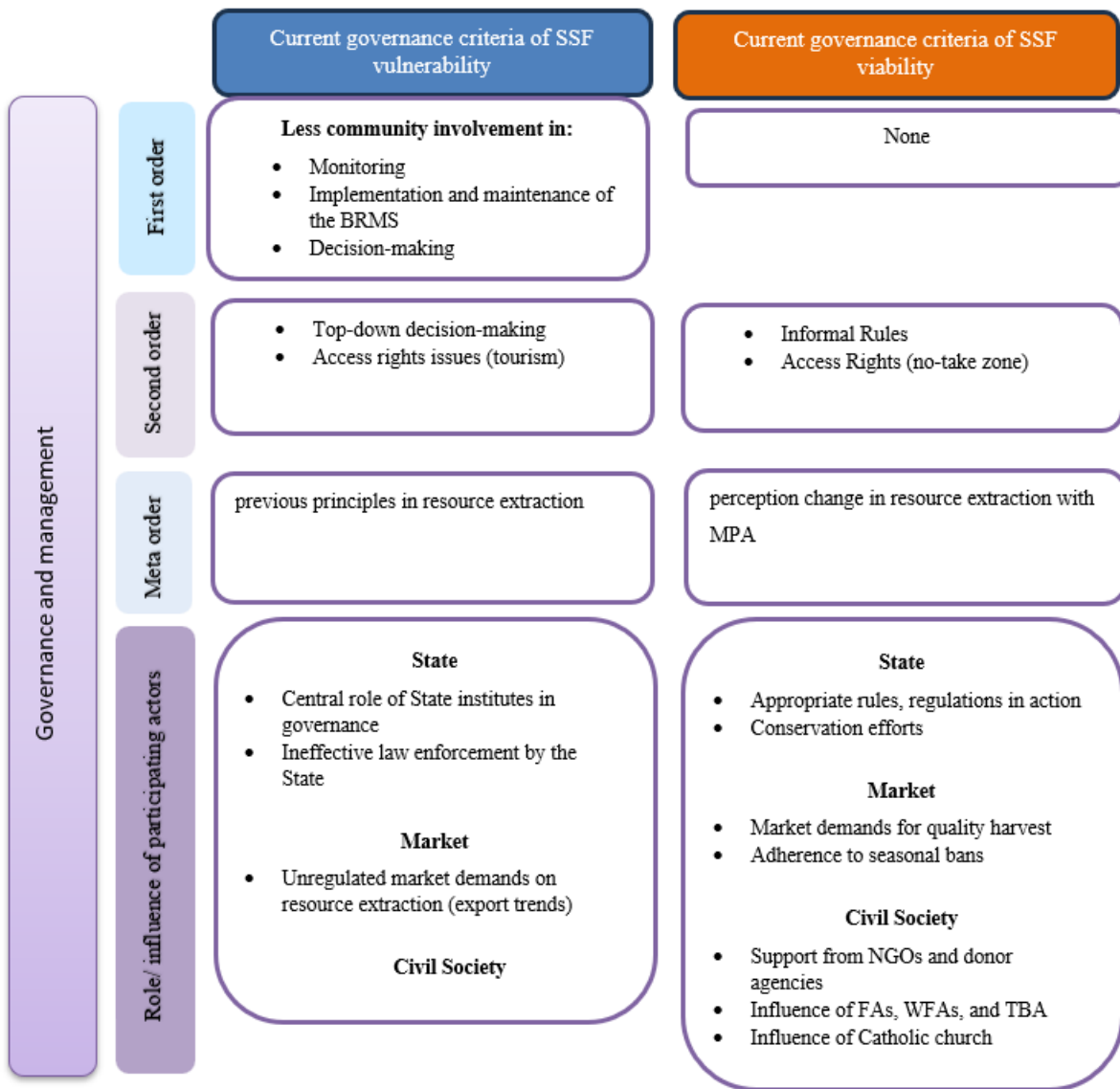


Figure 6.2. Categorization of governance attributes by realm and order of governance under Governance and management driver of SSF vulnerability and viability

Despite state, markets also have vulnerable and viable effects on SSF (Figure 6.2). High market demand for certain species, offering higher prices, leads to higher levels of resource extraction by other types of fishing (export-oriented and large-scale), exaggerating marine resource imbalances and disturbing underwater ecosystem functions. Further, price fluctuations and unfair pricing structures set by markets leave SSF particularly vulnerable to reduced income levels. In contrast, the market's role in satisfying

consumer demand through the supply of high-quality harvests has some viable impacts. Buyers tend to reject or offer lower prices for damaged fish harvested by destructive fishing methods (e.g., explosive fishing), encouraging more responsible fishing practices. Additionally, markets adhere to government guidelines, refraining from buying prohibited (e.g., turtles) or those subject to seasonal bans (e.g., lobster), further promoting sustainable resource use.

Moreover, the involvement of civil society, including NGOs and donor agencies, also has both vulnerable and viable impacts on SSF (Figure 6.2). NGOs and donor agencies are crucial in providing financial aid in conservation efforts and supporting local fisher communities by improving their life standards. From the fishers' experience, they have benefitted from NGOs to their households and livelihoods financially and through other means (building sanitary facilities, providing fishing gear and boats, capacity building of fisherwomen, and helping with children's education). Further, the influence of the Catholic Church plays a positive role by facilitating communication and mediating conflicts between the fisher community and authorities, taking the fisher perspective to decision-making levels. Community-led associations (e.g., FAs, WFAs, and TBA) play key roles in supporting viable fisheries. These village-level community associations are instrumental in communicating with authorities, educating fishers, collectively defending fisher rights, and mediating conflicts. Additionally, women-oriented village associations contribute to building the capacities of fisherwomen and providing credit loans to fisher households. However, the active functioning of stronger community-led associations is essential to effectively stand for its communities.

In summary, the analysis of drivers through SES, interactive governance, and domains of vulnerability and viability indicates that drivers influencing SSF within MPAs are not merely independently functioning. The drivers interact with one another, impacting each other's functioning, leading to dynamic, complex, and interlinked systems. These dynamics of drivers often create complexities making it difficult to govern resource usage. Therefore, careful consideration in conservation strategy development and governance interventions is needed to mitigate vulnerabilities and enhance SSF resilience.

6.4 Governance insights for future governance implications for transitioning from SSF vulnerability to viability

This section aims to propose future governance implications based on the drivers and attributes leading to the vulnerabilities and viabilities of SSF as examined through the social-ecological system (SES) and the current governance discussed in the above sections. Figure 6.3 illustrates how SES characteristics and governance systems impact the major domains of vulnerability and viability- ecological/environmental, socio-cultural, economic/development, and governance/management (Dias et al., 2023). As identified by the study, future governance implications involve three major improvements:

- (i) Incorporating SES characteristics in policy implementation (section 6.4.1)
- (ii) Increased community engagement (section 6.4.2)
- (iii) Improving institutions (section 6.4.3)

6.4.1 Consideration of SES characteristics in policy implementation

As discussed in section 6.3, the characteristics of core systems within the social-ecological systems of SSF and MPA contribute to the four major domains- ecological/environmental, socio-cultural, economic, and development and governance and management of vulnerability and viability of SSF (Figure 6.3). As examined in Figure 6.1, the third-tier and second-tier variables of the resource system, resource units, users, and interactions impact these major domains differently. Implementing new rules, regulations, and policy changes may exacerbate the vulnerabilities of the fisher community if the social and natural systems are not properly evaluated. A systematic evaluation of the social-ecological system enables hidden intrinsic characteristics of these systems to emerge and become visible in decision-making stages. Thus, when formulating policies, rules, and regulations on marine conservation, it is essential to consider the impact and interaction of these variables. This helps to identify the dynamics of the interconnected social and ecological systems. Evaluating contextual variables of an SES across multiple levels is essential for assessing governance outcomes (Ostrom, 2007b). In regards to this, Freitas et al., (2022) emphasize the importance of analyzing fishers' historical and cultural context and the existing power relations among stakeholders to navigate the challenges for fisher engagement in MPAs effectively. A systematic assessment of SES characteristics can be utilized to determine how policy implementation or changes affect the resilience of fisher communities. Hence, this characterization can be employed in building more adaptive governance

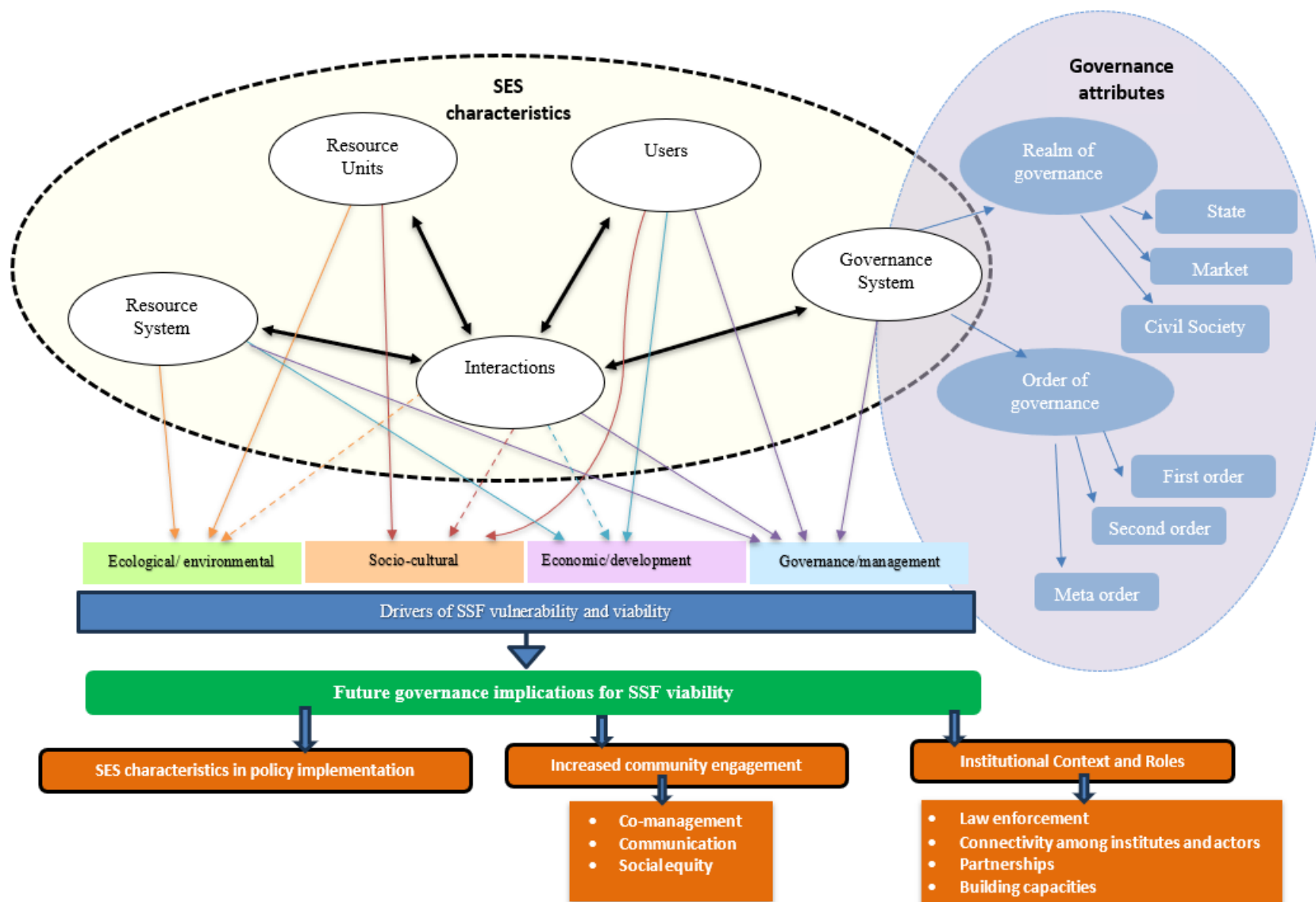


Figure 6.3. Attributes of SES and governance impacting domains of SSF vulnerability and viability

frameworks to ensure SSF resilience. Plummer & Armitage (2007) emphasize the need to assess ecological and livelihood sustainability as critical parameters in adaptive co-management for increasing resilience.

6.4.2 Increased community engagement

The study findings emphasize three key areas to consider in fostering community engagement: facilitating co-management, improving communication and feedback channels, and considering social equity in conservation efforts.

- **Co-management of MPA**

As discussed under governance and management in sections 6.3.4, the state's dominant role in decision-making and governance often results in limited community participation at both decision-making and operational levels. MPAs and fisheries are often complex and interconnected social-ecological systems to govern while being case-specific. This case study highlights the diversity within the fisheries system (small, medium, large scale, and export-oriented fishing), each contributing to varying levels of resource extraction and interactions that affect the health of the natural systems and SSF vulnerability. When the system under consideration is more complex, encompassing biophysical aspects and people, there is a greater need for careful consideration of collective judgment and interpretation (Berkes 2007). Thus, the paper proposes that future governance consider multiple resource users' perspectives, interactions, and impacts, encompassing different fishing scales and communities' geographical locations. Zagonari (2008) emphasizes that an integrated approach is more effective than a non-integrated one, including all sectors, prioritizing the local contexts over national strategies and concentrating user needs. Pomeroy & Berkes (1997) highlight the significance of governments' ability to accommodate shared responsibility and authority through more decentralized co-management that involves communities. They further suggest that restructuring existing legal frameworks may require consultations with communities. Further, decision-making can be encouraged to emerge at the community level with a bottom-up approach. Pathways should be created to engage fishers and community members to participate in and be responsible for governance tasks in day-to-day MPA activities, including monitoring, routine maintenance, ongoing decision-making, and enforcing rules. Community-centered management can be facilitated by building capacities of communities through outreach awareness programs and training in

sustainable fisheries and creating incentive systems to recognize and reward people's contribution to active governance.

- **Improved communication and feedback channels**

Community involvement in decision-making is crucial for effectively communicating fisher's perspectives in policy formulations. Further, expanding the room for open, transparent discussions and negotiations between authorities and communities is essential. Thus, community-centered management can be strengthened by encouraging the formation of formal and informal associations and committees at the village level. As stakeholder participation empowers local communities, with their images and expectations negotiated, MPA governance is more likely to achieve both the conservation and socioeconomic goals of communities (Chuenpagdee et al., 2020).

- **Considerations on social equity**

To enhance inclusive governance, future governance may seek ways to reach out to and engage more diversified community groups, encompassing locations and resource dependencies (e.g., fishing scales). To reach remote communities, strategies are needed to overcome geographical, logistical, and infrastructure barriers. An improved understanding of diverse stakeholder perceptions is recognized as an effective strategy in MPA management by Bennett et al., (2020) in their case study of SSF social equity in the Mediterranean Sea. Another study that follows interactive governance theory from Global South emphasizes the necessity of increasing inclusive participation of local communities within the governing system to ensure equitable and environmentally sustainable arrangements (Das et al., 2022).

Moreover, the case study highlights the disparity in economic benefits accrued from MPA across villages based on their location, limiting access to alternative income sources and infrastructure. Thus, future governance may benefit from assessing the social impacts and injustice associated with MPA and related development projects, such as tourism, by addressing equitable benefit-sharing (Kirkman et al., 2023).

6.4.3 Institutional context in governance

Future governance implications may incorporate the institutional context concerning law enforcement, connectivity among institutes and actors, partnerships for consistent governance, and the development of communities' adaptive capacity.

- **Law enforcement**

While community engagement is instrumental in MPA governance, the guidance of robust institutional frameworks is crucial as institutes and laws help shape the governance. The case study's findings indicate that a significant proportion of governance perspectives lean towards second-order governance arrangements, highlighting the need for more effective law enforcement. The need for more efficiently enforced and adaptive rules is considered to strengthen governance. This emphasizes the critical role of institutional governance in formulating and enforcing. This community perception aligns with Oliveira Júnior et al., (2024) that emphasizes that strong, enforced legal frameworks are effective in managing MPAs. Further, the institutional role in fostering comprehensive fisheries management is vital in ensuring fair access to resources and the survival of marginalized fisher communities. The research findings underscore the urgent need to address overfishing, transboundary fishing, and destructive resource extraction for sustainable future resource governance. Wimalasena & de Mel (2012) in their study on Kalpitiya fisheries highlight that the resource rent of purse seiners is significantly higher, and thus, prompt regulatory actions are required to offset exploitation rates. Moreover, the research findings align with Mattingley et al. (2016), emphasizing governance requires regulating transboundary fishing to preserve the system from overexploitation. Additionally, Kirkman et al. (2023) highlight the need for dedicated, well-trained staff to facilitate effective enforcement of MPA and fishery regulations.

- **Connectivity among institutes and actors in governance**

As identified in governance attributes, the state, markets, and civil society play vital roles in MPA governance and the fisher community. Mattingley et al. (2016) reveal that the lack of engagement by higher government levels is the biggest challenge when proceeding with the ecosystem approach to

fisheries management of the Kalpitiya spinner dolphin. Thus, future governance implications may involve more cohesion among these actors. While the state plays an instrumental role in formulating policies, collaboration among state institutes is equally important. Improving clarity regarding the goals and objectives of each institution and their complementary role in MPA governance is essential to establish a clear understanding of institutional responsibilities. Additionally, effectively communicating these roles to communities is needed to avoid confusion about institutional functions and services provided. Other than that, the state's role in regulating markets is essential to widening equal market opportunities and ensuring fair prices for different fishing scales. The regulatory framework is also powerful for regulating destructive fishing and communicating conservation regulations. Many underprivileged fishermen rely on these business owners and fishmongers for their livelihoods, often borrowing gear and boats and working as laborers under their large-scale fishing activities. Thus, addressing existing power imbalances among market actors, such as fishmongers and businessmen, is necessary to regulate certain fishing activities.

In addition to markets, the study highlights the instrumental role of civil society, including NGOs, donor agencies, FAs, WFAs, TBA, and the Catholic Church in governance. NGOs and donor agencies can provide vital financial, physical, and human capital to successfully operate conservation projects. These agencies have also proved their ability to improve the life standards of fishing communities at household levels, as discussed in the previous sections. These agencies are further helpful in building capacities of fishers, women, youth, and schoolchildren and educating and developing skills in alternative livelihoods. Moreover, community-driven organizations such as FAs, WFAs, and TBA are essential for representing their community segment in negotiations, capacity building, connecting communities, and conflict resolution. Therefore, these institutes must actively engage in governance tasks and decision-making processes. A comprehensive governance framework thus requires considering all these three major actors -state, markets, and civil society - engaged actively in governance, performing their influential tasks at all stages possible.

- **Partnerships for consistent governance of MPAs**

Participants in this study highlighted the need for consistent, ongoing monitoring and maintenance to ensure viable fish stocks and restore life below water. These activities are often restricted by inadequate funding and inconsistent partnerships with NGOs and donor agencies. Thus, long-term maintenance plans that include these stakeholders are crucial to achieving sustainable governance practices. Meilana et al. (2023) their study on Indonesian MPAs emphasizes inadequate funding for necessary infrastructure, facilities, and human capital as a significant challenge to effective MPA governance. Therefore, building partnerships with NGOs, donor agencies, businesses, and other institutes (research, academic) is crucial to ensure a continuous supply of funding and technical assistance. The study findings align with Giakoumi et al. (2024) in MPAs in Southern European Seas, who highlight the need for adaptive monitoring frameworks, collaboration and knowledge co-production among stakeholders, budgetary allocations, and technological utilization for monitoring MPAs.

- **Building adaptive capacity of communities**

Cinner et al. (2018) highlight how technological advancements build the adaptive capacities of communities. Technological advancements increase communities' adaptability, improving productivity through the usage of new technologies and improving efficiencies, particularly in tropical coastal communities (Cinner et al., 2018). The study's respondents expressed optimistic opinions regarding the potential for new tech advancements to improve their fisheries activities. The fisher community's needs can be coupled with institutional initiatives to introduce sustainable fishing gear and techniques and educate them regarding sustainable resource use.

Tourism development resulted after the MPA implementation in the case study location, generating new livelihood opportunities. Livelihood diversification can further enhance the adaptive capacity of the fisher community, leading to relying on several income sources. Alternative livelihoods help increase economic resilience, reducing pressure on marine resources (Allison & Ellis, 2001).

6.5 Conclusions and Chapter Summary

This chapter highlighted two major domains that exacerbate vulnerabilities and undermine the viabilities of SSF in MPA, namely, governance and management and economics and development (section 6.2.1). Moreover, ecological and environmental, and economic and development domains are further highlighted to contribute to facilitating viable fisheries (section 6.2.2). In addition to identifying the most impacting domains in section 6.2, this chapter further expanded into categorizing the social-ecological system characteristics of SSF and MPA under each of the four major domains, discussing how they impact SSF vulnerability and viability (section 6.3). The study findings on MPA governance (in Chapter 5) were further categorized under the governance and management domain, highlighting how the order of governance and role of institutes lead to the vulnerability and viability of SSF. Finally, the chapter synthesized its findings, proposing future governance implications for facilitating SSF viability (section 6.4). These implications included considering SES characteristics in policy implications, increased community engagement in governance, and effective institutional role in governance.

Chapter 7

Summary and Conclusions

7.1 Introduction

This chapter summarizes the case study findings discussed throughout the paper so far. The case study was focused on transitioning from vulnerability to viability of SSF based on Bar Reef Marine Sanctuary, Kalpitiya, Sri Lanka, an island country in the global south. The chosen study location, Kalpitiya, is a popular fishing area with diverse users in Sri Lanka, as well as tourism and recreational activities resulting from the MPA implementation. The study was conducted in four fishing villages in the Kalpitiya DS, both mainland -Kandakuliya, Kudawa, Kalpitiya, and island -Uchchimunei. The study employed a qualitative approach in examining the vulnerabilities and viabilities of SSF regarding the existing MPA governance structure, reaching out to diverse stakeholders (n=51) in Kalpitiya over a three-month period from October 2023 to January 2024. The study employed snowball sampling to recruit participants, including small, medium, and large-scale fishers, export-oriented fishers, fish mongers, presidents and secretaries of village-level associations (FA, WFA, TBA), tourism persons, and state institute officials. The data collected through semi-structured interviews, focused group discussions, observations, and literature were analyzed using social-ecological systems framework and interactive governance to identify drivers and attributes of SSF vulnerability and viability and future MPA governance attributes. Thus, this chapter summarizes the research findings under each research objective, highlighting recommendations, key contributions, and insights for future research.

7.2 Summary of research findings

The following four objectives and related research questions guided the case study. Objective one aimed at building a thorough understanding of small-scale fisheries and MPA governance in the chosen case study location, characterization of the MPA, SSF, and their interactions. Objective one was examined broadly under Chapters 4 and 5.

Objective 01: To characterize the MPAs, SSF, and their interactions

- **RQ 01:** *What are the characteristics of SSF, MPA, and their interactions?*

Chapter 4 aimed to contextualize the social and natural systems of SSF and MPA and identify their intrinsic characteristics. For this purpose, the social-ecological systems framework was employed to examine the second-tier and third-tier variables of the core subsystems-resource system, resource unit, users, and their interactions separately for each of the social-SSF and ecological- MPA systems.

The SSF Kalpitiya was identified to be an industry passed down from generation to generation, using and evolving over the years in low-tech gears, non-motorized/motorized boats, less tech usage, and highly dependent on skills and mostly targeting the domestic market. Further, SSF is a labor-intensive (1-3 persons) job, levels and generating lower income levels compared to other fishing jobs in the area. SSF in Kalpitiya is mainly limited to nearshore and lagoon regarding resource system boundaries. Fishers have lower formal education levels yet a higher understanding of natural system dynamics in the area where fishing is an early learned life skill in these fisher communities. Island fishers face challenges in access to infrastructure, markets, transportation, and alternative livelihoods. In general, the fishing industry in the area is challenged by an increasing population, which increases pressure on resource extraction.

The MPA of interest, with an extent of 30,670 ha, is a rich ecologically, biologically, and aesthetically important ecosystem generating economic benefits to the community. This is a marine space that provides fish habitat and breeding places. However, the natural system is challenged by past natural disasters (El Nino) and fishing practices. Its spillover effect positively impacts increasing fish stocks and fish availability in other marine spaces. However, respondents had mixed perceptions of its regeneration rates. Currently, tourism economically benefits from the MPA and mainly relies on the MPA and its adjacent tourism development projects.

This analysis of the social and ecological systems enabled us to identify each of the system characteristics impacting SSF vulnerability and viability discussed in Chapter 6.

- **RQ 02:** *What are the current practices of MPA governance in the selected study location?*
- **RQ 03:** *How has the governance of the MPA impacted its local SSF industry?*

Then, chapter 5 was designed to examine the SES's governance system, evaluating its current governance, institutional roles, and governance challenges. An interactive governance framework was utilized to thoroughly analyze the governance system, highlighting the roles of the actors involved in governance and governance by orders.

The MPA governance involved several key state institutions with a top-down decision-making approach in governance structure with less fisher participation, highlighting the key role of the state encompassing first and second-order governance. The current management faced several challenges: ineffective monitoring, poor communication and connection with fisher communities, unclear institutional roles, and unregulated fishing practices. The potential role of the market in influencing fishing practices is also highlighted for having vulnerable and viable impacts on SSF. Civil society (NGOs, donor agencies, community-led associations, Catholic church) further influences supporting conservation efforts, improving life standards of fishers, communication, and conflict resolution.

The findings of Chapters 4 and 5 were then incorporated into Chapter 6 to identify major drivers and attributes of SSF vulnerability and viability.

Objective 02: To examine the key drivers that exacerbate the vulnerability of SSF in MPAs

- **RQ 04:** *What are the key drivers that exacerbate the vulnerability of SSF in an MPA governance setting?*

The first part of Chapter 6 addressed objectives 2 and 3 of this research. The first section discussed two major domains; (i) governance and management and (ii) economic and development—and their drivers exacerbating vulnerabilities and undermining the viability of SSF. Governance and management included ineffective management (no ongoing monitoring, law enforcement, unregulated markets, poor fisheries management) and less community involvement in decision-making. However, 21 respondents mentioned that the MPA has not impacted SSF vulnerability.

Objective 03: To examine the key drivers that facilitate the viability of SSF in MPAs

- **RQ 05:** *What are the key drivers that facilitate the viability of SSF in an MPA governance setting?*

The next section of Chapter 6 identified two major domains; (i) ecological or environmental and (ii) economic and development that have viable impacts on SSF. Ecological /environmental included drivers such as restoration of marine ecosystem (habitat restoration, coral replanting), higher fish stock/biodiversity (fish habitat and breeding place), regeneration of fish stock by spill-over effect, and natural disasters resulting from protection from corals.

The economic and development domain involved drivers of diversification of livelihoods through more tourism opportunities to have viable impacts generating alternative income sources while having vulnerable effects leading to exclusion from landing sites and having negative impacts on socio-cultural aspects.

Objective 04: To examine the key attributes of an appropriate MPA governance arrangement effective to facilitate the transition of SSF from vulnerability to viability

- **RQ 05:** *What are the appropriate MPA governance practices for making small-scale fisheries viable?*

The latter part of Chapter 6 synthesized Chapter 4- characterization of SES and Chapter 5- governance system to identify the criteria to consider for an appropriate MPA governance. This was done by categorizing the key findings of Chapters 4 and 5 under each of the four major domains highlighted by Dias et al. (2023)- ecological and environmental, socio-cultural, economic and development, and governance and management. This highlighted the SES characteristics and governance attributes leading to each of the above major vulnerability domains and SSF's viability. Based on this, three major future governance implications were proposed: (i) considering SES characteristics in policy development, (ii) increasing community involvement in governance, and (iii) considering the context and roles of institutes in governance. This section emphasized the importance of a comprehensive evaluation of the core elements of SES – resource system, resource units, users, governance system, and their interactions in

policy design. This allows us to uncover SES dynamics in decision-making processes. Moreover, Chapter 6 discussed the importance of increasing community engagement through co-management, improved communication, and social equity. Additionally, the chapter highlighted the roles and context of institutes in terms of law enforcement, strong institutional roles, the importance of partnerships, and capacity building in future governance.

7.3. Key contributions

This section highlights how the case study contributes to the social-ecological systems framework adopted by the research and to transition from vulnerability to viability of SSF.

- **For Theoretical framework - Social-ecological systems framework**

The SES framework was used to examine the core systems (resource system, resource unit, users) and their interactions with the social and natural systems of the case study. This assessment aimed to identify the characteristics of the SSF and MPA under second-tier and third-tier variables to develop a thorough understanding of the social-ecological system of interest. The broad core systems of SES can be unpacked into multiple tiers, which can be further unpacked into different tier levels (Ostrom, 2007). The conceptual hierarchy of these multiple variables can be decided based on the needs of the researcher to fit into a particular empirical or policy question under investigation (Ostrom, 2007). Thus, the empirical case study unpacked the general second-tier variables into their third-tier variables that can be employed to broadly characterize the small-scale fisheries and MPA systems as summarized in the below tables (tables 7.1, 7.2, 7.3, and 7.4). However, applying the third-tier variables may be case-specific depending on the social and natural systems under examination. Identifying third-tier variables enables a deep examination of the intrinsic features of SSF and MPAs, describing the core components: resource system, resource units, users, and interactions. Most importantly, this extended framework components up to third-tier variables can be utilized in policy design at the initial levels to develop a detailed image of the MPA and related systems under consideration. Moreover, these can be used to measure ongoing assessments and progress evaluations of conservation projects and their impacts on each variable. In this way, the variable identification helps identify how each social and natural system under consideration is vulnerable to existing conditions and policy changes.

Table 7.1. The third-tier variable of the resource system of SSF and MPA

Second-tier variables	Third-tier variables	
	Small-scale fisheries	MPA
Sector	Tradition	Biological components
	Type of gears	Physical components
	Type of boats	Aesthetic value
	Labour usage	Economical value
	Socioeconomic condition of SSF	Biological value
	Duration/Time of the day	
Clarity of resource System Boundaries	Marine spatial distance	Zones & demarcation
Size of resource system		Area of the MPA
Human-constructed facilities	Services	On-site facilities
	Markets	Off-site facilities
	Fish processing	
Productivity of system		Number of marine species
		Fish breeding place
		Fish habitat
		Productivity rate
Equilibrium properties		Natural disasters
		Man-made destructions
		Status of equilibrium
Predictability of system dynamics	Seasons	Seasons
	Climate conditions	Fish navigation patterns
	Fish behaviour	Fish availability
	Fish navigation patterns	Impact of fishing practices
	Fish availability	
Storage characteristics	Post-harvest practices	Status
Location	Transportation	Administration zone

	Less infrastructure Access to markets Alternative livelihoods	Geographical location
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Table 7.2. The third-tier variables of resource units of SSF and MPA

Second-tier variables	Third-tier variables	
	Small-scale fisheries	MPA
Resource Unit Mobility	Fish migratory patterns	Mobility rate
	Spatial distribution	Spillover effect
Growth and replacement rate		
Interaction among resource units	Underwater food chain	Biological effects
Economic Value	Market value	Alternative livelihoods
	Harvest level	Disparity of opportunities
	Price negotiation	
Number of units	Fish stock	Stocks of marine life
Distinctive characteristics	Fish Species	Ecosystem functions of flora
	Other species	Ecosystem functions of fauna
	Distinct taste of fish	
Spatial and temporal distribution	Location	
	Seasonal effect	

Table 7.3. The third-tier variable of users of SSF and MPA

Second-tier variables	Third-tier variables	
	Small-scale fisheries	MPA
Number of users		
Socioeconomic attributes of users	Gender	Alternative income sources
	Race	Income levels
	Population and density	Access to infrastructure
	Livelihoods	
	Household income	
	Education levels	
History of use	The transition between fishing jobs	Extractive activities
		Unintentional impacts by humans
Location	Dispersal of different fishing jobs	Proximity to MPA
	Proximity to landing sites and markets	
	Migration	
Leadership/Entrepreneurship	Institutions Community members	Conservation
Norms/social capital	Social connectivity	Social connectivity
	Norms	
	Conflicts	
Knowledge of SES/mental models		
Dependence on resource	Livelihoods	Livelihoods
	Skills	
Technology used		

Table 7.4. The third-tier variable of interactions

Second-tier variables	Third-tier variables
Harvesting levels of diverse users	Intensity
	Techniques
	Markets
	Seasonality
Information sharing among users	Organizations
	Civil
Deliberation processes	Communication channels
	Power dynamics
	Exclusion/Inclusion
Conflicts among users	Resource unit wise
	Scale wise
Investment activities	State
	Donors
Lobbying activities	

- **For transitioning from vulnerability to viability of SSF in MPAs**

As mentioned in Chapter 01, the study aimed at contributing to a systematic understanding of key drivers of vulnerabilities and viabilities of SSF communities in MPAs and suggesting ways of shaping the identified vulnerabilities of SSF into viable options within the MPA governance context and proposing the most appropriate and collaborative MPA governance practices. The study intended to explore ecological, socio-cultural, economic and governance considerations. As discussed in Chapter 6, the major vulnerabilities and viabilities of the case study area were identified under ecological/environmental, socio-cultural, economic and development, and governance domains. Additionally, the characteristics of the social-ecological system identified in Chapter 4 were further categorized under each of the above four

domains based on the ways the characteristics of core subsystems make these natural and social systems vulnerable or viable. Identifying and categorizing vulnerabilities and viabilities is essential to lay the foundations for the V2V transition process. Further, recognizing system characteristics adds to MPA's impact on communities. In addition to systems contextualization, the governance perspectives recognized from the research findings in Chapters 5 and 6 can be utilized in future governance of MPAs or conservation practices. Chapter 5 highlighted the drawbacks and limitations of the existing MPA governance with centralized state involvement and limited community participation. As discussed in Chapter 6, these drawbacks can be addressed by contextualizing existing SES and increasing community involvement with more considerations of institutional roles. The research findings align with co-management practices in MPA governance as an effective way to transition from SSF vulnerability to viability. Thus, the empirical knowledge built through the case study helps build literature confirming the need for more community involvement in protected area governance and the effective role of institutions encompassing state, markets, and civil society.

7.4. Recommendations

The research findings can be applied to the growing policy considerations in MPA and protected area governance.

1. Shifts towards more fluid and adaptive governance rather than rigid structures through constant assessing and learning from systems under consideration.
 - Conservation practices and policy formulations may shift towards adaptive governance practices contextualizing highly complex and interconnected natural and social systems (such as MPA and SSF) under consideration at the initial stages of policy design and ongoing progress evaluations while assessing the impacts made by governance.
2. Increasing community participation in decision-making and operationalizing protected area governance through co-management.
 - Community perspectives need to emerge at decision-making tables. They can be encouraged through routine consultations with communities and broadening pathways for the community

members to hold responsibilities in routine management tasks such as monitoring, maintenance, and law enforcement.

3. Improving communication and feedback channels

- More open, transparent discussions and negotiations must occur with the participation and representation of the diverse user groups in the community and authorities. Most importantly, feedback channels needed to be carefully developed and maintained.

4. Effective assessment of outcomes of development projects

- Certain MPA governance may come with an attached tourism development plan, as in this case study. Thus, it is necessary to closely evaluate the equal benefit distribution of these projects among communities. In contrast, impacts from other development projects (power plants) on environments and society may be intensively assessed to minimize disastrous outcomes.

5. Effective law enforcement in conservation and fisheries management

- Future governance needs to prioritize developing and reinforcing rules and regulations on conservation and fisheries, addressing issues such as overfishing, destructive fishing and resource extraction, and transboundary fishing.

6. Institutional collaboration in governance

- Future governance may consider more cohesive and collaborative functioning among state, market, and civil society actors. Clear communication among these institutions, clarity of goals and objectives, and addressing power imbalances within institutions need to be considered.

7. Building partnerships for facilitating governance and community capacity building

- Collaboration with NGOs and donor agencies is essential to meet desired conservation goals through a continuous supply of financial, physical, and human capital. In addition, these

institutions help develop communities' well-being while building capacities and providing alternative livelihood opportunities.

8. Future research implications

- MPA governance is a complex and pressing concern with a broad spectrum of components, including regional, national, and international considerations. Thus, the research suggests areas to uncover through future research as follows.
 - Future research may consider more diverse social groups, encompassing Indigenous communities and communities in different geographical locations worldwide, to build a comprehensive MPA governance strategy.
 - This paper is limited in its representation of various experiences and insights, particularly those of women. Hence, future research may incorporate more diverse gender perspectives on MPA governance.
 - Community perceptions based on ethnicity, race, religion, values, and beliefs may vary from one community to another or even within the same geographical area. These diverse perspectives affect resource utilization differently, which needs to be researched extensively.
 - Political influences and tensions in MPA and fisheries management are other areas that can be extensively researched to strengthen governance perspectives.

7.5. Final remarks

Based on a case study, this paper tries to develop a comprehensive understanding of these systems, the domains, attributes of vulnerabilities, and vulnerabilities of SSF, and how those can be utilized in governance implications in the future. Governance of complex interconnected social and ecological systems such as fisheries and MPAs is not a uni-directional method. The connected nature and dynamics existing within these systems make it difficult to draw rigid lines in policy implications. However, more interdisciplinary measures may be adopted in policy formulations in protected area governance. Most importantly, as the researcher, I find that the majority of the fisher communities are optimistic about MPA outcomes and are willing to be a part of it. However, there is still a good potential to educate communities

and build their resilient capacities while adopting sustainable fishing practices. Moreover, conservation may be in vain if local communities are barely represented in decision-making due to rigid, ineffective institutional dominance. Thus, more collaborative measures needed to be taken to involve them in the future.

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Appendix A

Semi-structured Interview Protocol- Community Member Version

The broad questions aim to examine the interactions of the complex, dynamic social-ecological system of small-scale fisheries and MPAs. The questions are focused to identify the key drivers that either exacerbate or undermine the vulnerability and viability of small-scale fisher communities and characterize key attributes of an appropriate and effective MPA governance arrangement that ensure the viability of small-scale fisher communities.

Begin audio-recording.

Section 1: Demographic Information

1. Please tell me about yourself and your family.

Section 2: Objective 01 -*Note these questions are intended to characterize the social-ecological system of MPA, SSF, and their interactions.*

1. How do you describe the ecosystem that has been protected under the MPA? (*Guide: national or world significance/home to endangered marine life/economic value/scenic value/role of hotel and tourism industry*)
2. Please describe the nature of the resource units in this ecosystem.
3. Please describe you and your community as small-scale fishers.
4. How important fishing is to you? (*Guide: Economically, socially, culturally, etc.*)
5. Please tell me about your fishing activities. (*Guide: How did it happen to fish in this area? How often do you fish? What tools do you use? Which species do you fish - endangered species or any other biotic and/or abiotic drivers that you extract from the sea? Your favorite or usual place of fishing based on distance from the coast, time of the day/season & the reason for that?*)
6. Please describe your connection to this marine and coastal ecosystem and the community. (*Guide: How important is this ecosystem to you? What are your social/cultural values related to this ecosystem?*)

7. What are the challenges to this ecosystem from your perspective? *(Guide: The reasons that led to setting up the MPA, ongoing challenges, illegal activities, IUU, water pollution, sea mining, tourism etc.)*
8. Please describe the actors involved in this SES and their interactions, and networks.

Section 3: Objective 02 - *Note these questions are intended to address the objective of key drivers and attributes that either exacerbate or undermine the vulnerability and viability of SSF in the MPA governance setting.*

9. How has the MPA impacted your life? *(Guide: Talk about any negative, positive, or mixed impacts)*
10. What are the benefits of the MPA to yourself, your community, your village, and the ecosystem? Please explain.
11. Can you compare how you feel about the marine ecosystem, your life, and your community before and after the implementation of the MPA? *(Guide: inclusion/exclusion)*

Section 4: Objective 03 - *Note these questions are intended to examine the current MPA governance strategies.*

12. Please describe the current MPA governance/management in this area. *(Guide: goals and objectives, zoning practices, rules, regulations, etc.)*
13. Let's talk about the institutions involved in MPA management in this area. What are those institutions? What is their contribution to MPA management? How do they interact with each other, the SSF community, and other stakeholders?
14. Please describe how you are being involved in the management of MPA and in which ways all these years. *(Guide: Talk about your traditional knowledge/values/skills being considered in MPA management)*
15. How are the current MPA governance/management practices being effective to meet its objectives so far? If they have failed, please describe why.
16. If you get an opportunity, what would you change about the current MPA governance system?

Section 5: Objective 03 - Note these questions are intended to address the objective of characterizing the key attributes of an appropriate MPA governance.

17. Please describe which criteria to be given more attention in the future when planning an MPA.

18. Please describe the role of the governing bodies that should involve in effective MPA governance.

19. How would you want to position your role/contribution in such an MPA governance system?

20. Describe the most appropriate governance of MPA look like to you.

End audio-recording.

- • Who else do you know that you think I should talk to?

Conclusion:

Thank you for taking the time to speak with me today. All the information you have disclosed will remain confidential. Feel free to contact me if you have questions or if you think of anything else you want me to know. May I contact you if I have any follow-up questions? Once I've transcribed this interview, I'll send

you a summary of our interview for you to review before incorporating it into my research findings.

Would you like to be contacted about my final research findings?

Appendix B

Semi-structured Interview Protocol- Official Representatives of State/NGOs/Other Related Institutions Version

Begin audio recording.

Section 1: Demographic Information

1. Which institution do you represent/work at?
2. What is your role there?

Section 2: Objective 01 -*Note these questions are intended to characterize the social-ecological system of MPA, SSF, and their interactions.*

1. Please describe the characteristics of the marine and coastal ecosystem protected under this MPA. *(Guide: national or world significance/home to endangered marine life/economic value/scenic value/role of hotel and tourism industry/threats & disturbances to the ecosystem/ any other distinct properties)*
2. Please describe the key characteristics and the nature of the small-scale fishing industry in this area.
3. Please describe the other activities happening around this ecosystem and their impacts? *(Guide: any industrial developments, tourism, and their impacts on the ecosystem)*
4. How do you explain the relationship between the local SSF industry, other related actors, and the MPA?

Section 3: Objective 02 - *Note these questions are intended to address the objective of key drivers and attributes that either exacerbate or undermine the vulnerability and viability of SSF in the MPA governance setting.*

1. Please discuss key vulnerabilities of the SSF in this area.
2. What are the drivers/drivers leading to SSF vulnerability?
3. Please explain the impacts of each of these drivers on SSF, ecosystem, livelihoods, and others.
4. Please discuss key viabilities of the SSF as impacted by the MPA.

5. In which aspects the MPA has impacted the post-harvest fish value chain and fish markets?

Section 4: Objective 03 - *Note these questions are intended to examine the current MPA governance strategies.*

1. Please discuss the current MPA governance in this area. (*Guide: rules, regulations, who/which institutions are involved in policy setup/decision-making process, enforcement, and monitoring, sanctioning, feedback system*) Please discuss the role of different related institutions in the MPA governance/management.
2. How do communication and coordination take place among these institutions?
3. Please discuss how the actors who are dependent on this marine and coastal ecosystem are involved in the MPA governance.
4. What are the impacts of current MPA governance on the vulnerability and viability of SSF?
5. Can you discuss any conflicts, or challenges regarding the current MPA governance and mitigation process?

Section 5: Objective 03 - *Note these questions are intended to address the objective of characterizing the key attributes of an appropriate MPA governance.*

1. Describe the elements, future governance structure, and interactions of an effective MPA governance from your perspective.
2. Explain how that can contribute to the vulnerability to viability transition of the resource-dependent community and SSF.
3. Describe the scale of community participation in future MPA governance and decision-making processes.

End audio-recording.

- Who else do you know that you think I should talk to?

Conclusion:

Thank you for taking the time to speak with me today. All the information you have disclosed will remain confidential. Feel free to contact me if you have questions or if you think of anything else you want me to know. May I contact you if I have any follow-up questions? Once I've transcribed this interview, I'll send you a summary of our interview for you to review before incorporating it into my research findings. Would you like to be contacted about my final research findings?

Appendix C

Focus Group Activity Guide

1. As a group, discuss the following with regard to the marine and coastal ecosystem, and your community.

- Discuss the characteristics of the marine ecosystem and the MPA.
- Discuss the characteristics of your small-scale fish industry and your community.
- Discuss relationships, interdependencies between the ecosystem and the community.

2. As a group, discuss how the MPA has impacted to you, and your community and the ecosystem.

- Gains and losses
- In which ways affected

3. As a group, discuss the most appropriate governance structure of an MPA.

- What should be the concerns, goals and objectives?
- Institutions, and personnel that governs, their role
- Community's role and participation in governance
- Governance practices

Appendix D

Ethics Clearance

UNIVERSITY OF WATERLOO

Notification of Ethics Clearance to Conduct Research with Human Participants

Principal Investigator: Prateep Nayak

Student investigator: Nilushika Gamage

File #: 45677

Title: Transitioning from Vulnerability to Viability: Small-Scale Fisheries in Marine Protected Areas

The Human Research Ethics Board is pleased to inform you this study has been reviewed and given ethics clearance.

Initial Approval Date: 10/13/23 (m/d/y)

University of Waterloo Research Ethics Boards are composed in accordance with, and carry out their functions and operate in a manner consistent with, the institution's guidelines for research with human participants, the Tri-Council Policy Statement for the Ethical Conduct for Research Involving Humans (TCPS2 2022), the Ontario Personal Health Information Protection Act (PHIPA), and all laws and regulations of the province of Ontario (as applicable). Additionally, CREB operates in a manner consistent with the International Conference for Harmonization of Technical Requirements for Pharmaceuticals for Human Use (ICH) Guidance E6(R2): Good Clinical Practice, the International Organization for Standardization of Good Clinical Practices (GCP) as set out by ISO 14155 - Clinical investigation of medical devices for human subjects, Part C, Division 5 of the Food and Drug Regulations, Part 4 of the Natural Health Products Regulations, Part 3 of the Medical Devices Regulations. Both Boards are registered with the U.S. Department of Health and Human Services under the Federal Wide Assurance, FWA00021410, and IRB registration number IRB00002419 (HREB) and IRB00007409 (CREB).

Expiry Date: 10/14/24 (m/d/y)

Multi-year research must be renewed at least once every 12 months unless a more frequent review has otherwise been specified. Studies will only be renewed if the renewal report is received and approved before the expiry date. Failure to submit renewal reports will result in the investigators being notified ethics clearance has been suspended and Research Finance being notified the ethics clearance is no longer valid.

Level of review: Delegated Review

Signed on behalf of the Human Research Ethics Board



Karen Pieters, Manager, Research Ethics, karen.pieters@uwaterloo.ca, 519-888-4567, ext. 41495

This above named study is to be conducted in accordance with the submitted application and the most recently approved versions of all supporting materials.

Documents reviewed and received ethics clearance for use in the study and/or received for information:

file: 1_Verbal_recruitment_script_Community_Member_Version3_20231001.pdf

file: 2_Organization_Recruitment_Material_Version_20231001.pdf

file: 3_FOCUS_GROUP_VERBAL SCRIPT_RECRUITMENT_MATERIAL_Version4_20231013.pdf

file: ConsentLog_version1_20230822.pdf

file: Photo_Video_Consent_Form_version3_20231001.pdf

file: 1b_INTERVIEW_VERBAL_CONSENT_SCRIPT_COMMUNITY_MEMBER_VERSION4_20231013.pdf

file: 2_INTERVIEW_WRITTEN_CONSENT_FORM_OFFICIALS_VERSION4_20231013.pdf

file: 1a_Interview_Information_Letter_Community_Member_Version4_20231013.pdf

file: 3_FOCUS_GROUP_WRITTEN_CONSENTFORM_VERSION4_20231013.pdf

file: Participant_Feedback_Appreciation_Letter_version3_20231001.pdf

file: Survey_Questionnaire_version2_20230919.pdf

file: Focus_Group_Activity_Guide_version2_20230919.pdf

file: InterviewProtocolCommunityMember_version1_20230822.pdf

file: InterviewProtocolRepresentatives_version1_20230822.pdf

file: Post_workgroup_information_sheet_Version4_20231013.pdf

Approved Protocol Version 6 in Research Ethics System

This is an official document. Retain for your files.

You are responsible for obtaining any additional institutional approvals that might be required to complete this study.