

Role of Social Capital and Relational Well-being in Shaping the Community Level Responses to
Tropical Cyclones among the Small-Scale Fisheries Communities in Chilika Lagoon, India

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.

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

Abstract

Small scale fisheries (SSFs) are more vulnerable to calamities brought on by natural hazards, changing climatic conditions, and climate change due to their proximity to the seashore. Dealing with these challenges is an added burden to already existing vulnerabilities, injustice and marginalization faced by them. The Indian subcontinent with a vast coastline extending up to 7516 kms (about 4670.23 mi), is vulnerable to world's 10% tropical cyclones, especially in the places adjacent to Bay of Bengal (BoB). Asia's largest and world's second largest brackish water lagoon, adjacent to BoB - Chilika lagoon, situated in Odisha state of India is extremely prone to catastrophic events, causing around 5-6 cyclones hitting the coast annually. SSFs who depend on the lagoon for their livelihood are on the forefront suffering from the repercussions of cyclonic activities. While resilience against events like cyclones is usually analyzed in terms of economic and infrastructure aspects, there is a lack of focus on the intrinsic material aspects contributing to community resilience in the face of climate related disasters. This research fills this gap by analyzing the community resilience of SSF's in Chilika Lagoon through the lens of social capital and relational well-being. Social capital measures the different links or connections a community has within and outside of their network that helps them build effective response strategies through collective action at the time of crisis. Communities with high social capital can bring community members together for better preparedness, emergency support, response, and recovery efforts. Nevertheless, it is not the existence of all these linkages that matters, but the quality and balance of all these ties are imperative. For instance, the effectiveness of these could be hindered in a community level resilience if it lacks the ability to address the power imbalance, social inequality, and trust.

Thus, relational well-being measures the quality of various networks through characteristics such as trust, reciprocity, support, and network dynamics which create a sense of motivation to work collectively. The study employs a qualitative case study approach and multiple data collection tools such as semi-structured interviews, non-participant observations, and focus group discussions. The key findings present the various

challenges faced by the communities in various systems like social, economic, environmental and physical and their interconnectedness, role of social capital and relational well-being in the various community level response to deal with the crises, the lack thereof due to power imbalance, social inequality, caste system and political power and finally providing recommendations to ensure tailored context specific approaches to enhance the community resilience against disasters like tropical cyclone in the future.

Keywords: Cyclones, Social capital, Relational well-being, Community responses, small scale fishers, Chilika Lagoon

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Table of Contents

Author’s Declaration.....	ii
Abstract.....	iii
Acknowledgements	v
List of Figures.....	x
List of Tables.....	xi
List of Boxes.....	xii
Chapter 1 Introduction.....	1
1.1 Background and Research Problem	1
1.2 Research Purpose and Objectives	5
1.3 Philosophical Worldview and Approach	6
1.4 Research Significance and Contributions	7
1.5 Study Limitations.....	8
1.5.1 Positionality Statement of Researcher	8
1.5.2 Limitations in data collection methods	9
1.5.3 Influence of external mediators.....	10
1.5.4 Triangulation.....	11
1.6 Organization of Thesis.....	11
Chapter 2 Literature Review	13
2.1 Introduction.....	13

2.2	Small-Scale Fishers' Vulnerability to Climate-related Disasters	13
2.3	Importance of Social Capital During Disaster Events	16
2.4	Measurement of Social capital: Relational wellbeing and Response Strategies	21
2.5	Chilika Lagoon: Small-Scale Fishers and Disaster Impacts	26
2.6	Conceptual Framework for Research.....	28
Chapter 3 Case Study Location and Methodolgy		31
3.1	Introduction.....	31
3.2	Case Study Locations.....	31
3.2.1	Villages selected for the case study	32
3.3	Research Design.....	37
3.4	Data Collection	39
3.4.1	Sampling	41
3.4.2	Scoping	43
3.4.3	Non-Participant Observation.....	43
3.4.4	Semi Structured Key Informant Interviews	44
3.4.5	Focus Group Discussions.....	45
3.5	Data Analysis	46
3.5.1	Multiple sources of data - A contribution to Data analysis.....	46
3.5.2	Thematic Data Analysis	47
3.6	Ethical Considerations	48

Chapter 4 Community Level Consequences in the Face of Cyclone Threats.....	49
4.1 Introduction.....	49
4.2 Cyclones as a major threat to the Small-Scale Fishing Communities of Chilika Lagoon	49
4.2.1 Cyclone Induced Challenges in the Case Study Villages	57
4.2.1.1 Impact of Cyclone on Groundwater quality.....	58
4.2.1.2 Impacts of Cyclone induced Flooding.....	60
4.2.1.3 Loss of Casuarina trees from Cyclone and other Vulnerabilities.....	65
4.2.1.4 Cyclone Induced Challenges to Livelihood System, and various Socio-Economic Conditions.....	67
4.2.1.5 Challenges from Cyclone Induced Socio-Economic disruptions and Inadequate Protective Infrastructures.....	73
4.2.1.6 Cyclone Induced Psychological Impacts on Communities.....	80
4.3 Discussions.....	85
4.4 Chapter Summary and Conclusions.....	89
Chapter 5 The Interplay of Social Capital and Relational Wellbeing in Shaping Community Responses and Its Effectiveness.....	90
5.1 Introduction.....	90
5.2 Different forms of Social Capital in Action.....	91
5.3 Corroborating Social Capital and Relational Well-being of the Communities.....	99
5.4 Analysis of the Effectiveness of Community Responses.....	107
5.4.1 Preparatory Phase of the cyclone	108
5.4.2 During the Cyclone and Rebuilding Phase	112

5.4.3 Long term Adaptive Strategies for Prevention, Effectiveness and Challenges	120
5.4.3.2 Status of Cyclone Resilient Houses.....	125
5.4.3.3 Adaptation Gaps in Flood Control Measures and Safe Drinking Water Access.....	129
5.4.3.4 Community-led Funding Strategies to deal with crisis.....	130
5.5 Discussion.....	131
5.6 Chapter Summary and Conclusions.....	142
Chapter 6 Conclusions and Recommendations.....	143
6.1 Introduction	143
6.2 Summary of Study Purpose and Methodology	143
6.3 Key Research Findings	144
6.3.1 Objective One	144
6.3.2 Objective Two.....	146
6.3.3 Objective Three.....	149
6.4 Recommendations.....	153
6.5 Final Conclusions.....	155
REFERENCES.....	157
Appendix A.....	191
Appendix B.....	193

List of Figures

Figure 1: Different forms of social capital.....	19
Figure 2 : Conceptual Framework derived from the Literatures	29
Figure 3: Location of Villages selected for the Case study within the Chilika Lagoon.	33
Figure 4: The condition of barriers in Parbatipur	62
Figure 5: Images of Gangadharpur village condition:	64
Figure 6: Gabakund Cyclone shelter	74
Figure 7: Gangadharpur Cyclone shelter	75
Figure 8: Various impacts, vulnerabilities, and their interconnectedness.....	88
Figure 9: Bar graph comparing the social capital forms in action at various phases of cyclone in Gabakund and Gagadharpur.....	94
Figure 10: Bar graph comparing the social capital forms in action at various phases of cyclone in Mirjapur and Sub village Parbatipur.....	97
Figure 11: Summary of various response strategies adopted by case study communities during the preparatory stage.....	108
Figure 12: Synopsis of response approaches in the immediate recovery/rebuilding phase.	115
Figure 13: Synopsis of historical and status of Cyclone Resilience Strategies.....	121
Figure 14: Images of Scheme labels marked on the front walls of the recently built houses.	127
Figure 15: Images of broken houses which remind that recovery is incomplete until everyone has equally rebuilt.....	128
Figure 16: Images of incomplete houses due to insufficient funding.	128

List of Tables

Table 1: Comparison of three selected Case study villages	36
Table 2: Summary of Data collection Methods	39
Table 3: Summary of Sampling Strategies.....	42
Table 4: The list of devastating Cyclones that affected Chilika lagoon.....	50
Table 5: The list of Reported Cyclone Experiences in Case Study Locations.....	53
Table 6: Comparison of various challenges in the three research villages based on fisher's perspectives	57
Table 6: The summary of Overall Challenges as Reported by the Respondents	85
Table 7: Types of Social capital mentioned by the Respondents.....	91
Table 8: Summary of Relational well-being aspects emerging from the existing social capital forms. ...	106
Table 9: Categorizing the community level responses based on the Sources of Support or origin.	132
Table 10: Summary of the Community responses that is shaped by the existing social capital and Relational Wellbeing Aspects	136

List of Boxes

Box 2: Overview of Research Objectives (Objective one - highlighted)	49
Box 3: Overview of Research Objectives (Objectives two and three - highlighted)	90

Chapter 1

Introduction

1.1 Background and Research Problem

Small-scale fisheries (SSFs) are broadly characterized as traditional fishers involved in fishing for local and domestic consumption, using small fishing vessels and equipment with low capital and energy input (Béné et al., 2007; Islam & Chuenpagdee, 2022). Even though the above description characterizes SSFs as a low-level and labor-intensive livelihood activity, SSFs remain significant due to their global ubiquity and contribution. Around 90% of individuals engaged in fishing worldwide participate in small-scale fisheries (SSFs) and contribute to nearly half of global fish consumption (Ilosvay et al., 2022). This makes the sector globally essential for livelihood, nourishment, food security and cultural tradition all around the world, especially in developing countries and rural coastal areas (Huynh et al., 2021). However, due to numerous factors such as global power imbalances, limited political influence, lack of access to services and resources, and marginalization by other social groups/broader society, SSFs are categorized as one of the most vulnerable populations (Chuenpagdee & Jentoft, 2018). Fishing is also recognized as a hazardous occupation that is highly exposed to multiple environmental factors such as changing season, weather, and climate (Wojciechowski et al., 2018). Communities that rely on fishing - particularly SSFs in tropical latitudes - are considered especially vulnerable to the impacts of natural hazards, changing climatic conditions (Coulthard, 2008; Islam & Jentoft, 2017a). According to predictions by the IPCC 2014, climate change and its adverse effects are expected to increase in the upcoming years. Consequently, the susceptibility of SSFs to disasters is also expected to rise. Islam & Chuenpagdee (2022) identified various levels of vulnerabilities faced by SSFs globally based on 20 years published articles/literature, categorizing them into different key themes such as biophysical changes, economic, social, governance and technological pressures. Among these main categories, biophysical changes - particularly weather or climate related conditions such as cyclones, storms, and irregular rainfall patterns - were identified as one

of the critical pressures on SSFs, particularly in the context of India (Islam & Chuenpagdee, 2022; Madhanagopal & Pattanaik, 2020).

As outlined above, coastal communities due to their proximity to the seashore, are exposed to nature's harshness and are particularly vulnerable to sudden environmental changes and natural disasters. Earlier disasters were infrequent, but over the past few decades there have been an abrupt rise in recurrent coastal disasters which is a pressing peril to small scale fisheries causing obstacles to their viability and promoting their role as a prospective driving force for human sustainable development (Abarquez & Murshed, 2004; Khan et al., 2023). The recent surge in the frequency of natural disasters is due to a myriad of factors such as climate change, development, industrialization and increase in population. Change in climate, weather patterns and the increasing occurrence of natural disasters do not impact all communities equally; vulnerable groups like small-scale fishers (SSFs) are often the ones who suffer the most. (Nayak, 2021a).

Additionally, cyclones, alluviums, tsunamis, and other underlying pressures like ocean acidification, habitat damage, increase in ocean temperature, loss of livelihood & infrastructures, migration of human population in consequence of sea level rise, variation in frequency and distribution of cyclones often propels drastic social and environmental changes to which communities like SSFs ought to respond, adopt, and cope (Daw et al., 2009; Marín, 2015). The implications of these catastrophic events on these communities implies a pivotal overlap between adapting to climate change and managing risks associated with disasters (Turner et al., 2020). The inevitable aspect of 13th sustainable development goals (SDGs) - "Climate Action" is to enhance the resilience and adaptive capacity to deal with natural disasters and climate change related risks (Doni et al., 2020). The consequences associated with climate change and natural disasters recognized the significance of studying the aspects of resilience, vulnerabilities, coping strategies, and social capital. As highlighted by Byg & Salick (2009), a local community level understanding of societal, cultural, and moral perspectives will be a key supplement for policymakers and the scientific community to know the different response pathways in dealing with natural disasters. These concepts assist in comprehending how

communities, organizations, institutions, and individuals can effectively respond to disruption, regain stability, and mitigate potential future risks (Roque et al., 2020).

According to Kendra et al. (2018), among the nine elements of resilience - which include social, economic, human, institutional, political, and community capital, as well as improvisation, natural resources and physical resources - social capital is particularly significant. Social capital is a multifaceted concept that refers to the presence of social networks, which typically exhibit characteristics such as shared norms and trust, leading to favorable outcomes for individuals (Bourdieu, 1986). Numerous disaster researchers have highlighted social capital as potentially decisive characteristic of social system that helps the community to build back after a damaging event (Dynes, 2003; GILL, 2014 Nakagawa & Shaw, 2004). Pertaining to resilience, the concept of social capital provides understanding of the intricacies and dynamics that a community encounters during periods of upheaval. People get a sense of power and meaning to life if surrounded by others, which helps them to feel better emotionally and mentally. Hence, the values people derive from social networks are one of the reasons that endow resilience to the community. Additionally, social capital aids in comprehending how the community coordinates by itself to operate with abrupt changes (Aldrich, 2012). According to Jentoft (2014), “Building communities is also about building social capital and networks between people based on familiarity, trust, solidarity and mutual support.” Overall, community resilience can be understood as the collective ability for a community to deal with unforeseen scenarios and gain strength after abrupt changes. Social capital is employed as a theoretical framework (Kulig et al., 2008) tool to analyze how communities’ function collectively. Studies by Danish & Gullotta (2000) and Breton (2001) have discovered events that enhance the sense of place, community, and place such as fairs, festivals and community gatherings acquire viability and vitality. This acknowledgement underscores the importance of social networks in improving the resilience of the community. Besides, some sets of studies have also apprehended few indicators of community strength; community ties, interactions, social support, social inclusion, sense of belonging, stewardship, adaptability, and knowledge acquisition (Bistar et al., 2010; Kulig et al., 2008; Ross et al., 2010). Moreover, natural disasters and their consequences

are “the commons” issue which necessitates a collective action. This, in turn, involves social networking, knowledge, and resource sharing - basic characteristics of social capital (Adger, 2024; Nayak, 2021).

Accordingly, as Dominelli (2012) suggested, the interaction among individuals, organizations, and institutions to enhance their collective capacity to recover from a tragedy is referred to as community resilience. This entails people working together to help one another, potentially leading to a significant transformation in how the communities are organized and governed. It implies that, in addition to individual efforts, group efforts and solidarity are essential, particularly for those who are most at risk in such situations (Paton et al., 2000; Wisner & Kelman, 2015). Similarly, it is crucial to acknowledge the significance of antecedent relational well-being originating from social networks, community coherence, and collaboration. However, it is not merely the presence of these social networks within the community, what are the functional dynamics? Are they available to everyone in the community? Are they promoting social equality? This demand for research focuses on measuring the quality of these forms of social capital existing within the community. Relational wellbeing solely focuses on how the various available social networks in a community contribute to meaningful, positive, supportive, and feeling of satisfaction to everyone in a community. Moreover, as pinpointed by Forster et al. (2022), fishing communities’ capacity to recover after a disaster is influenced by their strong social capital. This must be prioritized when emphasizing resilience and well-being to “build back better”. Considering the above context, this study aims to explore how relational well-being is shaped by the existing social capital in the community and is indeed contributing to different community level responses towards overall community resilience. My research on the importance of relational wellbeing and social capital in promoting communal resilience during disasters can be a valuable addition, particularly for marginalized communities like SSFs in Chilika who are under various levels of vulnerabilities (P. Nayak, 2010). Additionally, this work explorations led me to author this thesis that presents the tale of fisher communities of Chilika lagoon amidst the challenges of natural disasters like tropical cyclones and emphasizing why their perspectives matter.

1.2 Research Purpose and Objectives

The purpose of this study is to assess how different community level responses derived from existing social capital and relational wellbeing are contributing to the overall community resilience amidst the challenges faced during tropical cyclones in Chilika Lagoon. My research findings indicate what stressors stemming from the cyclone are affecting the community, what are the different forms of social networks available to deal with the crisis, and how the existing relational wellbeing arising out of these different networks helps in response mechanisms. Overall, making a shift from the existing literature, this thesis assesses community resilience by considering responses during crises emerging from non-material factors such as social capital and relational well-being. The research objectives and questions that guided this thesis work are as follows:

1) To explore how cyclones are impacting the SSFs in Chilika Lagoon.

- a. What are the damage and difficulties faced by the community in the wake of cyclones?

Here, I seek to understand various stressors and impacts caused by cyclones.

2) To examine the interactions between social capital and relational wellbeing of SSFs in their response to cyclones in Chilika lagoon.

- a. What are the various kinds of social capital available to SSFs in Chilika?
- b. How do these social capitals corroborate with relational wellbeing to influence responses to cyclones?

Here, I seek to identify the various networks of relationships that exist within the communities that have helped to deal in the time of crisis for this community. And to identify the existing relational wellbeing arising out of these networks. Thus, helping to conclude how it can be tailored to ensure better management of disaster in the future unexpected scenario.

3) To analyze community level responses to cyclones that are shaped by the available social networks and their effectiveness.

- a. What are the various community level responses at the various stages of the cyclone?
- b. How effective are those strategies and what is needed to ensure viability/ resilience of the SSF community?

Here, I seek to understand the different community level responses of SSFs in Chilika to cyclones, the lack thereof, and recommendations to ensure community resilience.

1.3 Philosophical Worldview and Approach

The research approach has three main components: philosophical, research design and methods. These components have an impact on the methodology's research techniques employed to provide accurate study data. According to Creswell and Creswell (2023, p. 3), research approaches are “plans and the procedures for research which begin with broad assumptions and move towards detailed methods of data collection, analysis, and finally interpretation.” The selection of research approaches normally depends on three criteria: the problem under study, notion of researcher, and population involved in the study.

In my research, I take a pragmatic approach, which implies that no single paradigm of reality or perception is central to the methodology. Pragmatism is a research paradigm that focuses on finding solutions to real-world problems. It is an approach grounded while investigating and analyzing a problem (Baker and Schaltegger 2015; Creswell & Creswell, 2023). Pragmatists believe that reality is true because it enables us to have fulfilling relationships with various aspects of our experiences. Whatever is profitable or endures the examination of individual users over an extended period is considered truth (Ray 2004; William James, 2000). But it is important to keep in mind that pragmatism entails more than just the belief that "if it works, then it's true" (William James, 2000). Pragmatist researchers ignore philosophical arguments, especially those pertaining to metaphysics, to complete their investigation and conclude that more expansive philosophical viewpoints are unsolvable.

While this research is primarily pragmatic in nature, it follows the features of constructivism and transformative paradigms. This study involves collecting data from communities' members by allowing them to share their perception and interpretation, which suggests traces of constructivism. On the other hand, as an outcome of this research, small-scale fishing communities in the area might undergo changes in the future which could indirectly pave the avenue for transformative outcomes (Creswell & Creswell, 2023). A qualitative approach, particularly an interview-based case study, is useful for exploring how to demonstrate, measure, and disclose intangibles through navigating the real context in which the phenomenon emerges (Creswell & Creswell, 2023). Hence, this study was conducted through the examination of research issues by using pragmatic approach and qualitative data collection methods.

1.4 Research Significance and Contributions

This study comprehensively evaluated the resilience of small-scale fisheries (SSFs) in the face of disasters such as tropical cyclones, with particular emphasis on how social capital corroborates with relational wellbeing to influence community responses. The recovering ability and vulnerabilities of a community depends on its resources and constraints and vary from community to community (Crow & Albright, 2021a); hence it is imperative to understand the local experience of disasters and their responses. This research involves the case study of Chilika Lagoon, the second largest coastal lagoon in the world. The region has experienced 110 extreme cyclones, which is approximately 33% of the tropical cyclones originated in Bay of Bengal (Pattanaik, 2021.). As a shift from the prevailing literature which focuses on material aspects, this study examined the role of social capital and relational wellbeing in developing different community level actions that helped to build community resilience.

The results of this research were able to provide an extensive understanding of how natural catastrophes like tropical cyclones impact communities, as well as their aftermath. Through an analysis of different forms of social capitals in disaster risk management and the contribution of preexisting relational wellbeing in effective responses, this research attempted to pinpoint the linkage between social networking, relational

wellbeing, and community resilience. Policymakers may find these insights extremely helpful in determining how to integrate social capital, network leadership, and community values into disaster management plans. Eventually, they may be able to direct the creation of policies that are more inclusive and equitable. Hence, these research findings could influence policy at all levels to incorporate relational well-being and social capital into frameworks for disaster management, encouraging community-centered strategies that prioritize social cohesion and well-being.

1.5 Study Limitations

Most of the qualitative case studies would encounter some challenges and limitations, particularly in my research. This section will provide a brief critique of a) positionality of the researcher b) data collection methods I used and the difficulties I encountered as an emerging qualitative researcher. c) the impact of employing external mediators translating and transcribing the data. d) influence of triangulation in minimizing the challenges and limitations in my research.

1.5.1 Positionality Statement of Researcher

This section of my thesis outlines the researcher's positionality statement explaining how my place of origin, educational background, and lived experiences influence the perspective of the research. In this research, I identify myself in a mixed position of being an outsider and insider. As an Indian, who is familiar with rural settings in the country, I was able to adapt more easily to local customs and traditions. However, regional and cultural differences positioned me as an outsider in the field and may have influenced my engagement with community members. The unfamiliarity with the deep rooted cultural and societal system which demands years of research might have affected data analysis and interpretation.

My educational background in Engineering influenced me to have problem solving and structured mindset. The transition into the social sciences - where the focus is on living realities, emotions, voices, and human

experiences - was not easy, but it was certainly enlightening. Even though I attempted to navigate this shift by immersing myself in social science literature and engaging with experienced senior researchers, I acknowledge that this shift might have influenced aspects of the research. Furthermore, being a woman researcher, I had both advantages and disadvantages. I was restricted to travel alone and to certain parts of the Chilika, but I had the unique privilege to connect with kids and women more while I was in the field. Despite that, the overall research experience was self-reflective in a way because I realized that research is not about acquiring information from people, but more about respecting participants' experience, and time. Hence, I approached each stage of the research process with reflectivity and openness.

1.5.2 Limitations in data collection methods

While qualitative data collection methods such as interviews, focus group discussion and participant observations provide researchers with in-depth information and more flexibility to delve into the phenomena under study, they also come with limitations such as researcher's bias, social desirability, and the character and willingness of respondents (Warren & Karner, 2014). Researchers engage directly with respondents at all the stages of data collection; however, there is a risk that their own values or beliefs may influence the avenue for subjective bias (Malterud, 2001). Recognizing this, I committed to constantly questioning and reflecting on my own biases and preconceived ideas or notions throughout the research process. However, there could be a certain level of bias that may not be eliminated, due to being an emerging researcher.

Researchers have a certain level of control on bias arising from their side; however, the respondent's bias is beyond their control. Respondents' biases are contingent upon conditions like their interest in getting involved, the theme of the study, methods used by the researcher to keep data, influence of observers such as researchers, and other people around leading to giving answers that are more socially acceptable than the real ones (Elston, 2021; Mansor et al., 2015). I recognized this in advance and conducted interviews in

places where they felt comfortable, generally their houses. I also tried to develop a rapport with them a few days before the interview days. This could have benefited to an extent to reduce the bias.

Focus groups were targeted only after the interviews were done in each village. This helped ensure that the villagers felt more comfortable with my presence and were more open to sharing their thoughts and feelings, as they were seeing me around for a while. Considering the social and cultural context of the study area, there is a possibility of dominance of higher caste and male gender, which may have led to a biased discussion (George, 2022; Sim & Waterfield, 2019). I tried to maintain homogeneity in the group by conducting focus groups based on caste and gender. This ensured a balanced and inclusive discussion. Furthermore, my translator, who has previous experience in moderating the focus group discussions, pointed out in advance the possibility of people not being present or leaving discussions early. Anticipating this, we invited around twelve people, so when some did not show up or left during the discussion, we still ensured a minimum criterion of six people (Morgan, 2002). Additionally, even though observation is a very flexible method to acquire data in a reliable way, I had some challenges because of multiple tasks involved such as noting down notes, observing surroundings, and keeping track of the recordings throughout the field work. It also has high chances of potential bias because it exclusively depends on the researcher's interpretation (Farid, 2022). I also acknowledge that there is possibility of potential limitations and bias that may have occurred because of the time constraint concerning a two-year master's level research work,

1.5.3 Influence of external mediators

This research has some limitations due to the mediation of two assistants that I had to hire for translation during field work and transcribing the recorded data. These were two inevitable parts for the successful completion of the project, especially because of the language barrier. Esposito (2001) has reported that miscommunication may arise between the translator and researcher, which could result in biased data. As a researcher I helped the translator to comprehend the scope of this study and all interview questions. I also spent an entire day in his village with him and his family, where we had our research discussion. Building

a good working relationship with the translator is imperative in enhancing the researcher's ability to comprehend the translation process and emerging themes that would impact the interpretation of the data (Choi et al., 2012). We then moved ahead with our field work, once he ensured that he completely understood the interview questions to translate it to the participants from English to Odia. This significantly supported my research to minimize the potential errors during data collection. Additionally, a transcriber was hired to convert the recorded Odia interviews to English transcripts, then it was cross checked with field notes for ensuring data accuracy. However, potential biases and errors can arise at all stages and there are inherent risks that cannot be fully avoided.

1.5.4 Triangulation

Triangulation involves convergent use of various research methods for studying phenomena with the aim to ensure the credibility and accuracy of your findings (Carter et al., 2014; Creswell & Creswell, 2023). There are different approaches to triangulation such as comparing data from various times or space, different investigators, using different theoretical lenses and different methodologies (Vivek et al., 2023). This research involved methodological triangulation that collected data using different methods such as interviews, focus group discussion and observations. By means of this approach, this research tried to capture unique variations or meaningful emerging themes that would have been overlooked if only one method was employed to get the data. This does not mean the whole aim of triangulation is to obtain consensus between different data sources, but also to embrace the contradiction that may arise. Hence, leading to a more consistent narration of the research problem with trustworthiness (Aguilar Solano, 2020; Chako, 2017).

1.6 Organization of Thesis

This thesis is composed of six main chapters. Chapter 1 has introduced the research problems and major themes analyzed in this study. It also provides research design used, purpose, significance, and plausible contributions along with a brief critique of various stages that would have introduced some biases and

limitations. Chapter 2 highlights the major literature that is used to conceptualize the framework of this study, and this chapter established the structure for various theories utilized in this thesis. Chapter 3 delves into the study area description, methodology involved with detailed explanation on data collection method, and analysis. Chapter 4 and Chapter 5 present the results and discussion with major findings and interpretations with respect to each corresponding objective of the research. Chapter 4 gives an in-depth analysis and discussion of various challenges and impacts of tropical cyclones faced by the communities. Chapter 5 focuses on objective two and objectives three, that is identifying the various forms of social networks available to the communities at the time of crisis, analyzing the relational wellbeing aspects of the existing networks and finally analyzing the various response strategies adopted by the communities with the help of these networks and their effectiveness. As conclusion of the whole research, chapter 6 gives an overall summary of the key findings and culminates with some recommendations.

Chapter 2

Literature Review

2.1 Introduction

This literature review chapter highlights the theoretical concepts utilized for this research work, which also aided in conceptualizing the research framework that provides a theoretical base for approaching the research problem identified. Each sub section in this chapter is arranged systematically organized to align with the research objectives, which were developed in response to the identified research problem. This chapter also describes the significance of conducting this research and the theoretical lens used for the investigation. The literature review includes the following: It begins with the impacts of climate related disasters on SSFs; analyzing the myriad challenges and emphasizing the urgent need for proactive interventions followed by a paradigm shift towards the importance of community resilience and social capital in the face of disasters. Thereafter, the review focuses on how the existing relational wellbeing emerging from the various forms of social capital in a community can led to better adaptive capacities through various effective responses. The last section of the review examines the circumstances surrounding Chilika Lagoon due to the frequent tropical cyclones as well as how they are affecting small-scale fishers in that locality. It also highlights the significance of this research framework within the context of the study area and SSFs of Chilika Lagoon. Finally, it also outlines the conceptual framework upon which this study is conducted.

2.2 Small-Scale Fishers' Vulnerability to Climate-related Disasters

Due to the high nutritional benefits of fish intake, even small quantities have the potential to improve people's diet. As per FAO (2012), between 660 – 830 million people globally rely on fisheries for their livelihoods, and they provide 16.6% of the world's animal protein supply. Hence, fisheries make a major contribution to food security by providing revenue. A conservative estimate of people employed in fisheries is around 43.5 million, and over 90 percent of which are small-scale fishers. Additionally, over half of the

fish caught is yielded by SSFs, with 90-95% utilized for local consumption (FAO, 2018). Alongside, the abundance of regional and traditional ecological knowledge held by fishers engaged in SSF has made significant contributions to biological research and fisheries management.

Despite their significant contributions, small-scale fisheries are often ignored, undervalued, and underestimated by policymakers. Alongside, they face higher-level risks such as large-scale industrial fisheries, increased fishing pressure brought on by poverty and market demands, unequal and unfavorable supply chains, habitat degradation, climate change, and coastal disasters (Ayilu et al., 2022; Jadhav, 2018). Among these challenges, the biggest concern of small-scale fisheries is the predicted rise in frequency and severity of climate-related disasters in the twenty-first century (Marín, 2015), possessing an existential threat to them and their ability to function as a sustainable engine for human development (Coulthard, 2008; Islam & Jentoft, 2017; Marín, 2015). According to the United Nations Office for Disaster Risk Reduction (UNISDR, 2009), disasters are defined as "a serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability, and capacity, leading to one or more of the following: human, material, economic, and environmental losses and impacts". The natural disaster is primarily defined as the entwinement of natural hazards with vulnerable populations (Melo Zurita et al., 2018). Addressing these sudden challenges typically involves dealing with the compounded challenges of persisting vulnerabilities and uncertainties while also managing survival, recovery, and adaptation for coastal people. All human beings in the world are affected by anthropogenic related climate change (weather patterns and disasters), but only a few shoulder the disproportionate burden of its consequences such as small-scale fisher due to climate sensitive livelihood and their limited resources to adapt to changing conditions (Nayak, 2021). The multifaceted interplay of various threats and stressors that include environmental hazards, climate variabilities, political instability and poor governance leads to the vulnerability of small-scale fishers (Islam & Chuenpagdee, 2022). In addition, the marginalized and low status of SSF within traditional hierarchical governance structure makes it difficult to secure sustainable outcomes SSF. Thus, all these changes can exacerbate already-existing

unfavorable conditions that small-scale fishing communities confront, such as poverty, a lack of financial resources, and isolation from decision-making (Andrew et al., 22007, Pomeroyet al., 2006). Furthermore, apart from responding and adapting to this crisis, they also need to tackle persisting vulnerabilities and uncertainties. Therefore, recovering from these devastating crises typically presents a compounding challenge (Marín, 2019). Although the environment usually returns to normal after a while, these kinds of disasters can have long-lasting effects on the prosperity and well-being of coastal communities (Kriegl et al., 2022). The government authorities usually focus on rebuilding the infrastructures, and coastal protection embankments to dampen the risk associated (Kriegl et al., 2022; Uekusa et al., 2022). Additionally, while pre-disaster preparations by institutions may be successful, certain occupational groups like SSFs often remain subjected to risk, inequity, exploitation, and political negligence. Some rural places may even lack a proper institution dealing with disaster management to manage sudden situations (Ireland & Thomalla, 2011; Islam et al., 2021).

However, a sole focus on structural risk reduction strategies is insufficient for addressing disaster impacts, as such events may have different implications for non-material stages of life. These demands for the focus on non-structural criteria such as social aspects play a key role in disaster management for these vulnerable communities (Forster et al., 2022; Zhao, 2013). However, although there will be pre-disaster vulnerability and different social risks, there will also be community resilience and positive capacities (Kriegl et al., 2022). Learning from the effects of disasters and how they are distributed - as well as from how the most vulnerable populations perceive and experience these effects - helps the local community focus their intentions and actions towards social sustainability, mutual aid, and cooperation, while also working collectively to reduce risks and impacts and enhance community wellbeing (Crow & Albright, 2021; Patrick Bixler & Jones, 2022). Therefore, collaborating with the vulnerable fishing communities is essential to developing viable adaptation and mitigation strategies that support the improvement of community resilience.

Considering the diverse perspectives held by different regions and communities, context specific research is imperative (Berenji et al., 2021; Chengappa & Saha, 2022; S. Ghosh & Mistri, 2023). Moreover, greater focus on community resilience research in marginalized communities - particularly small-scale fisheries (SSFs) - is needed because preserving the sustainability of SSFs and enhancing the standard of living for fishers are also matters of social justice (Lopes et al. 2021). Hence, SSFs should garner increased attention, as achieving sustained SSFs is a crucial task because a flourishing, properly protected SSF leads to more stable societies and increased economic well-being. Notably, there is a gap in studies analyzing the overall community resilience of SSFs in the Chilika Lagoon (Das & Mandala, 2020; Mohanty & Panda, 2020) in the face of climate related disasters.

2.3 Importance of Social Capital During Disaster Events

Building on the previous discussions of SSFs exposure to climate related vulnerabilities, this section explores the concept of resilience and social capital in dealing with crisis. To begin with, one of the major conceptual approaches to deal with abrupt change in multiple levels of organizations from local to global, used in environmental discourse is resilience theory (Berkes & Ross, 2013). This was introduced by Holling in 1973 into the discourse of ecology to comprehend the intricate dynamics observed in the ecosystem. In most disaster management research, resilience is viewed as adapting and learning to ensure the continuity of a system's functioning, rather than maintaining equilibrium (Doorn et al., 2019; Folke, 2006) and the ability to bounce back to a stable state after a disruption (Adger 2000; Walker et al., 2004). Comprehending resilience as bouncing back has the possibility of reproducing the already existing vulnerabilities (Jordan and Javernick-Will 2013) that would hamper the long-term improvement of the system. According to the Committee on Increasing National Resilience to Hazards and Disasters (2012), disaster resilience has been defined as “the ability to prepare and plan for, absorb, recover from, or more successfully adapt to actual or potential adverse events.”. The concept of resilience in disaster concentrates on the intrinsic factors contributing to capacity to adapt to change (Kendra et al., 2018). But giving a social approach to

“resilience,” it can be decoded as how a community is absorbing stressors, adapting to restore using various alternative pathways, and continuing and improving the capacity and resilience to deal with future disasters while exploring ways for the diminution of existing vulnerabilities (Imperiale & Vanclay, 2016).

In social science, even though resilience can be further analyzed at various levels such as physical, ecological, social, city, community and individual, “community” resilience was given more importance for fostering disaster resilience and response (Brown & Westaway, 2011; Doorn, 2017; Norris et al., 2008). This could be because focusing on community resilience will address the underlying factors of vulnerabilities, enhance adaptivity ability and social cohesion. Resilient communities often exhibit characteristics such as network, trust, and cooperation among members, which is essential for effective disaster response and recovery (Dominelli, 2012; Kulig et al., 2008; Wisner & Kelman, 2015). Accordingly, as Dominelli (2012) suggested, the interaction of individuals, organizations, and institutions to enhance their combined capacity to recover from a tragedy is referred to as community resilience. This entails people working together to help one another and might cause a big shift in the way the community is organized and run. It implies that, in addition to individual efforts, group efforts and solidarity are essential, particularly for those who are most at risk in such situations. Overall, community resilience is defined as the collective ability for a community to deal with unforeseen scenarios and as well as to gain strength after abrupt changes. It is often used as a theoretical framework tool to analyse how communities’ function collectively (Kulig et al., 2008). Studies by Breton (2001) and Danish & Gullotta (2000) have discovered events that enhance the sense of place, community, and place such as fairs, festivals and community gatherings acquire viability and vitality. This acknowledgement underscores the importance of social networks in improving the resilience of the community. Besides, some sets of studies have also apprehended few indicators of community strength; community ties, interactions, social support, social inclusion, sense of belonging, stewardship, adaptability, and knowledge acquisition (Buikstra et al., 2010; Kulig et al., 2008; Ross et al., 2010).

Understanding the significance of community solidarity and collective action in fostering resilience, the concept of social capital seems to be an effective aspect which has the intrinsic features such as networking, shared norms and collective actions (Fukuyama, 1995; Lin, 2001; Putnam et al., 1993), these are imperative during a crisis. Pierre Bourdieu (1986) explained the three types of capitals (economic, cultural, and social) and mentioned their interconnected and interchangeable characteristics (Bourdieu, 1986; Häuberer, 2011). He further emphasized that while both economic and cultural capitals have their own potential, social capital is sometimes indispensable for the other two. This is because while some goods and services can be employed through economics, some demand strong social ties and kinship. In the context of disaster, social capital can be effective in acting as a medium to transfer resources and support that is not accessible through other forms of capital. Similarly possessing strong cultural capital cannot always guaranteed entitlement because individuals with strong social capital often establish meaningful relationships with various actors in a society leading to the widening of their opportunity (Bhandari & Yasunobu, 2009). So according to Coleman's notion, the main characteristics of social capital are cooperation, and collective action is critical for disaster resilience. Communities with high social capital can bring community members together for better preparedness, emergency support, response, and recovery efforts. Hence, social capital is one of the major factors which influence community resilience and disaster management effectiveness.

Most research focusing on the role of social capital in disaster management has focused on the categorizing social capital based on the different levels of actors (i.e. linking, bridging, and bonding) (Behera, 2023; Delilah Roque et al., 2020; Devkota et al., 2016; Panday et al., 2021; Shah et al., 2024; Szreter & Woolcock, 2004). Figure 1 gives a detailed synopsis of the three categories of social capital. Bonding social capital refers to relationships between individuals in comparable circumstances, such neighbors, close friends, and direct relatives. One type of network that includes farther-reaching connections between similar individuals from other communities or groups is called bridging social capital. Another network called Linking Social Capital reaches out to people in different circumstances - like those who are completely outside of the

community and hold a different position of authority (i.e., government organizations) (Aldrich, 2012). This categorization is based on the hierarchy and levels of different actors in a community.

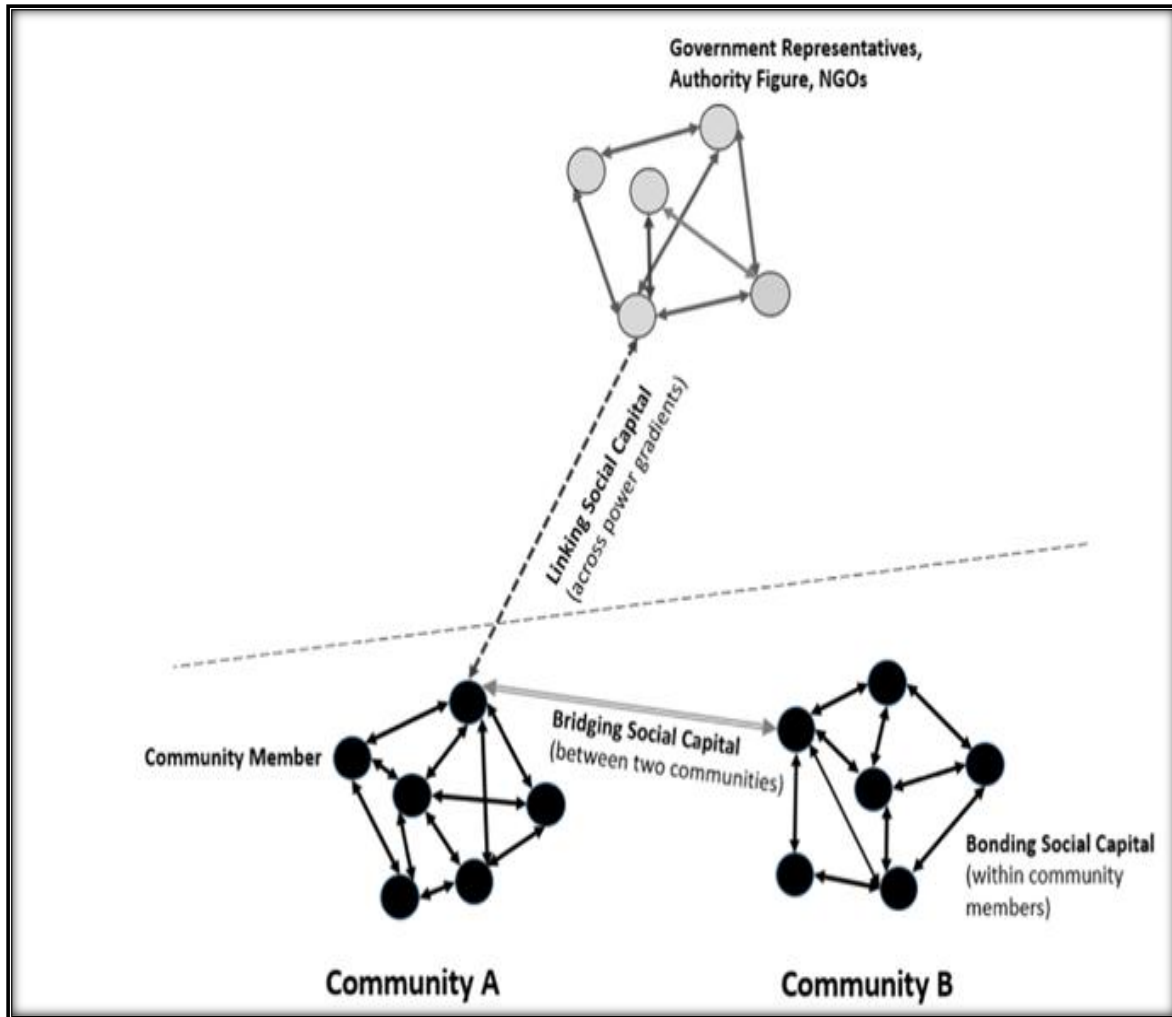


Figure 1: Different forms of social capital (Aldrich, 2012)

Many examples exist where communities lacking financial resources and capacity bounced back from the crises through collective actions (Joerin et al., 2012; Mimaki & Shaw, 2007; Nakagawa & Shaw, 2004). From the numerous examples presented by Shah et al. (2024), it was inferred that during the preparatory phase of a disaster, bonding social capital formed through mutual trust played a significant role. It helped

to disseminate information and prepare well in advance. All the examples also highlighted the importance of community-based institutions, which helped the communities to cope and adapt during a crisis (Bhakta Bhandari, 2014; Chamlee-Wright & Storr, 2009). Additionally, the role of bonding social capital does not stop at the initial phase. In the response phase, before the community receives assistance from outside, close relatives and friends engage in volunteering activities to help and evacuate people (Schellong & Langenberg, 2007). The Sendai framework for disaster risk reduction (SFDRR) addresses the importance of generating community awareness and assigning roles within the community level for collectively formulating disaster risk reduction strategies, thus leading to policies that reflect communal needs (UNDRR, 2015). This also highlights the inevitable part of social networking in disaster management strategies, leading to community resilience.

Authors such as Mathbor (2007) and Mimaki & Shaw (2007) have demonstrated the role of bridging social capital and played a role in managing the disaster. Sometimes, individuals from different communities voluntarily assist others in crisis situations, especially when both communities exhibit inclusive cultures embedded within their networks. Lastly, a community which is strong in networking will impose intense pressure on the government for taking actions thus enabling linking social capital. This can further result in community need based policy implementations (Hishida & Shaw, 2014; Joshi & Aoki, 2014; Mimaki & Shaw, 2007). Overall, bonding social capital plays a prominent role in all the phases compared to other types. However, if bonding is strong and they exhibit inclusive characteristics, it can lead to assistance from bridging social capital. Linking social capital primarily influences recovery and preparedness stages. Besides providing emergency services and aid, social networks also proved to play a role in the well-being of the people. There is evidence showing how social networks have positively impacted emotional and psychological well-being. Engaging in open communication and forming associations with others are the best way to help individuals develop their social networks and social capital, leading to resilience (R. Islam & Walkerden, 2014; Zhao, 2013). Despite evidence from various parts of the world, there is a similarity in

the working of social capital, but differences may exist in the drivers of social capital. Hence, context specific research is imperative.

Additionally, Chamlee-Wright & Storr (2011) underscores the significance of examining how social capital in the form of collective narratives influences recovery strategies. This collective narrative has the potential to shape the identity of community and resilience by serving as a reminder of their shared experiences and ability to overcome the crisis together. Also, their study highlights that in communities where trust is strong, self-reliance becomes prevalent, with residents depending on themselves rather than relying on government assistance. The prevailing literature highlights the importance of social networks, trust, and cooperation in fostering community resilience. Alongside, there are little evidence (Mann and Pass, 2011; Jerolleman 2019, p. 32) regarding how marginalized communities affected by racism, civic neglect and community disrupts, have failed to gather strong bonding social capital. This calls for need in understanding how dynamic social status, marginalization, societal and policy negligence influence SSFS's overall community resilience in the face of climate related disasters. Most of the studies so far focus on financial aspects, livelihoods, strategies, and the overall economy, but little attention towards the social dynamics of SSFs (Bhowmik et al., 2021; Rosado et al., 2022). Thus, demanding a need for research to delve into the social dimensions and its influence on community resilience.

2.4 Measurement of Social capital: Relational wellbeing and Response Strategies

Wellbeing is an objective framework for comprehending the individual's experiences and perceptions as they strive to achieve a fulfilling life (Sollis et al., 2022). Armitage et al., 2012 define social wellbeing as "A state of being with others and the natural environment that arises where human needs are met, where individuals and groups can act meaningfully to pursue their goals, and where they are satisfied with their way of life." This social concept of wellbeing emphasizes the significance of relational aspects and subjective values, which are often regarded as outcomes stemming from strong relational dynamics between the actors (Armitage et al., 2012).

Social capital demonstrates how people are connected through various networks, while relational well-being focuses on how people within the community can collaborate and work together effectively (Quinn et al., 2021). The key elements of relational wellbeing such as trust, reciprocity, support, reciprocity, and network dynamics create a sense of motivation to work collectively and to pave the avenue for moral force to ensure the well-being of each other. Relational well-being indicates how enriched a community's social capital is and it highly depends on the relation with others and ideas that form a relationship, all this, in turn, creates a stronger social capital. Hence, relational well-being is the intrinsic factor that measures the quality of social capital (Masud-All-Kamal & Monirul Hassan, 2018; Coleman, 1990). For instance, a lack of trust may result in less bonding social capital, while the presence of inhibiting rules and regulation within a community can inhibit social inclusion leading to inadequate bridging social capital. Additionally, absence of proper norms, attitude and network may result in a lack of adequate representation to connect with the government. There is growing evidence highlighting the importance of having strong pre-existing relational well-being fostered through social networks and community cohesion and cooperation (Forster et al., 2022, p. 52).

Research by Gillam & Charles (2018); Marín et al. (2015) through the lens of social capital, identified the importance of social networking among fishing communities' in helping them to recover after a disaster. Moreover, fishers' relational wellbeing, bolstered by community cohesion, empowers them to organize and fight against environmental shocks. Notably, relational wellbeing can be leveraged to enhance material and subjective wellbeing following an environmental disaster. This is because relational dimension of wellbeing determines what an individual values in an environment (material dimension), and what an individual is doing (subjective dimension) (Johnson et al., 2018; Koralagama & Peramunagama, 2022; Marín et al., 2015). It is seen that social capital peaks in the wake of a disaster, often referred to as " disaster social capital. However, once the honeymoon phase of disaster ends, the disillusionment phase sets in and there is a gradual decline in social capital as it was formerly proposing specific and resource dependent (Richardson, 2020). The aftermath consequences such litigation, disputes, disaster led migration can further

deteriorate the social capital. Hence, how the existing relational wellbeing, which forms the core of social capital, helps the community to recover from a disaster by paving the avenue for different response strategies and pathways for better preparedness, recovery and eventually resilience is an essential area of study. This understanding can help communities to better prepare collectively for and mitigate the impacts of future unseen events. (Chaigneau et al., 2021; Forster et al., 2022; Johnson et al., 2018)

Due to family ties, some community members are compelled to return and rebuild after disasters, which have severe physical, social, and financial repercussions (Vale, 2005). But if basic concerns about persistent fear, grieving, and inequality in the community are not addressed, rebuilding infrastructure might not be enough to improve resilience. Important variables include communities' well-being and the strength of their social networks; differences in money, age, and caste can also have an impact on their resilience (Boano, 2013). Rebuilding infrastructure alone might not bring about true community resilience; while some may recover, others may continue to experience hardship. Hence, following a tragedy, focus should turn to addressing emotional damage, dispute, insecurities, and reestablishing social ties, highlighting the significance of relational well-being for both community resilience and long-term healing (Armitage et al., 2012; Berkes & Ross, 2013).

It is apparent from studying fishing communities' dynamics that the quality of their relational well-being plays a key role in determining how resilient and competent they are at overcoming hardships. These communities' complex web of social links not only forms the foundation of their identity but also acts as an invaluable support system in times of hardship (Symes & Phillipson, 2009). Strong social ties and mutual support among community members characterize relational well-being, enabling them to create fishing unit survival plans and deal with problems together. Furthermore, cultivating relational well-being in these communities can strengthen their overall potential by enabling people to identify and capitalize on their own as well as the group's assets. Communities that put a high priority on relational well-being are better able to adapt to change and endure outside stresses like climate related disasters. As a result, fostering and investing in relational well-being becomes essential to creating fishing communities that are resilient and

sustainable (Gillam & Charles, 2018). Thus, inferring that the ways in which people interact and network, and the subjective dimensions derived through these interactions are more influential in shaping adaptation strategies at both individual and societal levels.

The case study conducted by Marshall & Marshall, 2007 gathered four key perceptions of fishers to change: First, vulnerability due to change, second, ability to adapt to abrupt changes, third, capability to organize, educate oneself, planning and strategizing, and, finally, personal inclination towards change. These findings highlight the importance of relational and subjective dimensions of wellbeing over material dimensions. Thus, inferring that ways in which people interact and connect, and the subjective dimensions derived through these interactions, are more influential in shaping adaptation strategies at both individual and societal levels. Additionally, strong relational well-being among members of the community creates a sense of “having a place” and instills a feeling of security, meaningfulness in life and identity. All these factors will facilitate collective mobilization against unfortunate circumstances (Gillam & Charles, 2018; McCubbin et al., 2013).

Shifting now to the discussion of responses to multiple pressures and abrupt changes in people's lives, adaptation refers to the deliberate adjustment individuals make in response to these changes. (Stringer et al., 2009, p.749). Furthermore, adaptation can take various forms, while social adaptation stands out for its aspect of resilience building and sustainability management. So, social adaptation refers to the strategies in the context of fishing communities that can be defined as their ability to collaborate and work together to address challenges and sudden changes (Adger, 2024; Perry et al., 2011). Social adaptive capacity is used as a parameter that measures resilience through social lens to minimize the vulnerabilities of communities, and social institutions to various stressors or shocks (Bennett et al., 2014). Long-term adaptation from catastrophic disasters occurs in local communities and fisheries, although adaptive capacities vary. Some groups can respond swiftly to the changing circumstances and adjust, but many find it difficult to return to their previous way of life and endanger their jobs or adopt non-sustainable habits. Robust social networks

facilitate efficient cooperation in times of crisis and build confidence and support for overcoming obstacles with resilience (Barnes et al., 2020; Salgueiro-Otero et al., 2022). Prioritizing connections gives communities the resources they need to deal with challenges while also building long-term resilience against unforeseen events. In communities, adaptive strategies and adaptive capability are both dependent on the well-being of relationships. Hence, based on a community's adaptive capacity, different forms of community responses in the context of tropical cyclones like disasters are coping and adaptive strategies. Adapting refers to dealing with stressors or shocks in a proactive way based on their previous experience, foreseeing the future shift in all the aspects of their life, thus leading a positive sustainable life system with no regrets (Sen et al., 2023). While coping refers to the immediate actions to survive or escape from the shock or crisis (Bennett et al., 2014; Green et al., 2021; Nakamura & Kanemasu, 2020). Cyclones are usually considered acute stressors that result in immediate reaction from the community. However, increase in the frequency of cyclone over time could perceive it as a chronic stressor that would push the communities to formulate adaptive strategies (Ehara et al., 2018; Green et al., 2021). The core principle of resilience which focuses on evolving the response strategies and maintaining improvement with the continuous dynamic changes by amelioration of the strategies for better future viability (Juhola et al., 2016; Schipper, 2020). Therefore, the effectiveness of the response strategies adopted by the communities depend on their flexibility to uncertainty, and ability to change in response to unique circumstances. If the adopted strategies fail to fulfil its intended purpose or create further consequences or vulnerabilities it results in maladaptation (Faruk et al., 2018; Siddik & Islam, 2024). This could impede the overall resilience and long-term sustainable development of the communities. Therefore, focusing on the response strategies used by the communities and analyzing them to decipher what worked and what failed is imperative.

Overall, understanding the operations of relational well-being within communities facing disasters or catastrophic events is imperative for evaluating long-term community resilience, as it is identified as a core factor that sustainable communities can withstand the storm of uncertainty and adversity. Even though a strong relational well-being within the community members plays a vital role in disaster recovery by

promoting collective problem-solving, resource-sharing, resilience and response pathways (Armitage et al., 2012; Berkes & Ross, 2013), they are often overlooked in disaster management efforts, despite their importance for long-term community healing (Zhao, 2013).

2.5 Chilika Lagoon: Small-Scale Fishers and Disaster Impacts

Tropical cyclones are highly destructive, often resulting in storms, heavy precipitation, flooding, and coastal inundation. Even a small percentage such as 5% of tropical cyclones that originating in the Bay of Bengal, caused approximately 75% of casualties in the adjoining countries such as Bangladesh, India, and Myanmar (Das & Mandala, 2020; Sahoo & Satpathy, 2020). The destructive effects of tropical cyclones are due to a wide range of reasons such as geographical conditions of the location, low lying coastal line and the funnel shape of Bay of Bengal that intensifies the storm surge due to pressure differences. Along with this, climate change associated with temperature rise escalates the strength and frequencies of the cyclone, exacerbating their impacts (Acharyya et al., 2020).

The Indian subcontinent with a vast coastline extending up to 7516 Km, is vulnerable to world's 10% tropical cyclones. Even though the effects of cyclones are seen in the entire coast of India, the east coast is more susceptible compared to west coast (Mohapatra et al., 2021.; Sahoo & Satpathy, 2020). Tropical cyclones that spawn from the Bay of Bengal follows North-Northwest direction hitting the shorelines on the east coast of India and other North-northwest directions moving towards Bangladesh and Myanmar (Alam & Dominey-Howes, 2015; Naskar, 2018.). Along with Andhra Pradesh, and west Bengal, in the eastern part of India, Odisha is one of the most affected states, having already experienced 110 extreme cyclones that is approximately 33% of the tropical cyclones that originated in Bay of Bengal. Annually, Odisha encounters five to six cyclones that fall under the severe category as per IMD reports (Acharyya et al., 2020; Muduli et al., 2022). Chilika lake which is surrounded by Bay of Bengal on three sides and situated in Odisha state of India, is Asia's largest and world's second largest brackish water lagoon. However, due to its geographical location, it is extremely prone to catastrophic events (Chhotray, 2022;

Das & Mandala, 2020; Mohapatra et al., 2021). It is estimated that 5-6 cyclones hit the coast annually, but this excludes the minor cyclones and storms that hit the shores. Furthermore, the Chilika has rich fisheries resources and sustains around 200,000 fishers in surrounding villages (Bhattacharya, 2020.; Kumar et al., 2020). Fishers who depend on the lagoon for their livelihood are at the forefront suffering from the repercussions of coastal disasters (Iwasaki et al., 2009; Muduli et al., 2022). Cyclone Fani, which occurred in 2019, had devastating effect on the small-scale fishers causing losses in all forms. Additionally, one study interviewing small scale fishers revealed that they felt the cyclone setbacks their development by approximately 30 years (Kanak News, 2019).

Throughout history, small-scale fishers in Chilika have been the victims of injustice and marginalization stemming from feudalistic, monarchist, colonialist, and caste-based social structures. These forms of systematic oppression have persisted into the present (Nayak, 2010). Adding to this, climate related disasters arising from Bay of Bengal have further doubled marginalization and exacerbated their already existing vulnerabilities. When considering how small-scale fishing communities have managed to withstand systemic vulnerabilities in the face of systemic injustices, one finds that these communities have shown incredible endurance and adaptation (Nayak, 2022; Pandit et al., 2021). Their ongoing contributions to the world economy, society, and systems highlight the innate capabilities woven into their very existence. These capabilities, which are frequently derived from strong social capital and relational well-being, act as the foundations of resilience, allowing communities to face hardship directly and emerge stronger consequently (Mozumder et al., 2018; S. Pattanaik, 2007; Samal & Meher, 2003).

In the context of disaster resilience, the importance of social capital and relational well-being cannot be overstated. In communities of small-scale fishers, these elements are essential for building solidarity, collaboration, and mutual aid. In times of disaster, robust social networks and communal relationships act as safety nets, enabling efficient reaction and recovery operations (Behera, 2023; Mohanty & Panda, 2020; Nagothu, 2004; Sekhar, 2007). Furthermore, these communities can withstand the storm of injustices and come out stronger on the other side because of their shared beliefs and intrinsic resilience (Bhattacharya,

2020; Nayak, 2022). There are only a few studies that look at community disaster resilience from the perspective of social capital and relational well-being, even though small-scale fisheries have a substantial resilience impact and are innately effective at overcoming adversity. Providing insight into the complex interactions among social capital, relational well-being, and disaster resilience in small-scale fishing communities of Chilika lagoon might be beneficial for formulating policies and community development programs (Forster et al., 2022; Quinn et al., 2021). Moreover, the deeper analysis of community resilience from the real victims of climate related disasters is pertinent for drawing conclusions and recommendations that resonate with their respective local knowledge and historical context.

2.6 Conceptual Framework for Research

A research study encompasses a set of ideas, theories, and assumptions that communicate and substantiate your work and is termed as conceptual framework. It gives a clear picture of what will be included and excluded from the study. Additionally, it also conveys what preliminary works and personal experiences you will make use of to decipher the issue and people under study (Maxwell, 2012). This research explores the function of relational well-being and social capital in disaster management and immediate recovery by providing access to various response pathways. Research on the importance of relational wellbeing and social capital in promoting communal resilience during disasters appears to be a valuable addition, particularly for marginalized communities lacking adequate infrastructure and disaster management protocols (R. Ghosh et al., 2022; Pattanaik, 2020). Figure 2 below shows the conceptual framework I employed, which facilitates an analytical lens for studying the community resilience of small-scale fishers in Chilika Lagoon.

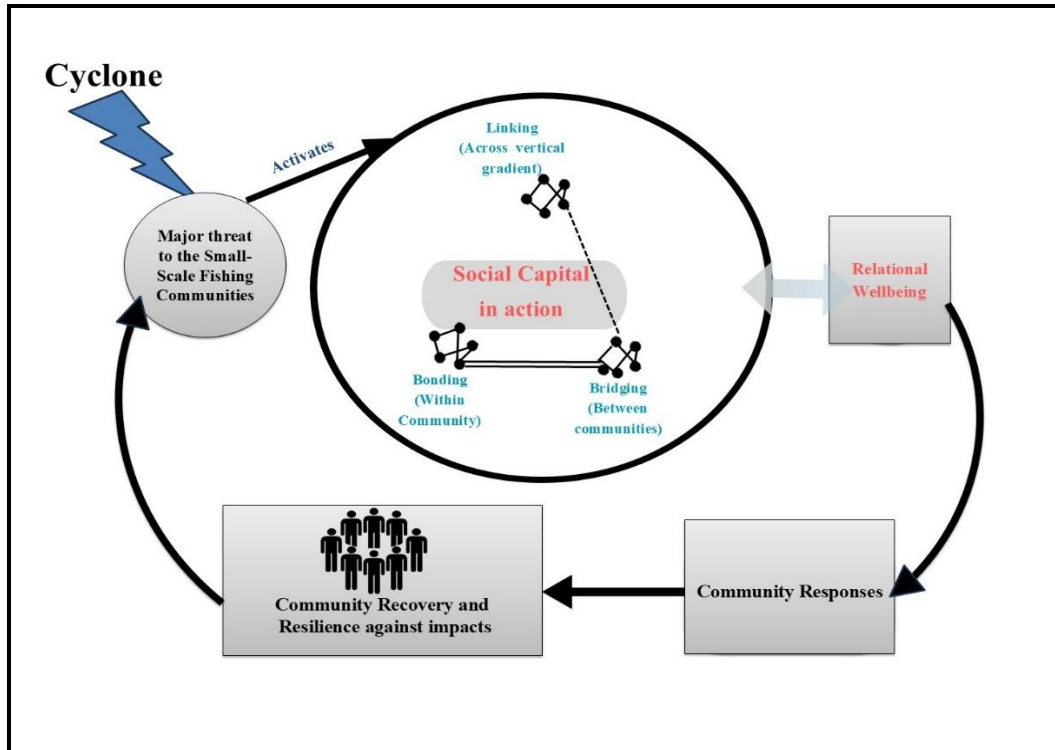


Figure 2: Conceptual Framework derived from the Literatures

This literature review delved deep into the various interrelated concepts to analyze the community resilience of small-scale fishers against climate related disasters. The goal of exploring these interlinked concepts was to derive a conceptual framework directing this research to accomplish all the mentioned objectives. The conceptual framework used for this research is figure 2 incorporates the following fundamental aspects: major stress - tropical cyclone, social capital, relational wellbeing, community responses and community resilience. The first objective focuses on various stressors that are associated with the onset of tropical cyclones to the communities, identifying the vulnerabilities and challenges are critical in understanding how the community is utilizing various forms of social network to navigate through it. It also informs of the strengths and weaknesses associated with their networking because a community with weak social capital will take longer to recover. The second and third objectives attempt to capture the various forms of social capital available to the community under study and further to analyze how the existing relational wellbeing is helping them to respond to the various stressors that have been identified. This is crucial

because it delves deeper into the dynamics of social capital and relational wellbeing in the community, bringing up the issues such as social inequality, political exclusion, and caste-based oppressions that may foster disparities in various responses that lead to slow recovery.

The conceptual framework in figure.2 envisions the key themes pertinent to the research context in Chilika lagoon in a sequential connection that links all the three objectives described above. The framework was formulated based on the research problem, objectives and overarching themes from the literature review that guide this study. The framework can be explained sequentially from left to right; the research initially identifies the various stressors faced by the community due to the impact of the tropical cyclones. Then the core of the research explores what are the various forms of social capital available for the community to deal with these stressors, and how the existing relational wellbeing emerged from these forms of networking is opening the avenue for different community level responses during all the stages of cyclone for better preparedness and recovery. And eventually how all these are helping build community resilience in the wake of tropical cyclone like disasters. Overall, community resilience will be analyzed through the lens of social capital and relational well-being. This framework emanated from the literature mentioned above serves as the primary anchor guide for the methodological approach I selected, achieving the research objectives, research analysis and interpretation of findings in the analysis chapter.

Chapter 3

Case Study Locations and Methodology

3.1 Introduction

This chapter expounds the study area, research design, methods used for collecting data, data analysis, and ethical considerations of this research work. The first session explains in detail the basic geographical characteristics of Chilika lagoon, followed by a synopsis of research villages selected. The second session describes the overall strategies used to conduct this research, followed by a detailed explanation of the data collection tools, which were adopted to ensure data validity. Each session in this chapter also highlights the rationale behind the methodology and methods utilized for this research. Subsequently, the chapter also explains benefits of the overall design approach for accomplishing the objectives of the study and how the researcher targeted at reducing bias while conducting qualitative data collection methods such as semi-structured interviews, focus group discussions, and non-participant observations. Additionally, it also outlines the strategies used for the data analysis part and the ethical consideration of the study.

3.2 Case Study Locations

Chilika Lagoon, which belongs to the state of Odisha in India, extends along the east coast with estuarine environments, making it highly productive and biologically diverse. It is the largest brackish water lagoon that adjoins the Bay of Bengal in the southern area with the presence of Eastern Ghat mountain ranges assembling all its catchment area to the north and west directions (Nayak, 2014). The entire lagoon area ranges between 906 km² to 1165 km² during summer and monsoon seasons. Furthermore, other peculiarities of the region include the following: those rare and threatened animal species listed in the International Union for the Conservation of Nature's (IUCN) Red List, Irrawaddy dolphins, (Das, 2013; Shukla et al., 2022) and more than 225 fish species are inhabited in the different parts of the lagoon area. It is the largest wintering ground for migratory birds, in the entire Indian subcontinent. Due to its large and diverse

biodiversity, it plays a key role in nurturing the livelihood and culture of around forty thousand caste-based fishers and their families living in 150 different villages surrounding the lagoon. The lagoon is home to four major fishing castes that are: Kaibartya, Khatia, Kandra, and Tiara (Nayak, 2010; Samal & Meher, 2003). The lagoon ecosystem services are also utilized by 800,000 non-fisher higher castes. The lagoon is not only a source of livelihood, but also centered on religious, cultural, and spiritual activities of the inhabitants.

There are a series of natural pressures related to climate such as flood, cyclones, and droughts that disrupt the socio-ecological balance that in turn have an enduring effect on the livelihood of fishers surrounding the lagoon. The lagoon which spreads over three distinct districts; Ganjam, Puri and Khodhra, is identified as a 'very high-risk damage zone' concerning heavy wind and cyclones (Acharyya et al., 2020; Ghosh et al., 2006; Iwasaki et al., 2009). The location of the lagoon is within the proximity of Bay of Bengal, making it one of the six major regions in the world with high susceptibility to cyclonic activities. These tropical cyclones that typically emerge during the months of April to May and October to November (Bhattacharya, 2020; Muduli et al., 2022; Panigrahi, 2003) have been reported to have prolonged consequences to the life of fishers causing damage to their boats, gears, houses and other essential infrastructure. This has left the fishers in Chilika with an enduring emotional distress and financial burden, exacerbating the already existing vulnerabilities (Chhotray, 2022; Mozumder et al., 2018). Apart from this, other issues concerning fishers in Chilika lagoon are overfishing, pollution, aquaculture boom that resulted in privatization of communal resources and conflicts between fishers and non-fishers, and the opening of artificial sea mouths (Sk. M. Islam & Paul, 2023; Sahu et al., 2014; Sundaravadivelu et al., 2019).

3.2.1 Villages selected for the case study

Chilika is divided into two sectors (Pandit et al., 2021) based on shoreline proximity: the northern sector, which is far from the Bay of Bengal, and the Outer Chilika, which is closer to the sea. Cyclones mostly affect the villages on the outer channel compared to the northern Chilika (Pandit et al., 2021). Previously

affected villages in the literature were identified to finalize the case study locations. Three villages; Gabakund, Mirjapur and Gangadharpur were selected for this thesis based on their proximity to Bay of Bengal, severity of damage based on previous cyclonic events (based on literature) availability of cyclone protection infrastructure, and social structure based on caste system. Furthermore, the location of these villages was within fifteen km of the host village - Satapada, which made daily travel for fieldwork convenient. Figure 3 shows the lagoon and case study villages locations within the country, prepared using ArcGIS 10.8. Additionally, table 1 below gives a comparative summary of three villages selected for this case study. The following section provides an overview of each village based on my observations, causal interactions, and overall experiences.

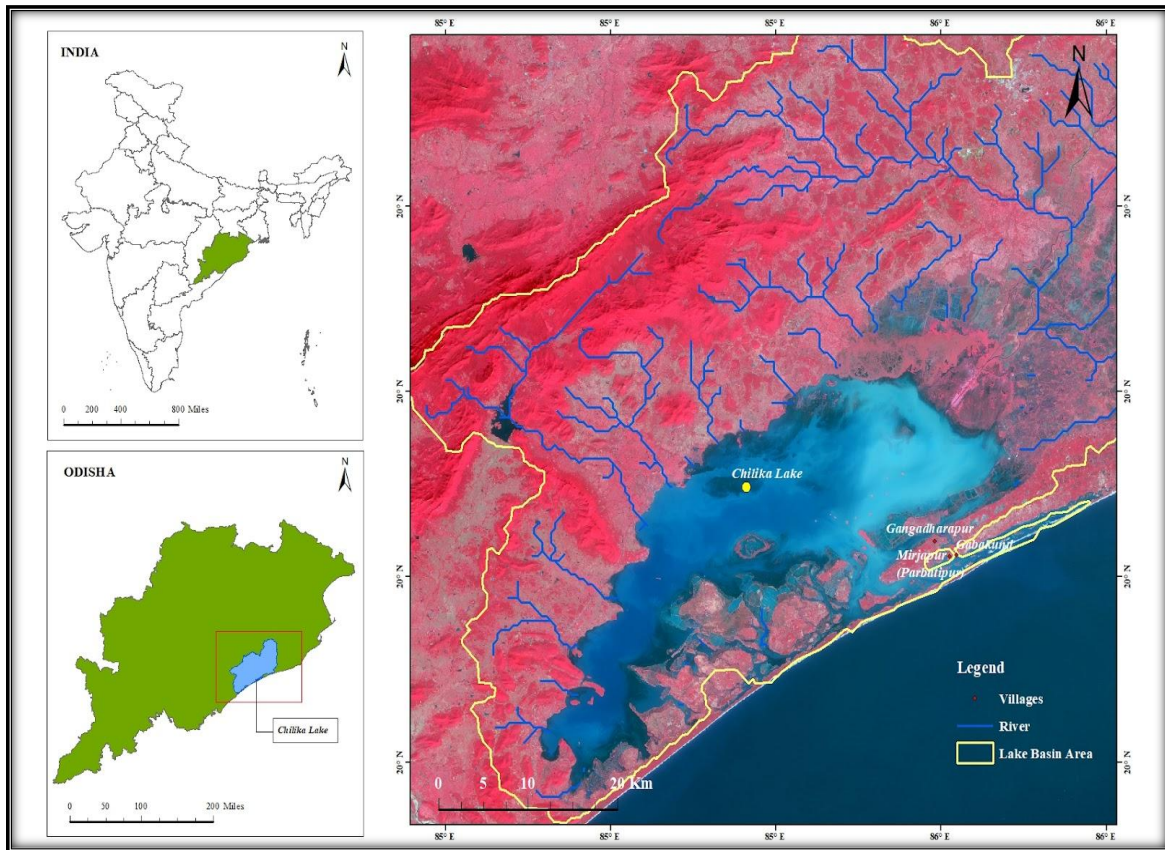


Figure 3: Location of Villages selected for the Case study within the Chilika Lagoon (Source: Satellite Image - USGS Earth Explorer (Landsat 8 Imagery), Administrative Boundary - Survey of India).

3.2.1.1 Gabakund

Gabakund was the first village I visited as part of my observation. I moved to Satapada on August 30, 2024. My translator lives in another village called Berhampur, an inner island in Chilika Lagoon. He travelled to Satapada daily by boat and from there we took a bus that took us to Dahikiaa Bridge, where we got involved in social interactions, had breakfast and tea every day during field work. From Dahikiaa junction, we mostly used to walk, get a lift from others, or sometimes travel in a mini auto that carried sand or other materials. All the three villages were four to five kilometers (Km) from this junction, hence, socializing with each shopkeeper, and having food from there had become a regular part of the day during the fieldwork period.

Gabakund has an approximate population of 1000 with an overall household number of 206. People in this village belong to the Khatia caste village, one of the higher fishing castes in Chilika. Fishing and tourism activities are the main livelihood practices, while some get involved in labor work, mechanical and electrical work, and shop business. In this village, there are around thirty-eight people who work as government employees. The women have a separate Self-Help group (SHG) that helps them to get financial loans to support their family or start a small business. The fisherwomen who are married in this village are housewives and engage in household activities like cooking, cleaning and oversee the overall wellbeing of the family members. Their caste custom restricts the women from working for paid labor, so only men go out for work. The village has an Indian Red cross society cyclone shelter that has been recently transferred to Odisha State Disaster Management Authority. This was initially constructed collectively for other surrounding villages such as Raipur, Mirjapur and Parbatipur, but as the population increased, those villagers stopped coming. And since the cyclone centre is in the Gabakund village land, where people have gained more power to access it. This village also had their own cyclone management committee with a total of ten separate groups like rescue teams, psych care teams, relief distribution teams and others. Apart from this, they also have a village committee association and tourism association. The coastal barriers were also present along the boundaries between the lagoon and village. There are around four to five NGOs that support this village, especially during the crisis. There is one 'Anganwadi' (village childcare centre) for 3-

5 years old children and one elementary school for 5 -10-year-old children. This village is remarkably close to the artificial sea mouth, so they also experience the drastic impacts on their livelihood. Also, due to the proximity of this village to Bay of Bengal, they are more vulnerable to climate related disasters. The village has good concrete structures and houses, as well as non-resilient roofed houses. There was the presence of shattered buildings that were broken during the last cyclonic events.

3.2.1.2 Mirjapur

The second village I have selected is Mirjapur that has a population of 1600 and an approximate estimate of 315. Out of this population and overall household number, sixty households belong to the sub village Parbatipur. The main caste of Mirjapur population is Khatia, while the sub-village population are people from lower fisher's caste known as Khandra. The main livelihood activities are fishing, tourism, shop business and labor work. Khatia fisherwomen are not allowed to go for any paid labor based on the social caste custom, while Khandra women go for labor work for supporting the family. There is no cyclone shelter or cyclone management association for this village. There is one 'Anganwadi' and an elementary school just like the Gabakund village. Comparatively, Mirjapur villagers have better housing infrastructure, while most of the houses in Parbatipur were non resilient roof buildings. Parbatipur population belonging to lower fisher caste are economically and socially backward.

There are around fifty government employees from Mirjapur village, while no government employees in Parbatipur village. Both villagers jointly formed a tourism association, but only thirty members from Parbatipur are given membership. Village committees are separately formed for each individual village, while major decisions for the whole village are taken by Mirjapur village committee members. Both villagers have NGOs support, while Parbatipur being economically and socially backward gets more help from NGOs. According to the respondents, there has always been friction between the Khandra caste and Khatia caste people regarding the sublease system. While this mutual hostility exists, some share good relationships with each other. Both villagers were completely evacuated to cities when they faced a cyclone last time, due to the absence of cyclone shelter. Parbatipur is situated in a low-lying area compared to

Mirjapur, making it more prone to flooding. Additionally, the barriers surrounding the boundary between lagoon and village area are partially deteriorated in the Parbatipur side.

3.2.1.3 Gangadharpur

Gangadharpur is located in the inner channel, unlike the other two villages, and has a population of 1400 with an estimated 281 households. The village is recognized as the Keuta caste village, another higher fisher caste in Chilika. Like the other villages, the main livelihood activities were fishing, tourism, and labor work. However, unlike the other villages, the leaders of this village were young people between the age of 25-30, while they took advice from older members in the village. This village has an Indian Red cross cyclone centre and a management association with separate groups for rescue, relief distribution and overall management. But there were no proper barriers surrounding the villages due to the encroachment of some village fishers towards the lagoon boundary. Hence, the barrier construction had to be withheld. There are four to five NGOs that help them during crises. This village also has ten active Self -Help groups for women that help them to get financial loans. There is one Anganwadi elementary school within a noticeably short distance from the village area, so it was feasible for them to utilize these areas during a cyclone.

Table 1: Comparison of three selected Case study villages

Village Characteristics	Gabakund	Mirjapur	Gangadharpur
Population	1000	1600	1400
Household	206	315	281
Location	Outer Channel, near artificial sea mouth	Outer Channel, near artificial sea mouth	Inner Channel

Proximity to Bay of Bengal (Distance in Kms)	2-3 Kms	2-3 Kms	4-5 Kms
Caste	Khatia (Higher Caste)	Khatia (Higher Caste) & Khandra (Lower caste)	Keuta (Higher Caste)
Livelihood	Fishing & Tourism	Fishing, Tourism, Labor work	Fishing, Tourism, Labor work
Cyclone Shelters	Indian Red cross Cyclone Centre	No	Indian Red cross Cyclone Centre
Coastal Barriers	Yes	Yes, partially damaged	Partially built
Healthcare access (Distance in Kms)	Three	Four	Five
NGO support	Yes	Yes	Yes

3.3 Research Design

The proposed study adopts a qualitative approach to its research design. When using a qualitative research technique, researchers investigate individuals, occurrences, processes, and general culturally shared actions

of people or groups (Creswell Creswell, 2023). To establish patterns, categories, and themes deductively from the bottom up, data is typically arranged into more abstract information units. The study involves qualitative analysis that will explore the experiences of community members, focusing on their in-depth perceptions on the role of social capital in disaster risk management and the contribution of existing relational well-being in the community for effective responses that help them to deal with the catastrophe.

Additionally, this research follows a case study method which allows for a comprehensive and multifaceted examination of challenging problems in a real-world setting (Ylikoski & Zahle, 2019). This method is particularly beneficial when one needs to acquire more in-depth information about an issue, event, or phenomenon of interest (Zainal, 2007). When obtaining data on more explicative topics, the case study methodology works effectively for answering questions like "how," "what," and "why." A case study approach can be centered on how the intervention is being implemented, offering insights into what situational shortcomings still exist and why a particular implementation strategy might be chosen over another, thus advances or improves theory (Zainal, 2007). In the present study, the focus of the case study method is on "how" the cyclone is impacting the community, "what" was the role of social capital and relational wellbeing for the different community level response at all the phases of the cyclone and "Why" some of the strategies still fail to achieve full recovery and resilience. The qualitative case study promotes the examination of phenomena using a range of data sources that are relevant to the research setting. This suggests that various perspectives are used to examine the issue, allowing for the exposure and appreciation of diverse facets of phenomena rather than just one. Case study, which is comprehensive, exploratory, and involves using multidimensional methodology (Priya, 2021) helps to throw light on aspects of human behavior and thought processes that other research methodologies would find ineffective. Overall, the research will use qualitative case study design and qualitative data collection instruments that combine deductive and inductive methods. This will allow for the generation of theories and insights from the data collection from a bottom-up approach (Creswell & Creswell, 2023), as well as the application of predetermined theory and concepts discovered in the literature review.

3.4 Data Collection

The processes, plans, or methods utilized to collect data for analysis with the goal of discovering new information or improving perception of the research context are referred to as methods of research (Creswell & Creswell, 2023). The data collection process in qualitative study consists of defining the boundaries of the study by setting sampling and selection criteria for participants, and planning for data collection (Bhangu et al., 2023). This involves various methods such as interviews, focus group discussions and document analysis. Data collection was conducted in two stages using multiple data collection methods in this research. The preliminary stage was the literature review for getting the context of the study area through secondary sources, while the secondary stage included qualitative data collection tools such as non-participant observation, semi structured interviews, and focus group discussions. Using multiple methods assisted in triangulating the data from different sources, hence converging towards a verified result (Creswell & Creswell, 2023; Taherdoost, 2021). Table 2 gives the summary of all the data collection methods used across various study villages.

Table 2: Summary of Data collection Methods

Method	Gabakund	Gangadharpur	Mirjapur (incl. Parbatipur)	Total
Key Informant- Semi- structured Interviews	14	13	20	47

Focus Group Discussions (FGDs)	2 ((Fishermen and Fisherwomen separately)	2 (Fishermen and Fisherwomen separately)	4 (2 castes (Fishermen and Fisherwomen separately))	8 FGDs
Non-Participant Observation	yes	yes	yes	All 3 Villages

The sampling criteria can be designed by the researcher based on the objectives of the study (Staller, 2021); hence I designed the criteria based on the context of the research as explained in section 3.4.1 below. Research Assistant, Tapan Kumar Behera, contributed a lot during the data collection process, especially during sampling activities. He, who lives in a different village and belongs to a fishing community, has profound knowledge of all the communities around Chilika lagoon due to his travel history within Chilika lagoon for various kinds of work. This made it easy for me to build camaraderie and rapport with the research village members. Given the challenges I initially faced in a new environment, the whole field work process, and insights I gained throughout the research work has allowed me to grow personally and professionally. Each data collection method and sampling criteria adopted in this research is explained in detail below.

3.4.1 Sampling

Sampling is the process of selecting only a portion of the population to represent the whole (Shaheen et al., 2019). Qualitative researchers usually follow non-probability sampling which involves sampling those populations reachable to researchers or are identified by researcher based on the study criteria. Unlike quantitative sampling strategies, qualitative sampling plans are broad and flexible throughout the study (Moser & Korstjens, 2017). Researchers must have a general idea about the sample size, but there are no specific rules - variation in sampling size may change at the later stages of the work. Sample size depends on “research saturation” and conceptual requirement rather than number, which is quality is preferred over quantity (Staller, 2021). A sampling strategy is considered effective if it has successfully extracted all the pertinent information with respect to the objectives, irrespective of the sample size. However, the rationale behind the researcher's choice is mandatory to prove the validity and reliability of the sampling plan adopted (Gill, 2020). The common qualitative sampling methods used in general are volunteer sampling or convenience sampling, snowball sampling, purposive sampling, and theoretical sampling (Naderifar et al., 2017). Based on researchers’ discretion, sometimes more than one sampling method may be used in their study to meet the conceptual requirements (Shaheen et al., 2019).

For my research, the sampling approach involved a combination of purposive sampling, snowball sampling and convenience sampling, which were used to identify the key informants. Key informants are defined as the experts or knowledgeable people in a community who have the potential to share both individual and community perspectives that enrich the data despite a small number of participants. The main category of Key informants in a rural community (Gauchan et al.,2022; Kibuacha, 2024) are village leaders, elderly people, association heads, women leaders and whoever has knowledge about the specific topic of research. In this research, key informants selected were community or village committee leaders, fisheries association head, women self-help group leaders, cyclone management committee leaders and young rescue members within the community. This category was predetermined based on the assumption that these groups of people, because of their responsibilities and activities involved in the past, would have greater

understanding of the problem under study. Hence, after selecting the category of people, through the existing contacts of research assistants in each community, potential participants under the predetermined categories were identified, this part of the process is acquired through snowball sampling. Additionally, during fieldwork, we casually engaged with community members near the gathering areas such as community center or other common spaces, when some fishers showed willingness and eagerness to share stories - this has helped me to explore further by prompting questions. This aligns with both convenient and volunteer sampling, which further helped to enrich data and validate the findings. In each village, my translator would find someone who he was already familiar with, this always made my work easy, especially for targeting potential respondents. Table 4 below provides an outline of various levels of sampling strategies utilised during the fieldwork.

Table 3: Summary of Sampling Strategies

Sampling Methods	Description
Purposive Sampling	Pre-determined key informant categories based on their experience and knowledge (Example: community or village committee leaders, fisheries association head, women self-help group leaders, cyclone management committee leaders and young rescue members.
Snowballing Sampling	Using translators, initial contacts established connections with a few of the key informants and others were identified and recruited based on the first set of respondents.

Convenience and Volunteer Sampling	Engaged in conversation with local fishers in informal community common spaces who exhibited eagerness to share their stories and experiences
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3.4.2 Scoping

A comprehensive review of the literature began prior to the data gathering phase and continued throughout the whole data collection procedure, data analysis and report writing. For this, peer-reviewed literature and reports published by NGOs, government organizations, thesis and dissertation reports and other reports from pertinent institutions were employed. This literature review assisted in gathering a more comprehensive understanding and analysis of the situation in relation to its historical and contemporary context. It not only provided a foundation framework prior to the work but also helped to validate the themes that emerged during the interviews and focus group discussions. By combining this with the other qualitative data collection research techniques listed below, a thorough and contextually rich investigation of the real-life condition of SSF communities in the context of the research objectives was carried out.

3.4.3 Non-Participant Observation

Qualitative observation involves data collection through detailed and descriptive observation and interpretation of the researchers based on what they see, hear, and feel about the interactions, behaviors, social settings, and environment around them (Abbott, 2023). Non- Participant observation involves examining the surroundings and respondents from an external position in a way that is non-interactive and unobstructive. In the preliminary stages of qualitative research, non-participant observation plays a pertinent role in finding potential respondents and becoming familiar with the social and cultural context of the study site, especially if the researcher is unfamiliar with the whole surrounding (Barner-Barry, 1986; Ciesielska et al., 2018). The other main goal of observation is building rapport with the community

members which aids researchers to gain trust and allows participants to feel comfortable and share deeper insights that leads to rich reliable data for the research (Ciesielska et al., 2018; Qaddo, 2019). It also facilitates studying the cultural context, the existing relationship between different stakeholders and their practices. Additionally, observation can be useful in triangulating the data collected from other qualitative research methods to enhance the credibility and robustness of the findings (Walshe al., 2011; Creswell & Creswell, 2023). In this research, non-participant observation helped to procure the objective (physical features of each village) and subjective (social interactions and building camaraderie with community members) aspects of the research content. The first few days were solely utilized for observation by spending time in building friendship and rapport with the aim of identifying the potential participants and understanding the overall community dynamics. This involved introducing myself and engaging with the members, especially near the tourism building, community centre and another key gathering spot. Along with establishing initial rapport, the continuous and direct observation of the physical aspects such as geographical features, structural components, the obvious fallout from past disasters and any new key features emerged during the data collection that influence the research was captured without participating in any activities. To conclude, the observation was the fundamental part of the field work which served as the initial reconnaissance phase to understand village dynamics before conducting the interviews and focus group discussions and helped in triangulating the data. Furthermore, as a novice social science researcher, this process has given enough time to build friendship with people from different cultural backgrounds and diverse linguists.

3.4.4 Semi Structured Key Informant Interviews

On a continuum of qualitative interviews, spanning from unstructured exploratory type interviews to structured interviews, semi-structured interviews (SSIs) lie in the middle, having the advantage of both other types (Magaldi & Berler, 2020). This type of interview involves a conversation between researcher and participant, influenced by a thematic framework, while also making provisions for additional questions

and probes as the interview progress with new themes and ideas that need further investigation based on researcher's discretion (DeJonckheere & Vaughn, 2020; Adams, 2015). Despite the drawbacks of SSIs such as time consuming and labor intensive, SSIs are best to delve deep into the conversation with flexibility and constructive essence that inspires new themes to emerge (Creswell & Creswell, 2023; Gill et al., 2008).

In this research, semi structured interviews with key informants were the crucial part to gathering in-depth data that incorporated the perspectives of participants aligning with the research objectives. The selection of key informants was the first critical step involved in the process. Participants for the interview were chosen using a combination of purposive sampling, snowball sampling, and convenience sampling as described in section 3.4.1. A comparable number of interviews were conducted in each village summing up to a total of forty-seven key informant interviews from all three villages, but overall, the focus was not the quantity of the respondents but the quality of data. Hence, interviews were stopped in each village when the “saturation” was reached, that is when no new themes or insights were emerging.

3.4.5 Focus Group Discussions

Focus group discussion facilitates communication among members by providing an opportunity to watch how situations are managed, how problems are formulated and resolved, and how agreements emerge in various settings (Basnet, 2018; L. Morgan, 1997). Planning for groups involves considering the interviewees' physical proximity to guarantee that all target participants are present at the same time and at the chosen location (O. Nyumba et al., 2018). By employing the snowball sampling technique, participants were identified. Places that are well known to the fishing community were chosen as the venue for group discussions such as the cyclone centre, community centre and sometimes at the house of village leaders. A total of eight focus group discussions was conducted, two in each village for men and women separately. In Mirjapur, two additional focus groups for Parbatipur villagers (men and women) were conducted, this was to ensure the homogeneity in the process. Homogeneity in terms of gender and caste was followed to avoid any barriers to gender or caste-based hierarchy that would hinder open communication and

discussions (Sim & Waterfield, 2019). The primary methods for capturing data were observation and specially designed interview protocols with questions. Audio recording and handwritten notes were used to keep the record of data for further analysis. The study's validity was assessed via triangulation process, which included analyzing data from other sources such as interviews and observation to develop a cogent case for the themes (Creswell & Creswell, 2018). By carefully reviewing transcripts for errors and precisely assigning codes at each stage of the coding process, the study's reliability was assessed and improved (Creswell & Creswell, 2018).

3.5 Data Analysis

Data analysis is qualitative analysis that involves organizing and preparing the data sets such as interview scripts, observation notes for systematic scrutiny to understand the phenomena under study (Wong, 2008). In this section, how the data collected during fieldwork was systematically analyzed to obtain presentable results and discussions.

3.5.1 Multiple sources of data - A contribution to Data analysis

Data collected during the fieldwork consisted of audio recordings of the interviews and focus group discussions, analytical field notes' that included physical writings of researchers based on interviews, observations, and casual social interactions (Wong, 2008). Written field notes in addition to the transcribed interview and focus group discussion audio tapes is considered as an efficient tool to provide key context that facilitate data analysis (Phillippi & Lauderdale, 2018). The audio recordings from all the interviews and focus group discussions in their local language "Odia" were recorded and a local dialect expert was hired to translate it into English texts. These texts along with the field notes, which were already in English were used in qualitative data analysis.

3.5.2 Thematic Data Analysis

Qualitative analysis software was used to code the transcripts of interviews. The primary data was managed using the NVivo tool. To effectively integrate the data gathered, the interviews were physically examined. After the data was transcribed and coding was done both deductively and inductively. It is not practical to follow only one of these approaches, because both require thorough understanding of the data and comprehend it (Byrne, 2022). However, in most of the research, either of the two will be dominant while performing the analysis. In this study, deductive analysis was predominant as the major categories or concepts were already determined based on the conceptual framework derived from the literature review. But at the same time, the analysis was kept flexible for the possibility of any new emerging themes or categories. The six-phase analytical process proposed by Bruan and Clarke (2012) was used to conduct deductive dominant thematic data analysis. The steps utilized for the entire data analysis are described below, however it was not a linear process, instead iterative as I had to go back and forth multiple times whenever it was necessary. The steps were as follows:

i) Organizing and Familiarizing with the data: The transcribed data was initially cross-checked with the field notes and then organized based on village wise interviews, focus group discussion and observations with respective participants code to maintain confidentiality. Then the files with proper names were imported to NVivo software.

ii) Creating predetermined codes: Using the option in NVivo, predetermined codes were created based on the conceptual framework for this study (see section 2.6). Then each respective text segment was assigned to the respective codes using the features in NVivo. The flexibility to create new codes based as it emerges from the data which might add relevance to the research was kept open throughout the coding process.

iii) Developing and Reviewing Themes: Next step involved generating themes. This was done in two ways; grouping those similar codes into overarching themes and sometimes promoting the code as themes

whenever it seemed relevant for the focus of the research. The themes are then reviewed with the transcribed data and then the relationship with each code that forms the theme was also cross-checked.

iv) Next step involved **defining the themes** in such a way that all the themes collaborate to give a narrative description of the whole data with respect to the research objectives. Finally, the report involves interpreting the findings based on themes and their relationships with each other regarding the reach objectives with appropriate quotes from the analysis and existing literature.

3.6 Ethical Considerations

This study involved collecting data in the form of interviews and focus group discussions from ethically vulnerable and marginalized communities. Hence, foreseeing the ethical problems that may affect the participants, necessary measures were taken to ensure the safety of the participants. Participants were informed prior to the study's objectives, and verbal consent was obtained before beginning the data collection. They were also informed prior that participation is completely voluntary and can withdraw from participation anytime they feel uncomfortable. My research assistant, who is a member of the same community, helped me to understand the cultural and social expectations. This helped me during and after the data collection process. Interviews were conducted in an honest manner, ensuring the anonymity of the participants. Overall, I aimed to build beneficial collaboration with the communities and anticipate making contributions that support the communities to build their resilience towards climate related disasters in the future. Ethical clearance for this study has been granted after thorough review and examination by university of waterloo Research Ethics Board (REB #46458), please see Appendix B.

Chapter 4

Community Level Consequences in the Face of Cyclone Threats

4.1 Introduction

This chapter focuses on presenting the key findings based on the first research objective. The key goal of the research is to explore how the existing social capital and relation wellbeing is offering possibilities for different community level responses that contribute to recovery and community resilience against frequent cyclonic activities. Initially, it is imperative to identify various challenges faced by the community at the onset of tropical cyclones, which is the first objective of this research (Box 4.1).

- 1) To explore how cyclones are impacting the SSFs in Chilika Lagoon.
- 2) To examine the interactions between social capital and relational well being of SSFs in dealing with cyclones in Chilika lagoon.
- 3) To explore different community level responses to cyclones that are shaped by the available social networks and their effectiveness.

Box 1: Overview of Research Objectives (Objective one - highlighted)

4.2 Cyclones as a major threat to the Small-Scale Fishing Communities of Chilika Lagoon

The Bay of Bengal is a high activity zone for the origin of tropical cyclones due to its vast expansion of shallow water and surrounding landmasses (Alam & Dominey-Howes, 2015). Exposure to frequent pandemonium such as tropical cyclones, storms and other coastal disasters creates a series of upheavals to those communities exposed to it. This further unveils emerging difficulties and exacerbates their existing vulnerabilities that can lead to another cycle of short term or long-term predicaments (Lock et al., 2012). Identifying and acknowledging these impacts and stressors are inevitable for successfully tailored adaptive

management planning and policies that are context specific (Bennett et al., 2018). Chilika lagoon is an epitome of the complex socio-ecological system (Nayak, 2014) with varied dynamics within. Over the last few decades, it has been through a series of environmental changes due to the influence of both natural and anthropogenic drivers. Out of all the environmental changes, tropical cyclones and the accompanied impacts such as floods, erosion of shorelines are concerning and has devastating effects on the community living along the coast (Mohanty et al., 2008). There are actually eight severe cyclones which originated from the Bay of Bengal, that affected the Chilika Lagoon as shown in the table 4.1 below (Acharyya et al., 2020; Islam & Paul, 2023). Table 5 gives the list of various cyclones, its landfall year, category of the cyclone according to IMD and the damages and actions prescribed by the IMD. In the following sub-section, Fisher's perspective on various environmental changes observed in relation to cyclonic activities are discussed.

Table 4: The list of devastating Cyclones that affected Chilika lagoon (Source: Acharyya et al. 2020; Indian Meteorological Department (IMD), 2021)

Name of the Cyclone	Year	Maximum Wind Speed (km/h) and IMD Classification	Damages and Actions
Odisha Super Cyclone	October 1999	260 km/h -Super Cyclone	Extreme Damages to all kinds of building, large scale evacuation, flooding, and complete halt of fishing activities.
Phailin	October 2013	215 km/h - Extremely Severe Cyclonic Storm	Extreme Damages to Kutcha houses and old structures, flooding,

			extensive evacuation, and complete half of fishing activities.
Hudhud	October 2014	185 km/h - Extremely Severe Cyclonic Storm	Extreme Damages to Kutcha houses and old structures, flooding, extensive evacuation, and complete halt of fishing activities.
Titli	October 2018	150 km/h - Very Severe Cyclonic Storm	Extreme Damages to Kutcha houses and old structures, flooding, moderate evacuation, and complete halt of fishing activities.
Fani	May 2019	215 km/h - Extremely Severe Cyclonic Storm	Extreme Damages to Kutcha houses and old structures, flooding, extensive evacuation, and complete halt of fishing activities.
Bulbul	November 2019	140 km/h - Very Severe Cyclonic Storm	Extreme Damages to Kutcha houses and old

			structures, flooding, moderate evacuation, and complete halt of fishing activities.
Amphan	May 2020	240 km/h - Super Cyclone	Extreme Damages to all kinds of building, large scale evacuation, flooding, and complete halt of fishing activities.
Yaas	May 2021	140 km/h - Very Severe Cyclonic Storm	Extreme Damages to Kutcha houses and old structures, flooding, moderate evacuation, and complete halt of fishing activities.

All the above listed cyclones are identified to have affected the fishing communities of Chilika Lagoon by disrupting their livelihoods, and destruction of their houses, boats, and other fishing equipment (Kanak News, 2019). With respect to this research and the selected case study villages, the key historical cyclonic events that affected the participants and their villages are super cyclone that happened in 1999, Phailin in 2013 and Fani in 2019. Table 6 below shows the cyclones and number of responses from the overall interviews. Only a few participants mentioned Titli, Hudhud and Amphan cyclones and they also reported experiencing very minimal effects in their respective villages compared to the other three cyclones in table 6. As mentioned by a fisherman in Gangadharpur. “During Phailin and Fani, we lost our houses, boat,

livestock, and trees, but Fani was severe. Titli and Hudhud did not had much impact in comparison to Fani and Phailin.” On a similar note, a fisherman from Mirjapur also expressed his views as ...” During other cyclones like Titli, Hudhud and Amphan, which had only less effect, we stayed here.” Considering this, the whole discussion and analysis for this research corresponds to the three main cyclonic events that are; Odisha Super cyclone 1999, Phailin 2013 and Fani 2019.

Table 5: The list of Reported Cyclone Experiences in Case Study Locations.

Cyclone Name	Year	IMD Classification	Reported (Yes/No)	Number of mentions in the interview
Odisha Super Cyclone	October 1999	260 km/h -Super Cyclone	Yes	8
Phailin	October 2013	215 km/h - Extremely Severe Cyclonic Storm	Yes	19
Fani	May 2019	215 km/h - Extremely Severe Cyclonic Storm	Yes	27
Titli	October 2018	150 km/h - Very Severe Cyclonic Storm	Yes	3
Hudhud	October 2014	185 km/h - Extremely Severe Cyclonic Storm	Yes	3

Amphan	May 2020	240 km/h - Super Cyclone	Yes	2
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There has been observed a remarkable shift in the track of cyclones due to various reasons in relation to climate variability, towards the western side during 2000 and 2001 compared to 1982-2000, making coastal areas of Odisha including Chilika more prone to cyclonic risk (Sil et al., 2021). Most of the participants have highlighted that they have observed substantial changes in the intensity and frequency of cyclonic activities affecting them compared to their childhood days. The community leader from Gabakund Fishing village made the following observation:

“I have noticed a stark difference in the intensity and impact of such events, before we would only be worried of flood & storms during rainy season but these days especially 2000 onwards, such incidences have become common and happens around August-September and November, which is a result of climate change and deforestation etc. Comparatively, the conditions have worsened these days as it destroys houses, trees, livestock, human life, and livelihood” (Fisher’s Community Leader, Gabakund).

This comment suggests that the impact of cyclones has increased profoundly affecting the entire life system from two thousand onwards, which implies a sharp rise in the intensity of cyclones. The communities experienced an increase in the effects of cyclone each year causing them more difficulties, especially the last few cyclones as highlighted by a fisherwoman in the focus group discussion:

“In my lifetime, while growing up in this village, I never saw this level of destruction from cyclones but the last four to five cyclones have affected us. Every year the intensity of cyclones keeps increasing” (Fisherwomen, Focus Group Discussion).

Some of the participants expressed how cyclones have become a part of their daily conversations these days indicating their passive acceptance as it has become so frequent and part of their life in their area. A fisherman who is a part of the rescue team in Parbatipur said, “I have never heard people around me talking about cyclones or getting scared during my childhood, but these days, cyclones come into our conversation frequently.” Also, another fisherman from Mirjapur compares his lifetime changes with respect to his father’s and makes the following assertion: “My father says that previously cyclones used to happen once in three to four years but these days, from the last 4-5 years, the frequency as well as the impact has increased. Cyclones are a normal thing these days, what matters is the landfall region” (Young Rescue Fisher, Mirjapur).

The perception of an increase in cyclonic events as compared to the past to the community members corroborates with the higher Power Dissipation index for cyclones indicating the same from the study by Sahoo & Bhaskaran (2018). The proximity of the villages to the Bay of Bengal creates a sense of uncertainty to the daily lives of fishers along with the escalating occurrence of cyclones these years. This feeling of ambiguity and worry is reflected in the following comments by the respondents:

“The frequency has increased from time to time, increasing frequency is creating damages to us back-to-back. Once we regain it, we are always in fear as it is uncertain when the next crisis will occur as we are living close to the Bay of Bengal” (Self Help Group President of Fisherwomen, Mirjapur).

In relation to the above statement, the Primary Fisher's society head of Mirjapur also made the following assertion:

“Not just the fishers of Mirjapur village, but the whole village in Chilika lagoon that is close to Bay of Bengal has the fear of losing life and pray to God that they do not have to face it ever in life. Which village people will be most affected depends on the landfall site of the cyclone, but our villages are close to the sea mouth and Bay of Bengal, so we are more vulnerable than the inner villages” (Primary Fisher's Society Head, Mirjapur).

The perception of increased severity and unpredictable cyclonic events were consistent across all the case study villages. Fishers are under constant fear of cyclones due to their past experiences; this was observed during my field work in October 2024. In the earlier periods, as is also reflected in table 7, cyclones usually occurred in the months of October, but marking 2019 Fani as an exception in the regular pattern. This deviation from the usual pattern seems to give a sense of unpredictability and constant fear among the fishers, as they anticipate that cyclones can occur anytime out of the predictable seasons. I have observed some fishers expecting a cyclone soon because of the extended periods of high temperature days from my casual conversation with them. My translator, who is a part of the Chilika Fisher communities, was also keeping track of the news updates regarding the low-pressure formation in Bay of Bengal, which is one the primary drivers of cyclones. A week after conducting my field work, Cyclone Dana hit the Odisha-West Bengal coast, havocking the lives of many farmers and fishers on the Odisha- west Bengal border (Sahoo, 2024). Reading the newspaper cuttings led me to ponder the risk and vulnerabilities faced by the other set of fishing communities. Hence, cyclones are a major threat that disrupts the life of small-scale fishers in the Chilika Lagoon. The following sections will discuss the various multidimensional challenges identified based on the perception of participants.

4.2.1 Cyclone Induced Challenges in the Case Study Villages

This sub section explores the various dimensions of challenges faced by the communities in the face of cyclonic events. The various challenges identified mainly fall under the main categories such as environmental challenges (flooding, ground water quality deterioration and loss of Casuarina trees), Physical challenges (destruction of houses, boats fishing equipment and inadequate protective infrastructure), socio-economic disruptions and emotional distress. The comparison of various challenges in the three different research villages as perceived by the communities is presented in table 7. The detailed description of all the above-mentioned challenges is explained in the following subsections below.

Table 6: Comparison of various challenges in the three research villages based on fisher's perspectives

Challenges	Gabakund (Outer Channel)	Mirjapur (Outer Channel)	Parbatipur (Outer Channel)	Gangadharpur (Inner Channel)
Deterioration of groundwater quality	✓	✓	✓	✗
Impacts through Flooding	No more, since 2019	No more, since 2019	✓	✓
Perceived impact of Casuarina tree loss	✓	✓	✓	✗

Loss of livelihood system	✓	✓	✓	✓
Out migration and diversified livelihood	✓	✓	✓	✓
Absence or lack of proper protective infrastructures	✓	✓	✓	✓
Emotional Distress	✓	✓	✓	✓

4.2.1.1 Impact of Cyclone on Groundwater quality

The tropical cyclones with extremely heavy wind speed cause storm surges that cause the modification of different physicochemical properties of coastal groundwater by enhancing the salinity variation and mobilization of contaminants (Mondal et al., 2024). Thus, making it unsafe and increasing the potential risk for the inhabitants. Additionally, continuous exposure to these activities can deteriorate the coastal ecosystem causing drinking water quality concerns and scarcity (Nordio et al., 2023). The quotes given below highlight the fisher’s notion of drinking water qualities from the groundwater source after the onset of the cyclones in Gabakund and Mirjapur.

“Drinking water quality is bad even now but at least it is usable, but after the cyclone the water quality is the poorest. It takes around 3-4 months for the water quality to slowly regain its actual taste” (Primary fisher’s Society Head, Mirjapur).

On a similar note, a group of fishermen also shared:

“The water quality has drastically reduced after Phailin and Fani. We cannot drink or use the tube well water for cooking purposes anymore” (Focus Group Discussion Men, Gabakund).

This statement indicates that they still have concerns regarding the water quality after the multiple exposure to cyclones. While some fishers have explicitly said the water regains its original composition in a few days, most of the fishers do not trust the local sources of water. Hence, most of them these days shift towards other sources, investing in filtering units, boiling water, or making use of borewells in an elevated location or far from the coastal line, as said by few of the respondents:

“After Phailin, the water has become poisonous, we cannot drink or cook food. Some people buy water, some use aqua guard, and some get drinking water from Bhabakundelswar (borewell water), which is situated in an elevated position” (Focus Group Discussion Women, Gabakund).

Relatedly, a fisherwoman in Parbatipur shared their change in drinking water source, as follows... “We could use the water from all tubewells before but not anymore, there is only one tubewell near the training centre which is still usable for cooking purposes” (Self Help Group Fisherwomen, Parbatipur). The situation is more or less the same in Mirjapur, as one of them responded;.. “We noticed a change in the water quality after the last two cyclones, since then we boil our water before use” (Fisherman, interview, Mirjapur). While fishers in Gabakund, Mirjapur and Parbatipur pinpointed the deterioration of groundwater, no fishers in Gangadharpur has experienced any changes in the water quality in the borewells or tubewells. Most of the respondents confirmed that there were no issues with the groundwater, and they only experienced taste differences in open sources of water, he said:

“There was no change in the boring water, only the quality of open water sources changed” (Young rescue fisherman, Gangadharpur).

This can be substantiated by the fact that the wells located far from the coastline and higher elevations have less or no chance of getting polluted (Mondal et al., 2024) due to the surge that happens because of tropical cyclones. Since Gangadharpur is in the inner channel, 4-5 km from the coastal line, the groundwater would not have affected much when compared to other two villages close to the coastal line.

4.2.1.2 Impacts of Cyclone induced Flooding.

The continuous heavy rainfall and heavy wind associated with tropical cyclones induce a disaster chain that creates other accompanying hazards such as flooding thereby interrupting various activities of the inhabitants (Ranjan & Karmakar, 2024). In my study, I identified disparities in how each village was affected by cyclone-induced flooding and waterlogging conditions. The super cyclone that happened in 1999 created more flooding related destruction, compared to the recent cyclones in Gabakund and Mirjapur specifically. This has inflicted heavy losses on those who had aqua farms and agricultural land like the other sources of livelihood. Many participants associated the reduction in agricultural yield over the years due to the flooding as a part of a cyclone, while they also mentioned that they did not face flooding in the village these days due to the presence of coastal barriers that were constructed six to seven years back, before the Fani cyclone happened in 2019. As highlighted by the Community leader of Gabakund:

“Our aquaculture farm and agricultural field were destroyed because of water logging that happened due to the cyclone. For the past ten years, we have had less yield from those fields, as a result we are forced to use more fertilizer, while some failed and stopped agricultural practices. But the village area is safe compared to past days, we never had a coastal barrier, so there was more flooding. But then we together requested the government for coastal protection, and we got it done before we faced less flooding”
(Community leader, Gabakund).

Fishers in Mirjapur also responded similarly regarding the flooding issue, as expressed by one of the participants:

“We faced submerged agricultural land in the past, especially in the 1999 and 2013 Phani cyclones that affected the yield and our income. After that we requested for coastal protection and it was implemented before Fani in 2019, so our village was protected from flooding” (Self Help Group President Fisherwomen, Mirjapur).

But the situation is entirely different in Parbatipur and Gangadharpur. It was observed during the fieldwork that even though Parbatipur is situated close to Mirjapur village, the former is in a low-lying landscape making it more prone to flooding. Additionally, the protection barriers surrounding the Parbatipur village were partially and wholly deteriorated as shown in figure 4. below. This has affected their agricultural lands, and community gardens, even in the last cyclone. While they regained the community garden, the agricultural practice was totally discontinued due to the ingression of saline water that happened during the cyclone. Some of the responses that echoes these issues are as follows:

“We live close to the lagoon and our houses are in a low-lying area than the rest of the houses in the village and have no proper protection barriers, the construction was not done properly in the first place, and it does not have sufficient height to withstand flooding. Boundary wall around the village should be fixed to prevent flooding, our village is low lying and gets flooded.” (Focus Group Discussion, Fisherman, Parbatipur).



Figure 4: The condition of barriers in Parbatipur (eroded and not in sufficient height) (Left) and the images of proper barrier walls in Mirjapur (in the same extend) (Right) (Photo: Greeshma Prakash Sherly)

As the assertion made by the group of fisherwomen in Parbatipur, the village community leader also made the following comment:

“Our village is low lying and has been subjected to flooding all the time. The coastal protection around our village has been eroded partially. There is no proper safety wall around our village, to save us from direct impact. The trees, agricultural land and our community vegetable garden were impacted by the flooding of salty water that happens every time we face a cyclone. We cannot grow wheat anymore because of the salty water and we no longer do any agricultural practices due to less yield “(Community Leader, interview, Parbatipur).

In the case of Gangadharpur, they do not have paddy fields, but their fish farm was severely affected and had to cease the fish farming for an extended period to rebank it. The lease period was extended without

any monetary benefits for the villagers due to the impacts of flooding. The absence of protection barriers around their village has exposed them to multiple occurrences of flooding in the village that interfered with their rescue activities and relief distribution. For instance, a few of the responses highlight their difficulties:

“We face flooding because we do not have a barrier around the village. We have requested the government that eventually they start, but it is disrupted due to some disputes” (Community Leader, interview, Gangadharpur).

Similarly, a fisherman explained how the flooding is affecting their rescue operations, and their subsistence as follows:

“Water gets into the village and after 4-5 days it recedes. But moving around and helping people becomes hard due to flooding. Our fish farms also get severely contaminated and takes months to come back to normalcy We do not have a coastal barrier as well, making our area prone to flooding, we have requested multiple times and the construction has begun, but it's disrupted due to some disputes” (Young Rescue fisherman, interview, Gangadharpur).

This was observed during the field work, that some of the villagers had their houses extended till the lagoon's shoreline and the construction of the barrier did not continue past that area. Villagers have different opinions regarding this, during the focus group discussion of fishermen, those fishes having their houses that disrupt the construction of barriers left the discussion when other groups of fishers were justifying their reasons for wanting a protective barrier. Figure 5 contains two pictures, one showing the entry point of water during flooding and the second image showing the halted barrier construction.

One of the conversations he had with one of his friends who was the head of Fisher's Primary Society in Gangadharpur revealed that some fishers are unwilling to leave the land for construction of coastal barriers, when attempted to explain how a protection barrier would help, the response was as follows:

“We are fishers by birth, if flooding becomes uncontrollable, we will use our boats to navigate. Our entire life revolves around boats, and we will somehow deal with it”
(Fisher’s Primary Society Head, Gangadharpur).

While this statement reflects their sense of dependence on their traditional and cultural way of life, the uncertainty and risk associated with these self-reliant perspectives can remain concerning with respect to effective disaster preparedness and strategies.



Figure 5: Images of Gangadharpur village condition: No protection barrier, the water enters through this open path during cyclone (Top) and the point where construction of the barrier halted (Down) (Photo: Greeshma Prakash Sherly).

4.2.1.3 Loss of Casuarina trees from Cyclone and other Vulnerabilities

During the beginning of the 20th century, casuarina tree plantation had been promoted as the coastal bio shield in the Indian coastal line for the protection of coastal inhabitants and their livelihood activities against

the high-speed wind due to cyclone and other coastal disasters (Das & Sandhu, 2014a). According to the records, in the coastal belts Odisha casuarina trees were initially planted for good wood supply to puri district, but over the years the perception of purpose of casuarina trees afforestation has changed from only wood supply to both timber provision and coastal shield due its widespread ecosystem services (Das & Sandhu, 2014b) such as salt tolerance, prevention of soil erosion, and habitat for birds. The notion of community members also aligns with these revelations, as few of the respondents said.

“In my memory, the plantation has always been here since his childhood, so we can safely predict that it has been since 1950s. As per our understanding, it saves us from harsh wind, it also prevents soil erosion, and we get dry woods for cooking purpose”
(Community Leader of Fishers, Gabakund).

The above comments clearly show the dual purpose of casuarina woods. In a comparable manner, one of the fishers shares his knowledge on how the casuarina trees act as a protection shield for the lagoon and communities residing over there. He explained:

“They are beneficial because to fight against the sea waves they are helpful. Else to prevent the violent sea waves from crashing into the land nothing else is there. If there is a shore, by planting trees on it, its roots hold the sand tightly together. Apart from that when there are strong winds/gale they get stopped and if suddenly the waves get inside the land, it acts as a barrier. It acts as a safety layer” (Young Rescue Fisher, Mirjapur).

While in contrast, some scientific communities have reported the ineffectiveness of Casuarina in coastal shields beyond a certain wind velocity and suggested blended plantation of casuarina (Das & Sandhu, 2014b). with other native species such as mangroves for better protection.

Discussion with a few respondents enabled me to capture an intriguing perspective of fishers, which associates the loss of casuarina trees with the artificial sea mouth opening. During 1973-1993, Chilika Lake

has undergone a drastic change due to littoral drift, resulting in the closure of old sea mouths that caused the transformation of brackish water ecosystem to freshwater ecosystem that affected the fish migration and overall ecosystem (Mishra & Jena, 2014). To address this issue and to maintain the ecosystem function of the lake, Chilika Development Authority (CDA), opened an artificial sea mouth near the Sipa Kuda village, along with some dredging activities in the northeast and southwest direction, with the aim of increasing the tidal current to maintain the optimal salinity (Mishra & Jena, 2014; Rajawat, 2024). However, after the intervention, due to the increased tidal current the sandbars adjoining the new sea mouth where the casuarina trees are planted have been continuously eroding. The littoral drift (movement of sand and sediments) was observed to be in the northward direction, causing erosion in northern direction and accretion in southern direction (Mishra & Jena, 2014; Sundaravadivelu et al., 2019). Due to this dynamic coastal morphology, the artificial sea mouth has gradually shifted towards the north, deteriorating the casuarina tea plantations. These insights align with the Fisher's belief as one of them responded:

“During the 1968 cyclone, the casuarina trees saved us from the impact of the high-speed wind, the height of the trees that were destroyed in the cyclone was around 20-30 ft. Also, the first has been deteriorating due to the shifting of sea mouth, caused due to the opening of artificial sea mouth. These trees help to control the wind speed. The newly planted trees were not big enough to withstand the wind.” (Villager leader, Mirjapur).

Additionally, a noteworthy observation from the above comments is that one of the reasons for enhancing the erosion of the northern bank and deteriorating the plantation is cyclones. Many studies have pointed out how the various highly devastating cyclones like Fani that hit the shore have enhanced the erosion process by opening various inlets to the Bay of Bengal opposite the Gabakund and Mirjapur Village, thereby destroying the trees on the sandbar stretch (Acharyya et al., 2020; Kanak News, 2019; Sangomla, 2019). This creates a vicious cycle of erosion and cyclones induced vulnerabilities to the coast. However, all these cascading effects are linked to the artificial sea mouth opening. Besides this issue, artificial sea mouths are

reported to have a rampant impact on the social and ecological system of Chilika lagoon (R. Ghosh, 2018; P. K. Nayak, 2022) such as population dynamics of fish which affected the livelihood of fisher communities, erosion of identity, and exodus of people due to economic hardships (Dujovny, 2009).

Two respondents highlighted the difficulties faced by the communities due to the intervention of artificial sea mouths in the complex socio-ecological system of Chilika Lagoon, as follows: In Parbatipur... “People do not want to marry their girls in our village, as we live so close to the sea mouth” (Young Rescue Fisher, Parbatipur). In Gabakund... “But these days we get less fish from the lagoon; there are many reasons for that but one evident is the artificial sea mouth. The day it was dredged, our life rhythm has been changed” (Young Rescue fisher, Gabakund). And one of the fishers connected the loss of casuarina trees to the opening of artificial sea mouth as follows:

“We lost the Casuarina trees because of the artificial sea mouth. Our income sources have gone down from fishing in comparison to the past. Artificial sea mouth is the reason for all these” (Fisherman, Gabakund)

4.2.1.4 Cyclone Induced Challenges to Livelihood System, and various Socio-Economic Conditions

The socio-economic and livelihood capacities of fishing communities that inhabit the lagoon, estuaries and marine regions are pushed to the brink of collapse (Marone et al., 2017; Paton & Johnston, 2001) in the face of severe cyclonic storms due to their proximity to sea. The various vulnerability and damage caused by these extreme climate related disasters targeting the livelihood and socio-economic context of Chilika Fishing communities are described in the subsequent sections. Livelihood is defined as the “adequate stocks and flows of food and cash to meet basic needs” (United Nations, 1987). The fishing communities in Chilika lagoon are based in activities such as fishing, tourism, aquaculture farming and agriculture to meet their basic needs, which get disrupted due to the vigorous winds, flooding and other environmental changes accompanied by tropical cyclones. Thus, making them more vulnerable and helpless. According to participants, the cyclone obliterated the small-scale fishing communities by destroying boats, fishing

equipment, Cashew tree plantations, agricultural lands, aquafarms, missing livestock, and lost days of fishing and tourism activities. As observed by the following participants:

“Because of our geographical location, we are prone to tidal water and cyclones, but we are mostly affected by cyclonic storms as it destroys boats, fishing related equipment, whatever small agricultural lands we have, livestock and entire livelihood in general” (Community leader, Gabakund).

Similarly, a fisherwoman from Mirjapur also shared the experience of the fishers:

“Boats were broken, fishing equipment were lost, asbestos houses were destroyed in the windstorm. We lost cows, buffaloes, and goats. Fishing and tourism will be completely stopped for many days” (Self Help group fisherwomen President, Mirjapur).

Before the onset of cyclone, fishers were banned from going fishing by the government authorities considering the safety of their life, however this will affect the fishing calendar days leading to less income and aggravated financial burdens. During a discussion, when asked about how disasters like cyclones are impacting their life, one of the respondents replied:

“We are already under the attack of ‘an economic instability disaster,’ these cyclones just worsen our situation, pushing us into additional economic hardship”
(Self-help group fisherwomen President, Gangadharpur).

The responses from the participants reflect how the natural vulnerability (location of the region) accompanied by exiting financial vulnerabilities and sudden stressors like cyclones has contributed to the elevated vulnerabilities in the fishing communities. In addition to this, few respondents highlighted the interference of new unexpected stressors like COVID 19 impacted their re-backing capacity following the cyclone Fani in 2019. The response was as follows:

“After Phailin, six months but after Fani, it took us around 3 years to get back to normalcy because covid happened within a few months of Fani. During Fani, all the boats were found

around fifteen kms away, dumped one above the other, so we had to rebuild everything from scratch and by then lockdown happened, which affected us very badly” (Young Recue Fisher, Gangadharpur).

Banning fishing activity combined with the inability to go back for fishing due to broken boats, and lost fishing equipment doubles the economic instability. While a few participants mentioned that they would get back to fishing within a week, some mentioned their inability to start fishing due to the huge loss they incurred. Hence, the study revealed a wide gap in recovery rate and regaining process among the fishers, as stated by one of the fishers:

“Before the cyclone, we were warned not to go inside Chilika. So, our fishing will be completely stopped for 4-5 days, we lose a lot and then after the cyclone subsides, we go back again depending on our damages. Depending on the impact of the cyclone, sometimes it takes a month or so and sometimes 2 months, we repair boats and fishing nets. The financial burden is always there, but after the cyclone it increases further because now, we must fix our houses, boats, fishing equipment and then meet the needs of our families” (Young Recue Fisher, Mirjapur).

Due to these financial crises, few participants were expressing how difficult it is to survive just by fishing alone, the income from fishing was never enough for meeting the family needs and repaying the loan they took for repairing the boats and buying new fishing equipment. Thus, forcing fishers to seasonally migrate to different places inside and outside countries for better opportunities, while some are seeking alternative livelihood to sustain their living such as small business, electrical work, and labor work.

“Due to the cyclone, our livelihood is heavily impacted, so, some people have moved out to work elsewhere and look for other means of livelihood. There is not much opportunity for us in Odisha, so people are moving out. Some people from our village

have moved out to Dubai. Only male members of the family go out for work, leaving their wife and kids here” (Focus ground discussion fisherwomen, Gabakund).

This study disclosed fishers with a diverse attitude towards interest in continuing fishing. Due to the exasperation from financial burden caused by the multiple occurrences of frequent cyclones and other drivers of changes in Chilika has led to decreased interest in fishing activity. This category of fishers preferred their kids to pursue a different career that would give them a better quality of life. While on the other hand, the other set of fishers consider fishing as life, more than a livelihood. Hence, even if they pursue some other alternative livelihood for meeting financial needs, they remain active in fishing for it being their core of existence. But most of the fishers believe that relying only on fishing would not address their challenges. These were captured in the following response:

“We take loans. Fishing equipment is worth Rs 20000-30000 and for that we need to take some loan to re-back our fishing. That is a huge amount for us. We built a pond to keep our boats inside the ring boundary; our boats flew out of the boundary due to high-speed wind. I had two boats, one for fishing and another for tourism, both were completely broken in the 2013 Phailin cyclone, and I was left with nothing. Also, fishers like me who have severe loss, will have to repair their boats too depending on the damage. Considering if we take out loans and only go fishing, we will not be able to look after our family or send kids for education. Hence, I lost interest in fishing these days. I do not want my kids to go fishing.” (Fisherman, Gabakund).

The above comment suggests that due to the financial burden that is exacerbated by the climate related disasters it affects their perception about fishing and that could lead to lower retention of families in future as highlighted by (Suh et al., 2023). However, the comment below shows a conflicting view that despite the financial burden, due to the deep cultural attachment to fishing activity, they would go fishing. It is evident from the responses that for most of the fishers, fishing is not merely a source of income, but a

traditional activity that gives a feeling of fulfilment (Delgado-Ramírez et al., 2023). Similarly, another fisherman said:

“No matter how severe the cyclone is, we go fishing because that feeds our stomach. But we do look for other livelihood options because we need money. Cyclone is a disaster that wipes all our savings, re-backing from itself needs a huge amount of money, hence we are forced to search for better jobs that give us money. I do labor work other than fishing. Money is needed to even repair things and go back to Chilika for fishing.” (Fisherman, Gangadharpur).

Similarly, the village head of Parbatipur expressed how important fishing is in their life but also highlighted the need for actively seeking other livelihoods for better stability. He said:

“Fishing is our life; we will not leave fishing at any cost. Nothing can stop us from doing that. But, nowadays, any other form of livelihood apart from fishing has become imperative for our survival. Fishing alone cannot help us much. We must take care of our family, loan, and children’s school fee” (Village head, Parbatipur).

Considering the above two perspectives that emerged from the data, it is suggested that fishermen's interest in fishing could have connection with the current economic status and opportunities they have. For instance, those fishers with other opportunities and financial sources expressed more interest in continuing fishing, maybe due to the traditional and cultural linkage rather than as an only source of income. Contrastingly, fishers who expressed less interest in continuing fishing seem to have more financial burden and fewer opportunities for other sources of livelihood.

The stories of women were captured while socializing with women during my leisure times, and during discussions. Due to the financial strain, women are getting involved in various income earning activities, for instance every village has more than ten groups of separate Self-Help groups (SHG) that help them to get financial loans to support their family, start a small business, and get livestock. The Khatia and Keuta

fisherwomen who are married are housewives and engage in household activities like cooking, cleaning and oversee the overall wellbeing of the family members. Their caste custom restricts their women from working for paid labor, so only men go out for work. However, the younger generation these days seems to prioritize getting government jobs for better pay and security. In Parbatipur, the story was slightly different, even women in their village go for labor work to support the family, along with active participation in SHGs. They initially had a Coconut coir work group, in collaboration with NGOs with the aim of empowering the women, earning money, and contributing to community development. One of the women also mentioned that they went to Kerala to get trained on how to make ropes and mats with an NGO. There is a training building in their village that was constructed for giving proper training on how to make ropes, door mats and sells and skills for uplifting the women group. However, the coconut coir workgroup is not functioning anymore due to less profit and lack of funding. These buildings are now used for community gatherings and as shelter during the cyclone. As observed by a fisherwoman in Parbatipur:

“Two SHGs used to get trained to make ropes, door mats and sell. We earned some money from it, but it was not profitable in the long run. No more training for the past few years, it is a closed building” (SHG Women President, Parbatipur).

4.2.1.5 Challenges from Cyclone Induced Socio-Economic disruptions and Inadequate Protective Infrastructures

The food, water unavailability and lack of proper sanitation was a major concern after the cyclone. Even though they stock some dry food and get relief funds from government and NGOs, it usually would not be enough for their kids and fisherwomen to describe how difficult it is to see your kids starving with no way to act on it. As highlighted by a group of fisherwomen:

“On day one, cooked food was provided but thereafter for two days, dry food and water with the government’s help was distributed, which was not sufficient for everyone, but we had to adjust and cope with the scary & dreadful storm situation. During Phailin, we did

not have enough food, so our kids also had to stay in an empty stomach the whole night. It was very difficult for us. Managing food was difficult, the shops were broken, our husbands walked a little far and got biscuits and dry foods” (FGD, Fisherwomen, Gabakund).

In Gabakund, the water supply to the tanks on the top of the shelter was stopped because of the leakage that affected the strength of the building. This highlights the construction flaws from the beginning because of the lack of attention from the authorities. In Gangadharpur, the water supply was not even initially implemented as per the people’s responses. Failure in the availability of proper sanitation facilities, forced some of them to defecate and urinate outside, specially making it hard for the disabled and older people.

Along with that, the inadequate space in cyclone shelters made it hard for the people to accommodate and survive, especially since sanitation and hygiene was a serious concern. Both the cyclone shelters were constructed more than twenty years back, considering the population at that time. However, due to the increased population, overcrowding is another main issue that people face. This pinpoints the inadequacy of existing shelters to accommodate the needs of the current population, hence demanding reassessment, and amelioration. Many also emphasized that the overcrowding along with unsanitary conditions due to lack of proper basic facilities resulted in communicative diseases after the onset of cyclone. Figures 6 and 47 clearly show the current condition of cyclone shelters in Gabakund and Gangadharpur.



Figure 6: Gabakund Cyclone shelter (Top), Presence of cracks in the shelter roofs (Down, left), and Condition of Washbasin and Washroom (Down, right) (Photo: Greeshma Prakash Sherly).



Figure 7: Gangadharpur Cyclone shelter (Top), Presence of cracks in the shelter roofs (Down, right), Broken outside toilet adjacent to cyclone shelter and Condition of Washbasin and Washroom (Down, right) (Photo: Greeshma Prakash Sherly).

During the Focus group discussion with fisherwomen in both Gabakund and Gangadharpur, they explicitly conveyed that there were instances of individuals defecating inside due to improper sanitation arrangement. These findings highlight the shortcomings in the planning for basic services in the time of crises. During my fieldwork, I have also observed that even though many concrete and kulcha thatched houses lacked a proper toilet, open defecation and urination were considered normal due to the lack of proper sanitation but

could lead to high hygiene and health risks. The responses highlighted below reveal the shortcomings in the cyclone shelters discussed so far:

“We faced sanitation and drinking water issues as well. We had a water tank above the cyclone shelter initially, but it later started affecting the building, hence direct water supply was stopped. So, we had to take water from the pipe outside every time. This was especially hard for disabled people. There were incidents of people urinating and defecating inside the cyclone shelter. Some people became sick and got diarrhea during Phailin. It was a very unhygienic condition to live in.” (Young Rescue Fisher, Gabakund).

Relatedly, a group of fishing women also expressed their experience:

“When the centre was built in 2001, our population was less back then but now our population has gone up and no one is looking after the maintenance of that building. The two-room centre is small for us. And the facilities are very poor. There is no water supply to the centre, making it especially for disabled people and pregnant ladies during the cyclone. As the toilet is not functioning, old people and kids pass urine and stool in the room, then their family and others also help them to clean” (FGD Fisherwomen, Gabakund).

The other basic services like electricity and transportation were also disrupted. Electricity was fully shut down for more than a month affecting their communication systems and daily activities. Due to the disrupted road service by fallen trees, it made it challenging for accessing medical facilities that were far from the villages, as mentioned by one of the respondents:

“We also need a nearby medical facility. Now we have one 5-6 kms away, it is very hard for kids and vulnerable populations especially during cyclones if we need emergency support. During the last cyclone we faced difficulties in taking a pregnant lady to the

nearby medical centre, the roads were blocked by trees” (SHG Fisherwomen President, Mirjapur).

Additionally, those fisher members of rescue teams highlighted that most of the rescue equipment, generators and other equipment like stretchers and megaphones are not well maintained and were not working properly during previous cyclones. Apart from the lack of facilities, and proper space, fishers also complained about cracks in the cyclone shelter and their uncertainty regarding its ability to withstand another strong cyclone. During my field observations, I have noticed structural damage, unsanitized surroundings and mismanagement of toilets, washing area (see figure 6 and 7). The responses with this regard are presented here:

“The walls are cracked, one can see the rods rusted, grills have broken down, color has chipped off, and everything is damaged inside. The generator and other things are not working anymore. Also, first aid box, stretcher, life jacket, helmet, all these equipment are not in good condition” (Young Rescue Fisherman, Gangadharpur).

“The facilities in the cyclone centre are not adequate anymore, generator, megaphone pillar lights, stretcher are all damaged” (Primary Fisher’s society head, Gabakund).

Furthermore, most of the houses back then were Kutcha thatched houses which were not resilient enough to withstand the strong winds, so many lost their houses. However, these days many have constructed concrete houses, but some portion of fishers live in thatched houses or broken houses covered with polythene sheets. The above research findings highlight the profound impact of inadequate infrastructure and disparity housing conditions among the vulnerable communities.

In the social sectors, education of kids was disrupted for a month, affecting their overall educational development. Likewise, many marriages were cancelled due to the physical and financial losses incurred due to the cyclone, as mentioned by the village committee leader of Gabakund:

“Cyclones not only affect fishing activity but our entire life. School was shut down for a month, many got sick after the cyclone. People could not afford education for kids, could not even provide bare necessities like food and clothing daily. Weddings were cancelled and the families had to wait for 4-5 years to arrange everything for their daughter/son marriages” (Village committee Leader, Gabakund)

Turning towards the context in Mirjapur and Parbatipur, the absence of cyclone centers forced them to leave the village and go to safer places was a concerning issue for them because of the fear of losing their belongings that were left behind. Few voices reflected the lack of proper relief distribution, management, and some discrimination they faced in the rehabilitation camp they were shifted to. And the fishers of these villages had to walk barefoot all the way from the far rehabilitation centre to their houses, as mentioned below:

“But during Fani, the damage was severe, and we suffered more. The government shifted us all to a safer place but there was no arrangement for us, no food and then we had to walk back to our village. When we returned, we saw destruction everywhere. Thatched houses were lost, boats were broken, water quality deteriorated, electricity connection was lost for 2- 3 months and took 4-6 months for us to build back” (Fisherman, Mirjapur).

Correspondingly, the protection barriers in the Gabakund, Mirjapur and Parbatipur were found to be deteriorating over the period. This makes all villagers susceptible to flooding in the future extreme weather conditions. The erosion of barrier walls reveals the fallout of inadequate construction practices that failed to adhere to standards. The Gangadharpur villagers have been subjected to flooding in the past due to the absence of barrier walls around their village. All these underscores the sudden need for protective infrastructure wherever needed and the proper maintenance of existing protective measures. The protection barrier in Parbatipur is not an adequate height and completely deteriorate on one side and faces many consequences with respect to that (see section 4.2.1.3).

A group of fishermen has highlighted their concerns regarding the improved structural measures as follows:

The protection wall is deteriorating these days which need rebuilding before another cyclone takes away our houses and livelihood. And some of the houses are not strong enough to withstand cyclones” (FGD Fishermen, Gabakund).

Respondents from Gabakund and Gangadharpur have mentioned that since they have a cyclone shelter in their village, people stay together and collectively work towards various activities, however due to the improper management of the existing facilities, villagers now fear to go to the cyclone shelter and prefer leaving the village or staying in their own houses regardless of the safety concerns, as expressed by one of the fisherwomen who is a member of cyclone management committee in the village:

“Many mostly prefer being at my own house no matter what, who wants to go cyclone shelter in this condition? It becomes unbreathable because of the crowd in the centre. Some people vomit and get diarrhea and feel anxious because of the cyclone. We got sick after the cyclone, because of the large crowd staying together without proper sanitation. The situation is traumatic inside, making it more difficult for people with medical issues and pregnant women to adjust there.” (SHG Fisherwomen President, Gangadharpur).

Due to the above circumstance, in all the villages, some responses expressed their reluctance towards shifting to the cyclone shelters and rehabilitation centre. Previous studies have also reported that improper cyclone centre management, lack of proper shelters and poor sanitation in shelters are the main reasons why people show unwillingness to evacuate (Alam. E, 2024; Binte Ibrahim et al., 2019). The issues related to inadequate infrastructures and people choosing to stay back in unsafe areas would make it difficult for coordinating and collectively managing the disaster risks in the village. In general, while Mirjapur and Parbatipur expressed their challenges about not having proper cyclone shelter and management systems, the other two villages raised concern regarding the improper facilities and inadequacy in their cyclone

shelter. Both highlight the critical gaps in infrastructure that require proper action to ensure safety and resilience against future disasters.

4.2.1.6 Cyclone Induced Psychological Impacts on Communities

Several studies have identified that harsh climate related events can trigger various psychological consequences to the victims affecting their overall mental health by reducing anxiety, stress, and depression (Heanoy & Brown, 2024). This distress is gradually developed in those communities facing multiple drivers of changes that affect their livelihood and security, every time they encounter a distressing situation it is further intensified. Hence, these psychological distresses highly relate to environmental vulnerabilities, damages incurred and existing difficulties and inequalities within the social system (Kabir et al., 2024; Rishi & Hota, 2023). Due to the multiple occurrences of traumatic cyclonic activities in the fishing community under study, psychological distress has become their part of life because of the persistent trepidation of future cyclone occurrences and its aftermath. The sudden changes in the atmosphere and calm just before the onset of the cyclone gives them a sense of apprehension. Some of the responses that resonate with these are as follows:

“It gets scary as the cloud grows dark and deadly silent before the wind lashes out to destroy our life., our livelihood, and our finances. We lose our houses and everything, we live under constant fear.” (FGD, Women, Parbatipur)

“Every year, especially in October and May, we feel the fear of losing livelihood and the damage a cyclone may incur, in general” (Village committee member, Gangadharpur).

Emotional turmoil and anxiety peaks right after they get the information about the cyclone. In general, fisherwomen become more uneasy concerning the safety of kids, older family members and their husband who rush toward the shore to safeguard boats and fishing equipment. Some fishing families refuse to leave their houses and go to the cyclone shelters or any safer places, because of the insecure feeling of leaving their houses behind. Once they get moved, they get nervous about the condition of their houses and people

they have left behind. Fishers also reported to have felt growing unease about shifting to cyclone shelter or rehabilitation camps because of the lack of sanitation, drinking water and proper hygiene facilities in the cyclone shelter or rehabilitation centers. The president of the cyclone committee in Gangadharpur expressed the following concern:

“Nowadays, people fear going to cyclone shelters or camps due to the lack of facilities and improper management. We are at greater risk of getting communicative diseases after the cyclone due to poor sanitation in the camp” (Cyclone committee President, Gangadharpur).

However, in Mirjapur and Parbatipur, respondents explained the isolation anxiety faced by some fishers who decided to stay back in the village, while most of them shifted. Deserted villages and changing weather with cloudy skies and strong harsh winds created a feeling of fearfulness. Overall, people in these two villages expressed distinct types of fears, fear of isolation and fear of leaving, the reason behind their demand for establishing a cyclone shelter exclusively for their village. A group of fisherwomen in Mirjapur jointly expressed how having a proper cyclone centre would have provided sufficient support and psychological comfort:

“If we have a cyclone shelter, we will feel more secure with all our villagers around us. The unity would be more if we had a cyclone shelter, as we could have stayed in one place and planned together to handle it. When people shift to far places, we feel scared of being left out alone. I have heard of the young person who stayed back saying that he was frightened to see the empty village roads when most of the people left, with the sounds of whirling wind sounds” (FGD Women, Mirjapur).

Discussion would be incomplete without the psychological story of out-migrant fishers and their families captured during the study. Out-migrants and their families undergo emotionless distress due to fear and helplessness because of the inability to get communicated with their loved ones. Even though they are away

for the welfare of their families, being not there for them during the crisis puts them under a sense of powerlessness affecting their overall mental wellbeing. My translator shared his own experience during the 2013 Phailin cyclone, when he was working in Andhra Pradesh in the textile industry. Before the landfall, he tried talking to his friend in the village, but unfortunately before the other person could explain the situation, the phone disconnected and did not get through to them again. He mentioned how stressful it was not being able to know about your family members for three to four days, the uncertainty and fear of not being able to confirm the safety of my children and wife made it harder for me to manage. In line with this, a group of fisherwomen expressed as follows:

“During the cyclone, some living outside were not able to connect with their families due to lack of network connection. This is sad and emotional as we will not know if our family is safe or not.” (Gabakund, FGD Women, Gabakund)

Similarly, a fisherman expressed the pain of separation as follows:

“It is a time of separation for some people from their families and always worried about their wellbeing as there is no means of contact” (Fisherman, Gabakund).

The post-cyclonic experiences of fishing communities are lugubrious and in shock, they only see losses everywhere, loss of houses, livelihood, livestock, and physical assets that rip them apart, as mentioned by one of the fishermen:

“After the cyclone subsides, people return to find their houses destroyed, goats and cattle dead and importantly, our livelihood resources such as boats and other fishing equipment are damaged. People lose their mental peace and strength after observing such a situation” (Fisherman, Gangadharpur).

Another notable finding was the influence of the caste system and its effect on fisher's mental strain. Caste based discrimination in any minor form can induce social, psychological stress and cause to continue the cycle of inequality by imparting the social perspective that lower caste members are inferior (Gupta &

Coffey, 2020; Pal, 2015). The voices of fishers in Parbatipur also echoed how they portrayed themselves as backward, powerless, and less privileged as compared to other caste fishers. While many fishers of Parbatipur (Khandra caste) expressed that they have a good relationship with the people of Mirjapur and some individuals often extended their support, few responses were contradictory. Those responses revealed how caste discrimination and higher caste domination keep them under continuous stress. These findings are mirrored in the following responses:

“Our relationship with Mirjapur people is not that great, they discriminate against us for our caste, and we live under constant pressure. But during crises when in need, some of them help us and we also help them” (Young Rescue Fisher, Parbatipur).

In the context of crises like cyclones, caste-based discrimination makes them concerned about sharing space and food with Mirjapur people. Some of the responses highlight past experiences that exacerbate this concern. From the conversation with Mirjapur fishers, it was identified that a new cyclone shelter has been granted recently for both villagers. But Parbatipur considers it as Mirjapur people’s centre, and they fear discrimination, if they ever must share the same cyclone shelter which was clear from their conversations during each interview. Hence, they have even requested the government for a separate school, Anganwadi and cyclone shelter for themselves, but that was not considered because of their low population. Additionally, few respondents shared a few experiences that instilled distress and additional burdens they had to face due to caste-based oppression. One was that the higher caste fishers sometimes halt and reroute the NGO’s relief vehicle and impede their access to aid resources. This information was validated by a discussion with a few NGO volunteers from the fishing communities during a casual conversation. Secondly, during the shifting operations and while docking boats to safety places before the cyclone, higher caste fishers act selfishly by asserting dominance to prioritize their own convenience, hence causing emotional suppression and stress that leads to a state of helplessness and vulnerability among lower caste fishers.

“During Fani, Mirjapur people initially refused to get shifted, when we got ready and planned to get into buses, they pulled ahead of us and got inside the bus. Similarly, we all dock our boats near this village. During the last cyclone, certain people in our village fought with us and our boats were left out with no places in the village, so we had to take it and dock in the inner channel towards Gangadharpur village, but God saved us. Our boats had only minor damage. So, they do dominate us sometimes but also help us in external issues” (FGD Fishermen, Parbatipur).

In supporting the above assertions, a fisherwoman said:

“The cyclone centre order has been passed for Mirjapur village and will be built sometime. We can adjust but not everyone is willing to share space with us. Some people from that village say that we are from lower caste and should not sit next to them. So, we need a cyclone shelter for us. We have informed everyone in the government and political party leaders, but everyone says that as our population is less, it is not possible for our village” (SHG Fisherwomen President, Parbatipur).

In situations other than crisis, there exists friction between the Khatia caste and Kandra caste in subleasing system and tourism activities, they tend to dominate and often assert control over the decisions made, as one of the fisherwomen said by one of the fisherwomen.

“Tourist centre was built in their village; one individual has 2-3 boats in the tourist business, and we have around thirty boats total from our village. And if they request to increase the number of boats, they do not allow it. They are using our village land for business and if we try to oppose it, they threaten our people that they will not allow us to do boat operations and harass us by stealing our fishing nets and all” (SHG Fisherwomen President, Parbatipur).

The government and various non-profit organizations have been identified as trying to fix the financial losses incurred by the fishing communities, but no attempts have ever been made to address the psychological distress of the communities. While they thrive to rebuild their lives, the previous traumatic experiences, constant anxiety of cyclone and the series of losses it follows trigger their mental strain, as one of the fisherwomen said.

“Remember me next time when you hear about a cyclone in our village and pray for us”
(Fisherwomen, Parbatipur).

4.3 Discussions

As discussed in sections 2.5 and 4.2, tropical cyclones are one of the identified external stresses that are followed by a cascade of impacts that challenge the communities in numerous aspects. Table 8 gives a detailed description of vulnerabilities and challenges in the various aspects of the communities in the face of cyclones.

Table 7: The summary of Overall Challenges as Reported by the Respondents

Aspects	Challenges/Impacts/Vulnerabilities	Description	Number of mentions in the interviews
	Strong Wind accompanied by rainfall		24
	Flooding		18
	Falling of trees		25

Environmental	Loss of Casuarina Forests	Changes that occur in the surrounding environment are due to cyclones.	9
	Changes in Potential Fishing grounds		2
	Damage to agricultural lands	Impact due to the environmental changes	11
	Deterioration of ground water quality		
Physical	Destruction of Kutcha houses	Impacts on Physical structures due to the cyclonic activities and associated environmental changes.	47
	Loss of Fishing Equipment and boats		47
	Destruction of other community buildings		4
	Interruption of electricity supply		17
	Disruption of transportation facilities		11
	Inadequate cyclone shelters and facilities		14
	Lack of cyclone shelters	Physical vulnerabilities that make the communities	19
	Lack of barrier walls		7
	Erosion of barrier walls		5

	Limited access to medical facilities	susceptible to disturbances.	6
Economic	Loss of fishing days	Various impacts of cyclones on the economic aspects of the communities.	43
	Hindered tourism activities		41
	Increased financial burdens (debts, loans)		46
	Loss of livestock		38
	Less livelihood options		9
	Decreased crop productions		7
Social	Food shortage	Various impacts of the cyclones on the social aspects of the communities	11
	Water Scarcity		13
	Poor Sanitation		26
	Disrupted Education System		9
	Cancellation of wedding ceremonies		2
	Spread of Communicative diseases		4
	Decline in emotional stability		19

The above-mentioned impacts, changes and vulnerabilities are interconnected causing multidimensional challenges. Figure 8. given below gives the synopsis of various challenges due to cyclones and their interconnectedness that was transpired from the findings above. The increased severity and unpredictability of cyclonic events in the last two decades have imposed a considerable level of challenges on the communities. Firstly, the environmental changes accompanied by the cyclone such as heavy winds, flooding and heavy rainfall cause serious environmental challenges such as falling of trees, loss of Casuarina forests, changes in fishing activities and damage to agricultural lands. Notably, the interplay of artificial sea mouth and cyclonic events as mentioned in the section 4.2.1.3 shows how the man-made human interventions (artificial sea mouth) and natural disturbances (cyclone) increases the risk of exposure of the communities to cyclone by washing away the sandbars and the tree plantations.

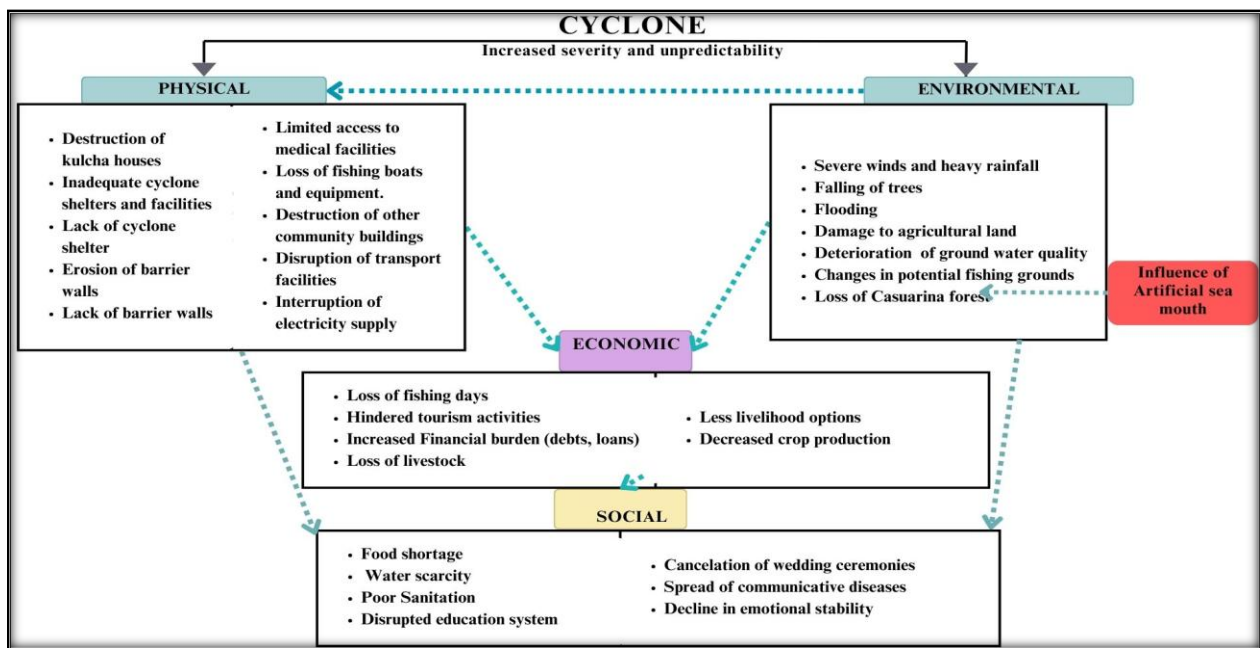


Figure 8: Various impacts, vulnerabilities, and their interconnectedness

These environmental changes and the associated challenges affect the physical, social, and economic aspects of the communities. For instance, environmental changes like heavy winds and falling of trees cause the destruction of houses fishing equipment, roads, and electricity supply. Along with the above, the physical damages, and existing physical vulnerabilities such as lack or absence of proper protective

infrastructures, absence, or erosion of coastal barriers. Similarly environmental changes also affect the economic aspects as well as social aspects such as loss of fishing days, loss of livelihood, food shortage water scarcity, emotional distress, and disrupted education system. Hence, all the challenges and limitations in all the aspects are interconnected and create multidimensional challenges across the fishing communities.

4.4 Chapter Summary and Conclusions

This chapter discusses the various challenges faced by the fishing community during and after the cyclone. Various secondary level stressors due to the consequences of cyclones in the form of environmental changes - such as increased frequency and uncertainty in extreme weather patterns, groundwater quality deterioration and flooding - were identified. Their effects on each village are discussed based on their communities' perspectives. Additionally, this chapter shared how these stressors influenced the socio-economic system and the psychological wellbeing of the whole community. The chapter also illustrates how the challenges caused by the communities were multiplied due to the absence of protective infrastructures and improper management of existing protective infrastructures. All these findings highlighted the unique challenges and circumstances in three distinct villages by providing contrasting analysis. The insights from the objective one contributed to the understanding of various forms of social capital that functioned and disrupted (see chapter 5) during the entire phases of the cyclone, which influenced the community level responses at the time of crisis.

Chapter 5

The Interplay of Social Capital and Relational Wellbeing in Shaping Community Responses and Its Effectiveness

5.1 Introduction

In the previous Chapter 4, I discussed various impacts and challenges arising from cyclone occurrences from the perspectives of case study communities, and how various systems such as environmental, physical, social, and economic are affected and their interconnected dynamics. Upon gaining insights on various vulnerabilities faced by the communities, the focus now shifts towards the second and third objectives which is to identify various forms of social capital and existing relational wellbeing within each community that has contributed to different community level responses and recovery activities during the time of crisis. Additionally, I have also discussed the effectiveness of these strategies along with the disparities and barriers associated with them and what is needed to ensure resilience of the SSF community in the future. Box 5.1 highlights objective two and three. The results and subsequent discussion in this chapter are influenced by the personal narratives of research participants.

- 1) To explore how cyclones are impacting the SSFs in Chilika Lagoon.
- 2) To examine the interactions between social capital and relational well being of SSFs in dealing with cyclones in Chilika lagoon.**
- 3) To explore different community level responses to cyclones that are shaped by the available social networks and their effectiveness.**

Box 2: Overview of Research Objectives (Objectives two and three - highlighted)

5.2 Different forms of Social Capital in Action

Social capital has been substantiated as a critical factor in enhancing the adaptive capacities of communities through various actions such as preparing, mitigating, and responding appropriately at the various stages of disaster or crisis (Behera, 2023; Cutter et al., 2008; Pelling & High, 2005).

From the perspective of community solidarity which assists in examining the intricate dynamic of social networks (Bhandari & Yasunobu, 2024; Kwon & Adler, 2014) and their influence on social cohesion and well-being of members in a community, the concept social capital is categorized as bonding, bridging and linking (Richmond & Casali, 2022; Visave & Aldrich, 2025) based on the different levels of stakeholders involved. In this section, I will discuss various forms of social capital that were accessible and leveraged by the fishing communities in Chilika at the various stages of cyclonic activities that were gathered during the data collection. Table 9 below shows the summary of social capital forms that arise from the data along with description and number of mentions during the discussions with the community members.

Table 8: Types of Social capital mentioned by the Respondents.

Types of Social Capital	Description	Number of responses from the interviews
Bonding Social Capital	Close relationships with family members or friends or neighbors within the same village.	47
Bridging Social Capital	Connection or help from people of different villages or community (outside the village)	5

Linking Social Capital	Vertical networks such as assistance from people in positions of power – Government, Other Institutions, or NGOs	47
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The dynamics of social capital in villages with cyclone shelters and management committees differ from those in villages without such structures. From the discussions with participants, it was clear that Gabakund and Gangadharpur (villages with cyclone shelter and management committee) have access to all three types of social capital - bonding (within communities), bridging (outside communities), and linking (institutions), but varying throughout the various phases of the cyclone. The super cyclone that happened in 1999 had a devastating effect on the coastal states of Odisha, taking the lives of more than ten thousand people (Padhy et al., 2013). This previous experience has led to the establishment of cyclone shelters and reliable early warning systems in coastal districts, which helped in timely evacuation and preparedness for the communities. In both Gabakund and Gangadharpur, fishers usually receive the cyclone landfall information from the news media, social media, block panchayat officer, and cyclone management heads within the communities rise to the occasion - pinpointing the functioning of linking and bonding social capital before the beginning of preparatory stage.

During the preparatory stage, fisheries rely on their bonding social capital to arrange food, assisting in boats, women preparing dry food, arranging documents, young fishers involved in rescue activity helps in evacuating and shifting people to cyclone shelter. And during the onset of cyclone activity as well, bonding social capital reaches its peak, by staying together, arranging food, and giving assistance to kids, women, and disabled people. Once the weather settles down, they get relief distributions from NGOs, some wealthy

people from outside, the government and other organizations. However, bonding social capital remains strong as they help each other to fix their houses and boats, and share food. Overall, bonding social capital is the dominant one in dealing with the crises, while linking social capital plays a pivotal role in information dissemination and providing necessary resources to cope with difficulties. Linking social capital also plays a significant role, especially NGOs and Odisha State Disaster Management Authority who provides yearly training through mock drills to be better prepared for the cyclone. Some respondents also mentioned that they get financial help from the non-fishers living in the other parts of the lagoon after the onset of cyclone - pinpointing the modest presence of bridging social capital during the recovery stage. The data analysis revealed participants' insights, as provided below, which reinforce the above findings. For visual representation, the level of involvement of various forms of social capital were categorized as low, medium, and high. High implies fully active engagement, while medium and low implies minimal or occasional help and no active help, respectively. Figure 9 illustrates the different forms of social capital in action at three stages of cyclone activity based on their degree of involvement ranging from high to low, based on its frequency on the data.

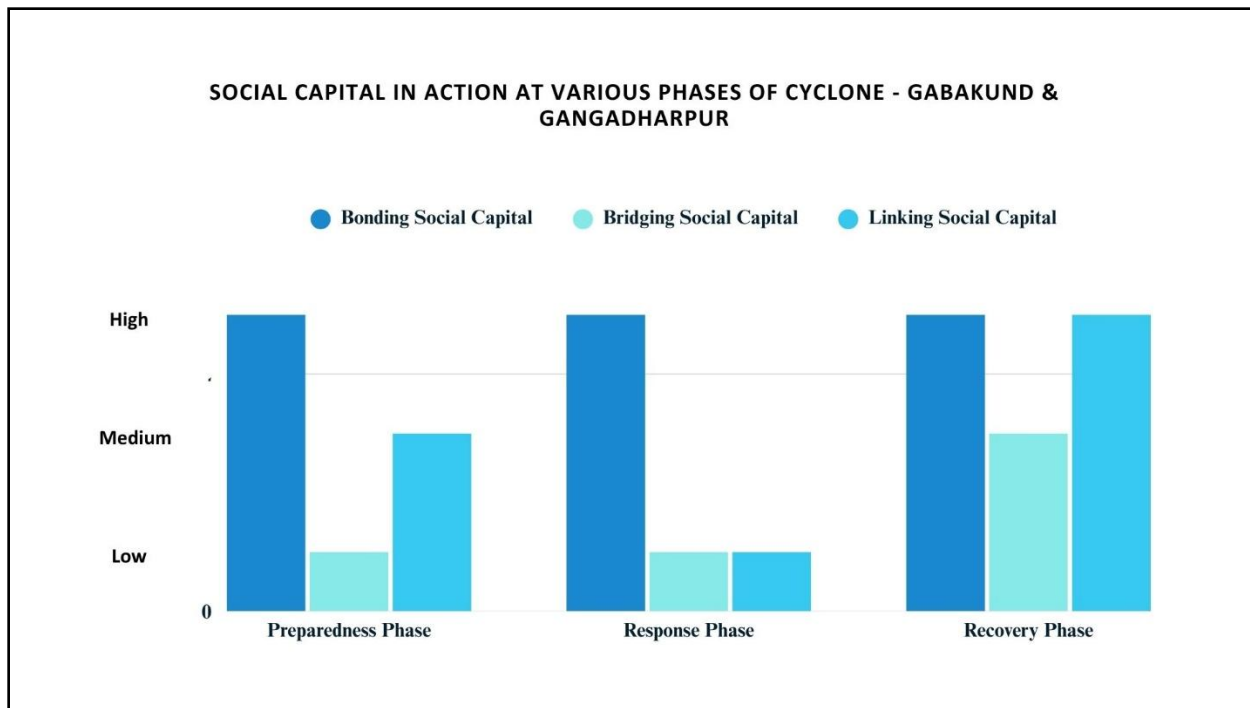


Figure 9: Bar graph comparing the social capital forms in action at various phases of cyclone in Gabakund and Gangadharpur.

The few responses below capture the level of involvement of various forms of social capital in Gabakund:

“We get information four days in advance through various media like TV news, Radio, Newspaper, and block panchayat officers also provided details regarding the time and date of the landfall, then the community members in charge of the cyclone shelter management announces and informs all the fishers in our village. We have some village funding available for crisis management which we will be utilized for the preparatory stage. Younger members of the cyclone management committee come together to stock drinking water, dry food (bread, puffed rice, biscuit & mixture etc.) diesel for generators and emergency lights prior to cyclones. Post the cyclone, people whose economic condition is good return to normalcy but people who lost houses and have nowhere to go, usually stay back in the shelter for a week or a fortnight and in between the

government & the NGO provide beddings, food torches or whatever is needed at the time.” (Community Leader, Gabakund).

The above comment conveys that during the preparatory stage, linking social capital lays a major role in passing the information and giving awareness to the community, but their level of involvement stops according to the fisher’s perspective. Then the active involvement of members within the community plays a major role in various response pathways, hence reflecting high involvement. Involvement of people outside the communities (bridging social capital) were also reported to be only in the post cyclone phase, as mentioned by the group of fishermen in Gabakund:

“And there are some rich people from outside who provide food or clothes to the people. But it is all personal. They do it out of goodwill. They are not associated with any project. Some are used clothes, while others are unused. Some clothes have gotten bigger. For every cyclone that has happened, these people have come” (FGD Men, Gabakund)

According to the above statement, the involvement of bridging social capital ends up providing some minimal help as compared to fishers within the communities, NGOs, and government authorities, hence falling into the category of medium involvement.

Focusing now on Gangadharpur which shares a similar pattern of involvement, based on the perspectives of fishers captured during the discussion. The level of involvement of bridging and linking social capital is higher in the recovery phase as compared to the other two phases. The primary Fishers Society head of Gangadharpur made the following observation:

“After a cyclone, we collect broken parts of our boats and houses, by then the panchayat, tehsil and collector office people come for survey and prepare a list accordingly. The Government monetary helps reach us within 2 months and in between we take loans from society, the panchayat provides houses, trees, and

livestock, while the society also provides for boat engines and fishing nets. NGO provides 60% help, like emergency lights, food, and other relief articles. We sometimes get financial assistance from non -fishers community in the lagoon as well, we then pay back slowly” (Primary Fishers Society Head, Gangadharpur).

In a similar context to Gabakund, the fishers of Gangadharpur also highlighted the high involvement of community members in helping each other at all the stages of the cyclone, as mentioned by SHG Fisherwomen President of Gangadharpur:

“The thirty-five members involved in cyclone management get together and help other community members in shifting old, disabled, and pregnant people to the centre. There are three different types of flags that are hoisted, and a siren is blown at the centre to inform us about the cyclone. We all do the needful at home and wait for the siren to blow, then all thirty-five members report to the centre and divide our responsibilities. The blue highlights that a cyclone is coming and looks after your safety. The orange/yellow color denotes that a cyclone is nearing by, and red color means the cyclone has started. Outsiders cannot help us during the cyclone, only our people can help us in that situation. Outside help comes after the cyclone” (SHG Fisherwomen President, Gangadharpur).

Contrastingly, the Mirjapur and Parbatipur fishers have distinct experience as compared to the above two villages. Due to the lack of cyclone shelter in their village, they get shifted to different safe places in government vehicles, where the food and other facilities would be provided by the government arranged agencies. Once they get in the information from the government and through the media, they arrange a village level meeting and decide whom to be shifted to first based on the priorities and some young members assist women, kids, and disabled women in shifting them to the buses. Majority of the villagers leave and only a smaller number of fishers stay back in the village who rely on community members for help.

Once the weather settles down, the villagers come back by themselves with the help of families, friends and neighbors with whom they shifted, bonding social capital peaks as they collectively work towards repairing boats, houses, cleaning roads, distributing relief funds, cooking food, while also getting assistance like food and other resources distribution from NGOs, and government institutions. Figure 10 shows the different forms of social capital in action at various phases.

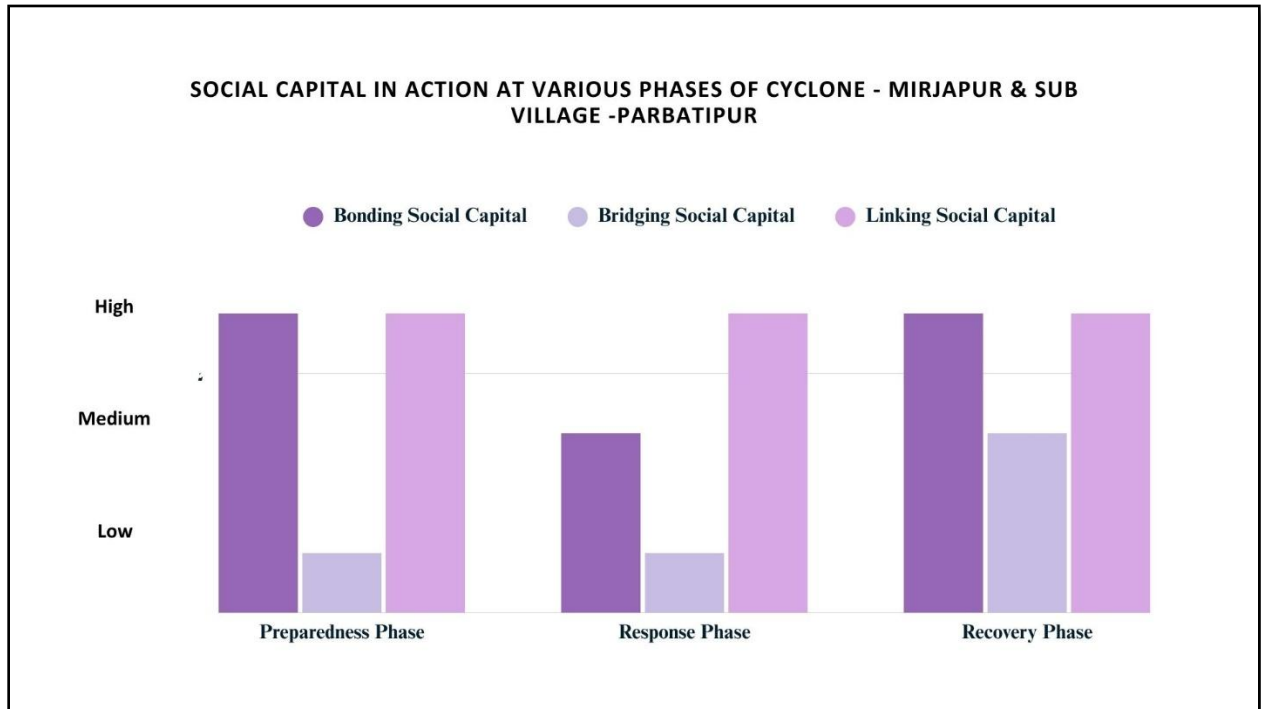


Figure 10: Bar graph comparing the social capital forms in action at various phases of cyclone in Mirjapur and Sub village Parbatipur.

Compared to other two villages with cyclone shelter, bonding social capital is comparatively weaker during response phase because of the dispersion of population, in which the majority leaves village in government vehicles while some stay back. Many fishers responded during the conversation that the community cohesion is scattered due to the absence of a cyclone shelter where they can unify and collaborate during the crisis, hence reflecting a medium level of involvement. The overall functioning of different forms of

social capital at various stages as described in figure 10 and in the above discussions resonates with the participants' responses given below:

“Before two-three days, we get the information through TV, Mobile, Radio and the government announcements through various other media, so that people can prepare and shift/move to a safer place. The village committee arranges a meeting once we hear about the cyclone, we discuss how to handle it, save helpless people, and decide to leave even if we lose our house. When the government provided vehicles, we gave priority to disabled population, pregnant ladies, and kids. The local people there help us by preparing food and other things. During this time, everyone helps each other. Moving away with all your family members is not easy, sometimes we leave our loved ones somewhere and go. Being separated during this period weakens our strength. The Government provides generator lighting, the government also shifts people to nearby towns/cities like Bhubaneswar, Bhadanpur, puri, Chandpur & Khurda by bus and some people go on their own. We do not have a cyclone shelter, so most of the people are moved from this place with the help of the government. There is a government. colleges and schools in Sunamukhi, Puri and Brahmagiri etc, where they take shelter” (Community Leader, Mirjapur).

The above response captures the high involvement of community members and governmental authorities during the preparatory phase in arranging facilities, evacuating, and ensuring safe shifting. Later in the recovery stage, as fishers move back to their village, the fishers help each other, along with the external support they receive, as mentioned by the Village committee Leader of Mirjapur:

“After the cyclone, initially the govt does a survey and provides relief funds for households which incurred losses and then various NGOs come and help. We all work together in such situations, the govt relief material (food & emergency lights) as well as our village community fund is also used to provide help to people in the

cyclone. Everything is equally distributed and makes sure that no one is left out”
(Village committee Leader, Mirjapur).

Relatedly, the response from a fisherman in Parbatipur also shared a similar insight:

The government provides relief materials and some financial help after the cyclone. Food like flattened rice, jaggery, polythene, shawl etc. NGOs do come. We took loans from other villagers in the lagoon, who are also into fishing but live far away from here. Save the children NGO came first, the govt came later. They did a survey and came back after a day or so and distributed ration. The NGO people took drone videos, and it went viral, post that a lot of NGOs came with relief materials” (Young Rescue Fisher, Parbatipur).

Following the identification of different forms of social capital that exists with the community, the subsequent section will discuss the relational wellbeing aspects arising out of these networks.

5.3 Corroborating Social Capital and Relational Well-being of the Communities

In the above section, I clearly described the various forms of social capital in action that were captured from the participants' responses. However, it is not merely the existence of these social capitals that ensures collective action and social progress in a community. Moreover, the classification of social capital into different forms such as bonding, bridging and linking, as explored in the section 2.3 & 2.4 aids in capturing the various forms of social networks available within the community, the performance outcome, effectiveness which determined the quality of these networks are not reflected (Satria, 2022). Pelling & High, 2005 has also explored how social capital has an ambivalent effect on a community which has the potential to produce positive and perverse results. This emphasizes the necessity to focus on understanding the deeper dynamics of these social networks available to the communities. That is what fisher's feel about these relationships, are these networks uniformly accessible for all the community members, are they feeling valued and recognized, what are the power dynamics, are their trust and emotional security. Relational wellbeing in this context explicitly examines whether all forms of social capital are balanced or

not, existence of trust within various actors, power balance, social inclusion, and decision-making power of all the actors involved (McGregor, 2004; White, 2010). These factors are recognized to have a significant impact on overall community resilience and adaptive capacity as identified based on the synthesis of various literature findings (Cutter et al., 2008; Grootaert & van Bastelaer, 2002; Kwon & Adler, 2014). For instance, strong bonding social capital may help in reacting quickly to the crisis, but if other social capitals are not equally balanced that could enhance continual survival or endurance mode over development. This could lead to social exclusion and flawed collective action, especially in communities with rigid caste systems. Another situation is in the case of linking social capital, where its innate hierarchical characteristics, communities might not have enough power to hold the higher institution accountable that could affect the resource distribution and other decision-making power (Pelling & High, 2005; Richmond & Casali, 2022; Xiang et al., 2021). This may equally exacerbate the existing inequality and marginalization by favoring those with high influence within the community. Hence, the social capital dynamics and emerging relational wellbeing with the existing social networks of the case study communities are discussed below.

In the context of this research, most of the responders mentioned they have trust in the fishers in the respective villages. As they have experienced numerous disasters together and shared struggles and hardships together, their voices reflected the true sense of unity and emotional bonds, resulting in long lasting trust and solidarity. During an interview with the village leader of Mirjapur, he narrates the story of their ancestors, which highlights the importance of shared narratives of resilience that further foster their trust and collective action in all the challenges they faced together, he narrated the story as below:

“The unity between village people is always there. For example, in 1994, we experienced a severe storm with heavy rainfall. Our villagers had so many buffaloes that they crossed the lagoon and grazed on an island in the middle of the lagoon. Due to heavy rain, buffaloes did not come back even after one night. Two of the villagers decided to see what happened, they went and did not return. The rest of the villagers

formed a group and did not wait and went to the lagoon in severe weather to rescue the two people and buffalo. So, we never let anyone suffer alone, we stay together, we help, and we fight. It does not matter even if we all die, it is all about staying together and supporting each other until the day we die” (Village Leader, Mirjapur).

Similarly, in addition to this functional support that exists within the fishers, Gabakund villagers shared a local story that embraces the act of giving as an expression of trust, support and emotional connection which enhances the relational well-being arising out of the close-knit of bonding social capital. The story is based on the local belief surrounding the Babakundeswar Temple in their village, they described Rama, a devotee of Lord Shiva who offered his precious earrings as a symbol of gratitude for the unwavering courage and support he has received during his tough times. Villagers take this story as a symbol of reciprocity and support, and they believe helping and supporting others would give them overall wellbeing for their community. This act of giving and supporting does not necessarily mean in a materialistic or financial way for them, but the mental support and emotional strength that they give each other, as highlighted by one the fisherwomen:

“Sometimes we feel hopeless & weak due to the loss, the community people boost our morale and motivate us. During such a situation, mental support is important to survive and fight back, staying together during the crisis helped us to go through the most fearful moments” (SHG Fisherwomen President, Gabakund).

In line with the above findings, the community leader of Gabakund also shares his notions as follows:

“My fishing community is always there for any help they can provide. We are financially backward, we may not be able to help monetarily all the time, but during these times more than money what matters is togetherness and support I get from my villagers” (Community Leader, Gangadharpur).

While the benefits of relational wellbeing emerging from this bonding social capital exists in all the villagers, some voices of the responders accentuate unintended consequences of the caste system in the community that hinders the overall collective action and recovery. The Parbatipur fishers, being from a lower caste Khandra faces social exclusion and marginalization that affects their day-to-day activities (see section 4.2.3). Majority of the upper caste fishers, these days help them irrespective of the class, but still some sort of friction exist, especially during the relief distribution and other recover activities, dominant caste fishers try to undermine and exclude them from receiving sufficient help, as highlighted during the focus group discussion of men in Parbatipur:

“They do say that we receive more relief, and they are not getting enough. At times, they stop the relief vehicle midway before it even reaches our village. But not every time, and they oppose the relief distributors. The NGO people took drone videos, and it went viral, post that a lot of NGOs came with relief materials, but they never reached our village, as they were diverted from the main road to other villages, we received the relief stuff later” (FGD Fishermen, Parbatipur).

Despite the existence of caste-based biases and hostility, most of the villagers support each other and offer help when they are in need. Fishers from Parbatipur mentioned the unwavering support and help they get from the Damu shopkeeper in the Mirjapur village, as the name of this person was highlighted multiple times by the responders from Parbatipur village, I decided to meet him and have a conversation. His comment below highlights the mutual solidarity with empathy and support:

“Unity in the community is something that makes us move forward with hope. We stick together as a constant source of support for both emotional strengths, sharing food and urgent financial help. For example, I provided some money and raw food items from my shop to the Parbatipur people for a community kitchen, as they had no resources and lost everything in the cyclone. The food was cooked for the whole Parbatipur village in one place for over a week with that. And I do not ask them to give it back because I trust them,

and they slowly repay back that when they get money and they eventually did too” (Damu shopkeeper, Mirjapur).

Some responses also highlighted that multiple occurrences of hazards have been a transformative experience for villagers, that many these days work collectively for the recovery from a collective crisis like cyclones. This was captured in the following conversation by the Primary Society Head Mirjapur:

“While some older members still show casteism, these days, especially after facing so many hard times due to cyclone, both the villagers work together in repairing boats and houses, which has changed the mindset of people and many these days do not show caste discrimination, a relationship of humanity is built” (Primary Society Head, Mirjapur).

The above comment highlights the repeated cyclone activity is shaping the dynamics of relational aspects of bonding social capital.

Later, I also explored the relational quality of other forms of social capital available to the communities. During the discussion, while most of the participants acknowledged the financial aid and other resources they received from the NGOs and Government, I identified the nuance of uncertainty, and diminished trust from the source of support they get from the external sources that are NGOs and Government. The discussions revealed the unequal and insufficient relief aid from the government that results in the social exclusion of some people. Many expressed that political influence, and political power has affected the unequal recovery and response pathways, as fishers with more political influence get the funding on time as compared to other minorities with less power. These feelings stem from their previous experiences and circumstances that force them to rely on internal solidarity over external assistance, however this reflects an imbalance in the various forms of social capital available to the communities. These instances can strengthen the bonding social capital further by fostering self-reliance but with its own set of challenges, for example this can impact a strong sense of belonging beyond its optimal limits resulting in negligence of external support even if available and over dependence of internal resources that may stress the

community management system leading to conflicts. These findings were interpreted from the following comments by the fishers:

“I trust in my community members, next time I would not leave the village and go. I will stay here and deal with it. And everyone wants to be together rather than leaving the village” (SHG Fisherwoman, Mirjapur).

“During Phailin, we were shifted by the government, we faced so much damage then and we came back by walking because roads were covered with trees and branches. And we did not get proper food and water in the rehabilitation centre. Due to that terrible experience, we never wanted to leave the village during Fani, but the police administration and government came and shifted most of us away. (Fisherman. Mirjapur).

The above comments that due to ineffective external sources of help, they do not trust their services and would prefer to stay behind with whatever they have. This strong sense of belonging can be detrimental in the future evacuation and recovery process in the long run. These voices were especially from the villages without a cyclone shelter and proper management strategy. While in those villages with cyclone centers and proper management system pinpointed how it helped them in gathering and distributing the relief funds more effectively, as described by one of the respondents:

“Cyclone center provides us shelter during cyclonic storms; we would have lost our lives otherwise. We find strength in togetherness, as we all are in the same situation. We never felt left out or lonely during fearful situations, being surrounded by our loved ones made a huge difference for us. Because of the centre, we got training and understood how to deal with cyclonic events. The establishment of cyclone shelter has helped us to form a cyclone committee within the villagers and organize, plan, and unite to deal with cyclones.” (Fisherman, Gangadharapur).

This response is an ideal example of how balance between various forms of support from the social capital can enhance overall disaster management. For example, adequate support like the establishment of cyclone centers, proper training and other facilities have accumulated all together with the internal support system in reacting effectively in times of crisis.

As mentioned earlier, the power imbalance that may exist in the linking social capital network would result in less hold of the higher institution accountable that could affect the resource distribution and other decision-making power. Responses in this regard were expressed for both relief distribution, financial aid, and lack of cyclone management infrastructures. Fishers expressed nuances of disempowerment and lack of control of their own life during the crises. One of the SHG Fisherwoman presidents of Mirjapur made the following assertion based on their experience:

“Cyclone centre is needed; it will help us to stay together safely during cyclones. Last time, we were all dispersed. Somewhere left here, some were taken in government vehicles. Nothing was in our control” (SHG Fisherwomen, President, Mirjapur).





Similarly, one of the fishers also commented regarding their helpless situation and how political favoritism complicates the recovery process by perpetuating inequality and interfering with the equitable access to support. The fisherman said:


“We do not have any control over government dealings; they may or may not provide help. Sometimes a type of monetary support through loans from the government would help us rebuild our house, repair boats, clothes, and livelihood again. This is not uniform now; some get and some will not. People with political influence have a better chance of getting adequate support compared to others” (FGD Fishermen, Gabakund).

Due to the unequal and insufficient funding mechanism, fishers are becoming self-reliant which in turn is exacerbating the psychological strain (see section 4.2.3) and financial stress leading to a feeling of unsatisfied life. During my field work in Parbatipur village, my translator and I were misunderstood as

government officers and the responses were hostile and stated that we should first provide us with enough funding to build a house. These reactions may have resulted from frustrations due to the inaction of government agencies, highlighting the ineffectiveness of linking social capital. Table 10 below gives an overall summary of the relational wellbeing aspects (both positive and negative influences) from the available forms of social capital described in section 5.2. This session covered the overall dynamics of various social capital forms that exist within the communities. Next session will analyse and discuss how these relationships shape the various response pathways from immediate crisis to long term rebuilding.

Table 9: Summary of Relational well-being aspects emerging from the existing social capital forms.

Types of Social Capital	Relational Well Being Aspects (Positive and Negative)	Number of responses from the interviews
Bonding Social Capital	 Sense of unity, emotional bond, emotional support, trust, solidarity, collective action, reciprocity	42
	 Caste is based on social exclusion, hostility, and domination	6
	 Internal conflicts	7
	 Recognized and supported through various services and schemes.	15

Linking Social Capital	 Social inequality in the services and scheme allocation, Political Favoritism, erosion of trust due to inaction of authorities.	37
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5.4 Analysis of the Effectiveness of Community Responses

In this section, the various community level responses at the different stages of the cyclone in the three distinct villages deal with frequent impacts of cyclonic activities, and face the challenges of preparedness, survival (cyclone response phase) and recovery and its effectiveness in long term community resilience or viability. For this research context, community responses are defined as the set of activities taken at community level with the help of various social capital forms as mentioned in the section 5.2 and 5.3 at the three stages of the cyclone such as preparedness stage, during and after the cyclone phase. It further discusses what was effective, what was ineffective and the barriers impeding their effectiveness for sustained community resilience. Responses to any natural disasters involve two types of strategies such as coping and adaptive strategies. Coping strategies are the short-term immediate solutions to survive the crisis. While adaptive strategies are long term proactive actions adopted to address future risk of a recurring issue (Nakamura & Kanemasu, 2020b; Sen et al., 2023). The major point observed is the disparities in the responses adopted within each community because of the poor relational wellbeing characteristics such as existing economic inequalities, caste based social exclusion, inaction of government, political favoritism and unequal access to resilient infrastructure and facilities. While some individuals exhibit effective adaptive individual responses, others were identified to be still in the coping stage based on the availability of support and resources. Additionally, some of the responses revealed that some of the implemented adaptive strategies lead to maladaptive consequences (see section 2.4). The various community level responses at the various phases of cyclone, captured from the discussions with community members are discussed below:

5.4.1 Preparatory Phase of the cyclone

In the preparatory phase of the cyclone, most of the fishers take immediate actions based on their previous experiences and the adaptive measures they have already implemented. However, the reaction varies in the villages with cyclone shelter and without adequate infrastructure facilities. This section will discuss all the coping responses fishers have used to prepare themselves to face the cyclone by utilizing the various forms of networks. The various responses involve dissemination of information after receiving early warning systems, coordination of community and support in preparedness, individual and household level preparation, and organized evacuation process. Figure 11 gives an overview of various response strategies utilized by case study communities in the initial preparatory stages.

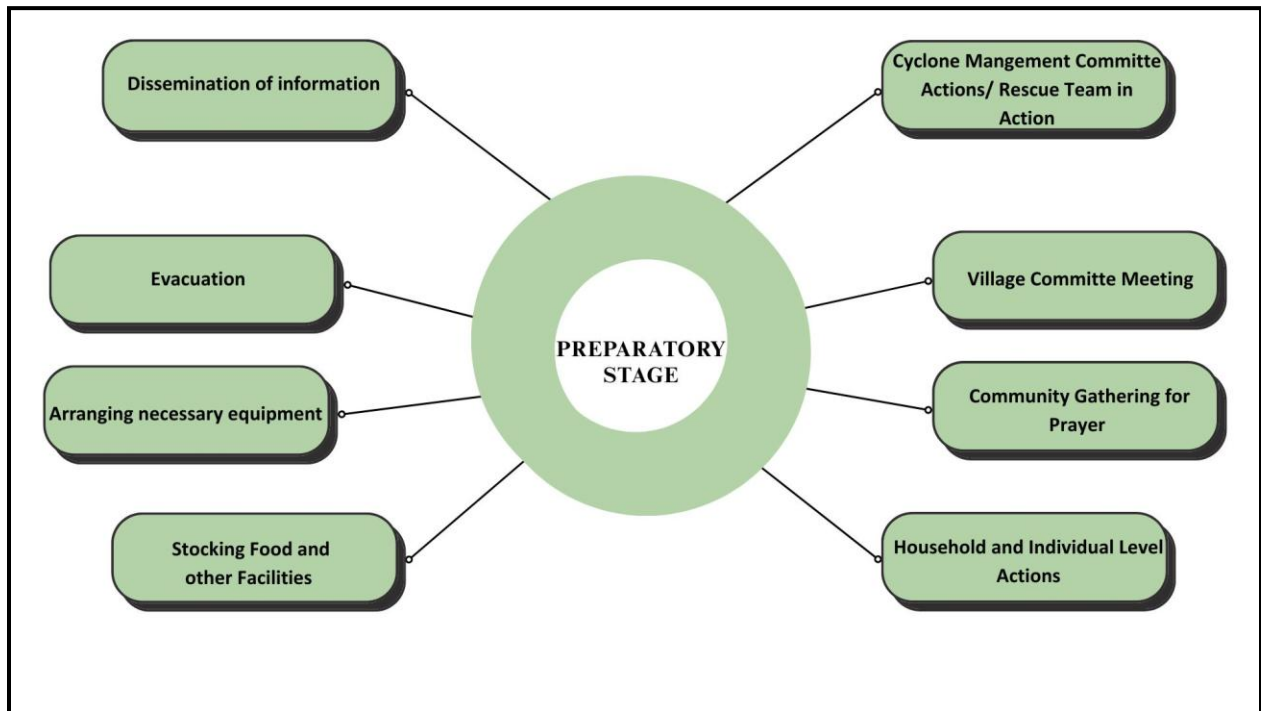


Figure 11: Summary of various response strategies adopted by case study communities during the preparatory stage.

Initially, once the communities receive information of cyclone landfall through various early warning systems two to three days before, they immediately rely on their close-knit networks and participate in community rituals and prayers for the wellbeing of whole community members. This response is primarily

identified as a coping strategy to address their fear, uncertainty, and stress that stem from the past challenges they faced during cyclones. Due to multiple incidents of such threats, this has been repeatedly and deeply rooted as a cultural coping mechanism to such hazards. The response with this regard reflects reliance on spiritual support to create a sense of hope and bravery to all fishers to surpass the situation with strong community solidarity. Responses from all the case study villages highlighted the same pattern of coping mechanism that subsequently fosters community solidarity and collective resistance to face the hardship together. For instance, the fisherwomen group discussion highlighted it as below:

“We understand that we can lose our life any moment, so we pray to God for everyone. Naamkaran Kirtan is performed every evening in the village for the safety and prosperity of our village. A religious flag is hoisted at the end of our village near the lagoon boundary; this is done so that water does not go above the level. Women also perform prayers and offer some food to Goddess Hara Chandi and Kali Jai” (FGD Fisherwomen, Gangadharpur).

The fishermen group also expressed similarly, as highlighted below:

“Once we hear about the cyclone, we collectively do prayers and move around the village and end in the end of the village, near the lagoon, where we place a flag and pray to Mother Chilika. Elderly people also do their traditional way of conducting group prayers and chant “hare Rama hare Rama” for the well-being of villagers during the crisis” (FDG Fishermen, Parbatipur).

Correspondingly, a fisherman expressed their trust in Goddess Kalijai - the guardian goddess of Chilika lagoon and the fishers residing in the vicinity. The local belief is that the goddess protects fishers from bad weather and storms. These forms of beliefs are identified as the most effective religious and cultural based coping strategies that give immense strength and resilience to local people at the time of crisis (Ballano, 2022; Das & DSouza, 2020). Few studies have also reported that people having faith and trust in any forms

of deity seems to exhibit better resilience against stressful situations as compared to non-believers (Nhamo & Chikodzi, 2021; Uddin et al., 2020). Hence these local beliefs are inevitable in building emotional strength and community solidarity, especially during the time of a natural disaster, as expressed by one of the fishermen:

“Some people rise above the occasion, and we unify ourselves and we put our beliefs in Maa [Goddess Kalijai]. Some do circles around maa, some call out to maa to stay safe. After all, we are fishers, we lived and grew close to the lagoon and sea. God has given us the strength to deal with all these cyclones and storms” (Fisherman, Gabakund).

At individual level, as a quick response, fishermen rush towards the lagoon to dock their boats in safer places and safeguard their fishing equipment. Concurrently, fisherwomen act like preparing dry food, packing their documents, and taking care of their kids and elders at home. Simultaneously, at community level, each village committee leader gathers and conducts a meeting to decide about the various preparations that should take place. However, the planning and preparation varies in villages with direct access to infrastructure compared to those lacking it. For instance, Gabakund and Gangadharpur villages having cyclone management systems in place give them a sense of power to make decisions and react appropriately based on the immediate priority. Especially during the preparatory stage and the peak hours, where there is hardly any help from the outside, they rely on the bonding social capital in arranging food, evacuation process and arranging things for the members of the family. Both villagers have a set of thirty members in place who take care of different activities like- rescue, psycho care group, women group to take care of pregnant ladies, kids and disabled people, relief distribution group, account loss monitoring group, and first aid teams. The rescue members actively engage in evacuating people and shifting them to safe places like cyclone shelter before the landfall. This is explained in the following response:

“We learn about cyclones from the cyclone centre; the government people announce it and advise us to shift to a higher ground or safer place. We then safeguard our boats inside a boundary and shift to the centre. We understand that not everyone uses media/phones, so

we instruct the early warning team to inform everyone in the village to keep their documents, stock food/water and shift to a shelter centre or in any concrete house. The shelter management committee ensures that the centre is clean, and all other arrangements are made before people move in. The relief distribution team is in charge to distribute relief material/articles equally and fairly to everyone. The rescue team takes care of getting people safely to the centre. Another team performs the last rights of human/livestock which died during the cyclone. Loss inspecting team, after the cyclone, who have lost what, prepares a list and submits it to the government. All arrangements are made by community people from the start to end of the cyclone” (FGD Fisherwomen, Gabakund).

As outlined in the above response, the immediate responses by the community members are shaped by the long-term strategies implemented such as a proper cyclone management committee in place. Proper management systems and training have helped them to respond effectively and coordinate properly as compared to those villages with a lack of proper adaptive strategies like cyclone shelter and management system.

Contrastingly, Mirjapur and Parbatipur hold a village committee meeting and form a rescue team in the evacuation process and then rely on external support to be evacuated. Some of the insights from discussions highlighted that some fishers shift to safer places on their own with the help of their families and relatives, but the majority are shifted to other rehabilitation centers in government vehicles. This implies how the lack of proper infrastructure affects their responses and decision making based on their priorities. A fisherman said:

“Before two-three days, we get the information through TV, Mobile, Radio and the govt announces through various other media, so that people can prepare and shift/move to a safer place. Once we hear the news, we arrange a village committee meeting to decide who all should be sent first, we give priorities to disabled people, pregnant ladies, kids, and elderly people. We all decide and help these people in shifting. Some people even go

to cities by themselves without waiting for anyone. There are few youngsters and some families with good concrete houses staying back.” (Fisherman, Mirjapur).

It surfaced during the interview with the fishers in Mirjapur and Parbatipur that most of them did not want to leave their houses and villages because of experience, and sense of attachment to their village and livelihood that is directly tied to their locality. For instance, the village leader commented... “Everyone had shifted to a safer place before the cyclone. The government came and told us to leave the village before the cyclone. We did not want to leave because of our experience in Phailin 2013, but considering the safety of our kids and women, we left” (Village Head, Parbatipur). However, they were forced to leave every time they faced a severe cyclone. It was already discussed in section 5.4 that lack of proper actions from linking social capital actors creates an imbalance in the optimal structure of community networks, hence fostering self-reliance and bonding social capital (Richmond & Casali, 2022; Xiang et al., 2021). But over-reliance on internal resources could impede better management and recovery. While leaving the Parbatipur village after the focus group discussion with fisherwomen, one of them asked me with desperation to do something for them to get a cyclone shelter soon. Revisiting that moment, I could see the impatience in them for not having a proper structure in place to withstand these hazards, which is an added burden to the existing vulnerabilities faced by the communities.

5.4.2 During the Cyclone and Rebuilding Phase

This section will discuss in detail the immediate actions taken by communities during and after the cyclone. During the peak time of the cyclone, fishers manage with the available supplies and facilities in the cyclone shelter or rehabilitation centers (in case of Mirjapur and Parbatipur). Sections 4.2.2.2 and 4.2.3 have already discussed the challenges faced by the communities at the time of cyclone active phase. According to the responses, the situation has been the same for the last two cyclones that happened in 2013 (Phailin) and 2019 (Fani).

Most of the participants outlined how they handled situations in the cyclone shelter and right after coming back to their houses and all the strategies they mentioned pinpoint the attribute of coping responses based on the survival and endurance instincts to deal with the immediate crisis. Majority of the fishers in Gabakund move to the cyclone shelter in their village except some people who shift by their own to cities like Puri, Bhubaneswar, and Khurdra with the help of their relatives residing there. People rely on the stocked food and water by the management until they get any external aid after the cyclone. During the interviews and focus group discussions that were carried out in each village that focused on inquiring about the challenges and damage they face in the aftermath of the cyclone (see section 4.2), fishers were asked how they respond to those challenges with the help of various social networks available to them (see section 5.2 and 5.3). The major problems they encounter in the aftermath of cyclone are wrecking of houses, loss of livelihood activities due to loss of boats, fishing equipment, destruction of agriculture, activities and fish farming, flooding, disruption of transport facilities and electricity, groundwater contamination and shortage of food and water.

Additionally, as described in section 4.2.2.2 & section 4.2.3, the fishers face numerous issues within the cyclone shelter due to the lack of sufficient space and facilities. For instance, responses by community leaders in Gabakund Village highlight that due to the lack of control over the circumstances at that stage, they accept and adjust with whatever they have at that time, he said:

“We had to adjust and cope with the scary and dreadful situation. No one can sleep, and we all sit together, we prioritize giving space to elders, women, and kids If we receive relief then it is equally distributed and if someone does not have food then our people share with each other” (Village community leader, Gabakund).

The situation is similar in Gangadharpur village, however based on the fisher’s explanation, it was understood that the majority stayed within the village and utilized cyclone shelter, school buildings and

tourism buildings for evacuation, unlike Gabakund. But, as discussed already, the situation is entirely different for Mirjapur and Parbatipur fishers. They are shifted to rehabilitation centers hosted by government authorities and all the facilities are provided by the government authorized local bodies (see section 4.2.2.2 and 4.2.3).

Immediately following the peak period, fishers rely on community support for immediate recovery measures and focus on financial recovery through various networks available to them. Figure 12 outlines the actions taken by the community in the immediate rebuilding phase. Initially, they respond by working together extensively in repairing damaged houses and boats. Those people with less damage would give space to fishers who lost their houses completely. In all case study villages share and prepare food together for the first one week, till people slowly move back to the houses after repairing.

The responses of fishers in the first few days are coping with the unique damage they have encountered. Regarding their disrupted livelihood, fishermen actively work together by repairing their damaged boats, fishing equipment, and cleaning the roads from debris. Damages vary from individual to individual, hence the responses. However, after the immediate responses like fishing boats, fishing equipment, and arranging food for families, fishers shift towards a more coping strategy of seeking loans with the aim of rebuilding their livelihood activities. From the discussions, it was clear that repairing boats and getting new fishing equipment needed enough financial support.

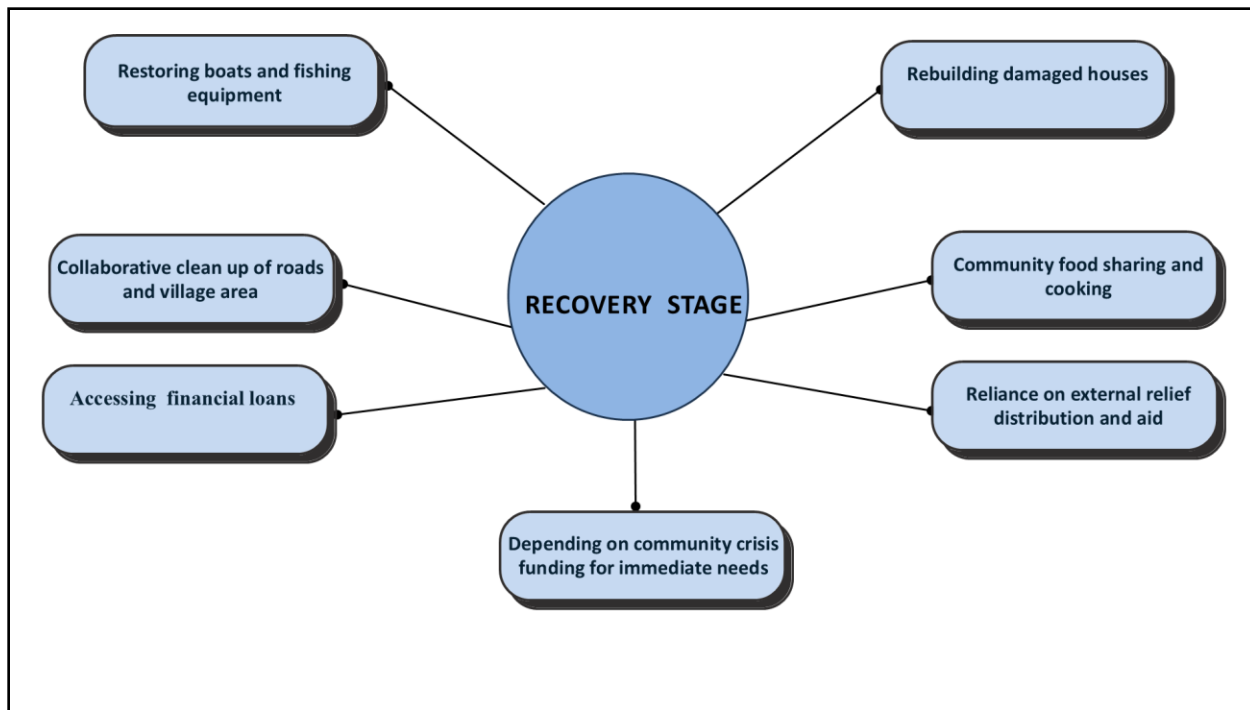


Figure 12: Synopsis of response approaches in the immediate recovery/rebuilding phase.

Post cyclone, the recovery rate of fishers varies from individual to individual based on the damage incurred, and pre cyclone financial status. Fishers expressed how they mobilize the internal community support initially for finding their boats and equipment, repairing houses, and sharing food among themselves, until they receive external support. Young active members of the rescue team also help the community in cleaning and fixing the houses. For example, one of the fishers responded as follows when asked about post cyclone immediate response strategies:

“If someone lost their boat, few people go in groups to search and retrieve the boat together. If someone’s house has broken down, people help in whatever way they can. Some people provide food for the needy and provide monetary help as well. Young community people, because they not only save us but also help us clear fallen trees and save stuck livestock during crisis. They do not bother about their own safety but help us,

so we trust Community people, as they help immediately in the situation” (FGD Fisherman, Gangadharpur).

As pointed out earlier, the communities also rely upon the community crisis funding that comes from two sources: village funding and boat association funding. A few discussions highlighted some situations in the case study villages where they coped with the situation because of the village funding strategies that they kept aside to deal with the crisis. For example, when the generator was not working properly at the time of need, they responded by getting news from the funding that they already had in place (adaptive strategy that developed based on their experience). A fisherman

said: “...We fixed the generator using village funding before the cyclone. The task force people (cyclone management committee) used to help people to go out for the toilet” (Fisherman, Gabakund). Not only about generators, but discussion also brought up various situations where they used their emergency funding such as for arranging food, water before the external help reached them, getting medicine when in need, cleaning community water well and many others. Various responses in this context are as follows:

“Our community well was polluted, so village funding was utilized to clean the well and restore it. Water was taken out by using a motor and bleaching was done to clean the entire well” (Young Fisher Rescue member, Gangadharpur).

These above responses pinpoint the fact that communities are using their bonding social capital and proactively organizing funds that may be needed at the time of crisis. The situation also implies that like a cyclone demands sudden responses based on the unique challenge that it may bring, but for the effective responses, a holistic adaptive strategy (Aldrich & Meyer, 2015) that gives the freedom to respond effectively in place is imperative.

The onset of surge of external aid from government and NGOs begins once the roads are cleared and accessible. They provide essential food supplies and other essentials such as polythene sheets, bed sheets,

some clothes, emergency lights and some utensils. Community leaders distribute it among the fishermen's household and cook food for the whole community for the first few days until people repair their houses. After this stage, fishers slowly start to rebuild their livelihood by seeking various financial assistance from the different sources of social networks they have across the lagoon. At the same time, community leaders inform the government authorities of the losses they have faced, this initiates the survey from the local authorities. And eventually, they get some financial aid from the different institutions, as mentioned by a group of fisherwomen:

In Gabakund, “Some people go and clear the debris from the road, so that the relief material can reach us, later NGOs and government authorities come to provide food, blankets, utensils and entertain us to support us. After 10-15 days (about 2 weeks) of this, when people regain some strength slowly people start working on rebuilding” (FGD, Fisherwomen, Gabakund). Also, in Parbatipur, “After some time, the government gives out immediate relief money (three thousand – seven thousand Rs) to people who have lost their doors or partly damaged houses. Eventually, the government survey takes place to identify and register total loss of livelihood and compensation is provided depending on the severity of damage, but the process takes a long time” (FGD Fisherwomen, Parbatipur).

Relatedly, a fisherman supported this by saying:

“We inform the government and show them the boat license; it provides us funds to repair or rebuild, and the state bank of India also provides some minimal loan amount which we return. We get some funding from the marine and fisheries department as well. Not everyone is lucky enough to get government help. Some may get some will not. Those who will not find their own ways to get money to repair their boats, houses, buying fishing equipment to re-back fishing activity. We take loans from money lenders, fix our boats, start tourist operations for our livelihood, and eventually start fishing. We do not sit idle; it is all about what we can do” (Fishermen, Mirjapur).

The above statement by the participants emphasized that the financial support from government departments is not uniform as not everyone will benefit from receiving it and it takes longer to process. During the continued discussion with all the communities, I was able to track the other sources of financial support received by them. Those include private loans from other financial institutions, non-fishing communities, warehouses, or godown wonders (which they repay back by selling fish stock to them), and other societies. Alongside, they also utilize the boat association crisis funding for immediate essential needs. The following comment by the fisherman highlights how seeking loan provides an immediate relief to sustain their livelihood and other losses, but repayment of loan pushes them to a high debt to income ratio that affects their long-term viability. This added financial burden is leading them to lose interest in fishing allied activities as their main source of income. A fisherman expressed his opinion in support of the above interpretation:

“Fishing equipment is worth Rs 20000-30000 and for that we need to take some loan to re-back our fishing. That is a huge amount for us. Also, for some people they will have to repair their boats too depending on the damage. Considering if we take out loans and only go fishing, we will not be able to look after our family or send kids for education. Hence, I lost interest in fishing these days. I do not want my kids to go fishing”
(Fishermen, Gabakund).

From the discussions, it was clear that while seeking loans from community members or any other sources of immediate support, it gradually imposed additional financial strains due to the repayment and interest. This in turn forced them to explore alternative livelihood opportunities. As a result, fishers solely focus only on fishing are less, most of them are seeking other livelihood options such as small retail shops, electrical and mechanical works, labor works, tourism activity, as drivers of other tourism boats and leaving to other cities and countries for better options. The long-term viability of these options is not clear from the data. However, from the responses obtained, it was clear that not everyone in the community is satisfied with their financial status and livelihood activities, as responded by one of the fishers as follows:

“Yes, people do tourism activity, labor work and small business. Some males even migrate to other parts of India like Kerala for more fishing related work and some go to countries like Dubai, leaving their family here. But these days, there are not enough opportunities and not everyone is lucky to get one that exists also. For some people, leaving Chilika and family is hard, so they try to manage whatever they have. We go to Chennai and Bengaluru, as whatever we earn here is not sufficient for livelihood sustenance” (Fisherman, Parbatipur).

Along with the struggles faced by the fishermen in the communities, discussion with a group of fisherwomen exposed how they are dealing with these financial challenges exacerbated by disasters like cyclones. Many studies have indicated how fisherwomen are affected in the post disaster period in dealing with caregiving and other responsibilities at home (Ajibade et al., 2013; F. N. Khan et al., 2018). Even though fisherwomen in Chilika are historically engaged in household chores and fish processing works, these days due to the growing financial strains, fisherwomen are seeking ways to support their family financially. Fisherwomen in Parbatipur village (from lower caste fishers - Khandra) have started supporting their family by engaging in labor work. In all upper caste villages, married women are not engaged in any livelihood activities except some households having government jobs. In addition to this, fisherwomen are engaged in Self-help groups (SHGs) in each village providing financial assistance through thrift and credit methods for taking care of kids, family, and other needs. Parbatipur women mentioned about the ICZM project that gave women training on making mats doors and other products using coconut coir. This is used to help them to become financially independent. However, due to lack of funding and proper management this is discontinued.

Overall, the interpretation based on the data is that all the above strategies the community adopt to become financially stable are not viable in the long term. Many mentioned that once they reach the stage of rebuilding another cyclone hits them, which again demands more money to even restart their fishing activity and rebuild their houses. Hence, entrapping them in a cyclone of recovery and collapse. These days, young fishers are working towards getting better jobs in government departments as an adaptive response to the

financial burden faced by the fisher families. It reflects how the young fishers are shifting careers for better future financial stability, but it affects the traditional knowledge and skills associated (Arulingam et al., 2020; Power et al., 2014)) with the fishing communities.

5.4.3 Long term Adaptive Strategies for Prevention, Effectiveness and Challenges

In the above sections, I covered the immediate responses taken by the communities to deal with damage caused by cyclones with the help of various networks available to them. This section now transitions to a discussion of long term proactive long term strategies, termed as adaptive strategies (Miller et al., 2025; Solecki et al., 2011) implemented for the long term viability of the communities in dealing with disasters like cyclones. During the discussion with the communities, four key historical events (as mentioned in the section 4.2) have emerged that provided valuable information regarding the initiating and transformation of adaptive strategies over that span of period. Fig 5.5 shows the span of period with the identified key historical events that marked the development of certain long-term strategies to deal with cyclones. The notable historical events and present status about cyclone resilience efforts that emerged from the data are grouped as i) Super cyclone happened in 1999, ii) Initial Cyclone Resilience Expansion Phase, iii) Cyclone Phailin in 2013 iv) Cyclone Fani in 2019, and v) Present Cyclone Resilience Status. The following sections will continue the discussion of various adaptive strategies with reference to these historical timelines and reference points.

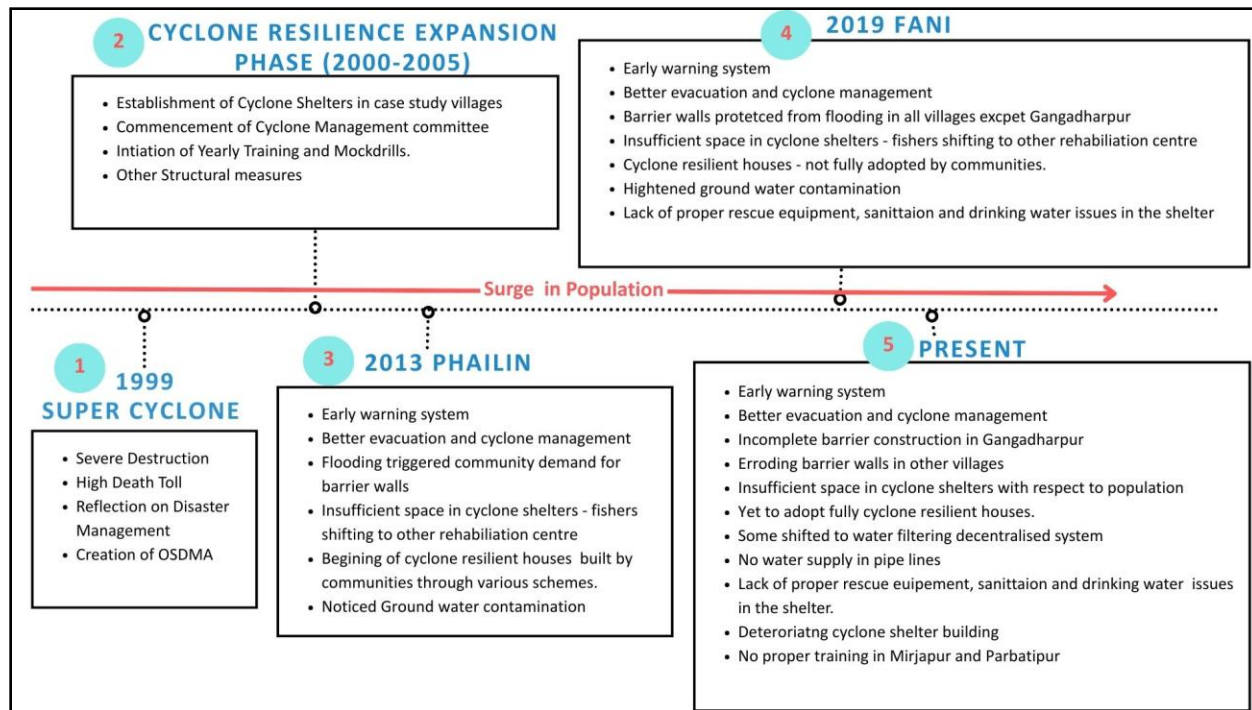


Figure 13: Synopsis of historical and status of Cyclone Resilience Strategies

5.4.3.1 Are cyclone centers a better adaptive strategy?

The super cyclone that happened in 1999 with a speed of 300 km (about 186.41 mi/hr) has caused the loss of ten thousand people within 24 hours (Chhotray, 2022). Many fishermen shared their experience regarding the 1999 super cyclone. A fisherman, for example, stated during the focus group discussion; “...We heard about cyclones for the first time in 1999, we saw dead bodies on the shore, from then to now, every year it has become a usual thing. Only difference it makes is where the cyclone landfall happens.” (FGD, Fishermen, Mirjapur). This incident revealed the shortcomings regarding the disaster management system, triggering a period of reflection and formation of a better disaster management system that paved the way for the creation of Odisha State Disaster Management Authority (OSDMA) (Patra, 2023). Structural measures adopted by OSDMA prioritized the construction of cyclone shelters by partnering with the red cross society and World Bank. Thus, contributing to an additional 144 cyclone shelters in the

cyclone prone areas within the next 10 years (Dasgupta & Priyadarshini, 2019). In the case of study villages, few responses align with the same period within which cyclone shelter was established. As mentioned by a group of fishermen in the group discussion, in Gabakund... “The cyclone shelter was established in 2000, for us and two more other villages. The cyclone shelter is closer to our village, so it is mostly used by this village population. Also, in Gangadharpur, “Inauguration of Red Cross cyclone shelter centre happened in 2005” (FGD Fishermen, Gangadharpur). Alongside this, yearly training and mock drills commenced and continues till date in these villages.

Tropical cyclones frequently affect the coastal districts of Odisha, (Muduli et al., 2022) accounting to an annual estimate of 5- 6 cyclones. However, according to the discussion with SSFs communities of all the case study villages, cyclones of 2013 (Phailin) and 2019 (Fani) were the most devastating incidents that affected their village. Hence, I exclusively considered these two events as key reference points for the analysis and interpretations of long-term adaptive strategies, aligning with the perception shared by the community members. The structural measures such as better communication system and construction of cyclone shelters that were implemented between 2000-2005 have resulted in better evacuation and saving human lives in the villages. A cyclone management system and proper training have equipped people to react abruptly during the crisis. The Cyclone management committee is formed by selecting the members within the communities by the local authorities and given yearly training to foster their skills to react abruptly during the crisis. Aligning with this, a group of fisherwomen from Gabakund made the following observation:

“The training groups are divided into different groups based on the work such as communication team, first-aid team, rescue team, psycho care team, management team, relief distribution team, accounting team and scared work group etc. These committee members ensure that the centre is clean, and all other arrangements

are made before people move in. They all are trained in advance during the mock drill that happens in every august month” (FGD Fisherwomen, Gabakund).

On a similar note, the cyclone management committee president of Gangadharpur also shared his observation regarding the functioning of the cyclone management committee in the village:

“There are thirty-five members from the village in the cyclone shelter committee. Twenty out of them are responsible for rescuing people and bringing them to red cross houses, if the house collapses and safeguarding livestock etc. And the rest of the twelve people are responsible for NGO engagement and other management activities. 12-15 are women, eight in the rescue team, women help us in rescuing pregnant ladies” (President of cyclone management committee, Gangadharpur).

As mentioned in section 5.2, previous devastating experience faced by the Odisha coastal communities due to the Super cyclone has led to the adaptive approaches such as early warning system, constructing cyclone shelters, and providing community led training and mock drills for preparedness (Pradhan, 2024). These proper management strategies that were developed with the help of linking social capital, but functioning with the help of bonding social capital showcases an example of how various forms of social capital can lead to effective strategies for the better resilient communities. While the implementation of cyclone shelter was initially planned as an adaptive strategy for multiple villages in the surrounding region and has helped to reduce the physical vulnerabilities to an extent, the increase in population in these villages has emerged as a factor (Singh & Jeffries, 2013) that leads to unequal access. For instance, the cyclone shelter in Gabakund village was initially constructed for them as well as the surrounding villages such as Raipur and Mirjapur. However, as years passed, the population surged, resulting in the failure of shelter to accommodate the whole population during the crisis. The community leader of Gabakund village made the following assertion in line with these findings:

“The cyclone shelter was established in 2000, for us and two other villages. But as the population increased, due to scarcity in sufficient space to accommodate, other village people stopped coming. The cyclone shelter is closer to our village, so it is mostly used by this village population. But during the last cyclone, only 75% of the villagers stayed in the cyclone shelter, even then it was so hard to adjust. Also, we faced sanitation and drinking water issues as well” (Community Leader, Gabakund).

The above assertion confirms that the formation of cyclone shelter, which served as a good structural measure to reduce the vulnerabilities initially, now seems to be partially malfunctioning as it failed to have evolved with respect to the current population and present challenges. Hence, it has been observed that the lack of proper restoration and maintenance from the higher authorities acts as a potential barrier for full effectiveness of adaptive strategies. The situation is identical in Gangadharpur village as well, the shelter was meant to accommodate the Gangadharpur villagers and the adjacent non fisher village. Nevertheless, over the years, growing population and rising demand have resulted in scenarios that the entire population did not benefit and those who have access face challenges like lack of proper equipment and basic facilities (see section 4.2.2.2). The reason behind the exclusion of other villagers from the access to cyclone shelters could be because of the lack of proximity and limiting capacity of the shelters.

From the data analysis, it was surfaced that those villages having access to centralized shelters have better cyclone management systems, highlight adaptive responses based on their previous knowledge, and availability of basic facilities and resources. Cyclone shelter seems to act as a local centralized point which makes it easy for facilitating various rescue, evacuation, and relief distribution activities and organizing proper training which helps in safeguarding human lives (Dash & Walia, 2020). In support of this, a fisherman expressed the following view:

“Cyclone centers provide us shelter during cyclonic storms; we would have lost our lives otherwise. We find strength in togetherness, as we all are in the same situation.

We never felt left out or lonely during fearful situations, being surrounded by our loved ones made a huge difference for us” (Fisherman, Gangadharpur).

Besides, as explained in detail in section 4.2.2.2, the inadequate facilities and partially deteriorated cyclone shelters in both Gabakund and Gangadharpur raise concern regarding the safety of fishers while relying on the shelters for the future need. The fishers in both the villages also highlighted their concern in this regard (see section 4.2.2.2).

Considering the other villages like Mirjapur and Parbatipur, with no access to cyclone shelter have inconsistency in training and preparedness. During my field visit, my discussion with different groups of fishermen and fisherwomen revealed the disorganization, inconsistency, and disparity in training, because some said they receive training yearly, some said they got training only once, some said women are involved, but no women group agreed that they get training. Additionally, further discussion also revealed that there is no proper management team for rescue, first aid, and relief distribution, here some young fishers voluntarily take part in these activities and help the community when in need. The above findings reveal the lack of social cohesion between the community members, as they mostly depend on external help for evacuation and shifting compared to other villages. Sections 5.4.1 and 5.4.2 elaborately discussed how the absence of a centralized point like cyclone shelter affected the various disaster management activities during pre-disaster, crisis phase and immediate recovery phase. As reported in previous studies by Alam, E. 2024 and Binte Ibrahim et al., 2019, lack of proper cyclone centers and poor condition i existing shelters are few of the main reasons behind people’s reluctance towards obeying to rescue teams for proper evacuation, fishers in this research case study villages also expressed similar reasons for their disinterest in shifting to cyclone shelters or rehabilitation centers (See section 4.2.2.2).

5.4.3.2 Status of Cyclone Resilient Houses

Fishers reported extensive damage to their houses as the main concern in the aftermath of the cyclone. In the aftermath of the 1999 cyclone, the government of Odisha initiated measures to improve the housing

infrastructure in rural cyclone prone areas by upgrading kutcha houses to pucca houses (Singh & Jeffries, 2013) by leveraging Indira Awas Yojna rural housing scheme that was ongoing during that time. However, the transition was happening at a slow phase. The response from the fishers in all study villages revealed that only a small portion of the population had good concrete houses at the time of Fani. Additionally, they also mentioned that compared to the 2019 situation, many fishers have good, connected houses they build with the help of various schemes such as Fani house scheme, and PM Awas yojana (2016) (Bhadauria, 2019; ShivamSoni.Dev, 2020) that gives a portion of money to support communities financially to build cyclone resilient buildings for better adaptation. As mentioned by the president of Self-Help group, Gangadharpur). A group pf fisherwomen shared:

“Before Fani in 2019, we had only 7-9 good concrete houses in the village, but now it has increased to 60-70 numbers. People are trying to build good houses through government provided schemes like PM Awaas Yojana. Only a few 5-10 houses are left” (SHG Fisherwomen President, Gangadharpur).

On a related note, the fisherwomen group of Mirjapur also made the following assertion:

“During Fani, we had only a small number of good houses, but these days it has increased to 70-80 % in total. I hope we do not have to leave the village anymore” (FGD Fisherwomen, Mirjapur).

However, support from government authorities is not uniform, adequate and takes longer time to get sanctioned. Figure 14 shows a fully constructed house with labels mentioning the scheme that provided financial support. Fisher's reaction was mentioned in section 5.3. Additionally, I have observed a few fishers who still live in their broken partially damaged houses and used polythene sheets in the roof and broken parts as in figure 15. Some respondents even mentioned that the amount they get through this funding is not sufficient to complete the construction process, hence remains as unfinished building as shown in the

figure 16, and they are finding their own ways to arrange money. Some also mentioned that political influence plays a major role in getting these funding sanctioned.



Figure 14: Images of Scheme labels marked on the front walls of the recently built houses (Photo: Greeshma Prakash Sherly).



Figure 15: Images of broken houses which remind that recovery is incomplete until everyone has equally rebuilt (Photo: Greeshma Prakash Sherly).



Figure 16: Images of incomplete houses due to insufficient funding (Photo: Greeshma Prakash Sherly).

During observation, the inequality in the form of building structures was evident; some had fully constructed houses, while some were partially built and few living in broken thatched houses. Especially the houses in Parbatipur village were mostly kutcha type with asbestos sheets and polythene sheets (they got from NGOs and government relief distribution during cyclone). From the observation and discussions with the fishers, it was revealed that adoption of fully cyclone resilient concrete houses is still uneven across the fishing communities of all three villages.

5.4.3.3 Adaptation Gaps in Flood Control Measures and Safe Drinking Water Access

Section 4.2.1.3 has already explored the flooding caused by cyclonic activities. According to the responses from the fishers of Gabakund, Mirjapur and Parbatipur, their village was subjected to flooding in 1999 super cyclone and in Phailin cyclone 2013. This has disrupted their agricultural land, aquafarms, and disrupted evacuation processes. These incidents prompted communities to demand protection barriers along the lagoon boundary, indicating a community led adaptive response in the wake of cyclone induced threat (see section 4.2.1.3). According to them, this has prompted the construction of barrier walls along the lagoon boundary in Gabakund, Mirjapur and Parbatipur villages. But the effectiveness of these adaptive strategies remains a concern as most of them have reported that recently in some parts of the lagoon boundary the protection barriers are eroded completely or partially exposing them to risk flooding in future. The Parbatipur village is highly susceptible due to its low-lying landscape and improper height of protection barriers as seen in Fig 4.1 of section 4.2.13. This implies that it is not about implementing adaptive strategies but also about having proper planning and maintaining it to meet the long-term benefits. This improper Planning and inconsistency from the side of the government authorities again keeps the communities back into the loop of risk and vulnerabilities. The scenario is different in the case of Gabakund village as explored in section 4.2.1.3, the conflicts between community members have halted the construction of boundary walls around the village. This highlights how lack of consensus and cooperation among the community members (relational wellbeing aspect of social capital) hinders the transmission of information and decision making (Cherng et al., 2019) which is crucial in determining the effective adaptive strategies against

environmental pressures. Subsequently, when the agricultural land was disrupted after the cyclone due to increased salinity and flooding, some used more fertilizers to increase the yield and are continuing the same process. While fishers from Parbatipur admitted that they do not spend money on agricultural activities as they do not get any profit from it. These responses expose the vulnerabilities of the communities in the changing environment where they focus on reacting to it with coping strategies rather than adapting more viable strategies due to the absence of enough support systems and economic inability.

Following that, another concern is regarding the access to safe drinking water (see section 4.2.1.2). When the villagers noticed changes in the borewell water quality after the cyclone, they reacted by reporting to the government authorities to seek advice. Then they started boiling the water before using it as a coping strategy. However, over the years some portions of the community who are economically viable shifted to filtering units, installed aqua guard filter units at home for better safety. While a small portion of the people have acquired these adaptive strategies, the rest of the population are still boiling water, or buying water from outside sources. From the side of the government, pipelines were installed in every village a few years back, but the implementation of these adaptive strategies is incomplete as water connections are not yet completed. This resulted in inequality and barriers to better recovery, impeding the long-term resilience and adaptation process.

5.4.3.4 Community-led Funding Strategies to deal with crisis

The utilization of community pooled funds such as Village committee funding and Boat association funding to meet the emergency needs during the preparedness and immediate recovery phase as mentioned in the section 5.4.1 and 5.4.2 exhibits locally driven adaptation in response to challenges like cyclones. During the conversations, many responders highlighted the situations where they made use of these funding to react to unique situations they faced every time after the cyclone (see sections 5.4.1 and 5.4.2). Village committee funding and Boat association funding play a big role in dealing with future uncertainties. The boat association collects one hundred Rs from each tourism boat daily for funding. Village funding is gathered by subleasing the common land for agroforestry (polango and cashew) and fish farming and by household

collection of Rs 300 – 500 (Approx. \$3.60 – \$6.00) from each household; these funds are saved not only for dealing with uncertainties, but also to arrange cultural events between the villages. In Mirjapur, Gabakund and Gangadharpur, village funding is collected by individual household collection and by subleasing common pond area for fish farming and aquaculture. But, in Parbatipur, village funding is not collected frequently due to their financial constraints.

Hence, they mostly seek help from Mirjapur village committee funding for their needs. This highlights the inability of certain groups of communities to develop their own resilient strategies due to financial constraints, causing disparities in the overall adaptive capacity. These funding strategies highlight the fact that communities are using their bonding social capital and proactively organizing funds that may be needed at the time of crisis.

5.5 Discussion

This chapter mainly identifies the various forms of social capital in action at the time of crisis and analyzing the social dynamics and the relational wellbeing aspects arising out of these networks. The first section of the chapter gives a grasp of various forms of social capital in action that shapes the community level responses. Connecting to the major impacts and challenges that were identified in chapter 4, the corresponding community level responses, along with corresponding social capital forms and relational wellbeing aspects that influence these responses captured from the whole discussion, are given in table 11 on the next page.

Figures 12 and 13 give a synopsis of various community level responses, however some of these responses as mentioned earlier are shaped by the external institutional supports. To distinguish this, table 11 below categorizes the community level responses based on its origin or sources, which highlights the equal significance of bonding social capital and linking social capital.

Table 10: Categorizing the community level responses based on the Sources of Support or origin.


Activity	Sources: Self-developed/ External /Mixed	Description
<p>..... Preparatory Stage</p>		
Dissemination of Information regarding cyclone	Mixed	Early warning system from government authorities, then shared through local leaders and members within the communities.
Cyclone management committee in action / Rescue team in action	Mixed	Local efforts and activities mobilized by the community leaders but supported by government and NGOs
Village committee meeting	Self-developed	Facilitated by community leaders to get prepared based on their previous experience and traditional knowledge
Community gathering for prayer	Self-developed	Organized by Community members for fostering emotional support and solidarity.

Household and individual level actions	Mixed	These involve securing documents, valuables and preparing dry food are influence by both traditional knowledge and external training
Stocking food, water, other facilities, arranging necessary equipment's	Self-developed	Community leaders organize stocking of food, water and other facilities based on the need of the hour by utilizing village funding
Evacuation	Mixed	This is accomplished with the support of local leaders and external authorities.
<p>..... Recovery Stage</p>		
Restoring boats and fishing equipment	Self-developed	Utilize the traditional knowledge and internal community support to repair boats and equipment.
Rebuilding damaged houses	Mixed	Both by using local support and external institutional support.


Community food sharing and cooking	Self-developed	Rely on mutual assistance and prepare and share food collectively
Reliance on external relief distribution and aid	External help	Reliance on external aid in the form of various resources and food supplies.
Depending on community crisis funding for immediate needs	Self-developed	Community led funding strategies (fund collected from within the communities yearly or monthly basis) are used to deal with crisis.
Collaborative clean-up of roads and village area	Self-developed	Community members voluntarily clean up the roads and surroundings post cyclone as a step towards returning to normalcy
Accessing financial loans	External help	To deal with the sudden financial crisis and to repair the incurred damages to boat and houses, they seek loan from higher institutions




Additionally, the analysis also examines the various adaptive strategies implemented and adopted by the higher authorities which shape the community level responses such as cyclone shelter implementation, yearly training and mock drills, and government schemes for cyclone resilient houses (see section 5.4.3 and figure 14). The results reflect how these strategies failed to adopt over time with respect to the surge in population and present needs, thus bringing further consequences and increasing susceptibility to the risk of the communities at the time of crisis.



Table 11: Summary of the Community responses that is shaped by the existing social capital and Relational Wellbeing Aspects



Types of Impacts/Challenges	Community Responses	Types of Social Capital Involved	Relational well-being Aspects positive or Negative
<p>Environmental Challenges</p>	<ul style="list-style-type: none"> Collective request for protection walls and resulting in its implementation by authorities before 2019 Fani. 	<p>Bonding Social capital and Linking Social Capital.</p>	<p> Social cohesion, solidarity, Institutional support, and recognition</p>
<ul style="list-style-type: none"> Flooding 			<ul style="list-style-type: none"> Internal conflicts – hence halted the construction process





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<ul style="list-style-type: none"> • Deterioration of Ground water quality 	<ul style="list-style-type: none"> • Some populations rely on other better sources of water within communities or use the water by boiling. • Economically viable population shifted to water filtration units 	<p>Weak linking social capital and bonding social capital (pipelines by authorities laid few years back, but no water supply yet and no collective action)</p>	<p> Inequality in coping strategies due to poor accountability of authorities and weak community solidarity for demand.</p>
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<ul style="list-style-type: none"> • Damage to agricultural lands 	<ul style="list-style-type: none"> • Increased use of fertilizers • Abandoned agricultural activities 	<p>Weak linking social capital and bonding social capital</p>	<p> Inequality in coping strategies due to no collective action and weaker institutional support</p>
<p>Physical Impacts / Challenges</p>	<ul style="list-style-type: none"> • Immediate reconstruction using community help. • Taking loans and financial assistance from non-fishing communities and other institutions • 	<p>Bonding Social capital, Bridging Social Capital, and Linking Social Capital</p>	<p> Collective action Reciprocity, institutional support and recognition, intergroup trust, and connection.</p>
<ul style="list-style-type: none"> • Destruction of houses, boats, and fishing equipment. 			
<ul style="list-style-type: none"> • Inadequate or lack protective measures / resilient houses 	<ul style="list-style-type: none"> • Using community level funding to arrange the fragmented 	<p>Strong Bonding Social capital and weak</p>	<p> Collective action and internal cooperation.</p>

	<p>facilities in the shelters</p> <ul style="list-style-type: none"> • Passive endurance (lack of space in shelters, poor sanitation or drinking water facilities) • Evacuated with the help of government support and passive acceptance of poorly functioning shelters. • Relying on financial schemes, and taking loans 	<p>Linking social capital</p>	<p></p> <p>Institutional neglect or inaction</p> <p>Unequal financial scheme distribution, political favoritism and social exclusion</p> <p></p> <p>Formal recognition and initial institutional support but lack of responsiveness</p>
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	<p>from the government to construct houses</p> <ul style="list-style-type: none"> • Hindered house construction and still adjusting in broken houses. 		
<p>Economic Impacts</p>	<ul style="list-style-type: none"> • Taking loans and financial assistance from community members non-fishing communities and financial aid from institutions • Outmigration and livelihood diversification • Women – labor work and NGOs 	<p>Bonding, Bridging and Linking Social Capital</p>	<p> Intra and Inter group support, recognition, and support from institutions.</p> <p> Unequal access to aid, political favoritism, inaction of government authorities</p>
<ul style="list-style-type: none"> • Loss of Livelihood 			

	support for SHGs		
Social Impacts	<ul style="list-style-type: none"> Using community level funding to arrange food and water Relying on aid from NGOs and Government authorities 	Bonding and Linking Social Capital	 Collective action and internal cooperation.
<ul style="list-style-type: none"> Food and Water Shortage 			 Formal recognition and initial institutional support  Unequal access to aid, political favoritism, inaction of government authorities
<ul style="list-style-type: none"> Poor Sanitation 	<ul style="list-style-type: none"> Passive endurance 	Linking Social Capital	 Institutional neglect or inaction

<ul style="list-style-type: none"> Emotional Distress 	<ul style="list-style-type: none"> Passive endurance and relying on communal and family support 	Bonding Social capital	 Emotional support and trust
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5.6 Chapter Summary and Conclusions

The discussion and analysis presented in this chapter primarily focuses on three areas, such as i) identifying the various social networks operating at different levels that are available to the communities, enabling timely responses at the time of crisis like tropical cyclone ii) beyond the existence of these networks do they ensure relational wellbeing by ensuring social equality, trust, better power dynamics and reducing casteism, thereby shaping the response pathways and strategies at the time of cyclone management ii) what are those repose pathways and strategies adopted by communities and are they viable in the long term? By exploring through all these above key areas, this chapter shares perspectives of fishing communities in all case study villages of Chilika Lagoon in this regard and pinpoints the adaptation gaps the communities have in dealing with the crisis. The following chapter will summarize the key findings and outcomes of the three main objectives and provide recommendations and conclusions.

Chapter 6

Conclusions and Recommendations

6.1 Introduction

This research aimed to listen to and learn from communities that have encountered and dealt with the aftermath consequences of a series of cyclonic events over the past few decades. It sought to capture the role of social capital and relational wellbeing arising out of it, which shapes the community level responses during and in the immediate future after the cyclone, thereby enhancing community resilience. The research also strived to evaluate the effectiveness of the various response strategies that case study communities utilized with the support of existing social networks. This chapter is divided into various sub sections that presents an overview of research purpose, methodology employed in this research, core findings in alignment with the three objectives of the research and concludes with recommendations and an overall summary.

6.2 Summary of Study Purpose and Methodology

In this study, I strived to assess the community resilience of Small-Scale Fishing communities against frequent tropical cyclones in Chilika Lagoon by focusing on the Social Capital and Relational Well-being arising from those networks. The conceptual framework in section 2.6 shaped the data collection, analysis, and interpretation of the results throughout the research work. The framework integrates the three main objectives of the research focus (see section 1.2) such as identifying the various impacts and challenges faced by communities due the tropical cyclones, what are the various forms of social capital available for the communities at the time of crisis, how is the relational dynamics of these social networks that foster the overall relational wellbeing, what are the various responses at community level shaped by those networks to deal with the crisis and how effective are those responses in sustaining long term recovery and community resilience.

In completing this research, I employed a qualitative case study approach by utilizing multiple methods (see section 3.4 & 3.5) to gather data, analyze and interpret the final finding. During a two-month period in the field, I employed semi-structured key informant interviews, focus group discussions and non-participant observations to acquire data from all the case study villages. Triangulating the data collected from various sources enhanced the consistent narration of the research problem by bringing diverse perspectives of the fishers and embracing the contradicting findings (see section 1.5.3). The overall summary of the core findings corresponding to each objective is given in the following section.

6.3 Key Research Findings

The following sections give the summary of research findings with respect to the three objectives of the research as already discussed in the analysis chapters 4-5.

6.3.1 Objective One

To explore how cyclones are impacting the SSFs in Chilika Lagoon.

Chapter 4 focused on the first objective of describing the various impacts, and challenges faced by the SSFs communities in Chilika Lagoon based on the perspectives of fishers gathered from the case study locations.

The major findings from the analysis of objective one is listed below:

- The increased frequency, unpredictability and severe cyclonic events affect the communities multidimensionally causing disruption in the following aspects: physical, environmental, social, and economic. These aspects are interconnected and impact on one aspect, triggering and exacerbating the impact on the another like a perpetuating cycle.
- The environmental aspect involves strong winds and heavy rainfall causing disruption to infrastructures and surroundings. Alongside, other impacts on the surrounding environment of SSFs include flooding, damage to casuarina trees, agricultural lands, change in potential fishing grounds and deterioration of ground water quality.

- The opening of artificial sea mouths in Chilika lagoon has resulted in a negative effect on the social and economic aspects of SSFs communities living adjacent to it. In addition to it, it indirectly exposes the villages to cyclone vulnerability, which is due to the gradual shift of artificial seamoth to the northern side as a part of coastal morphology is eroding the banks of casuarina trees which act as protection against cyclones. However, the frequent cyclonic activities also play a role in enhancing this erosion, resulting in a perpetuating cycle of erosion and cyclone vulnerabilities.
- The physical damage specified in figure 8 is the direct consequence of environmental changes. Additionally, it also outlines the physical vulnerabilities such as improper access to proper shelter and facilities to withstand the environmental stressors.
- The identified environmental changes (like intense winds, flooding), environmental vulnerabilities (loss of protective natural measures), physical damage (destruction of houses or boats) and physical vulnerabilities (absence of adequate infrastructure) collectively trigger secondary social and economic consequences as described in figure 8.
- The economic challenges are inextricably associated with physical and environmental aspects discussed earlier. SSFs in Chilika are highly dependent on natural resources based economic activities such as fishing, agriculture and tourism which are heavily impacted by the cyclonic consequences. This further induces livelihood destruction, economic instability, financial burden (taking loans for recovering damages) and increased cost of recovery. Therefore, diversifying livelihood, and outmigration have become a common phenomenon in search of financial stability in all the case study villages.
- The social issues placed at the bottom of the diagram in figure 8 are the outcomes of all the above-mentioned changes and vulnerabilities such as physical, environmental, and economic. Social issues identified in this research context are the absence of necessities, disruption to social events and other systems like education, decreased social wellbeing due to unequal access to necessities, financial burden, and damages.

- Once, the major challenges and impacts were identified, research shifted towards analyzing the community level responses to tackle the issues by relying on the existing social capital and relational wellbeing were identified, which is further discussed in relation to objective two and objective three.

6.3.2 Objective Two

To examine the interactions between social capital and relational wellbeing of SSFs in dealing with cyclones in Chilika lagoon.

After outlining the various challenges faced by the communities in the wake of cyclone in Chapter 4, the first half of Chapter 5 engages with the second objective which focuses on investigating the type of social capitals (bonding, bridging and linking) accessible at the community level that aids in the preparedness and recovery process of the cyclone. The critical findings regarding this are as follows:

- The level of involvement of various forms of networks in the three distinct stages of cyclone such as preparedness, response and recovery phases are categorized as high, medium, and low for analysis purposes. High indicates active involvement and support; medium implies occasional source of assistance and low reflects no active involvement of support. Visual graphical representation with respect to this in all case study villages are shown in figures 9 and 10.
- The level of involvement for various forms is identical for those villages (Gabakund and Gangadharapur) with cyclone shelter and management systems, however it differs in the case of villages with no access to cyclone shelters and exhibit a proper management system.
- For instance, villages like Gabakund and Gangadharapur already have a proper management committee in place of around thirty members within the communities. In the initial phases of the preparedness phase, the early warning system, information sharing and public awareness are managed by institutions such as local government authorities (linking social capital). According to

the responses from the fishers, later the mutual aid and assistance mostly came from the community members described in section 5.2.

- Bonding social capital seems to be the stronger source of assistance at all the phases of cyclone in Gabakund and Gangadharpur, mostly because of their privilege to stay together in the cyclone centers. While linking social capital plays equally high involvement at the last stage of the cyclone, that is in the recovery stage in the form of relief materials, and financial aid.
- Bridging social capital plays only a medium level of interaction at the recovery stage, because based on the participants' response only some seek or get financial assistance from the non-fishing communities or different fishing villages within the Chilika Lagoon. No participants mentioned the involvement of outsiders (bridging social capital) in the preparedness or response phase.
- The situation contrastingly varies in Mirjapur and its sub village Parbatipur. Due to the absence of cyclone shelters, most of the fishers are shifted to safe rehabilitation centers in other cities with the help of local authorities. Hence, at all stages of a cyclone, linking social capital plays a major role in shifting, arranging necessary facilities and later in the distribution of relief funds and financial assistance.
- Along with the presence of linking social capital, bonding social capital also plays a major role in the initial preparedness phase because rescue members within the community assist each other in shifting, docking boats and preparedness activities. However, since the villagers are dispersed now of response phase, bonding social capital involvement is comparatively low, but later in the recovery stage involvement increases. Like the Gabakund and Gangadharpur, the involvement of bridging social capital is intermittent in the response phase as few get assistance in the form of financial help.
- Following the examination of various forms of social capital available to the communities at the time of cyclone, the analysis of these social networks through the lens of relational wellbeing was explored. Majority of the fishers' responses confirmed that they trust their fisher's community more

as compared to other external social networks based on previous experiences, especially due to persistent emotional support, collective action, and solidarity in the moment of necessities.

- Although there exists a strong trust and reciprocity among within the community members of all the case study villages, those villages (Mirjapur (Khatia-upper caste) and Parbatipur (Khandra-lower caste) with mixed caste fishers have subtle form of friction due to the existing caste system in society.
- The above-mentioned hierarchical caste system sometimes hinders the preparedness and relief distribution process as mentioned in section 5.3. There were exceptions to these at times, especially certain people in Mirjapur give helping hands to people at the time of crisis. Some even mentioned how multiple occurrences of hardships like cyclones have become a learning and transforming experience that made most of the fishermen move beyond the caste system and embrace unity. This finding highlights how the repeated cyclone activity itself is shaping the relational quality of bonding social capital. However, the voices of those fishers experiencing caste discrimination and domination need to be acknowledged to ensure social inclusion as mentioned in the sections 4.2.3 and 5.3.
- While analyzing the relational well-being aspects of other social networks within each community, the previous experiences have resulted in the lack of trust towards the external sources of support such as NGOs and government authorities. This stems from the unequal and insufficient distribution of relief aid and political favoritism they have experienced in the past. These factors push many of them to rely strongly on bonding social capital. The above scenario was more prevalent in communities with no cyclone shelter and proper management system.
- However, those villages with proper management systems and cyclone shelter as the main centre location of sheltering and distribution of aid emerges as a good example of how balance between various forms of social capital can result in better preparedness and immediate recovery.

- Another notable finding is that the lack of ability of fishers to hold accountable of higher authorities' inactions such as improper cyclone shelter management, lack of proper shelter unit, unequal financial aid has resulted in additional vulnerability and lack of control of their own life and decision making at the time of crisis as mentioned in section 5.2.
- Once I identified the various forms of social capital and the merging relational wellbeing from those networks. The research shifted towards examining the various community level responses and strategies shaped by the interplay of social capital and relational wellbeing arising out of those social networks. This is summarized in relation to the three objective key findings below.

6.3.3 Objective Three

To explore different community level responses to cyclones shaped by the available social networks and their effectiveness.

The latter sections of Chapter 5 continued the discussion engaging with objective three as highlighted above, which focuses on the analysis of various community level responses facilitated by these social networks for preparedness, immediate recovery, and long-term viability, along with its effectiveness and barriers to achieve long term resilience. Table 10 in section 5.5 gives a detailed discussion regarding how various community responses are shaped by the social capital forms and the merging relational wellbeing aspects from it. The core findings from the data analysis with respect to objective three are as follows:

- With the aim of systematically presenting the results and discussions, the community level responses adopted by the communities influenced by the various sources of networks were discussed in three stages: preparedness stage, during and rebuilding stages of the cyclone. The long-term adaptive strategies that were identified from the data during the 1999 super cyclone and present time were also examined in detail.
- After the dissemination of information regarding the cyclone, the various responses that were identified during the preparedness phase were prayer gatherings, village level committee meeting,

cyclone management committee or rescue members in action, household or individual preparations, stocking of food, water, and other facilities, arranging necessary rescue equipment, and evacuation or shifting.

- The immediate preparedness actions in Gangadharpur and Gabakund were shaped by the long-term strategies they have adopted over the years, especially the cyclone management team working systematically based on the assigned tasks like rescue activity, relief distribution team, first aid management team and account loss monitoring groups who all are well trained.
- Contrastingly, the Mirjapur and Parbatipur had a different experience and were shifted forcefully to rehabilitation centers in far cities by government authorities, while some were left behind in the village. While the others in the village had the privilege of taking immediate action and reacting accordingly, they were lost and focused fully on external sources of help for shifting.
- The sections 4.2.2.2 and 4.2.3 have explained in detail the challenges faced by the communities during the response stage. Even Though the Gabakund and Gangadharpur villagers had the privilege of staying in the village and acting spontaneously, they faced numerous challenges due to the improper facilities in the cyclone shelter such as lack of proper drinking water, scarcity in food, poor sanitation and crowded environment resulting in the spread of communicative diseases in the aftermath.
- The fishers of Mirjapur and Parbatipur also voiced their helplessness and passive endurance due to the lack of a proper management system in place and the challenges they faced in the government assigned rehabilitation centers (see section 4.2.2.2).
- The immediate recovery stages of the fishers included following activities, rebuilding damaged houses, restoring broken boats, and fishing equipment, cleaning up of roads and village space collectively, food gathering and sharing, utilizing village crisis funding for immediate needs, reliance on external relief aid and financial assistance and accessing financial loans. The reliance

of external financial aid and loans, as well as recovery rates depends on the damage incurred and the earlier financial status of everyone.

- The fisher's voice reveals how the frequent cyclonic activities and other pressures in the Chilika lagoon as mentioned in Chapter 4 thrust them into a loop of financial struggles, which is demanding them to seek alternative livelihood activities, and out migration. The growing financial strains prompted the fisherwomen to also seek financial opportunities such as active participation in Self-help groups (SHGs) in each village providing financial assistance through thrift and credit methods for taking care of kids, family, and other needs. Due to the traditional custom, married women are not allowed to go out for work, especially in higher castes like Khatia. But these days, women of lower caste such as Khandar are seeking labor to support their families. And the younger generations are keener towards securing their career by shifting their career towards getting government jobs. Younger generations, both male and female, seem to have less interest in continuing the traditional fishing activities due to the uncertainty in providing a stable source of income.
- The last section of Chapter 5 explored in detail the long-term adaptive strategies that were identified within the case study villages such as implementation of cyclone shelters, construction of cyclone resilient houses, flood control measures and community led funding strategies. The section analyses the evolution of these strategies over the period of 1999 to the present, thereby bringing out their effectiveness and barriers affecting their full functioning.
- Even though cyclone shelters present in two of the case study villages have initially served as a good structural measures aimed for the viability of the communities, it is now seem to be partially malfunctioning (as explained above) as it has failed to evolve with respect to the increasing population and lack of proper maintenance and restoration has affected in the deterioration of both the centers as shown in the figures 6 and 7. Fishers also mentioned the inaction of government

authorities for its restoration even after multiple requests from the communities, which implies the lack of proper power balance in the social networks as mentioned in section 5.2.

- All the case study villages have an increase in the number of cyclone resilient houses as compared to the last time they faced the cyclone in 2019. The houses built with the help of various government schemes have helped a major portion of the communities; however, some are still living in partially broken houses waiting for their funds to get sanctioned for many years. Additionally, some portions of the population have not completed their construction because of the insufficient funds they received from the authorities. Hence transition to better viability through cyclone resistant buildings are still not uniform within the communities.
- The protection walls around the villages such as Gabakund, Mirjapur and Parbatipur were constructed before the 2019 Fani cyclone which prevented their villages from getting flooded. However, the erosion of barrier walls, especially near the Parbatipur villages and some parts of the other two villages highlights the lack of proper planning and inconsistency from the side of the authorities, exposing the communities again to the risk of flooding. In Gangadharpur, the lack of social cohesion and internal conflict between the community members have resulted in the suspension of protection wall construction midway.
- The safe drinking water facilities are another concern for the communities, while some financially stable fishers have transitioned to decentralized filter systems, the majority still rely on conventional ways of boiling water before use. This highlights the disparities existing with the communities in shifting to better adaptive strategies. Additionally, the government laid a pipeline a few years back, but no water supply has been provided to date. This indicates how the government's inaction and the fisher's inability to hold the authorities accountable because of the existing power imbalance in the linking social capital hinders effective adaptation strategies.
- The last section of chapter 5 discusses the community led funding strategies such as village committee funding and boat association funding that have helped the communities to deal with

immediate needs at the time of crisis before they received any external source of support. However, the Parbatipur village members no longer have their own funding strategy as per their responses, hence rely upon Mirjapur fishers. This funding strategy highlights the importance of bonding social capital and their proactive collective actions that have helped them to stay self-reliant at the time of need.

6.4 Recommendations

The findings from the study, drawn from interactions with fishers in the case study villages, provide great insights for providing recommendations on how to enhance the equitable disaster preparedness and recovery, and to ameliorate the existing adaptive strategies for ensuring its optimal functioning tailored to present needs. The recommendations and results from this research may be relevant in bringing attention to the voices of small fishing communities of the case study villages which are a part of Chilika Lagoon, thereby suggesting changes to current practices of the disaster management process for ensuring equitable recovery and resilience. Reflecting the discussions shared in Berkes & Nayak (2018), the upliftment of economic aspects for financial independence, promoting social cohesion, fostering balanced political representation are inevitable to ensure community resilience. In line with this and consolidating the thoughtful analyzing of the data and the direct feedback provided by the local fishing community members of case study villages, the recommendations suggested are given below.

Based on the analysis of the data, the current change in the disaster management plans and policies should be aimed at ensuring the optimal and equitable balance of all forms of social capital forms functioning within the communities to ensure the overall community resilience. For instance, while bonding social capital provides support to meet immediate needs at all the stages of the cyclone, the power imbalances within the bonding social capital based on caste and politics dominate and secure aid and other government benefits as compared to the other groups. Additionally, the conflicts between some of the community

members hinder the effective implementation of adaptive strategies like protective barrier constructions. While structural measures are necessary to address the proper disaster management, empowering communities to build trust and empathy irrespective of caste and political influence, the policies should be ameliorated in a way that is more participatory which reflects the needs of all the fisher groups irrespective of the caste system and political influence.

Inaction of the government authorities to evolve the existing adaptive strategies which leads to the poorly maintained cyclone shelters, lack of proper facilities, lack of water supplies, deteriorating protection walls, unequal funding discussion of cyclone resilient building, lack of sufficient spaces in the cyclone shelters for the localities and no access to cyclone resilient structures indicates an underperforming social capital. This demand for incorporating community feedback programs in the policies thus has the potential to hold the higher authorities accountable.

The training activities and mock drills should be carried out uniformly across all the villages. To ensure this, training activities should happen at a location that is equally accessible across all the villages and should be informed through a public announcement by mobilizing with the local leaders. Otherwise, smaller sessions of training in each village should be carried out by giving prior notice. Additionally, since fisherwomen complained about their lack of inability to attend the workshops due to their household responsibilities, a tailored working plan to accommodate the availability of community members before scheduling the workshop and training activities should be done to ensure an inclusive training program. All the above activities should also be accompanied by a feedback collection from the participants, thus encouraging transformation into existing activities based on community needs.

Financial security is the major concern for most of the fishers. Fishers in the communities are identified to have explored other ways of livelihood such as ecotourism, shopkeeping, and other businesses. But economic stability is not uniform and there exists a pronounced socio-economic gap. Hence it is imperative to conduct further interactive research methods to explore the socioeconomic profile, power dynamics and the underlying reasons behind the existing profile.

Once it has been identified, training and workshops with the help of NGOs and local authorities that focus on financial education, skill development and awareness about opportunities should be provided, while also acknowledging their cultural and traditional knowledge. These interventions should be accessible to everyone irrespective of caste and gender. Also followed by a feedback system to ensure reliability and transparency of the interventions.

As outlined in section 4.2.3, fishers are in continuous emotional distress due to financial instability, frequent cyclonic events and other pressures that hinder their livelihood and wellbeing. This demands for the formation of a community support group in collaboration with local authorities and NGOs for addressing mental wellness by facilitating activities or workshops to relieve their stress and traumas in connection with their challenges.

A shift towards a bottom-up approach in all the external interventions and policy changes is inevitable to address the needs of local people. This would ensure development with sustainable progress and traditions reinforcing each other. As explained by Himes-Cornell & Jentoft, 2012, we need both the roots of the communities that instill a sense of belonging and identity, as well as openness to grow along with globalization.

6.5 Final Conclusions

The analysis of community response through the lens of social capital and relational wellbeing in the small-scale fishing communities of Chilika lagoon uncovered the limitations in disaster management plans in place and significant flaws accompanied by explanations. The research analysis concluded that structural measures alone would not be sufficient for community resilience in the aspects of disasters, equal emphasis should also be given to the social dynamics within the communities such as social inequity, power dynamics, political favoritism, and caste system. Without addressing these underlying causes, structures, measures, or any other policy measures would not evolve with respect to the current needs of the communities or promote community resilience. This research also identified some aspects of other issues

such as ongoing financial challenges which undermine their ability to deal with sudden crises. Hence, a proper management plan to address all the grassroot issues along with the implementation of disaster resilience strategies like cyclone shelters, barrier walls and cyclone resilient houses are also required.

The above research findings are formulated by only gathering the information's from local fishers of the selected villages (Gabakund, Gangadharpur, Mirjapur and Parbatipur). Moving forward, more research on different villages should be carried out to know about the unique conditions that prevail there to get the overall context of the small-scale fishing communities of Chilika lagoon. Additionally, to obtain multiple layers of perspectives, it is imperative to incorporate the insights of local authorities and NGOs functioning within the region.

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Appendix A

Interview And Focus Group Guide

The questions aim to gain insights into the experiences of SSFs in Chilika Lagoon regarding the frequent occurrences of tropical cyclones. The questions are designed to identify the extent of damage and challenges faced by the communities, forms of social capital available at the community level and the quality of those social networks through relational wellbeing lens, response strategies and pathways shaped by these social capital and existing relational wellbeing and its effectiveness.

Please note that your identity will be kept confidential, and you can skip questions or stop the interview at any time. With your agreement, I would like to begin the audio recording to document your responses for further analysis.

Demographic Questions

Can you tell me about your role in the community?

How long have you been living in this village?

What caste do you and your community members belong to?

General Questions: These questions are aimed at capturing all three objectives of the research.

Have you noticed any change in the pattern of the cyclone over the years?

What is the damage these cyclones cause to your community?

Can you share your experience on a past cyclone you and your community have faced?

Who helps the community most before, during and after a cyclone?

Whom do you and your community trust the most at the time of crisis and why?

What is the hardest part of getting prepared before a cyclone?

How do the relationships between fishers in your community help each other when a cyclone occurs?

How do external sources of support help in dealing with cyclones?

What specific changes would you like to see in your community to deal with cyclones, especially to be prepared and to recover better?

Are there any long-term plans for your community to handle the future crisis?

**The above questions were the general guidelines to conduct the interviews and focus group discussions. However, based on the responses from the participants, questions were slightly modified, some were skipped or followed by subsequent questions to explore more with respect to the context of villages and social settings. **

Appendix B

Ethics Approval

UNIVERSITY OF WATERLOO

Notification of Ethics Clearance to Conduct Research with Human Participants

Principal Investigator: Prateep Nayak

Student investigator: Greeshma Prakash Sherly

File #: 46458

Title: Exploring the influence of social capital and relational well-being on small scale fishers' resilience to Bay of Bengal natural disasters in Chilika Lagoon, India.

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

Initial Approval Date: 06/11/24 (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: 06/12/25 (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

