Women and Environmental Change:
A Case Study of Small-Scale Fisheries in Chilika Lagoon

by
Fatima Noor Khan

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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

In recent decades, many lagoons around the world have experienced environmental degradation resulting from impacts of various drivers of change (e.g., natural disasters and aquaculture). This has created adverse consequences for lagoon ecosystems (e.g., habitat and species loss) and human societies (e.g., loss of fishing livelihoods and commons rights). Asia's largest lagoon, Chilika lagoon, situated along the eastern coastline of Odisha, India, is no exception. This thesis investigates the gendered implications of environmental change in the small-scale fishery system of Chilika lagoon. It focuses on fisherwomen's perspectives about changes in the fishery commons in relation to processes of adaptation. Three main research objectives frame this study: 1) to examine fisherwomen's perspectives about drivers of change within the social-ecological system of Chilika lagoon and resulting changes in the fishery commons; 2) to analyze how environmental change (i.e. objective one) is impacting the livelihood of fisherwomen and how fisherwomen are responding; and 3) to examine how fisher communities are adapting to the ongoing process of environmental change, with a focus on the gendered implications of out-migration. As a result, this thesis addresses an important research gap by conducting a gender sensitive analysis of environmental change in Chilika that highlights often neglected perspectives of fisherwomen. Adopting a gender lens on environmental issues in the context of this research is crucial. This is because of the differential risks women experience as individuals, groups, community members, and in relation to men, and the specific knowledge and insights they have on processes of change.

This research applied a participatory and qualitative case study based approach. A combination of research methods were employed including document review, semi-structured interviews, focus groups, and participant observation. Additionally, an integrative conceptual framework was utilized to explore women's narratives in relation to the uncertainty and complexity of environmental change, drawing on theories and concepts associated with social-ecological systems, drivers of change, the commons, and adaptation. Research findings demonstrate that gender is one of the primary social constructs that mediates resource use and community relationships. For example, traditionally, fishermen engage in catching fish in the lagoon, whereas fisherwomen participate in fish processing activities within their homes. An analysis of findings reveals that fisher communities in Chilika lagoon face a commons crisis that

presents gender differentiated impacts and challenges for livelihoods to respond and adapt to environmental change. As fisher communities experience fishery resource access issues, rights infringements, and institutional rearrangements, fishermen are forced out of fishing and many fisherwomen show to bear the brunt of change.

The results of this research provide useful insights and recommendations for practitioners and policy about sustaining the commons through collaborative approaches and decision-making that actively engages the fisher communities of Chilika lagoon–particularity the experiences and knowledge of fisherwomen.

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CHAPTER ONE: INTRODUCTION

1.1 PROBLEM CONTEXT

There are some 51 million fishers (i.e. fishermen and fisherwomen) in the world. Approximately 99% of these fishers are involved in small-scale fisheries, which include traditional, artisanal and subsistence fisheries (Berkes, 2003). Many fisheries worldwide have sharply declined due to overfishing, pollution, mismanagement, and coastal zone modifications amongst other issues (Badjeck, Allison, Halls, & Dulvy, 2010). The decline of fisheries has had adverse consequences including habitat and species loss, along with livelihood crises in fishing communities. Livelihoods comprise of assets (natural, physical, human, financial, and social capital) and activities, and access to these (mediated by institutions and social relations) that determine the living situation developed by an individual or household (Anthony et al., 2009; Allison & Ellis, 2001). In small-scale fisheries, livelihoods are often based on a diversity of species and stocks, and a diverse range of other productive fishing activities (Berkes, 2003).

There is a dynamic relationship between people and the fishery resources they use and depend upon for a large range of goods and services. The process of defining this relationship is iterative and must account not only for changing natural resource conditions but also changing social conditions (Loomis & Paterson, 2014). Such dynamics suggest that fisheries function within complex social-ecological systems. Anderies, Janssen, and Ostrom (2004) define a social-ecological system as an ecological system that is intricately linked with one or more social systems where "relationships among humans are mediated through interactions with biophysical and non-human biological units" (pg.3). Social-ecological systems reflect an integrative connection between humans and nature. My research examines this relationship by analyzing environmental changes in the small-scale fisheries of Chilika lagoon. In the context of my research, environmental change is associated with both social and ecological factors and their relationships.

Lagoons are considered to be amongst the most productive ecosystems in the world and many of them support important fisheries and fishers' livelihoods (Pérez-Ruzafa & Marcos, 2012). In Chilika lagoon, there is greater variability, uncertainty, and unpredictability of events which has had serious consequences on fishing activities (Nayak, 2014). In the fisheries of Chilika lagoon, global and local level drivers have led to environmental changes (e.g., resource

depletion, water depth issues). A driver of change is defined as any natural or human-induced factor that directly or indirectly causes a change in an ecosystem (MA, 2003). Two key human-induced drivers of environmental change are aquaculture which began in the 1980s, and the opening of a new sea mouth which occurred in 2001 (Nayak & Berkes, 2012). Biophysical changes in this lagoon ecosystem associated with these drivers include fresh water and salt water level fluctuations, salinity issues, and invasive species. In this thesis, drivers and consequences of environmental change are understood by examining the commons and fishers' responses and adaptations to change. Broadly defined, commons are resources that are owned and/or shared by groups of people (Bromley, 1992).

My case study of small-scale fisheries in Chilika lagoon offers insight on how fishers are impacted and responding to environmental change. More specifically, my study outlines perspectives and provides insight on gender differentiated relationships with access to and use of fishery resources, and experiences with impacts of change. Gender is viewed as one of the primary social constructs that mediates relations between individuals and significantly determines individuals' relationships with resources and their engagement with nature (Meinzen-Dick, Kovarik & Quisumbing, 2014). Using a gender lens is important because research has shown that there are gender specific implications of environmental change (Adger et al., 2007). Since the 1980s, the body of research on gender and the environment has expanded to include relationships between men and women, and more nuanced views of women across different cultural, social, and environmental contexts (Meinzen-Dick et al., 2014). Sustaining communities has largely been the task of women, who not only play the role of wives and mothers, but who contribute substantially in many ways to the well-being of family members. Women have been viewed as those primarily affected by environmental change in the developing world (Meinzen-Dick, et al., 2014). With regard to fisheries, fisherwomen's tasks have become more difficult due to environmental change. Fisherwomen have to cope not only with uncertainties in the market due to economic changes and depletion in fish, but they suffer many consequences from the out-migration of men who leave communities due to issues related to environmental change (Meinzen-Dick, et al., 2014; Nayak & Vijayan, 1996).

Chilika lagoon is an intricate social-ecological system impacted by environmental change. Consequently, complexities related to the fishery commons, gender relations, and how people and their livelihoods are responding and adapting to changes are increasing. My research

shows how fisherwomen experience and live through environmental change in different ways in comparison to fishermen, and how fisherwomen face unique challenges directly and indirectly connected to their gender. My research inquiries guided me to writing this thesis that shares the story of the fisherwomen of Chilika lagoon and why their narratives are important.

1.2 RESEARCH PURPOSE & OBJECTIVES

The purpose of this research is to investigate the gendered implications of environmental change in the fishery commons, with a focus on fisherwomen's perspectives, using small-scale fisheries in Chilika lagoon as a case study. My research reveals how fisherwomen perceive and interpret environmental change, and how they respond to changes through particular livelihood adjustments and adaptations. Out-migration of villagers is discussed as one of the most notable adaptations to change. Adopting a gender lens on environmental issues in the context of my research is crucial because of the different risks fisherwomen face as individuals, groups, and in relation to fishermen, and specific knowledge they bring about the environment. With regard to fisherwomen's perspectives, this thesis shares research findings that have not been adequately addressed in past research conducted in Chilika.

Research Objectives:

1. To examine fisherwomen's perspectives about changes in the fishery commons, with a focus on understanding fishers' rights, resource access, and institutional processes in relation to drivers of change within the social-ecological system of Chilika lagoon.

2. To analyze the key impacts of environmental change (i.e. objective one) on the livelihoods of fisherwomen and how fisherwomen are responding.

3. To examine how fishing communities are adapting to the ongoing process of environmental change, with reference to fisherwomen's experience with villagers out-migrating and their perceptions about fishers' changing relationships with the lagoon.

All three objectives of this research are interrelated and build upon the central purpose of my research which aims to understand fisherwomen's experiences of environmental change in Chilika lagoon. To summarize, objective one focuses on understanding fisherwomen's

perspectives about environmental changes occurring within the social-ecological system of Chilika lagoon and the impact of changes on the fishery commons. Three key aspects of the commons (rights, resource access, and institutions) are explored to capture the main commons issues in Chilika. Objective two shares findings about how changes in the commons are impacting the livelihood of fisherwomen and how fisherwomen perceive and respond to changes. Objective three synthesizes information gathered through the exploration of objective one and two to further examine how fishing communities in Chilika are adapting to environmental change. Specifically, objective three examines out-migration practices as a consequence of rearrangements in the commons and processes of environmental change.

1.3 INTRODUCTION TO STUDY AREA

A lagoon is a shallow coastal body of water that is separated from the ocean by a barrier and connects at least intermittently to the ocean by one or more restricted inlets (Kjerfve, 1994). Chilika lagoon (also known as Chilika lake) is situated along the eastern coastline of Odisha (previously known as Orissa), India, and is the largest brackish water lagoon in Asia (Mishra & Jena, 2014) (see Figure 1.1). Covering the Puri, Khurda and Ganjam districts of Odisha, this lagoon is located between 19°28′ and 19°54′ North latitude and 85°05′ and 85°38′ East longitude with an average lagoon area of 1,055 sq. km. The area increases to 1.165 sq. km during the rainy season and shrinks to 906 sq. km during the summer season (Pattnaik, 2002). The lagoon can be broadly divided into four ecological sectors: northern sectors, southern sectors, central sectors and an outer channel (CDA, n.d.).

Chilika lagoon is connected to the Bay of Bengal and has a unique assemblage of marine, brackish water and fresh water ecosystems (Pattnaik, 2002). The lagoon hosts an environment for over 700 species of plant flora and 800 species of fauna, including some vulnerable and endangered varieties including the Barkudia limbless skink and the Irrawaddy dolphin (Pattnaik, 2003; Nayak, 2014). The number of fish species is reported to be more than 225 (Nayak, 2014). The lagoon also serves as the largest wintering ground for migratory waterfowl in the entire Indian subcontinent. Over one million migratory waterfowl, shorebirds, and resident birds winter in Chilika lagoon (UNESCO, 2014). These unique qualities, amongst others, make this lagoon a major tourist attraction (UNEP, 2009). In recognition of its rich biodiversity, Chilika lagoon was designated a Ramsar site in 1981 (Ramsar, 2012). Chilika lagoon contributes to the livelihood

and culture of approximately 150 fishing villages with over 400,000 caste-based fishers and their families (Nayak, 2014). My research was conducted in two fisher-caste villages called Khatisahi and Biripadar. Village profiles for Khatisahi and Biripadar, along with information on village selection criteria, are provided in Chapter 3.

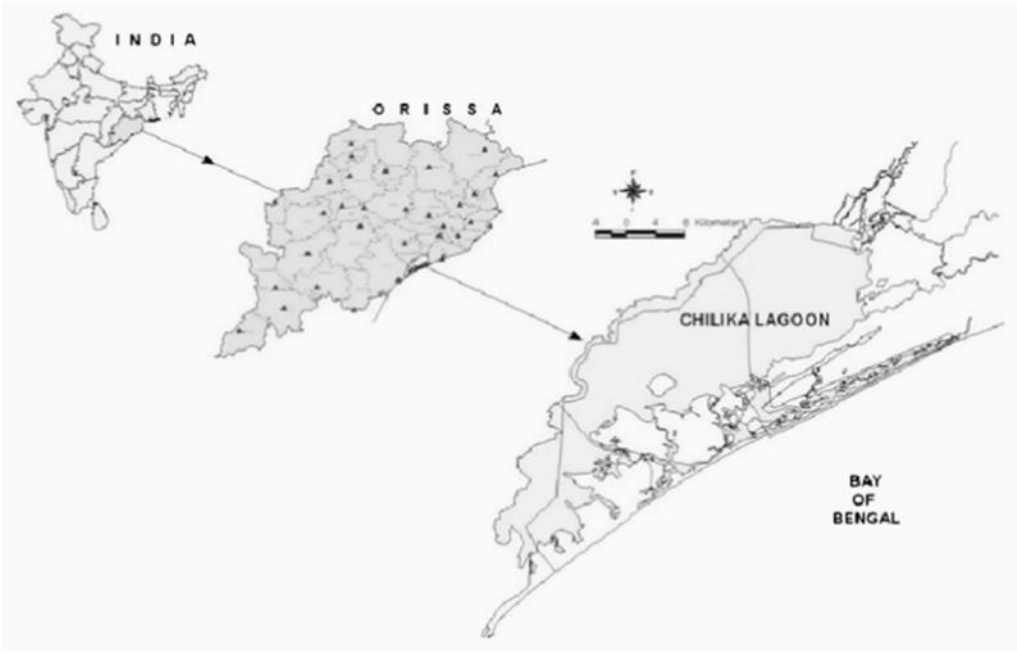

Figure 1.1: Map of Chilika lagoon, Odisha, India (Source: Nayak, 2014)

1.4 THESIS STRUCTURE

This thesis is comprised of seven chapters. Chapter 1 has provided an overview of the concepts and topics covered in this thesis by discussing the problem context, and a brief introduction to the general area of Chilika lagoon. Chapter 1 has also introduced the purpose and objectives of the research. Next, Chapter 2 summarizes the literature upon which my research is based, presents a conceptual framework, and sets the foundation for the theoretical approach used in the research. The main areas of literature associated with my research objectives include, women and environmental change, gender and the commons, and adaptation and out-migration. Chapter 3 outlines the research methodology and describes the study area and study context in detail. I present details about the two villages (Khatisahi and Biripadar) where my research was primarily conducted. Chapter 3 also elaborates on the qualitative case study approach used, and explains

the choice of methods and the data analysis process. Chapters 4-6 are the results and analysis chapters that discuss research findings along with a critical reflection of each of the research objectives. Each of the results chapters primarily corresponds with one of the research objectives. Chapter 4 provides an analysis for objective one with a focus on fisherwomen's perspectives about drivers of environmental change and the commons. Chapter 5 targets objective two and elaborates on the information shared in Chapter 4, to recognize the impact of changes in the commons on the livelihoods of fisherwomen and how they are responding. Chapter 6 presents an analysis about how environmental changes, involving changes in the commons, have transformed fisher communities and reflect maladaptation. Here, I focus on out-migration as a key adaptation strategy and response to changes. In Chapter 7, I summarize research outcomes, including key lessons, contributions and recommendations, and offer final conclusions.

CHAPTER TWO: LITERATURE REVIEW

This literature review sets the foundation for the theoretical approach used in my research and draws connections to the overall purpose of my research which is focused on women and environmental change. Each literature review area corresponds primarily to one of the research objectives (see section 1.2). The following literature review includes: 1) contextualizing literature on women and environmental change with particular reference to gender differentiated impacts of change (objective 2) ; 2) an overview of commons literature as it relates to women and gender (objective 1); 3) literature on environmental change and adaptation, with a focus on the gender implications of out-migration (objective 3). Further, the literature review is used as the basis for the conceptual framework which links a gendered perspective of environmental change, with a focus on women, to processes related to drivers of change, the commons, and adaptations in the social-ecological system of Chilika lagoon.

2.1 WOMEN AND ENVIRONMENTAL CHANGE

Ignoring gender concerns with regard to environmental change can reinforce the differential gender dimensions of vulnerability (Denton, 2004). In the context of this research, vulnerability is defined as "the susceptibility [to] disturbances determined by exposure to perturbations, sensitivity to perturbations, and the capacity to adapt" (Nelson, Adger, & Brown, 2007, p. 396). According to Adger (1999), it is helpful to differentiate between two types of social vulnerability although they are evidently linked: individual vulnerability and collective vulnerability. Individual vulnerability is determined by access to resources and diversity of income sources. Individual vulnerability is also impacted by the social status of individuals or households within a community. Collective vulnerability of a community, region, or nation is determined by institutional and market structures. This includes the predominance of social security and insurance, and also infrastructure and income (Adger, 1999). These definitions of vulnerability help us understand women's individual and collective vulnerability to environmental change as I further discuss in the analysis chapters, particularly Chapter 5.

Nellemann, Verma and Hislop (2011) have found that women in the Global South are particularly vulnerable to the impacts of environmental change due to skewed power relations and inequitable cultural and social norms. Adger et al. (2007) document that in South Asia,

adverse effects of environmental degradation intersect with the use of resources and fall disproportionately upon poor women. In general, women make up 70% of the world's poor and have less access to financial resources, land, education, health care, and other basic rights in comparison to men (Mitchell et al., 2007). A relatively recent World Bank (2011) survey revealed that 103 of the 141 countries surveyed continue to impose legal differences on the basis of gender that contribute to the hindrance of women's economic opportunities. Women's opportunities are constrained by gender-based differences in access to assets and credit and treatment by markets and formal institutions (including the legal and regulatory framework). This contributes to a global gender gap in earnings and productivity—women make between 30-80% of what men earn annually (Habtezion, 2013).

Habtezion (2013) argues that a number of factors account for the discrepancy between women's and men's differentiated exposure and vulnerability to environmental risks. Environmental risks can be defined as risks with the potential to fundamentally disrupt the stability of the Earth's systems (IGBP, 2012). Risk itself is defined as the combination of the probability of an event and its negative consequences (Nadim, 2011). The cumulative effects of poverty, social, economic, and political barriers often disadvantage women to appropriately deal with adverse impacts of environmental change. Habtezion (2013) finds that socio-cultural norms can often limit women from acquiring the information and skills necessary to escape or avoid hazards (e.g., swimming and climbing trees to escape rising water levels). Additionally, women take on primary caregiving responsibilities. As a consequence of environmental change, women's caregiving responsibilities increase and they predominately carry burdens related to the health and well-being of family members (Mitchell et al., 2007).

The literature on gender and climate change implies that the impacts of environmental change are gender differentiated and in many cases women bear the brunt of change. Additionally, women are seldom involved in decision-making processes. Despite calls for greater inclusion of women in decision-making and policy development, women's lived experiences are rarely documented and they are seldom the target of adaptation strategies (Mitchell et al., 2007). Using the example of climate change as a form of gender sensitive adaptation to environmental change, the climate change narrative often presents women as "victims, rather than as agents capable of contributing to solutions" (Figueiredo & Perkins, 2013, p.188). Figueiredo and Perkins (2013) have found that women possess valuable local, ecological, and social knowledge

derived from their traditional gender roles. Women are also active agents of adaptation in rapidly changing contexts who negotiate, strategize, and contest discourses and policies that disadvantage them. In many countries women contribute substantially to community development, natural resource management, education of children, and family care. Therefore, it is essential to support the activities and needs of women for socio-economic development and involve women's knowledge in decision-making processes (Habtezion, 2013).

Relations between women and the environment cannot be understood outside the context of gender relations, and it is important to understand that gender relations are by no means universal (Meinzen-Dick et al., 2014). Meinzen-Dick et al., (2014) emphasize the need to move beyond simplistic views of gender to acknowledge the differences amongst women and men and factors besides gender that are relevant to individuals' identities. For example, gender intersects with factors such as age, human capital, position in the family, and caste. Cronin, Prakash, Priya, and Coates (2014) explain that "the class-and caste-based biases that deprive the poorest and most marginalized in society compound gender inequity (p. 431)". For instance, women of lower castes are sometimes further disadvantaged; they have limited access, control and ownership of resources, and are excluded from decision-making at the community level (Cronin et al., 2014). Kaijser and Kronsell (2014) note that social categories, in combination, serve as grounds for inclusion and exclusion, and contribute to defining what is considered normal or deviant. There is a wide range of intersectionality with gender which implies that women are not homogenous as a group. In this thesis, the concept of intersectionality is used to connote the various ways in which gender interacts with other dimensions of identities (e.g., caste and class) and shapes intragroup differences (Crenshaw, 1991). In relation to my own research, fisherwomen of different castes and villages expose differential relationships with fishery resources and experiences with environmental change. This indicates diversity and heterogeneity amongst the fisherwomen of Chilika and complexity related to the intersectionality of gender with various social and ecological factors and issues (see Chapter 5).

2.2 GENDER AND THE COMMONS

My research contributes a gender perspective about changes in the fishery commons of Chilika lagoon. Ostrom et al. (1999) define common pool resources (CPRs) as natural and human-constructed resources with two characteristics: excludability and subtractability. Excludability

involves the control of access or exclusion of potential users from resources. Subtractability reflects the capacity of users to subtract from the welfare of other users (Berkes, 1989). CPRs (which this thesis refers to as the commons) differ from one another in various attributes such as size, mobility, storage, and production over time and space, but universally possess excludability and subtractability problems (Dolšak & Ostrom, 2003). The commons are regulated through property rights regimes and decision-making (made by the government, markets, and communities, as separate bodies, or a combination thereof) which controls access to resources and addresses subtractability concerns (Berkes et al., 2001; Bromely, 1992). Common property can relate to four property rights regimes: open access, private property, state property, and communal property. Open access means that resource access is free and available to all. Private property means a person or corporation has the right to exclude others and regulate the use of resources. State property relates to the condition where the government controls access and use of resources, and fourth, communal property means that resources are held by an identifiable community of users who can regulate use and exclude others (Berkes, 2005). Property rights and commons arrangements in Chilika lagoon are detailed in Chapter 4.

Feeny (1990) stresses the importance of recognizing the process of decision-making when examining the commons, who is or is not involved, the nature of resources, and how users and regulators interact with resources. Historically, resource-dependent communities have acted collectively to manage weather-dependent, seasonal, and fluctuating resources such as fish and livestock on which their livelihoods depend. Simultaneously, governments have intervened to manage and regulate resources as well (Wilson, 2006). In Chilika lagoon, the stratification of societies has been reinforced by a complex caste-based system which facilitated the emergence of specific caste-based occupations that defined rights and access entitlements specifically for fishing castes. For example, specifications of when fishers could fish, which species they were designated to fish, and how much they could fish were rooted in this system (Nayak, 2014).

To understand the commons, it is imperative to look carefully at generations of social, institutional, and cultural norms and how they evolve, change, and shape the rules of natural resource use. With regard to access to water in India, Cronin et al. (2014) mention that the Government of India recognizes that there are disturbing reports of social exclusion, with marginalized lower castes and tribal groups highly discriminated against. In the context of Cronin et al.'s (2014) research, water resource governance is controlled by institutions and

organizations that are imbued by relations of power in Indian society. The poor are often excluded from decision-making processes. Indian society is deeply stratified along the axes of class, caste, religion, language, and education (amongst others), all of which intersect with gender (Cheria & Edwin, 2011). Literature on the commons indicates that complex interactions amongst the characteristics of the resource and the socio-economic environment contribute to the degree of resource management success or failure. These complex interactions are also important to understand environmental conditions and changes in the commons (Feeny, 1990).

Adger (1999) explains that opportunities to avoid poverty (i.e. by raising income) are often constrained by rights to buy or sell resources and he gives the example of households in coastal areas. Households may have rights to products extracted from mangroves for subsistence, but they are legally prohibited to trade products commercially. "The household's apparent income poverty does not in this case reflect lack of access to the resources, but rather lack of access to markets" (Adger, 1999, p. 253). Under particular conditions, poverty is a meaningful proxy for access to resources, and income is a good proxy for poverty. Chapter 4 elaborates on how the depletion of fish, aquaculture, and market shifts towards the prawn export industry have impacted fishers' rights and access to fishery resources and ultimately their incomes.

Literature on commons management often argues that socio-economic homogeneity is beneficial, and that homogeneity of resource use builds cooperation. According to Cleaver (2000b), such a perspective overlooks many basic divisions amongst people such as age, class, and gender in the social organization of daily life. Categories such as gender imply difference, but not necessarily conflict (Cleaver, 2000b). Commonality of interest can exist although resource use and priorities maybe different. Gender plays a role at multiple levels and the gendered division of labour necessitates exchange and cooperation between different genders, such as between men and women. Cleaver (2000b) gives the example of water use in villages and how perceptions and uses are in part shaped by gender identities. Men may prioritize and use water for cattle, whereas women may prioritize and use it for people. This is an example of negotiated cooperation where gendered positions with respect to division of labour allow different genders to mediate the use of a resource.

Considering the roles of women and men in households and society, and the distinct expertise women and men possess in managing resources, it is evident that there are different areas of 'knowledge commons' which are gender specific (Aier, 2011). The idea of knowledge

commons suggests that the commons are more than the resources we share. Communities have sets of 'commoners' who share resources and who define rules and rights related to how the commons are accessed and used. There is a social process that creates and reproduces the commons, and people's relationship with the commons depends on the broader social setting within which people live (Aier, 2011; Ostrom, 1999). A community is not homogenous, and it is largely structured along gendered categories. Gender often determines access, rights, and control over resources (Aier, 2011). Meinzen-Dick and Zwarteveen (2003) argue that there is a lack of attention given to the difference between women's and men's needs and priorities with regard to resource use, especially with regard to the barriers women face in accessing and achieving control over resources. Cleaver's (2000a) research shows that resource management is a site of complex gender dynamics that does not simply reflect men's dominance and women's subordination. Cleaver (2000a) also states that an oversimplified focus on women's issues may result in policies that miss the realities of complex gender relations.

Commons literature has considered the role of institutions to design, implement, and enforce appropriation and provision rules, but has not adequately investigated the diverse role of women and men in these institutions. This is a gap my research seeks to address using the case of Chilika lagoon. As such, my research examines different attributes of the commons (i.e. rights, access, and institutions, and biophysical conditions) using as an entrée a focus on excludability and subtractability as it pertains to fisherwomen. Consequently, consideration is also given to norms, management structures, and policies which my research shows are related to the attributes mentioned above. Chapter 4 examines changes in the fishery commons of Chilika. Chapter 5, and specifically Chapter 6, describe how changes in the commons are triggering particular responses and adaptation strategies.

2.3 ADAPTATION AND OUT-MIGRATION

Interactions between humans and nature in social-ecological systems, including adaptation to environmental change, are important to explore. Adaptation occurs in physical, ecological, and human systems as an ongoing process (Adger et al., 2007). In a broad sense, adaptation refers to the act of making something fit for a new situation or use. As Smit and Wandel (2006) point out, adaptation in the context of human dimensions of environmental change refers to a process, action, or outcome in a system (household, community, group, sector, region, country) in order

for the system to better cope with, manage or adjust to some changing condition, stress, hazard, risk, or opportunity. Adaptation is also associated with maintaining the capacity to deal with current or future predicted change (Nelson et al., 2007).

Adger et al.'s (2007) research has shown that adaptation activities are impacted by multiple factors such as age, ethnicity, class, religion, and gender. Additionally, adaptation actions are in part controlled by institutional processes such as regulatory structures, property rights, and social norms associated with rules in use (Adger, Arnell, & Tompkins, 2005). Similar to the way commons decisions are decided upon, decisions on adaptation are made by individuals, groups within society, organizations, and even governments on behalf of society (Adger, 2003). Adger (2003) explains that adaptation decisions privilege one set of interests over another and create winners and losers. Empirical research shows that people adapt to multiple processes, without differentiating responses from one stressor to another (O'Brien, 2012). For my research, fishers' adaptations to environmental change are examined holistically and adaptation strategies are understood as being shaped and influenced by both social and ecological circumstances.

Allison and Ellis (2001) provide a literature review about adapting to fishery resource fluctuations, which describes a range of strategies and responses at individual, household, and community levels, including livelihood diversification. Livelihood diversification is explained as a household strategy, where members of fishing households often become involved in different economic sectors to smooth the effects of fishery resource variations. Household level responses include the allocation of family labour in time of need, or acceptance of income variation and modification of consumption patterns (Allison & Ellis, 2001).

McLeman and Smit (2006) highlight that amongst the many potential impacts of environmental change on human societies, is the possibility of changes in human migration patterns. The United Nations estimates that there are about 210 million international migrants and as many as 740 million internal (intranational) migrants worldwide. As Perry et al. (2011) note, "Migration is a well-established response by human societies to ecosystem variability and change" (p.439). Perry et al., (2011) describe several types of temporary migration relating to fisheries. Migration may include internal migration within a country or region to exploit different species, short-term migrations lasting less than a fishing season to follow fish stocks, and seasonal migrations for one or two seasons to foreign fishing settlements (Perry et al., 2011).

One form of migration is to move temporarily to another location for employment (which may involve a diverse range of occupations other than fishing) referred to as 'leaving in order to stay' (Perry et al., 2011). In this case, fishers out-migrate to different locales where they live and work in order to financially support their families back home (Perry et al., 2011). People out-migrate for a variety of reasons which may include: to improve incomes, to escape persecution, or remove themselves from environmental threats, often temporarily (Black, Bennett, Thomas, & Beddington, 2011). When community institutions are unable to cope with environmental changes, individual households remain under pressure to implement their own adaptive strategies. For some households, out-migration of one or more members into other communities may be such a strategy (McLeman & Smit, 2006). Intersecting inequalities produce differing experiences of power and powerlessness between and amongst diverse groups of women and men, which in turn enable or deny them certain choices. An example would include determining whether out-migration in the face of environmental change is a viable option (Demetriades & Esplen, 2008). Adaptations, including out-migration, alter human relations with nature which has shown to have profound social, economic, and psychological effects on individuals, families, and communities. In this thesis, a gendered assessment of the out-migration is emphasized.

Over time, social aspects of fishing systems can be restructured due to long term consequences of environmental and socio-economic stresses, which may also involve poor policy decisions. Such circumstances can ultimately reduce traditional ways of coping and adapting to change, and lead to adaptation strategies such as occupational pluralism and migration (Perry et al., 2011). In Chilika lagoon, the social and ecological degradation of fisheries has played a major role in pressuring fishers (mostly men) to out-migrate (to urban centres) and leave their villages and fishery-based livelihoods behind. According to Laudazi's (2003) research, the number of women-headed households often increases when livelihoods are in jeopardy and when men out-migrate for work. This results in women becoming *de facto* heads of households and taking on men's roles in addition to their existing responsibilities. Assessments of this nature often demonstrate that many present day adaptation actions reinforce existing inequalities and do little to alleviate underlying vulnerabilities. Barnett and O'Neill (2010) suggest that certain adaptations can even exacerbate vulnerability and risks which this thesis refers to as maladaptation.

2.4 CONCEPTUAL FRAMEWORK

Figure 2.1 offers a visual representation of the conceptual framework that categorizes and describes the key concepts relevant to my research in Chilika lagoon, and maps relationships amongst them. This framework results from the purpose of the research, the three objectives, and the main concepts from the literature review that guide my research and analytical process. Key concepts (i.e. social-ecological and drivers of change) shared in Chapter 1 (see section 1.1) are also integrated into the framework.

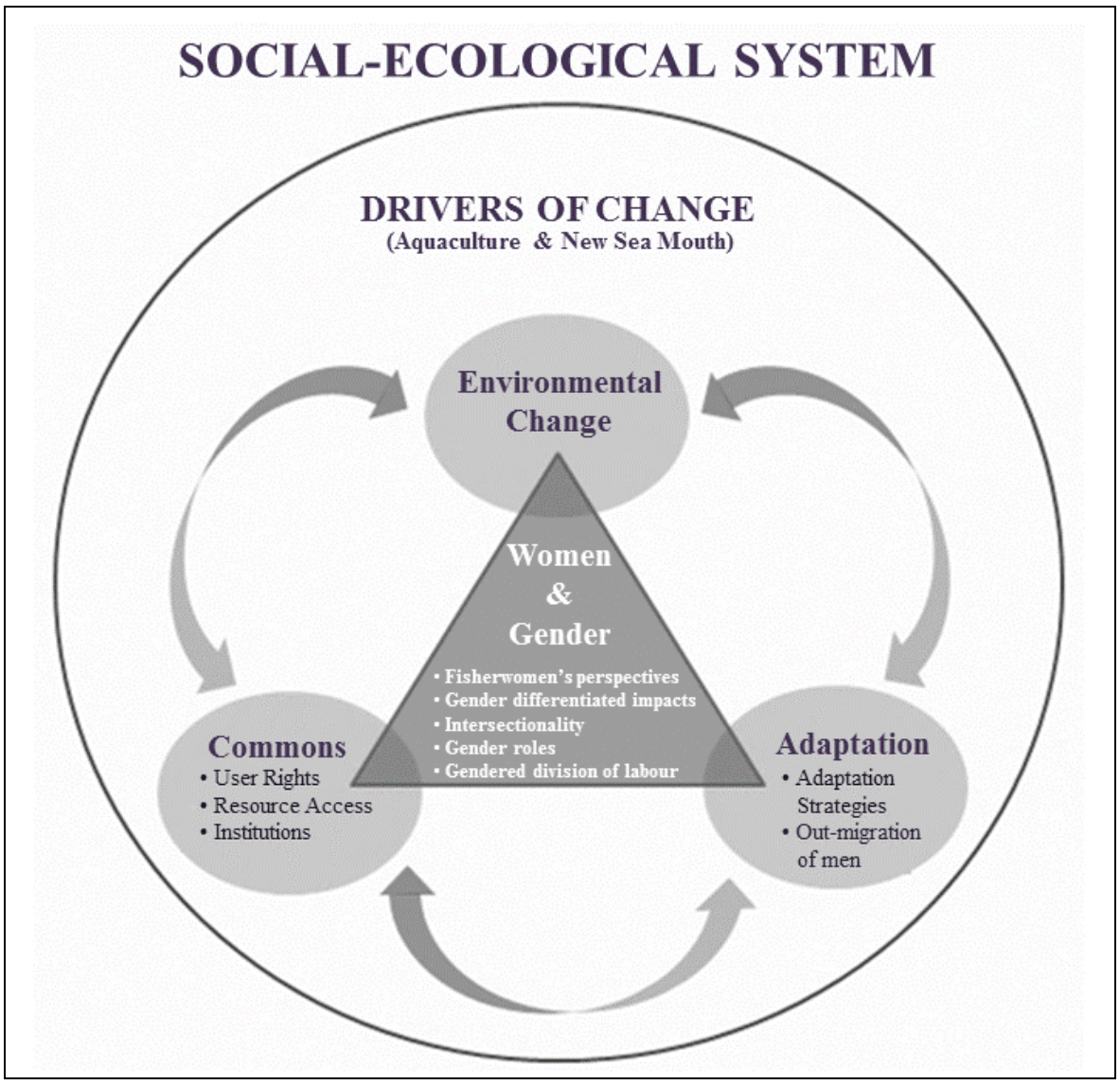

Figure 2.1: Conceptual framework representing the core relationships and phenomena my research measured and assessed in Chilika lagoon.

Figure 2.1 can be explained from the central focus (Women & Gender) outwards (Social-Ecological-System). The core of my research explores how women are impacted by environmental change and how they perceive, interpret, and respond to change. Specifically, my research shares the perspectives and knowledge of fisherwomen in Chilika which functions as the basis for all other inquiries and analysis. The centre of Figure 2.1 is titled *Women & Gender* because the relationships I explore, which involve women, cannot be understood outside the context of gender and relations amongst other genders (i.e. men). *Environmental Change*, *Commons*, and *Adaptation* collectively represent the main themes of my research objectives and the theoretical areas I use to measure and asses fisherwomen's experiences in Chilika lagoon. Interactions amongst these three areas are examined and women are recognized as being recipients of change and also contributors to change.

Environmental change is an overarching topic that initiates shifts in the commons and triggers adaptations and responses that impact the livelihood of women and men. Environmental changes are examined in relation to the commons and its various aspects (rights, resource access, and institutions) acknowledging that women are an integral part of the commons and users of resources. Adaptation strategies are indirectly or directly tied to environmental change and processes in the commons. For example, fisherwomen in Chilika are increasingly experiencing the consequences of out-migration. Out-migration is largely a response to environmental degradation and changes in the commons involving fish depletion and lack of access to such resources. The commons are changing as a result of adaptation as well. As fishers adapt a diverse range of occupations or out-migrate, there is a reconfiguration of how fishery resources are organized and managed. The feedback between environmental change, the commons, and adaptations, suggests the iterative and interrelated nature of issues in Chilika lagoon and ongoing processes of change experienced by women.

Interconnectivity between these factors and issues also suggests how environmental changes are not autonomous but reflect various relationships and conditions that are largely influenced by different *Drivers of Change*. Drivers of change represent the factors that are triggering changes in Chilika, whether natural or human induced. Aquaculture and the opening of the new sea mouth are the key human induced drivers of environmental change that my research investigates. These drivers reflect direct shifts in the fishery commons and initiate adaptation processes which in turn also contribute to environmental change. Further, drivers of

change are understood as functioning within the *Social-Ecological System* of Chilika lagoon. A social-ecological systems perspective offers a channel to understand relationships between human and natural systems which is integral to my research approach and analysis. This conceptual framework offers a reference point for the interpretations of findings reflected in the analysis chapters (Chapters 4-6). The basic premise of this framework also influenced my methodology and the qualitative approach I selected which is discussed in Chapter 3.

CHAPTER THREE: STUDY CONTEXT AND METHODOLOGY

This chapter describes the study context of Chilika lagoon and the two research villages (Khatisahi and Biripadar) where research was conducted. Additionally, the chapter discusses the type of research employed, including why and how particular methods were used. My research is framed within a qualitative case study that used a constructivist, grounded theory approach along with participatory rural appraisal (PRA). This research employed multiple methods including semi-structured interviews, focus groups, and participant observation which were feasible within the timeframe and boundaries of the research. An explanation of sampling methods, the challenges and limitations of the methods used, and data analysis process is also provided.

3.1 STUDY CONTEXT

Chilika lagoon possesses a fascinating interplay of biophysical and human systems (Nayak, 2014). People living in Chilika have developed many traditions and customs that carry religious and cultural significance (UNEP, 2009). In Chilika lagoon a caste-system is entrenched within a stratified society that greatly influences the status of fishing communities (Sekhar, 2004). There are a number of high castes (e.g., Brahmins, Karans, Khandayats, and Khetriyas) who typically are non-fishers. There are several caste-based groups of customary fishers, including seven castes and their five sub-castes. Fishers are generally considered lower castes on the caste hierarchy (Nayak, Oliveira, & Berkes, 2014). This caste-system defined the customary rules and norms of the Chilika lagoon commons which were once sanctioned through legal arrangements (Nayak & Berkes, 2011). Research for this project was conducted in two fisher villages (Khatisahi and Biripadar), each village with a distinct fisher caste population.

Chilika lagoon is subject to constant pressures from both natural processes and human activities. Some problems include overfishing, pollution, tourism, sedimentation, and aquaculture which result in a degradation of the lagoon (CDA, 2012). Using the example of aquaculture, one of the many harmful consequences of this practice includes the use of active shrimp pens and abandoned nets that trap sediment and kill juvenile fish (CDA, 2012). In the 1980s, the growth of export oriented shrimp aquaculture introduced the practice of culture fishing and acted as a driver of environmental change (see Chapter 4). During this time, the State Government of Odisha shifted from a role of recognizing caste-based fishery management, which meant that

only fisher castes managed and fished in the lagoon, to passing rights to non-fishers and corporations (Ghosh & Pattnaik, 2005). These new resource users encroached upon customary fishing areas and privatized what were once communal resources. Lease policies were extended to include non-fishers, ultimately supporting resource users who practiced shrimp aquaculture. During this period of change, aquaculture developed with great intensity throughout the lagoon. The promotion of the shrimp and prawn industry by the government was perceived in the fishing communities as being primarily beneficial to non-fishers' interests in the global market (Dujovny, 2009). The new lease order was challenged by fisher cooperatives and aquaculture was banned by the High Court in 1993 and by the State in 2001, but illegal shrimp aquaculture continues to persist and areas continue to be encroached upon (Dujovny, 2009). Fisher villages receive a lease from FISHFED (The Odisha State Fishermen's Co-operative Federation Ltd.) that manages leasing protocols. To pay for their lease, fishers are designating sections of their leased areas to non-fishers in the form of a sublease. Non-fishers primarily use subleased areas for aquaculture purposes (see section 4.2.2.2.2).

Shortly after shrimp aquaculture was banned, another driver of environmental change emerged. The sedimentation and infilling of a sea mouth that attached the lagoon to the Bay of Bengal was one of the problems that lead to the constructed opening of a new sea mouth in 2001 to alleviate the problem of increasing siltation in the lagoon (Dujovny, 2009; Nayak et al., 2014). Although this was deemed as being a solution to ecosystem problems, studies have shown that the new sea mouth actually exacerbated social and ecological problems. Research shows that after the opening of the new sea mouth, illegal aquaculture increased (Dujovny, 2009).

Poor fisher households have either opted for coping strategies (loans, mortgage, asset liquidation, changing food habits, etc.) or occupational diversification, including labour migration, in their search for alternate livelihoods (see Chapters 4-6). More than one-third of adult fishers and their families have been occupationally displaced from fishing and have either out-migrated to urban centers as unskilled workers or taken up daily wage labour (2007-2009) (Nayak, 2014). This trend is likely to continue as villages become increasingly involved in conflict with higher powers (Robson & Nayak, 2010). Research objectives explore how a combination of drivers of change, including aquaculture and the opening of the new sea mouth, have resulted in environmental degradation, shifts in the commons, and consequently adaptations, including out-migration in Chilika lagoon.

3.1.2 Research Villages

The villages of Khatisahi and Biripadar were selected for this thesis because they offer exposure to different village characteristics including two different castes (one higher ranking and one lower ranking), and they both are influenced by aquaculture and the opening of the new sea mouth (see Table 3.1). Additionally, the proximity of the villages (approximately 20 km from one another) made it feasible for me to travel from one village to the other with comfort and in a timely fashion for the duration of my fieldwork in Chilika (see Figure 3.1). The following subsections will 1) provide a village profile for Khatisahi and Biripadar, including the level of my interaction in each village, and 2) offer a basic comparison of the two villages.

3.1.2.1 Khatisahi

Khatisahi is the village I lived in while conducting my research in Chilika lagoon. I moved to Khatisahi on August 4, 2015 and moved out on October 28, 2015. I lived with a host family in this village in their home (included in my household case studies). This was the home in which I obtained most of my in-depth ethnographic experiences.

The population of Khatisahi is approximately 1,000 people (including out-migrants) and there are approximately 230 households. 53% of the population consists of women with the remaining 47%, men. Khatisahi is a Khatia caste village, representing one of the higher fisher castes in Chilika. In this thesis "Khatia" refers directly to the Khatia fishermen and fisherwomen of Khatisahi although there are other Khatia villages in Chilika. In this village there are twelve businessmen who manage fish marketing and twelve women's thrift and credit groups. The village has a cyclone centre created by the Chilika Development Authority (CDA) to protect villagers from natural disasters due to their proximity to the lagoon. The CDA is a governing body which is responsible for the formulation and implementation of management action plans for Chilika lagoon. There are no non-governmental organizations (NGOs) currently active in Khatisahi. The village has one elementary school (for ages 5-10). An increasing number of youth, both women and men, are obtaining a post-secondary education. Khatisahi is one of eleven Khatia villages in Chilika. This village is surrounded by six non-fisher villages with which Khatisahi has a neutral relationship, with some inter-village conflict. Khatisahi has little agricultural land for cultivation.

The fisherwomen of this village are housewives (if married) and live in their homes engaging in household activities if unmarried. In the most basic form, Khatia women's household activities involve cooking and cleaning, along with taking care of children and the well-being of their family. The gendered division of labour is facilitated by caste customs which restrict Khatia women from paid labour that requires them to leave their village. Khatia women's work processing fishery resources is done primarily at home (see Chapter 5). Khatia fishermen (both married and unmarried) traditionally engage in fishing activities and work in Chilika lagoon to provide for their families. Traditionally, the Khatia are capture fishers who rely on the marketing of fish, shrimp, and crab as their main source of income throughout the year. Further description of fishing practices is shared in Chapter 6. About 117 (25%) Khatia men have experienced out-migration at some point in their lives with three women identified by villagers to have out-migrated.

Khatisahi is relatively close to the new sea mouth (although the village is located deeper into the lagoon as compared to Biripadar) and villagers are experiencing the impact of the new sea mouth on their livelihoods (see Figure 3.1). Aquaculture is not as prominent as it is in other villages but is increasing in practice with time. The village has obtained a lease from FISHFED of approximately 900 hectares, some of which is being subleased for aquaculture purposes.

3.1.2.2 Biripadar

Biripadar is the second village in which I conducted research. Commencing September 15, 2015, I made frequent day trips to Biripadar through to October to conduct interviews and focus groups, and spent a few nights in the village as well. Making frequent visits enhanced my participant observation experiences (see section 3.2.1.6). For overnight trips I stayed with families in their homes and one of the Biripadar families I stayed with was included as a household case study.

The population of Biripadar is approximately 1,500 people (including out-migrates) and there are approximately 200 households. 47% of the population consists of women with the remaining 53% men. Biripadar is a Khandra caste village which is a lower fisher caste in Chilika. In this thesis "Khandra" refers directly to the Khandra fishermen and fisherwomen of Biripadar although there are other Khandra villages in Chilika. There are two businessmen who manage fish marketing and eight women's thrift and credit groups. There are various NGOs currently

active in Biripadar. Education in this village is quite low. There are no educational intuitions within the village. A small percentage of youth, both women and men, are obtaining a post-secondary education. Biripadar is one of eleven Khandra villages in Chilika. Biripadar is surrounded by nine non-fishers villages with which Biripadar has a significant amount of inter-village conflict. Biripadar has little agricultural land for cultivation although the village had much more land 20-25 years ago.

The Khandra women are traditionally housewives (if married) and live at home, engaging in household activities if unmarried. Khandra women have a significantly different lifestyle than Khatia women. In addition to household activities such as cooking and cleaning, Khandra women take part in selling dry fish in marketplaces and also travel through different villages selling fish. Some Khandra women also participate in fishing activities in the lagoon. This includes hand picking shrimp from mud in shallow parts of the lagoon and setting fish nets. Over the last 10-15 years, Khandra women have increasingly become local wage labourers (i.e. construction workers) working in villages throughout Chilika. Khandra fishermen (both married and unmarried) traditionally engage in fishing activities and work in Chilika lagoon to provide for their families. Traditionally, the Khandra are capture fishers who rely on the marketing of fish, shrimp, and crab as their main source of income throughout the year. Over the last 10-15 years there has been a drastic decrease in men fishing and a higher rate of unemployment. About 358 (45%) of men have experienced out-migration at some point in their lives with approximately 10-15 women identified by villagers to have out-migrated as well.

Biripadar is located relatively close to the new sea mouth and villagers are experiencing the impact of the new sea mouth on livelihoods (see Figure 3.1). Aquaculture is actively practiced and is intensifying with time. The village has obtained a lease from FISHFED of approximately 567 hectares with a large portion of the lease being subleased for aquaculture purposes.

3.1.2.3 Research Village Comparison

The following chart summarizes village level information related to Khatisahi and Biripadar. It offers a comparison of some of the characteristics used for village selection.

Table 3.1: Village profile chart for Khatisahi and Biripadar

VILLAGE COMPARISON	KHATISAHI	BIRIPADAR
Population	1,000	1,500
Percentage of Women	53%	47%
Percentage of Men	47%	53%
Households	230	200
Caste Rank	High ranking fishers (Khatia)	Low ranking fishers (Khandra)
Married women	Housewives	Housewives/labourers
Married men	Fishers by tradition	Fishers by tradition
Unemployment of Men	Low	High
Unemployment of Women	High	Low
Out-migration	Relatively low/increasing	Relatively high/increasing
Education/literacy	Higher	Lower
Aquaculture	Prominence low/increasing	Prominence high/increasing
Fishery Resources	Fish, shrimp, crab	Fish, shrimp, crab, dry shrimp
Leased area	900 hectares	567 hectares
Agricultural/cultivation land	Very little	Little/used to have more land
Fisher Businessmen	12	2
Women's thrift and credit groups	12	8
Cyclone centres	1	0
NGO support	None	Various organizations
Surrounding non-fisher villages	6	9+
Language	Odiya	Odiya

Village Location Map

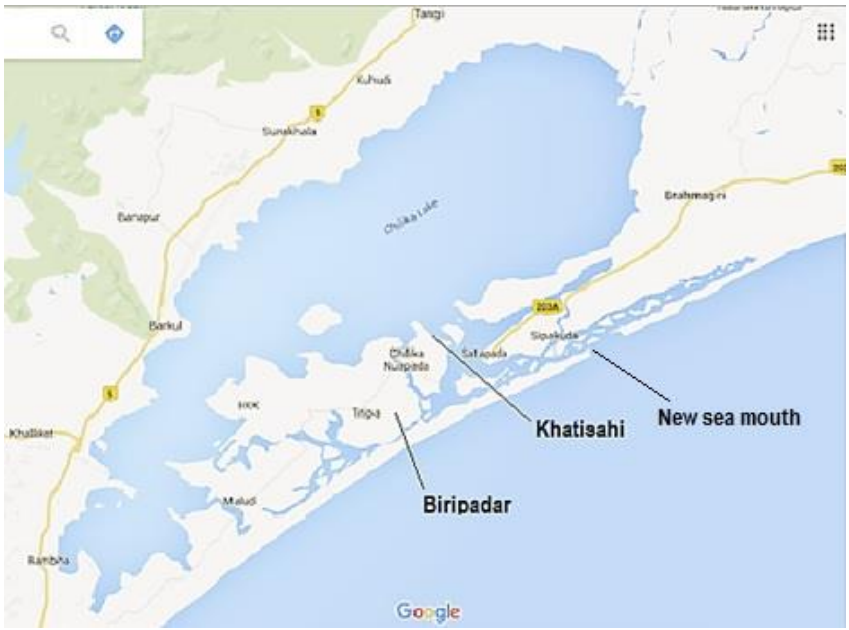

Figure 3.1: Map of Chilika lagoon identifying the location of Khatisahi, Biripadar, and the new sea mouth (Google Maps, 2015)

3.2 QUALITATIVE CASE STUDY

Qualitative research is concerned with assessment of attitudes, opinions, behaviours, and the meaning individuals and groups ascribe to social phenomena (Harrell & Bradley, 2009). Qualitative research is largely inductive and iterative. A qualitative case study enables researchers to explore a program, event, activity, or process of one or more individuals in great depth. The aim is not to cover an entire population but instead provide an in-depth analysis of a particular area within a real life context (Kohlbacher, 2006). A qualitative case study approach can be an appropriate method when "how" and "why" questions are being asked, such as those my research poses (Yin, 2009). Examples from the semi-structured interviews I conducted included asking participants *how* aquaculture is impacting household incomes or *why* people are out-migrating from villages. These are specific examples that suggest that responses could vary from person to person and direct the research and questions towards new inquires. Essentially, my research objectives pose questions that aim to better understand *how* people are impacted by particular changes and *why* they are responding and adapting in certain ways.

The qualitative case study in Chilika lagoon was informed by constructivist, grounded theory, although I did not follow the grounded theory process in its purest form. My research did benefit from the constructivist and grounded theory approach in which data and theory development is recognized as an 'evolving process'. In grounded theory, the theory develops from the data as it is collected and simultaneously analyzed (see section 3.2.3). The process of analysis takes place from the beginning of data collection until the research study is complete (Charmaz, 2000). This theoretical position rejects the possibility of absolute truth and scientific objectivity (Charmaz, 2011). In contrast, I followed an approach in which a researcher is encouraged to start with the assumption that social reality is multiple, procedural, and constructed. This was particularly appropriate when trying to understand the personal experiences of fisherwomen and fishermen with regard to environmental change in Chilika. This approach also supports the idea that gender categories are socially constructed. My research proposes that gender is a subjective and shifting concept which makes it suitable to be examined through a constructivist, grounded theory approach. As a researcher, I quickly recognized that communities and individuals that are categorized under particular gender groups are in fact quite diverse; their identities are constantly in flux and open to different modes of interpretation.

I lived in the villages of Chilika lagoon for approximately three months which supported my decision to employ a qualitative case study since it gave me enough time to execute my research methods sufficiently. A total of six in-depth household case studies (three in each research village) were completed. I spent time revisiting these same households where I engaged in discussions and participated in household activities. The household case studies were largely ethnographic and the semi-structured interview format assisted in gathering key insights during household visits. Within the two villages, semi-structured interviews and focus groups with additional village locals and key informants were conducted. Abiding by the ethical principles of this research, pseudonyms are used for all participants referenced in this thesis. A copy of the ethics clearance form is provided in Appendix A.

3.2.1 Data Collection

One data collection method on its own was not sufficient to address the objectives of this research. Document review, semi-structured interviews, focus groups (with PRA tools), and participant observation were employed for data collection and triangulation. Here, triangulation involves using a combination of methods to enhance the quality of the research process and the gathering of data. Sampling methods were used for semi-structured interviews and focus groups, and those methods are outlined below.

3.2.1.1 Sampling

Snowball sampling is noted as being useful in case studies (Yin, 2009). Snowball sampling includes identifying a few initial key informants who are people directly involved in the activity the researcher is trying to study (Coyne, 1997). Once key informants have been approached, they can suggest other people who the researcher can involve as participants. This produces a second group to contact. Researchers can use the same process with the second group and continue developing their contacts and participants. This "snowballing" can continue until new contacts are not suggested, further contacts are not needed, or the data is no longer producing information that is necessary to incorporate in the research (Drever, 1995; Galletta, 2013). For this project I used snowball sampling because I was conducting research in villages that I had no prior access to and was initially given a few key informants' contacts. Once I was in the field I asked initial interview participants and villagers I had developed rapport with to help me build my sample and

gather participants for interviews and focus group discussions. Individuals, whom I had met through interviews, focus groups, or while engaging in participant observation in the villages, were asked to contribute towards household case studies. Of note, approximately 84% of the research participants were married. This is largely because my research involved adult participants, majority whom married in their late teenage years or 20s. It is for this reason that my research regularly references married women with husbands and children. Although most research participants were women, men were also involved as participants to develop more of a holistic perspective about fisher communities and livelihoods. To clarify, throughout this thesis, "total participants" refers to all of the Khandra and Khatia fisherwomen and fishermen involved in my research, including interview, focus group, and household case study participants.

A community researcher (Tapan Kumar Behera) assisted me throughout my fieldwork and contributed to sampling activities. He helped me gather participants for interviews, focus groups, and participant observation activities. Tapan was from another village in Chilika, but he was familiar with villagers in Khatisahi because he was from another Khatia caste village. He also had close contacts in Biripadar who worked with him and I to involve Khandra research participants.

3.2.1.2 Participatory Rural Appraisal (PRA)

This research used participatory rural appraisal (PRA) to help facilitate data collection and analysis. PRA is a methodology of learning about rural life and the environment from rural people (Narayanasy & Boraian, 2005). PRA requires researchers to act as facilitators and is based on the principle that local people are capable of doing their own investigations, analysis, and planning. This "bottom-up" approach assisted in ensuring that the knowledge obtained reflected the lived experiences of locals and built capacity for them to engage with research as active participants. PRA encouraged me as an outsider to accept my limited knowledge about the study site, with a willingness to learn from local people as my research progressed (Chambers, 1994). This was essential for my research because I was living in rural villages I had never visited before and was exposed to a culture I was not completely familiar with.

There is nothing inherent in the PRA approach that addresses gender, but PRA is deeply rooted in a philosophy of respect, in which the contributions of diverse members of a community are solicited and valued. PRA principles suggest that gender would automatically be taken into

consideration as a component of people's diverse identities (Narayanasy & Boraian, 2005). PRA incorporates a number of different communication tools used to gather and analyze information. These tools encourage participation and make it easier and accessible for people to express their views. Using PRA tools in my research contributed to the clarity of research findings and assisted with my on-going data analysis (see section 3.2.3 for details).

3.2.1.2.1 PRA Tools

PRA tools including social maps, seasonal calendars, activity profiles, and Venn diagrams were employed during focus groups (see section 3.2.1.5). These tools augmented verbal communications by providing visual representations, and enabled an activity based analysis of findings during the discussions. Below is a brief description of the PRA tools that were employed and how they contributed to the research objectives.

Social Map: A sketch of the community was compiled with a group of local men or women to identify details about the ecological and socio-economic infrastructure available in the community. Social maps were used to identity commons arrangements and resource availability and use patterns (objective 1, 2). Social maps helped present a visual depiction of the geographic space of Chilika lagoon and how the perspectives of fisherwomen varied from fishermen. Two social maps were made in each research village. One map was created during the women's focus groups and the other during the men's focus groups (two per village) (see Appendix B, C, D, and E).

Seasonal Calendar: Seasonal calendars were used to identify variables such as intensity of rainfall, land use and fishing patterns, out-migration patterns, food availability, and income and expenditure throughout the year (objective 2, 3). This helped record villagers' views of problems and opportunities in Chilika lagoon related to their social and economic status and adaptations to change. One seasonal calendar was made in each research village. The calendars were created during the mixed focus groups (see Appendix F and G).

Activity Profiles: Activity profiles are exercises which help explain daily patterns of activity and routines. These profiles can chart typical activities people engage in throughout the day, the amount of effort involved, time taken, location of work etc. Activity profiles were used to

explain routines of fisherwomen and fishermen and to compare activities in Khatisahi and Biripadar. Moreover, this activity was used to compare the livelihood activities of Khatia and Khandra women (objective 2). This tool was used to juxtapose findings collected through household case studies as well. Activity profiles were created during the women's focus groups and men's focus groups (two per village) (see Appendix H, I, J, and K).

Venn diagram: Venn diagrams were used to visually depict the positioning of different stakeholders and intuitions within Chilika. Circles of different sizes and colours were drawn to represent relationships between organizations, institutions, and village groups and their importance in the community. Venn diagrams helped to explain commons arrangements with regard to institutional processes, resource access, and rights in each village (objective 1). One Venn diagram was created in each research village. Venn diagrams were made during the mixed focus groups (see Appendix L and M).

Details and descriptions about the PRA tools mentioned above are derived from the following source: (Narayanasy & Boraian, 2005)

3.2.1.3 Document Review

Data collection involved a document review of past research on environmental changes and the history of the commons in Chilika lagoon (objective 1). Documents are central to case study research as they provide sources of data about previous events which can be used to support data gathered from other methods (Yin, 2009). Document review included peer-reviewed publications as well as relevant agency reports, community profiles, management plans, and other written materials (e.g., theses). Drawing on both quantitative and qualitative research pertaining to environmental changes in Chilika lagoon, documents helped contextualize the research study and inform the other methods of data collection. Document review was used throughout the research process and established the foundations of the theoretical approach/ literature review.

3.2.1.4 Semi-Structured Interviews

Qualitative interviews are one of the most well-known methods for qualitative study and researchers can use interviews for a variety of purposes, including gathering information from

individuals about their practices, beliefs, or opinions. Semi-structured interviews are typically based on an interview guide comprised of generally open-ended questions covering basic themes/ideas, leaving other details and spontaneous questions to be developed during the interviews (Drever, 1995). The flexibility of semi-structured interviews makes them a valuable tool for researchers to engage participants in a topic focused conversation, while providing enough freedom for interviewees to expand on their own thoughts and perceptions (Huntington, 2000).

Semi-structured interviews were an appropriate method for this research because research was not focused on quantitative generalizable truth, nor was it testing a hypothesis (Rubin & Rubin, 2012). Rather, this research was looking to expose the complexity in the social-ecological system of Chilika lagoon. Semi-structured interviews enabled a partially guided conversation with local fishers (see Appendix N). Specifically, interviews helped gather information on how women were interacting with resources, their understandings and perceptions of environmental change and also how they are adapting to change (objectives 1, 2, 3). Although the gender focus was on women, men were also interviewed because gender identities are mutually reinforcing and men's perspectives were important in contextualizing women's perspectives.

Khatia and Khandra women and men were interviewed including members of in-depth household case studies. A total of 79 individual, village level interviews (39 in Khatisahi and 40 in Biripadar) were conducted. External key informant interviews (a total of 4), with tailored questions and interview guides were conducted with organizations in Odisha. This included interviews with FISHFED, the Government of Odisha (District Fisheries Office), Government of Odisha (Forest & Environment Department, Chilika Wildlife Division), and the Sadpata Motorboat Association.

3.2.1.5 Focus Groups

Focus groups refer to a group of usually 4-6 or less individuals who are gathered to discuss a particular topic, problem, or idea. Similar to the semi-structured interview, the facilitator poses questions to the group, which are often based on a prepared discussion guide (Robson, 2002) (see Appendix N). Focus groups provide a strategy for data collection that allows the involvement of a relatively large sample of people to collectively convey information. In

addition, they offer a site for analyzing the process of social interactions within the context of the study (Warren & Karner, 2010). Morgan (1996) explains that focus groups assist in clarifying and amplifying meanings through the presence of multiple informants which aids in underscoring nuances and multiple points of view.

Further, focus groups facilitated the gathering of fisherwomen to share knowledge on how women collectively relate in terms of perceiving environmental changes and their relationship with fishery resources (objective 1), how they respond to change (objective 2), and their perspectives about out-migration (objectives 3). Conducting focus groups with fishermen was also beneficial to gain insight about fishing practices and men's out-migration patterns and experiences (objective 3). Hence, different focus group categories (i.e. only women, only men) contributed to different aspects of my research objectives. A total of 6 focus groups (3 per village, with 4-6 participants in each group) were conducted during the course of my fieldwork. For each village, the first focus group included only women, the second included only men, and the third included both women and men (referred to as a mixed focus group). Focus groups served as a supporting method in relation to data collected from semi-structured interviews. PRA tools were used to facilitate focus group discussions. Additionally, PRA tools contributed to data analysis pertaining to specific research objectives (see section 3.2.1.2).

3.2.1.6 Participant Observation

Participant observation was an essential component of my fieldwork. Case studies with an ethnographic approach, such as my research involved, include continual and ongoing participant observation of a situation to reveal how people describe and structure their world (Bogdan, 1973). Bogdan (1973) explains that participant observation refers to a research approach in which there are prolonged periods of contact with subjects in places where they normally spend their time. Participant observation entails the researcher taking part in a social setting and recording the ethnographic details of what he/she experiences (Bryman et al., 2012). This method helps in understanding the culture of a community and gathers information about people's behaviour, the nature of relationships amongst different actors, and common practices (Rubin & Rubin, 2012). The main strength of participant observation is that it provides direct and immediate access to the social phenomena under consideration (Warren & Karner, 2010). Bogdan (1973) explains that the purpose of the method is to develop an understanding of

complex social settings and complex social relationships by seeing them holistically. He also says that, "perhaps the only way to understand the complexity of social life is to immerse oneself in it… The researcher is a mixture of an objective recording machine and an empathetic human being" (p.303). Considering that I was living in the villages of Chilika lagoon for approximately three months, I participated in the everyday life of villagers which involved engaging with locals in casual conversation, eating with them, joking with them, and even sharing their concerns. These engagements helped me better understand fishers' livelihoods as they understand and contributed to my constructivist, grounded theory approach.

Participant observation was actively used throughout my field experience but was especially useful during the early stages of my stay in Chilika. Participant observation helped me familiarize myself with the Chilika community and become comfortable in the environment I would be living in. This method also gave me an opportunity to introduce myself and build rapport with locals as I travelled through villages. Participant observation involved activities such as joining fishermen on boats as they fished, or watching from a distance (on land) what fishers were doing in the lagoon. This method was also frequently applied as I walked the paths of villages noting how people were carrying out their daily tasks. I also took an active role participating in women's household activities such as cooking or collecting shrimp from the lagoon. Once I was well adjusted into the villages, this method helped guide the direction of semi-structured interviews and focus groups. I was able to incorporate interview questions based on my observations. For example, initially I noticed fishers using different fishing techniques in the lagoon and was later able to ask questions during interviews about why and how different fishing techniques are used. Field notes and recordings of my experiences and observations were systematically collected. Along with observations, I took photos and/or videos which helped retrieve my own memory of experiences and presented an alternative way of documenting my findings. Permission was granted for any photos or videos that were taken and used in this research.

3.2.1.7 Summary of Methods

The following chart summarizes the methods used in this research. Methods are divided based on the two research villages (Khatisahi and Biripadar) except for four key informant interviews which were which are listed in section 3.2.1.4.

Table 3.2: Summary of methods used in research

METHOD	Khatisahi				Biripadar				Total
---	**Female**	**Male**	**Mixed**	**Village Total**	**Female**	**Male**	**Mixed**	**Village Total**	**-**
Document Review	-	-	-	-	-	-	-	-	**-**
Semi-Structured Interviews	21	18		39	26	14		40	**79**
Key informant Interviews	-	-	-	-	-	-	-	-	**4**
Focus Groups	1	1	1	3	1	1	1	3	**6**
Social Map	1	1	-	2	1	1	-	2	**4**
Seasonal Calendar	-	-	1	1	-	-	1	1	**2**
Activity Profile	1	1	-	2	1	1	-	2	**4**
Venn Diagram	-	-	1	1	-	-	1	1	**2**
Participant Observation	-	-	-	-	-	-	-	-	**-**
Household Case Studies	-	-	-	3	-	-	-	3	**6**

3.2.2 Challenges and Limitations of the Research Approach

There are some challenges and limitations associated with qualitative case studies, and my research specifically. This section offers a critical analysis of: 1) the qualitative data collection methods I used and how I managed issues associated with semi-structured interviews, focus groups, and participant observation, 2) the impact my position as a researcher and identity as a Canadian woman had on my fieldwork and data analysis process, and 3) how triangulating data assisted in overcoming some of the challenges and limitations my research presented.

3.2.2.1 Overcoming Issues Associated with Data Collection Methods

Qualitative methods including, semi-structured interviews, focus groups, and participant observation do take into account flexibility, but there is never a guarantee that the researcher will obtain the information required or as much information as expected (Warren & Karner, 2010). Factors such as the willingness of a participant to talk, the topic, and the presence of a recording method (electronic recorder or note writing by the interviewer) associated with these methods might impact the success of the interview and how participants respond (Warren & Karner, 2010). Louise Barriball, and While (1994) explain that some topics or questions may make

participants uncomfortable or not as open to responding with great detail (for example questions about income). Social desirability may also be an issue as well, involving the tendency of some participants responding in a way that makes them seem more socially acceptable rather than giving their "true" answer. This may be due to the presence of a researcher during an interview, or presence of other participants in a focus group (Harrell & Bradley, 2009). The outcome can result in the over-reporting of socially desirable behaviours and attitudes and the underreporting of socially undesirable behaviours and attitudes (Louise Barriball & While, 1994).

More so related to participant observation, I had some difficulty documenting data because it was hard to keep a record of details while I was participating and observing. Also, a fundamental weakness of participant observation is that it is susceptible to observer bias and the observer effect. Participant observation is generally unobtrusive, but as a researcher I may have had a bias in the field about what I chose to notice and leave unnoticed. In the case of observer effect, my presence as an observer may have influenced the behaviour of those being observed (Warren & Karner, 2010). I made sure I recognized these limitations in my notes and during my data analysis process.

To overcome some of the challenges and limitations presented by semi-structured interviews and focus groups, I implemented different methods throughout the duration of my fieldwork and also strategically when suitable opportunities arose. At times I experienced unexpected delays, participants disagreeing to participate and cancelling interviews. I took certain precautions to confirm scheduling and participation to make sure I had a sufficient number of interviews completed by the end of my fieldwork. An average of 2-3 interviews per day were conducted once I was settled in the field. I informed participants prior to the interview about what they could expect from the interview in terms of the types of questions, the purpose of my interview, and why a recorder would be used if they agreed to a recording. There were times when I was conducting up to five interviews per day. I recognized that this was not effective in helping me process the information I was gathering. To improve my approach, I took breaks between interviews and minimized the number of interviews per day as I progressed through my fieldwork.

Focus groups were facilitated in the villages after the first third of my time in the village was complete. I did not begin focus groups in Khatisahi until September. This helped me build rapport with some of the participants in advance and gave sufficient time to arrange the groups.

Many of the participants agreed to participate in focus groups, but I noticed after the first two focus groups, that not all the participants stayed for the entire duration of the discussion and PRA activities. Moving forward, I aimed to gather six people for focus groups so that I would still have enough people in case a few people wanted to leave during the focus groups. I also wrapped up the initial discussion component before half of the focus group time was over in order to begin engaging in the PRA activities. This enabled discussions to continue while PRA tools were being facilitated.

My fieldwork experience exposed that potential limitations may arise from time constraints associated with the nature of a two-year Master's research project. Within the three months I spent living in Chilika lagoon, I was not able to fully understand the complex and intricate cultural system that is deeply rooted within the community. This might have taken years to thoroughly understand. Consequently, this lack of understanding may have impacted how data was interpreted and analyzed. Time restrictions also limited the number of informants and participants engaged in the research, reducing the sample size. My position and identity as a researcher also presented certain advantages and disadvantages in the field as explained in the following section.

3.2.2.2 Positionality as a Researcher

As a researcher it was important for me to consider my own character and personality when selecting my research approach and methods. It was also important to consider when I was in the field applying my methods, conducting research, and even when analyzing data. This was especially important because for my research I was engaged in social settings and interacting and communicating with people.

I realized that it was essential to acknowledge my gender as a woman in the field. Gurney (1985) suggests that as a researcher there are gender-related challenges and benefits. Being a woman in the field affected the freedom I had or did not have to gain access to particular areas in Chilika, the freedom I had to travel alone, and the treatment I received from both women and men. The fact that I was an outsider from Canada also largely influenced my acceptance in the field and at times it was difficult to determine which experiences were attributed to my gender and which were attributed to being an outsider. There were instances when I was restricted from travelling on my own in and around the villages because I was a woman and unfamiliar with the

area. In the villages I was living in, particularly Khatisahi, it is unacceptable for unmarried women to travel alone after sunset or overtly socialize with men alone. Most of the time I travelled with Tapan to avoid situations where going off on my own may have been perceived as being dangerous, for example, going into neighbouring villages outside of Khatisahi and Biripadar where I was unfamiliar with the locals. In these relatively conservative fisher communities, my experiences varied when I was conducting research in parts of the fisheries which were dominated by men (such as in the lagoon when men were fishing) or in the homes where mostly women would be busy with household activities such as cooking. I was with Tapan majority of the time during travels and when interacting with men. Tapan was not likely to be present when I was socializing and spending time with women (other than when I was interviewing women). Khatisahi and Biripadar's married men were comfortable with me speaking with their wives and family members, and many women shared that they felt comfortable speaking to me since I am a woman.

Furthermore, it is important to note that I partially selected the qualitative methods of semi-structure interviews, focus groups, and participant observation because I consider myself a social person who likes to talk to people and interact with communities and cultures. I also enjoy learning through visual tools. Therefore the combination of using PRA tools in focus groups gave me the opportunity to exercise different learning methods that I enjoy, also providing variety for participants involved in my research. Triangulating data may not have eliminated all issues and challenges in my research but it certainly enhanced the quality of the research process and data collection.

3.2.2.3 Triangulating Data

The objective of this research was to discover variation, portray shades of meaning, and examine complexity. This was achieved through the combined use of document review, semi-structured interviews, focus groups, PRA tools, and participant observation. By using these different methods and setting myself directly into the research context in Chilika lagoon, I was able to collect and convey details about the site and its people in a variety of ways.

Document review was used predominately in the first phase of data collection and was also used throughout the research process to contextualize findings from the other methods. Household case studies, semi-structured interviews, focus groups, and participant observation

were applied concurrently. This enabled cross referencing between information gathered from different methods. For example, focus group discussions were informed by ideas and questions developed during semi-structured interviews and household case studies and vice versa. Participant observation aided in contextualizing discussions and shaping questions based on what I was experiencing and seeing in the villages as well. This approach reflects the inductive and iterative process of qualitative research (Creswell, 2013).

As methods of inquiry, interviews/focus groups are consistent with people's ability to make meaning through language, and I had access to directly speak to people in Chilika lagoon (Seidman, 2013). Oriya is spoken in Odisha and this was a language I was not familiar with prior to living in Chilika. I worked with Tapan who assisted as a translator during interviews and focus groups. Even though I had the benefit of speaking with some participants in Hindi and English, the research approach I used accounted for when language was a barrier because PRA tools aided in overcoming some language barriers. PRA tools offered opportunities to transfer verbally communicated knowledge and data into visual data which was triangulated with my written notes and recordings. Additionally, participant observation helped me participate in activities fisherwomen and fishermen described during interviews. For example, during interviews many fisherwomen would describe their cooking activities and fish processing tasks. Through participant observation I got to directly observe such activities and spent time with fisherwomen in their kitchens when they were cooking or processing fish.

Rather than seeing triangulation as a method for validation or verification of research only, qualitative researchers generally use this technique to ensure that findings are rich, robust, comprehensive, and well-developed (Guion, Diehl & McDonald, 2003). Guion et al. (2003) caution that it is a common misconception that the goal of triangulation is to arrive at consistency across methods or approaches. Different methods may actually present inconsistency and reflect the strengths of different approaches to uncover greater depth in the data. Using multiple methods enabled me to compare and contrast data and this contributed to the depth and breadth of analysis, interpretation of findings, and theoretical implications of the study.

3.2.3 Data Analysis

By applying grounded theory, the process of analysis takes place from the beginning of data collection until the research study is complete (Charmaz, 2000). As an ongoing process, each

step of my data collection fed into the analysis. As Charmaz (2000) shares, this approach to analysis calls for creativity, closeness to the informants and their claims, and immersion in the field which I had the opportunity to avail in Chilika lagoon.

I kept a diary for household monitoring, written interview notes, and written focus group summaries. A laptop for note taking was also used when needed and where appropriate. I did not transcribe discussions verbatim or use software such as Nvivo. This was in part due to the fact that discussions took place in a combination of Hindi, Oriya, and English. What I found more effective was to write memos to record thoughts on the nature of the phenomena, relationships between topics, categories, and codes. Recorded interviews were replayed and further notes were taken based on the recording. Coding was used to organize and analyze written notes and interview details. After completing individual interviews and focus groups, I use analytical tools to examine my written notes. This included finding key phrases or words. Open coding was used as a process to identify concepts and properties of concepts retrieved from the data. Codes and concepts were added, amalgamated, and/or removed as new data emerged. This enabled me to rethink what had been discovered and adjust it as necessary (i.e. recreating interview questions). Though axial coding I created subcategories of concepts and ideas. Lastly, selective coding integrated and refined my findings by using categories and their associations with subcategories to create a case of the phenomena under study (Charmaz, 2000). PRA tools served as a form of analysis to help enrich the selective coding process in order to provide a richer context for findings. Grounded theory requires re-evaluation of concepts, themes, and categories throughout the research process at various stages; therefore the process of coding was on-going throughout the research.

Thematic analysis is a form of pattern recognition that involves the identification of key themes that emerge which are relevant to the phenomena under study (Fereday & Muir-Cochrane, 2008). I used thematic analysis while taking notes in households, and during interviews and focus groups. I also applied this when revisiting notes, pictures, and videos from participant observation. Tapan also assisted in the analysis process and contributed to the interpretation of findings. I would have monthly meetings with Tapan to summarize the work we had done together and to also discuss key themes and ideas that were emerging which helped refine my research approach in the field.

3.3 CHAPTER SUMMARY

A qualitative caste-study based on a constructivist and grounded theory approach guided this research in the villages of Khatisahi and Biripadar to elicit nuances related to fisherwomen's experiences with environmental change in Chilika lagoon. Data collection methods including document review, semi-structured interviews, focus groups, and participant observation were used and facilitated through PRA techniques and tools. To overcome challenges associated with data collection and my position as a Canadian, woman, and researcher, data was triangulated which supported various modes of data collection and outlets for interpretations of findings. The on-going analysis of themes, concepts, and events through coding and thematic analysis revealed key insights related to my research objectives. Data analysis activities during my fieldwork and after, materialized into research findings and results that are shared in the following chapters of this thesis.

CHAPTER 4: ENVIRONMENTAL CHANGE AND THE COMMONS

This chapter presents research findings related to the first research objective. Fisherwomen's perspectives about environmental changes and drivers of change within the social-ecological system of Chilika are shared, which sets the foundation for an analysis about the changing nature of the commons. Specifically, I gather information about key drivers of change through fisherwomen's assessment and interpretations about: 1) biophysical changes including climate variability and extreme weather, 2) human induced drivers of change including the opening of the new sea mouth and aquaculture, and 3) the social and ecological impacts of changes including the depletion of fishery resources (fish, shrimp, and crab). Further, a commons analysis develops with a focus on discussing 1) fishers' resource access rights in relation to conflicts with non-fishers and 2) institutional rearrangements and changes in the commons.

4.1 KEY DRIVERS OF CHANGE

Social-ecological systems consist of natural, socio-economic, and cultural resources whose use and flow is regulated by a combination of ecological and social systems (Redman, Grove, & Kuby, 2004). Chilika lagoon is a complex social-ecological system that is subject to an assortment of environmental changes and drivers of change, both natural and human induced (see section 1.1). In the following subsections, fisherwomen's knowledge about biophysical changes in Chilika is integrated with understandings of human induced drivers of change. The discussion further expands to describe the depletion of fishery resources and impacts of change on fishers' livelihoods.

4.1.1 Climate and Biophysical Changes

Fisherwomen's perspectives suggest that the fisher communities of Chilika depend greatly on the biophysical condition of the lagoon to sustain their livelihoods. Climate variability in relation to anomalies in seasonal and weather patterns, including extreme weather, were amongst the most concerning biophysical aspects observed and discussed by both Khatia and Khandra women. Table 4.1 displays a summary of the key biophysical changes discussed by fisherwomen and the overall impacts of change which are further detailed in section 4.1.1.1 and 4.1.1.2.

Table 4.1: Impacts of biophysical changes discussed by fisherwomen

Biophysical Changes		Overall Impacts of Changes
Climate Change and Climate Variability	• Seasonal cycles and weather patterns are unpredictable • Much less rain during the monsoon season • Increase in temperature throughout the year with severe heat	• Decrease in water depth and increase salinity in the lagoon • Difficulty fishing and maintaining traditional fishing practices • Depletion of fishery resources
Extreme Weather	• Increased frequency of natural disasters • Greater intensity of cyclones, storms, and floods • Unpredictable spells of extreme weather conditions	• Costly damage to villages and homes • Increased fear of human survival • Adverse impacts on natural cycles of fish growth • Depletion of fishery resources

4.1.1.1 Changing Climate and Variability in Seasonal Cycles and Weather Patterns

The world's climate is continuously changing and in turn the earth and ocean ecosystems are responding to climate change (Kim et al., 2007). Brander (2010) offers insight on the impacts of climate change on fisheries by clarifying that 'climate' includes wide ranges of timescales of change in the physical and chemical environment. 'Climate variability' denotes "changes in temperature, wind fields, hydrological cycles, etc. at annual to decadal time scales" (p.389). 'Climate change' denotes longer-term shifts in the mean values. Brander (2010) states that climate change is an additional pressure on the many other stresses (loss of habitat, pollution, invasive species) fish stocks already experience.

Khatia and Khandra women expressed concerns about experiencing anomalies in annual seasonal and weather patterns, implying that climate variability and climate change is adversely impacting the fisheries of Chilika. Communications with fisherwomen and fishermen suggest that variation in rainfall during the monsoon season along with increasing temperatures throughout the year are major concerns for fisher communities. The monsoon season which visits Chilika from June until August has progressively become shorter and unpredictable with many more hot and dry periods instead of the wet and humid weather which the season used to bring. During the Biripadar women's focus group, participants communicated that salinity is increasing in the lagoon due to the dry and hot weather which is also contributing to the reduction in water depth.

> *It is now August. By this time of year (20 years ago) my father used to bring nets full of fish. It used to rain so much during the monsoon season that all I could see was a white sheet of rain falling from the sky. The lagoon was full of water but now rain is becoming rare and the lagoon remains thirsty…This change is not good for Chilika which we are a part of.* (Jamuna Behera, personal communication, women's focus group, Biripadar, October 12)

To support many of the claims made by villagers, my field notes and journal show that I rarely documented rainy days. Although I was staying in Chilika during part of the monsoon months, most of the days were very hot, 35˚C+, and dry.

Concerns about seasonal fluctuations and diminishing fish stocks were also shared during the mixed focus group in Khatisahi and Biripadar. Participants collectively expressed that it has become harder for fishers to make fishing schedules based on seasons because the seasons have become more unpredictable. Similar concerns were also discussed during the seasonal calendar activity in both villages (See Appendix F and G). Fisherwomen shared the opinion that their seasonal calendar may not be accurate or applicable in years to follow because of increasing variability in weather and seasons which is ultimately impacting fishing activities.

40% of total fisherwomen interviewed believe that climate variability, which has intensified over approximately 15 years, is contributing to the decrease in fish, shrimp, and crab populations in the lagoon, and ultimately fishing success. *"When the rain isn't falling and it is too hot, the fish are not comfortable. Their [habitat] is greatly disturbed and there are less fish to catch"* (Subashi Dali, personal communication, interview, Khatisahi, October 25). Kim et al. (2007) find that fish spawning is influenced by climate variability and that changes in abiotic conditions such as temperature and salinity in coastal habitats are threatening the survival of fish species. In the Asia Pacific region it has been discovered that extremely high and low water temperature associated with extreme weather can change fish spawning seasons, feeding grounds, and decrease the hatching rate and population of fish (Chang, Lee, M., Lee, K., & Shao, 2013).

4.1.1.2 Cyclones and Disasters

In addition to fluctuations in seasonal and weather patterns in Chilika, the coastal belt of Odisha is vulnerable to cyclones, storm surges, and floods which cause considerable damage to life and property (Mohanty, Panda, Pal, & Mishra, 2008). Between the years 1804 and 2000, the coast of

Odisha was hit by 128 cyclones with 56 of these cyclones occurring in the twentieth century. The number of cyclones occurring in the twentieth century was fewer than the number of cyclones documented in the 1800s. However, Mohanty et al. (2008) explain that the severity of many of the cyclones at the end of the 1900s was much greater with unprecedented damage to people's lives. Khatia and Khandra women were expressive about their fear of unpredictable weather, extreme weather, and disasters striking their village. *"Cyclones and floods are visiting Chilika lagoon so often. They have become so common. More recently, villages in Chilika have been visited by big cyclones in 1999, 2013, and 2014. Some were very severe"* (Krishni Jena, personal communication, interview, Khatisahi, August 12). Krishni's comment suggests that into the twenty-first century, cyclones may be increasing in frequency and also becoming more intense.

53 % of total fisherwomen interviewed expressed a fear of future cyclones hitting their village, of which 65 % were women of Khatisahi. Khatia women do not go to the lagoon to work but claimed that much of their fear comes from the fact that they live so close to the lagoon. *"Some villages are further, deep in the land. Our village and homes are located where Chilika is right at our feet. I see the water all around. It can be scary sometimes"* (Sulochna Jena, personal communication, interview, Khatisahi, September 16). Houses in Khatisahi are adjacent to lagoon waters as opposed to Biripadar where the houses are in the interior at some distance from the water. Proximity may be one reason why more Khatia women than Khandra women expressed fear of the lagoon and potential disasters. However, this does not imply that Biripadar is less likely to suffer the consequences of disasters. Ahalya Behera, a Khandra woman involved in one of my household case studies, sadly shared that her family had to temporarily leave their village in 2013 in search of a safe place to escape Cyclone Phailin. Some people in her village had died and there was a lot of costly damage to homes and the village (personal communication, interview, Biripadar, October 21). Worth noting is that many houses in Khatisahi and Biripadar are poorly constructed with materials such as mud bricks and palm leaves. These houses are unsuitable to withstand the impacts of extreme weather or to offer safety and shelter in the event of a disaster.

Fishers communicated that cyclones tend to hit Chilika around the month of October. I was in the field in October of 2015 and frequently observed villagers discussing their fear about the potential of a cyclone striking Chilika. Interview notes and observations reveal that it was

mostly women who were in fear of cyclones and how they and their families would survive. This relates to the research findings of Mitchell et al. (2007) that present a gender perspective of women as the primary care takers of their families with a greater responsibility for the health and well-being of their children as compared to men. Along with damaging households and property, tropical cyclones and floods create turbulence and high turbidity in coastal waters. As a result, the behaviour of fish and their availability is affected which will be further discussed in section 4.1.3 regarding resource depletion.

4.1.2 Human Induced Drivers of Change

Particular biophysical changes impacting fishers' livelihoods, such as seasonal fluctuations and extreme weather, are associated with variations in climate. With regard to direct anthropogenic stressors contributing to environmental change, two intricately co-related drivers of change in Chilika lagoon are the opening of the new sea mouth and aquaculture. Impacts of these drivers are listed in Table 4.2 and further explained in subsections 4.1.2.1 and 4.1.2.2.

Table 4.2: Key impacts of opening the new sea mouth and aquaculture

DRIVERS OF CHANGE AND THEIR IMPACTS	
New Sea Mouth	**Aquaculture**
• Amplifying the impact of biophysical changes (i.e. contributing to reduced water depth issues) • Increased tide (pulling resources into the ocean) • Increase of sand in lagoon • Invasive species • Weed infestation • Increased aquaculture activities • Depletion of fishery resources	• Exploitation of Resources (especially prawn/shrimp) • Hindrance to natural growth patterns of fish, shrimp, and crab • Reduction of fishing space and capture fishing • Habitat loss for species • Pollution • Influx of non-fisher use of lagoon • Depletion of fishery resources

4.1.2.1 The New Sea Mouth

Chilika lagoon is connected to the Bay of Bengal by openings which are commonly known as sea mouths. Sea mouths maintain the flow of water and function as an opening between the lagoon and the sea to keep the lagoon environment and its natural resources stable (Shaw & Iwasaki, 2010). Sea mouths affect the hydrological cycle and salinity level of the lagoon which impacts the lagoon's resource stocks. Additionally, the size and location of a sea mouth

physically enables species such as fish to move in and out of the lagoon which largely determines the availability of fishery resources in the lagoon environment (Shaw & Iwasaki, 2010).

Dujovny (2009) explains that an old sea mouth of Chilika lagoon was located and formed in a way that controlled the movement of water and maintained the properties of the lagoon. Sea mouths naturally open and close and in the 1990s this old sea mouth started to close due to natural factors. As a result of the old sea mouth closing, the salinity of the lagoon changed, and eutrophication and fresh water weed infestation increased (Dujovny, 2009). Multiple village level interviews and an interview with the Fisheries Department of Odisha reveal that an artificial sea mouth was opened in 2001 by the government and the help of the Chilika Development Authority (CDA). My thesis refers to this sea mouth as the "new sea mouth" (see Figure 4.1).

The new sea mouth reduced the distance between the main body of the lagoon and the Bay of Bengal and seemed to have solved salinity issues in some parts of the lagoon (Dujovny, 2009). However, the new sea mouth amplified some other issues and brought about many new problems as well. There are many changes that fisher communities shared about the opening of the new sea mouth and the general consensus was that it was not beneficial.

4.1.2.1.1 Impacts of Opening the New Sea Mouth

Environmental changes have amplified from the opening of the new sea mouth. Interviews and focus groups with Khatia and Khandra fishers conclude that three of the main impacts of opening the new sea mouth were: 1) water depth reduction in the lagoon, 2) depletion of fish, shrimp, and crab, and 3) changes in fishing practices including an increase in aquaculture activities.

Khatia and Khandra fishers described that the lagoon's depth has been affected by changing water flow from opening the new sea mouth. Opening the new sea mouth intensified the pre-existing issue of reduced water depth from the lack of rain.

> *We fishermen of Khatisahi have been fishing in the lagoon for years and we still try to. Yes, the depth of the lagoon has reduced since the lack of rain but the new sea mouth has not helped. It has reduced the depth even more which has made our living condition worse.* (Babina Kumar Jena, personal communication, interview, Khatisahi, September 1)

Babina explained that the new sea mouth brings a strong tide into the lagoon and has contributed to filling the lagoon with sand. The new sea mouth is continuously changing the composition of

the lagoon and is impacting the vegetation, phytoplankton, and overall ecosystem of the lagoon in adverse ways.

Additionally, fishers explained that the new sea mouth has created a more aggressive tide from the Bay of Bengal. This is pushing fish, shrimp, and crab deeper into the lagoon and also pulling these resources into the sea with the rise and fall of the tide. Sukanti Das is a fisherwoman from Biripadar who spoke in detail about her concerns about the new sea mouth. Sukanti explained that she noticed a decrease in her fish processing activities approximately two years after the opening of the new sea mouth. This is a concern that she shares with her husband who has to travel long distances into deeper areas of the lagoon for a profitable catch.

> *I am used to working with many types of fish. Before the opening of the new sea mouth, my husband would bring home nets full of shrimp, fish, and crab– a lot of what we used to enjoy for ourselves. Now he hardly needs my help because hardly any fish comes home. It is as if the sea is eating up all of our resources through the [new] sea mouth.* (Sukanti Das, personal communication, interview, Biripadar, October 3)

With the stronger tide due to the new sea mouth, new "creatures" and invasive species are entering the lagoon as well. *"Sometimes I get afraid of what I see when I fish. My husband and I go fishing and we see creatures like [octopus] or sea creatures…I believe the new sea mouth brought them into the lagoon"* (Sanju Lada Das, personal communication, mixed focus group, Biripadar, October 21).

80% of total interview participants from both Khatisahi and Biripadar share the opinion that the opening of the new sea mouth was not beneficial to their community and created more problems. Fourteen years after the opening of the new sea mouth, the adverse effects of this decision were still being experienced by fishing communities.

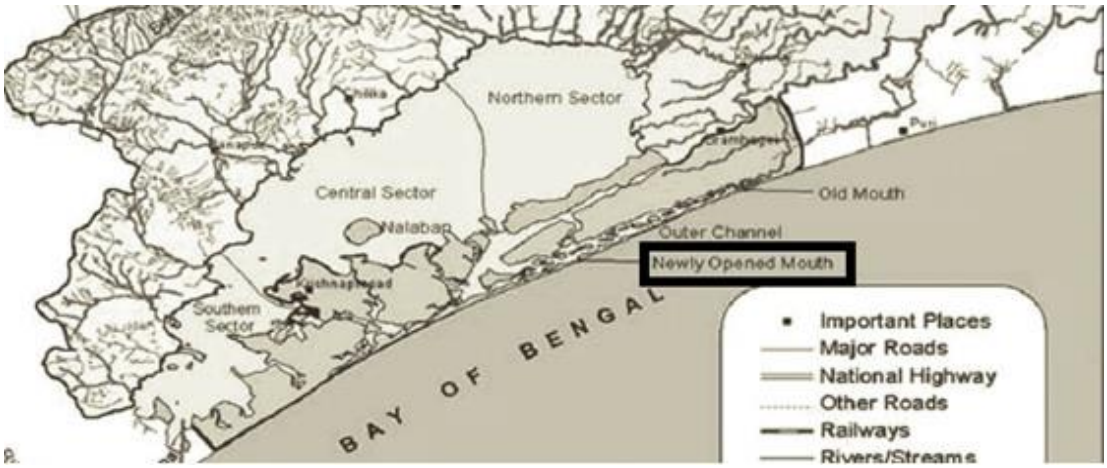

Figure 4.1: Clipping of a map of Chilika locating the placement of the new sea mouth (Source: Dujovny, 2009)

4.1.2.2 Aquaculture Ascending

Research findings indicate that the new sea mouth exacerbated social and ecological issues including the expansion of aquaculture in Chilika lagoon. 65% of Khandra fisherwomen participants and 40% of Khatia fisherwomen participants believe that the opening of the new sea mouth was problematic because it advanced the development of aquaculture and its illegal practice. The new sea mouth is understood as increasing the salinity of the lagoon with the influx of sea water which is beneficial to the cultivation of shrimp. Additionally, fishers mentioned that the new sea mouth contributed to the reduction of lagoon depth with the influx of sand. This has made it easier for aquaculture nets to be casted into the sand. Lastly, the new sea mouth has decreased the natural cycles of fish growth which has increased the dependence on controlled cultivation of shrimp in shrimp pens though aquaculture. Biripadar is more aggressively affected by aquaculture than Khatisahi which may explain the higher response by Khandra women (see section 4.2.2.2.2).

There are many issues associated with aquaculture, reasons as to why it was banned, and why it still persists in Chilika lagoon. Dujovny (2009) claims that after the opening of the new sea mouth, illegal aquaculture increased which my research findings in Khatisahi and Biripadar support. During the focus group with men in Khatisahi, Dandapani Behera, who is a fisherman, described different types of aquaculture activities and associated problems they present in the lagoon.

> *There are different types of aquaculture like aquaculture that is done using sand bunds and the other commonly done in deep waters with netting… Shrimp are meant to travel freely in the [lagoon, but because of aquaculture] shrimp seeds are restricted and have nowhere to travel and grow. Shrimp are not spreading throughout the lagoon like they naturally should.* (personal communication, men's focus group, Biripadar, October 11) (see Figure 4.2)

Other focus group participants explained that juvenile fish and shrimp become trapped in fine mesh nets called "zero nets" which prematurely kills many of these fish and shrimp. The wide spread presence of aquaculture in the lagoon is placing pressure on remaining fish stocks available for capture fishing. Pollution in Chilika is also linked to aquaculture with an increased use of chemicals and pesticides for the cultivation of shrimp and fish. Participants identified issues related to disrupted fish growth cycles and habitat loss due to aquaculture occupying the lagoon and different chemicals used to control shrimp growth. Section 4.2.1.1 explains how the involvement of non-fishers has greatly contributed to the prominence of aquaculture in Chilika lagoon.

Figure 4.2: Sand bunds created for aquaculture purposes in the lagoon area of Biripadar (Photo: Fatima Noor Khan)

4.1.3 Fishery Resources Depleting as a Result of Drivers of Change

Due to a combination of social and ecological pressures including climate related changes, opening the new sea mouth, and aquaculture, fishers are suffering the consequences of depleting fishery resources (see Table 4.2). 85% of total fisherwomen participants recognize a direct

connection between the ecological condition of the lagoon and the depletion of resources. With regard to fisherwomen's perspectives and interpretation of the depletion of fish, shrimp, and crab, it is important to understand the division of labour in Chilika associated with gender and caste. Household roles and associated activities contribute to varying levels of knowledge men and women have about the lagoon and its resources. *"Our husbands are fishermen and it is our duty to help them. We hope large amounts of fish come home every day. I help separate and categorize the fish and shrimp before it is sold for business or kept for cooking"* (Vijaylaxmi Jally, personal communication, interview, Khatisahi, September 18). Both Khatia and Khandra women work closely with fish that men generally bring home for the purpose of processing before it is sold, or cooked and consumed in the household. Fisherwomen's engagement with fish processing provides them with significant knowledge about the condition of fishery resources (see Figure 4.3).

Fisherwomen learn about the state of fishery resources, not only through observations and handling the fish, but through knowledge exchange with men, especially their husbands. Discussions about fishing and lagoon conditions were frequent in four of my six household case studies. Such conversations usually occurred over dinner when men had returned from the lagoon, or when fish catches were brought home.

> *I recall speaking to my husband about how I was noticing less migratory birds visiting Chilika a few years back. He told me that weeds which are food for birds were pulled away from the lagoon because of Cyclone Phailin. Related to what he told me, I understand that the cyclone may have also disrupted fish populations.* (Pramila Das, personal communication, interview, Biripadar, October 8)

Vijaylaxmi's and Pramila's comments offer examples of how gender is associated with particular knowledge commons and the development of particular expertise about the lagoon and fishery resource conditions.

Fisherwomen are generally responsible for the nurturing activities in their homes which include preparing and cooking fish, shrimp, and crab which consists of the traditional diets of fisher caste households in Chilika. 90% of total fisherwomen participants claimed that they recognize that fishery resources in Chilika are decreasing because less fish catch is coming home for their families to consume. *"Sometimes our families have little or nothing to eat. There are times when I can only offer one meal to my children and I remain hungry not knowing when our next meal will come"* (Mandi Behera, personal communication, interview, Biripadar, October

20). Eating habits are changing due to fishery resources declining and fisherwomen are using particular livelihood strategies, including changing eating habits, which are discussed in Chapter 5.

During interviews, I asked women what specific fishery resources the lagoon provides for them and their community. 74% of total fisherwomen participants from both villages mentioned that the lagoon provides fish and shrimp with a reduction of crab. Some women failed to mention crab as a resource that is currently available to them.

> *There was a time when we couldn't catch all the crab because there would be too many. Now catching [crab] is like a dream. Before we would get very big fishes too and they would be delicious. We don't get all that anymore. If we did we couldn't eat it anyway, we would have to sell it.* (Anita Das, personal communication, Biripadar, interview, October 25)

For remaining species, 25% of Khatia women noticed a decrease in the size and the taste of resources, especially fish.

Figure 4.3: Khatia woman (left) and Khandra woman (right) separating and cleaning fish and shrimp caught from the lagoon (Photo: Fatima Noor Khan)

The lagoon is traditionally fishers' primary source of food and income. Two Khatia women referred to the lagoon as their "rice store" as if it was a bank or deposit of livelihood resources. Similar observations have also been reported by Nayak and Berkes (2010) in their study of fisher metaphors on the extent of environmental change in Chilika. The depletion of fish, shrimp, and crab results in less income for fishers who depend on these resources. *"About*

20 years ago, there was more [fish] than we could handle in Chilika. I never thought I would see the day Chilika became dry. Now fishing is more like a lottery with many players and fishers are becoming more poor" (Sukanti Das, personal communication, interview, Biripadar, October 3). Prafula Jena, a Khatia fisherman who has been fishing for 25 years stated that 10-15 years ago, bringing 23-30 kg of fish home was quite common (personal communication, interview, Khatisahi, August 12). Now he says it is difficult to bring home even 5 kg. Earning Rs. 3000-5000 ($60-$110) is the average monthly income for majority of fishers in Khatisahi according to data gathered from interviews, focus groups, and fisherwomen in Khatisahi who handle household incomes and expenses. Dilip Jena who works with a local fish businessman in Khatisahi said,

> *You never know how much or little money a fisher will make in a month. It depends on so many factors like the season and fishing expenses as well. Fishers have never been rich people but our financial condition is becoming worse because of the poor condition of Chilika. A fisherman may make up to Rs.5000 in a month but he might have been making double that amount in fish before we started facing problems in the lagoon. Heck, he could have caught Rs.5000 worth of fish in one catch in the past if it was a good [catch]!...Now fishers are competing for what remains of Chilika.*(personal communication, interview, Khatisahi, September 16)

Impacts of depleting fishery resources and income pressures on the livelihoods of fisherwomen will be further discussed in Chapters 5 and 6.

Box 4.1: List summarizing the overall impacts and implications of depleting fishery resources

Overall Impacts and Implications of Depleting Fishery Resources
• Changes in fishing and fish processing practices
• Dietary changes in households with less fish, shrimp, and crab consumption
• Income instability from decrease in quantity of fishery resources being sold
• Decrease in diversity of species, especially crab
• Decrease in quality of fishery resources (size/taste)
• Growing competition for remaining resources
• Devastation of fishers' livelihoods

4.2 IMPLICATIONS OF CHANGING COMMONS ON RESOURCE USERS AND COMMUNITIES

Changing dynamics in Chilika's social-ecological system involves changes in the commons. In this chapter thus far, women's perspectives about biophysical changes and human induced drivers of change have been discussed in relation to degradation of the lagoon and depleting

fishery resources. This section transitions to an analysis about how the resource access rights of fisher communities are restricted due to non-fisher activities and key drivers such as aquaculture as well as limited availability of fishery resources. Changes in the commons are contextualized in relation to shifting governance structures and institutional processes.

4.2.1. Resource Access and Fishers' Rights

The Hindu caste-system in Chilika lagoon created caste-based property rights, access and entitlements, and developed caste-based occupations that defined the commons. Khatia and Khandra women expressed their rights as fisherwomen living in Chilika based on their caste, relationship with the lagoon resources, and dependence on the lagoon as members of fisher communities. *"I am a fisherwoman because I am born into a fisher caste and community. I may not actually catch fish but my birth right gives me the privilege to enjoy the lagoon and all that it offers"* (Priti Balia Jena, personal communication, mixed focus group, Khatisahi, October 6). Similar comments made by other fisherwomen signify that fisherwomen understand access rights as being "God given" and exercised for generations passed. Using a metaphor to describe the relationship fishers have with the lagoon, Sulochna Jena explains, "*Similar to the way a child has the right to be nurtured by his/her mother, fishers are all children who have the right to be nurtured by their Mother Chilika"* (personal communication, interview, Khatisahi, September 16). The reference to Chilika as Mother Chilika was made by 58% of total fisherwomen participants and Khatia and Khandra fishers described how they reciprocate their thanks for the subsistence the lagoon provides through prayer rituals and offerings to the lagoon. Customary understandings of fisher rights included the right to protect the lagoon which involved communally harvesting the lagoon in a sustainable way (see section 4.2.2.1).

Historically, fisheries in Chilika lagoon have been managed as communal property by fisher village communities which enabled fishers to exercise their access rights. Shaw & Iwasaki, (2010) explain that there was a close linkage between fisher communities and the lagoon, and a "regulatory system of traditional fisheries in a niche space among them was developed" (pg. 46). 67% of Khatia women respondents and 35% of Khandra women respondents are of the opinion that it is the obligation of their communities to work with the lagoon through a reciprocal relationship. Of these respondents, one-third of Khatia women and over two-thirds of Khandra women believe that their communities are increasingly becoming incapable of fulfilling this

obligation. A large majority of Khandra fishers, as compared to Khatia fishers, have shifted occupations away from fishing due to growing pressures (further discussed in Chapter 6) which may relate to the relatively low percentage of women identifying fishing as an obligation. Khatia and Khandra rights, which have been enjoyed for generations, are progressively being stripped away. Infringements on rights are occurring through the collapse of customary commons approaches (see section 4.2.2.2), assisted through growing heterogeneity of users and shifts towards private property as discussed in the following subsection.

4.2.1.1 Heterogeneity of Resource Users in Chilika

There are a range of non-fisher caste groups living in Chilika. Non-fishers have traditionally engaged in activities such as land cultivation and earned their livelihoods from sources other than fishing (see Box 4.2). Traditions have shown to shift with an influx of non-fishers harvesting the lagoon. Feeny (1990) asserts that it is globally recognized that resources attract multiple users which creates great complexity and increased challenges to manage resources. Khatisahi is surrounded by six non-fisher villages and Biripadar by nine non-fisher villages with approximately 26 other non-fisher villages in the interior lands. Non-fisher encroachment on land is also becoming an issue (see Chapter 5). Presently, majority of these non-fisher villages are engaged in some form of fishing in Chilika which is contributing to the heterogeneity of resource users and privatization of the lagoon, mostly through culture fishing.

Before the advent of aquaculture in Chilika, non-fishers were ostracised if they engaged in fishing which was perceived as a lowly occupation within the social strata (Dasharathi Das, personal communication, men's focus group, Biripadar, October 11; Sekhar, 2004). Dasharathi Das, who is a Biripadar elder, narrated a story about fishing customs in the 1940s when he was learning how to fish with his father.

> *Non-fishers wouldn't be seen fishing the lagoon. That was not their job. We had good relations with them and some would even wait at the shore for our boats and help us carry our nets back to the land. Now, we see washermen, barbers, and even Brahmin (referring to different castes and vocations of non-fishers) fishing.* (personal communication, men's focus group, Biripadar, October 11)

Currently, the number of non-fishers engaged in fishing, especially aquaculture, is growing. Khatisahi and Biripadar fishers are increasingly becoming overwhelmed by the interference of non-fishers co-opting the lagoon.

Box 4.2: Excerpts from discussions with non-fishers

Speaking to Non-Fishers about Fishing

October 26, 2015

It was very insightful to speak to a group of non-fishers today who were introduced to me by my host family in Khatisahi. Interviewing fishers who spoke about non-fisher issues developed my interest to also speak to non-fishers and learn their perspectives as well. My host family introduced me to three non-fisher men who agreed to have a discussion with me about my research and also answer a few questions. These men were from Gurubai which is a non-fisher (Khandayt caste) village neighbouring Khatisahi.

I discovered that all three of these men were involved in some form of fishing in Chilika. Two of them were engaged in culture fishing activities and the other was engaged in capture fishing. I was eager to ask them about their caste traditions and entry into fishing which my analysis thus far shows is not their traditional line of work. I learned that the people of their village are farmers and traditionally engage in agricultural activities. It is in the last 30 years the Gurubai village community has taken up fishing as a profession with 90% of their male population fishing. Only a small percentage of people are still farming on land. It was captivating to hear that many of the Khandayt caste members have left farming due to the poor condition of their crops and issues with drought and lack of rain over the years. One of the men expressed his concern about the growing population in his village and lack of land and agricultural resources to share. He stated that he is fishing in the lagoon to survive since his crops no longer provide an income for him.

I was also informed that Gurubai and Khatisahi have good relations and the Gurubai community is fishing primarily in the lagoon area adjacent to the Gurubai village land and have taken a sublease from fishers (see section 2.2). The non-fishers are happy that they are not having to pay a formal lease but also feel like they have a right to the lagoon as fishers do because they live in Chilika. They would like the government to recognize their right to fish as well though they understand that the Khandayt are not "actually fishers" because they are not fishers by caste or tradition. This discussion with non-fishers enlightened me on the growing issue of natural resource deficiency and environmental problems that a diverse range of communities in Chilika are facing, not only fisher castes. Experiencing many of the same challenges fisher communities are facing in the lagoon, a large percentage of villagers from Gurubai are migrating out of state to find work.

4.2.2.1.1 Subtractability and Excludability Issues

The emergence of the export industry in the 1980s and growing demand for shrimp on an international scale sparked the interest of non-fishers to invest time and money into aquaculture

pursuits in Chilika. Non-fishers recognized the financial benefit of working in the lagoon, left their traditional jobs, and began aquaculture in Chilika. The entrance of non-fishers triggered subtractability and excludability issues (see section 2.2) in the lagoon which also contributed to the loss of fishers' rights. With regard to subtractability, fishery resources that were already undergoing decline due to biophysical changes were now introduced to the additional pressure of new users competing for the same resources. Excludability issues quickly developed with non-fishers limiting fishers' access to the lagoon. Subtractability and excludability issues further escalated with the emergence of protected areas and top-down decision-making processes which will be discussed in section 4.2.2.2.

The influx of non-fishers was spoken about by 89% of total fisherwomen participants as directly infringing on fisher communities' resource access rights. One of the greatest problems with this influx involves the reduction of lagoon space for capture fishing as large portions of the lagoon are encroached on by non-fishers for aquaculture (see section 4.2.2.2.2). Tulsi Jena has observed how aquaculture has developed throughout Chilika. "*The entire lagoon has been captured in the nets and sand bunds of aquaculture. Fishers feel trapped, sometimes findings it difficult to navigate their boats through the web of aquaculture nets in the water"* (personal communication, interview, Khatisahi, October 14). I regularly travelled through Chilika lagoon during my fieldwork and noticed vast areas of the lagoon marked with nets for aquaculture that my community researcher assistant helped me identify. Specifically in Biripadar, there were areas where sand bunds were being constructed for aquaculture (see Figure 4.2). 40% of Khatia women and 65% of Khandra women interpret the entrance of non-fishers as having contributed to the depletion of fishery resources. One reason for this is that existing fish stocks are pressured by non-fishers who predominately engage in aquaculture which is perceived by fisherwomen as an unsustainable practice. In the following section, resource access issues will be further examined through the analysis of commons governance and institutional arrangements.

4.2.2 Gendered Perspective about Institutional Arrangements and the Commons

This section explains how the Chilika commons shifted from bottom-up approaches through customary commons governance, to top-down centralized state governance structures that have gradually disturbed the Chilika commons. Fisherwomen's perspectives about changes in

institutional arrangements and governance structures are emphasized. Secondary research findings through document review help contextualize historical changes in the commons.

4.2.2.1 Customary Commons Governance

Common-pool resources can be held under various governance arrangements (Ostrom et al., 1999) (see section 2.2). Governance is different from 'government' and involves the agency of a variety of social actors and institutions in a broader process through which societies make decisions (Lemos & Agrawal, 2006; Armitage et al., 2009). Institutions provide systems of rights and rules governing how and by whom resources are made available, accessed, and used (Bromley, 1992).

Traditionally, communities living in Chilika exemplified a bottom-up, caste-based management and governance system. In the customary commons arrangements, fisher communities adjusted their own rules. *"When I was a child in the 1940s my father would fish with groups of other fishers who as a group would divide their catch. Communication with other fishing castes was important to organize fishing boundaries and fishing patterns"* (Dasharathi Das, personal communication, men's focus group, Biripadar, October 11). Customary fishing involved determining where and when fishing could be practiced based on species availably and active fishery seasons for different fish and fisher groups. According to Berkes' (1989) research in Chilika lagoon, community associations and multi-level governance which established boundary, membership, and collective choice rules, resolved the excludability and subtractability problems in the commons.

Tracing the history of the commons in Chilika, it is evident that customary rules and norms of the Chilika lagoon commons were once sanctioned through legal arrangements. In 1942, a state lease system was implemented which regulated fishers' activities in designated fishing areas (Nayak & Berkes, 2011). Mixed focus group discussions with both Khatia and Khandra fishers highlighted that a key feature of the leasing policy was that it offered fishing rights only to fisher caste communities, not individual fishers, and excluded non-fishers. In addition to this leasing system, supporting local institutional arrangements were established. Traditionally, leadership had been provided by elders and village committees. Following 1959, the Primary Fishermen Cooperative Society (PFCS) was designated as the main community institution for fisheries management. The PFCS worked with traditional village communities and

was managed by the regional level Central Fishermen Cooperative Marketing Society (CFCMS) which maintained communication with government departments (Nayak & Berkes, 2011).

In the fishery management and governance system described above, power and decision-making was representative of multi-level interactions that supported communal property. During the time when the CFCMS was active, the resource base was healthy and fishing conflicts were minimal which exemplified successful management of the lagoon. The customary commons arrangements in Chilika are a good example of what Nayak and Berkes (2011) term as commonisation. Commonisation is a process through which resources are converted into jointly used resources under commons institutions that deal with excludability and subtractability.

Fisherwomen noted that traditional fishing customs are beneficial to the ecological condition of the lagoon and fishers' livelihoods. This signifies that fisherwomen understand that the commons are a part of social-ecological system that was supported through customary approaches. Rani Jena who was born in 1947 explained,

> *Knowledge about Chilika and its [resource base] was passed down in families. Fishers were successful at managing fishery resources because they had years of knowledge working together in the lagoon. Fishers knew how to work together and how to protect and share the lagoon.* (personal communication, interview, Khatisahi, August 21)

Rani's comment reflects that customary commons governance, which began at the local level, was best to sustain fisheries because rules were created by stakeholders who had knowledge about the lagoon and were the ones directly impacted by these rules. Her comment also supports earlier findings by Shaw and Iwasaki (2010) describing that customary fishing prevented occupational competition since fisher sub-castes worked collectively to prevent conflict.

My ethnographic accounts from household case studies in Khatisahi and Biripadar indicate that some traditional customs related to the religious and ritual practices still persist. Household case studies gave me opportunities to spend time with women and participate in household activities such as cooking and preparing meals. During the holy month of Karthika in October, I noticed that women were only preparing vegetarian meals, refraining from eating non-vegetarian food including fish, shrimp, and crab. *"Karthika is a time when I do not cook non-vegetarian food. During this month the fish are breeding and it is forbidden to eat them. It is a time for the lagoon to reproduce its resource base"* (Pratima Jena, personal communication, interview, Khatisahi, September 16). Pratima makes apparent how some traditional customs and

norms exemplify sustainable management of the lagoon. Customary practices during the month of Karthika control fishing and resource consumption in a way that supports the natural cycles of fish. Fisherwomen mentioned that it is becoming more difficult for fishers to observe religious customs during the month of Karthika. 65% of total fishermen stated that they catch and sell fish all year round because of growing financial pressure in households. Reasons for such changes and fishers' struggles to maintain traditions can be better understood through examining shifts in commons governance in Chilika (see Table 4.3).

4.2.2.2 Changing the Commons through Centralized Governance

Changes in the commons represent a significant deviation from customary commons governance to top-down approaches (see appendix L and M). State property and centralized governance has significantly marginalized the customary management structures that once prevailed and protected the commons. Displacement of customary governance has led to the process of decommonisation where characteristics of jointly used resources under commons institutions are destroyed (Nayak & Berkes, 2011). Analyzing institutional changes in the commons offers an opportunity to build on perspectives shared by fishers about fishers' rights and resource access issues. Key changes in the commons include: 1) the designation of protected areas in Chilika, 2) appropriation of lease policies in favour of aquaculture, and 3) neglecting fisher communities in decision-making processes.

4.2.2.2.1 Designating a Protected Area

Institutional adjustments and changes to the customary commons governance system in Chilika lagoon began in the 1970s. In 1972, this involved designating Nalabana Island, which is situated within the lagoon, as a bird sanctuary under the Wildlife (Protection) Act as a priority site for conservation (Sekhar, 2004). Interviews with fishermen reveal that recognizing Nalabana as state property and as a protected area prohibits fishers from accessing it, including fishers who have customarily used this part of the lagoon for livelihood purposes. Between the two research villages, greater effects of this designation have been experienced by Khandra fishers.

Nalabana Bird Sanctuary is a two hour boat ride away from Biripadar. 53% of total Khandra participants stated that Nalabana has become a fishing area for Khandra fishers from Biripadar, although it was not a traditional fishing site. Commenting on Nalabana as a protected

area, Tulsi Das explained that in the 1960s when her husband was fishing, Nalabana was a communal property regulated by fishers. *"Nalabana is now an area for the protection of only birds, but it doesn't protect and respect our fishing traditions. Also, this area has become a regular place the Khandra men fish in because our own leased area has been encroached upon"* (personal communication, women's focus group, Biripadar, October 12). Examining Tulsi's statement, it is evident that the designation of Nalabana as a protected area focused strictly on ecological conservation but did not safeguard fishers' access and rights to the lagoon.

Participants of the mixed focus group in Biripadar exposed how the creation of protected areas such as the Nalabana Bird Sanctuary has ironically led to further exploitation of the lagoon. This can be understood through the ongoing violation of laws by fishermen and rangers alike. *"As Biripadar fishermen we have to regularly travel for hours to and from Nalabana because our own leased area has been encroached upon by non-fishers. We have to 'illegally' fish in Nalabana and put nets in at night so no one can see*" (Judhistir Behera, personal communication, interview, Biripadar, October 7). Jamuna Behera added that in order for her husband to fish in the Nalabana area, he has paid bribes to rangers who are government employees that supervise the island. Jamuna has had to take loans on behalf of her husband for him to pay these rangers who demand approximately Rs.1000 for one month of fishing in Nalabana Island (personal communication, women's focus group, Biripadar, October 12). Five Khandra fisherwomen explained to me that fisher communities are expanding their fishing endeavours to areas such as Nalabana in part due to leasing issues (i.e. lagoon encroachments) they are facing in their village (see section 6.1.1). These women also explained how the designation of this area as a protected area has not enhanced the conservation and protection of this site, rather it has contributed to the restructuring of communal fishing rules and ultimately unsustainable fishing practices.

4.2.2.2.2 Aquaculture Initiating Lease Policy Adjustments

In the 1980s, with the growth of export oriented shrimp aquaculture, the State Government of Odisha shifted from a role of non-interference and recognizing caste-based fishery management, to passing rights to non-fishers and corporations (Nayak & Berkes, 2011). Sudarsan Jena, who is a village leader actively involved in Khatisahi's fisher cooperative, communicated that the new lease policy shifted customary fishing areas to non-fishers through the creation of "gramathalee" areas (adjacent areas of a village) which essentially introduced aquaculture practices in Chilika

and marginalized fishers (personal communication, interview, Khatisahi, October 20). Gramathalee areas were designated lagoon areas surrounding non-fisher villages which were being used for aquaculture. In 1991 lease policies were extended to include non-fishers, ultimately benefiting resource users who practiced shrimp aquaculture. Furthermore, lease prices increased by 27%, making it financially difficult for fisher communities to engage in fishing activities. In this same year, The Odisha State Fishermen's Co-operative Federation Ltd. (FISHFED), a state level institution that is now managing leasing protocols in Chilika, replaced the PFCS and CFCMS (Nayak & Berkes, 2010). Although lease policies were challenged and non-fishers no longer receive a formal lease, fishing areas continue to be under the control of non-fishers and primarily used for aquaculture.

Biripadar has been assigned a leased area of approximately 567 hectares by FISHFED. Kailas Das claims that Biripadar's leased area continues to be encroached upon by non-fishers, generally referred to as the "shrimp mafia". 60% of Biripadar's leased area is unofficially being subleased to non-fishers by Khandra fishers in order to pay increasing lease fees.

> *There are some Khandra people subleasing to non-fishers who use it for aquaculture. That is the only way fishers can afford to pay lease debts. The formality of holding a lease is all that we have that provides us with lagoon ownership, so we must pay for it. Subleasing is still in our benefit [as opposed] to other options. In most cases the shrimp mafia would take it away from us anyway and pay us nothing.* (Kalias Das, personal communication, men's focus group, Biripadar, October 11)

Khatisahi has approximately 900 hectares of leased area, 10% of which is being subleased. According to Sudarsan, encroachment issues have not interfered in Khatia fishing practices to a great extent, but he fears that encroachment will continue to grow and aquaculture will develop (personal communication, interview, Khatisahi, October 20).

Although fishermen participants demonstrate having more formal knowledge about lease policies than fisherwomen, largely due to their direct involvement in fishing in the lagoon and involvement with fisher cooperatives, it is evident that fisherwomen are recognizing the negative impacts of contemporary lease management. All participants of the Biripadar women's focus group and over 50% of other Khandra women individual interview participants claim that contemporary lease systems allow the government and its associated parties to control access to the lagoon and regulate its use. Ahalya believes that the gramathalee system gave non-fishers an entry to start fishing in the lagoon although the government has ordered them to stop fishing in

fishers' leased areas and engaging in aquaculture. According to her views, non-fishers continue to extract from the lagoon's resource base with the added benefit of not having to pay a lease (personal communication, interview, Biripadar, October 21).

Furthermore, communications with fishers indicate that approximately 20% of total fishermen in Khatisahi and 10% of fishermen in Biripadar have or are currently engaged in aquaculture activities to help pay for increasing lease fees and household expenses. Fishers' engagement in aquaculture represents a clear diversion from customary practices and suggests that capture fishing is becoming financially unprofitable. Krishni Jena, explained that her husband started investing in aquaculture because it was the only way her family could sustain themselves. Capture fishing was not providing enough income for her family to pay basic expenses (personal communication, interview, Khatisahi, August 12). Three Khandra fisherwomen explained that aquaculture requires financial investments and savings which also suggests that aquaculture is exclusive and not financially feasible for all fishers to participate in.

4.2.2.2.3 Top-down decision-making

50% of total fisherwomen participants shared the perspective that the government is not adequately communicating with fisher communities to solve lagoon issues for long term success. Of this group, 80% of fisherwomen also interpret centralized approaches as further undermining women's knowledge and participation in decision-making. Using the example of lease policy decisions, Urbashi Jena affirmed that through the PFCS and CFCMS, fishermen were able to contribute to decision-making and ultimately management of the lagoon. When fishermen were involved in local level decision-making, information about lagoon politics and management approaches was readily available to women as well.

> *My husband was greatly involved in the PFCS before they began to breakdown. Women were not active at PFCS meetings but our husbands and other community men were able to share information about lagoon management with us on a household level. We were also able to share our opinion and input with them but now fishermen are not as involved in decision-making, and neither are fisherwomen.* (Urbashi Jena, personal communication, interview, Khatisahi, August 21)

Urbashi's comment suggests that the breakdown of customary approaches to management has marginalized the perspectives of fisher communities and has further marginalized women's voices.

Also, the decision-making process to open the new sea mouth is a good example of ineffective communication between fisher communities and government authorities. Although it is a mandate of the CDA to engage community participation in conservation efforts, local fishers were not appropriately consulted (Dujovny, 2009). 65% of total fisherwomen participants claimed they would have disapproved of the proposal to open the new sea mouth, had they been consulted, because they believe the natural system of the lagoon should not have been disturbed through human intervention. The remaining 35% were indifferent. Many fishers stated that the government and more specifically the CDA works only with "pen and paper," claims to assist fishers, but ultimately marginalizes fishers in the process of regulating the lagoon. The new sea mouth project exemplifies a decision-making process in the commons that differs greatly from customary approaches which were inclusive of stakeholders.

Contrary to customary ideologies that recognized the importance of both social and ecological functions in the commons, top-down decision-making reflects governance approaches that fail to recognize how social dynamics are contingent upon ecological systems and how this relationship is interchangeable in the commons (Nayak & Berkes, 2011). There is a growing realization that without the active participation of fishing communities in decision-making and management, it is not possible to ensure sustainable use of the lagoon.

Table 4.3: Summary of changes in the commons from customary commons governance to top-down commons governance arrangements

Characteristics/Conditions of Customary Commons Governance	Characteristics/ Conditions of Top-down Commons Governance
Caste-based fisher management	Government/external authority management
Fisheries managed by village communities and elders	Fisheries managed by government and external authorities
Capture fishing and sustainable fishing practices	Culture fishing and unsustainable fishing practices
Locals established a relationship with the lagoon based on reciprocity	New users/authorities have established a superficial relationship with the lagoon based on economic gain
Regional institutional support from the PFCS and CFCMS	FISHFED state level support
Communal fishing areas	Encroached and privatized areas
Bottom-up multi-level governance	Top-down centralized governance
Fishers as resource users	Heterogeneity of resource users
Absence of 'Protected Areas'	Nalabana Bird Sanctuary
Lease policy for fisher caste communities only	Lease policy for non-fishers
Multi-level decision-making processes	Centralized decision-making processes
Sustainable ecological conditions	Unsustainable ecological conditions
Holistic social-ecological systems understanding	Non-integral systems focus, disconnecting social and ecological systems

4.3 CHAPTER SUMMARY AND CONCLUSIONS

This chapter discussed environmental changes in the context of social-ecological changes with a focus on women's perspectives. Biophysical changes and human induced drivers of change were jointly examined as contributing factors to the depletion of fishery resources. An analysis of changing commons offered insight on how resource access issues with non-fishers and infringements on fishers' rights have triggered subtractability and excludability problems. This chapter also shared a story about institutional rearrangements through a shift from customary commons governance that once protected Chilika lagoon, to centralized state governance that is further degrading the lagoon and the livelihoods of fishers. This chapter illustrates how that the commons are as much about people as they are about resources. Both social and ecological processes are contributing to the creation and recreation of the Chilika lagoon commons which can be perceived as going through rapid decline and impacting fisherwomen in particular ways (see Chapter 5).

CHAPTER 5: THE IMPACTS OF ENVIRONMENTAL CHANGE ON FISHERWOMEN'S LIVELIHOODS

As discussed in Chapter 4, there are complex processes of environmental change, largely involving changes in the commons, occurring within the social-ecological system of Chilika lagoon. In this Chapter, I discuss findings related to the second research objective, which analyzes the key impacts of environmental change on the livelihoods of fisherwomen and how they are coping and responding. In doing so, this chapter elaborates on the commons crisis, and specifically how fisherwomen have become increasingly vulnerable to and impacted by: 1) extreme weather and disasters, 2) depleting fishery resources (fish, shrimp, and crab) and resource access issues, and 3) non-fisher encroachment on the lagoon and adjacent land. Fisherwomen's participation in: 1) local wage labour, 2) thrift and credit groups, and 3) coconut coir work, is examined to exemplify ways in which fisherwomen are dealing with environmental change through employment and self-help groups. An analysis of the diversification of fisherwomen's roles and intersectionality further explains the differential experiences and impacts of environmental change on Khatia and Khandra women and the growing heterogeneity of fisherwomen as a group.

5.1 FISHERWOMEN'S VULNERABILITY TO ENVIRONMENTAL CHANGE

Thematic analysis based on interview responses, focus group activities, household case studies, and observations (see Chapter 3) reveals three key processes of environmental change impacting fisherwomen's livelihoods and increasing fisherwomen's vulnerability. These changes involve: 1) extreme weather and disasters endangering fisherwomen's lives and increasing their household burden, 2) fishery resource access issues and resource scarcity contributing to fisherwomen's financial pressure, and 3) non-fisher encroachment jeopardizing fisherwomen's safety in villages. I examine each of these below.

5.1.1 Fisherwomen's Vulnerability to Extreme Weather and Disasters

Increased frequency and intensity of extreme weather and disasters, including cyclones, storms, and flooding (see section 4.1.1.1), is reinforcing fisherwomen's fear and vulnerability to environmental risks, and disproportionally impacting fisherwomen as compared to fishermen.

"*Every year I fear a cyclone will wash me and my children into the lagoon. I don't know what I would do on my own to save my children, especially if my husband wasn't with me. I can't even swim to save my own life"* (Anita Das, personal communication, interview, Biripadar, October 25). With regard to perceived vulnerability to natural disasters such as cyclones, 75% of total fisherwomen participants including Anita believe that they lack necessary skills (i.e. swimming, climbing) to survive a natural disaster. Habtezion (2013) argues that women are often disadvantaged to deal with environmental risks because socio-cultural norms often limit women from acquiring the skills and information necessary to avoid particular hazards. Supporting this argument, fishers in Khatisahi and Biripadar communicated that fisherwomen are seldom involved in meetings with government representatives that offer disaster warnings and pre-disaster training in villages. Fishermen attend these meetings and are perceived as being primarily responsible for the protection and well-being of their families at the time of a natural disaster.

Although fishermen may be recognized as having heroic tendencies, fisherwomen inevitably bear the burden of protecting children and elders in the household. Ajibade, McBean, and Bezner-Kerr, (2013) state that a number of disaster studies indicate that the division of labour, particularly regarding caregiving roles and responsibilities at home, often increases women's pre-disaster vulnerability and places additional burdens on women during disaster recovery. Household case studies and a comparison of fishermen's and fisherwomen's activity profiles in Khatisahi and Biripadar (see Appendix H-K) indicate that fisherwomen generally have greater responsibilities within the household, they spend more time within their homes, and are the primary caregivers for children and the elderly. Women are therefore more likely than men to be home at the time of a disaster and responsible for the safety and survival of others and themselves. Fisherwomen's responsibility and vulnerability to disasters is more likely to increase with the growing absence of fishermen in villages as they out-migrate (see Chapter 6). Elaborating on Ahalya Behera's experience with Cyclone Phailin shared in Chapter 4, Ahalya explained,

> *My husband had out-migrated to Delhi three months before Cyclones Phailin. I was left alone in the village with my two children. In early October there were talks about a cyclone hitting Chilika and during that time I felt like I had to leave the village to keep my children safe. A lot of people were evacuating the village. I had some relatives living deeper into the [Ganjam district of Chilika] who I went to stay with along with my children. When I came back home after the cyclone I noticed that a tree had collapsed on*

> *a part of my home. If we stayed in Biripadar, my children and I might have died.* (personal communication, interview, Biripadar, October 21)

Ahalya continued to describe her struggles working as a wage labourer to feed her children and pay for costly damages to her home from the cyclone until her husband returned to Biripadar in November (see section 5.2.1).

Anita and Ahalya's stories are amongst many fisherwomen's stories that exemplify how environmental degradation, specifically natural disasters such as cyclones, adversely impact fisherwomen. Fisherwomen demonstrate being affected indirectly through social arrangements that limit their ability to deal with disasters, and directly through physical damage on their settlements and loss of life. Ahalya's precautionary approach to dealing with Cyclone Phailin also illustrates that fisherwomen are not only victims of environmental change. Rather, fisherwomen are active agents who negotiate and strategize through change which is further discussed in the following sections, specifically section 5.2.

5.1.2 Fisherwomen Facing Economic Issues

Changes to fishers' livelihoods as a result of depleting fishery resource and access issues (see section 4.1.3 and 4.2.1) involve greater financial constraints for fisherwomen.

> *Almost daily, I would cook fish that my husband caught from the lagoon. Fish was a [staple food] in the household before aquaculture and the depletion of fishery resources began. Now, [in the house] there is hardly ever any fish to eat, hardly any fish to sell, and ultimately no money to buy food. Some days we have only leftover rice and onions for meals.* (Sulochna Jena, personal communication, interview, Khatisahi, September 16)

95% of total fisherwomen participants identify as primary household caregivers responsible for feeding family members before themselves. Traditionally, the diets of fishers consist of fish and shellfish, but food insecurity within villages is growing and fisherwomen are amongst the highest experiencing malnutrition. Biophysical and human induced drivers of change (see section 4.1) are collectively reducing the fishery resource base, and simultaneously fishers' access to remaining fish stocks is constrained by non-fishers and aquaculture. Such commons issues are hindering fishers' activities in the lagoon, consequently contributing to food insecurity, and adversely impacting household incomes.

The extent of fisherwomen's involvement in contributing to household incomes and managing finances largely determines the degree of financial pressure they experience. In 25 of 33 Khatia households involved in my research, women were responsible for household budgeting which includes managing incomes, expenses, savings, and debt repayment. *"Whatever my husband earns from fishing he gives me. I don't earn money or provide an income, but I help manage the household income and budget"* (Sasi Jally, personal communication, women's focus group, Khatisahi, October 4).

Khatia women generally depend on men in their households to provide incomes, but many women manage household budgeting. As fishermen's capture fishing activities become harder to sustain, Khatia women's access to funds decreases and their household budgeting task becomes much more difficult. *"Ever since my husband began catching less fish our household budget has been very tight. I have had a hard time determining how the little money we have will continue to pay for expenses such as food, clothes, and medicine"* (Sasi Jally, personal communication interview, Khatisahi, August 18). In 20 of 29 Khandra households involved in my research, women were responsible for household budgeting and were increasingly becoming the primary providers of household incomes. In Biripadar, higher levels of non-fisher encroachment and aquaculture as compared to Khatisahi has pushed many fishermen out of the lagoon which has resulted in a greater loss of livelihoods, higher rates of fishermen being unemployed, and higher rates of fishermen out-migrating. This has pressured many Khandra women to find employment as wage labourers (see section 5.2.1).

Khatia and Khandra women show to be coping with financial pressures associated with lacking household savings and difficulties paying ongoing expenses. Coping refers to short-term, immediate, and reactive responses motivated by a situation or crisis, and due to necessity, before any long term strategies are considered (Nelson et. al, 2007). 48% of Khatia women and 62% of Khandra women participants have used coping strategies including taking monetary loans and mortgages to pay for costs related to food, clothing, health care, wedding events, religious festivities, and children's education. Some fisherwomen have also taken loans to pay out-standing debts which are compounded with interest. This suggests that coping strategies involving loans and mortgages are not alleviating economic issues in Chilika but instead contributing to a financial crisis as families become entrenched in perpetuating cycles of debt and financial instability. The following comment made by a Khandra woman suggests that some

coping strategies are also becoming unavailable which is instigating adaptation responses including occupational diversification.

> *I used to take loans from family, close friends, or local businessmen… In the last couple of years I have noticed that less people have the capacity to give loans, everyone is experiencing financial problems. Also, paying loans started becoming increasingly difficult with the little income my husband was generating from fishing. I had never worked outside of fishing but I decided I would start working as a labourer to [supplement] the household income.* (Sukanti Das, personal communication, interview, Biripadar, October 3)

In addition to further explaining fisherwomen's wage labour activities, section 5.2 describes how fisherwomen are dealing with financial burdens through self-help groups.

5.1.3 Safety Concerns and Violence towards Fisherwomen

In addition to financial pressures and exposure to natural disasters, qualitative interpretations of fisherwomen's responses from interviews and focus groups suggest that fisherwomen, especially Khandra women, are becoming increasingly susceptible to public threats and domestic violence in villages. These problems are perceived by fisherwomen to have escalated alongside property right infringements by non-fishers (see section 4.2.1.1 and 4.2.2.2.2). 85% of Khandra women participants interpret the entrance of non-fishers into the lagoon as a threat to women's safety and well-being in villages.

Non-fisher encroachment on the lagoon through aquaculture is perceived to have led to non-fishers infringing on fishers' land as well. *"Non-fishers have taken over our lagoon and now they are taking over Biripadar land… Non-fishers' population is greater than that of fishers and they are using the money they are making from aquaculture to build on Biripadar property"* (Tulsi Behera, personal communication, interview, Biripadar, October 5). Supporting Tulsi's comment, while conducting fieldwork in Biripadar, I noticed roadway construction and the building of new homes along the peripheries of the village. I was informed by many Khandra locals that the construction I was seeing were non-fishers' developments on property that belonged to the fisher community of Biripadar. Such land rights issues are recognized as contributing to violence towards Khandra women.

90% of Khandra women I spoke with feel unsafe travelling through Biripadar and surrounding areas because they fear violence from non-fishermen. 50% of Khandra women

participants reported having experienced some form of violence and harassment by non-fishers on Biripadar property. This includes physical abuse (i.e. being pushed, spat on) and verbal assault (i.e. receiving death threats, name calling) while undertaking daily activities that require women to travel throughout the village. Khandra women travel a few kilometres away from their homes to ponds and open fields in order to bathe or find space to defecate where many of these women state to have been attacked by non-fishermen. These findings coincide with Cronin et al.'s (2014) research that exposes how many women living in poor rural and urban settlements in India do not have access to basic facilities such as toilets and often have to walk long distances in search of private places to defecate where they experience a higher risk of harassment, rape, and loss of the most basic levels of dignity.

In the case of my research, Khandra women's safety is understood to be at greater risk because of non-fisher encroachments and growing conflicts between fishers and non-fishers over the lagoon (see section 4.2.1). Four Khandra women I spoke to, clarified that approximately 20 years ago, the ponds and fields fisherwomen travel to for personal matters were considered as communal-property which non-fishers encroached upon soon after they began engaging in aquaculture. All Khandra men involved in my research believe that fisher and non-fisher conflicts originated from lagoon property rights issues and involve physical and verbal violence by non-fishers towards both men and women. 64% of Khandra men participants commented that Khandra women have by and large been made targets of this violence. Higher populations of fisherwomen remaining in villages as compared to fishermen who are showing to increasingly out-migrate may also be contributing to increasing rates of non-fisher violence against women (Chapter 6).

Only 19% of Khatia women participants expressed fear of non-fishers while travelling through Khatisahi. This smaller percentage as compared to Khandra women may reflect that in Khatisahi, non-fisher conflicts have not escalated to the extent they have in Biripadar. Greater non-fisher populations surrounding Biripadar as compared to Khatisahi may also be contributing to this discrepancy (see section 4.2.1.1). Additionally, the infrastructure of Khatisahi is more developed, with facilities such as pit latrines/toilets, showers, and ponds available within the village. Therefore, Khatia women do not have to travel to distant territories where safety may be a greater concern.

However, changes in the commons are not only recognized as contributing to fisher and non-fisher conflicts, but are also perceived as contributing to intra-village conflicts and domestic abuse. 46% of Khandra women participants and 25% of Khatia women participants associated the lagoon crisis with increased alcohol and drug abuse and domestic abuse targeting women.

> *Soon after my husband stopped fishing the lagoon six years ago, he has remained mostly unemployed and started smoking a lot of ganja and wasting his money on alcohol. I labour all day doing construction work in a nearby village and many times my husband takes my hard earned money for alcohol and drugs. Sometimes he even gets violent with me when he is drunk.* (Rajani Das, personal communication, interview, Biripadar, October 20)

There was also a general consensus between Khatia and Khandra men participants that drug and alcohol abuse and domestic violence towards fisherwomen has increased in the last 15-20 years alongside growing issues with non-fishers and degradation of the lagoon. Although the increase in alcohol and drug abuse and violence may not be completely attributed to changing commons, such issues can be understood as systemic problems in villages that are amplified by the livelihood crises and fishers' detachment from the lagoon.

5.2 FISHERWOMEN RESPONDING TO ENVIRONMENTAL CHANGE

As discussed in Chapter 3 (sections 3.1.2.1 and 3.1.2.2) which outlines fishers' caste-based activities and the gendered division of labour, both Khatia and Khandra communities traditionally rely on fishing for their livelihood. Khatia and Khandra men customarily engage in fishing activities in the lagoon as capture fishers, and Khatia and Khandra women customarily engage in household activities, including fish processing tasks. Changes in the commons (i.e. heterogeneity of resource users, centralized governance) (see section 4.2) have resulted in restrictions in capture fishing, higher rates of fishermen unemployment, and increased out-migration. Over the last 15-20 years, fisherwomen's traditional roles have shown to shift as they become increasingly involved in income generating and community building activities in order to deal with the commons crisis.

Previous sections in this chapter use key examples related to natural disasters, financial pressures, and village safety to describe how Khatia and Khandra women are differentially vulnerable and impacted by environmental change. This section examines how fisherwomen are dealing with environmental change, with a focus on fisherwomen's responses to financial

pressures (see section 5.1.2), and how fisherwomen's roles and identities are evolving and diversifying as a result (see Figure 5.1). The diversification of fisherwomen's roles, largely associated with income generation activities, is examined through the division of labour and fisherwomen's involvement and interest in wage labour, and self-help groups in the form of thrift and credit groups and coconut coir work groups (Table 5.1). Further, I explain how changes in fisherwomen's household and community activities demonstrate the growing heterogeneity of fisherwomen as a group.

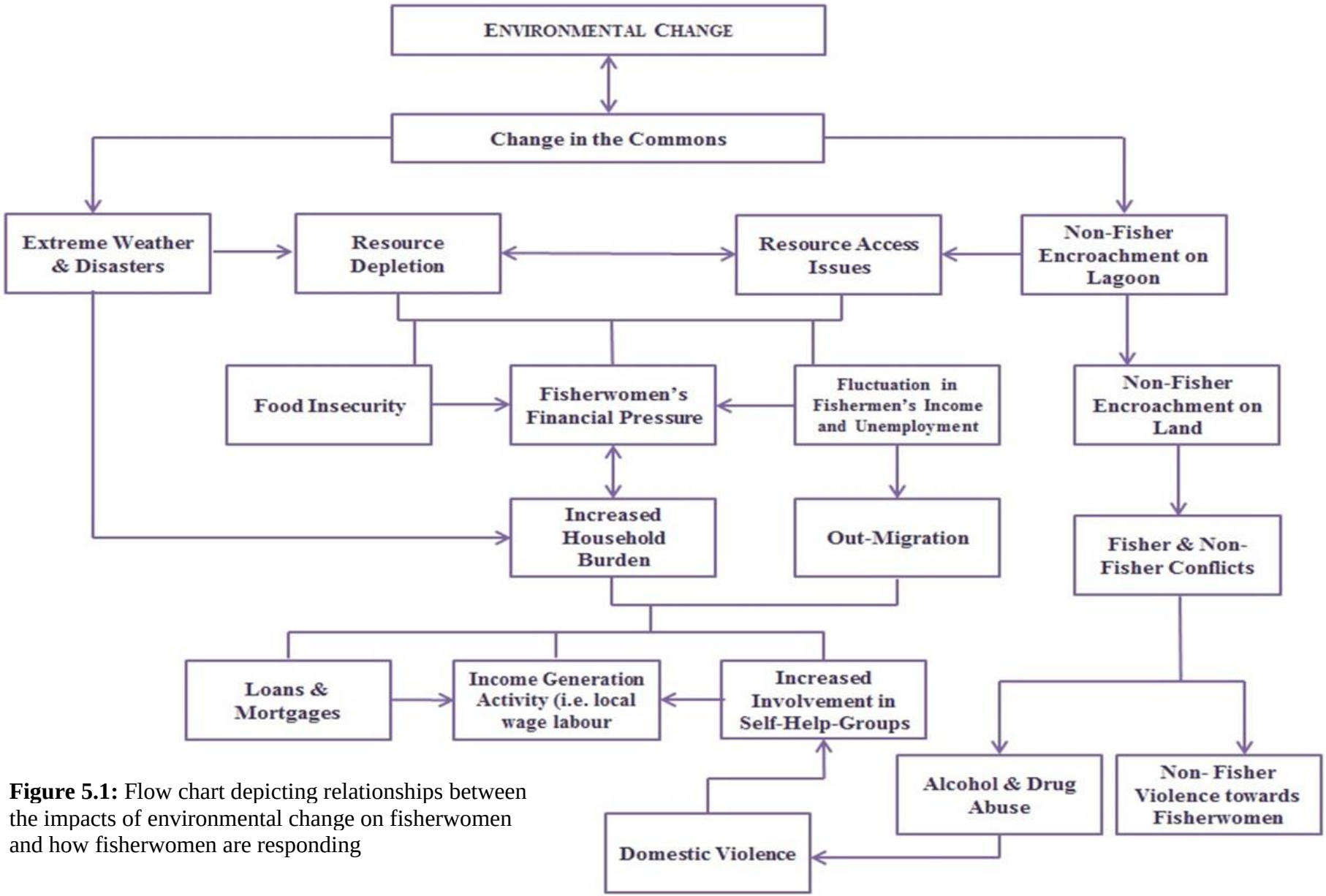

Figure 5.1: Flow chart depicting relationships between the impacts of environmental change on fisherwomen and how fisherwomen are responding

5.2.1 Fisherwomen Working as Local Wage Labourers

All research participants involved in wage labour recognize occupational diversification in their village resulting from fishers losing their traditional fishing activities and livelihoods. This is largely due to resource scarcity and non-fisher encroachments on the lagoon. For 62% of Khandra women participants and 30% of Khandra men participants, income generation involves wage labour such as road construction, masonry, and rice cultivation. Local wage labour contractors are generally non-fishers and the majority of labour is based in non-fisher villages. During the women's focus group in Biripadar, participants shared the perspective that there are more Khandra women working as wage labourers because of fishermen's conflict with non-fishermen over the lagoon. Many Khandra men refuse to work for non-fishers because of this conflict and some Khandra men are denied employment by contractors because they are fisher'men' (personal communications, men's focus group, Biripadar, October 11). Fisherwomen's involvement in wage labour relative to men exemplifies the gender-based caste politics of labour and how some fisherwomen are bearing the brunt of changes in the commons with regard to generating income through local employment.

Generally, Khandra women communicated that they do not feel satisfied working for non-fishers, but are working out of compulsion because of the decrease in Khandra men's fishing incomes, men's unemployment, or increased out-migration of men. 40% of Khandra women participants claimed that they are working as labourers out of desperation to either supplement household incomes or because they have solely become responsible to provide the household income. Financial pressures have even pushed some women into aquaculture related labour. Chanchala Das explained that her husband is in his 70s and is too old and unhealthy to be fishing or working as a labourer. Chanchala and her husband live alone in Biripadar and also have no children to financially support them, which has made Chanchala responsible to earn an income. Chanchala explained that the only job she was able to find, involved building sand bunds for aquaculture in a nearby village which she feels she had no choice but to take.

> *In a way I am ashamed that I am contributing to aquaculture activities as a Khandra woman, but what choice was I left with to survive? The job I have building sand bunds is the only thing bringing in enough money to feed our bellies. I am grateful I have a job right now. I don't know what I will do once the working season is over.* (personal communication, interview, Biripadar, October 5)

Although local wage labour is a means of financial support for women, many wage labour jobs such as building sand bunds, or road construction are seasonal and can be difficult to obtain due to high demand. Wage labourers also do not make very much money, approximately Rs. 350 for a day's work, and some women reported being unpaid. 45% of wage labourer women participating in my research reported unsafe conditions including, harassment and injuries, and health problems due to strenuous labour and the lack of proper safety equipment (i.e. dusk masks, safety glasses, gloves, and boots) (see Figure 5.2). These examples expose that wage labour may be increasing fisherwomen's vulnerability and even advancing the village crises which is further discussed in Chapter 6. Wage labour is also increasing women's household burden. Rajani Das explained that her work days involve travelling with groups of women to and from villages and strenuous physical labour which largely involves her lifting and carrying bricks. After a long day at work she has difficulty attending to household duties such as cooking, cleaning, and child-rearing (personal communication, interview, Biripadar, October 20). For the women's activity profile in Biripadar, participants outlined the typical day of a Khandra women wage labourer which also exemplifies their double burden of working inside and outside of the house (see Appendix I). Participants explained that the activity profile represents the activity patterns of most Khandra women, implying that many women have become wage labourers.

30% of Khatia women are inclined to work as wage labourers to supplement their household income but do not work because their caste restricts women from engaging in such work. Speaking to women and men in Khatisahi, I recognized that financial risks for Khatia women are in part linked to their unemployable status and reflect a gender bias that is caste related. This supports Datta and Gailey's (2012) research which claims that often women's access to resources, particularly jobs, can be limited due to cultural conditions that subordinate the role of women and their decision-making power. Khatia women's unemployable status with regard to wage labour presents a challenge to deal with financial problems along with cultural expectations and norms. However, Khandra women's employment through wage labour is only one way environmental change has diversified women's income generation activities. Fisherwomen are also engaging in self-help groups to generate income which is discussed in the following section.

Figure 5.2: Group of fisherwomen including Khandra women arriving in a non-fisher village to begin construction work. Women are wearing sarees and have no safety equipment or gear (left) (Photo: Fatima Noor Khan)

5.2.2 Fisherwomen's Self-Help Group Activities

Wage labour is not the only way fisherwomen are generating income and responding to the commons crisis. Fisherwomen are also participating in self-help groups which involve thrift and credit activities and partnerships with NGOs facilitating coconut coir work. Self-help groups are contributing to fisherwomen's economic security, increased financial contributions to households, and the development of community building activities within villages.

5.2.2.1 Fisherwomen's membership in Thrift and Credit Groups

Thrift and credit groups are based on the principle of collective action and enable members to reap economic benefits through mutual support and joint responsibility (Jerinabi, 2006). In Khatisahi, there are twelve active women's thrift and credit groups, and in Biripadar there are eight. These groups consist of 10-15 members and promote savings amongst women in common funds which in most cases are linked to commercial banks. Members deposit Rs.100-300 per month in a group bank account with compounded interest. These savings are distrusted to group members as profits or to other community members as loans with flexible repayment systems.

76% of Khatia women participants are members of thrift and credit groups and recognize their activities in these groups as an outlet to help alleviate financial pressures in households related to fishermen's fluctuating incomes. Although thrift and credit groups are reported to have been functioning in Chilika for over 25 years, Khatia fisherwomen explained that their

engagement with these groups has increased with the intensification of economic problems in the village which are linked to aquaculture and resource access issues. These groups have enabled fisherwomen to design and manage mutual financial services and collect funds to help pay for food, events such as marriages, household repairs, children's education, medicine, and other necessities. Thrift and credit groups have also helped fund women's entrepreneurial initiatives in the village. *"As a Khatia woman I am not allowed to work outside of my village. The thrift and credit group I am a member of helped me purchase a sewing machine and start my own tailoring business at home which has helped supplement my husband's fishing income a little bit"* (Urbashi Jena, personal communication, interview, Khatisahi, August 21). Additionally, thrift and credit groups can be understood as empowering women, offering a common platform for fisherwomen to share and discuss problems and issues and overcome their social limitations including financial dependency on men, and lack of access to local decision-making.

Thrift and credit groups are a great resource for fisherwomen, but compared to Khatia women, only 42% of Khandra women participants are involved in these groups. I attended a thrift and credit group meeting in Biripadar in October. During this meeting I was informed by members that a few thrift and credit groups have become inactive as women prioritize time towards wage labour and coconut coir work which is described in the following section.

5.2.2.2 Fisherwomen's Engagement in Coconut Coir Work

In addition to wage labour activities and thrift and credit groups, Khandra women are learning new skills and earning cash by participating in coconut coir work groups. About half a million people are employed in the coir industry in India and 80% of workers engaged in spinning coir yarn are rural women (ICZM Project, 2009). The abundant production of coconut in Odisha has generated large scale employment for coir artisans, especially in coastal districts. In these groups, women extract fibre from coconut husks, spin coir fibres into yarn, and weave yarn into various products such as coir rope, door mats, toys, wall hanging, and cushions. These end products are later sold in local markets and government shops as artisan crafts (ICZM Project, 2009).

65% of Khandra women participants are members of coconut coir work groups. In Biripadar, NGOs have been involved in the formation and handholding of these coir groups for almost ten years and provide marketing support for final products. 45% of Khandra women participants engaged in these groups recognize coir work as providing supplementary income for

households but more so contributing towards community building in their village. Sanju Behera has been working with a coir group called *Gadiswar Swyaon Sahayak Sangathan* (Gadiswar women's self-help group) for two years and earns approximately Rs. 500-700 a month through this group. As Sanju explained, *"Coir work is not making women rich, it only gives us some pocket money. We are still very poor but these groups help women work together and share community concerns"* (personal communication, mixed focus group, Biripadar, October 21). Sanju continued to explain that coir work also allows her to be near her children and work within the comfort of her own village.

While I attended a coir group meeting, women demonstrated how to spin and weave coir fibre into mats. I realized that coir work is a strenuous and labour-intensive, involving long hours of sun exposure and monotonous, repetitive physical tasks for which women get paid relatively low wages (see Figure 5.3). Fisherwomen indicated that they earn little money but coir work helps women gain some financial independence, augment household incomes, and take part in skills training. Coconut coir groups, which are essentially self-help groups, are also helping increase village level awareness and are assisting women in addressing fisherwomen's concerns (see section 5.1).

> *Involvement in coir groups helps women discuss concerns and deal with village problems. For example, groups have talked about making more pit latrines available in the village for women to use. We talk about ways we can work with the NGOs helping us to develop such facilities in our village.* (Dona Behera, personal communication interview, Biripadar, October 15)

These groups are helping women cope and respond to changes in the commons by facilitating women's economic development and social activities for community development.

In comparison, Khatisahi currently has no NGOs supporting self-help groups through coconut coir work or similar group micro-enterprise activities. An analysis of environmental change and fisherwomen's vulnerability identifies greater financial and social problems in Biripadar as compared to Khatisahi (see section 5.1). NGO partnerships in Biripadar are therefore necessary, however, the development of coir groups in Khatisahi has the potential to contribute to Khatia women's monetary earnings while enabling them to still observe caste rules. *"If there were coir groups in Khatisahi I would be able to make some money without going against caste customs and rules. I could help alleviate some of the financial burden in the household which is only growing because my husband is catching less and less fish"* (Anita Das,

personal communication, interview, Biripadar, October 25). Women's involvement in wage labour, different self-help groups, or lack thereof, reflects what opportunities women have, their access to participate in such opportunities, and also what their priorities maybe as they pursue alternative means of livelihood.

Figure 5.3: Biripadar woman demonstrating how coconut coir is spun and pulled to later be woven into final products such as mats (Photo: Fatima Noor Khan).

Table 5.1: Summary of Khatia and Khandra women's activities and experiences engaging in local wage labour and self-help groups

Activity	Khandra Women	Khatia Women
Local Wage Labour	• Working for non-fishers in non-fisher villages • Seasonal wage labour including road construction, masonry, rice cultivation, and aquaculture related labour • Larger population of Khandra women as wage labourers compared to Khandra men • Working to supplement household income or solely provide household incomes • Increasing Khandra women's household burden	• Some Khatia women have shown an interest in wage labour to supplement household incomes • Khatia women are restricted to work as wage labourers due to caste rulings

Thrift and Credit Groups	• 8 active groups • Help pay for ongoing expenses • Financial support for women • Enables women to engage in income generation activities within their own village • Contributing to community development • Notable decrease in these groups as Khandra women prioritize wage labour and coconut coir work	• 12 active groups • Help pay for ongoing expenses • Financial support for women • Enables women to engage in income generation activities within their own village • Contributing to community development • Groups/membership increasing in number alongside a decrease in fishermen's incomes
Coconut Coir Work Groups	• These groups are partnered with NGOs • Women make coir products such as coir rope, door mats, toys, wall hanging, and cushions • Development of new skills and training • Increase in income and savings • Contributing to community development • Enables women to engage in income generation activities within their own village	• Currently there are no coconut coir groups established in Khatisahi • Some Khatia women would like to get involved with NGOs and coir work in the future to increase Khatia women's income generating activities

5.2.3 Growing Heterogeneity of Fisherwomen

Khatia and Khandra women's household responsibilities, levels of community involvement, and identity as fisherwomen is diversifying and reflects a growing heterogeneity of experiences amongst fisherwomen as an identifiable group. This diversification can be traced to the consequences of changes in the commons. For example, 70% of total fisherwomen participants believe that their roles are changing as they shift away from traditional caste-based roles towards alternative vocations, and a diverse range of household and community activities. As a response to fishery resource issues and household income pressures, fisherwomen have shown to increasingly engage in income generating activities through wage labour and self-help groups.

Khatia and Khandra women are still observing their customary caste duties (i.e. processing fish, household tasks) but their traditional activities are becoming increasingly difficult to manage and in some cases fading, which is accompanied with new roles, norms, and adjustments in the division of labour between fisherwomen and fishermen. In Khatisahi and

Biripadar, traditionally, women's primary roles and responsibilities are domestic, and there is a cultural preference for women to attend to these while men perform the role of primary breadwinners. Khandra women's involvement in wage labour exemplifies how the division of labour between women and men is redefining. 65% of Khandra women participants referred to the women of Biripadar as 'labourers' as opposed to 'fisherwomen' which conveys the perspective that fisherwomen's livelihoods and identities are transforming (see section 6.1). Women are increasingly engaging in a variety of income generating activities and some are becoming primary breadwinners of the household as fishermen face difficulty fishing and some become unemployed. These examples show that fisherwomen are crossing gender barriers and entering into what are traditionally "men's zones" which is further emphasized in Chapter 6 through the discussion about fisherwomen pursuing out-migration.

Additionally, it is evident that gender differentiated impacts of environmental change and the livelihood strategies that result are not the same for all fisherwomen. The differential experiences of Khatia and Khandra fisherwomen signify that gender alone is not a determinant of women's vulnerability or response to environmental change. Rather, there is an 'intersectionality' of gender and gender roles with social, cultural, and political factors such as caste, income, geographic location, age, and household membership that increases heterogeneity between different fisherwomen. These factors not only differentiate women of different castes, but also lead to intra-group differences between fisherwomen of the same caste and village. Lastly, although changes in the gendered division of labour involving wage labour can be understood as increasing women's burdens or household pressure, women's involvement in self-help groups can be understood as empowering women in a positive way. Through these self-help group activities, fisherwomen are gaining economic, social, and political strength in their communities and also developing confidence in their capacities. This involves fisherwomen exercising assertiveness in collective decision-making and growth processes which is enabling women to challenge attitudes about their orthodoxy and traditional roles.

5.3 CHAPTER SUMMARY AND CONCLUSIONS

This chapter examined the gendered impacts of environmental change, describing fisherwomen's vulnerability, along with how fisherwomen are responding to change in ways that are transforming their identity, and contributing to the heterogeneity of fisherwomen. By examining

changes including extreme weather and disasters, fishery resource depletion, non-fisher encroachments, and loss of fishers' livelihoods, fisherwomen's increasing susceptibility to environmental risks, financial burdens, and safety concerns were examined. This chapter also contextualized fisherwomen's roles in relation to fishermen and the differential experiences of Khatia and Khandra women. Results reveal how different fisherwomen perceive and experience environmental change in diverse ways in part because of their distinct socially constructed gender roles, responsibilities, and identities which result in various coping strategies and responses including local wage labour and engagement in self-help groups. This chapter further discussed intersectionality and how gender is an impactful and socially constructed variable, influenced by factors such as caste, income, geographic locations, etc. Additionally, this chapter discussed how women's diversifying roles play a part in contributing to fisherwomen's empowerment as women show greater interest and involvement in income generation activities and community initiatives to stabilize the impacts of environmental change. Although it is not completely clear what the future of fisher communities in Chilika looks like with regard to the gendered division of labour and women's community activities, it is evident that fisherwomen's and fishermen's roles and identities are not static, and no longer simply reflect women as fish processors and men as fishers. Chapter 6 further discusses the division of labour in relation to how fisher communities are adapting to environmental change, with a focus on women's perspectives about out-migration and the commons crisis in Chilika.

CHAPTER 6: COMMONS IN CRISIS AND THE PROCESS OF ADAPTATION

Chapter 4 describes environmental changes within the social-ecological system of Chilika lagoon and includes an analysis of the commons, focusing on fishers' rights, resource access, and institutional processes in relation to natural and human induced drivers of change. Chapter 5 highlights key processes of environmental change discussed in Chapter 4, emphasizing the impacts of changing commons on fisherwomen's livelihoods and how they are coping and responding through wage labour and self-help groups. Expanding on the analysis shared in Chapters 4 and 5, Chapter 6 presents research findings related to the third research objective, focusing on fishers' altering relationship with the lagoon and the challenges of adapting to environmental change. Specifically, Chapter 6 examines: 1) transformations in fishers' livelihoods, including changing fishing methods and occupational diversification, 2) out-migration as a key adaptation strategy to environmental change and fishers' growing disconnection with the lagoon, and 3) the crisis in fisher villages in relation to changing commons and maladaptation.

6. 1 TRANSFORMATIONS IN FISHERS' LIVELIHOODS

Traditionally, fishers' livelihoods in Chilika depended on productive activities related to the lagoon, and included fishing methods that had been sustained for many generations through customary commons governance structures (see section 4.2.2.1). With increasing environmental degradation of the lagoon and institutional rearrangements largely associated with aquaculture and non-fisher encroachments, fishers' traditional livelihoods have transformed. This involves new fishing methods that fishers are complying with in order to continue fishing in the lagoon, and occupational diversification as fishers search for alternative means of livelihood. These changes, referenced as transformations, are associated with fishers describing new fishing methods and occupational diversification as extreme shifts from traditions and influential in redefining their livelihoods.

6.1.1 Adapting New Fishing Methods

Fishers have implemented various intensification and extensification strategies, detailed in this section and categorized in Table 6.1, that have enabled them to continue fishing and compete for remaining fishery resources in Chilika. Srikanta Jena who began fishing as a teenager in 1977 explained, *"The ways of fishing are changing more and more from the way my father used to fish and from when I started fishing. There are many things fishers do different now, from where they go to fish, when they fish, and the types of netting techniques they use"* (personal communication, interview, Khatisahi, August 2). Prior to the 1980's, before the entry of non-fishers and aquaculture, Khatia and Khandra fishers used a variety of methods that were based on caste, season, species, and designated fishing locations (see section 4.2.2.1). With degradation of the lagoon and the emergence of top-down governance systems, traditional fishing methods have largely become obsolete (see section 4.2.2.2)

65% of total fishermen participants reported that they are fishing throughout the year, reflecting a shift away from customary fishing systems that established rules and restrictions associated with fishing seasonality. The most common explanation for year-round fishing given by fishermen was that seasonal and weather patterns have become unpredictable along with fish growth cycles. Also, fishers are compelled to fish more frequently to pay ongoing household expenses. Unfortunately, year-round fishing promotes continuously and more vigorously fishing resources that are already scarce and is contributing to further exploitation of the lagoon.

While discussing men's activity profiles in Khatisahi and Biripadar (see Appendix J and K), fishermen explained that the profiles portray an ideal fishing day, although in most cases fishing schedules and timings are highly unpredictable. This is largely because fishermen are increasingly travelling to non-traditional fishing areas to find space to fish. Similar perspectives about extending fishing timings and areas were shared by fisherwomen who commented on fishermen's activities. *"My husband stays out fishing for a long time to get the same amount of catch my father would have gotten in a few hours of work, maybe 15 years ago. A big part of this has to do with my husband travelling long distances outside our village to find fish."* (Rajani Das, personal communication, interview, Biripadar, October 20). Participants commented on how fishermen are travelling into new territories, what some fishers called "free fishing areas", to obtain a profitable catch. These are areas that are not leased to fishers and include protected areas such as the Nalabana Bird Sanctuary (see section 4.2.2.2.1). Fishermen explained that

aquaculture and non-fisher encroachments are presenting obstacles for them to fish in their villages' designated leased areas, which is motivating them to explore new territories. 70% of Khandra men participants and 50% of Khatia men participants reported fishing in new territories in addition to their leased area. A higher response given by Khandra men can be associated with growing incidents of non-fisher encroachment on Biripadar's leased area, which is described throughout Chapters 4 and 5.

Representing an intensification strategy, fishers are also staying overnight on the lagoon to protect their nets and catches from theft. A qualitative analysis of interview and focus group responses suggests that net theft has increased with the depletion of resources, increased competition, and the use of synthetic nets which is linked to the prominence of individualized fishing as opposed to collective fishing practices. Traditional nets and traps were made of materials such as cotton and bamboo and were often used for group fishing techniques, for example particular "kandajala" (cotton net) techniques that required two to three fishermen to work together to throw and pull nets. With the advent of aquaculture and the introduction of synthetic nets made of nylon, fishing has increasingly become an individual activity that to a great extent involves the use of semi-permanent gill nets that are placed in the lagoon in the day and are gathered along with catches in the next morning. Many nets are stolen when they are left unattended overnight. In addition to using synthetic nets, fishers are also using motorized boats as opposed to traditional country boats for fishing and travelling the lagoon (see Figure 6.1). *"Fishermen with motor boats can travel to different areas more easily and increase their opportunity to catch fish. If they use country boats they will not be able to keep up with other fishers, nor travel as quickly…I am lucky I can afford a motor boat, not all fishers can"* (Prafula Kumar Jally, personal communication, men's focus group, Khatisahi, September 13). Prafula's comment illustrates how fishermen are becoming dependent on motorized boats and how the use of motorized boats is associated with social and financial pressures.

With regard to a gendered perspective on the topic of new fishing methods, fishermen participants tended to focus on describing new fishing methods and how they are different from traditional methods. Comparatively, fisherwomen described new fishing methods but focused on discussing the impacts new fishing methods have had on households and fisherwomen's lives. 78% of total fisherwomen participants stated that deviation from customary fishing to new fishing approaches has increased fisherwomen's household burden and levels of stress.

Fisherwomen explained that new fishing methods have contributed to an increased absence of fishermen from households as they spend longer periods of time fishing. This has left many fisherwomen to manage household tasks on their own and also worry about the well-being of fishermen while they are away. *"About five years ago, when [my husband] wasn't away fishing as long as he is these days, he would be home to help me with marketing and managing the house and children. Now I am left to do many of these things on my own"* (Anita Das, personal communication, women's focus group, Biripadar, October 12). *"I worry about my husband's safety when he stays overnight on the lagoon. I worry that he might get in a fight with non-fishers and that he might get hurt fishing* (Jamuna Behera, personal communication, women's focus group, Biripadar, October 12). 58% of total fisherwomen participants believe that new fishing approaches are leading to further depletion of resources and exploitation of the lagoon which is negatively impacting household incomes (see section 6.3). Furthermore, all fishermen and fisherwomen involved in my research share the perspective that traditional capture fishing and even new fishing approaches are becoming increasingly difficult to sustain. Households are increasingly being pressured to abandon fishing and assume alternative means of livelihoods through occupational diversification.

Table 6.1: Summary of intensification and extensification strategies used by fishers in Khatisahi and Biripadar

Intensification Strategies	Extensification Strategies
• Year-round fishing • Longer hours fishing • Overnight trips to fish • Increased monetary investment for fishing • Use of synthetic (nylon) nets • Individualized fishing • Increased fishing labour	• Fishing in new (non-traditional) territories • Use of motorized boats • Fishing a more diverse range of species

Figure 6.1: Motorized boats lined up on the shore of Khatisahi (left) and fishermen fixing synthetic fishing nets (right). Common sights in Chilika depicting the contemporary methods and gear used for fishing (Photo: Fatima Noor Khan)

6.1.2 Transitioning to Alternative Occupations

Changes in the commons have initiated the use of new fishing methods and also occupational diversification, which for some fishers means a divergence from fishing altogether. More commonly, in fisher villages, occupational diversification is reflecting the difficulty many households are facing to keep their primary caste-based vocation as fishers. The depletion of fishery resources, along with other biophysical, social, and political issues related to non-fisher conflicts and centralized governance structures, are contributing to increases in both fishermen and fisherwomen engaging in non-traditional work. Related research findings are introduced in Chapter 5, which detail how the commons crisis has motivated fisherwomen to work as local wage labourers and join self-help groups. This section expands on the gendered division of labour, explaining how Khatia and Khandra fishermen have become increasingly involved in a range of occupations and livelihood strategies as they move away from fishing.

65% of Khatia men participants and 40% of Khandra men participants are still fishing in the lagoon as their primary vocation, but the remainder of men who are working have permanently transitioned to occupations involving small-scale local businesses, local wage labour, or out-migration. I interviewed three Khatia men and two Khandra men who have discontinued fishing to start their own businesses which include rearing buffalo, becoming produce vendors, and driving rickshaws. Himansu Jena had been fishing for 15 years but for the last five years he has been rearing buffalo.

> *I have been a fisher my whole life. Fishing is what the people of my caste were meant to do. I would have liked to continue fishing but I just was not making enough money to support my family and kids. Now, I am raising buffalo and selling buffalo milk. It is not like I make a lot of money doing this, but the work is more stable. I am amongst only a few people (in the village) rearing buffalo so there is little competition and my business is doing okay.* (personal communication, interview, Khatisahi, October 6)

Shanti, who is Himansu's wife, also explained how her role has changed since her husband began this new business.

> *About ten years before my husband stopped fishing, he was making enough money that I didn't need to work. I was helping him process fish but that wasn't work to me, it was something I enjoyed. It also wasn't as labour and time intensive as milking buffalo and selling milk which is what I now help my husband do.* (personal communication, interview, Khatisahi, October 6)

Other than the fishermen I interviewed who have started their own non-fishing business, I was informed about only a small number of fishermen (approximately 10-15) who shifted their occupation from fishing to non-fishing businesses and local wage labour. I was informed that financial capital is needed for entrepreneurial initiatives and to start businesses, which is not a viable option for most fishermen, and as discussed in Chapter 5 (see section 5.2.1), local wage labour jobs are increasingly becoming difficult for fishermen to obtain. In many cases, out-migration has become the only livelihood option for fishers.

6.2 FISHERS' EXPERIENCE WITH OUT-MIGRATION

In Chilika lagoon, the mobility and distribution of fisher populations has been affected as fisher communities increasingly pursue out-migrating as a key adaptation strategy to environmental change. Out-migration is mainly the result of environmental degradation and the loss of traditional livelihoods as exploitation of fishery resources increases and fishers are perpetually deprived of their fishing rights and access to the lagoon. The following sections explain Khatia and Khandra fishers' experience with out-migration, highlighting the impacts of out-migration on fisherwomen's livelihoods. A summary of Khatia and Khandra men and women's migration details is presented in Table 6.2.

6.2.1 Fishermen Out-Migrating

Out-migration in the context of this research, refers to villagers temporarily relocating to cities in India to avail employment opportunities. Villagers migrate to cities throughout India, commonly to urban centers in the southern states of Tamil Nadu, Karnataka, and Kerala. Migrants generally work as wage labourers in the construction, textile, culinary, and electrical industry.

In Khatisahi, approximately 25% of the men's population is reported to have experienced out-migration compared to 45% in Biripadar. 30% of Khatia men and 52% of Khandra men involved in my research have out-migrated once or more in the last ten years. During the men's focus group in Biripadar, participants communicated that out-migration began in their village approximately 15 years ago around the time the new sea mouth opened and aquaculture intensified. In the early 2000s, fishermen used to out-migrate as seasonal migrants who would leave their villages when fish production was low in Chilika lagoon (in the winter months) and would return to fishing for the summer months. Out-migration gradually intensified in fisher villages with greater numbers of fishermen abandoning their fishing practices all together, higher populations of fishermen pursuing migration, and increased frequency of migration throughout the year.

> *Fishermen are migrating throughout the year with no guarantee of when they will leave or come back. I am going to be leaving for Bangalore next week and was told about the job from the contractor nine days ago. I may be gone for three months or maybe six.[Migration] has become a primary source of income for a lot of people in our village so people try to keep migration jobs for as long as they can, or migrate as often as they can.* (Amarnath Das, personal communication, interview, Biripadar, October 2)

Migrants, including Amarnath, indicated that the surge of out-migration in fisher villages is directly related to the growing commons crisis which in many cases is pressuring fishers to make hasty decisions to leave their villages to earn an income.

The average age of migrants is 18-40 with youth populations (aged 18-25) progressively becoming the most common population to migrate. Research participants in Khatisahi and Biripadar communicated that young men are more likely to migrate as opposed to older men because they are not learning how to fish, which leaves out-migration as one of the only options from them to earn an income. Gagindar Jena, aged 24, said,

> *I have been migrating now for four years. I am the oldest son of two and I have one younger sister. My father died seven years ago and since I am the oldest son I am responsible to provide for my family. I used to fish in the lagoon as a teenager with my father but rely more on migration now. Sometimes when I am back in the village I fish but usually wait for my next opportunity to migrate as it brings in more money than fishing.* (personal communication, interview, Khatisahi, October 8)

In Biripadar, Surrendar Das, aged 19, started migrating to Chennai as a painter at the age of 16 as an underage employee and never learned how to fish. Surrendar and his mother, who works as a local wage labourer, have become responsible for managing their household income ever since Surrendar's father quit fishing.

64% of total fishermen participants explained that one of the major reasons men migrate on a continuous basis is because employment through migration offers a more steady income, on average Rs. 6000-8000 a month, as opposed to a fluctuating income through fishing. Supporting this finding, Dasharathi Das, a Khandra fisherman said,

> *Fishing was getting harder and harder for me, both physically and financially. There were many days I would come home with empty nets. When I out-migrate I don't get paid a large salary, but I get a steady salary as opposed to the gamble of fishing and not knowing if I'll even make a profit…More and more fishers are becoming migrants because it is actually becoming one of the only ways to make money.* (personal communication, interview, Biripadar, September 22)

Similar to the way many Khandra women identify as labourers instead of fisherwomen (see section 5.2.3), fishermen are increasingly referring to themselves as 'migrants' as opposed to 'fishers'. The inference that can be drawn from this is that fishermen's identities are being redefined and fishers' are increasingly becoming detached from the lagoon.

6.2.1.1 Fisherwomen's Perspectives about Fishermen Out-Migrating

Household case studies and interviews with fisherwomen expose that the out-migration of men has adverse impacts on fisherwomen's livelihoods. In cases of out-migration in Khatisahi and Biripadar, household men, including husbands, fathers, sons, and brothers make for the majority of the population migrating. When men out-migrate, they tend to leave their families behind which increases women's household burden and in some cases pressures women to generate incomes while men are away (see section 5.1). Increasingly, women are becoming *de facto* head of households, taking the roles of men in addition to their tasks and responsibilities as mothers

and caregivers (see Box 6.1). Amongst the group of fisherwomen involved in my research whose husbands have out-migrated, 78% of fisherwomen communicated that their financial pressure increases when their husbands migrate. This is largely because fisherwomen have little to no savings or access to money to pay for ongoing expenses or unpredictable costs for the duration their husbands are away. Many of these respondents who are Khandra women are pressured to earn income through wage labour which is perceived as an increased burden (see section 5.2.1). Fishermen involved in my research, who have migrated, explained that they try to send money to their families, if they have the means to do so through a trusted friend or family member they have migrated with, but in most cases bring back money upon returning to their village. In Khatisahi, the out-migration of men from households is especially challenging since women are generally restricted from working and have to resort to coping strategies such as taking loans to pay for necessities as basic as food.

A qualitative analysis of communications with all fisherwomen participants suggests that out-migration has become the most prominent adaptation strategy to the commons crisis. Furthermore, fisherwomen communicated that out-migration activities can be perceived as disconnecting fishers from the lagoon and contributing to the loss of fishing knowledge for future generations. *"My husband is not fishing the lagoon at all anymore since he started out-migrating. My fourteen year old son has not learned fishing from his father which has been a tradition for generations. Slowly fishermen and fisherwomen are losing their fishing skills and knowledge"* (Urmila Jally, personal communication, interview, Biripadar, September 25). Additionally, Priti Balia, who is a Khatia women said,

> *Fishing and the lagoon is a part of our lives in so many ways. How we work, what we eat, and what we teach our children is all tied to Mother Chilika. That is all washing away as fishers stop fishing and rush to find jobs outside of Chilika. This saddens me, and sometimes I wonder if we are any good if we can't even fish, which is the job we were born to do.* (Priti Balia Jena, personal communication, mixed focus group, Khatisahi, October 6)

Discussions with Priti Balia exposed that fishers are also losing their sense of purpose as they lose their traditional livelihoods. Imperative to also recognize is that with the progression of time, there are growing reports of women out-migrating and adapting the migrant lifestyle. This signifies how out-migration is intensifying as an adaptation strategy in Chilika lagoon and further disconnecting fisher communities from their traditions.

Box 6.1: Excerpts from field notes

The Experience of Out-Migration

September 19, 2015

Today was my first day meeting the Das family that will be contributing as one on my household case studies in Biripadar. The Das household consists of a mother, a father, and three children (two girls and one boy). The oldest daughter is 13 years old and is living with her grandpa in another village where she is attending school. The younger daughter is 11 years old and the son, 8 years old. I was introduced to the family today and came to know that the mother (Tulsi) began working in non-fisher villages last week as a labourer helping build roads. I met Tulsi in the late evening because she was away for work during the morning and afternoon. Judhistir, the father in the household is a fisherman and has been fishing for 14 years. The Das family is living on the peripheries of the village, closer to the Bay of Bengal, and they are saving to build a house. Currently, they are living in a hut made primarily of mud and palm leaves.

October 12, 2016

Whenever I visit Biripadar I spend some time at the Das household and chat with Tulsi and Judhistir. Today's visit was different. Four days ago Judhistir left the village to out-migrate for the first time. He has gone to Chennai for work and Tulsi is not even sure for what work he has been employed. Judhistir had decreased his fishing practice and many times had mentioned to me that fishing was not something he could depend on for much longer because he was making very little money as a fisher. Tulsi had told me that she started working because her husband's income from fishing was not enough to sustain household expenses. She also mentioned that Judhistir had been considering out-migration for a couple of months. When a family friend of theirs from the village offered Judhistir the opportunity to out-migrate with him to Chennai, Judhistir felt like that was his only option to support his family financially. Tulsi has expressed that she is already experiencing the pressure of her husband having left. She is having trouble managing the household and children without his presence. Tulsi explained that it is very challenging for her to juggle tasks such as getting her children ready for school and marketing, which were tasks Judhistir would help with. Tulsi also said that she does not feel as safe and secure in the village without her husband.

October 21, 2016

I am going to be wrapping up my fieldwork in the next few days, and today is one of my last visits to Biripadar. I spent the day and night at Tulsi's home and participated in some fishing activities with Tulsi and her son. Tulsi learned fishing from Judhistir and is fishing now more than ever before because it is the cheapest way for her to feed her children. She sets nets in shallow waters of the lagoon in the morning at 5am and pulls the nets, gathering the fish at around noon. Although she does not catch very many fish, she catches enough to feed her and her children for the day. Judhistir is still in Chennai and has had a few chances to speak to his family on the phone, sharing the message that he hopes to be back home in June. He also told Tulsi that he will try to send some money with a friend from Chilika who will be moving back to the village in December. In the meantime, Tulsi is working less as a wage labourer, focusing on taking care of her children, and fishing to feed her family.

6.2.2. Fisherwomen Out-Migrating

Cases of fisherwomen out-migrating are relatively few in number compared to fishermen, but my research reveals that women are increasingly adapting out-migration as a practice. For women in Khatisahi, the first cases of fisherwomen out-migrating began approximately five years ago, and in Biripadar approximately eight years ago. Similar to men, women migrate for periods ranging from 3-12 months and mostly migrate to states in South India. Their work is predominately in the textiles industry or construction for which they earn Rs. 6000-7000 per month. Majority of women who migrate, migrate on their own or with other family members to work and earn an income. I was informed that some women move out of state with their husbands, who out-migrate for work, but the women themselves do not work or earn an income. These women out-migrate with their husbands and children in order to continue living together as a family. While I was in the field, I was informed about three women in Khatisahi and 10-15 women in Biripadar who have out-migrated. I did not have the opportunity to speak to any of the three Khatia women, as they were out of state for work during my fieldwork. Two of these women had migrated with their husbands to work, the other was a widow who had migrated alone. In Biripadar, I had the opportunity to speak to two Khandra women who had experienced migration in the past, and one Khandra woman who was preparing to migrate for the first time in October.

Sharing findings from one of my household case studies in Biripadar, two sisters named Priti Behera (age 23) and Prabati Behera (age 20) were interviewed before they left to out-migrate to Bangalore in October. Priti and Prabati are from a household consisting of three sisters, a mother, and a father. Both of these sisters expressed that they have no choice but to out-migrate in order to support their household because their father is no longer fishing—remains unemployed, and because their mother is suffering from multiple injuries sustained from local wage labour, and is no longer working. Their youngest sister is 13 years old and too young to be working.

Prabati explained how she worked on and off for a few years as a local wage labourer with her mother but felt like she was not getting paid enough for the work she was contributing, and sometimes she would not get paid at all. She decided she was going to migrate with Priti in October. *"My sister Priti left for Bangalore three months ago for the first time and worked in a factory doing textile work. Now she has been back home for a few months and is ready to migrate again. This time I will go with her to work"* (personal communication, interview,

Biripadar, October 17). Priti, who I had the opportunity to interview a few days after Prabati, explained her experience out-migrating to Bangalore and the stages of out-migrating, which she described as overwhelming and stressful. Priti explained that before leaving for Bangalore she had to pay the contractor, who was hiring her, money in order to secure her job. Although she did not disclose how much, she said that she had to borrow money from a cousin to pay the contractor. Also, Priti had no experience working in the textile industry and had to be trained for some time before she started working and receiving payment.

> *It was hard at times because I had to support myself to get to Bangalore and pay for housing and food. I started getting paid only after I was trained, which took over a week. While in Bangalore, I was living in a crowded building with other migrants. I am happy to be visiting home and hope that my next experience migrating will be better because my sister will be with me.* (personal communication, interview, Biripadar, October 20)

Priti also explained the difficulty she had contacting her family in Chilika while she was in Bangalore because she was saving money for her family and was therefore not able to afford a phone.

All fisherwomen participants communicated that the main reason women are migrating is to generate income and to support households, especially in cases where women are forced to become primary earners. This was certainly true for the third Khandra woman I interviewed, named Satya Bhama Behera (age 40), who was a widow and had out-migrated twice last year along with two other fisherwomen from her village who are also widows. Satya described how she has been migrating because she has no financial support since her husband passed away, nor does she have any children for support.

Traditionally, Khatia and Khandra women's roles and duties were primarily confined within their households, and income generation was associated with fishing activities. The growing trend of fisherwomen out-migrating from fisher communities like Khatisahi and Biripadar, suggests that social and cultural values along with caste norms in Chilika are changing. *"Women's roles tended to generally be in the home. Now more and more women are out-migrating for work. Women are being pressured to out-migrate because they have to make money and out-migration is the only way they can make money"* (Mandi Behera, personal communication, interview, Biripadar, October 20). 65% of total fisherwomen participants believe that out-migration is contributing to fisherwomen's detachment and alienation from traditional roles and customs. 75% of total fishermen and fisherwomen participants believe that

fisher communities will continue to suffer the loss of fishing as a source of livelihood, and predict growing trends of fisherwomen out-migrating as fishers' search for alternative occupations to support their households.

Table 6.2: Summary of Khatia and Khandra men and women's migration details

Out-migration Details	Men	Women
# of Migrants from Khatisahi	117	3
# of Migrants from Biripadar	358	10-15
Average Age	18-40	18-45
Locations	Throughout India, mostly southern states (Tamil Nadu, Karnataka, Kerala)	Throughout India, mostly southern states (Tamil Nadu, Karnataka, Kerala)
Time Periods	3-12 months	3-12 months
Employment Industry	Construction, textiles, culinary, electrical	Construction, textiles
Salary	Rs. 5000-8000 per month depending on type of work and hours worked	Rs. 5000-7000 per month depending on type of work and hours worked
Migration groups	• Unmarried men (increase in youth migrating) • Married men	• Unmarried women • Married women who migrate with their husbands • Widows

6.3 FISHER VILLAGES IN CRISIS

Environmental change and the process of decommonisation (discussed in Chapter 4) has dismantled fishers' customary governance structures and continues to change caste-based traditions and livelihoods on an individual, household, and community level. As fishers are pressured out of the lagoon due to a combination of interrelated issues such as fishery resource depletion and non-fisher activities involving aquaculture, their rights and traditions are perpetually stripped away. Also, village level unity and cooperation amongst fishers and non-fishers continues to weaken. As discussed throughout the analysis chapters, many fisherwomen have shown to bear the brunt of environmental change. On the whole, the social-ecological condition of Chilika lagoon and fishers' changing livelihoods illustrate a case fisher villages undergoing a commons crisis.

Adaptation, in the context of environmental change, refers to an ongoing process of actions which assist a system to cope, manage or adjust to a changing condition (Smit &Wandel, 2006). Adaptations are not autonomous activities, rather they are related to a continuous stream of social and ecological processes. The escalating crisis has triggered various adaptations involving local wage labour, new fishing methods, and out-migration. In Chilika lagoon, fisher communities are using adaptation and coping strategies on their own or combined, to deal with the commons crisis, which requires fishers to continuously revaluate and redefine how they respond to change. Adaptation strategies are also interacting with existing problems and in some cases can be characterized as maladaptations which further intensify the commons crisis.

The term 'maladaptation' is associated with the problem of increasing risks from adaptation (Barnett & O'Neill, 2010). Specific to the context of my research, in Chilika lagoon, maladaptation can also be linked with adaptations to social-ecological changes that are unsustainable and increasing fisherwomen's vulnerability. Participants' responses and activities documented during my fieldwork expose that fisher villages are experiencing issues dealing with the commons crisis, which largely involves hardship accepting the loss of traditional livelihoods and difficulty adapting to change. 76% of total fishers commented that they are experiencing challenges effectively responding and recovering from the environmental changes they are exposed to on an ongoing basis. Coping strategies such as taking loans and mortgages have proven to only increase perpetuating cycles of debt for fishers (see section 5.1.2). Additionally, new fishing practices and occupational diversification through local wage labour and out-migration can be recognized as maladaptation, because such responses are degrading the ecological condition of the lagoon and contributing to the commons crisis as opposed to improving it.

As explained throughout this thesis, the natural fish resource base from Chilika which fishers have heavily depended upon for generations is depleting. Shifting away from sustainable, customary fishing methods (see section 4.2.2.1 and 6.1.1), new fishing methods which involve intensification and extensification practices (see Table 6.1) are placing additional pressure on remaining resources. For example, customary fishing practices promoted catch and release fishing methods as opposed to new methods and techniques that use fine meshed nets that kill juvenile organisms prematurely, and involve the capturing of a wider range of species throughout the year. Also, the use of motorized boats is contributing to increased pollution and further

degradation of the lagoon. I observed, for example, that motorized boats are readily being used in the lagoon. I experienced how they contribute to noise pollution, which fishers explained also disturbs aquatic resources and wildlife in the lagoon. Additionally, these boats leak chemicals into the water which affects the ecological system of the lagoon and harms fish populations.

Furthermore, adaptations involving occupational diversification are a response to the degradation of the lagoon and the social, economic, and political deprivation fisher-castes are suffering. Fisher communities expressed being apprehensive about adapting local wage labour and out-migration strategies and the uncertainty such practices present for livelihoods and the future of fisher communities. Rather than rebuilding the commons, these adaptation strategies are adversely impacting livelihoods and reconfiguring the commons in a way that is further marginalizing and displacing fisher communities. For instance, fishers who do diversify their occupations, take alternative jobs for which they have little to no skills, many experience unstable and unsafe employment conditions, and oftentimes still face income insecurity as they are cheated out of work or unfairly paid. Fishers' absence from fishing is also giving non-fishers greater access and control over the lagoon. Additionally, contemporary forms of adaptation are alienating fishers from the lagoon and forcefully disconnecting fishers from their traditions. During the women's focus group in Biripadar, four of the six participants shared that they have discontinued their fish processing chores and communicated that they feel estranged from the lagoon not only because they have been pushed away from fishing activities, but also because they are absent from their villages when they are forced to prioritize work as local wage labourers or migrants. When fishers are absent from fishing and their villages, the unity and cohesion of fisher communities' which was indicative of customary governance structures and the success of the commons, is further dismantled. The reality of fishers increasingly being forced to adapt new fishing methods and occupations, suggests that such adaptations are accommodating the commons crisis as opposed to contesting it.

6.4 CHAPTER SUMMARY AND CONCLUSIONS

Throughout the analysis chapters of this thesis, I have referenced how, over time, caste-based traditions and customary fishing systems have been restricted and in some cases completely obliterated as a consequence of environmental change. Specifically, this chapter addressed how the commons crisis has impacted fishers' traditional livelihoods by triggering adaptation

strategies that are helping fishers deal with change, but are in turn also contributing to the commons crisis as maladaptation. This chapter explains how fishermen's and fisherwomen's livelihoods are transforming as they adapt new fishing methods and transition to alternate occupations. With a focus on examining out-migration as a key adaptation strategy, this chapter analyzed fishermen and fisherwomen's perspectives about increasing trends of fishers' out-migrating and the impact this has had on fisherwomen's lives and their communities. This chapter reveals that by practicing new fishing methods and occupational diversification, the fisher communities of Khatisahi and Biripadar are further experiencing loss of livelihoods and disconnection from the lagoon and their traditions. Finally, this chapter shares the perspective that fisher communities continue to face challenges as they proceed to adapt to the commons crisis and the uncertainty it presents for future change. The following and final chapter (Chapter 7) summarizes key outcomes and findings in relation to the three research objectives and presents recommendations and final conclusions.

CHAPTER 7: CONCLUSIONS

The first section of this concluding chapter summarizes the research purpose and methodology in relation to the conceptual framework that guided my research and the analytical process. The following section revisits key findings in relation to the three research objectives and corresponding analysis chapters (Chapters 4-6). Further, the chapter highlights the key lessons and contributions of my research, after which the chapter closes with recommendations and final conclusions.

7.1. SUMMARY OF RESEARCH PURPOSE AND METHODOLOGY

For this research project, I used a gender lens with a focus on fisherwomen to examine environmental change and fishers' livelihoods, highlighting two fisher-caste villages called Khatisahi and Biripadar. The conceptual framework used for this research guided a social-ecological systems analysis that focused on contextualizing women's perspectives about environmental change in relation to drivers of change, the changing nature of the commons, and adaptation (see section 2.4).

This research measured and assessed interrelationships between humans and nature in an inductive, iterative, and integrative fashion, using constructivism and grounded theory as a methodology. The qualitative case study approach combined a variety of research methods to facilitate the data collection and analysis process in order to address my research purpose and objectives (see section 1.2). Document review, semi-structured interviews, focus groups, household case studies, and participant observation, was employed over the course of three months in the field. PRA tools (social maps, seasonal calendars, activity profiles, and Venn diagrams) were also used to actively engage research participants and to ensure that research findings and analytical results reflected the nature of the research setting and the lived experience of locals. Triangulating data was essential to gather information at different stages of my fieldwork and to facilitate data analysis on an ongoing basis (see section 3.2.2.3). Household case studies gave me the opportunity to learn from ethnographic experiences which helped expand understandings of similarities and differences in fishers' livelihoods in relation to social and ecological realities. Research findings in relation to the three research objectives are summarized in the following section.

7.2 SUMMARY OF FINDINGS

Research findings address the three objectives which are closely related, and build off the main research purpose (see section 1.2). Results were analyzed in relation to the conceptual framework which also draws on secondary research detailed in the literature review (see Chapter 2). The following subsections summarize the research findings in relation to the research objectives as presented in the analysis chapters (see Chapters 4-6).

7.2.1. Objective One

To examine fisherwomen's perspectives about changes in the fishery commons, with a focus on understanding fishers' rights, resource access, and institutional processes in relation to drivers of change within the social-ecological system of Chilika lagoon.

An analysis of dynamic interactions within the social-ecological system in Chilika lagoon reveals that both natural and human induced drivers of change are contributing to exploitation of the commons, including the depletion of fishery resources. Natural drivers include biophysical changes involving climate change and variability, and extreme weather and disasters. Aquaculture and the opening of the new sea mouth are recognized as human drivers of change that are furthering the degradation of the lagoon, and ultimately, exacerbating the commons crisis (see section 4.1).

My research focused on women's perspectives of environmental change, and outlined a story of the Chilika lagoon commons retreating from customary governance and commonisation, to top-down governance and decommonisation (see section 4.2.2). For generations, customary fishing practices and governance structures dealt with excludability and subtractability issues in a manner that protected the commons and prevented occupational competition and conflict (see section 4.2.2.1). Shifts in the commons from commonisation to decommonisation can be associated with institutional rearrangements that have contributed to infringements on fishers' rights and diversified patterns of resource use, most significantly through the influx of non-fishers practicing aquaculture (see section 4.2.2.2). Institutional rearrangements have also involved the replacement of local institutions such as fisher cooperatives (i.e. PFCS and CFCMS) with state level authority and regulatory bodies such as the CDA and FISHFED, transitioning communal property to state property and privatization. These changes initiated the

designation of protected areas, such as the Nalabana Bird Sanctuary which has hindered fishers' access to customary fishing sites, lease policy restructuring which has increased non-fisher encroachments and the illegal practice of aquaculture, and top-down decision-making which neglects the perspectives and knowledge of fisher communities. With the breakdown of local institutions and prominence of centralized governance approaches, fisher communities continue to be pushed out of their primary vocations as fishers, into new fields of work and unsustainable practices that are leading to further degradation of Chilika lagoon.

Fisherwomen perceive and interpret change in the commons as transforming fishers' livelihoods in ways that are marginalizing fisherwomen and increasing their household burden. With the process of environmental change, specific challenges for fisherwomen, with regard to changes in the division of labour and the diversification of gender roles, have emerged which are further discussed in relation to objective two.

7.2.2. Objective Two

To analyze the key impacts of environmental change (i.e. objective one) on the livelihoods of fisherwomen and how fisherwomen are responding.

Processes of environmental change are contributing to a commons crisis which is adversely affecting fisherwomen and their livelihoods. Fisherwomen are becoming increasingly vulnerable and impacted by extreme weather and disasters, fishery resource depletion and resource access issues, and non-fisher encroachments (see section 5.1). Changes associated with increased frequency and intensity of natural disasters, such as cyclones, are disproportionally increasing fisherwomen's responsibilities as primary caregivers and increasing risks for fisherwomen. Fishery resource depletion and resource access issues have shown to increase fisherwomen's household burden as fishermen are pushed out of their primary vocations. In many instances, fisherwomen are becoming *de facto* head of households and primary earners of household incomes. Additionally, non-fisher encroachments have disturbed fishers' access to the lagoon, and encroachments have extended to adjacent village lands. This has amplified property rights concerns for fisher communities and conflicts and violence in villages for which fisherwomen have been made targets.

Fisherwomen are increasingly becoming vulnerable to environmental risks, financial pressures, and lack of safety in villages with the growing commons crisis. However,

fisherwomen are actively coping and responding to environmental change as well (see section 5.2). Fisherwomen facing financial constraints are taking loans and mortgages to support their family's basic needs (i.e. food and clothing), especially in cases when household men have out-migrated. In the case of increasing household burdens, fisherwomen are engaging in local wage labour to earn incomes. Furthermore, fisherwomen are becoming involved in self-help groups. In Khatisahi, these groups function as thrift and credit groups, and in Biripadar they also include coconut coir work groups. These self-help groups are perceived as empowering fisherwomen as they provide outlets for women to gain some financial independence and contribute to community building initiatives.

Fisherwomen's activities reflect ways in which they are responding within the scope of their traditional gender roles, but in a growing number of cases, outside of these roles as well (see section 5.2.3). As fishermen progressively disconnect from traditional fishing practices, gender roles and the division of labour between fisherwomen and fishermen has shown to change. Although women have traditionally engaged in household activities (i.e. cooking and cleaning) and fish processing activities, fisherwomen's tasks and roles are diversifying. Fisherwomen's changing household and community activities demonstrate that gender roles and identities are not static; rather they are constantly in flux with the changing environment. Furthermore, gendered impacts of environmental change are not only differentiated between genders (i.e. men and women), they vary within gender groups. The intersectionality of gender with factors such as caste, age, income, and marital status, plays a major role in shaping livelihoods and responses, which is contributing to the growing heterogeneity of fisherwomen as a group. For example Khatia and Khandra women's involvement in local wage labour, as a response to the commons crisis, largely varies because of caste customs that permit Khandra women from engaging in wage labour, but condemn Khatia women when they do so. However, some fisherwomen are considerably redefining gender assumptions and expectations. This can be recognized through fisherwomen's increased involvement in out-migration which is discussed in the following section.

7.2.3. Objective Three

To examine how fishing communities are adapting to the ongoing process of environmental change, with reference to fisherwomen's experience with villagers out-migrating and their perceptions about fishers' changing relationships with the lagoon.

With the decline of customary governance structures and decommonisation, fishers' livelihoods are transforming on an individual, household, and community level. Fishers are forced to adapt new fishing methods to compete for limited resources, and many fishers are pursuing alternative occupations (see section 6.1). New fishing methods are significantly different from customary fishing methods and include intensification and extensification practices (e.g., fishing in non-traditional territories and using synthetic fishing nets). New methods are understood by fishers as unsustainable and contributing to further exploitation of the lagoon. For many fisher households, fishing is no longer a feasible option due to the severity of social and ecological pressures and changing village dynamics. Fishers are therefore diversifying their occupations and in many cases transitioning away from fishing based livelihoods.

Although fisherwomen and fishermen are working jobs including local wage labour and small businesses, out-migration is increasingly becoming a popular adaptation strategy (see section 6.2). Out-migration of fisherwomen is a completely new trend which has emerged approximately in the last five years in Khatisahi and last eight years in Biripadar. This trend reflects the severity of the commons crisis which has pushed fisherwomen away from their traditional roles and pressured them to substantially contribute to household incomes, especially Khandra women. Although Khatia women typically do not work outside of their village, their entrance into out-migration reflects changes in caste traditions associated with the gendered division of labour and the ongoing process of adaptation to a commons crisis which is escalating.

One of the greatest implications of livelihood changes in fisher communities has been the disconnection of villagers from the lagoon and their traditions (see section 6.3). Many Khatia and Khandra women and men, especially youth, are becoming alienated from their traditions and are self-identifying as labourers and out-migrants as opposed to fishers. Fishers' detachment from the lagoon and absence from fishing has simultaneously increased the prominence of non-fishers occupying the lagoon. This demonstrates how adaptation strategies not only function as a response to the commons crisis, but also contribute to change. This suggests that some adaptation

strategies are in fact ‘maladaptive’ and are amplifying the commons crisis instead of alleviating it.

7.3 KEY LESSONS AND CONTRIBUTIONS

Research findings collectively illustrate that environmental change in Chilika lagoon is mediated through complex social and ecological processes, including drivers of change (e.g., opening of the new sea mouth and aquaculture), that are contributing to the continuous creation and recreation of the commons. This thesis addresses a research gap by calling attention to fisherwomen’s perspectives about environmental change which are often neglected. The utilization of a gendered lens highlights the reality of fisher communities in Chilika lagoon facing a commons crisis that presents gender differentiated impacts and challenges for livelihoods to respond and adapt to change. Fisherwomen’s narratives contribute to an understanding of the changing nature of the commons and ongoing processes of adaptation. In relation to this, it is evident that the impacts of environmental change and the livelihood strategies that result are not unanimous amongst gender groups (i.e. between fisherwomen). This has especially been made apparent through a comparative analysis of fisherwomen’s experiences and knowledge in the villages of Khatisahi and Biripadar which represent distinct castes and locations in Chilika. Further, the analysis of fishers’ adaptation strategies in Chilika lagoon uncovers a novel contribution regarding the new trend of fisherwomen out-migrating as a response to the growing commons crisis. This trend reflects the critical state of the commons which has had profound consequences on fishers’ caste-based culture, specifically gender roles and the division of labour. Fisherwomen’s experiences and perspectives convey messages of great uncertainty about how the Chilika commons will progress and what the future holds for fishers’ livelihoods.

7.4 RECOMMENDATIONS

Research findings provide useful insights for making recommendations about sustaining the Chilika lagoon commons through inclusive governance approaches and decision-making that actively engages and recognizes fisher communities–particularity the experiences and knowledge of fisherwomen. Results and recommendations drawn from this research project may be relevant for policy and planning bodies, and NGOs involved in Chilika. The following recommendations

have been developed by combining a critical analysis of research findings with direct suggestions given by Khatia and Khandra fishers during data collection activities.

1. Involvement of fisher communities through multi-level governance approaches and inclusive decision-making is vital. This has potential to improve the commons and empower fisher communities who are perpetually being marginalized through centralized governance structures (see section 4.2.2.2). As an alternative to contemporary top-down approaches, multi-level governance would bridge the gap between centralized governance structures and customary governance approaches. Multi-level governance would involve recognizing fisher-caste communities and their rights in order to enable equitable and inclusive decision-making, communications with a wide range of stakeholders—including fishers and non-fishers, and collaboration with various institutions (i.e. village level institutions and state institutions). This would replace current decision-making approaches that have disregarded fishers' perspectives (e.g., in the case of opening the new sea mouth), and foster an environment to work towards resolving fisher and non-fisher conflicts. Furthermore, a multi-level governance approach would facilitate participatory processes and opportunities for co-management of the lagoon commons. This has potential to connect community based management with both regional and state level management, link knowledge systems, and promote collaboration in order to make sound assessments and management decisions.

2. Decision-making that acknowledges gender differentiated impacts of environmental change and adaptation is important. This is especially imperative to highlight fisherwomen's knowledge and concerns, noting their increased burdens, inequitable access to resources, and absence from decision-making processes in the face of a commons crisis. For example, communications with fisherwomen uncover how fisherwomen are often excluded from decision-making and participation in government training initiatives (i.e. pre-disaster training workshops) (see section 5.1.1). Recognizing fisherwomen's exposure to environmental change, but also the knowledge they possess with regard to the environment and resources, suggests the necessity to include fisherwomen in decision-making and adjudication processes. Such inclusivity and knowledge exchange will help fisherwomen exercise their rights and empower fisher

communities as whole. This would also include giving fisherwomen the opportunity to define their own concerns and issues to help devise appropriate action plans and policies. For example, basic facilities such as pit latrines/toilets are not available in Biripadar. Khandra women voiced their urgent request for pit latrines/toilets to be built within their village. This was a greater concern for Khandra women as opposed to men, not only to fulfil a basic need, but in relation to non-fisher violence (see section 5.1.3). This illustrates an example about why dealing with the commons crisis through gender sensitive assessments and protocols is necessary.

3. There is a need for effective implementation of policies, including further enforcement to eradicate aquaculture from the lagoon. The advent of aquaculture in Chilika has increasingly contributed to biophysical changes such as fishery resource depletion and institutional rearrangements in favour of the commodification of fishery resources, particularly through the shrimp export industry. Recognizing that aquaculture has been legally banned, fishers propose that strict law enforcement and policy implementation is necessary to deal with aquaculture encroachments and to safeguard the lagoon and its fisher communities. Fishers explained that organizations such as FISHFED and the CDA should be held accountable for their inaction in response to the illegal practice of aquaculture and should revisit management protocols. Further consultation with fisher communities and monitoring is necessary to make sure policies and procedures are followed and aquaculture practices are ceased. Since aquaculture is largely associated with the influx of non-fishers in the lagoon, fishers also make recommendations to negotiate/restructure lease policies in accord with non-fishers to deal with conflicts and encroachment issues (see section 4.2.2.2.2). This would in part involve the reduction of lease fees, which would assist in reducing growing instances of fishers subleasing areas which are ultimately converted for aquaculture use.

4. Fisherwomen from both Khatisahi and Biripadar recognize that collaborations with NGOs are beneficial for village development and the empowerment of fisherwomen. Although further restructuring of governance approaches is necessary to work towards rectifying issues and improving the commons, fisherwomen's perspectives indicate that

engagement with NGOs, particularly NGO assistance with women's self-help groups, has helped fisherwomen cope and manage through the commons crisis (see section 5.2.2). For instance, NGO involvement in Biripadar, which has helped establish coconut coir work groups for women, has helped highlight local community needs and concerns from a gender perspective. Khatia fisherwomen have suggested that such projects be established in their village as well. Understanding that NGOs work closely with fisherwomen in villages, it is important that NGOs continue such engagements and strengthen gender sensitive assessments for future projects.

Furthermore, increased opportunities for skill development and training through government support and NGOs should be offered to fisherwomen to enhance their financial security and protection in villages. This would include implementing culturally appropriate programs that help fisherwomen deal with changes associated with the commons crisis. For example, including fisherwomen in pre-disaster training workshops, violence intervention and self-defence programs to address domestic abuse issues, and village counselling services to help fisherwomen cope and manage through livelihood changes associated with out-migration (see section 5.1).

External intervention strategies pursued by agencies and NGOs should be collectively monitored, with ongoing communication with locals, for successful implementation and to determine whether or not local needs are addressed appropriately. This "bottom-up" approach will assist in ensuring that knowledge and action is grounded in and reflects the lived experiences and sensitivities of locals, building capacity for them to engage as active participants.

7.5 FINAL CONCLUSIONS

The examination of small-scale fisheries in Chilika lagoon offers extensive insight about the interconnectivity between social and ecological systems, and various processes of environmental change that are continuously reorganizing the commons. Chilika lagoon reflects many stories of complex, convoluted, and multi-faceted problems related to a commons crisis. Evidently, fisher communities in Chilika that depend on the lagoon for their social, cultural, and economic needs are constantly adapting to environmental change and the chronic uncertainty it presents.

The gender lens used throughout this project highlights how gender plays a large role in mediating people's relationships with one another and the biophysical world. Focusing on women and environmental change, my research reveals that fisherwomen experience and live through environmental change in different ways as opposed to fishermen, and that fisherwomen face unique challenges directly and indirectly connected to their gender. Especially, in cases of maladaptive practices (i.e. new fishing methods and out-migration), fisherwomen's exposure and vulnerability to environmental change is increasing and fisher communities' livelihoods are further disconnecting from their traditions and the lagoon.

Moving forward, it is important to continue to work towards better understanding the social-ecological system of Chilika lagoon and both natural and human drivers of change. An ongoing assessment of the gender sensitive impacts of environmental change and resulting adaptation strategies is important to appropriately identify issues and formulate solutions that are viable for dealing with the commons crisis in relation to governance approaches. In relation to this, a people oriented and a practical approach for addressing the multi-faceted problems is a priority to empower fisher communities, especially fisherwomen, to help foster positive change.

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APPENDIX A- ETHICS CLEARANCE FORM

UNIVERSITY OF WATERLOO

OFFICE OF RESEARCH ETHICS

Notification of Ethics Clearance of Application to Conduct Research with Human Participants

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Faculty Supervisor: Derek Armitage **Department:** Environment & Resource Studies

Faculty Supervisor: Prateep Nayak **Department:** School of Environment, Enterprise and Development

Student Investigator: Fatima Noor Khan **Department:** Environment & Resource Studies

ORE File #: 20809

Project Title: Women and Environmental Change: A Case Study of Small-Scale Fisheries in Chilika Lagoon

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This certificate provides confirmation the above project has been reviewed in accordance with the University of Waterloo's Guidelines for Research with Human Participants and the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans. This project has received ethics clearance through a University of Waterloo Research Ethics Committee.

***Note 1**: This ethics clearance is valid for one year from the date shown on the certificate and is renewable annually. Renewal is through completion and ethics clearance of the Annual Progress Report for Continuing Research (ORE Form 105).*

***Note 2**: This project must be conducted according to the application description and revised materials for which ethics clearance has been granted. All subsequent modifications to the project also must receive prior ethics clearance (i.e., Request for Ethics Clearance of a Modification, ORE Form 104) through a University of Waterloo Research Ethics Committee and must not begin until notification has been received by the investigators.*

***Note 3**: Researchers must submit a Progress Report on Continuing Human Research Projects (ORE Form 105) annually for all ongoing research projects or on the completion of the project. The Office of Research Ethics sends the ORE Form 105 for a project to the Principal Investigator or Faculty Supervisor for completion. If ethics clearance of an ongoing project is not renewed and consequently expires, the Office of Research Ethics may be obliged to notify Research Finance for their action in accordance with university and funding agency regulations.*

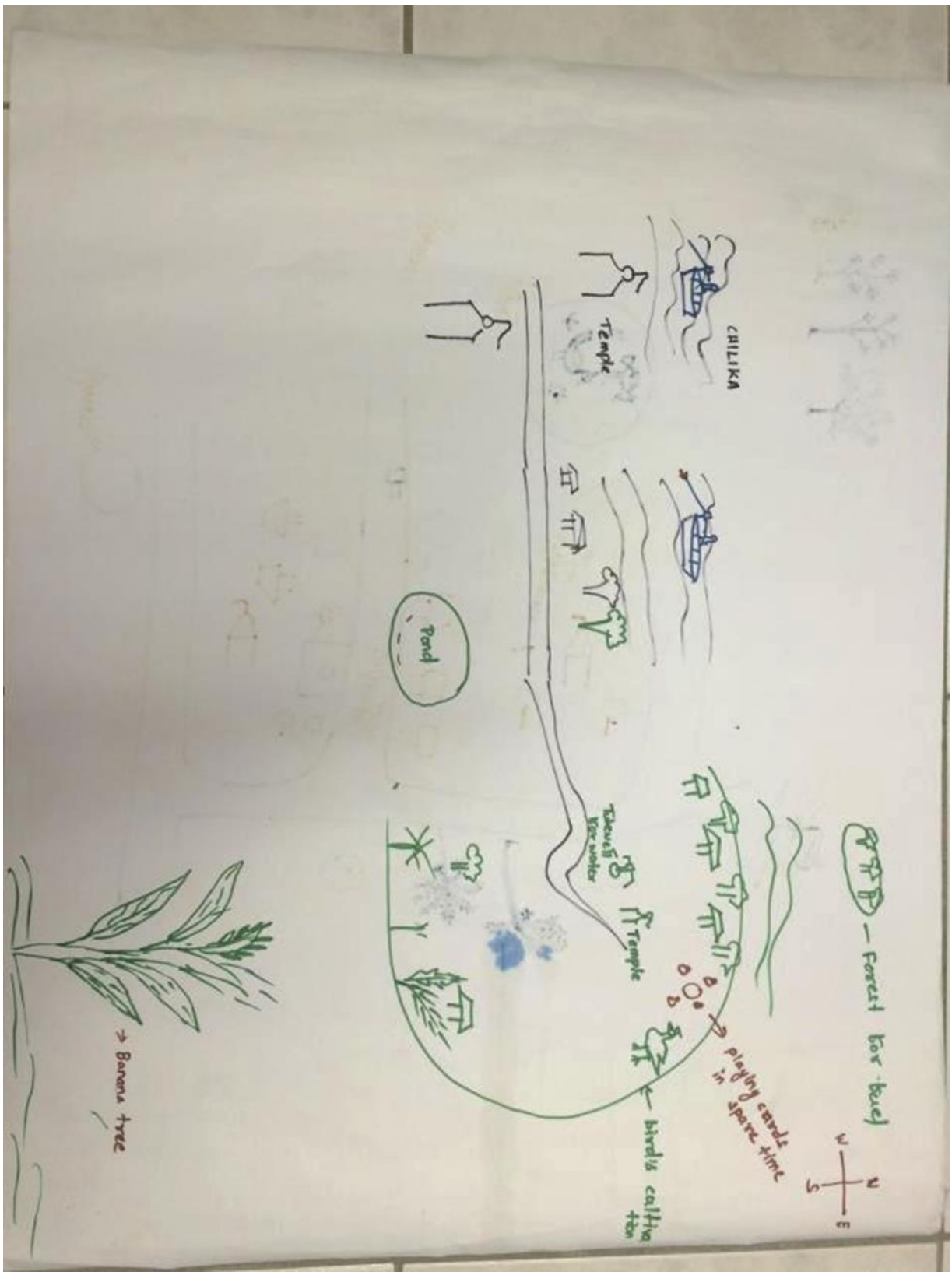
***Note 4**: Any unanticipated event involving a participant that adversely affected the participant(s) must be reported immediately (i.e., within 1 business day of becoming aware of the event) to the ORE using ORE Form 106. Any unanticipated or unintentional changes which may impact the research protocol must be reported within seven days of the deviation to the ORE using ORE form 107.*

Maureen Nummelin, PhD
Chief Ethics Officer

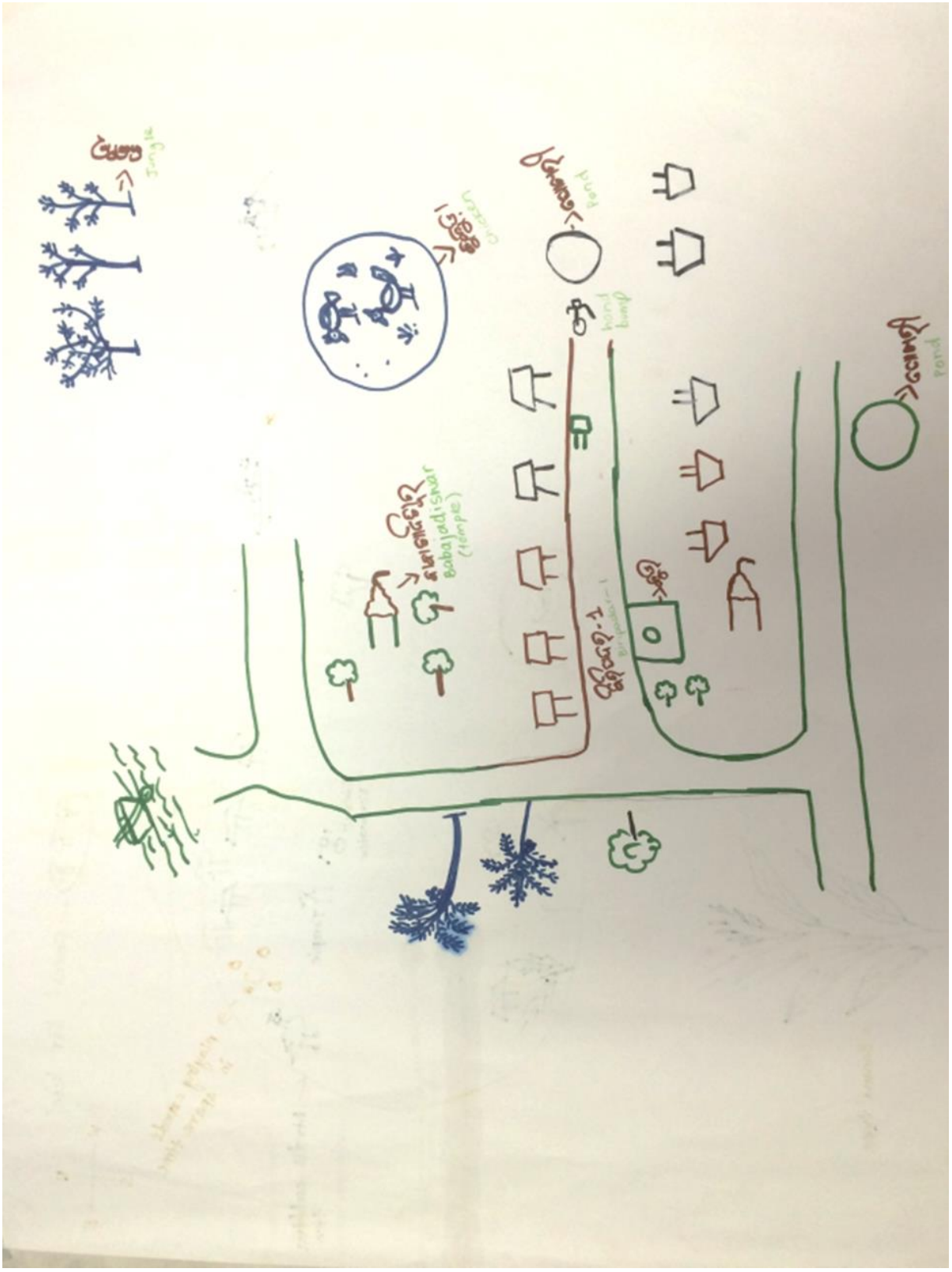
7/6/2015
Date

OR
Julie Joza, MPH
Senior Manager, Research Ethics

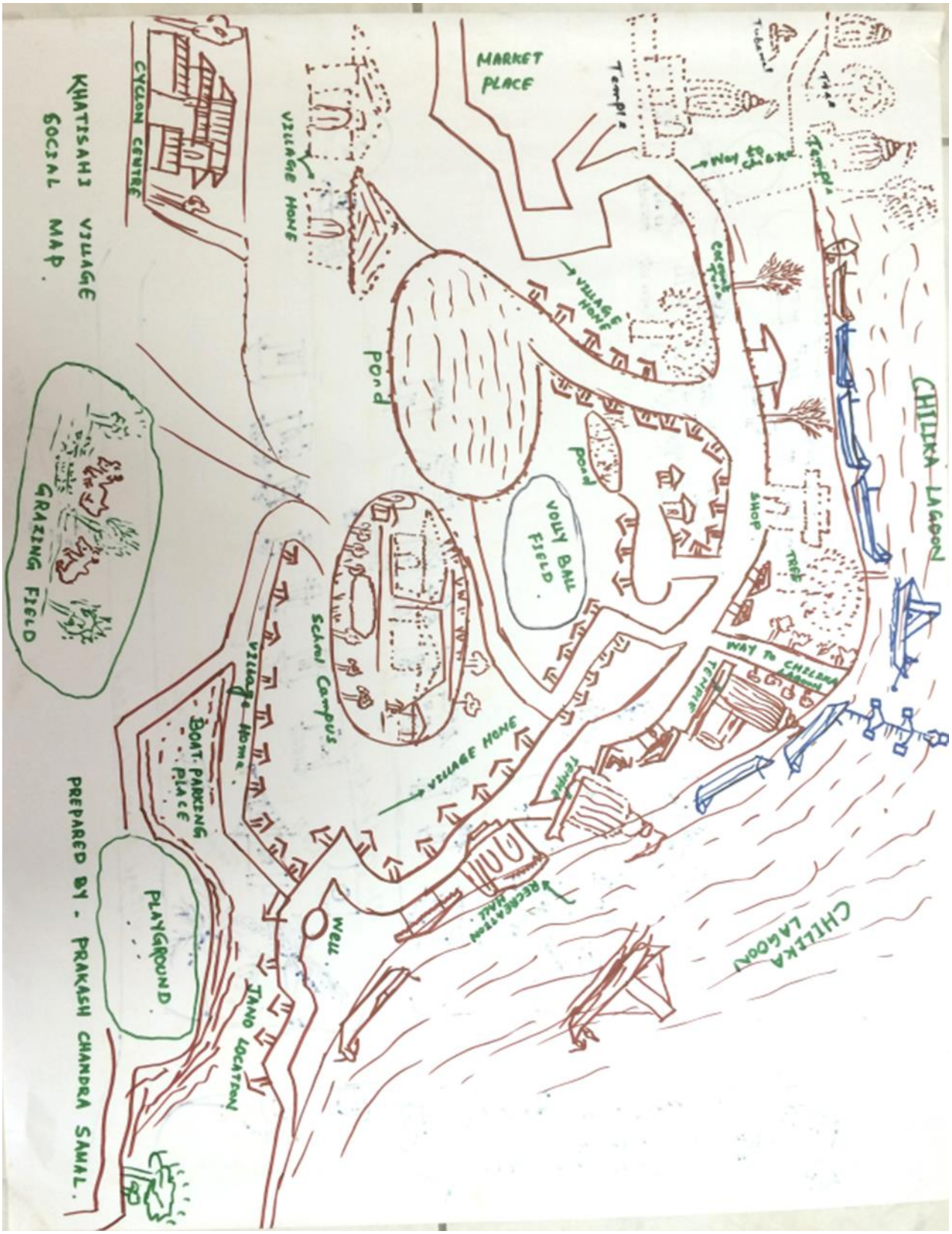
APPENDIX B- WOMEN'S SOCIAL MAP (KHATISAHI)



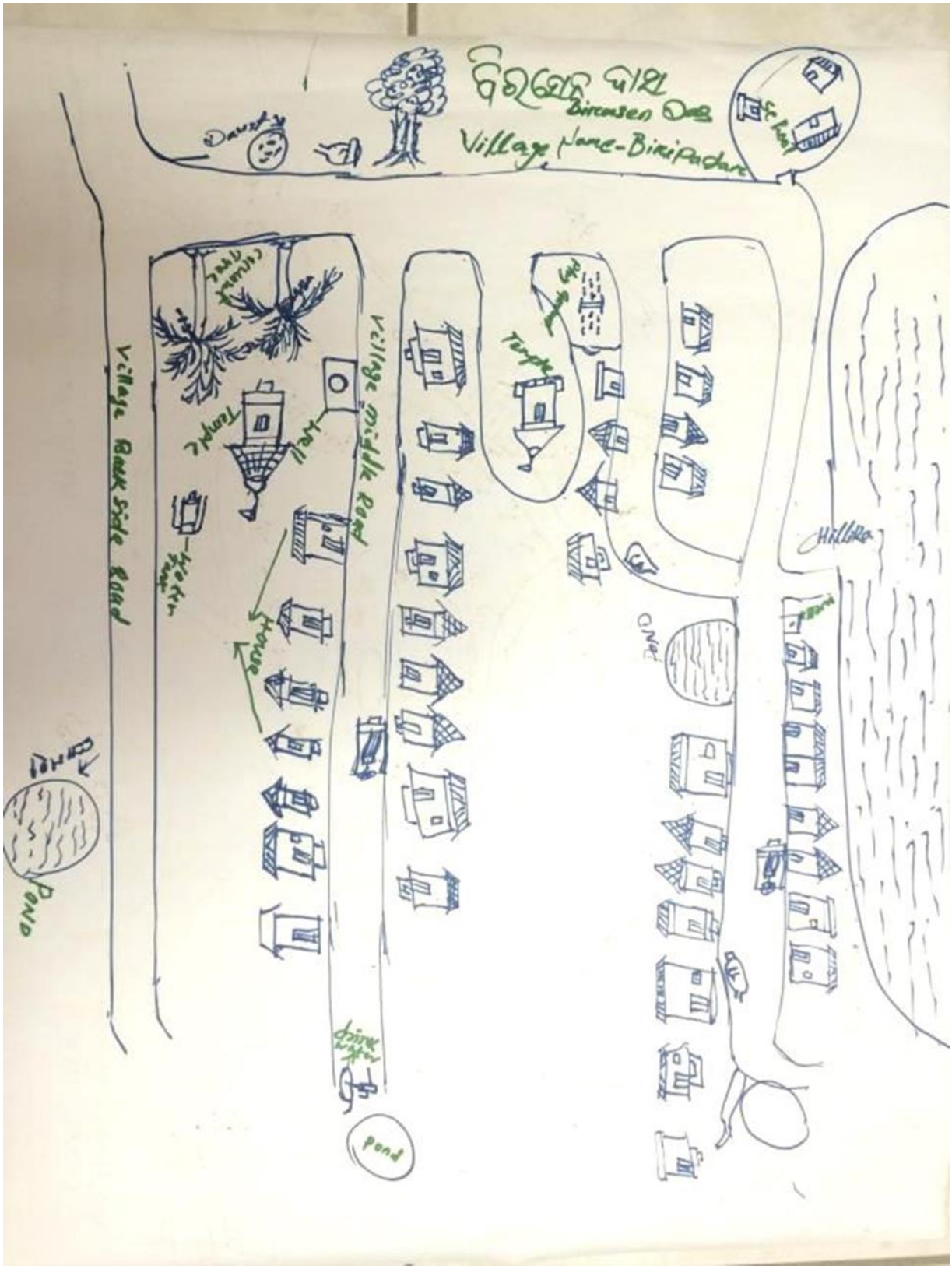
APPENDIX C- WOMEN'S SOCIAL MAP (BIRIPADAR)



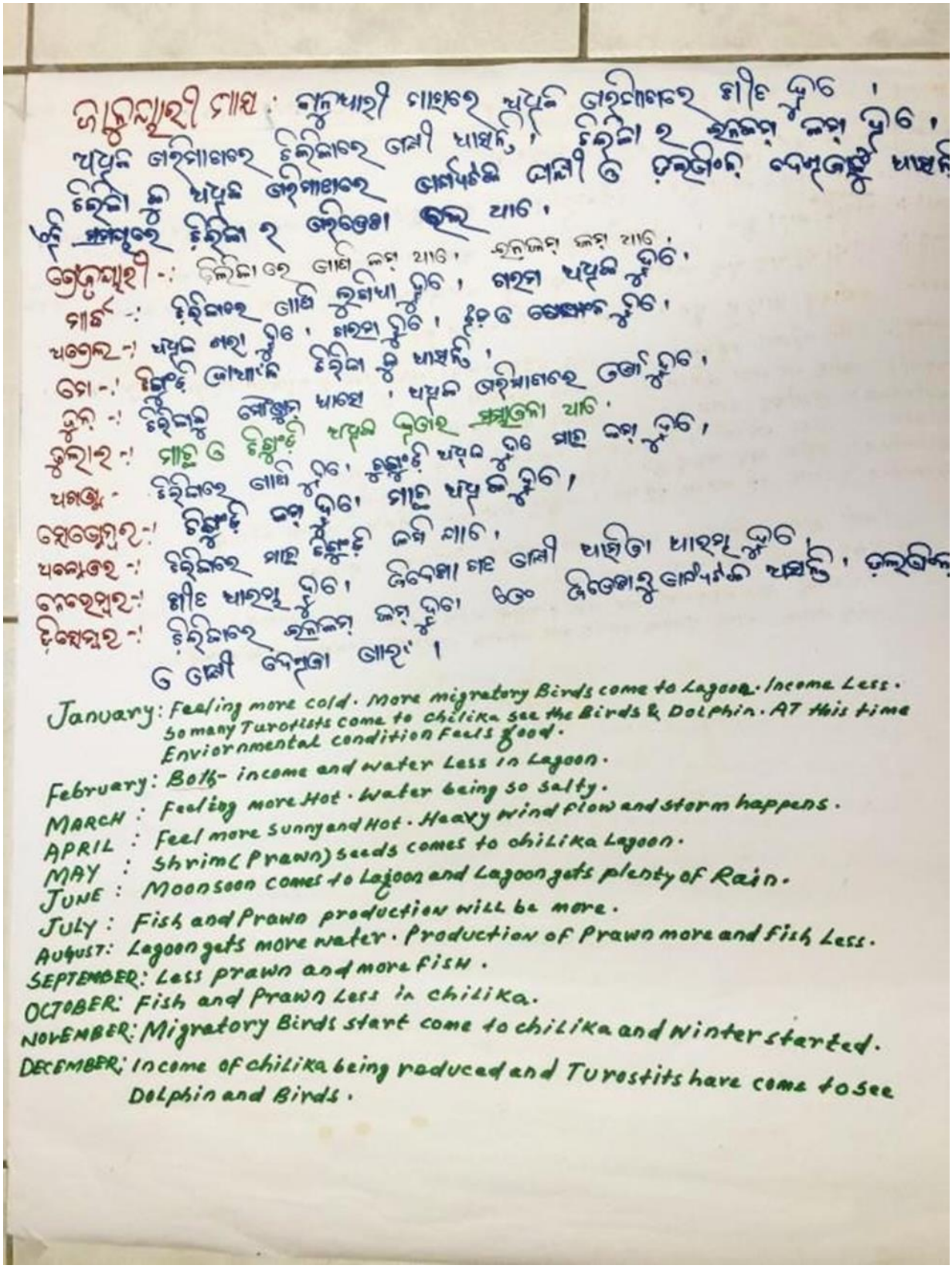
APPENDIX D- MEN'S SOCIAL MAP (KHATISAHI)



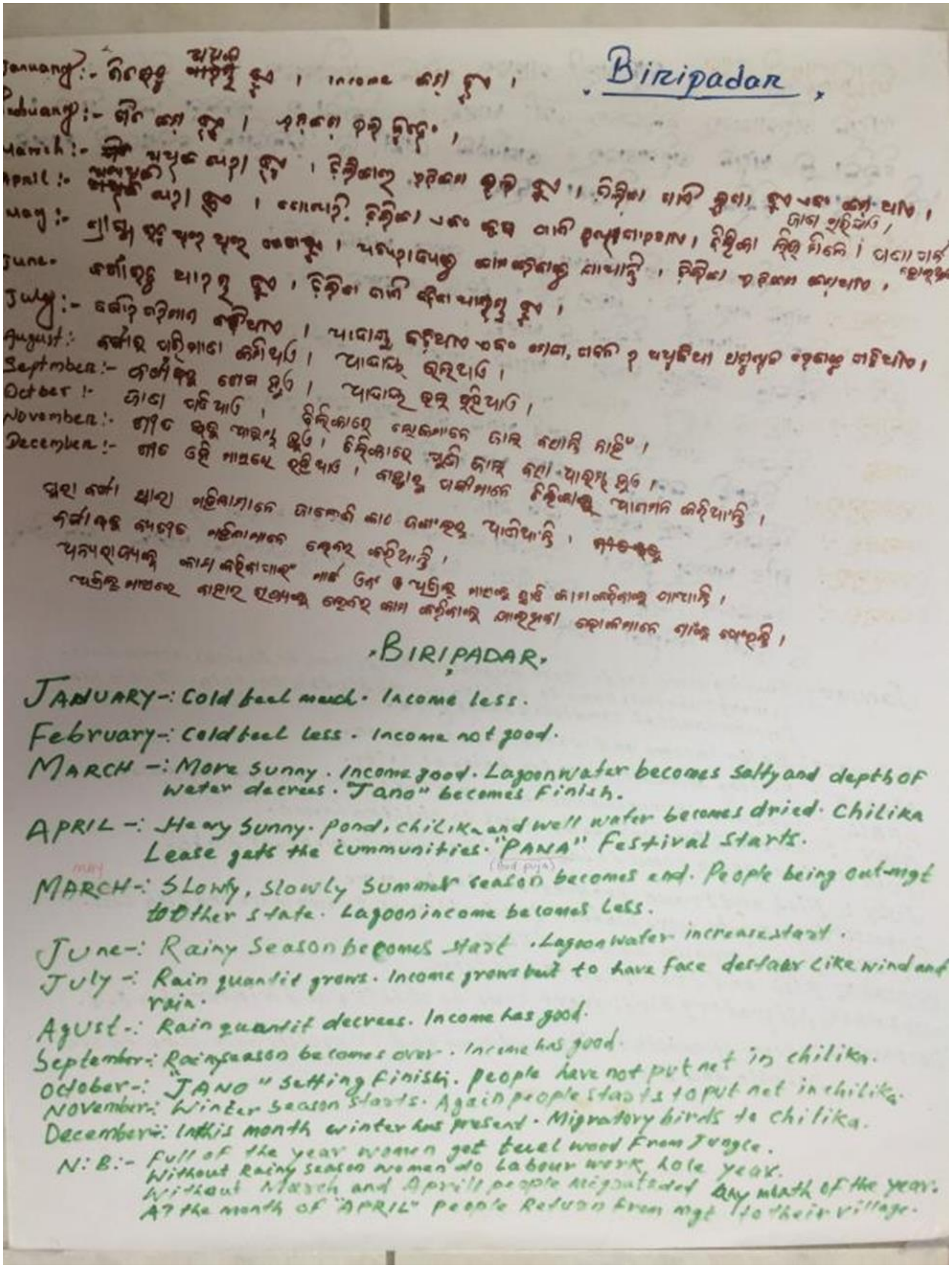
APPENDIX E- MEN'S SOCIAL MAP (BIRIPADAR)



APPENDIX F- SEASONAL CALENDAR (KHATISAHI)



APPENDIX G- SEASONAL CALENDAR (BIRIPADAR)



Biripadar

BIRIPADAR

JANUARY-: Cold feel much. Income less.

February-: Cold feel less. Income not good.

MARCH -: More sunny. Income good. Lagoon water becomes salty and depth of water decrees. "Jano" becomes finish.

APRIL -: Heavy Sunny. pond, chilika and well water becomes dried. Chilika Lease gets the cummunities. "PANA" Festival starts.

MARCH-: Slowly, slowly summer season becomes end. People being out-mgt to other state. Lagoon income becomes less.

June-: Rainy Season becomes start. Lagoon water increase start.

July -: Rain quantit grows. Income grows but to have face destaler like wind and rain.

Agust-: Rain quantit decrees. Income has good.

September-: Rainy season becomes over. Income has good.

October-: "JANO" setting finish. people have not put net in chilika.

November-: Winter season starts. Again people starts to put net in chilika.

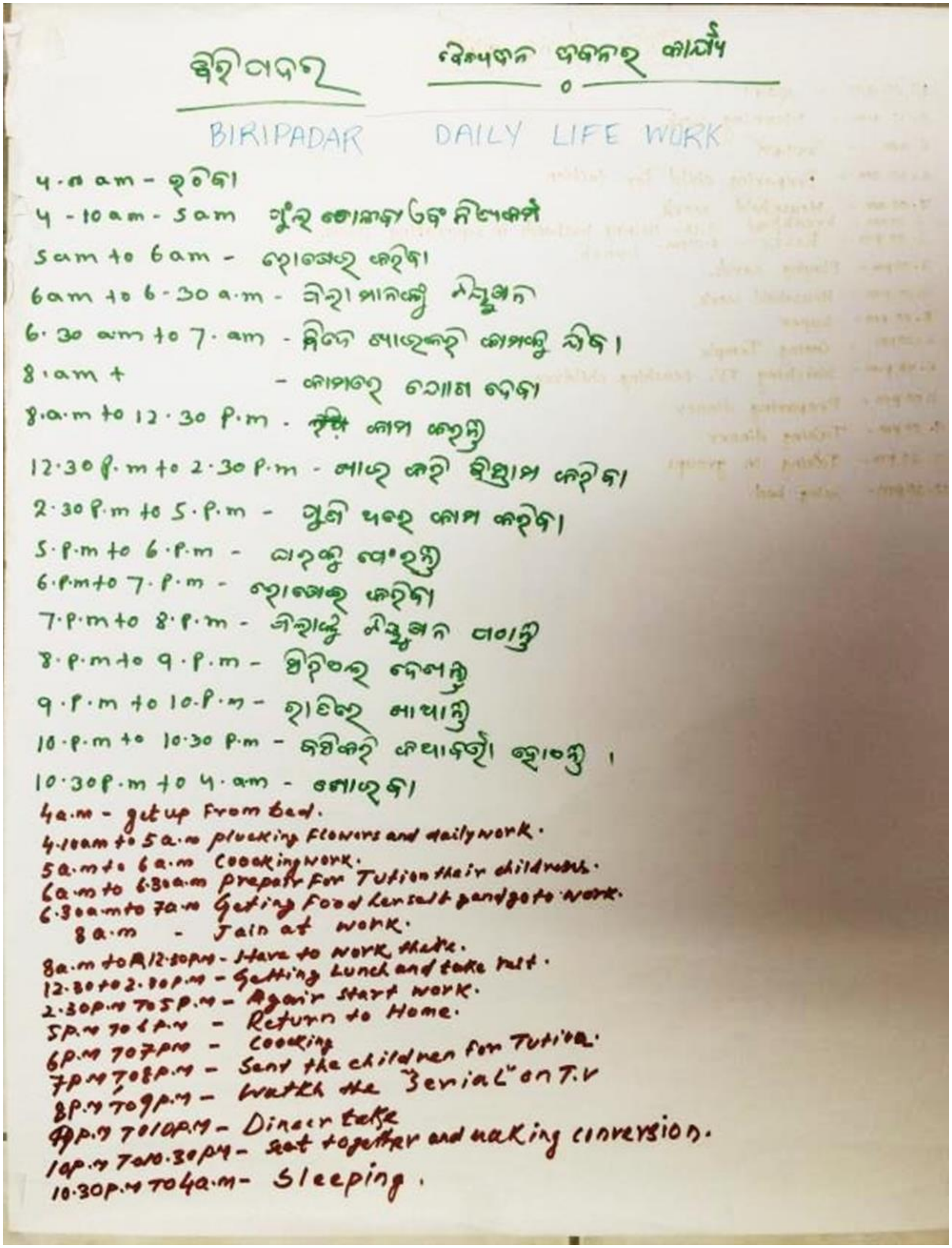
December-: In this month winter has present. Migratory birds to chilika.

N:B:- Full of the year women get fuel wood from Jungle.
Without Rainy season women do labour work hole year.
Without March and April people migrated any month of the year.
At the month of "APRIL" people Return from mgt to their village.

APPENDIX H- WOMEN'S ACTIVITY PROFILE (KHATISAHI)

5.00 a.m - উঠা।
5.10 a.m - Morning work
6 a.m - নিত্যকর্ম
6.30 am - Preparing child for tuition
7.00 am - Household work
9.00 am - breakfast
2.00 pm - Rest ← 9.15- Helping husbands in separating dishes.
3.00pm - Playing cards. 2.00pm - Lunch
4.00 pm - Household work
5.00 pm - Super
6.00pm - Going Temple
6.45 p.m - Watching TV. teaching children
8.00 pm - Preparing dinner
9.00 pm - Taking dinner
9.20 pm - Taking in groups
10.30 pm - Going bed.

APPENDIX I- WOMEN'S ACTIVITY PROFILE (BIRIPADAR)


ବିରିପଦର ଦୈନନ୍ଦିନ ଜୀବନର କାର୍ଯ୍ୟ

BIRIPADAR DAILY LIFE WORK

4.00 am - ଉଠିବା

4-10 am - 5 am ଫୁଲ ତୋଳିବା ଓ ନିତ୍ୟକର୍ମ

5am to 6am - ରୋଷେଇ କରିବା

6am to 6-30 a.m - ପିଲାମାନଙ୍କୁ ଟିୁସନ

6.30 am to 7.am - ନିଜେ ଖାଇକରି କାମକୁ ଯିବା।

8.am + - କାମରେ ଯୋଗ ଦେବା

8.a.m to 12.30 p.m - କାମ କରନ୍ତି

12.30 p.m to 2.30 p.m - ଖାଇ କରି ବିଶ୍ରାମ କରିବା

2.30 p.m to 5.p.m - ପୁଣି ଥରେ କାମ କରିବା।

5.p.m to 6.p.m - ଘରକୁ ଫେରନ୍ତି

6.p.m to 7.p.m - ରୋଷେଇ କରିବା

7.p.m to 8.p.m - ପିଲାଙ୍କୁ ଟିୁସନ ପଢ଼ାନ୍ତି

8.p.m to 9.p.m - ସିରିଅଲ ଦେଖନ୍ତି

9.p.m to 10.p.m - ରାତିରେ ଖାଆନ୍ତି

10.p.m to 10.30 p.m - ବସିକରି କଥାବାର୍ତ୍ତା ହୁଅନ୍ତି।

10.30p.m to 4.am - ଶୋଇବା

4a.m - get up From bed.

4.10am to 5a.m plucking Flowers and dailywork.

5a.m to 6a.m Coooking work.

6a.m to 6.30a.m prepair for Tution their childrens.

6.30a.m to 7a.m Geting Food hersalf andgoto work.

8 a.m - Jain at work.

8a.m to R12.30pm - Have to work there.

12.30 to 2.30p.m - Getting Lunch and take rest.

2.30p.m To 5p.m - Again start work.

5p.m To 6p.m - Return to Home.

6p.m To 7pm - Cooking

7p.m To 8p.m - Sent the children for Tution.

8p.m To 9p.m - Watch the "Serial" on T.V

9p.m To 10p.m - Dinner take

10p.m To 10.30pm - sat together and making conversion.

10.30p.m To 4a.m - Sleeping.

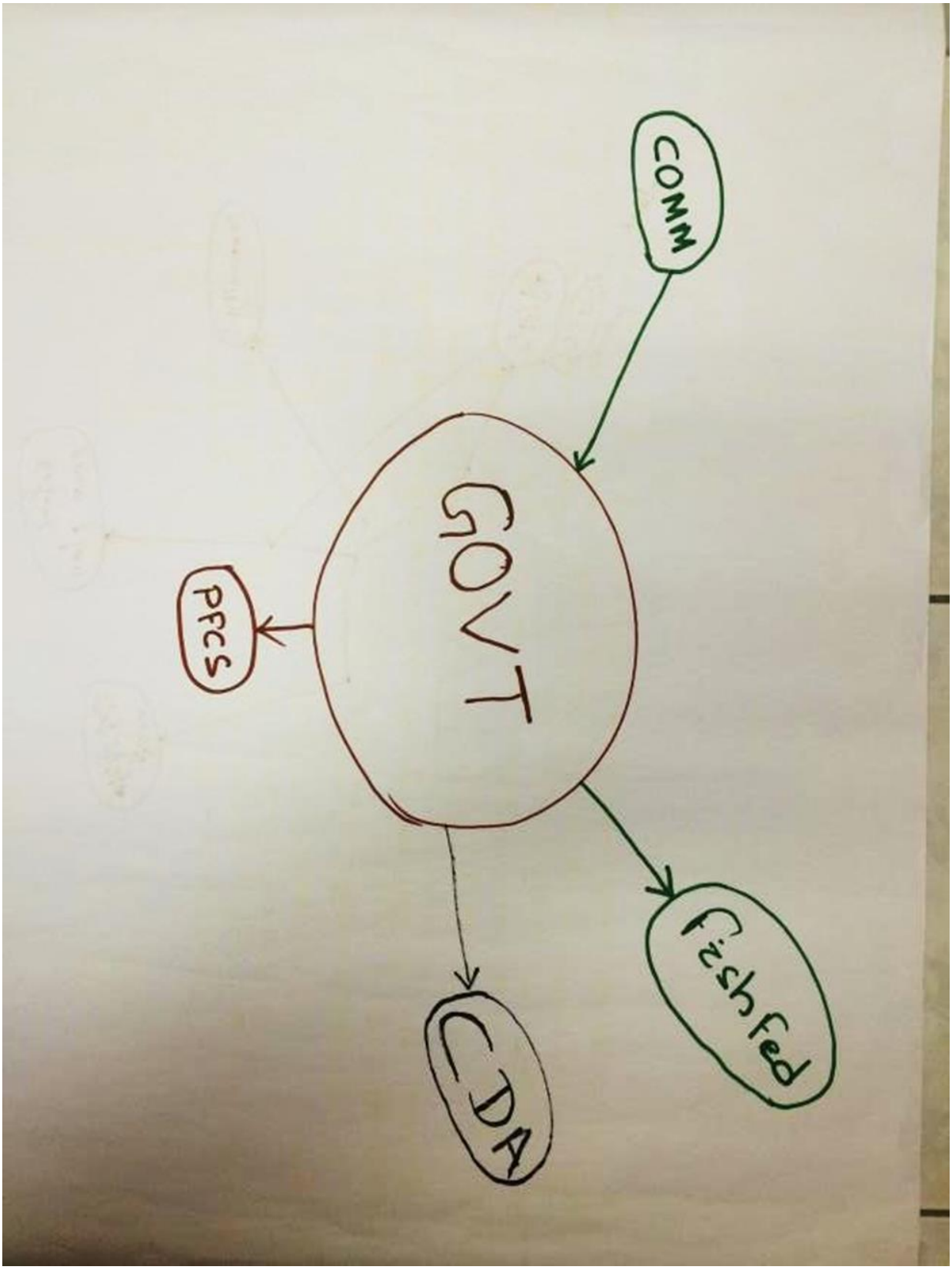
APPENDIX J- MEN'S ACTIVITY PROFILE (KHATISAHI)

APPENDIX K- MEN'S ACTIVITY PROFILE (BIRIPADAR)

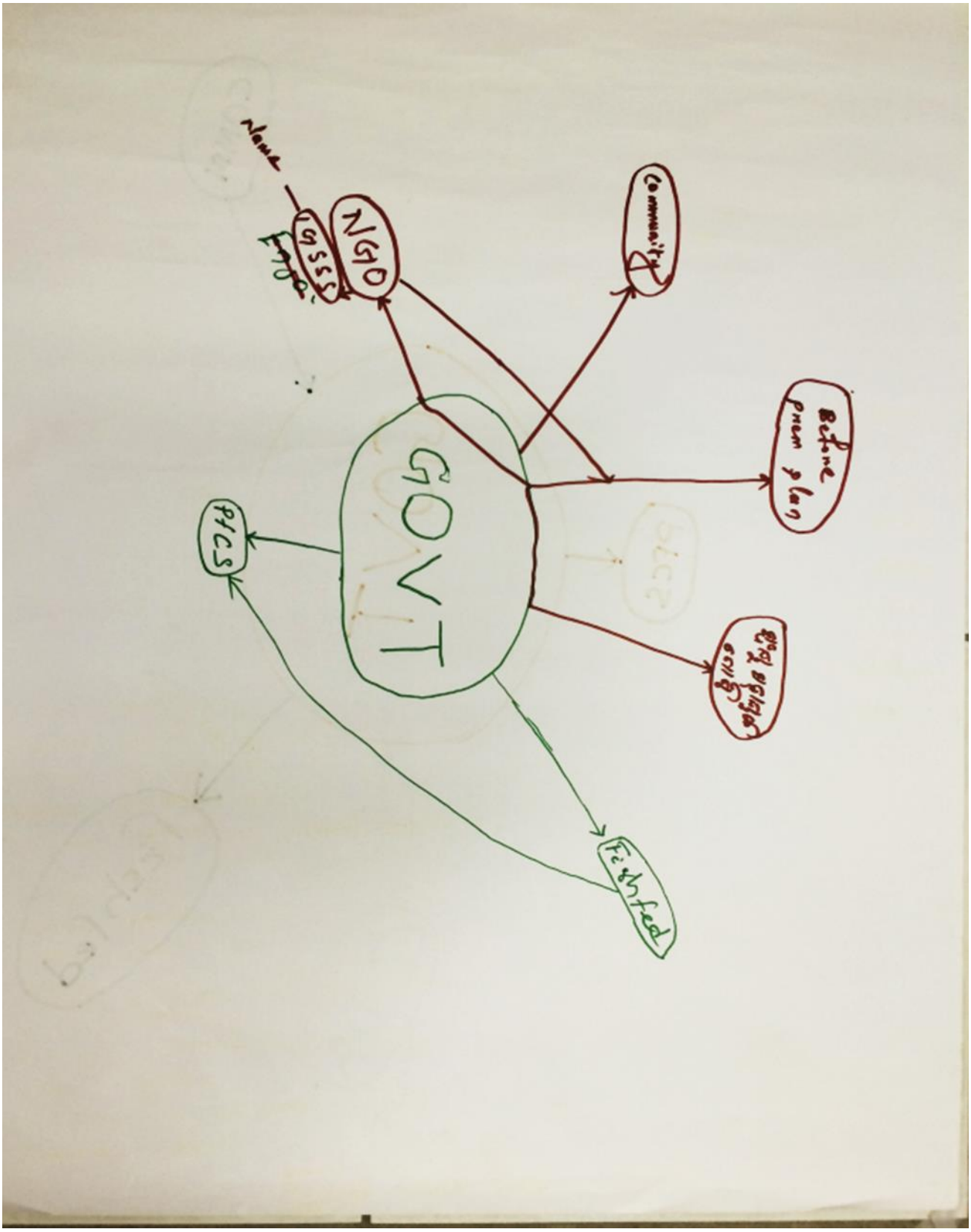
DAILY PROFILE

5 4.30 A.M got up Bed and going Lagoon
8.30 A.M Return to village
9.00 A.M TO 9.15 A.M getting Breakfast
9.30 A.M Taking Rest and Net Preparing
12.30 P.M Taking Lunch and Rest
2.30 P.M again going to chilika
5.30 P.M TO 6 P.M Return to village
6 P.M TO 8 P.M they smoke Ganja & drink.
8 P.M TO 9.30 P.M they Watch Television
10 P.M Take Dinner and got Sleep.

APPENDIX L- VENN DIAGRAM (KHATISAHI)



APPENDIX M- VENN DIAGRAM (BIRIPADAR)



APPENDIX N- INTERVIEW AND FOCUS GROUP GUIDE

Interview Script (approximate time: 30-60 minutes)

Please remember that you may stop the interview at any time, and that you may choose not to answer any question that you do not feel comfortable answering. With your permission, I would like to record your answers on this recorder. Are you ready to begin?

GENERAL

- What comes to mind when you think about Chilika Lagoon?
- Is the lagoon important to you? Why or why not?
- Do you like living in Chilika lagoon?
- Have you lived anywhere other than Chilika lagoon?
- Is there anything else you would like to share?

COMMONS

Resources

- What resources does the lagoon provide in your community?
- What do you use these resources for (e.g., food, market, etc.)?
- Have you noticed any changes in resources?

Access/Rights

- How often do you interact with the lagoon?
- For what purposes do you interact with the lagoon?
- Does everyone in the community have equal access to the lagoon?
- How do beliefs and customs influence how the lagoon is used in the community? (i.e. caste system)
- Can you tell me about the caste-system you are a part of?
- What are the current rules and regulations that influence how you use resources?
- How would you feel if you no longer had access to the lagoon?

Institutions

- How is the lagoon managed?
- How has the government and organizations impacted the management of the lagoon?
- How would you like the lagoon to be managed?

SOCIAL/ECONOMIC STATUS

- What are the sources of conflict in Chilika lagoon?
- How have environmental changes impacted your social life?
- What is the main source of livelihood associated with the lagoon?
- What is your main source of income?
- Do you have any other sources of income? (others in your household)
- Has your occupation ever changed?

ENVIRONMENTAL CHANGE (DRIVERS OF CHANGE)

- How would you describe the current condition of the lagoon (e.g., very good, good, average, poor)?
- Do you feel that the current condition of the lagoon in your community is adequate to meet your needs?
- Have you noticed any changes in the physical environment over the course of your life?
- How have environmental changes affected your connection with the lagoon?
- What has been the impact of opening the new sea mouth?
- What are the impacts of aquaculture in Chilika lagoon?

ADAPTATION

- What strategies are you using to adapt to changes?
- What problems have you faced in the process of adaptation?
- How has adaptation helped you?
- What are your future plans?

Out-migration

- How would you feel if you had to move from the lagoon in order to find employment?
- What are your views on the growing out-migration rate in Chilika?
- Why are men out-migrating from Chilika lagoon?
- How has out-migration impacted the lagoon?
- Where are men out-migrating to and for how long?

*These are questions that will be asked during household case studies and semi-structured interviews with village locals involved in the fisheries of Chilika lagoon. Question composition will vary depending on who is being interviewed (i.e. women, men, role in community, etc.)

Key Informant Interview Guide

- What is your role in Chilika lagoon?
- How long have you held this position?
- How do you feel about the current condition of the lagoon?
- What is your role in managing resources?
- What would you like to have done to improve the condition of the lagoon?
- Have you contributed to the improvement of the lagoon system? If so, how?

* Question composition will vary depending on who is being interviewed (i.e. government official, member of NGO, community leader , etc.).

Focus Group Script (approximate time: 45-60 minutes)

Today, you will be participating in a focus group to collectively answer some questions and create one (insert name of PRA activity) together. (Explain selected PRA activity based on description shared in C1b). Please consider that all members of the focus group will hear what you say during this session. Remember that you may withdraw from this activity at any time, and that you may choose not to answer any questions that you do not feel comfortable answering.

This focus group will be a relatively open discussion. Here are three initial questions to start discussion:

- How do you feel about the current state of the lagoon?
- How do you work together in the village?
- How the lagoon is communally managed?

* Question composition will vary depending on focus group participants (i.e. only women, only men, women and men).

For PRA Activity:

*Example explanation of how seasonal calendar activity will be introduced to group.

Part 1: To begin, as a group, make a list of important periods or events that happen every year in this community, and write down the times that they occur. Then, think about how these important times fit together over the period of one year. For example, over 12 months, or over the different seasonal periods, you may choose your own time scale.

**Complete initial brainstorming*

Part 2: Think about how this time scale might be represented in a visual way. I have several examples of seasonal calendars on this paper (provide examples) that you may refer to if you are not sure where to begin. You may choose to follow one of these examples, or you may also create your own picture and format. With your individual permissions, I would like to record your discussions on this recorder during this session. Do you have any questions about this activity?