Rapid Environmental Change, Psychological Distress and Well-being in Chilika Lagoon, India

by

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A thesis
presented to the University of Waterloo
in fulfillment of the
thesis requirement for the degree of
Master of Environmental Studies
in
Sustainability Management

Waterloo, Ontario, Canada, 2020

AUTHOR'S DECLARATION

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

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Abstract

As the effects of climate change are increasingly occurring throughout the world, costal fisheries are at risk of experiencing significant impacts on their environment. As recent studies indicate that psychological distress is associated with environmental distress, this research aims to shed light on the relationship between environmental distress and human distress. Chilika Lagoon, India is a common resource shared independently by caste-based fisher communities. In the last four decades, Chilika has experienced significant changes to its ecosystem including changes and loss in ecology, economy and culture, but none have explicitly addressed the issue of psychological distress. The view on psychological distress brings a new perspective to Chilika's current environmental and social interactions with the Lagoon. Studies show that the Lagoon's environmental changes impact the livelihood of the local fishers. Their access to the customary fishing grounds have been restricted through largescale encroachment for aquaculture leading to significant number of fishers migrating to distant places in search of income and employment. On this backdrop, the purpose of this research is to analyze the psychological health conditions of the local fishers who have been exposed to rapid transformation of the Lagoon. In addition, this study examines the coping strategies and sources of social support of the fishers to analyze their ability to manage their psychological distress. The findings reveal that the fisher communities were exposed to significant environmental distress of the Lagoon from 1980 to 2017. In addition, the fishers have experienced significant impacts on their livelihood, resource access and migration associated with the environmental change. As a result, the psychological distress of the fisher communities had significant impacts on feelings of insecurity and intense worry associated with environmental change. Moreover, the results indicate that the majority of the participants had effective coping strategies and sources of social support that helped manage other psychological distress symptoms associated with environmental change, such as feelings of social isolation and loss of connection. Due to the effective coping strategies and social support, the participants were able to reduce the impact on their overall psychological distress. This study concludes that further research is needed to fully understand how humans cope with

environmental change and develop effective coping strategies to reduce the psychological distress associated with environmental distress.

Keywords: Chilika Lagoon, Environmental Change, Psychological Health, Psychological Distress, Small-Scale Fisheries, Caste System, Marginalization, Community Rights, Solastalgia, Coping.

Acknowledgements

Firstly, I would like to thank my thesis advisor Professor Prateep Nayak of the School of Environment, Enterprise and Development at the University of Waterloo. With his extensive work in Chilika Lagoon, India, and his resources I was able to put together this research. Without his encouragement I would not have been able to accomplish this thesis. I would also like to thank my committee member, Derek Armitage, and my reader, Simron Singh, for their support in completing my thesis.

I would also like to thank NIRMAN and the research assistant, Tapan, who were involved in the semi-structured interviews for this research. Without their passionate participation and input, the interviews could not have been successfully conducted.

Finally, I must express my very profound gratitude to my mom, my partner, Kayce, and my friends, Divya, Hameet and Tasnia, for providing me with unfailing support and continuous encouragement throughout my years of study and through the process of researching and writing this thesis. This accomplishment would not have been possible without them. Thank you.

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Chapter 1

Introduction: Environmental Change and Psychological Well-being in Marginalized Fisher Communities

1.0—Purpose of This Study

Rapid environmental change is increasingly becoming an important topic in academic research as humans struggle to adapt to the changes (Albrecht, 2006; Selye, 1946). The impacts of climate change not only threaten the economy and the Earth's ecosystem, but also the ability to adapt to the changing environment (Zacharia et al., 2016; Albrecht, 2005). Climate change is a global issue, which is why it is essential that humans learn to effectively adapt to the environmental changes (Senapati & Gupta, 2015; Selye, 1946). Psychological well-being plays an important role in the overall health of humans (Fritze, Blashki, Burke & Wiseman, 2008). Furthermore, psychological health is closely linked with environmental health (Chukwuorji, Ifeagwazi & Iorfa, 2015; Albrecht, 2007). Vulnerable groups, such as small-scale fisheries, face additional barriers in adapting to environmental changes, as they face social and economic issues (Senapati & Gupta, 2015). Small-scale fisheries in developing countries are often found marginalized socially and economically (Nayak, Oliveira & Berkes, 2015). India's coastal fisheries are at risk of experiencing severe consequences due to climate change, such as intensified whether patterns and sea level rise (Senapati & Gupta, 2015). As a result, the increase occurrences of natural disasters further marginalize vulnerable groups (Senapati & Gupta, 2015). Unfortunately, there is limited research on the relationship between human health and environmental health and thus, little is known of the psychological impacts associated with environmental distress, especially among vulnerable groups like small-scale fisheries (Albrecht, 2009).

Due to the lack of academic research on marginalised coastal fisheries and the environmental impacts on the psychological well-being, this study aims to shed light on the adverse psychological distress caused by adverse environmental changes. Due to the increased environmental impacts associated with climate change as well as anthropogenic changes, it is critical that further research is conducted regarding the impacts of environmental changes on the

psychological well-being. Understanding the link between environmental health and human health will help marginalised communities develop ways to effectively adapt to the environmental changes. This study focuses on the marginalised fishing communities in Chilika Lagoon, which have faced complex environmental issues. This study aims to not only address the psychological distress associated with environmental issues in Chilika, but also encourage further research on adapting to adverse environmental changes and effectively cope with the distress caused by those changes.

1.1—Background and Key Issues in Chilika Lagoon

Chilika Lagoon in Orissa, India is located on the eastern coast of India and is the largest lagoon in India, which is composed of biological and human systems. The Lagoon biological system is composed of 225 fish species, 800 different types of fauna, and 710 different types of flora (Pattanaik, 2003; Zoological Survey of India 1987).The Lagoon human system is composed of 150 villages surrounding the Lagoon with over 200,000 caste-based fishers in 40,000 households (Nayak & Berkes, 2010). In this case study, the caste-based fishers are referred to fishers. For generations, these fishers have worked and thrived off the Lagoon for its productive biological ecosystem for their survival, cultural and livelihood needs (Nayak, 2011).

Chilika Lagoon has experienced large-scale degradation of the natural system. The ecosystem in Chilika Lagoon has significantly changed since the 1980s due to increased aquaculture operations by non-fishing communities starting in the1980s and the dredging of a new sea mouth in 2001 that changed the salinity of the Lagoon. These environmental changes have contributed to the marginalization of the fisher communities in Chilika Lagoon, which in turn has affected the livelihood, resource access and migration.

1.1.1—Impacts of the New Artificial Sea Mouth

The opening of an artificial sea mouth in 2001 has caused a lot of distress to the Lagoon's biological ecosystem and the fishing economy (Nayak & Berkes, 2010). The purpose of the new sea mouth was to allow the sediments and silt to flush out from the Lagoon into the Bay of Bengal, but consequently the location it was dredged increased the intensity of water inflow and outflow (Nayak & Berkes, 2012). One of the negative impacts of the new sea mouth caused salinity to

increase and brought new invasive species. The invasive species have contributed to negative changes to the Lagoon's native species including the decline in certain native fish. (Nayak, 2014). Additionally, some of the invasive species, such as barnacles and jellyfish, affected the fishers and their equipment (Nayak & Berkes, 2012). Consequently, the biological ecosystem of the Lagoon environment changed rapidly, which affected the fishing activity of the fishermen (Nayak & Berkes, 2010).

The changes in salinity and increased competition for fishing grounds contributed to wetland habitat and biodiversity loss in the Lagoon (Nayak & Berkes, 2014). Additional practices, such as net enclosures and the use of nylon nets also contributed to decreasing amounts of fish stock in the Lagoon and catch in fish, prawn and crab
(Nayak & Berkes, 2011). Net enclosures are long bamboo embankments that are erected for long periods of time or left in the Lagoon permanently by non-fishers (Pattanaik, 2007). These net enclosures disrupt the levels of oxygen, salinity and tidal flushing, which reduce the natural growth of fish and make it difficult for fishers to use traditional methods of fishing as the fish sizes are decreased (Pattanaik, 2007). Many fishers and non-fishers have substituted traditional fishing methods with illegal nylon nets, such as "zero nets", as nylon nets are more efficient (Nayak & Berkes, 2011; Pattanaik, 2007).

1.1.2—Aquaculture and Encroachment of Customary Fishing Grounds

In addition to permanent net enclosures and illegal nylon nets, encroachment of fishing grounds of the fisher communities by aquaculture operations have also contributed to the decline in fishing grounds and, in turn, the depletion of fish in the Lagoon (Nayak, 2014). Fishers who are not caste-based operate the majority of the aquaculture practice in Chilika. The aquaculture operations increased in the Lagoon, which marginalized the fisher communities and forced them to bereave with less area to fish (Nayak & Berkes, 2010). Aquaculture operations in the Lagoon has led to encroachment on important fish habitats, which limits fish feeding and breeding grounds and aggravates the depletion of fish stocks (Nayak, 2014). As a result, resource disputes between fisher communities and non-fisher communities have led to conflict as fisher communities had started to lose their customary fishing grounds (Nayal & Berkes, 2012). Additionally, the rates of annual lease fees for fishing in the lagoon have increased drastically. While a new bill was implemented

in 2002 to allow the local fishers gain access to the lagoon, the lease fees increased by 27 percent, making the leases less affordable for the fishers and resulting in the sub-leasing of their lease (Nayak & Berkes, 2010). Non-fisher communities hold higher power compared to fisher communities, which marginalizes them even further as they struggle to fight for their customary fishing grounds (Nayak, Oliveira & Berkes, 2015). Consequently, the fishers' vulnerability is increased as their access to the Lagoon is limited and their livelihood is negatively impacted. As the Lagoon ecosystem changed negatively and non-fishers have taken over the customary fishing grounds of fisher communities, the fishers are now marginalized and unable to practice their traditional fishing. As a result, the environmental changes have impacted the livelihood and resource access of the fisher communities. Consequently, the decline in household income has resulted in forced migration among the fisher communities (Nayak & Berkes, 2012). The impacts on livelihood, resource access and migration create challenges for the fisher communities, which in turn, would impact the psychological well-being. The following section briefly mentions some of the psychological effects that the fisher communities may experience as a consequence of the impacts on livelihood, resource access and migration.

1.2—Potential Impacts on Psychological Well-being in Chilika Lagoon

The factors that contribute to marginalization in Chilika are affecting the locals' access to the lagoon, reducing their income and impacting their livelihood (Nayak & Berkes, 2011). The fishers are caste-based, meaning that their caste is primarily focused on fishing, while other castes are focused on other activities such as agriculture. Once the fishers are not able to fish, they are not fulfilling their traditional caste roles so they are functioning out of the caste system, which can have major impacts on their well-being and livelihoods (Nayak & Berkes, 2011). With the negative impacts on the local fishers, there are reasons to believe that the psychological health of the locals is affected.

Studies show that unemployment that is not due to retirement has negative effects on physiological well-being (Taris, 2002). In addition, there is growing evidence that unemployment may cause psychological effects, not just economic consequences
(Hofsten and Backman, 2000). People in Chilika are experiencing unemployment, which is potentially affecting mental health in that region. Also, socioeconomic status and living

arrangements are shown to contribute to depression (Lorant et al., 2007). It is important to examine the effects of unemployment on psychological health in Chilika. Furthermore, unemployment can result in forced migration, which has many implications on psychological health. Culture shock is a common experience among migrants as new environments cause significant distress (Bhugra & Ayonrinde, 2004). Additionally, changes in cultural identity are also a common experience as migrants attempt to adapt to new environments (Bhugra & Becker, 2005). Consequently, culture shock and cultural identity can lead to social alienation and depression (Bhugra, 2003). As research indicates that the fishers are exposed to various environmental stressors, this study examines whether their psychological health is impacted by these environmental changes. The following section reveals the objectives of this study and describes the purpose of each objective.

1.3—Objectives of this Study

Based on the issues in Chilika Lagoon regarding the environmental changes and the impacts on psychological health, this study aims to answer the following question: What is the relationship between environmental health, psychological health and well-being in Chilika, India?

The following are the three objectives of this study:

1. (A) To understand the nature of the changes to the commons taking place in Chilika Lagoon and (B) its impact on the local fishers' livelihood, resource access to the Lagoon and out migration.
2. To examine the main impacts of the common resource changes on the psychological health of the fishers, specifically the stress experienced including emotional symptoms, physical symptoms and behavioural symptoms of distress.
3. To determine the current coping strategies of the fisher communities and how effective or ineffective the strategies are against psychological stressors and wellbeing.

Objective One focuses on the adverse environmental changes in Chilika Lagoon and their impacts on livelihood, resource access and migration. Objective One is separated into parts A and B. Objective One A focuses on the environmental changes in Chilika from 1980 to 2017, while Objective One B focuses on the impacts of environmental changes on livelihood, resource access

and migration. Essentially, the purpose of Objective One is to determine the types of adverse environmental changes in Chilika Lagoon and how they have impacted the fisher communities by examining the impacts on livelihood, resource access and migration.

Objective Two focuses on the impacts on psychological distress associated with environmental changes in Chilika Lagoon. There are three categories of psychological distress symptoms, which include physical, emotional and behavioural distress. Physical symptoms include physical pain, which can be any type of body ache associated with stress, including headaches, muscle aches, and chest pain. Physical symptoms from stress also include high blood pressure and trouble digesting which are associated with stress disorders. Emotional symptoms include senses of insecurity, social isolation, loss of connection and intense worry. Behavioural symptoms include eating disorders and sleeping disorders. These symptoms of psychological distress are associated with negative impacts of environmental changes on the participants' livelihood, resource access and migration.

Objective Three focuses on the coping strategies used by the participants and the sources of social support. The coping strategies include any strategies used by the participant to cope with the psychological distress symptoms that the participant claims to have experienced. Sources of social support includes anyone that provided support to the participant who is coping with psychological distress symptoms and includes any spiritual sources such as praying to God and meditating. The following section summarizes the literature described in Chapter 2, which includes the seven psychological distress symptoms used to answer Objective Two.

1.4—Literature Summary

Although there is a lack of research on environmental change and psychological distress, the literature reveals that there is a link between environmental health and human health (Albrecht, 2009). Regions that are at risk of environmental disasters may experience disruptions to their society, economy and environment, which in turn can affect the psychological well-being, especially among vulnerable groups (Fritze, Blashki, Burke & Wiseman, 2008). Adverse environmental changes can cause negative impacts on livelihood as the environmental changes become uncontrollable (Shukla, 2013). Adverse environmental changes can also impact access to resources among vulnerable groups who are economically disadvantaged and cannot afford

methods to adapt to the environmental changes (Chukwuorji, Ifeagwazi, & Iorfa, 2015). Consequently, as livelihoods and resource access are impacted, forced migration occurs, which can cause additional stress from adapting to new environments (Nesdale et al., 1997).

This study measures the psychological distress among fisher communities caused by the environmental changes that occurred in Chilika Lagoon. There are seven psychological distress symptoms associated with environmental change, which include: physical pain, sense of insecurity, feelings of social isolation, loss of connection to the environment, feelings of intense worry, eating disorders and sleeping disorders. The seven psychological distress symptoms are described in Chapter 2, under section 2.4. Distress in social organization is inevitable, which is why it is important to develop coping strategies to better manage the impacts of distress (Aneshensel, 1992). Measuring the ability to cope is important as it helps determine the extent of the impacts of distress and the individual's ability to cope with distress. The following section briefly outlines the key methods used to answer each of the objectives and the key findings of this study.

1.5—Key Methods

Semi-structured interviews were conducted in this study to determine the types of environmental changes that occurred in Chilika and the impacts on livelihood, resource access and migration, the severity of the psychological distress symptoms and the coping strategies and social support of the fisher communities in Chilika. A total of 75 participants from 15 fisher communities participated in this study. This study is organized into the three objectives. Objective One determines the types of environmental changes that occurred in Chilika and the impacts on livelihood, resource access and migration from 1980 to 2017. The types of environmental changes include: change in salinity in the Lagoon, decreased quantity of native fish, severe weather occurrences, new species in the Lagoon, decreased size of native fish, increased pollution in the Lagoon, Lagoon depth changes, and wetland habitat loss. The impacts of environmental changes on livelihood include: decreased income from the environmental changes, inability to afford all basic needs, limited household spending money, and decreased leisure time. The impacts of environmental changes on resource access include: conflict between communities regarding fishing space, theft of fishing equipment, decreased fish catch size and use of 'zero nets' (nylon nets). The impacts of environmental changes

on migration include: local labour, non-local labour, seasonal migration, temporary migration, and permanent migration. The environmental changes and the impacts on livelihood, resource access and migration are further described in Chapter 3 under section 3.3. Each participant was asked to indicate whether they have observed any of the environmental changes and which impacts on livelihood, resource access and migration they have experienced.

Objective Two examine the severity of the psychological distress symptoms associated with environmental change of each participant. As mentioned earlier, the psychological distress symptoms include: physical pain, sense of insecurity, feelings of social isolation, loss of connection to the environment, feelings of intense worry, eating disorders and sleeping disorders. Each symptom was ranked to determine its severity. Low severity signifies that the symptom experienced is mild. Medium severity signifies that the symptom experienced is moderate. Lastly, high severity signifies that the symptom experienced is severe. The severities of the symptoms were analyzed to examine the overall psychological well-being of the fisher communities.

Lastly, Objective Three examines the coping strategies and social support of the participants to analyze the extent of the psychological distress and the ability to cope with the symptoms. Each participant was asked to identify any coping strategies that are effective in managing his or her psychological distress symptoms. Additionally, each participant was asked to identify any sources of social support that helped manage the psychological distress symptoms. The data was then analyzed to determine the effectiveness of the coping strategies in reducing the psychological distress. The qualitative methods used to collect and analyze the data is further described in Chapter 3.

1.6—Key Findings

This study involves 15 fisher communities surrounding Chilika Lagoon and includes 76 total participants, both men and women. The findings of this study indicate that Chilika Lagoon has experienced adverse environmental changes which has severely impacted the livelihood, resource access and migration of the fisher communities. As a result, both men and women have experience significant impacts on their psychological well-being. The results show that both men and women have experienced two out of seven psychological distress symptoms, which were ranked as severe symptoms of distress. However, due to the extent of the environmental stressors that the fisher

communities were exposed to, it is surprising that only two out of the seven psychological distress symptoms were ranked severe. This indicates that both men and women had effective coping strategies and sources of social support, which helped reduce the psychological distress symptoms.

1.7—Organization of Chapters

Chapter 1 includes the introduction of the research and information on the background and key issues in Chilika Lagoon, India. Chapter 1 also describes the three main objectives of the study. Chapter 2 unravels the literature on environmental health and human health. Chapter 2 also describes the types of psychological distress symptoms associated with environmental change that this study used to examine the psychological well-being of the participants in this study. Chapter 3 reveals the qualitative methods used for this study to collect and analyze the data on types of environmental changes, impacts on livelihood resource access and migration, psychological distress symptoms, coping and sources of social support. Chapter 3 also includes a "Study Area" which describes the eight types of environmental changes used in this study to examine the conditions of the Lagoon environment and the impacts on livelihood, resource access and migration. Chapter 4 reveals the results of the study, which includes tables and figures to visually represent the data. Chapter 5 and 6 analyze the results using figures and comments from the participants. Chapter 5 reveals the findings for Objective One, which include the environmental changes that occurred in Chilika Lagoon and the impacts on livelihood, resource access and migration. Chapter 6 reveals the findings for Objectives Two and Three, which include the psychological distress symptoms associated with environmental changes, types of coping strategies and sources of social support. Finally, Chapter 7 discusses the findings, draws conclusions based on the analysis of the results and provides some implications of the study.

Chapter 2

Literature Review: The Relationship Between Environmental Distress and Human Distress

2.0—Historical Context on Environmental Health and Human Health

There are few concepts in the world academia concerning the interaction between environment and humans (Albrecht, 2009). The relationship between ecosystem distress and human distress has not been adequately researched and has been poorly considered in the history of mental health, especially in developing countries (TED, 2010; Chukwuorji et al., 2015). In the history of academia, Aldo Leopold (1970), first elucidated the concept with respect to ecosystem health and human health, in his discussions around 'The Land Ethic'. 'The Land Ethic' unfolded a new perspective on how human interaction with the environment can affect the ecosystem's health (Leopold, 1970). Though, 'The Land Ethic' lacked an alternate perspective of human distress resulting from ecological distress, Aldo Leopold's concept inspired David Rapport to develop a new perspective on how "transformation of ecosystems from healthy to unhealthy states is readily explained by the cumulative impacts of chronic stress from human activities" (2011, p.5), meaning that humans can negatively impact the ecosystem with their actions. In 1946, Elyne Mitchell first unfolded the impact on the psychic state when one has lost his or her land, or as Mitchell says, "divorced," from his or her land, and breaks the unity between them (1946). One of Mitchell's conclusions on ecological distress and psychic instability suggests that humans would not have survived this long on earth if they did not maintain unity between the earth and their psychic stability (1946).

More recent discoveries have been made on the relationship between distressed humans and distressed environments and what distress entails for humans. For example, Glenn Albrecht (2007), whom will later be discussed about in the next section, expressed a palpable empathy for a growing number of indigenous people in the Upper Hunter Region in Australia who have been negatively impacted by an expansion of a coal mine. Albrecht could empathize the distress caused by their threatened identity and well-being of the affected indigenous people who lived near the

coal mine. This cause inspired Albrecht to study the relationship between distressed ecosystems and distressed humans. In order to further our understanding on linking ecosystem health and human psychological health this literature review focuses on three themes, Solastalgia, distress, and coping, which have been derived from the relationship between the environment and humans.

2.1—Solastalgia: Linking Environmental Distress and Human Distress

This research aims to link environmental distress and human distress by using an environmental psychological perspective and focusing on the emotional well-being of the fisher communities in Chilika Lagoon, India. Environmental psychology is a multidiscipline that focuses on the interactions between humans and the physical environment (Craik, 1973). Gleen Albrecht, an Australian philosopher fascinated by the impact of environmental change on psychological health, developed a new concept called 'solastalgia'. The short definition of solastalgia is, "the homesickness you have when you are still at home," which this section will further clarify by focusing on its neologistical meaning (TED, 2010). Inspired by David Rapport's new insight on human distress from ecological distress, Glenn Albrecht proposed the new concept of solastalgia, which refers to the "pain or sickness caused by the loss or lack of solace and the sense of isolation connected to the present state of one's home and territory" (2007, p.42). As explained by Albrecht, the term solastalgia is a combination of 'solace', 'desolation' and 'algia'. The meaning of 'solace' entails distress, while 'desolation' entails abandonment and loneliness and lastly, 'algia' means pain, suffering or sickness (Albrecht, 2007). Solastalgia can be experienced from human-induced environmental distress, such as coal mining, or natural environmental changes, such as climate change. The following paragraph unravels the meaning of solastalgia, quoted in Glenn Albrecht's article *Solastalgia: The Distress Caused by Environmental Change:*

> *"Solastalgia, in contrast to the dislocated spatial and temporal dimensions of nostalgia, relates to a different set of circumstances. It is the pain experienced when there is recognition that the place where one resides and that one loves is under immediate assault (physical desolation). It is manifest in an attack on one's sense of place, in the erosion of the sense of belonging (identity) to a particular place and a feeling of distress (psychological desolation) about its transformation.*

It is an intense desire for the place where one is a resident to be maintained in a state that continues to give comfort or solace" (2007, p. 45).

Solastalgia focuses on the lived experiences of the people suffering from changing environments. In Glenn Albrecht's new perspective claims that those affected by solastalgia are negatively impacted and distressed through social, physical or psychological health problems. Albrecht proposes that the neologism of solastalgia should be viewed as a "newly defined human illness" (2007, p. 55) and that understanding the ancient relationship between humans and earth will help discover new ways to treat solastalgia. The following two themes, 'Psychological Distress' and 'Coping' elaborate on what psychological distress and coping are in the context of rapid environmental change.

2.2—Rapid Environmental Change and Psychological Distress

The three themes examined—solastalgia, psychological distress and coping—strongly suggest a desperate need to critically analyze the psychological distress of peoples who are suffering from their changing home environment. In addition, the literature review suggests that academic research requires further knowledge on the relationship between environmental health and human health, especially in developing countries (Chukwuorji, Ifeagwazi & Iorfa, 2015). However, environment related psychological health issues, such as solastalgia, are not yet integrated into the psychological health language, and should be used with caution as it may further complicate the labeling of illnesses in the world of psychological health (MacSubhne, 2009). 'Psychoterratic' is a new proposed psychological diagnosis that combines the illnesses associated with the environment, psyche and physical body (Albrecht, 2011). Environmentally induced psychological illnesses, such as psychoterratic, are to be used with caution as the literature indicates that more research is needed to fully understand the link between environmental health and human health. With that being said, the world academia should acknowledge the neologism of solastalgia and further encourage academics to view solastalgia as an important tool to investigate human distress of rapidly changing environments that are considered home to grieving dwellers. As mentioned earlier, distress is an inevitable process of social organization (Aneshensel, 1992), thus research on environmental change and human distress in developing countries should be emphasized. In

addition, further research on environmental health and human health will educate health professionals and provide them with the necessary skills to prevent or treat people who are severely impacted and help restore the ecosystem (Warsini, Mills & Usher, 2014).

Research in regions of at-risk of environmental disasters strongly suggests that rapid environmental changes may cause distress in humans (Fritze, Blashki, Burke & Wiseman, 2008). Communities that experience disruptions to their society, economy and environment may experience negative impacts on their psychological health and those who have pre-existing severe impact on their psychological health are even more vulnerable to rapid changes in their environment (Fritze, Blashki, Burke & Wiseman, 2008). In addition, disruption to traditional livelihoods can also impact psychological health during uncontrolled, rapid environmental changes (Shukla, 2013).

As a result of income change, families may experience less interaction and leisure time, which can negatively impact their psychological well-being (Padhy, Sarkar, Panigrahi & Paul, 2015). A study conducted in Nigeria concluded that communities with less economic resources experienced psychological effects due to their environment changing, more strongly because of their lack of ability to afford methods to adjust to the changing environment (Chukwuorji, Ifeagwazi, & Iorfa, 2015). Albrecht adds that people who are affected by negative environmental changes experience a sense of powerlessness or lack of control (2007). As a way of coping with the decline in livelihoods, migration is often a strategy to improve livelihood conditions. Migrating can be even more stressful as it requires changing many aspects of living, which can cause additional stress (Nesdale et al., 1997). Changing work environments can also be stressful to the individual as it requires a significant amount of adaptation to the new environment (Barnett & Brennan, 1997). The following section discusses the types of psychological distress caused by changes in livelihood, resource access and migration associated with rapid environmental changes.

2.3—What is Psychological Distress?

For the purpose of understanding the meaning of psychological distress, the term ‘mental health’ is examined, as it is often times used interchangeably with the term ‘psychological distress’. According to the Victorian Health Promotion Foundation, “[m]ental health is the embodiment of social, emotional and spiritual wellbeing. Mental health provides individuals with the vitality

necessary for active living, to achieve goals and to interact with one another in ways that are respectful and just" (Fritze, Blashki, Burke & Wiseman, 2008, p. 3). Hans Selye first coined the definition of stress in 1936 as the body responding to a demand for change (1936) and concluded that adapting to the surrounding is one of the most important psychological human reactions (1946). The stress that negatively impacts one's well-being is referred to as 'distress' and the body's response to the distress is referred to as 'stressors' (Gerrig & Zimbardo, 2010).

Carol S. Aneshensel (1992) explains in her article, *Social Stress: Theory and Research*, that those undesirable events, 'life-event stressors' as she calls it, are most psychologically distressing, while other stressors that can be controlled or predicted are secondary effects. In addition, some stressors cause more stress to some people more than others and vice versa (Aneshensel, 1992). Thus, Aneshensel concludes that stress is measured by the amount of readjustment the person requires to manage the stress. The terms 'stress' and 'distress' are often used interchangeably in academia, so for consistency purposes, this study refers to stress as 'distress' from now on. Distress can be measured by its direct and indirect impacts on the person. Indirect effects refer to physiological changes, such as headaches and pain (Bruce, 2009), which effects the immune system's functioning (Morrison and Bennett, 2009). Meanwhile indirect effects of distress include behavioural changes such as sleeping disorders, eating disorders and substance abuse (Morrison and Bennett, 2009), which are further described later in this chapter.

2.4—Types of Psychological Distress Symptoms

This study focuses on the environmental changes that occurred in Chilika Lagoon, India, which have significantly impacted the psychological well-being of the local fishers. A significant portion of this study examined the psychological distress of participants who have been exposed to various environmental stressors, which have impacted their livelihood, resource access and migration. The environmental stressors, which are referred to 'environmental changes', are individually described in the Methods Chapter. The environmental changes that occurred in Chilika include: change in salinity in the Lagoon, decreased quantity of native fish, severe weather occurrences, new species in the Lagoon, decreased size of native fish, increased pollution in the Lagoon, Lagoon depth changes, and wetland habitat loss (as defined in the Methods Chapter under section 3.3.1). This study examines how the livelihood, resource access and migration within the fisher communities

in Chilika Lagoon have been impacted due to the environmental changes. Subsequently, this study examines the psychological well-being of the fisher communities as they have experienced the environmental stressors. The psychological well-being of the participants in this study is measured through analyzing seven different types of psychological distress symptoms, which are physical pain, sense of insecurity, feelings of social isolation, loss of connection to the environment, feelings of intense worry, eating disorders and sleeping disorders. Additionally, each psychological distress symptom of all participants is examined to determine the severity (as described in the Methods Chapter). The seven psychological distress symptoms are defined in the following section, and are cross-referenced throughout Chapters 4, 5 and 6.

2.4.1—Psychological Distress Symptom of Physical Pain

Shukla (2013) describes the impacts on human physical and psychological health due to maladaptive responses to adverse environmental changes. Human distress can significantly impact the individual's immunity and can cause diseases (Hussain, 2009). Physical pain is a sign of unstable psychological state, which is why it is an important aspect of psychological well-being to examine in this study. According to Shukla (2013) and Hussain (2009), diseases that are related to psychological distress associated with adverse environmental changes include diabetes, heart disease, high blood pressure and digestive issues. Physical diseases are included in the physical pain symptoms of psychological distress, which are: diabetes, heart disease, high blood pressure and digestive issues. In addition to physical diseases, the physical pain symptom of psychological distress includes: headaches, muscle pain, chest pain and joint pain. Headaches are known to correlate with psychological disorders (Swartz, Pratt & Armenian, 2000; Bruce, 2009), which are emphasized in this study, as body aches are terms that are often times used to describe the psychological distress within one's own body (Connell, O'Cathain & Brazier, 2014). Subsequently, the presence of physical pain is closely linked with taking medications as a coping strategy. Medication can reduce physical pain (diseases and body aches) through relieving psychological distress by increasing serotonin and dopamine levels, which in turn reduces the pain caused by the psychological distress (Borg-Stein & Simons, 2002). The use of medication to cope with psychological distress is further discussed in this chapter under section 2.5.

2.4.2—Psychological Distress Symptom of Insecurity

This study considers feelings of insecurity around household income to be a psychological distress symptom. Communities that experience challenges in accessing resources and skills to adapt to the rapid changes of their environment are at higher risk of impacting their psychological health (Shukla, 2013). For example, food and water shortages threaten the community's basic sense of security and can even cause Posttraumatic Dress Disorder (American Psychological Association, 2014). In addition, communities with poor access to infrastructure experience worse physical and psychological effects of the changing environment and competition for scarce resources results in increased violence and crimes (American Psychological Association, 2014; Speiser 2014). Shortages in resources can cause both direct and indirect effects on the communities experiencing environmental stressors. Lack of security is closely linked with unstable household income. Changes to household income can cause feelings of insecurity, which in turn can decrease the individual's confidence (Fritze et al., 2008; Sepa et al., 2004). The lack of confidence in an individual can also impede his or her ability to adapt to new ways of generating income. Additionally, when household income is unstable, it becomes difficult for the individuals to fully participant in society, as it often requires spending money (Marmot, 2002). As a result, unstable income can aggravate the feelings of insecurity by hindering the individual from fully participating in their community. Not being able to fully participate in one's own society can, in turn, aggravate the individual's ability to feel connected to his or her community. Feelings of social isolation and loss of connection are other symptoms of psychological distress that are included in this study and are described in the following sections.

2.4.3—Psychological Distress Symptom of Social Isolation

Other impacts on psychological distress associated with adverse environmental changes include feelings of social isolation. Social isolation can occur when an individual is experiencing high levels of psychological distress (Albrecht, 2009; Fritze et al., 2008). Social isolation occurs when an individual feels that he or she wants to be alone from others and refrains from socializing. Socioeconomic disadvantages and unemployment may cause social isolation, negative self-perception and reduced personal autonomy (Fritze et al., 2008). This includes crying spells and

lack of confidence in adapting to new changes in generating income. Depending on the individual, one can feel socially isolated from his or her community members and/or family members, such as spouse and children. The factors that facilitate feelings of social isolation associated with environmental changes include impacts of climate change and anthropogenic environmental changes. Impacts of climate change include extreme weather events and natural disasters such as changes in rainfall pattern and tsunamis (Shukla, 2013). Impacts of human-induced alterations to the environment include intensive industries that significantly change the physical and ecological characteristics of the environment (Fritze et al., 2008). Moreover, regions populated with vulnerable groups, such as indigenous people and communities with lower-socioeconomic status, are prone to higher impacts of natural and anthropogenic environmental changes on their psychological well-being (Shukla, 2013). The impacts of climate change and anthropogenic environmental changes in regions inhabited by vulnerable groups directly intensify feelings of social isolation (Albrecht, 2005). Loss of connection and intense worry are also psychological impacts of natural and human-induced adverse environmental changes on psychological well-being.

2.4.4—Psychological Distress Symptom of Loss of Connection

This study considers feelings of loss of connection associated with adverse environmental changes to be a psychological distress symptom. Loss of connection to one's home environment can occurs when the people residing within the environment cannot adapt to the rapid changes (Albrecht, 2006). As mentioned earlier in this chapter, Albrecht (2009) refers to this concept as 'Solastalgia'. The rapid environmental changes that cause loss of connection can be natural or human-induced, which include extreme weather impacts associated with climate change and resource extraction, such as large-scale fisheries and mining. As a result of these adverse environmental changes, 200 million people are expected be involuntarily displaced worldwide by 2050 (Shukla, 2013). The involuntary displacement of vulnerable populations can result in cultural threats and disrupt traditional livelihoods (Shukla, 2013). Cultural threat may be associated with loss of connection to a place and sense of belonging (Fritze, Blashki, Burke & Wiseman, 2008). In addition, vulnerable groups that are forced to migrate are at higher risk of facing cultural and racial discrimination (Shukla, 2013). As vulnerable groups are forced to migrate, they lose connection

with their home environment and those who are left behind struggle to adapt to the disrupted community (Shukla, 2013). Thus, vulnerable groups who live in a community that suffers from adverse environment changes are either forced to migrate or continue to live in the declining community, which both have consequences on the psychological well-being of the individuals.

2.4.5—Psychological Distress Symptom of Intense Worry

This study considers feelings of intense worry associated with adverse environmental changes to be a psychological distress symptom. This study examines feelings of intense worry associated with uncertainty of the future environment as well as safety issues that arise in communities that have been disrupted by adverse environmental changes. Vulnerable groups who are affected by adverse environmental changes may experience fear, sadness, depression, numbness, hopelessness, frustration, or anger which interfere with their day-to-day living (Fritze, Blashki, Burke & Wiseman, 2008). In this study, all these feelings are used to describe the complex psychological distress symptom of intense worry. Moreover, those affected by adverse environmental changes may experience a sense of uncertainty about the future of their chronically distressed environment, such as frequent hurricanes, which causes more distress and may also result in substance abuse and suicide (Dohertyy & Clayton, 2011). Additionally, safety issues arise in regions affected by adverse environmental changes, which is a consequence of intense worry associated with psychological distress. Safety issues that arise in areas affected by adverse environmental changes include increased crime rates and violence (Shukla, 2013). Psychological distress associated with environmental changes, that include loss of connection and intense worry within vulnerable groups, result in violence and conflict that is often associated with anxiety, depression and PTSD (Post-traumatic Stress Disorder) (Shakula, 2013). Research shows that violence and conflict rates increase in regions that are affected with adverse environmental changes, which include death-related violence (Shukla, 2013). Thus, vulnerable groups who live in a community affected by adverse environment changes suffer from intense worry that is often associated with increase in violence and conflict, which both have consequences on the psychological well-being of the individuals.

2.4.6—Psychological Distress Symptom of Eating Disorders

Eating disorders are behavioural psychological distress symptoms that are linked with anxiety and depression. When an individual experiences high levels of distress, he or she may show behavioural signs of poor self-care, which includes eating unhealthily, such as under eating or overeating (Patrick et al., 2011; Venditti et al., 1996). Adverse environmental changes can cause anxiety when the individual struggles to adapt to the environmental stressors (Shakula, 2013). Eating disorders are a common symptom of psychological distress as feelings of anxiety can reduce appetite (Dohertyy & Clayton, 2011). Eating disorders includes lack of appetite that results in decreased numbers of meals or decreased amounts of food due to high levels of stress that is not managed effectively (Patrick et al., 2011). Subsequently, eating disorders commonly arise when an individual has experienced or is experiencing signs of depression (Devlin & Walsh, 1989). Overeating is a coping strategy that can result from experiencing high levels of stress and depression (Venditti et al., 1996; Devlin & Walsh, 1989). Overeating is considered to be an ineffective way of coping with stress because it negatively impacts the health of the individual (Patrick et al., 2011). Overeating is perceived as a secondary symptom to a larger underlying psychological problem as it masks the impacts of depression (Devlin & Walsh, 1989). There are various types of eating disorders such as anorexia nervosa and bulimia nervosa, but for the purpose of this study, only symptoms of general eating disorders are being examined rather than the symptoms of diagnoses. Thus, this study examines the conditions of under eating and overeating to determine the severity of such conditions.

2.4.7—Psychological Distress Symptom of Sleeping Disorders

Sleeping disorders are behavioural psychological distress symptoms that are linked with anxiety and depression. When an individual experiences high levels of distress associated with adverse environmental changes, he or she may show behavioural signs of poor self-care, which includes over sleeping and under sleeping (Dohertyy & Clayton, 2011; Padhy et al., 2015). Impacts on sleeping include trouble falling or staying asleep and oversleeping, which can amplify the negative impacts on the health of the individual (Moldofsky, 2001). Research indicates that adverse environmental changes and socioeconomic stressors can trigger PTSD symptoms, such as

flashbacks of the hapless event, increased arousal, and avoidance of being reminded of the event (Padhy et al., 2015; Hill, Burdette & Hale, 2009). Anxiety, panic attacks and irritability can also arise as a consequence of adverse environmental changes (Padhy et al., 2015). Subsequently, research sconsistently shows that poor sleep quality, especially trouble falling and staying asleep is linked to depression (Tsuno, Besset & Ritchie, 2005). About 90 percent of patients that suffer from depression experience issues with sleep quality, which indicates a strong relationship between depression and sleep (Tsuno, Besset & Ritchie, 2005). There are various types of sleeping disorders, such as insomnia and obstructive sleep apnea, but for the purpose of this study, only symptoms of general sleeping disorders are being examined rather than the symptoms of diagnoses. Thus, this study examines the conditions of under sleeping and oversleeping to determine the severity of such conditions.

2.5—Coping with Psychological Distress

Distress is an inevitable consequence of social organization, which stresses the importance of effective responses to environmental changes (Aneshensel, 1992). As communities are forced to experience chronic distress associated with adverse environmental changes, adaptation may be unattainable. Some of the maladaptive responses to environmental change include anxiety or depression, suicidal behaviours, and PTSD (Shukla, 2013). The psychological distress symptoms described in the previous section are used to measure the extent of the maladaptive responses to the environmental changes. Coping with psychological distress refers to the process when a person uses emotional and behavioural efforts in adapting to a stressful situation (Folkman & Lazarus). This research studies the psychological distress associated with environmental change and thus, it analyses the ability to cope with the environmental change rather than the ability to adapt to the environmental change. Research apprises effective coping strategies that communities have incorporated during their readjustment. For example, physical and emotional well-being is enhanced when the environment of an individual is predictable and controllable (Stokols, 1992). This means that when an individual has some control over the environment that surrounds him or her, it increases the certainty of the individual's future and, in turn, aids in maintaining psychological stability. In addition, psychosocial interventions and social support act as a buffer to distress that impacts psychological well-being (Aneshensel, 1992). Psychosocial refers to the

influence that social environmental factors have on an individual's mind or behaviour (Ahearn, 2000). According to Aneshensel, psychosocial interventions and social supports should buffer at least some of the distress caused by adverse environmental changes. This study examines the sources of social support of each of the participants to gain a deeper understanding of the effectiveness of the existing social supports.

This study uses qualitative approach to determine the types of coping strategies that the participants in this study used to manage their psychological distress symptoms. Chapter 3 on methods reveals how frequency coding was used to analyze the qualitative data to determined he types of coping strategies used. Research on literature shows that there are three common coping strategies that are generally used among humans when managing psychological distress, which are described in this section. There are effective and ineffective coping strategies to manage distress. Engaging in spiritual activities and socializing are considered to be effective ways of coping with psychological distress. Engaging in spiritual activities include: praying, meditating, breathing exercises, ceremonies and rituals (Levine, 2009; Graham et al., 2001). Engaging in spiritual prayer helps cope with distress and improves the well-being of the individual (Levine, 2009; Graham et al., 2001). Prayers help cope with stress because it allows the mind to organize the distressed thoughts in such a way that it can be managed (Levine, 2009; Graham et al., 2001). Studies indicate that socializing is more common among women than men (Ptacek et al. 1992; Gloria, 2006). Socializing can relive some of the psychological distress, which includes psychosocial interactions such as talking to loved ones or professionals on an emotional level (Taormina, 2001). Psychosocial interventions are not only helpful in coping with physical pain but also helps treat diseases and reduces the need for medication (Sobel, 1995). Social isolation can be treated effectively when both friends and family are included in psychosocial interventions of coping with psychological distress (Spiegel, 1990). Additionally, taking medication is another effective form of coping with psychological distress, especially when combined with other coping strategies. Medication, such as painkillers, can relive psychological distress by increasing serotonin and dopamine levels, which in turn reduces the pain caused by the psychological distress (Borg-Stein & Simons, 2002).

Substance use, on the other hand, is an ineffective coping strategy, which includes abuse

of drugs, alcohol, tobacco and cannabis. Substance use indicates that the individual faces barriers to effective coping methods to manage psychological distress (Ouimette et al., 1998). Substance use is an ineffective coping strategy because it may cause more harm to the individual's health (Ouimette et al., 1998; Dougherty et al., 2000). Additionally, substance use can negatively impact an individual's performance on daily activities. For example, drinking alcohol impairs the individual's motor skills, which causes the individual to perform poorly on tasks that require intense physical movement (Dougherty et al., 2000). As mentioned earlier, distress is measured by evaluating the individual's ability to readjust to environmental stressors (Aneshensel, 1992). Thus, this study aims to measure the overall psychological distress of individuals by examining the severity of the psychological distress symptoms and the effectiveness of coping strategies.

2.6—Conclusions from Literature

The literature on psychological distress symptoms and coping are used in this study to examine the extent of the psychological distress among the fisher communities in Chilika Lagoon. The psychological distress symptoms are physical pain, insecurity, social isolation, loss of connection, intense worry, eating disorders and sleeping disorders. The seven symptoms are associated with environmental distress and are used to examine the psychological well-being of the fisher communities who have experienced adverse environmental changes in Chilika Lagoon. Moreover, this study examines the coping strategies and social support of the fisher communities to determine if they are effective in reducing the psychological distress. This study examines the psychological distress by examining the severity of each of the symptoms and also by measuring the extent of the adverse environmental changes and the ability to cope with the distress. Based on the literature presented and the adverse environmental changes that occurred in Chilika Lagoon (as described in Chapter 3 under section 3.3) this study expects two outcomes, which depend on the fisher communities' ability to cope with psychological distress. If the coping strategies and social support of the fisher communities are ineffective, the outcome would reveal severe psychological distress symptoms among the fisher communities. If the coping strategies and social support are effective in managing distress, the outcome would reveal low or moderate psychological distress symptoms. Thus, examining the psychological distress symptoms and ability to cope with distress are important in determining the psychological well-being of the fisher communities.

Chapter 3

Methods and Study Area

3.0—Introduction

This chapter focuses on the qualitative methods used in this study. This chapter first discusses the validity and reliability of this study. It includes information on the sample population chosen for this study, which includes locations of the 15 communities where the interviews were conducted. This chapter includes information on the data collection process and participant selection criteria when choosing interviewees who would best represent the general population for this study. This chapter includes a "Study Area" which describes the types of environmental changes that have occurred in Chilika Lagoon from 1980 to 2017 and the impacts on livelihood, resource access and migration. This chapter also includes information on how the data is analyzed in the Results Chapters. Lastly, this chapter includes information on research ethics, limitations and assumptions. The following are the research question and objectives for this study.

Research Question:

> What is the relationship between environmental health, psychological health and well-being in Chilika, India?

Objectives:

4. (A) To understand the nature of the changes to the commons taking place in Chilika Lagoon and (B) its impact on the local fishers' livelihood, resource access to the Lagoon and out migration.
5. To examine the main impacts of the common resource changes on the psychological health of the fishers, specifically the stress experienced including emotional symptoms, physical symptoms and behavioural symptoms of distress.
6. To determine the current coping strategies of the fisher communities and how effective or ineffective the strategies are against psychological stressors and wellbeing.

Objective One focuses on the adverse environmental changes in Chilika Lagoon and their impacts on livelihood, resource access and migration. Objective One is separated into parts A and B. Objective One A focuses on the environmental changes in Chilika from 1980 to 2017, while Objective One B focuses on the impacts of environmental changes on livelihood, resource access and migration. Essentially, the purpose of Objective One is to determine the types of adverse environmental changes in Chilika Lagoon and how they have impacted the fisher communities by examining the impacts on livelihood, resource access and migration.

Objective Two focuses on the impacts on psychological distress associated with environmental changes among the fisher communities in 2017. There are three categories of psychological distress symptoms, which include physical, emotional and behavioural distress. Physical symptoms include physical pain, which can be any type of body ache associated with stress, including headaches, muscle aches, and chest pain. Physical symptoms from stress also include high blood pressure and trouble digesting which are associated with stress disorders. Emotional symptoms include senses of insecurity, social isolation, loss of connection and intense worry. Behavioural symptoms include eating disorders and sleeping disorders. These symptoms of psychological distress are associated with negative impacts of environmental changes on the participants' livelihood, resource access and migration. Although this study examines the environmental changes and the impacts on livelihoods, issues of resource access and migration during the period 1980 to 2017, the studied participants were asked to reflect on their psychological health using the last 15 years as a reference point.

Objective Three focuses on the coping strategies used by the participants and the sources of social support. The coping strategies include any strategies used by the participant to cope with the psychological distress symptoms that the participant claims to have experienced. Sources of social support includes anyone that provided support to the participant who is coping with psychological distress symptoms and includes any spiritual sources such as praying to God and meditating.

3.1—Research Validity: Study Boundary

According to Yin (2009), there are two critical parts to developing a valid research. The first part ensures that a proper boundary is selected in which the specific changes studied are present (Yin,

2009). The second part ensures that within the boundary chosen, the selected measures of the changes reflect the specific changes being studied (Yin, 2009). Regarding the first part of research validity, the boundary chosen for this study is located in Chilika Lagoon where significant negative environmental changes have occurred from 1980 to 2017. The types of environmental changes include: change in salinity in the Lagoon, decreased quantity of native fish, severe weather occurrences, new species in the Lagoon, decreased size of native fish, increased pollution in the Lagoon, Lagoon depth changes, and wetland habitat loss (as defined later in this chapter under section 3.3). The specific boundary chosen for this study includes three main sectors surrounding Chilika Lagoon (see Figure 1). There are five fisher villages in each of the sectors, which bring to a total of 15 villages. Sector One is located southeast of Chilika Lagoon and includes the following villages: Berhampur, Mahinsa (Maensa), Khatisahi, Sipakuda, and Biripadar. Sector Two is located west of Chilika Lagoon and includes the following villages: Barkul, Chadraput, Gabapadar, Langaleswar and Pathara. Lastly, Sector Three is located northeast of Chilika Lagoon and include the following villages: Mangalajodi, Balinasi, Jaganathpur, Paniduar, and Balipatapur (Bhusandpur).

There is limited information on the demographic changes from 1980 to 2017, but according to sources, the fisher population in Chilika has increased in the last four decades (Iwasaki, 2016). According to a study conducted in Chilika, there were approximately 48,000 fishers in total in the 1970s, of which 8,000 were full-time fishers (Senapati & Kuanr, 1977). The fisher population has then increased, but it is not clear what the total population is. It is estimated that by 2005, the total fisher population was between 103,454 and 122,339 of which approximately 30,936 we full-time fishers (ARCSCCB, 2005; JICA-CDA, 2009). Despite the decline in fish availability in the Lagoon and the lack of access to fishing grounds, the fisher population continued to increase from 1980 to 2001. Due to the limited research on the demographics in Chilika Lagoon, it is unclear as to what demographic pressures took place in Chilika from 1980 to 2017. That said, due to the lack of education among the fisher communities, the job availability among fisher communities is limited to fishing, which increases the fisher population (Iwasaki, 2016). The population increase in 2001 started to decline from 38.8 percent to 37.1 percent and studies indicate that there was a significant decline in newborns from 2001 to 2011 (Iwasaki, 2016). In Chilika Lagoon, fishers generally start

fishing by the ages of 10 to 14, so the majority of the fisher population are between 10 and 29 years of age. Due to the duration of the environmental changes which have significantly started in the 1980s, this research focuses primary on males and females between the ages of 45 to 55.

Figure 1 shows the locations of all 15 villages, which are indicated with blue and white pins around Chilika Lagoon. The three sectors are clearly visible in Figure 1. Sector One is located southeast of the Lagoon. Sector One is located near the artificial sea mouth that was opened in 2001, which caused changes to the environment that are unique to Sector One. The new sea mouth was dredged in a location that resulted in significant changes in salinity and severely impacted the ecosystem of the Lagoon (Nayak & Berkes, 2010). Sector One was chosen due to its proximity to the new sea mouth and its direct impacts of environmental changes caused by the sea mouth, such as invasive species and intensified inflow and outflow of water. Sector Two is located west of the Lagoon where the majority of Chilika's tourist hubs are located (Khuntia & Mishra, 2016). Sector Two was chosen due to its unique tourist activities. The tourist activities include landscape viewing, boating, bird watching and visiting the famous Kalijai Temple. The tourist industry in Sector Two allows the fisher communities to partake in tourism and generate additional income. Lastly, Sector Three is located northeast of the Lagoon and was chosen due to its unique changes in the water depths and invasive plants. This sector had experienced an infestation of Nalagrass (Phragmites karka) along the shoreline, which covered 286 sq. km by June 2008 (Ministry of Environment and Forests, 2008). Nalagrass are think plants that are about 7-9 feet tall, which impede the fishers from accessing the Lagoon and results in additional difficulties in fishing activities. The Nalagrass infestation and its impacts on the fisher communities are further in this chapter under section 3.3.1. Table 1 summarizes the unique characteristics of the three sectors.

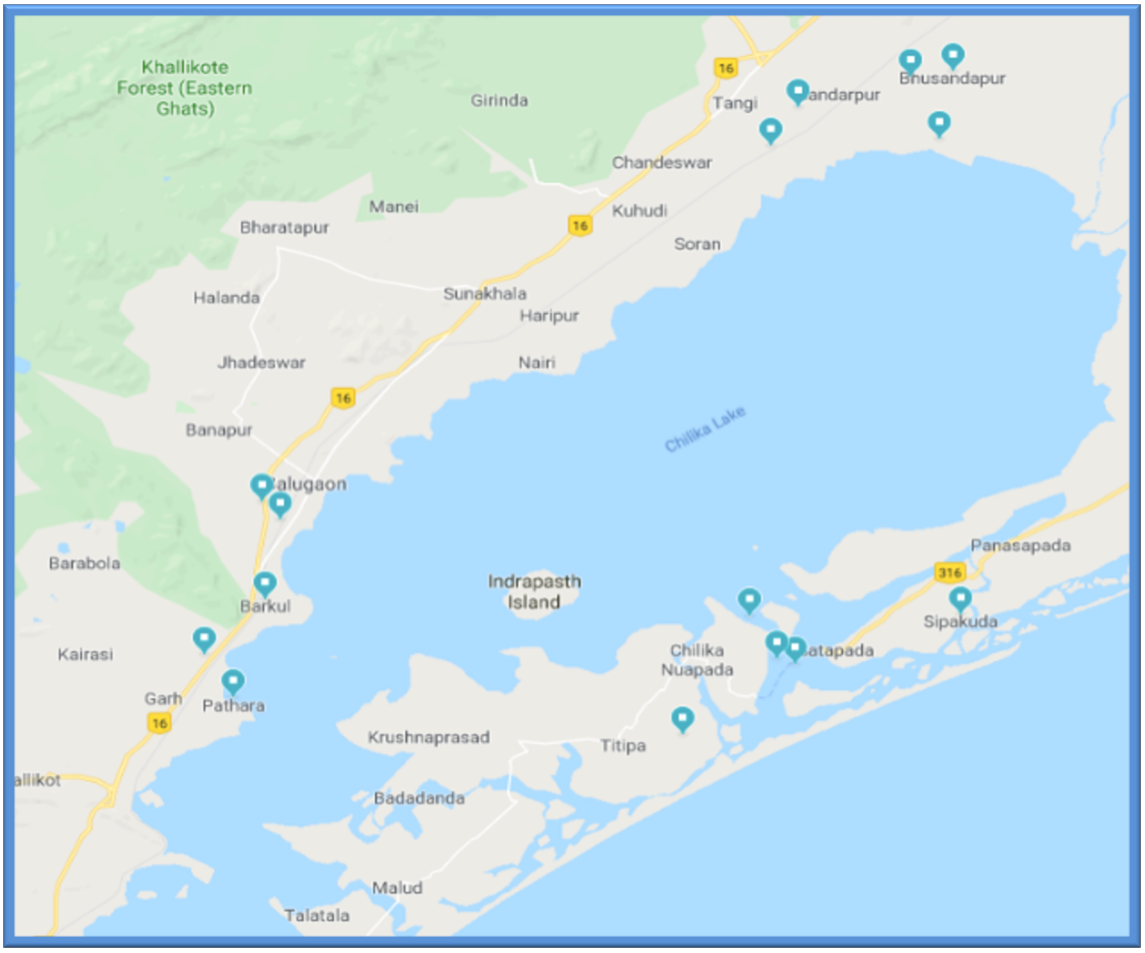

Figure 1—Boundary Location of 15 Villages (Three Sectors) in Chilika Lagoon (Chilika Lake)

Table 1—Characteristics of the Sectors Studied in Chilika

Sector	Characteristics
One	Close to artificial sea mouth opened in 2001, which caused intensified inflow and outflow of water, invasive species and salinity imbalances.
Two	Located in major tourist hubs, which allows additional sources of income.
Three	Nalagrass infestation impedes fishers from accessing the Lagoon.

All 15 villages are fisher caste-based, which includes traditional small-scale fisheries. With the local knowledge of the research assistant, the three sectors and communities were chosen based on their locations where rapid environmental changes have occurred between 1980 and 2017. The role of the research assistant, Tapan is described in section 3.1.3. The sample population of 15

fisher communities represent the general population of those fisher communities only as each of the three sectors studied have unique environmental changes. Thus, this study cannot be used to generalize the total fisher population in Chilika Lagoon. That said, the research conducted in the three sectors contains rich information on the effects of environmental changes on psychological health. Despite the uniqueness of the environmental changes in Chilika Lagoon, effects of climate change are occurring across the world, which means that the effects of environment changes on psychological health may occur in other parts of the world, but may show different impacts on the psychological health than those of the fisher communities in Chilika.

Regarding the second part of research validity, the boundary chosen for this study should demonstrate a likelihood of local fishers experiencing psychological distress. The ecosystem in Chilika Lagoon has significantly changed since 1980 due to natural and anthropogenic changes including the new artificial sea mouth that changed the salinity of the Lagoon and the increased aquaculture practice by non-fishing communities (Nayak & Berkes, 2010, 2014). The adverse environmental changes in Chilika Lagoon are described later in this chapter. It is likely that the fishers in this boundary experience psychological distress because research indicates that the environmental changes that have occurred within this region from 1980 to 2017 have shown to be adversely negative. The types of environmental changes studied in Chilika Lagoon include: changes in salinity, changes in depth, decreased quantity of fish, decreased size of native fish, severe weather occurrences, increased pollution, invasive species and wetland habitat loss (as defined in section 3.3). The adverse environmental changes that have occurred in Chilika indicate that the livelihood, resource access and migration of the fisher communities would have been negatively impacted. The impacts on livelihood, resource access and migration are described in section 3.3. The impacts on livelihood, resource access and migration indicate that the psychological well-being of the fisher communities would have been negatively impacted. The psychological well-being of the fisher communities was measured by ranking the severity of seven psychological distress symptoms (as defined in the Literature Chapter under section 2.2). The seven psychological distress symptoms include: physical pain, insecurity, social isolation, loss of connection, intense worry, eating disorders and sleeping disorders. Subsequently, the coping

strategies and sources of social support of the fisher communities are determined to examine how the participants cope and if it is effective.

3.1.1—Semi-Structured Interviews in Person and by Phone Interviews

This research used a case study method, which includes qualitative evidence collected via semi-structured interviews in person and by phone interviews conducted in local fisher communities in Chilika Lagoon, India. The semi-structured interviews were conducted from January to April 2017 and follow-up phone interviews were conducted from January to June 2019. The semi-structured interviews included four main sections. The first section aimed to determine the types of environmental changes that took place in Chilika Lagoon. The second section examines the impacts of environmental changes on the fisher communities' livelihood, resource access and migration. The third section of the semi-structured interviews aimed to determine the types of psychological distress symptoms experienced by the individuals who participated in this study. The fourth section of the semi-structured interviews aimed to determine the coping strategies and the sources of social support of the individuals who participated in this study. Lastly, the phone interviews consisted of follow up questions on coping with psychological distress symptoms.

Qualitative data was used to capture the voices expressed in the fisher communities in Chilika regarding the impacts of the environmental changes on their livelihood, resource access and migration and the implications on their psychological well-being. An empirical and qualitative research inquires on individuals or groups who are experiencing a social or human problem (Creswell, 2007). The qualitative evidence in this case study was collected through the semi-structured interviews. Counting was used as a method of representing the qualitative data when analyzing the types of environmental changes that took place in Chilika and the types of impacts on livelihood, resource access and migration. Magnitude coding was used to determine the severity of the psychological distress symptoms experienced by the fisher communities, which are associated with the adverse environmental changes. Lastly, the qualitative data was analyzed via frequency coding to determine the coping strategies and sources of social support of the individuals who participated in this study. Magnitude coding and frequency coding are described in this chapter under sections 3.4.2 and 3.4.3.

According to John Creswell (2007), qualitative study requires a natural setting to collect the data, which means that the data had to be collected when the participants were located in the environment where they were potentially experiencing psychological distress (Creswell, 2007). The data was collected in Chilika Lagoon where the participants were potentially experiencing the effects of psychological distress due to the adverse environmental changes that took place. Creswell (2007) adds that the qualitative research must follow the participants' meaning and not the researcher's meaning that is brought into the research (2007). Additionally, the interview questions must use "how" and "why" questions, which are explanatory and useful for exploring questions that focus on a specific topic that is occurring over time (Yin, 2009). This means that the semi-structured interview questions in this study were catered to the participants' view of environmental changes and physiological distress. The semi-structured interviews were conducted in a form that would be open to new ideas introduced by the interviewees, regarding environmental changes, psychological distress, and coping. Thus, the semi-structured interviews conducted focused on the participants' responses to environmental change and their interpretations of their psychological distress symptoms associated with the environmental changes.

Table 2 shows all the individuals from fisher communities in Chilika Lagoon who have participated in this study, which are given unique three to four-digit codes for confidential purposes. There is a total of 76 participants in this study of which, 52 are males and 24 are females. There are 15 communities in total and about five to six individuals were interviewed from each community. There are 14 males in Sector One, 15 males in Sector Two, and 23 males in Sector Three. There are 11 females in Sector One, 10 females in Sector Two and three females in Sector Three. There are three main sectors surrounding Chilika Lagoon, each containing five fisher caste-based communities (as shown in Figure 1).

Table 2—Participant Information by Sector, Identified by a Unique Code and Gender

Sectors	Number of Communities	Participant				
		Male			Female	
One	5	102	205	504	107	404
		105	301	505	110	405
		106	302		201	501
		202	304		303	502
		203	401		305	503
		204	403		402	
Two	5	601	703	902	603	805
		602	801	904	604	903
		605	802	1001	704	905
		701	804	1002	705	1003
		702	901	1005	803	1004
Three	5	1101	1301	1404	1104	
		1102	1302	1405	1105	
		1103	1303	1501	1204	
		1106	1304	1502		
		1201	1305	1503		
		1202	1401	1504		
		1203	1402	1505		
		1205	1403			

3.1.2—Participant Selection Criteria and Generalization of Population

To participate in this study, each individual had to meet specific criteria to partake in this study. The criteria include males and females from local fisher case-based communities in Chilika Lagoon. All 15 communities visited in this study are caste-based communities that focus on fishing. Every individual interviewed has either lived in the community their whole lives or has moved into the community from a different fisher caste community through marriage. Each participant had to be between the ages of 45 to 55 because that would give the individual enough experience of living in Chilika Lagoon to have observed the adverse environmental changes that

took place between 1980 and 2017. Additionally, individuals of 45 to 55 years of age would have enough experience with the impacts of environmental changes on their livelihood, resource access and migration. Lastly, individuals within the age range of 45 to 55 would have enough experience with the impacts of environmental changes that their psychological well-being would potentially be affected. Table 3 summarizes the criteria used to select participants for this study.

Table 3—Criteria Used to Select Participants

Participant Selection Criteria
Males and females from caste-based fisher communities
Lived in Chilika and observed environmental changes
Ages 45 to 55

There are roughly 150 communities surrounding Chilika Lagoon, which includes 200,000 caste-based fishers in 40,000 fisher households (Nayak & Berkes, 2010). This study assumes that five participants per community will saturate the data, as long as all five participants provide similar findings regarding environmental changes, livelihood, resource access, and migration (Fusch & Ness, 2015). If, for any reason, five participants did not provide similar findings, an additional individual was interviewed. Each participant was chosen randomly to partake in the interviews, but only during the hours between 9A.M. and 5P.M. This means that only individuals who were available during this timeframe were able to participate in this study, which led to an exclusion of fishers who work outside of their community (as described in section 3.6). Each participant met the criteria requirements to partake in this study. In conclusion, the data collected in this study is saturated and can be used to generalize the total population of the 15 communities in Chilika that were involved in this study.

3.1.3—Role of Research Assistant

According to Yin (2009) it is essential that errors and biases be minimized during the data collection process. In order to minimize errors and biases in this study, the semi-structured interviews and phone interviews were properly documented. The local research assistant, named Tapan, played an important role during the data collection process. As mentioned earlier, Tapan has lived in one of the fisher communities that was included in this research and has extensive

knowledge on the fisher-caste system and the communities surrounding Chilika Lagoon. Tapan is a middle-aged father of three who has lived in Berhampur, a fisher community, all his life. For over 20 years, Tapan has worked in miscellaneous tasks, which required travelling throughout Chilika. His extensive traveling experience in Chilika has aided in selecting the appropriate fisher communities that were involved in this research. The three sectors chosen for this research is found in this chapter under section 3.1. To properly document the interviews, the researcher ensured that Tapan had a clear understanding of the scope of the study and fully understood all interview questions. The first role of the research assistant was to provide guidance in navigating through the communities in Chilika Lagoon. The second role of the research assistant was to translate the local language, Odia, to English. Ensuring the research assistant fully understood the research question and objectives and was able to translate the interview questions from English to Odia in a form that was understandable by the participants minimizes errors and biases during data collection. Additionally, the research assistant understood that the participants lacked knowledge on psychological distress and scientific terms, which were translated in terms that were understandable to the locals. To achieve this, the research assistant along with the primary researcher both read the interview questions prior to the interviews and clarified the meaning and purpose of each question in English and then translated to Odia. Lastly, to provide proper documentation for this study, the semi-structured interviews were recorded and written notes were taken during the interviews, upon participants' consent.

3.2—Data Collection

This section focuses on the methods used to collect the data for this study. Qualitative evidence was collected through semi-structured interviews and follow-up phone interviews. The interview questions are found in the Appendix. The interviews were divided into four main sections. The first section determined the types of adverse environmental changes that took place in Chilika Lagoon. The second section determined the impacts of environmental changes on livelihood, resource access and migration. The third section determined the psychological distress symptoms of the individuals and examined the severity of each symptom. Lastly, the fourth section of the interviews determined the coping strategies used to manage the psychological distress symptoms and determined the sources of social support in aiding with the coping strategies.

The first section of the interviews determined the types of adverse environmental changes, which include: change in salinity in the Lagoon, decreased quantity of native fish, severe weather occurrences, new species in the Lagoon, decreased size of native fish, increased pollution in the Lagoon, Lagoon depth changes, and wetland habitat loss (as defined in this chapter under section 3.3). Each of the 76 participants were asked if they had observed any of the eight environmental changes and impacts in Chilika Lagoon from 1980 to 2017. Each participant was asked to expand on the particular environmental change that they claimed to be significant. Some of the comments of the participants regarding the adverse environmental changes are shown in Chapter 5.

The second section of the interviews determined the impacts of environmental changes on livelihood, resource access and migration. Each participant was asked to identify the effects of the environmental changes on their livelihood, resource access and migration, which are defined in this chapter under section 3.3. The impacts of environmental changes on livelihood include: decreased leisure time, unable to afford all basic needs, limited spending money, and decreased income from 1980 to 2017. The impacts of environmental changes on resource access include: conflict between communities regarding fishing space, decreased amount of fish caught from the Lagoon, having their household fishing equipment stolen and use of zero nets (nylon nets) from 1980 to 2017. The impacts of environmental changes on migration include: local labour work, non-local labour work, seasonal migration for work, temporary migration for work, and permanent migration for work, from 1980 to 2017.

The third section of the interviews determined the types of psychological distress symptoms associated with the environmental changes that the participants experienced. Each participant was asked to identify the symptoms of psychological distress that he or she had experienced in 2017 due to the impacts of the environmental changes that occurred from 1980 to 2017. The qualitative evidence collected in this section of the interviews was later analyzed to determine the severity of each of the psychological distress symptoms during the data analysis process, which is described in this chapter under section 3.4. The types of psychological distress symptoms include: physical pain, insecurity, social isolation, loss of connection, intense worry, eating disorders and sleeping disorders. The seven symptoms include physical, emotional and behavioural symptoms of psychological distress, which help examine the overall psychological

well-being of the participants. The seven psychological distress symptoms are described in detail in Chapter Two on Literature Review under section 2.2.

Lastly, the fourth section of the interviews determined the types of coping strategies and the sources of social support. Qualitative evidence was collected during this section of the interviews. Each participant was asked to identify the types of coping strategies that he or she uses to manage his or her psychological distress symptoms. Coping strategies are an important part in managing psychological distress symptoms. The coping strategy or strategies needed varies from one individual to another (Carver, Scheier & Weintraub, 1989). An individual can use multiple types of coping strategies to manage his or her psychological distress. The common types of coping strategies are taking medication for physical pain, socializing to relieve stress and practicing spiritual activities such as praying or partaking in rituals and celebrations (Borg-Stein & Simons, 2002; Taormina, 2001; Levine, 2009). That said, there are other types of coping strategies that the participants used in this study, which are described in Chapters 4 and 6. Additionally, each participant was asked to identify the sources of social support that he or she received to help manage his or her psychological distress symptoms. The data collected was then analyzed to determine the types of coping strategies and sources of social support that the sample population used to manage their psychological distress symptoms. The methods used in the data analysis process on coping strategies and sources of social support are described in this chapter under section 3.4.3.

3.3—Study Area: Introduction

This section focuses on the types of environmental changes that occurred in Chilika Lagoon from 1980 to 2017 and the impacts on livelihood, resource access and migration. This study focuses on the environmental changes that have occurred in Chilika starting in 1980 because by then, aquaculture operations have started to increase significantly in Chilika Lagoon and thus, the environment of the Lagoon would have started to experience adverse changes around 1980 and increasing through the years until 2017. These environmental changes have impacted the lives of the fisher communities as aquaculture operations have taken over fishing grounds of the fisher communities. The fisher communities in Chilika have been marginalized through decline in livelihood, resource access and migration, which are further explained in this section. Essentially,

this section describes each of the environmental changes that occurred in Chilika, and the impacts on livelihood, resource access and migration, which are used as indicators in the data analysis process. Refer to section 3.4.1 for more information on how the data was analyzed. Chapter 4, 5 and 6 reference this section as it describes the environmental changes and the impacts so that they are not repeated in those chapters.

3.3.1—Study Area: Types of Environmental Changes

This study examines eight types of adverse environmental changes that have occurred in Chilika from 1980 to 2017. The types of environmental changes include: severe weather occurrences, change in salinity in the Lagoon, Lagoon depth changes, new species in the Lagoon, increased pollution in the Lagoon, wetland habitat loss, decreased quantity of native fish, and decreased size of native fish. This study examines these environmental changes and their contribution to the decline in livelihood, resource access and migration of the fisher communities.

3.3.1.1—Severe Weather Occurrences

The consequences of climate change are predicted to impact the ecosystems involving fisheries around the world. The increase in greenhouse gases intensifies the impacts of climate change on the Erath's ecosystem, including in India (Zacharia et al., 2016). India's economy is strongly tied to its natural resources, which are at risk of experiencing economic consequences due to climate change (Senapati & Gupta, 2015). Research indicates that the livelihood of many coastal fisheries in India have been impacted by climate change, which include rise in temperature, rise in sea level, change in rainfall patterns, and availability of fish (Senapati & Gupta, 2015). As a result of climate change, the livelihoods of the fisher communities in Chilika are potentially negatively impacted. In this study, climate change impacts in Chilika Lagoon are referred to severe weather occurrence.

3.3.1.2—Salinity Changes

The change in salinity resulted from the opening of an artificial sea mouth to the Bay of Bengal in 2001 (Nayak & Berkes, 2010). Prior to dredging the sea mouth in 2001, there were a few natural sea mouths that connected the Lagoon to the Bay of Bengal, which allowed inflow and outflow of water. All sea mouths were eventually closed naturally. The lack of sea mouths blocked the flow

of sediments from the rivers that reached the Lagoon, which impeded the sediments from being flushed from the Lagoon into the Bay of Bengal (Nayak & Berkes, 2010). By 1990s the last sea mouth was blocked, which resulted in the dredging of the new sea mouth in 2001. The intentions of opening the sea mouth was to benefit the fisheries in Chilika Lagoon, but it was dredged in a location that resulted in drastic changes in the salinity of the Lagoon, which negatively impacted the local fisheries (Nayak, 2014). Although the location of the new sea mouth was recommended by scientific studies, the location increased the intensity of the water inflow and outflow with daily high and low tides, which resulted in an increase of salt water (Nayak & Berkes, 2012). Additional impacts caused by the new sea mouth include sand infestation near the sea mouth, and random changes in the depth of the Lagoon (Sahu, Pati & Panigrahy, 2014; Nayak and Berkes, 2010). The result of these changes to the Lagoon's biological ecosystem caused significant distress to the fishing economy of the small-scale fisheries in Chilika (Nayak and Berkes, 2010).

3.3.1.3—Depth Changes

The changes of salinity in Chilika Lagoon caused random depth changes
(Nayak and Berkes (2010). The natural sea mouth that was blocked in early 1990s caused an increase in salinity inside the Lagoon, which resulted in changing the depth of the Lagoon (Nayak & Berkes, 2011). The artificial sea mouth that was dredged in 2001 caused additional imbalances in the salinity of the Lagoon, which further caused changes in the depth profile of the water (Nayak & Berkes, 2012). In addition to the changes in water depths, in the region located northwest of Chilika Lagoon, there had been an increase in weed infestation along the shoreline. A 1995 report stated that extensive development of brackish water ponds for fish culture has resulted in eutrophication of the Lagoon as well as Lagoon area decreasing by 1.45 to 1.6 sq. km per year (Pattanaik, 2007). By 2008, The Chilika Development Authority (CDA) noticed invasive weeds in the northern sector of the Lagoon called Nalagrass (Phragmites karka) that are about 7-9 feet tall (Ministry of Environment and Forests, 2008). The infested region of Nalagrass weeds covered about 286 sq. km by June 2008, as reported by the CDA (Ministry of Environment and Forests, 2008). This region used to be a fishing spot for the communities located along the shoreline, but because the water had become shallower, it was not possible for the fishers to continue to fish. In addition, this area became infested with Nalagrass, which made it difficult for fishers to travel

across the shallow water into deeper parts of the Lagoon (Ministry of Environment and Forests, 2008).

3.3.1.4—New Species in the Lagoon

The artificial sea mouth and its impact on the Lagoon's salinity negatively affected the fishing activities by allowing invasive species to entre the Lagoon, such as jellyfish (Cnidaria scyphozoa aurelia), stingray (Trygon sephen) and barnacles (Balanus glandula) (Nayak & Berkes, 2010). Jellyfish and stingray can harm the fishers while they are in the Lagoon, which impacts fishing activity (Nayak, 2014). Barnacles infest fishing equipment and are sharp enough that can cut through the skin. The presence of invasive sea species not only caused harm to fishers but also caused physical alteration in Lagoon habitat (Nayak & Berkes, 2012). The alternations in the Lagoon habitat also contributed to the habitat loss of the native species, which, in turn, resulted in a decline in breeding grounds and fish stock.

3.3.1.5—Wetland Habitat Loss

The fluctuations of the ecosystem in Chilika that resulted in the presence of invasive species altered the native species and their food webs (Nayak, 2014). The wetlands inside the Lagoon that provided food and shelter for native species have declined (Nayak & Berkes, 2012). Furthermore, significant changes in fish nursery inside the Lagoon have occurred (Nayak & Berkes, 2012). In addition to the fish biodiversity loss caused by the artificial sea mouth, the practice of aquaculture activities that turned species-rich areas into monocultures also contributed to the biodiversity loss and fish habitat loss in Chilik Lagoon (Nayak, 2014). Other factors that have contributed to the loss of wetland habitat include overfishing practices and lack of attention to breeding periods (Nayak, 2014). Overfishing became a problem as aquaculture operations increased inside the Lagoon by non-fisher castes, which increased the overall demand for fish and fishing grounds (Nayak, 2014).

3.3.1.6—Increased Pollution in the Lagoon

As global fisheries doubled from 1970 to 2001, so did the practice of aquaculture in India, which significantly expanded in the mid 1980s (Nayak, 2011). The brackish water in Chilika Lagoon is

suitable for practicing aquaculture, which increased drastically and resulted in taking over the fishing grounds of the fisher caste-based communities (Nayak & Berkes, 2012). Aquaculture practice not only destructs coastal habitat, but also causes pollution and diseases in the species in Chilika Lagoon (Nayak & Berkes, 2010). The increase of aquaculture practice in Chilika has increased chemical pollution in the water, which significantly impacts fish habitat and fish stock (Nayak, 2014). The practice of aquaculture in Chilika Lagoon has resulted in widespread of disease outbreaks in fish species from 2003 to 2005 (Nayak, Armitage & Andrachuck, 2015). The increase of aquaculture practice as well as encroachment by caste groups that are not based on fisheries in Chilika Lagoon has resulted in conflict between non-fisher and fisher castes, which is described in this chapter under section 3.3.3.

3.3.1.7—Decreased Quantity of Native Fish

There are two main drivers that contributed to the decline in fish stock in Chilika Lagoon which were intensive aquaculture practice and the opening of the sea mouth. The fish stocks in Chilika Lagoon have decreased drastically since the increase of aquaculture operations in the 1980s. The practice of aquaculture turns fishing grounds from species-rich into monocultures, which significantly impacts the biodiversity of Chilika Lagoon (Nayak & Berkes, 2012). The aquaculture operations also resulted in decreasing the fishing grounds of the fisher communities, which led to overfishing and neglecting breeding grounds (Nayak, 2014). In addition to aquaculture practice, the opening of the artificial sea mouth to the Bay of Bengal in 2001 has also contributed to the decline in fish stocks due to the changes in salinity and allowing invasive species to entre the Lagoon (Nayak & Berkes, 2012). Aquaculture practice and the hydrological changes caused by the artificial sea mouth resulted in a decline in fish habitat (Nayak, 2014). As a result of the two drivers that caused a decline in fish stocks, there were 11 species of fish that were once abundant in the Lagoon and most were market-valued species (Nayak, 2014). According to the fishers in Chilika the fish species that became scarce included: “gania (four-lined therapon, Pelates quadrilineatus), chauli (Commerson’s anchovy, Stolephorus commersoni), chandi (naked-head glassy perchlet, Ambassis gymnocephalus), and seba (milkfish, Chanos chanos)” (Nayak & Berkes, 2012). In addition to the decline in fish stocks, some species appeared before or after their expected season as a result of the changes in the ecosystem of the Lagoon (Nayak & Berkes, 2012).

3.3.1.8—Decreased Size of Native Fish

As practice in aquaculture operations and encroachments increased in the 1980s the fishing ground for capture fisheries decreased (Nayak, 2011). Additionally, the biodiversity loss in the Lagoon also resulted in a decline in fish stocks. The decline in fish stocks has resulted in overfishing which also contributed to the decline in fish size (Nayak, 2014). As the catch size decreased the number of juvenile fish caught by the fisher communities increased. As a result of overfishing, women noticed a decline in fish size and have started cooking juveniles, which affected the nutritious intake in household meals (Nayak & Berkes, 2012). The fisher communities in Chilika held customary and legal rights to fishing the Lagoon since the 1500s (Nayak, 2014). The decline in fish stocks and fish size in Chilika Lagoon posed concerning impacts on the income of the fisher communities and their livelihood conditions.

3.3.2—Study Area: Impacts of Environmental Changes on Livelihood

The environmental changes described in the previous section have contributed to the decline in livelihood. This study examines how the livelihood of the fisher communities has been impacted through the increased aquaculture operations, encroachment and decline in fish stocks. The impacts on livelihood pose a concern for the psychological well-being of the fisher communities, which is later examined in this study. This section describes the impacts of environmental changes on livelihood, which include: decreased income from the environmental changes, inability to afford all basic needs, limited household spending money, and decreased leisure time. The four categories of livelihood are used to describe how the overall livelihood has been impacted among the fisher communities. The category on decreased income focuses on whether fishing in the lagoon has negatively impacted the household income. The categories on household spending money and affording all basic needs focus on whether the decreased income has limited only household spending money or limited both household spending money and affording all basic needs. If household spending money and affording all basic needs have not been impacted, the last category on leisure time indicates whether the fisher households have increased the number of working hours to maintain household income in order to afford all basic needs and have spending money. That said, increasing the number of working hours does not necessarily increase household

income. These categories of livelihood are only used to give context on how the livelihood has been impacted among the fisher households. The following subsections describe each category of livelihood in more detail.

3.3.2.1—Decreased Income due to Environmental Changes

There is a discrepancy between the information on income provided in government documents and the real income of the fisher communities. Despite the records from the State Government of Odisha indicating an increase in overall fishing income in Chilika Lagoon, which include aquaculture, the caste-based fishers have not been able to contribute to that income increase (Nayak & Berkes, 2010). Additionally, the sources of the data presented in the government documents on household income in fisher communities in Chilika are not clear (Nayak & Berkes, 2012). The fishers are caste-based, meaning that their caste is primarily focused on fishing, while other castes are focused on other sources of income. Once the caste-based fishers are not able to fish, they are not fulfilling their traditional caste roles, so they are functioning out of the caste system, which have major impacts on their livelihoods (Nayak and Berkes, 2011). By 2012, over 60 percent of what used to be customary fishing grounds of the fisher communities have turned into shrimp aquaculture operated by non-fisher groups (Nayak, 2011). Investing in shrimp aquaculture requires intensive capital, which most caste-based fishers cannot afford (Nayak, 2011). Additionally, caste-based fishers had less access to the Lagoon due to unaffordable leases of fishing grounds (Nayak and Berkes, 2010). The rates of annual lease fees for fishing in the Lagoon have increased drastically. While a new bill was implemented in 2002 to allow the fishers to gain access to the Lagoon, the lease fees increased by 27 percent, making the leases less affordable for the fishers and resulting in the sub-leasing of their lease (Nayak and Berkes, 2010). As a result, caste-based fishers are left with few fishing grounds and limited fish stock, which leaves them economically and socially vulnerable.

3.3.2.2—Inability to Afford all Basic Needs

The decline in household income of the fisher communities has resulted in severe food security and inability to afford all basic needs. A study indicates that 88 percent of households in fisher communities in Chilika have experienced severe food shortages (Nayak & Berke, 2012). The food

culture is based on rice and fish, which was significantly impacted by the decline in household income. Additionally, the decline in household income has resulted in a decline in children attending school. A study indicates that there was a 70 percent decrease in high school examinations due to the decline in household income (Nayak & Berkes, 2012). The decline in household income has not only limited the affordability of education fees for children, but also increased the demand for women and children to contribute to income generation activities (Nayak, 2014). This is an indication that households in fisher communities have limited spending money and leisure time due to the demand of additional income generating activities.

3.3.2.3—Limited Spending Money and Leisure Time

Having limited spending money can severe impacts the individual's ability to fully participate in his or her own society (Marmot, 2002). The decline in household income and the demand for women and children to partake in income generating activities has concerning impact the households' ability to fully participate in their communities. Additionally, not being able to fully participate in one's own community can have drastic consequences on the individual's connection to his or her community environment (Marmot, 2002). This is closely linked to the fisher communities in Chilika as their livelihoods depend on the Lagoon environment and the loss of connection to the environment can have serious consequences on their psychological well-being. The decline in income has resulted in the demand for women and children to participate in income generating activities, which decreases leisure time for the household. A decrease in an individual's leisure time due to an increase in working hours can significantly impact the individual's psychological health (Heintzman & Mannell, 2010). This indicates that the fisher communities were facing psychological distress not only due to limited spending money but also due to limited leisure time.

3.3.3—Study Area: Impacts of Environmental Changes on Resource Access

The environmental changes described previously in the "Study Area" have contributed to the limited access to the Lagoon. This study examines how resource access of the fisher communities has been impacted through the increased aquaculture operations, encroachment and decline in fish stocks. The impacts on livelihood pose a concern for the psychological well-being of the fisher

communities, which is later examined in this study. The impacts of environmental changes on resource access include: conflict between communities regarding fishing space, theft of fishing equipment, decreased fish catch size and use of 'zero nets' (nylon nets).

3.3.3.1—Conflict and Fishing Equipment Theft

The environmental impacts that occurred in Chilika Lagoon from 1980 to 2017 have facilitated in the growing conflict between caste-based fisher groups and non-fisher groups. The dredging of the sea mouth to the Bay of Bengal in 2001 has caused drastic changes to the Lagoon ecosystem (Nayak & Berkes, 2010). The increase in aquaculture starting in the 1980s has intensified the impacts on the Lagoon ecosystem (Nayak, 2014). Additionally, non-fisher groups who held higher political power compared to the capture fisheries controlled the aquaculture operations in Chilika Lagoon (Nayak, Oliveira & Berkes, 2015). Over 60 percent of the Lagoon fishing grounds have been converted into aquaculture and 94 percent of those who operate the aquaculture farms are non-fisher groups (Nayak, 2011). The practice of aquaculture involved encroachment from traditional fishing grounds of the fisher communities who are politically, economically and socially vulnerable (Nayak, 2014). In addition to encroachment, illegal fishing activities took place, which included net enclosures. Net enclosures are long bamboo embankments that are erected for long periods of time or left in the Lagoon permanently by non-fishers **(**Pattanaik, 2007). These net enclosures disrupt the levels of oxygen, salinity and tidal flushing, which reduce the natural growth of fish and make it difficult for fishers to use traditional methods of fishing as the fish sizes have decreased (Pattanaik, 2007). As fisher communities started losing their customary fishing grounds, conflict started to escalate between fisher groups and non-fisher groups (Nayak & Berkes, 2012). This has resulted in significant concerns over the fisher communities' ability to access the Lagoon's resources. Furthermore, when conflict escalates and living costs increase, theft is expected to increase as well (Fafchamps & Minten, 2003). As a result, theft of fishing equipment is also an impact on the fisher communities' access to the Lagoon as it impedes the fishers from fishing.

3.3.3.2—Decreased Fish Catch Size and Use of 'Zero nets' (Nylon Nets)

As aquaculture operations have decreased the fishing grounds of the fisher communities, the fishers have experienced a consistent decline in fish catch size. The decline in fish stock and fish yield has resulted in overfishing the Lagoon (Nayak & Berkes, 2012). Moreover, the fishermen had started fishing all fish sizes and neglecting fish breeding areas (Nayak, 2014). The use of nylon nets had increase due to the decline in fish stock and fish catch size (Nayak, 2014). Many fishers and non-fishers had substituted traditional fishing methods with nylon nets, which locals referred to them as 'zero nets' and 'disco nets', as nylon nets are more efficient **(**Pattanaik, 2007). Nylon nets are considered illegal because they impede the growth of marine species as they catch juveniles and non-targeted species including fish eggs (Pattanaik, 2007). In turn, the use of nylon nets had contributed to the exploitation and depletion of fish in the Lagoon.

3.3.4—Study Area: Impacts of Environmental Changes on Migration

The environmental changes described previously in the "Study Area" have contributed to forced migration among the fisher communities in Chilika. Since the traditional fishers have experienced a decline in livelihood and resource access, forced migration had become a method of searching for alternate source of income (Nayak and Berkes, 2010). This study examines the impacts on migration, which also pose a concern for the psychological well-being of the fisher communities. The types of migration associated with the adverse environmental impacts in Chilika Lagoon from 1980 to 2017 include: local labour, non-local labour, seasonal migration, temporary migration, and permanent migration.

3.3.4.1—Daily Wage Labour: Local and Non-local Jobs

As a result, in the decline in household income, the fishermen are forced to take daily wage jobs, which are not related to fishing. Furthermore, women and children had started to contribute to income generation activities (Nayak, 2014). Daily wage jobs include positions in construction, tourism, and retail. The category of 'local labour' includes local jobs that are not related to fishing, but are located in Chilika, which would not require long distance for the individual to travel to work. 'Non-local labour' includes daily wage positions outside of Chilika but close enough that would allow the individual to travel long distance on a daily basis. Traveling long distance for

work is not a popular choice since the public transportation in rural areas in India is inefficient and time consuming (Chakroborty, 2016). For the purpose of this study, both local and non-local daily wage jobs are examined to determine the types of alternative income generating activities that the fisher communities may have. That said, as the fisher communities were marginalized through livelihood decline and limited resource access, the fishers may face additional challenges to finding other types of employment within or near Chilika.

3.3.4.2—Seasonal Migration and Temporary Migration

Some of the fishers had migrated seasonally or temporarily either in distant urban areas or out of the province (Nayak, 2014). In this study, seasonal migration includes migrating for work from one to four months, while temporary migration includes migrating for work from four to twelve months, either within the province or outside the province. Seasonal and temporary migration could be used as an additional source of household income, which means that the fishers could also fish inside Chilika Lagoon when they were not seasonally or temporarily migrated for work. Seasonal migration can be combined with seasonal fishing. During off-season in fishing, the fishers generate less income form the lagoon. During this time, the fishers can migrate out of Chilika for work for a portion of the year to generate more income and return during fishing season. On the other hand, temporary migration does not necessarily mean that the individual is migrating for work during off-season in fishing. As the income from fishing has declined severely, the fishers are forced to migrate out of Chilika during any time of the year regardless of the fishing season. Temporary migration can also be considered a step closer to permanent migration as the fisher communities may not be ready to migrate permanently but are forced to seek new employment outside of Chilika. Furthermore, seasonal and temporary migration does not necessarily mean that the entire household migrates together, but rather a one member of the household migrates for work while the rest of the household stays in Chilika.

3.3.4.3—Permanent Migration

Lastly, permanent migration had become a common method for obtaining a more reliable source of income compared to the income in fisher communities in Chilika. In this study, permanent migration includes moving out away from Chilika with no intentions of moving back. A study

indicates that between 2007 and 2009 one third of the fisher communities had migrated to urban centres in Odisha and other provinces and had taken daily wage jobs (Nayak & Berkes, 2012). Furthermore, the migration crisis between 2007 and 2009 in Chilika had been unknown to the Odisha State Government, which poses serious concerns for the fisher communities' livelihoods (Nayak & Berkes, 2012). The impacts on migration may cause serious concerns for the psychological well-being of the individuals and the culture of the fisher communities. Unemployment and changes in employment has negative effects on the psychological well-being as the individual is exposed to major stressors that are difficult to adapt to (Taris, 2002). In addition, the fisher households migrating can experience culture shock, which in turn, aggravates the difficulty in adapting to new environments and can result in alienation from society (Bhugra, 2004).

3.4—Data Analysis

This section focuses on the methods used to analyze the data collected, which is structured into the three objectives of this study. Section 3.4.1 focuses on the methods used for Objective One, which includes quantifying the data collected regarding the types of environmental changes that took place in Chilika Lagoon from 1980 to 2001 and the impacts on livelihood, resource access and migration. Section 3.4.1 focuses on the methods used for Objective Two, which includes using Saldaña's (2009) magnitude coding to determine the types of psychological distress symptoms experienced by the participants and the severity of each of the symptoms. Lastly, section 3.4.3 focuses on the methods used for Objective Three, which includes using Lecompte and Schensul's (1999) frequency coding to determine the types of coping strategies used by the participants and the sources of social support.

3.4.1—Data Analysis: Environmental Changes, Livelihood, Resource Access and Migration

This section focuses on the analysis of the data collected for Objective One, which includes environmental changes that have occurred in Chilika from 1980 to 2017 and the impacts on livelihood, resource access and migration. There are eight types of environmental changes and the impacts for each of the following areas: livelihood, resource access and migration, which are referred to indicators (see Table 4). All of the indicators in Objective One are analyzed using the

same method of counting to represent the qualitative data. All indicators are quantified to determine the number of participants who claimed to have observed the types of environmental changes and who have experienced impacts on their livelihood, resource access and migration. Chapter 4 and 5 reveal the number of participants who have observed the environmental changes and experienced the impacts. Additionally, qualitative data is used in Chapters 4 and 6 to reveal the context of the participants who have observed and experienced the changes and impacts.

Table 4—Indicators for Objective One: Types of Environmental Changes and the Impacts on Livelihood, Resource Access and Migration

Types of Changes and Impacts	Indicators
Environmental Changes	• Severe weather occurrences • Change in salinity in the Lagoon • Lagoon depth changes • New species in the Lagoon • Increased pollution in the Lagoon • Wetland habitat loss • Decreased quantity of native fish • Decreased size of native fish
Livelihood	• Decreased income • Unable to afford all basic needs • Limited spending money • Decreased leisure time
Resource Access	• Conflict between communities regarding fishing grounds • Theft of fishing equipment • Decreased fish catch size • Use of 'zero nets' (nylon nets)
Migration	• Local labour • Non-local labour • Seasonal migration for work • Temporary migration for work • Permanent migration for work

3.4.2—Data Analysis: Psychological Distress Symptoms

This section focuses on the analysis of the data collected for Objective Two, which includes seven psychological distress symptoms associated with environmental changes, which include: physical pain, insecurity, social isolation, loss of connection, intense worry, eating disorders and sleeping disorders. This data analysis consists of two steps, which uses qualitative methods. Step one

consists of counting the number of participants who have experienced the psychological distress symptoms associated with the environmental changes. Step two consists of using Saldaña's (2009) magnitude coding for ranking the severity of each of the psychological distress symptoms. The severity of the psychological distress symptoms is ranked "low", "medium", "high", or "N/A". Low severity signifies that the severity of the distress symptom experienced by the participant was mild or showed little to no significant impact on the overall psychological well-being of the participant. Medium severity signifies that the severity of the distress symptom experienced by the participant was moderate or showed moderately significant impact on the over psychological well-being of the participant, but not enough to be labelled as high severity. High severity signifies that the severity of the distress symptom experienced by the participant was significantly severe. Lastly, N/A was used when there was not enough data to determine the severity of the psychological distress symptom. This includes when the participant chose not to answer the question during the interviews. Each severity was determined by examining the intensity of the words used by the participants when describing each of the seven psychological distress symptoms. For example, the word "worry" would be ranked as medium severity while the word "fear" would be ranked as high severity. Once the severities of the psychological distress symptoms were ranked, the data was then categorized by gender and sector to examine the overall psychological well-being in men and women in each of the three sectors of this study. Magnitude coding is a qualitative method appropriate for studies in social sciences and aims in quantifying rich qualitative data and enhance description (Saldaña, 2009). Magnitude coding was chosen for this research because it is an effective tool in quantifying a phenomenon's intensity, frequency, direction or presence within qualitative data (Tashakkori &Teddlie, 1998). However, the data was analyzed manually, thus potential human errors may have occurred during the data analysis. In addition, the interviews were translated from Odia to English, which may have caused some errors as well. That said, the primary researcher and translator worked closely together to limit any errors caused by the language barriers.

3.4.3—Data Analysis: Coping Strategies and Sources of Social Support

This section focuses on the analysis of the data collected for Objective Three, which used qualitative methods to determine the coping strategies and the sources of social support of the

participants. During this data analysis, Lecompte and Schensul's (1999) frequency coding was used twice, first, to determine the coping strategies and second, to determine the sources of social support. Frequency coding was used to determine the coping strategies of the participants used to manage their psychological distress symptoms. First, each participant was asked what coping strategies he or she used to manage their psychological distress symptoms. Then, the copings strategies mentioned by the participant were categorized and its frequency was calculated in order to determine the number of participants who have claimed to use the coping strategy. Note that participants may have used more than one coping strategy and as a result, the number of respondent answers overlap. Also, note that if a participant mentioned the same coping strategy more than once, it counts as one. Lecompte and Schensul's (1999) frequency coding was used again to determine the sources of social support of the participants that helped them manage their psychological distress symptoms. The same process in determining the coping strategies was used to determine the sources of social support. Frequency coding is a process used in qualitative data analysis to describe the total frequency of particular words found in the interview transcripts (Lecompte & Schensul, 1999). Frequency coding includes words that are associated with the particular word, such as synonyms. Frequency coding was chosen for this section of the research to determine the types of coping strategies and sources of social support of the participants.

3.5—Research Ethics

This study has undergone the Research Ethics Board Review under the University of Waterloo. Information on the research topic and consent form was given to each participant prior to interviews and was verbally translated into Odia, the local language. As a significant amount of the data analysis surrounds the opinions and emotions as well as historical accounts given by individuals involved, the researcher took responsibility to ensure that participants were aware of their right to refuse to answer questions during the interviews and their right to access the findings of the research once the study is completed. They were assured that their anonymity would be secure, and that personal information would be omitted from the study as that sort of data does not directly affect the research analysis at hand and might harm the anonymity of the participants.

3.6—Limitations and Assumptions

There are two limitations in this study, which include language barriers, time barriers, generalization limitations and unknown changes to livelihood perception. The language barrier made communication difficult between the primary researcher and the participants during the semi-structured interviews and phone interviews. To fully understand the emotions and concerns expressed at the time of the interviews, the limitation was mediated by using a research assistant (translator). The research assistant ensured to transcribe the entirety of each of the interviews; as well as maintaining the emphasis that this research is a snapshot in time rather than an analysis of change over time. The time barrier in this study limited the time that the semi-structured interviews were conducted. There may be bias when choosing the participants as the interviews were conducted between the hours of 9A.M. and 5P.M. Some of the community members were busy working during these hours when the interviews were conducted and some may not have been present in their community. This may cause some bias, as the data collected may not fully represent the general population since potential important information of the community members who were not present in the community were not included in the data. This includes information on migration, as the fishers affected by it would have been migrated or working outside of Chilika during the time that the interviews were conducted.

This study holds two important assumptions regarding migration and cultural customs of the men and women in Chilika. First, due to the limitation regarding time barriers during the time that the semi-structured interviews were conducted, this study assumes that the data collected on migration is underrepresented. Second, the study holds the assumption that men tend to spend more time fishing inside the Lagoon than women do. This study assumes that men often hold roles of non-household work and women often hold roles of household work such as cleaning and cooking. The interview questions on environmental changes include questions that both male and female participants were able to answer. The questions on environmental changes include the physical changes of the Lagoon as well as the physical changes of the species. Both male and female participants were able to answer these questions since male participants who had non-household roles would notice physical changes of the Lagoon while female participants who had household roles would notice changes to the fish as they cook meals for their families.

The third limitation of this study is that the results obtained can only be used to generalize the 15 fisher communities involved in this research. The environmental changes that took place in Chilika Lagoon are unique and thus, the generalization of the results is limited to the 15 fisher communities. Although other regions in the world may be experiencing impacts on the psychological health associated with environmental change, the results from this research can not be used to generalize those areas. That said, climate change is a global issue and its effects are occurring throughout the world (Zacharia et al., 2016). Thus, there may be some impact on the psychological health associated with rapid environmental change in other parts of the world but the results from this study may not reflect the actual effects on the psychological health in those areas. The last limitation of this study is the lack of knowledge on the changes in the perception of household basic needs among the fisher communities. This research examines the changes in livelihood from 1980 to 2017, during which the perception of what is considered to be a household basic need may have changed. That said, the main components of household basic needs include the ability to afford nutritious food, adequate shelter, proper clothing and access to education.

Chapter 4

An Overview of the Impacts of Environmental Changes, Psychological Distress and Coping Strategies in Chilika Lagoon

4.0—Research Overview

Failing to adapt to changes in the commons occurs frequently across the world, especially in high-risk regions, such as Chilika Lagoon. These alterations to the commons include various natural disasters and anthropogenic ecological changes, such as floods, storms, aquaculture and pollution. The purpose of this thesis is to shed light on the issues that arise in the commons and in psychological health in developing countries, specifically in marginalised coastal communities. The main focus is on the question of how changes to the commons in Chilika are affecting the psychological health conditions of the fisher communities as they struggle to cope and adapt to these changes. "[S]tress is an inevitable consequence of social organization" (Aneshensel, 1992, p. 16), thus research on environmental change and human distress in developing countries should be emphasized as they lack mental health knowledge in general. This study focuses on such topic to hopefully contribute to mental health awareness in developing countries.

The findings of this study focus on the following research question: What is the relationship between environmental health, psychological health and well-being in Chilika, India? This chapter is organized by objectives. Objective One determines the types of environmental changes and impacts in Chilika Lagoon and the impacts on livelihood, resource access and migration of the fisher communities. Objective Two examines the psychological distress symptoms of the fisher communities, which are associated with the environmental changes and impacts. Objective Three examines the coping strategies used to manage the psychological distress symptoms of the fisher communities.

Objective one focuses on the adverse environmental changes in Chilika Lagoon and their impact on livelihood, resource access and migration. Chilika Lagoon has experienced drastic environmental changes, which has impacted the ecosystem of the Lagoon. These environmental changes have impacted the fisher communities in Chilika. This study examines the impacts of

environmental changes on the livelihood, resource access and migration of the fisher communities in Chilika. Objective two focuses on the impacts on psychological distress, which includes ranking the severity of seven individual psychological distress symptoms associated with negative environmental changes. The seven psychological distress symptoms include physical, emotional and behavioural symptoms, which are given a rank of low, medium or high severity for each of the participants' responses. Lastly, objective three focuses on the types of coping strategies of the participants and the sources of social support that they receive. The findings are organized in various tables, which can be analyzed in Chapter 4, 5 and 6.

Table 5—Participant Information by Sector

Sectors	Number of Villages	Participants	
		Male	Female
One	5	14	11
Two	5	15	10
Three	5	23	3

The data was collected from three sectors surrounding Chilika Lagoon in a period of four months from January to April 2017 and from January to June 2019 through semi-structured interviews and phone interviews. The exact locations of the sectors are explained in the Methods Chapter. The sample population is divided into three sectors because each sector has a unique set of environmental changes that differ from each other. The tables in this chapter are categorized by sector to properly represent the data collected from each of the sectors. Each of the participant's privacy was respected and the researcher and translator both ensured that all participants were given their rights at the time of the interview and could refuse to answer any questions or withdraw from the interview at anytime. The identities of all participants were kept private and each one of them was given a unique code number. Table 5 shows the number of participants involved in this study from each of the sectors. At the end of each interview, each participant was given a thank you letter in which included the researcher's contact information for questions regarding the research. More information on the interview process is found in the Methods Chapter.

4.1—Objective One A and B: Understanding Changes and Impacts in the Chilika Lagoon Commons

Objective One:

(A) To understand the nature of the changes to the commons taking place in Chilika Lagoon and (B) its impact on the local fishers' livelihood, resource access to the Lagoon and out migration.

Objective One focuses on the adverse environmental changes in Chilika Lagoon and their impacts on livelihood, resource access and migration. Objective One is separated into parts A and B. Objective One A focuses on the environmental changes in Chilika, while Objective One B focuses on the impacts of environmental changes on livelihood, resource access and migration. Objective One A determines the types of environmental changes occurring in Chilika Lagoon from 1980 to 2017. Each of the three sectors has a unique set of environmental changes, which is why the tables are organized by sectors. The findings for Objective One B are separated into three parts, which include impacts on livelihood, resource access and migration associated with adverse environmental changes. Essentially, the purpose of Objective One is to determine the types of adverse environmental changes in Chilika Lagoon from 1980 to 2017 and how they have impacted the fisher communities by examining the impacts on livelihood, resource access and migration.

The findings for Objective One A and B are organized in Tables 6, 7, 8 and 9. Table 6 presents the findings for Objective One A, which identifies the environmental changes that took place in Chilika Lagoon from 1980 to 2017 and the environmental changes observed by the participants. Table 7, 8, and 9 presents the findings for Objective One B. More specifically, Table 7 shows the findings for impacts on livelihood, Table 8 shows the findings for impacts on resource access, and finally Table 9 shows the findings for the impacts on migration. To simplify the tables "M" refers to male participants and "F" refers to female participants.

4.2—Objective One A: Types of Environmental Changes in Chilika Lagoon

The following Table 6 shows the eight major environmental changes that have been recorded in Chilika Lagoon from 1980 to 2017, which include: change in salinity in the Lagoon, decreased quantity of native fish, severe weather occurrences, new species in the Lagoon, decreased size of

native fish, increased pollution in the Lagoon, Lagoon depth changes, and wetland habitat loss (described in the Methods Chapter under section 3.3.1). Table 6 reveals the environmental changes that have been observed by the participants. Each number represents the number of participants (both male and female) who claimed to observe the environmental changes and impacts, which are categorized by sector.

Table 6 reveals that 28 out of 76 total participants claimed they have observed changes in salinity of the Lagoon from 1980 to 2017. These changes include increase in salinity, decrease in salinity or both occurring throughout the years, which resulted in unstable levels of salinity (as defined in Methods Chapter section 3.3.1). Out of the 28 participants who claimed to notice changes in salinity, 21 are from Sector One (13 males and eight females), only four males are from Sector Two, and only three males are from Sector Three. Thus, 20 out of 52 total male participants and eight out of 24 total female participants claimed that the salinity in the Lagoon changed overtime from 1980 to 2017.

69 out of 76 total participants claimed they have observed a decreasing amount of local fish in the Lagoon from 1980 to 2017 (Table 6). The types of fish species that have decreased are defined in the Methods Chapter under section 3.3.1. Out of the 69 participants who claimed to notice decreasing amount of fish, 23 are from Sector One (13 males and 10 females), 32 are from Sector Two (14 males and eight females), and 24 are from Sector Three (22 males and two females). Thus, 49 out of 52 total male participants and 20 out of 24 total female participants claimed that the quantity of the local fish from the Lagoon has decreased overtime from 1980 to 2017.

40 out of 76 total participants claimed they have observed more frequent severe weather occurrences such as storms, flooding and cyclones from 1980 to 2017 (Table 6). The types of severe weather occurrences in Chilika are defined in the Methods Chapter under section 3.3.1. Out of the 40 participants who claimed to notice more frequent severe weather occurrences, 13 are from Sector One (nine males and four females), 14 are from Sector Two (10 males and four females), and 13 are from Sector Three (11 males and two females). Thus, 30 out of 52 total male participants and 10 out of 24 total female participants claimed that severe weather occurrences have become more frequent from 1980 to 2017.

27 out of 76 total participants claimed they have observed an increasing amount of new marine species in the Lagoon from 1980 to 2017 (Table 6). These species include any species that are invasive to the Lagoon ecosystem and/or cause traditional fishing to be more difficult for the locals (as defined in the Methods Chapter under section 3.3.1). Out of the 27 participants who claimed to notice new species, 21 are from Sector One (12 males and nine females), four are from Sector Two (three males and one female), and two males are from Sector Three. Thus, 17 out of 52 total male participants and 10 out of 24 total female participants claimed to have notice new marine species in the Lagoon from 1980 to 2017.

41 out of 76 total participants claimed they have observed the size of local fish decreasing overtime from 1980 to 2017 (Table 6). The changes in sizes of fish species are defined in the Methods Chapter under section 3.3.1. Out of the 41 participants who claimed to notice a decrease in fish size, 13 are from Sector One (seven males and six females), 12 are from Sector Two (seven males and five females), and 16 are from Sector Three (14 males and two females). Thus, 28 out of 52 total male participants and 13 out of 24 total female participants claimed that the size of the local fish from the Lagoon has decreased overtime from 1980 to 2017.

Six out of 76 total participants claimed they observed an increase amount of pollution in the Lagoon from 1980 to 2017 (Table 6). Pollution includes presence of gas in the water from use of motorboats in the Lagoon (as described in the Methods Chapter under section 3.3.1). Out of the six participants who claimed to notice pollution, two are from Sector One (one male and one female), four males are from Sector Two, and none are from Sector Three. Thus, five out of 52 total male participants and one out of 24 total female participants have noticed an increase amount of pollution in the water overtime from 1980 to 2017.

43 out of 76 total participants claimed they have observed changes in the Lagoon depth from 1980 to 2017 (Table 6). These changes include increasing in depth and/or decreasing in depth depending on the location inside the Lagoon (as described in the Methods Chapter under section 3.3.1). Out of the 43 participants who claimed to notice depth changes, five males are from Sector One, 14 are from Sector Two (13 males and one female), and 24 are from Sector Three (21 males and three females). Thus, 39 out of 52 total male participants and four out of 24 total female

participants claimed that the depth of the Lagoon has decreased and/or decreased overtime from 1980 to 2017.

32 out of 76 total participants claimed they have observed significant wetland habitat loss overtime from 1980 to 2017 (Table 6). The type of wetland habitat loss that has occurred in Chilika is described in the Methods Chapter under section 3.3.1. Out of the 32 participants who have noticed wetland loss, 24 are from Sector One (14 males and 10 females), seven males are from Sector Two, and one male is from Sector Three. Thus, 22 out of 52 total male participants and 10 out of 24 total female participants claimed that the wetlands have decreased significantly overtime from 1980 to 2017. The following tables reveal the impact of the environmental changes identified above on the livelihood (Table 7), resource access (Table 8), and migration (Table 9) of the fisher communities.

Table 6—Environmental Changes Observed in Chilika Lagoon

Sectors	Changes in Salinity		Less Quantity of Fish		Severe Weather		New Species		Size of Fish Decreased		Pollution		Depth Changes		Wetland Loss	
One	**21**	13M 8F	**23**	13M 10F	**13**	9M 4F	**21**	12M 9F	**13**	7M 6F	**2**	1M 1F	**5**	5M 0F	**24**	14M 10F
Two	**4**	4M 0F	**22**	14M 8F	**14**	10M 4F	**4**	3M 1F	**12**	7M 5F	**4**	4M 0F	**14**	13M 1F	**7**	7M 0F
Three	**3**	3M 0F	**24**	22M 2F	**13**	11M 2F	**2**	2M 0F	**16**	14M 2F	**0**	0M 0F	**24**	21M 3F	**1**	1M 0F
Total	**28**	20M 8F	**69**	49M 20F	**40**	30M 10F	**27**	17M 10F	**41**	28M 13F	**6**	5M 1F	**43**	39M 24F	**32**	22M 10F

4.3—Objective One B: Impacts of Environmental Changes on Livelihood

Table 7 shows the results for Objective One B, which focuses on the impacts of environmental changes on the livelihood of the participants. The indicators include: decreased leisure time, unable to afford all basic needs, limited spending money, and decreased income from 1980 to 2017 (as

described in the Methods Chapter under section 3.3.2). The following are answers from the participants regarding their perspective on their home environment negatively impacting their livelihood. The indicators chosen for Objective One B regarding livelihood is further explained in the Methods Chapter. Each number in the table represents the number of participants who claimed to have a negative impact on their livelihood from 1980 to 2017.

Table 7 reveals that 37 out of 76 total participants claimed that their family leisure time has decreased from 1980 to 2017 due to financial instability and/or increased working hours, which leaves fewer hours for leisure time (as described in the Methods Chapter under section 3.3.2). Out of the 36 participants that claimed have less family leisure time, 15 are from Sector One (10 males and five females), 12 are from Sector Two (four males and eight females), and only 10 males are from Sector Three. Thus, 24 out of 52 total male participants and 13 out of 24 total female participants claimed that they have less leisure time.

Table 7 also reveals that 44 out of 76 total participants claimed that their household struggles to afford all of their household basic needs, including clean water, nutritious food, adequate shelter and miscellaneous fees such as school and utility fees (as described in the Methods Chapter under section 3.3.2). Out of the 44 participants who claimed to not meet all basic needs, 13 are from Sector One (seven males and six females), 18 are from Sector Two (11 males and 7 females), and 13 are form Sector Three (12 males and one female). Thus, 30 out of 52 total male participants and 14 out of 24 total female participants claimed their household has increasingly struggled to meet all basic needs due to financial difficulty from 1980 to 2017.

72 out of 76 total participants claimed that their household has less household spending money in 2017 compared to 1980 (Table 7). Decreased spending money in fisher communities is described in the Methods Chapter under section 3.3.2. 24 are from Sector One (14 males and 10 females), 24 are from Sector Two (14 males and 10 females), and 24 are from Sector Three (22 males and two females). Thus, 50 out of 52 total male participants and 22 out of 24 total female participants claimed that their household has a decreased amount of spending money in 2017 compared to 1980.

75 out of 76 total participants claimed that their total household income has decreased since 1980 (Table 7). Note that this criterion only looks at the total income of the household, though the

income sources may have changed from 1980 to 2017 (as described in the Methods Chapter under section 3.3.2). 24 participants who claimed to have decreased income are from Sector One (14 males and 10 females), 25 are from Sector Two (15 males and 10 females), and 26 are from Sector Three (23 males and three females). Thus, all 52 total male participants and 23 out of 24 total female participants claimed their household income has decreased from 1980 to 2017.

Table 7—Impacts of Environmental Changes on Livelihood

Sectors	Impacts on Livelihood							
	Less Leisure Time		Inability to Afford Basic Needs		Limited Spending Money		Less Income	
One	**15**	10M 5F	**13**	7M 6F	**24**	14M 10F	**24**	14M 10F
Two	**12**	4M 8F	**18**	11M 7F	**24**	14M 10F	**25**	15M 10F
Three	**10**	10M 0F	**13**	12M 1F	**24**	22M 2F	**26**	23M 3F
Total	**37**	24M 13F	**44**	30M 14F	**72**	50M 22F	**75**	52M 23F

4.4—Objective One B: Impacts of Environmental Changes on Resource Access

Table 8 shows the results for Objective One B, which focuses on the impacts of environmental changes on the resource access of the participants regarding the Lagoon. The indicators for resource access include: conflict between communities regarding fishing space, decreased amount of fish caught from the Lagoon, having their household fishing equipment stolen and use of 'zero nets' from 1980 to 2017 (as described in the Methods Chapter under section 3.3.3). 'Zero net' refers to a nylon type of net used to catch fish that is non-traditional and harmful for the sustainability of the fish since it also captures young fish that are not fully developed (Pattanaik, 2007, 298). The following are answers from the participants regarding their perspective on their household's access to the Lagoon associated with the rapid environmental changes that have occurred from 1980 to 2017. The indicators chosen for Objective One B regarding resource access

is further explained in the Methods Chapter under section 3.3.3. Each number in the table represents the number of participants (both male and female) who have experienced the particular negative impact on their resource access from 1980 to 2017.

Table 8 reveals that 67 out of 76 total participants claimed that their household has experienced some conflict with non-fisher communities regarding fishing space due to scarcity of the fish and lack of fishing space in the Lagoon from 1980 to 2017 (as described in Methods Chapter under section 3.3.3). Out of the 67 participants that have claimed to experience conflict, 22 are from Sector One (12 males and 10 females), 22 are from Sector Two (14 males and eight females), and 23 are from Sector Three (22 males and one female). Thus, 48 out of 52 total male participants and 19 out of 24 total female participants claimed that conflict has occurred between their household and members from other fisher communities regarding resource scarcity between 1980 and 2017.

60 out of 76 total participants claimed that their household has caught a decreased amount of fish from the Lagoon from 1980 to 2017 (Table 8). The decreased quantity of fish in Chilika in described in the Methods Chapter under section 3.3.3. Out of the 60 participants who claimed to have caught less fish, 17 are from Sector One (10 males and seven females), 19 are from Sector Two (12 males and seven females), and 24 are from Sector Three (21 males and three females). Thus, 43 out of 52 total male participants and 17 out of 24 total female participants claimed that their household has caught less fish from 1980 to 2017.

15 out of 76 total participants have had their household fishing equipment stolen between the years of 1980 and 2017 (Table 8). Stolen fishing equipment is also considered to be part of the conflict in Chilika Lagoon, but it is analyzed separately as it also impacts the fishers' access to fish in the Lagoon (as described in the Methods Chapter under section 3.3.3). Out of the 15 individuals who claimed to have their equipment stolen, two are from Sector One (one male and one female), seven are from Sector Two (four males and three females), and only six males are from Sector Three. Thus, 11 out of 52 total male participants and four out of 24 total female participants claimed to have their household fishing equipment stolen.

20 out of 76 total participants have seen the use of 'zero nets' in the Lagoon, although none of them claimed to have used it between the years of 1980 and 2017 (Table 8). The use of zero

nets (nylon nets) is described in the Methods Chapter under section 3.3.3. Out of the 20 individuals who have seen 'zero nets' being used, only four males are from Sector One, five are from Sector Two (three males and two females), and only 11 males are from Sector Three. Thus, 18 out of 52 total male participants and two out of 24 total female participants claimed to have seen 'zero nets' being used while fishing in the Lagoon from 1980 to 2017.

Table 8—Impacts of Environmental Changes on Resource Access

Sectors	Impacts on Resource Access							
	Conflict in Fishing Space		Decreased Fish Catch		Fishing Equipment Stolen		Use of (nylon) Zero Nets	
One	**22**	12M 10F	**17**	10M 7F	**2**	1M 1F	**4**	4M 0F
Two	**22**	14M 8F	**19**	12M 7F	**7**	4M 3F	**5**	3M 2F
Three	**23**	22M 1F	**24**	21M 3F	**6**	6M 0F	**11**	11M 0F
Total	**67**	48M 19F	**60**	43M 17F	**15**	11M 4F	**20**	18M 2F

4.5—Objective One B: Impacts of Environmental Changes on Migration

Table 9 shows the results for Objective One B, which focuses on the impacts of environmental changes on migration of the participants in Chilika Lagoon. The indicators used to define migration include: local labour work, non-local labour work, seasonal migration for work, temporary migration for work, and permanent migration for work, from 1980 to 2017 (as described in the Methods Chapter under section 3.3.4). Local labour work is any local work that is not related to fishing, such as construction and tourism. Non-local work is any work that is not related to fishing but is also not local and the household member has to travel long distances to get to work and continues to live locally. Seasonal migration includes moving away from Chilika to work elsewhere for one to three months at a time. Temporary migration includes moving away from Chilika to work elsewhere for four to 12 months. Lastly, permanent migration includes moving

away from Chilika to work elsewhere for at least one year. Each number in Table 9 represents the number of participants that have experienced the particular negative impact on migration for work, which has occurred in the participant's household from 1980 to 2017.

Table 9 reveals that 25 out of 76 total participants claimed that their household has experienced migration for local work, between the years of 1980 to 2017. Local work includes local employment alternative to traditional fishing, such as construction, tourism and services (as described in the Methods Chapter under section 3.3.4). Out of the 25 participants whose household has experienced local migration for work, five are from Sector One (three males and two females), 13 are from Sector Two (six males and seven females), and six are from Sector Three (four males and two female). Thus, 13 out of 52 total male participants and 11 out of 24 total female participants reported that their household has experienced local migration for work between 1980 and 2017.

76 total participants claimed that their household has experienced long-distance travel for labour work, meaning that the household or one member of the household traveled long-distance for work but continues to live locally (Table 9). Non-local labour work is further described in the Methods Chapter under section 3.3.4. Out of the four individuals who claimed their household to be affected by long-distance labour, none are from Sector One, only one female is from Sector Two and only three males are from Sector Three. Thus, three out of 52 total male participants and one out of 24 total female participants reported that their household has been affected by long-distance travel for labour, though still living in the local village between 1980 and 2017.

Nine out of 76 total participants claimed that their household has experienced seasonal migration for alternative work, meaning that the household or one member of the household travels seasonally for work but comes back to live locally during off season (Table 9). Seasonal migration is further described in the Methods Chapter under section 3.3.4. Out of the nine individuals who claimed their household to be affected by non-local migration for work, five are from Sector One (three males and two females), only one male is from Sector Two, and only three males are from Sector Three. Thus, seven out of 52 total male participants and two out of 24 total female participants claimed that their household has been affected by seasonal migration between 1980 and 2017.

17 out of 76 total participants claimed that their household has experienced temporary migration for alternative work, meaning that the household or one member of the household migrates for work temporarily but plans to return to live locally in the future or has come back from the temporary job (Table 9). Temporary migration is further described in the Methods Chapter under section 3.3.4. Out of the 17 individuals who claimed their household to be affected by temporary migration, five are from Sector One (four males and one female), only three males are from Sector Two, and nine are from Sector Three (eight males and one female). Thus, 15 out of 52 total male participants and two out of 24 total female participants claimed that their household has been affected by temporary migration between 1980 and 2017.

76 total participants claimed that their household has experienced permanent migration for alternative work, meaning that the household or one member of the household has migrated permanently into a new location and does not plan to come back to live locally (Table 9). Permanent migration is further described in the Methods Chapter under section 3.3.4. Out of the six individuals who claimed their household to be affected by permanent migration for work, three are from Sector One (one male and two females), two are from Sector Two (one male and one female), and only one female is from Sector Three. Thus, two out of 52 total male participants and four out of 24 total female participants claimed that their household has been affected by permanent migration between 1980 and 2017.

Table 9—Impacts of Environmental Changes on Migration

Sectors	Impacts on Migration									
	Local Labour Jobs		Non-Local Labour Jobs		Seasonal Migration		Temporary Migration		Permanent Migration	
One	5	3M 2F	0	0M 0F	5	3M 2F	5	4M 1F	3	1M 2F
Two	13	6M 7F	1	0M 1F	1	1M 0F	3	3M 0F	2	1M 1F
Three	6	4M 2F	3	3M 0F	3	3M 0F	9	8M 1F	1	0M 1F
Total	25	13M 11F	4	3M 1F	9	7M 2F	17	15M 2F	6	2M 4F

4.6 –Objective Two: Symptoms of Psychological Distress Associated with the Environmental Changes in Chilika Lagoon

Objective Two:

To examine the main impacts of the environmental changes on the psychological health of the fishers, specifically the stress experienced including emotional symptoms, physical symptoms and behavioural symptoms of psychological distress.

Objective Two focuses on the impacts on psychological distress associated with environmental changes in Chilika Lagoon. There are three categories of psychological distress symptoms, which include physical, emotional and behavioural distress. Physical symptoms include physical pain, which can be any type of body ache associated with stress, including headaches, muscle aches, and chest pain. Physical symptoms from stress also include high blood pressure and trouble digesting which are associated with stress disorders. Emotional symptoms include senses of insecurity, social isolation, loss of connection and intense worry. Behavioural symptoms include eating disorders and sleeping disorders. These symptoms of psychological distress are associated with negative impacts of environmental changes on the participants' livelihood, resource access and migration. More information on these symptoms and why they were chosen for this study is

found in the Literature Chapter under section 2.4. The findings for Objective Two are organized from Table 10 to Table 17. Table 10 shows the number of participants from each of the three sectors that have experienced psychological distress symptoms in 2017 with medium and high severities.

Table 10 reveals that 48 out of 76 total participants experienced some physical pain, including body aches, digestive issues, and/or high blood pressure associated with psychological distress (as defined in the Literature Review Chapter under section 2.4). Out of the 48 participants who experienced physical pain, 18 are from Sector One (eight males and 10 females), 17 are from Sector Two (12 males and five females), and 13 are from Sector Three (11 males and two females). Thus, 31 out of 52 total male participants and 17 out of 24 total female participants experienced physical symptoms associated with psychological distress.

65 out of 76 total participants experienced sense of insecurity associated with psychological distress (Table 10). Sense of insecurity includes feelings of insecurity that are associated with unstable household income, which impacts the psychological distress (as defined in the Literature Review Chapter under section 2.4). Out of the 65 participants who experienced insecurity, 22 are from Sector One (12 males and 10 females), 21 are from Sector Two (12 males and nine females), and 22 are from Sector Three (19 males and three females). Thus, 43 out of 52 total male participants and 22 out of 24 total female participants experienced feelings of insecurity within their community environment, associated with psychological distress.

23 out of 76 total participants experienced feelings of social isolation within their own community (Table 10). Feelings of social isolation involve an individual's decreased ability to socialize or an increase in feeling distraught when socializing (as defined in the Literature Review Chapter under section 2.4). Out of the 23 participants who experienced social isolation, nine are from Sector One (four males and five females), 13 are from Sector Two (six males and seven females), and one male is from Sector Three. Thus, 11 out of 52 total male participants and 12 out of 24 total female participants experienced feelings of social isolation within their community environment, associated with psychological distress.

10 out of 76 total participants experience feelings of loss of connection from their own community environment (Table 10). Feelings of loss of connection involve an individual's

decreased connection to their home environment, which includes the household environment as well as the natural environment surrounding the home (as defined in the Literature Review Chapter under section 2.4). Out of the 10 participants who experience loss of connection, only three females are from Sector One, only two males are from Sector Two, and only five males are from Sector Three. Thus, seven out of 52 total male participants and three total female participants experience loss of connection within their community environment, associated with psychological distress.

66 out of 76 total participants experienced feelings of intense worry associated with psychological distress (Table 10). These intense worries include worries associated with financial struggles and worries associated with environmental disasters such as flooding and cyclones (as defined in the Literature Review Chapter under section 2.4). Out of the 66 participants who experienced intense worries, 22 are from Sector One (12 males and 10 females), 20 are from Sector Two (12 males and eight females), and 24 are from Sector Three (21 males and three females). Thus, 45 out of 52 total male participants and 21 out of 24 total female participants experienced feelings of intense worry within their community environment, associated with psychological distress.

25 out of 76 total participants experienced eating disorders associated with psychological distress (Table 10). Eating disorders include an increase or a decrease in appetite and eating more or less than the normal daily intake (as defined in the Literature Review Chapter under section 2.4). Out of the 25 participants who experienced eating disorders, 11 are from Sector One (five males and six females), seven are from Sector Two (four males and three females), and seven are from Sector Three (six males and one female). Thus, 15 out of 52 total male participants and 10 total female participants experienced eating disorders associated with psychological distress.

Lastly, 53 out of 76 total participants experienced sleeping disorders associated with psychological (Table 10). Sleeping disorders include trouble sleeping and over sleeping than the regular amount needed (as defined in the Literature Review Chapter under section 2.4). Out of the 53 participants who experienced sleeping disorders, 18 are from Sector One (10 males and eight females), 18 are from Sector Two (12 males and six females), and only 17 males are from Sector Three. Thus, 39 out of 52 total male participants and 14 total female participants experienced sleeping disorders associated with psychological distress.

Table 10—Psychological Distress Symptoms Associated with Environmental Changes

Sectors	Psychological Distress Symptoms													
	Physical Pain		Insecurity		Social Isolation		Loss of Connection		Intense Worry		Eating Disorders		Sleeping Disorders	
One	**18**	8M 10F	**22**	12M 10F	**9**	4M 5F	**3**	0M 3F	**22**	12M 10F	**11**	5M 6F	**18**	10M 8F
Two	**17**	12M 5F	**21**	12M 9F	**13**	6M 7F	**2**	2M 0F	**20**	12M 8F	**7**	4M 3F	**18**	12M 6F
Three	**13**	11M 2F	**22**	19M 3F	**1**	1M 0F	**5**	5M 0F	**24**	21M 3F	**7**	6M 1F	**17**	17M 0F
Total	**48**	31M 17F	**65**	43M 22F	**23**	11M 13F	**10**	7M 3F	**66**	45M 21F	**25**	15M 10F	**53**	39M 14F

4.7 –Objective Two: Severity of Psychological Distress Symptoms

While Table 10 reveals the total participants, who have experienced psychological distress symptoms, the following tables in this subsection of 4.7, reveal the severity of each of the psychological distress symptoms as stated by the participants. Saldaña's (2009) Magnitude Coding is used to analyze and organize the severity of each of the seven psychological distress symptoms of all participants' responses. "Low Severity" is the lowest severity ranked and it represents zero to an insignificant amount of distress of that particular symptom. "Medium Severity" is the second severity ranked which signifies that there is a significant amount of distress of the particular symptom indicated, but the distress occurs only some of the time or roughly half of the time. "High Severity" indicates that there is a significant amount of distress of the particular symptom indicated, which occurs most of the time or all of the time. Further information on the severities of the psychological distress and why their definitions were chosen is found in the Methods Chapter.

4.7.1 –Objective Two: Severity of Physical Pain Symptoms

Table 11 shows that for physical pain symptoms, 27 total participants experienced physical pain at low severity, 40 total participants experienced physical pain at medium severity and eight total participants experienced physical pain at high severity. Physical pain is defined in the Literature Review Chapter under section 2.4. Out of the 27 total participants who experienced physical pain at low severity, six are from Sector One (five males and one female), eight are from Sector Two (three males and five females), and 13 are from Sector Three (12 males and one female). Out of the 40 total participants who experienced physical pain at medium severity, 16 are from Sector One (eight males and eight females), 12 are from Sector Two (10 males and two females), and 12 are from Sector Three (10 males and two females). Out of the eight total participants who experienced physical pain at high severity, two females are from Sector One, five are from Sector Two (two males and three females), and one male is from Sector Three. Thus, out of the 52 total male participants interviewed, 20 males experienced physical pain at low severity, 28 males experienced physical pain at medium severity, and three males experienced physical pain at high severity (Table 11). Out of the 24 total female participants interviewed, 24 females experienced physical pain at low severity, 12 females experienced physical pain at medium severity, and five females experienced physical pain at high severity.

Table 11—Number of Participants Experiencing Physical Pain Associated with Psychological Distress

Sectors	Physical Pain					
	Low Severity		*Medium Severity*		*High Severity*	
Sector One	**6**	5M 1F	**16**	8 M 8 F	**2**	0M 2F
Sector Two	**8**	3M 5F	**12**	10 M 2 F	**5**	2M 3F
Sector Three	**13**	12M 1F	**12**	10 M 2 F	**1**	1M 0F
Total Participants	**27**	20M 7F	**40**	28 M 12 F	**8**	3M 5F

4.7.2 –Objective Two: Severity of Insecurity Symptoms

Table 12 reveals that for symptoms of insecurity, 11 total participants experienced insecurity at low severity, 37 total participants experienced insecurity at medium severity, and 28 total participants experienced insecurity at high severity. Insecurity is defined in the Literature Review Chapter under section 2.4. Out of the 11 total participants who experienced insecurity at low severity, three are from Sector One (two males and one female), four are from Sector Two (three males and one female), and four males are from Sector Three. Out of the 37 total participants who experienced insecurity at medium severity, 10 are from Sector One (seven males and three females), 10 are from Sector Two (five males and five females), and 17 are from Sector Three (14 males and three females). Out of the 28 total participants who experienced insecurity at high severity, 12 are from Sector One (five males and seven females), 11 are from Sector Two (seven males and four females), and five males are from Sector Three. Thus, out of the 52 total male participants, nine males experienced insecurity at low severity, 26 males experienced insecurity at medium severity, and 17 males experienced insecurity at high severity (Table 12). Out of the 24 total female participants, two females experienced insecurity at low severity, 11 females experienced insecurity at medium severity, and 11 females experienced insecurity at high severity.

Table 12—Number of Participants Experiencing Insecurity Associated with Psychological Distress

Sectors	Sense of Insecurity					
	Low Severity		*Medium Severity*		*High Severity*	
Sector One	**3**	2M 1F	**10**	7M 3F	**12**	5M 7F
Sector Two	**4**	3M 1F	**10**	5M 5F	**11**	7M 4F
Sector Three	**4**	4M 0F	**17**	14M 3F	**5**	5M 0F
Total Participants	**11**	9M 2F	**37**	26 M 11 F	**28**	17M 11F

4.7.3 –Objective Two: Severity of Social Isolation Symptoms

Table 13 reveals that for symptoms of social isolation, 52 total participants experienced social isolation at low severity, 20 total participants experienced social isolation at medium severity, and three total participants experienced social isolation at high severity. Social Isolation is defined in the Literature Review Chapter under section 2.4. Out of the 52 total participants who experienced social isolation at low severity, 16 are from Sector One (10 males and six female), 11 are from Sector Two (9 males and two females), and 25 are from Sector Three (22 males and three females). Out of the 20 total participants who experienced social isolation at medium severity, nine are from Sector One (four males and five females), 10 are from Sector Two (four males and six females), and one male is from Sector Three. Lastly, the three total participants who experienced social isolation at high severity are from Sector Two only (two males and one female). Thus, out of the 52 total male participants, 41 males experienced social isolation at low severity, nine males experienced social isolation at medium severity, and two males experienced social isolation at high severity (Table 13). Out of the 24 total female participants, 11 females experienced social isolation at low severity, 11 females experienced social isolation at medium severity, and one of the females experienced social isolation at high severity.

Table 13—Number of Participants Experiencing Social Isolation Associated with Psychological Distress

Sectors	Social Isolation					
	Low Severity		*Medium Severity*		*High Severity*	
Sector One	**16**	10M 6F	**9**	4M 5F	**0**	0M 0F
Sector Two	**11**	9M 2F	**10**	4M 6F	**3**	2M 1F
Sector Three	**25**	22M 3F	**1**	1M 0F	**0**	0M 0F
Total Participants	**52**	41M 11F	**20**	9M 11F	**3**	2M 1F

4.7.4 –Objective Two: Severity of Loss of Connection Symptoms

Table 14 reveals that for symptoms of loss of connection, 65 total participants experienced loss of connection at low severity, seven total participants experienced loss of connection at medium severity, and three total participants experienced loss of connection at high severity. Loss of connection is defined in the Literature Review Chapter under section 2.4. Out of the 65 total participants who experienced loss of connection at low severity, 21 are from Sector One (13 males and eight females), 23 are from Sector Two (13 males and 10 females), and 21 are from Sector Three (18 males and three females). Out of the seven total participants who experienced loss of connection at medium severity, one female is from Sector One, one male is from Sector Two and five males are from Sector Three. Out of the three total participants who experienced loss of connection at high severity, two females are from Sector One, and one male is from Sector Two. Thus, out of the 52 total male participants, 44 males experienced loss of connection at low severity, six males experienced loss of connection at medium severity, and one male experienced loss of connection at high severity (Table 14). Out of the 24 total female participants, 21 females experienced loss of connection at low severity, one female experienced loss of connection at medium severity, and two females experienced loss of connection at high severity.

Table 14—Number of Participants Experiencing Loss of Connection Associated with Psychological Distress

Sectors	Loss of Connection					
	Low Severity		*Medium Severity*		*High Severity*	
Sector One	**21**	13M 8F	**1**	0M 1F	**2**	0M 2F
Sector Two	**23**	13M 10F	**1**	1M 0F	**1**	1M 0F
Sector Three	**21**	18M 3F	**5**	5M 0F	**0**	0M 0F
Total Participants	**65**	44M 21F	**7**	6M 1F	**3**	1M 2F

4.7.5 –Objective Two: Severity of Intense Worry Symptoms

Table 15 reveals that for symptoms of intense worry, seven total participants experienced intense worry at low severity, 43 total participants experienced intense worry at medium severity, and 23 total participants experienced intense worry at high severity. Intense worry is defined in the Literature Review Chapter under section 2.4. Out of the seven total participants who experienced intense worry at low severity, two males are from Sector One, four are from Sector Two (two males and two females), and one male is from Sector Three. Out of the 43 total participants who experienced intense worry at medium severity, nine are from Sector One (four males and five females), 13 are from Sector Two (nine males and four females), and 21 are from Sector Three (18 males and three females). Out of the 23 total participants who experienced intense worry at high severity, 13 are from Sector One (eight males and five females), seven are from Sector Two (three males and four females), and three males are from Sector Three. Thus, out of the 52 total male participants, five males experienced intense worry at low severity, 31 males experienced intense worry at medium severity, and 14 males experienced intense worry at high severity (Table 15). Out of the 24 total female participants, two females experienced intense worry at low severity, 12 females experienced intense worry at medium severity, and nine females experienced intense worry at high severity.

Table 15—Number of Participants Experiencing Intense Worry Associated with Psychological Distress

Sectors	***Intense Worry***					
	Low Severity		*Medium Severity*		*High Severity*	
Sector One	**2**	2M 0F	**9**	4M 5F	**13**	8M 5F
Sector Two	**4**	2M 2F	**13**	9M 4F	**7**	3M 4F
Sector Three	**1**	1M 0F	**21**	18M 3F	**3**	3M 0F
Total Participants	**7**	5M 2F	**43**	31M 12F	**23**	14M 9F

4.7.6 –Objective Two: Severity of Eating Disorders Symptoms

Table 16 reveals that for symptoms of eating disorders, 50 total participants experienced eating disorders at low severity, 17 total participants experienced eating disorders at medium severity, and eight total participants experienced eating disorders at high severity. Eating disorders is defined in the Literature Review Chapter under section 2.4. Out of the 50 total participants who experienced eating disorders at low severity, 14 are from Sector One (nine males and five female), 17 are from Sector Two (10 males and seven females), and 19 are from Sector Three (17 males and two females). Out of the 17 total participants who experienced eating disorders at medium severity, six are from Sector One (three males and three females), four are from Sector Two (two males and two females), and seven are from Sector Three (six males and one female). Out of the eight total participants who experienced eating disorders at high severity, five are from Sector One (two males and three females), and three are from Sector Two (two males and one female). Thus, out of the 52 total male participants, 36 males experienced eating disorders at low severity, 11 males experienced eating disorders at medium severity, and four males experienced eating disorders at high severity (Table 16). Out of the 24 total female participants, 14 females experienced eating disorders at low severity, six females experienced eating disorders at medium severity, and four females experienced eating disorders at high severity.

Table 16—Number of Participants Experiencing Eating Disorders Associated with Psychological Distress

Sectors	Eating Disorders					
	Low Severity		*Medium Severity*		*High Severity*	
Sector One	**14**	9M 5F	**6**	3M 3F	**5**	2M 3F
Sector Two	**17**	10M 7F	**4**	2M 2F	**3**	2M 1F
Sector Three	**19**	17M 2F	**7**	6M 1F	**0**	0M 0F
Total Participants	**50**	36M 14F	**17**	11M 6F	**8**	4M 4F

4.7.7 –Objective Two: Severity of Sleeping Disorders Symptoms

Table 17 reveals that for symptoms of sleeping disorders, 22 total participants experienced sleeping disorders at low severity, 43 total participants experienced sleeping disorders at medium severity, and 10 total participants experienced sleeping disorders at high severity. Sleeping disorders is defined in the Literature Review Chapter under section 2.4. Out of the 22 total participants who experienced sleeping disorders at low severity, six are from Sector One (four males and two females), seven are from Sector Two (three males and four females), and nine are from Sector Three (six males and three females). Out of the 43 total participants who experienced sleeping disorders at medium severity, 14 are from Sector One (seven males and seven females), 13 are from Sector Two (nine males and four females), and 16 males are from Sector Three. Out of the 10 total participants who experienced sleeping disorders at high severity, four are from Sector One (three males and one female), five are from Sector Two (three males and two females), and only one male is from Sector Three. Thus, out of the 52 total male participants, 13 males experienced sleeping disorders at low severity, 32 males experienced sleeping disorders at medium severity, and seven males experienced sleeping disorders at high severity (Table 17). Out of the 24 total female participants, nine females experienced sleeping disorders at low severity, 11 females experienced sleeping disorders at medium severity, and three females experienced sleeping disorders at high severity.

Table 17—Number of Participants Experiencing Sleeping Disorders Associated with Psychological Distress

Sectors	Sleeping Disorders					
	Low Severity		*Medium Severity*		*High Severity*	
Sector One	**6**	4M 2F	**14**	7M 7F	**4**	3M 1F
Sector Two	**7**	3M 4F	**13**	9M 4F	**5**	3M 2F
Sector Three	**9**	6M 3F	**16**	16M 0F	**1**	1M 0F
Total Participants	**22**	13M 9F	**43**	32M 11F	**10**	7M 3F

4.8—Objective Three: Coping with Psychological Distress Symptoms

Objective Three:

To determine the current coping strategies of the fisher communities and how effective or ineffective the strategies are against psychological stressors and wellbeing.

Objective Three focuses on the coping strategies used by the participants and the sources of social support. The coping strategies include any strategies used by the participant to cope with the psychological distress symptoms that the participant claims to have experienced. Sources of social support include anyone that provides support to the individual participant who is coping with psychological distress symptoms and also includes any spiritual sources such as praying to God and meditating. The findings for Objective Three are shown in Tables 18 and 19, which show the number of responses from each participant to the following questions regarding coping:

1. Do you practice any coping strategies to manage your emotional or physical stress? (Q11 from Interview Questions in the Appendix).
2. Do you receive social support from anyone to cope with your stress? (Q12 from Interview Questions in the Appendix).

4.8.1—Objective Three: Coping Strategies for Managing Psychological Distress Symptoms

The data in Table 18 is analyzed using Frequency Coding (LeCompte & Schensul, 1999), which measures the frequency of a word mentioned in the interviews. The purpose of Frequency Coding is to first determine the coping strategies that the participants used to cope with their psychological distress symptoms associated with negative impacts of environmental changes on livelihoods, resource access, and migration (as explained in the Methods Chapter under section 3.5).

Table 18 shows the frequency of coping strategies mentioned when answering the following question: "Do you practice any coping strategies to manage your emotional or physical stress?" (Q11 from Interview Questions in the Appendix). The coping strategies are categorized in nine main coping strategies which are listed from the most commonly used to the least commonly used coping strategies, which include: Medication, Socialization, Spiritual, Hobbies,

Substance Use, Homemade Remedies, Nature, Resting, and Exercise. It is important to note that every single participant has mentioned at least one coping strategy. Also, if an answer from one participant includes multiple words to describe one category, it counts as one. Lastly, note that one participant may use more than one coping strategy and as a result the number of respondents overlap in Table 18.

Taking medication includes painkillers and inflammation relief medications that can help cope with physical pain symptoms of psychological distress. Physical pain symptoms include body aches, digestive issues, and high blood pressure associated with psychological distress. Taking medications, as prescribed by a professional, to cope with physical pain is an effective way to cope with psychological distress as it reduces the pressure on physical pain, which decreases the psychological distress of the individual (Borg-Stein & Simons, 2002; Flaten, 2014; Gu et al., 2012). Although it is more effective in women than men, socializing is a coping strategy that helps manage psychological distress, which includes participating in social activities that causes the individual to receive social support through expressing their emotional hardships and feeling accepted within his or her community (Taormina, 2001; Ptacek et al. 1992; Gloria, 2006). Practicing spiritual activities can help cope with psychological distress, which include praying, meditating, breathing exercises, spiritual ceremonies and rituals (Levine, 2009; Graham et al., 2001). Having a hobby or leisure time also helps the individual cope with psychological distress as it allows the individual to manage his or her emotions (Heintzman & Mannell, 2003). Reading books and watching television seem to be common hobbies in this study as televisions and books are shared in common areas where community members get together.

Substance use is a category that includes drinking alcohol and smoking or ingesting tobacco and cannabis, which are coping strategies that are not as effective because it may harm the individual's health. Substance use often occurs when the individual faces barriers to effectively treat his or her psychological distress (Ouimette et al., 1998). Substance use can also cause the individual to perform poorly on their daily activities. For example, dinging alcohol impairs the individual's motor skills, which causes the individual to perform poorly on tasks that require intense physical movement (Dougherty et al., 2000). Although the effectiveness of homemade remedies is not well known, it is widely practiced by the participants in this study (Van der Watt

et al., 2008). The homemade remedies used by the participants in Chilika include massage oils as they claimed it helps with physical pain and relieve stress through forms of relaxation. The massage oils were typically composed of mustard oil as it helps reduce back pain (Danasu, Sridevi & Sangeetha, 2016). Spending time in nature includes walking, gardening or nature viewing outside the home environment, which can help reduce stress and high blood pressure (Kondo et al., 2018). Outdoor recreation also helps improve self-esteem and mood (Barton & Pretty, 2010). Resting, such as taking breaks from daily activities, can help cope with psychological distress. Studies show that when an individual is exposed to high stressors, he or she may require taking breaks in order to complete tasks and avoid burnout (Wilkinson, 2014). Additionally, the tasks themselves can add more stress to the individual and can cause burnout, which impedes them from completing the task (Wilkinson, 2014). Taking breaks from daily tasks is an effective way to reduce the stress of the individual by relaxing and in turn he or she can complete the task (Krischer, et al. 2010). Lastly, exercising is another form of coping with psychological distress and can help improve the individual's physical health. Exercising helps coping with psychological distress as it improves energy levels, sleep quality and even physical pain (Hurwitz et al., 2011). Exercising includes physical movements such as running, lifting weights and stretching. Yoga is an effective form of exercise, as it helps reduce depression and improves muscle strength, respiration, and metabolism and also protects the individual from injury (Pilkington, 2005). Although exercising is effective in coping with psychological distress, it is not a common coping strategy within the participants in this study. Table 18 shows the number of participants in this study using the nine coping strategies mentioned above. The methods used to determine the nine coping strategies of the participants are described in the Methods Chapter under section 3.5.

Table 18 shows that 39 out of 76 total participants used medication to cope with their psychological distress. Taking medication is an effective coping strategy to manage psychological distress symptoms (as defined in the Methods Chapter under section 3.5). Out of the 39 total participants who used medication to cope, 18 are from Sector One (10 males and eight females), 18 are from Sector Two (12 males and six females), and three are from Sector Three. Thus, 25 out of 52 total male participants and 14 out of 24 total female participants claimed to use medication to cope with their psychological distress symptoms.

21 out of 76 total participants socialized with friends and neighbours to cope with psychological distress (Table 18). Socializing is an effective coping strategy to help manage psychological distress symptoms (as defined in the Methods Chapter under section 3.5). Out of the 21 total participants who socialized to cope, three are from Sector One (two males and one female), four are from Sector Two (two males and two females), and 14 are from Sector Three (11 males and three females). Thus, 15 out of 52 total male participants and 6 out of 24 total female participants socialized with friends and neighbour to cope with their psychological distress symptoms.

20 out of 76 total participants practiced spiritual activities such as praying and meditating to cope with psychological distress (Table 18). Praying, meditating and other spiritual activities are effective in coping with psychological distress symptoms (as defined in the Methods Chapter under section 3.5). Out of the 20 total participants that practiced spiritual activities to cope, one female is from Sector One, three are from Sector Two (one male and two females), and 16 males are from Sector Three. Thus, 17 out of 52 total male participants and three out of 24 total female participants practiced spiritual activities to cope with their psychological distress symptoms.

14 out of 76 total participants have hobbies that helped them cope with psychological distress (Table 18). Hobbies are an effective coping strategy to manage psychological distress symptoms (as defined in the Methods Chapter under section 3.5). Out of the 14 total participants whose hobbies helped them cope, none are from Sector One, three are from Sector Two (one male and two females), and 11 are from Sector Three (10 males and one female). Thus, 11 out of 52 total male participants and three out of 24 total female participants have hobbies that helped them cope with their psychological distress symptoms.

Eight out of 76 total participants used substances to help cope with psychological distress, which includes drinking alcohol and smoking tobacco or cannabis (Table 18). Substance use is a type of coping strategy, though not as effective as the other strategies, it is still a strategy that is used among the participants in this study. Substance use is defined in the Methods Chapter under section 3.5. Out of the eight total participants who used substances to cope, none are from Sector One, two males are from Sector Two, and six males are from Sector Three. While eight out of 52

total male participants used substances to cope with their psychological distress, none of the female participants have claimed to use substances to cope with their psychological distress.

Seven out of 76 total participants used homemade remedies to cope with psychological distress, which includes homemade massage oils (Table 18). Homemade remedies are defined in the Methods Chapter under section 3.5. Out of the seven total participants who used homemade remedies, only three are from Sector One (two males and one female), four are from Sector Two (three males and one female), and none are from Sector Three. Thus, five out of 52 total male participants and two out of 24 total male participants used homemade remedies to cope with their psychological distress symptoms.

Six out of 76 total participants went for walks in nature, which helped them cope with their psychological distress (Table 18). Spending time outdoors in nature is an effective coping strategy to manage psychological distress symptoms (as defined in the Methods Chapter under section 3.5). Out of the six total participants who coped by spending time outside in nature, three males are from Sector One, one female is from Sector Two, and two males are from Sector Three. Thus, five out of 52 total male participants and one out of 24 female participants spent time outside in nature to cope with their psychological distress symptoms.

Only four out of 76 total participants took breaks to cope with their psychological distress, which includes taking breaks from work or household chores (Table 18). Taking breaks from daily work is an effective coping strategy to manage psychological distress symptoms (as defined in the Methods Chapter under section 3.5). Out of the four total participants that took breaks in order to cope with their psychological distress, two females are from Sector One, two are from Sector Two (one male and one female), and none are from Sector Three. Thus, one out of 52 total male participants and three out of 24 female participants took breaks to cope with their psychological distress symptoms.

Only three out of 76 total participants used a form of exercise to cope with their psychological distress, which includes cardio exercises and yoga practices (Table 18). Although it is not a common coping strategy, exercising is effective in managing psychological distress symptoms (as defined in the Methods Chapter under section 3.5). One male from each of the three sectors claimed that exercising helped cope with their psychological distress. None of the females

claimed to exercise in order to cope with psychological distress. Thus, only three out of 52 total male participants used a form of exercise to cope with their psychological distress symptoms.

Table 18—Coping Strategies for Managing Psychological Distress Symptoms

Sector	Coping Strategies																	
	Medication		Socialize		Spiritual		Hobbies		Substance Use		Homemade Remedies		Nature		Resting		Exercise	
One	**18**	10M 8F	**3**	2M 1F	**1**	0M 1F	**0**	0M 0F	**0**	0M 0F	**3**	2M 1F	**3**	3M 0F	**2**	0M 2F	**1**	1M 0F
Two	**18**	12M 6F	**4**	2M 2F	**3**	1M 2F	**3**	1M 2F	**2**	2M 0F	**4**	3M 1F	**1**	0M 1F	**2**	1M 1F	**1**	1M 0F
Three	**3**	3M 0F	**14**	11M 3F	**16**	16M 0F	**11**	10M 1F	**6**	6M 0F	**0**	0M 0F	**2**	2M 0F	**0**	0M 0F	**1**	1M 0F
Total	**39**	25M 14F	**21**	15M 6F	**20**	17M 3F	**14**	11M 3F	**8**	8M 0F	**7**	5M 2F	**6**	5M 1F	**4**	1M 3F	**3**	3M 0F

4.8.2—Objective Three: Sources of Social Support

Frequency Coding was used again to determine the types of social support that each participant received regularly within their support network. Frequency Coding was used to analyze the answers to the following interview question: "Do you receive social support from anyone to cope with your stress?" This question is also found under question number 12 in the Interview Questions under the subsection of Psychological Distress Questions (see Appendix). Table 19 shows the results of applying Frequency Coding to determine the sources of social support of the participants. The five categories are in order from most common to least common source of social support, which are Family, Community, Spiritual, Friends and Professional. Note that the categories Friends and Professionals are separated from Community because it is not clear whether the friends and the doctors mentioned by the participants lived in the community, which are separate resources of social support. Also, note that if an answer from one participant includes multiple words to describe one category, it counts as one. More information on how Frequency Coding was used in this study is found in Methods Chapter.

Table 19 shows that 52 out of 76 total participants had at least one family member that provided social support to help cope with psychological distress symptoms. Out of the 52 total participants, 19 are from Sector One (10 males and nine females), 17 are from Sector Two (11 males and six females), and 16 are from Sector Three (14 males and two females). Thus, 35 out of 52 total male participants and 17 out of 24 total female participants had at least one family member that helped them cope with their psychological distress symptoms by providing social support.

27 out of 76 total participants received social support from their community to cope with their psychological distress (Table 19). Community support includes anyone from the community who provides help with work, household chores or socializes to help the individual cope with his or her psychological distress symptoms. Out of the 27 total participants who received social support from the community, nine are from Sector One (six males and three females), 10 are from Sector Two (seven males and three females), and eight are from Sector Three (seven males and one female). Thus, 20 out of 52 total male participants and seven out of 24 total female participants received social support from their community.

Only five males out of 76 total participants received social support through spiritual activities such as praying, meditating, and partaking in rituals and celebrations (Table 19). Out of the five total participants who received social support through spiritual activities, none are from Sector One, only one male is from Sector Two, and only four males are from Sector Three. None of the female participants claimed to receive social support through practicing spiritual activities.

Only two males out 76 total participants received social support from friends (Table 19). One male is from Sector Two and the other is from Sector Three. None of the female participants claimed to receive social support from friends. Table 19 also reveals that only one female out of the 76 total participants received social support from a professional, such as a doctor or therapist. None of the male participants claimed to receive social support from a professional.

Table 19—Sources of Social Support that Helped Manage Psychological Distress Symptoms

Sector	Sources of Social Support									
	Family		Community		Spiritual		Friends		Professional	
One	**19**	10M 9F	**9**	6M 3F	**0**	0M 0F	**0**	0M 0F	**0**	0M 0F
Two	**17**	11M 6F	**10**	7M 3F	**1**	1M 0F	**1**	1M 0F	**1**	0M 1F
Three	**16**	14M 2F	**8**	7M 1F	**4**	4M 0F	**1**	1M 0F	**0**	0M 0F
Total	**52**	35M 17F	**27**	20M 7F	**5**	5M 0F	**2**	2M 0F	**1**	0M 1F

4.9—Conclusions: Environmental Changes, Psychological Distress and Coping in Chilika Lagoon

Objective One reveals the types of adverse environmental changes in Chilika Lagoon from 1980 to 2017, and its impact on livelihood, resource access and migration. The types of negative environmental changes that have occurred in Chilika Lagoon include: change in salinity in the Lagoon, decreased quantity of native fish, severe weather occurrences, new species in the Lagoon, decreased size of native fish, decreased income from fishing, increased pollution in the Lagoon, Lagoon depth changes, and wetland habitat loss. Less quantity of fish, severe weather occurrences, decreased size of fish, less income from the Lagoon and depth changes are the most common types of environmental changes. The least common types of environmental changes are changes in salinity, new species, water pollution and wetland habitat loss.

The impacts of environmental changes on livelihood include: decreased leisure time, unable to afford all basic needs, limited spending money, and decreased income from 1980 to 2017. At least half of the participants claimed that the impacts on livelihood have affected all four categories. Decreased leisure time is the least common impact on livelihood, while decreased income in the most common impact on livelihood. The impacts of environmental changes on resource access include: conflict in fishing space, decreased fish catch, fishing equipment stolen,

and use of zero nets. Stolen fishing equipment is the least common impact on resource access, while conflict in fishing spaces is the most common impact. Lastly, the impacts of environmental changes on migration include: local labour jobs, non-local labour jobs, seasonal migration, temporary migration and permanent migration. The least common impact on migration is non-local labour jobs, which means the individuals traveled long distances to work but continued to live in Chilika. The most common impact on migration is local labour jobs, which means the individuals had local jobs that were not related to fishing such as construction and tourism.

The data in Objective Two on physiological distress symptoms are associated with impacts of environmental changes on livelihood, resource access. There are seven psychological distress symptoms, which include: physical pain, insecurity, social isolation, loss of connection, intense worry, eating disorders and sleeping disorders. The least common psychological distress symptoms are social isolation, loss of connection and eating disorders. The most common psychological distress symptoms are physical pain, insecurity, intense worry and sleeping disorders. Each psychological distress symptom is ranked by severity of the symptom. The severities include low, medium and high severities. The majority of the participants who experienced the psychological distress symptoms of social isolation, loss of connection, and eating disorders ranked low in severity. The majority of the participants who experienced the psychological distress symptoms of physical pain, insecurity, intense worry and sleeping disorders ranked medium in severity. The majority of the psychological distress symptoms of the participants ranked low or medium in severity. This insight indicates that the participants may be coping effectively with their psychological distress symptoms.

The data on coping strategies in Objective Three reveals that the participants use a variety of effective coping strategies. These coping strategies include: taking medication, socializing, spiritual activities, hobbies, substance use, homemade remedies, nature, resting and exercising. The four most commonly used coping strategies are taking medication, socializing, spiritual activities and hobbies. The rest of the coping strategies are not as commonly used among the participants in this study. The data in Objective Three also reveals that the sources of social support include: family, community, spiritual, friends and professionals. The data shows that family and

community are the two most common sources of social support, while spiritual, friends and professional are the least common sources of social support.

This concludes Chapter Four on the results of this study, which provides qualitative findings for Objective One, Two and Three. Given the amount of stress that the participants are under, specifically the amount of psychological distress that they claimed to have in Objective Two, they generally managed their stressors well with coping strategies and social support mentioned in Objective Three. As shown in Tables 18 and 19, almost all participants had coping strategies and social support that are effective in managing the overall psychological distress from environmental changes associated with livelihood, resource access, and migration. Chapters 5 and 6 explore a deeper understanding of the results from this chapter.

Chapter 5

Results: Adverse Environmental Changes in Chilika Lagoon from 1980 to 2017

5.0—Research Objective Overview

This chapter seeks to answer the following research question: What is the relationship between environmental health, psychological health and well-being in Chilika Lagoon, India? This chapter focuses only the first objective of this study and highlights the important insights from the results in the previous chapter. Objective One determines the types of environmental changes and impacts in Chilika Lagoon and the impacts on livelihood, resource access and migration of the fisher communities. The purpose of Objective One is to determine the types of environmental changes and impacts taking place in Chilika Lagoon. There is a total of three sectors surrounding the Lagoon, each containing five villages. The types of environmental changes vary from sector to sector, but each sector experienced adverse environmental changes and impacts which include: change in salinity in the Lagoon, decreased quantity of native fish, severe weather occurrences, new species in the lagoon, decreased size of native fish, increased pollution in the Lagoon, Lagoon depth changes, and wetland habitat loss. The participants were asked to indicate if they observed any of the nine types of environmental changes and impacts. The results for Objective One indicate that some of the environmental changes significantly impacted the environment of the Lagoon and thus affected the livelihood, resource access and migration of the fisher communities. Therefore, the impacts of environmental changes on livelihood, resource access and migration were documented from each participant to examine how the environmental changes in Chilika Lagoon impacted the lives of the fisher communities. The results for Objective One also indicate that the livelihood, resource access and migration of the fisher communities were impacted. The results for Objective One are further described in this chapter.

5.1—Objective One A: Understanding the Environmental Changes in Chilika Lagoon

Objective One:

(A) To understand the nature of the changes to the commons taking place in Chilika Lagoon and (B) its impact on the local fishers' livelihood, resource access to the Lagoon and out migration.

The purpose of Objective One A is to determine the types of environmental changes that occurred in each of the three sectors. Each sector had a unique set of environmental changes as their location around the Lagoon varies. Each sector contains five fisher communities, which experienced similar environmental changes. The Results Chapter shows that Sector One experienced significant types of environmental changes which include: changes in salinity, less quantity of fish, invasive species and wetland habitat loss (as described in the Methods Chapter under section 3.3.1). Sector One is located south-west of Chilika Lagoon where an artificial sea mouth was opened in 2001 (Nayak & Berkes, 2010). The new sea mouth caused drastic changes to the Lagoon's salinity and brought in invasive species (Nayak & Berkes, 2010). As a result, the ecosystem of the Lagoon and its wetland habitat was negatively impacted (Nayak & Berkes, 2014). The results from Sector Three show that the participants noticed environmental changes related to decreased quantity of fish and depth changes (as described in the Methods Chapter under section 3.3.1). Sector Three is located north-east of Chilika Lagoon, where the shoreline has moved inwards which caused the land along the shoreline to decrease in levels. As a result, the participants indicated that depth changes are one of the most significant environmental changes in Sector Three. Figure 2 represents the percentage of total participants, both men and women, who observed negative environmental changes in Chilika Lagoon.

Figure 2 displays concerning amounts of negative environmental changes occurring in Chilika Lagoon from 1980 to 2017. Decreased quantity of fish is the most concerning negative environmental impacts that the participants observed from 1980 to 2017 (as described in the Methods Chapter under section 3.3.1). 94 percent of males and 83 percent of females noticed a decreased amount of fish living in the Lagoon. 92 percent of both males and females noticed a significant decrease in income from fishing activities in the Lagoon. Salinity changes in the Lagoon, severe weather, decreased size of fish and depth changes pose challenges to fishing

activities (as described in the Methods Chapter under section 3.3.1). The following sections focus on the comments of the participants on salinity changes, decreased quantity of fish, decreased size of fish and depth changes to understand the struggles that these environmental changes pose to the participants.

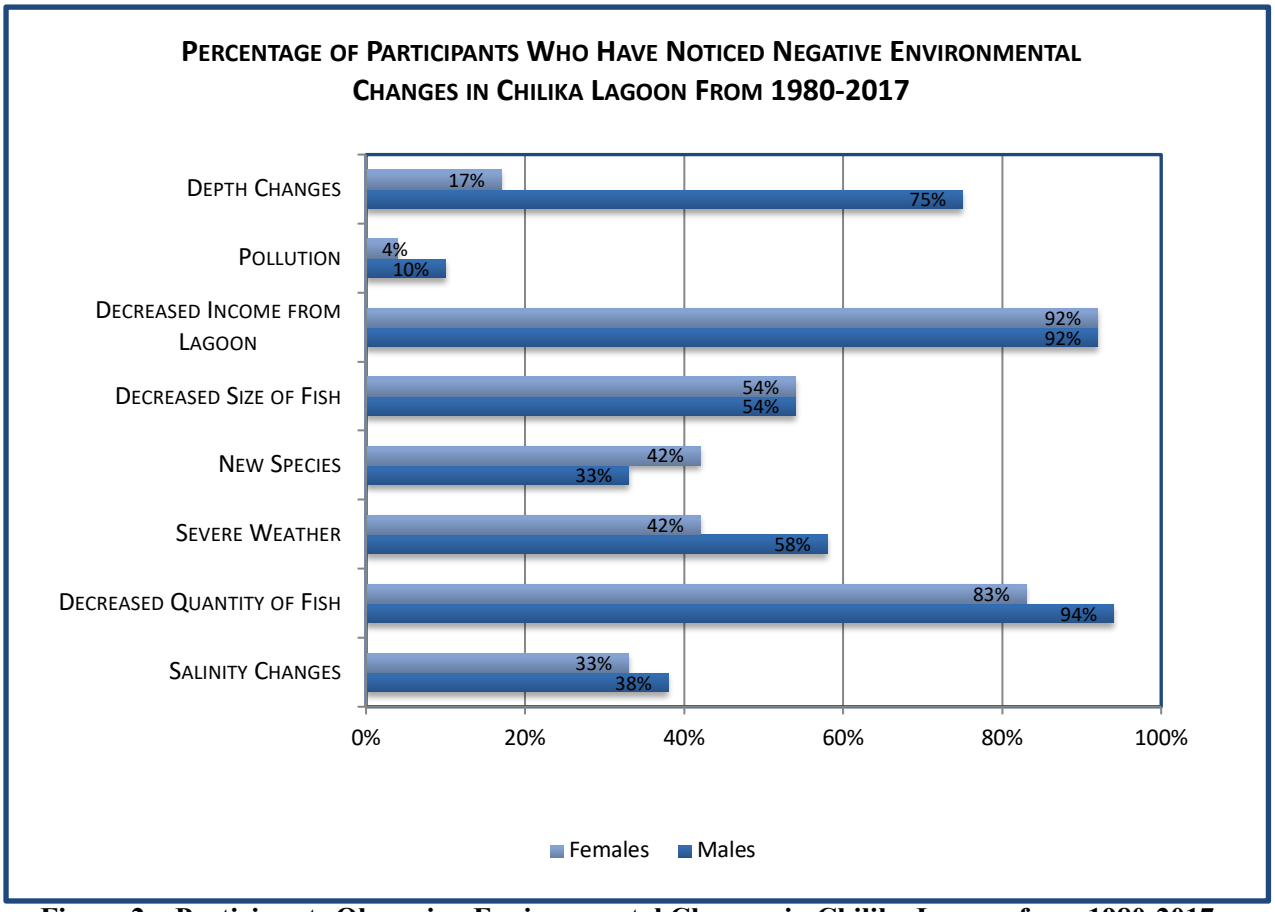

Figure 2—Participants Observing Environmental Changes in Chilika Lagoon from 1980-2017

5.2—Comments on Salinity Changes in the Lagoon

The levels of salinity increased significantly from 1980 to 2017 (as described in the Methods Chapter under section 3.3.1). The changes to the salinity of the Lagoon alter the ecosystem of the fish and as a result, it can bring in new species, which can be invasive and challenging to fishermen (Nayak & Berkes, 2010). Table 20 shows the comments from the participants regarding salinity changes and the challenges it brings to fishermen. The table shows answers to the following

question, which is found in the Interview Questions (see Appendix): "Have you noticed any changes in the salinity of the water in the last 15 years?"

Table 20 shows the comments made by three participants regarding changes in salinity of the Lagoon. Participant 304's comment reveals that the changes in salinity impacts the ecosystem of the Lagoon as well as the ability to fish as the skin of the fishermen get itchy and causes fishing activities to become difficult to carry out. Additionally, participant 401's comment supports the fact that the marine species are heavily impacted as the salinity impedes proper development of the fish. Participant 404's comment also supports the fact that the increased salinity causes additional issues to the fishermen, as the salinity in the Lagoon is harsh on the bodies of the fishermen, including their eyes. As a result, the salinity has not only made fishing activities more difficult for the fishermen but also has negatively impacted the growth of fish, which means fish scarcity increases. All three participants whose comments are shown in Table 20 are from Sector One, which has experienced significant changes to the salinity as its location is close to the artificial sea mouth that was opened in 2001 (Nayak & Berkes, 2010). As a result, it is common for the locals in this location to observe such changes in salinity and the impacts on the environment of the Lagoon.

Table 20—Comments on Salinity Changes in the Lagoon

Participant Code	Comment
301	15 years ago, the salinity was balanced. Now it's high and fish and crab die. Also, the legs of fishermen get itchy because of the salt in water.
401	15 years ago, the salinity was bracken, but now it is high, and it doesn't support the growth of all fish.
404	Salinity has increased in the past 15 years. If water gets in the eyes, they become highly affected from the salinity, more than it did 15 years ago.

5.3—Comments on Decreased Quantity of Fish in the Lagoon

The quantity of fish in the Lagoon has decreased significantly since the new sea mouth was opened in 2001 (as described in the Methods Chapter under section 3.3.1). The fish stock has decreased due to the alterations in the Lagoon's ecosystem caused by the artificial sea mouth and fishing practices that include over-fishing and the use of illegal fishing equipment, such as nylon net,

which are also referred to “zero nets” in the local communities. Certain fishing practices, such as net enclosures and the use of nylon nets contribute to decreasing amounts of fish stock in the Lagoon and therefore the fishermen are catching less fish **(**Pattanaik, 2007). Table 21 shows the comments made by the interviewees regarding the fish stock in Chilika Lagoon. These comments are answers to question number two in Interview Question (see Appendix): “Have you noticed any changes in fish, prawn or crab in Chilika Lagoon in the past 15 years?” Only comments regarding the quantity of fish the Lagoon are included in Table 21.

Table 21 shows the comments made by four participants regarding Chilika Lagoon’s fish stocks. Participant 403’s comment reveals that many of the Lagoon’s marine species have declined from 1980 to 2017. The decline in fish stocks is significantly impacted and as a result, this individual stopped noticing some of the species. According to the participant, these fish species that have declined include: Kundal, Ilish, Khuranta and Bacha. The names of these species are in Oriya and it is not translated into English. Unfortunately, the direct translation of the names is unknown, but the comment made by the participant entails that there has been a decline in native species. Participant 404’s comment reveals the difficult reality of the decreased fish catch of the fisher communities. The decline in fish catch has resulted in decreased income and lack of fish to eat for the families of the fishermen. Participant 2001’s comment indicates that the use of nylon nets (locally referred to as “zero nets”) is common in Chilika Lagoon, which hinders the development of fish and decreases fish stocks (Pattanaik, 2007). The use of nylon nets is illegal, yet it is still being used to fish in Chilika Lagoon (Pattanaik, 2007). Participant 404’s comment reveals the difficult reality of the fishermen, which have to work longer hours to catch the same amount of fish they caught 15 years ago. These comments strongly indicate that the fish stocks in Chilika Lagoon have declined not only due to the natural environmental changes, but also due to illegal fishing activities that changed the environment.

Table 21—Comments on Decreased Fish Stock in the Lagoon

Participant Code	Comment
403	15 years ago, I saw the following species: Kundal, Ilish, Khuranta and Bacha. Now I don't see these species anymore.
404	15 years ago, from all the fish caught we were able to eat some of it at home and sell the rest. Now there is not enough to sell, let alone to eat at home.
1201	Due to the use of "zero nets" (nylon nets), the quantity of fish decreased to about 25% of what it used to be.
1304	The quantity of fish decreased since 22-30 years ago. Then, the Lagoon was in good condition. We only needed to work 1-2 hours per day, which was sufficient, but now we have to work a lot longer.

5.4—Comments on Decreased Size of Fish in the Lagoon

The size of fish species has also decreased significantly from 1980 to 2017. The cause of this includes overfishing and the use of illegal fishing equipment, such as nylon nets (as described in the Methods Chapter under section 3.3.1). Many fishers and non-fishers substituted traditional fishing methods with nylon nets, as they are more efficient **(**Pattanaik, 2007). Table 22 shows the comments by the interviewees regarding the decreased size of fish in the Lagoon. These comments are answers to the same question used in the previous paragraph on decreased fish stocks. The question is: Have you noticed any changes in fish, prawn or crab in Chilika Lagoon in the past 15 years (see Appendix)? Only answers regarding the size of fish species are provided in Table 22.

Table 22 shows the comments made by three participants regarding the changes in size of fish species. Participant 602's comment indicates that the scarcity of fish has resulted in fishermen catching the small fish that are not fully developed. This comment reveals the difficult reality of the fishermen who need to make adequate income for their families, so they catch smaller fish to make a living. Participant 801's comment reveals that the use of illegal nylon nets continues to be used in Chilika Lagoon. The reality is that nylon nets not only catch the smaller and underdeveloped fish but also the eggs of the fish, which contributes to the decline in fish stocks (Pattanaik, 2007). Participant 902's comment reveals the difficult reality of the fishermen who get back home empty handed or with very few fish after a long day of fishing. The increase of non-fisher castes over the last couple of decades has contributed to the overfishing and scarcity of fish species in Chilika Lagoon. The vulnerability of the fisher communities hinders them from having

full access to the Lagoon, which creates additional issues for the fishermen. Not only has the quantity of fish in the Lagoon decreased, but also the fisher communities have difficulties fighting for their rightful fishing spaces. The impacts on the fishermen's access to the Lagoon are described later in this chapter.

Table 22—Comments on Decreased Size of Fish in the Lagoon

Participant Code	Comment
602	15 years ago, the sizes of fish were bigger than now. Due to fish scarcity, people catch the small fish as well.
801	15 years ago, the sizes of fish were bigger. Now fishers and non-fishers use "zero" nets which kill small fish and fish eggs, which decreases the fish stock.
902	15 years ago, my father and I never returned from fishing empty handed. Back then, non-fisher castes were not fishing like they are now.

5.5—Comments on Depth Changes of the Lagoon

The ecosystem of the Lagoon in the third sector, which is located northeast of the Lagoon, has changed from 1980 to 2017 (as described in the Methods Chapter under section 3.3.1). Depths in the Lagoon are significantly changing according to the qualitative data collected. The daily activities of men involve fishing in the Lagoon, while women's daily activities include household chores, which explain why mostly men participants noticed the depth changes. Depth changes are the most drastic type of environmental change in Sector Three. In this sector the shoreline of the Lagoon has moved away from the village, which is poses challenges to the local fishermen as they have to transport the fishing equipment for kilometers at a time to reach the shoreline. To combat this issue, canals have been dredged to transport fishing equipment to the shoreline. Traveling from the Lagoon to fish is a major concern for this area as the depths of the canals fluctuate throughout the year. When the canals are shallow, the boats have to be pushed by multiple people to reach the shoreline. This challenge of reaching the shoreline adds to the total time of fishing. As a result, some fishermen spend days at a time inside the Lagoon to avoid wasting time struggling to push their boats through the canals. Table 23 shows some of the comments from the participants in Sector Three, which depicts the challenges that the depth changes create for the fishers. The table

shows answers to question number one in the Interview Questions (see Appendix): "What physical changes have you noticed in the Lagoon in the past 15 years?"

Table 23 shows comments made by three participants regarding the changes in water depths of Chilika Lagoon. These comments are from participants in Sector Three. Sector Three has experienced significant changes to its water depths as the shoreline as moved inwards and has dried up the land close to the communities, which causes additional issues to the fishermen when accessing the Lagoon (Ministry of Environment and Forests, 2008). Participant 1203's comment indicates that the shoreline has moved away from his community and the area where there used to be water, is now all dried up. Participant 1301's comment indicates that the area where the Lagoon shore used to be is not only dried up, but it is covered in plants which make it difficult for the fishermen to access the Lagoon shore that is currently located. The locals call these plants Nalagrass, which are tall and thick which makes it impossible for fishermen to walk through (Ministry of Environment and Forests, 2008). As a result, canals are dug up so that there is access to the Lagoon shore (Ministry of Environment and Forests, 2008). Unfortunately, these canals are difficult to travel through and are sometimes shallow depending on the season, which makes it difficult for the fishermen to push their boats through. Lastly, participant 1302's comment depicts the difficulty in traveling through the canals when they are shallow. The environmental changes in water depths created difficulties in fishing for the fisher communities. The location of Sector Three is affected the most by water depth changes, which has made fishing more difficult for the local communities since they not only have to deal with the decline in fish stocks but also reaching the Lagoon with their fishing equipment.

Table 23—Comments on Depth Changes in the Lagoon

Participant Code	Comment
1203	15 years ago, the shoreline was much closer to the Lagoon. We used to fish close to the village, but now that area is all dried up.
1301	The Lagoon shoreline moved further away from the village. Now the area where we used to fish is covered in plants.
1302	Now it is difficult to travel to the Lagoon because the land is dried up most of the year, so we need 3-4 people to push one boat and reach the shoreline through a shallow canal.

5.6—Objective One B: Livelihood, Resource Access and Migration

Objective One:

(A) To understand the nature of the changes to the commons taking place in Chilika Lagoon and (B) its impact on the local fishers' livelihood, resource access to the Lagoon and out migration.

The purpose of Objective One B is to examine the impacts of the environmental changes on the livelihood, resource access and migration of the fisher communities in Chilika Lagoon (as described in the Methods Chapter under sections 3.3.2, 3.3,3 and 3.3.4). The conditions of livelihood, resource access and migration are examined separately to determine the significance of the impacts. The impacts on livelihood of the fisher communities are examined by determining the conditions of livelihood, which include: leisure time, ability to afford household basic needs, household spending money and household income. The impacts on resource access of the fisher communities are examined by determining its conditions, which include: conflict in fishing space, decreased fish catch, stolen fishing equipment and use of nylon nets. The impacts on migration of the fisher communities are examined by determining the conditions of migration, which include: local labour, non-local labour, seasonal migration, temporary migration and permanent migration. By determining the impact on the livelihood, resource access and migration conditions, this study can draw conclusions on how the environmental changes in Chilika Lagoon impacted the fishing communities.

5.6.1—Objective One B: Environmental Change Impacts on Livelihood

The conditions of livelihood are examined by determining the impacts on leisure time, ability to afford basic needs, household spending money, and household income (as described in the Methods Chapter under section 3.3.2). Leisure time consists of the total time that the individual has to enjoy himself or herself and does not have to work or do household chores. When an individual has to work more in order to have more income, he or she has less leisure time, which can impact the individual's psychological health (Heintzman & Mannell, 2010). Affordability of basic needs focuses on the ability of the household to afford all their basic needs such as shelter, food, clothing and clean water. As the household income decreases, it is expected that the ability

of the household to afford all basic needs may be impacted. A study indicates that 88 percent of households in fisher communities in Chilika have experienced severe food shortages (Nayak & Berke, 2012). The food culture is based on rice and fish, which was significantly impacted by the decline in household income. Additionally, the decline in household income has resulted in a decline in children attending school. A study indicates that there was a 70 percent decrease in high school examinations due to the decline in household income (Nayak & Berkes, 2012). Household spending money focuses on the household's ability to participate in their community, which often requires spending money. The less spending money a household has, the less they can participate in their community (Marmot, 2002). Lastly, decreased household income focuses on the household's income from 1980 to 2017, which is significantly impacted due to the environmental changes impacting Chilika Lagoon. The decline in fish stocks and fish size resulted in a rapid decline in household income, which caused a concerning livelihood crisis for the fisher communities in Chilika (Nayak, Armitage & Andrachuck, 2015). The economic status in many of the fisher communities declined significantly which resulted in the fishing livelihoods to become unfeasible (Nayak & Berkes, 2010). The results for impacts of environmental changes on livelihood show that participants in all three sectors experienced significant impacts on their household spending money and decreased household income.

Livelihood impacts of environmental changes include decreased leisure time, inability to afford all basic needs, limited spending money, and decreased income (as described in the Methods Chapter under section 3.3.2). As shown in Figure 3, decreased income and limited spending money are the two most concerning impacts of environmental changes on the local communities' livelihood. Between 92 percent and 100 percent of all males and females reported their income decreasing and their spending money decreasing overtime from 1980 to 2017. This poses challenges to the livelihood of the fisher communities as their household income and spending money both decreased. Lack of spending money indicates that the majority of the fisher communities cannot fully participate in their communities since it often requires spending money (Marmot, 2002). About half of the male and female participants reported having increasing issues regarding inability to afford all basic needs and decreased leisure time from 1980 to 2017. The decreased leisure time indicates that the individuals may be working longer hours to increase their

income, which takes time away from leisure activities. Table 24 shows the comments of participants regarding the struggles associated with the decline in household income.

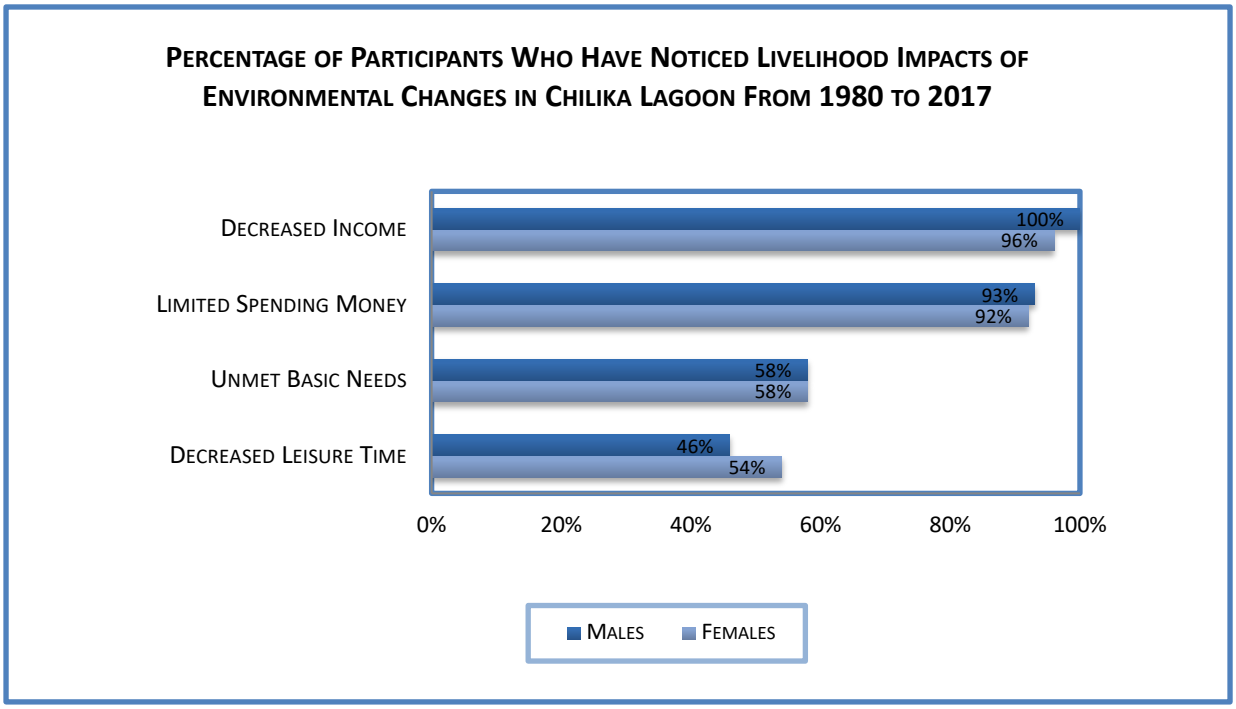

Figure 3—Livelihood Impacts of Environmental Changes in Chilika Lagoon from 1980 to 2017

Participant 501 is a woman who started working in local daily wage jobs due to the decline in household income (Table 24). The decline in household income of the fisher communities has resulted in severe food security and inability to afford all basic needs. A study indicates that 88 percent of households in fisher communities in Chilika have experienced severe food shortages (Nayak & Berke, 2012). The food culture is based on rice and fish, which was significantly impacted by the decline in household income. The decline in household income has also resulted in a decline in children attending school. Participant 501's comment reveals that when household income is low, she takes her children to work with her. The decline in household income has not only limited the affordability of education fees for children, but also increased the demand for women and children to contribute to income generation activities (Nayak, 2014). This is an indication that households in fisher communities have limited spending money and leisure time

due to the demand of additional income generating activities. Participant 205's comment reveals that his working hours in the Lagoon have increased due to the lack of household income from fishing. Having limited spending money can severe impacts the individual's ability to fully participate in his or her own society (Marmot, 2002). The decline in housheold income and the demand for women and children to partake in income generating activities has concerning impact the households' ability to fully participate in their communities. A decrease in an individual's leisure time due to an increase in working hours can significantly impact the individual's psychological health (Heintzman & Mannell, 2010). Additionally, not being able to fully participate in one's own community can have drastic consequences on the individual's connection to his or her community environment (Marmot, 2002). This is concerning for the fisher communities in Chilika as their livelihoods depend on the Lagoon environment and the loss of connection to the environemnt can have serious consequences on their psychological well-being. This indicates that the fisher communities were facing psychological distress not only due to limited spending money but also due to limited leisure time. These results pose an important challenge to the psychological distress of the fisher communities, which are described in Chapter 6.

Table 24—Comments on Impacts of Environmental Changes on Livelihood

Participant Code	Comment
501	The lack of income has limited our household access to food and education for the children. When income is low, the children come to work with me so they do not end up going to school.
205	Compared to 15 years ago, there is less fishing space, so the income has decreased, and I need to work longer hours in the Lagoon. As a result, I limit my leisure time with my family.

5.7—Objective One B: Environmental Change Impacts on Resource Access

Resource access and focuses on the individuals' ability to access the Chilika Lagoon and its resources, such as being able to fish successfully. The conditions of resource access are examined by determining the impacts on conflict in fishing space, decreased fish catch, stolen fishing equipment and use of nylon nets (as described in the Methods Chapter under section 3.3.3). Conflict in fishing space focuses on any aggressive behaviour between fisher castes and non-fisher

castes that fish in the Lagoon. Aggressive behaviour includes verbal threats and violence between the two groups. Decreased fish catch focuses on the quantity of fish, prawn or crab caught by the fishermen on a daily basis from 1980 to 2017. This criterion focuses on the quantity of fish the fishermen are able to catch rather than the quantity of the fish stock of the Lagoon. Stolen fishing equipment focuses on the fishing equipment of the fishermen that often get stolen either due to conflict between the different castes or due to poverty increase. It is not clear whether theft in fishing equipment is due to conflict or poverty, so it has its own category under resource access. When living costs increase, so does theft and crime, which is why stolen fishing equipment has its own category from conflict in fishing space (Fafchamps & Minten, 2003). Use of nylon nets ("zero nets") focuses on the presence of nylon nets in the Lagoon, which impedes the growth of marine species as it catches small and underdeveloped species (Pattanaik, 2007). Lastly, illegal net enclosures and embankments managed by non fisher-castes decrease the fisher communities' access to the Lagoon (Pattanaik, 2007). The results show that the participants in all three sectors experienced significant impacts on conflict in fishing space and decreased fish catch.

Figure 4 reveals the percentage of males and females who reported environmental impacts on accessing the Lagoon. More men than women observed issues regarding resource access perhaps due to the difference in social roles of men women. Men in fisher caste communities tend to spend more time in the Lagoon since they spend their time fishing and women tend to spend more time indoors and overseeing household chores. About half of the males interviewed reported a decrease in fish catch and increase in conflict in the Lagoon from 1980 to 2017. Since the men in the fisher caste communities tend to fish more than women, it is expected that they observed increased conflict and decreased fish catch more than women. The decrease in fish catch indicates scarcity in fish stock, which impacts the access to the Lagoon for the fisher communities, as there is less fish to catch. Additionally, conflict may arise between fisher castes and non-fisher castes as communities from higher castes have a higher status than fisher castes, which results in fisher caste communities being vulnerable to conflict in Chilika Lagoon which in turn reduces their access to the Lagoon. The vulnerability to conflict of the fisher caste communities decreases their rights in the Lagoon which impedes them from effectively solving conflict with non-fisher caste communities.

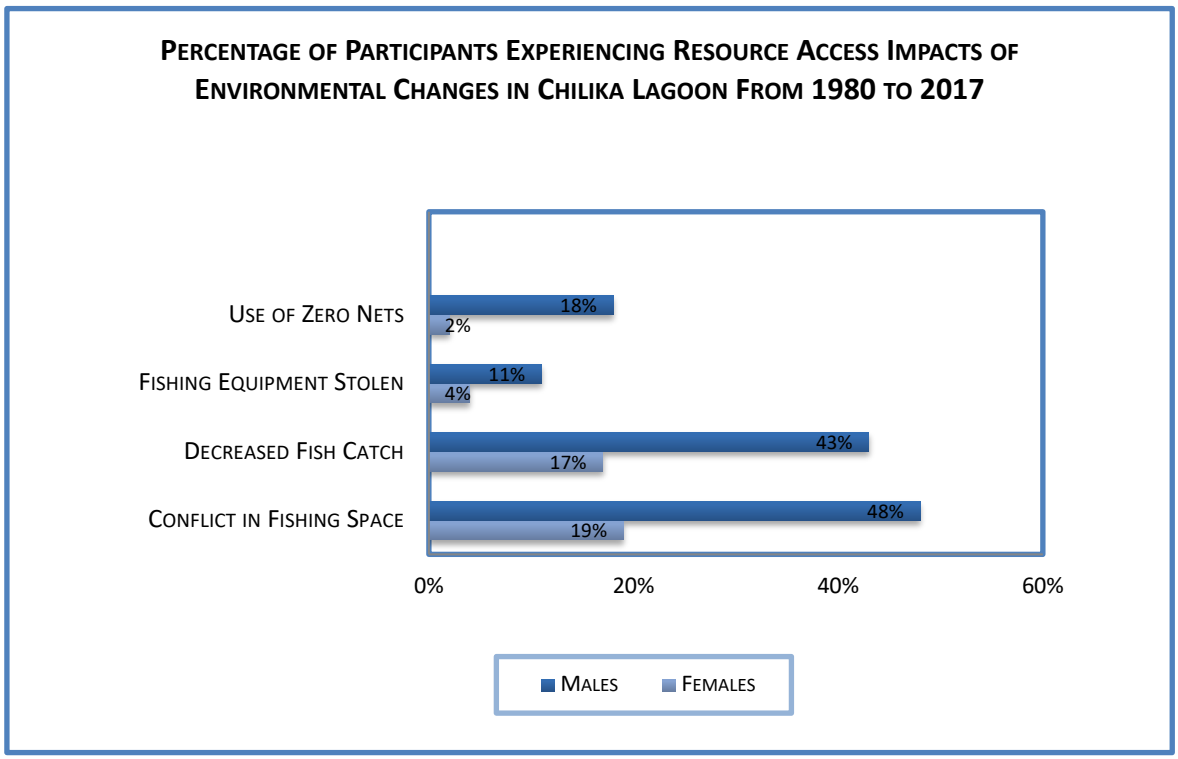

Figure 4—Resource Access Impacts of Environmental Changes in Chilika from 1980 to 2017

5.7.1—Conflict in the Lagoon

Conflict occurs in Chilika Lagoon because the negative environmental changes pose challenges to all the fishers in the Lagoon (as described in the Methods Chapter under section 3.3.3). Through the semi-structured interview process, this study raised some concerns as many interviewees mentioned conflict to be an issue for all fishermen, including concerns about safety while fishing out in the Lagoon. These conflicts include violence between various fisher castes as well as verbal threats. Non-fisher castes started to fish the Lagoon, which increases the demand of fish (Nayak et al., 2014). This includes illegal enclosures and embankments of non-fisher castes that have taken over fishing space of the fisher castes (Pattanaik, 2007). The decline of access to the Lagoon is a major factor that facilitates conflict in the Lagoon as well as tensions between fisher and non-fisher castes. Table 25 shows some of the comments from the participants regarding conflict and safety

in fishing. The comments in the table pertain to question six in the Interview Questions (see Appendix): "What are the sources of conflict in Chilika Lagoon?"

Table 25 shows the comments made by three participants regarding conflict and safety in Chilka Lagoon. Participant 1304's comment reveals the dangerous reality in the conflict between fisher communities and non-fisher communities. Fisher communities felt threatened by non-fisher communities as they are from a lower caste and are more vulnerable than higher castes. Participant 1305's comment reveals that the conflict between fisher castes and non-fisher castes involves stealing fishing equipment, which escalates the conflict. When the fishermen have their fishing equipment stolen, they cannot go out fishing and thus cannot make a living. Participant 1402's comment indicates that the conflict between the fisher castes and non-fisher castes occur throughout Chilika and not just in their communities. Unfortunately, every community that has participated in this study has indicated that conflict is a serious issue that hinders fishermen from making a living.

Table 25—Comments on Conflict and Safety Regarding Fishing

Participant Code	Comment
1304	Since 2005, non-fishers who practice aquaculture have blasted bombs in my village. They use guns, killed people and stole fishing nets.
1305	Fishers steal other fisher's equipment. They steal fishing nets that sit in the Lagoon at night. If other fishers catch them stealing, the conflict escalates.
1402	We used to fish just outside our homes because the Lagoon shoreline was there. Now, due to the Lagoon shoreline moving inwards and away from the villages, fishers have to travel far into the centre of the Lagoon and some leave nylon nets permanently, which used to not occur. In addition, both fisher castes and non-fisher castes fish throughout the Lagoon, which adds to the conflict.

5.7.2—Use of "Zero Nets" and Decreased Fish Catch

Table 26 shows the comments made by three participants regarding the use of "zero nets" and enclosures in Chilka Lagoon. Participant 1303's comment reveals that many fishers have left nets inside the Lagoon permanently, which caused problems to the ecosystem of the Lagoon. As these long enclosures sat near the sea mouth for long periods of time, the fish could not reach other parts of the Lagoon. In addition, the enclosures have contributed to the decrease in fishing grounds for other fishers. Another factor that contributed to the decrease of fish stock in the Lagoon is the use

of nylon nets, which are locally referred to as "zero nets". Participant 1302's comment reveals the damage that nylon nets have caused to the fish stock of the Lagoon, which was already scarce. The decline in fish stock has resulted in overfishing which also contributed to the decline in fish size (Nayak, 2014). Many fishers and non-fishers had substituted traditional fishing methods with nylon nets, as nylon nets are more efficient **(**Pattanaik, 2007). Nylon nets are considered illegal because they impede the growth of marine species as they catch juveniles and non-targeted species including fish eggs (Pattanaik, 2007). In turn, the use of nylon nets had contributed to the exploitation and depletion of fish in the Lagoon. Participant 602's comment reveals the difficult reality of the fisher communities who had no choice but to fish juveniles so they can feed their families. As a result, the fishermen had started fishing all fish sizes and neglecting fish breeding areas (Nayak, 2014). The livelihoods of the fisher communities have become more difficult due to the conflict between fishers and non-fishers, the decrease in fishing grounds, and the scarcity of fish stock, which have all contributed to the decline in household income.

Table 26—Comments on the Use of "Zero Nets" and Enclosures

Participant Code	Comment
1303	Near the artificial sea mouth, there are many nets the sit in the water permanently; so all the fish cannot entre the Lagoon. During high tide, the water does not reach my village [located northwest of Chilika Lagoon, opposite of the artificial sea mouth].
1302	One of the reasons why the fish stock has decreased in the Lagoon is that more people are using zero nets to fish in the Lagoon, which kills the fish eggs.
602	Due to scarcity, the fish sizes are a lot smaller now and fishers have no choice but to catch the small fish so they can feed their families.

5.8—Objective One B: Environmental Change Impacts on Migration

The conditions of migration are examined by determining the impacts on local labour, non-local labour, seasonal migration, temporary migration and permanent migration (as described in the Methods Chapter under section 3.3.4). Local labour includes local job alternatives to traditional fishing, such as construction, tourism and services, while non-local labour includes employment positions outside of Chilika, which would require for the individual to travel long distance on a daily basis. Seasonal migration includes migration from one to four months. Temporary migration includes migration from four to twelve months. Lastly, permanent migration includes moving

away from Chilika to work elsewhere for more than one year. The results show that the participants in all the sectors experienced similar impacts on migration. The most significant impacts on migration are local labour and temporary migration.

As Figure 5 indicates, most males and females responded that migration is the result of adverse environmental changes in Chilika Lagoon. Temporary migration and local labour are also a significant result of environmental changes. 29 percent of males indicated that either a family member or themselves migrated temporarily at the time of the interview or in the recent past for employment purposes from four months to 12 months. Additionally, a significant number of males and females responded that either a member of the family or themselves had a local job, which was not related to fishing, but it was close to their community. These local jobs include positions in construction, tourism and retail. As a result, in the decline in household income, women and children had started to contribute to income generation activities (Nayak, 2014). As mentioned earlier regarding the impacts of environmental changes on livelihood of the fisher communities, the decline in household income had forced other members of the household such as women and children to contribute to income generating activities.

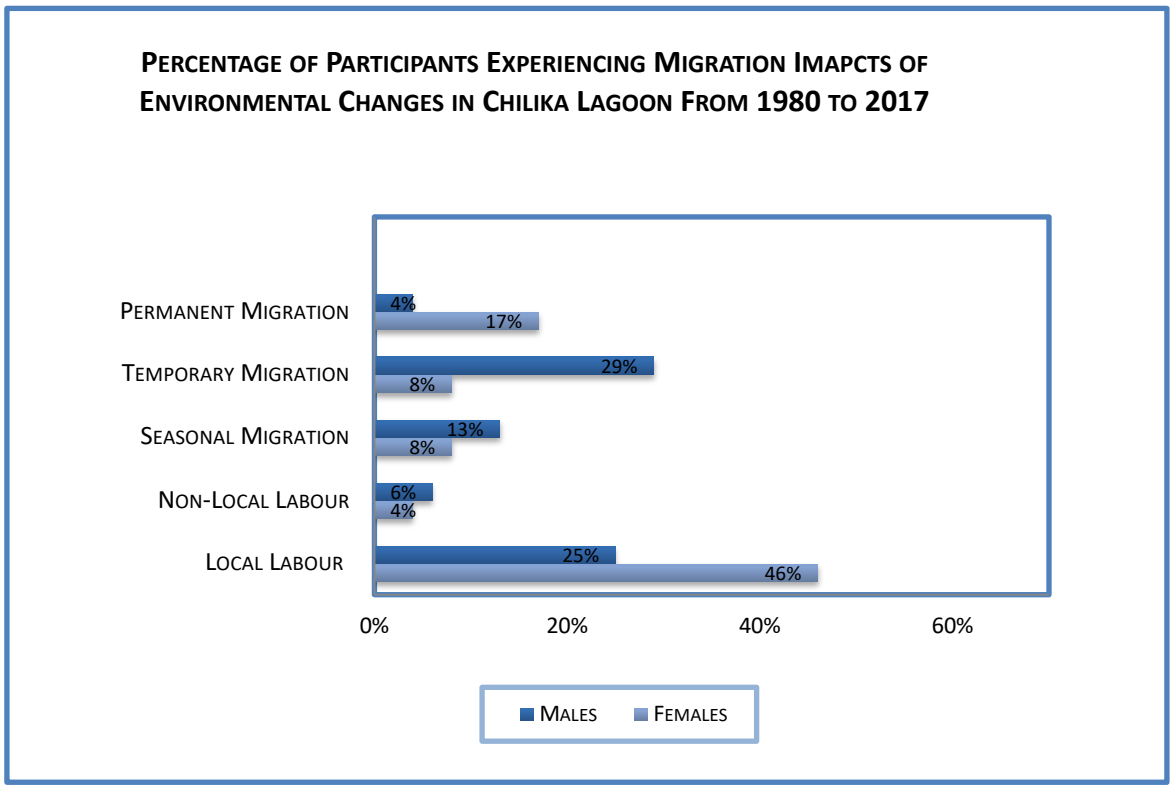

Figure 5—Percentage of Participants Experiencing Impacts on Migration from 1980 to 2017

There is a lack of significant permanent migration, seasonal migration and non-local labour, which includes daily long-distance travel to work. This study assumes that the number of people in Chilika who experienced permanent migration, seasonal migration and non-local labour may be higher than represented in this study. Individuals who were impacted by seasonal or permanent migration would not have been present in their community to be interviewed. Additionally, since the data was collected between 9 A.M. and 5 P.M., individuals who may have been impacted with non-local job may not have been present in their community to be interviews, as they would have been commuting to work earlier than 9 A.M. and commuting home later than 5 P.M. Table 27 shows comments made by the participants regarding migration in Chilika Lagoon.

Table 27 shows comments made by three participants regarding impacts of environmental changes on migration. Participant 303's comment indicates the seasonal migration is common because the fish stock in Chilika Lagoon is impacted. When fish stocks decline, the fishermen cannot catch enough fish to make a living and support their families. As a result, the fishermen

looked for other ways of making money and seasonal migration is an option only if they had other qualifications than fishing. Participant 401's comment reveals the difficult reality of migration for employment. Many of the fishermen held only fishing qualifications and had a difficult time finding non-fishing related jobs. Migrating can also be difficult because adjusting to new environments can impact the health of the individual (Nesdale et al., 1997). Participant 1302's comment reveals the stressful time he had when he migrated with his whole family who ended up sick from adjusting to the new environment. This caused more stress because they needed additional income to pay for medications and other health related costs. Migration has many complications and is not always an effective option for the fisher communities.

Table 27—Comments on Forced Migration due to Impacts of Environmental Changes

Participant Code	Comment
303	My husband migrates for work seasonally. When fish stock in the Lagoon is bad, he migrates for work.
401	If I migrate for work I will not be able to find a job because the only skill I have are related to fishing. I do not have any other skills so it would be hard to get employed.
1303	I migrated for work in 2016 and 2010-2011. I brought my whole family with me and we got sick from trying to adjust to the new environment. I had to borrow money in order to pay for medication and other costs.

5.9—Conclusions: How Environmental Changes Effected Livelihood, Resource Access and Migration of Fisher Communities

The results for Objective One indicate that the environmental changes in Chilika Lagoon from 1980 to 2017 have significantly impacted the livelihood, resource access and migration of the fisher communities. The types of environmental changes that are significant include decreased quantity of fish, severe weather occurrences, decreased size of fish and changes in water depths. These types of environmental changes are significant in all three sectors, except for changes in water depths. Only Sector Three has experienced drastic changes in water depths due to the environmental conditions of the Lagoon where Sector Three is located. The communities in Sector Three are located north-east of the Lagoon. From 1980 to 2017, the fisher communities identified changes regarding the Lagoon's shoreline. The shoreline has moved inwards away from the fisher communities, which has caused difficulties in accessing the Lagoon. That said, this study indicates

that the adverse environmental changes that occurred in each of the three sectors have significantly impacted the livelihood and resource access of the fisher communities.

The results of Objective One indicate that over half of the fisher communities felt that their livelihood has been impacted through decreased household income, limited household spending money and inability to afford all household basic needs. 75 out of 76 total participants claimed that their household income has decreased due to the environmental changes in Chilika Lagoon from 1980 to 2017. The results for Objective One also indicate that the environmental changes impacted the resource access of the fisher communities. Over half of the fisher communities indicated that conflict in fishing spaces and decreased fish catch has been significantly impacted due to the environmental changes. 67 out of 76 total participants expressed conflict to be a major obstacle for fishermen. Conflict between fisher and non-fisher castes escalated and the fisher communities felt vulnerable as their caste ranks lower than non-fishing castes. 60 out of 76 total participants felt that the fisher communities are catching less fish, due to environmental changes of the Lagoon as well as increased demand of fish. The demand for fish in Chilika Lagoon has increased from 1980 to 2017, which has contributed to the decreased fish catch in the fisher communities.

As a result of the impacts of environmental changes on livelihood, resource access, many locals from fisher communities migrated. The most common types of migration include local labour and temporary migration. Local labour involves any other sources of income that is not fishing related, but it is local, which are jobs in construction and tourism. Local labour does not require much change in the household living conditions as it is local, but it does causes additional stresses to the individual because changes in employment causes stress (Barnett & Brennan, 1997). Temporary migration is the second most common type of migration in this study. Temporary migration involves at least one household member to move away from Chilika to work elsewhere for income, which lasts from four months to 12 months. The limitations of this study suggest that the number of households impacted by migration may be higher than what the results reveal. Households who were migrated during the time of the interviews that were conducted for this study could not have been present in their communities to provide their information. Therefore, this study suggests that more households may be impacted by migration than what has been

documented. That said, there are indications that the impacts on livelihood, resource access and migration caused significant physiological distress in men and women in the fisher communities. The following chapter describes the impacts on the psychological distress of the fisher communities in Chilika Lagoon.

Chapter 6

Results: Psychological Distress in Fisher Communities and Coping Strategies

6.0—Research Objectives Overview

This chapter seeks to answer the following research question: What is the relationship between environmental health, psychological health and well-being in Chilika Lagoon, India? This chapter describes only the second and third objectives of this study and highlights the important insights from the results in the previous chapter. Objective Two examines the psychological distress symptoms of the fisher communities, which are associated with the environmental changes and impacts. Objective Three examines the coping strategies used to manage the psychological distress symptoms of the fisher communities. The purpose of Objective Two is to examine the conditions of livelihood, resource access and migration to determine their impacts on the psychological distress of the individuals. To analyze the physiological distress of the fisher communities, each participant was asked to answer questions regarding their psychological distress by categorizing the psychological distress into seven symptoms. The psychological distress symptoms include: physical pain, insecurity, social isolation, loss of connection to the environment, intense worry about the future environment as well as the future of the household, eating disorders and sleeping disorders. The psychological distress symptoms documented are then examined to determine the severity of distress of each participant. Each psychological distress symptoms documented is ranked low, medium or high severity. The results for Objective Two are further explored in this chapter.

The first purpose of Objective Three is to examine the coping strategies used by the participants to cope with their psychological distress symptoms. There are different types of coping strategies, which include: taking medication, socializing, spiritual activities, hobbies or leisure time, substance use, homemade remedies, nature or outdoor recreation, resting and exercising. The coping strategies were then examined to determine their effectiveness in coping with the psychological distress. Lastly, the second purpose of Objective Three is to determine the sources of social support that the participants received in order to help cope with their psychological distress. These sources of social support include: family, community, spiritual, friends and

professionals. The results for Objective Three indicate that the majority of the participants used effective coping strategies and had effective sources of social support. The results for Objective Three are further explored in this chapter.

6.1—Objective Two: Environmental Change Impacts on Psychological Distress

Objective Two:

To examine the main impacts of the environmental changes on the psychological health of the fishers, specifically the stress experienced including emotional symptoms, physical symptoms and behavioural symptoms of psychological distress.

The purpose of Objective Two is to examine the psychological distress of the individuals by determining the physiological distress symptoms and the severity of each of the symptoms. The severity levels include low, medium and high severity. Low severity means the psychological distress symptom is insignificant to the overall psychological distress of the individual. Medium severity means the psychological distress symptom is moderately impacting the overall psychological distress of the individual. High severity means the psychological distress symptom heavily impacts the overall psychological distress of the individual. There are seven psychological distress symptoms examined in this study, which are physical pain, insecurity, social isolation, loss of connection, intense worry, eating disorders and sleeping disorders (as defined in the Literature Review Chapter under section 2.4). Physical pain focuses on pain that is caused from distress of the individual, which include headaches, chest aches, joint aches, high blood pressure and other diseases related to stress (Hussain, 2009; Shukla, 2013). Insecurity focuses on instability in household income, which in turn causes the individual to feel insecure about his or her life as well as the lives of their household (Sepa et al., 2004). Social isolation focuses on the impacts on the individual's ability to socialize when under stress which can be significantly impacted when the individual cannot effectively cope with their stress (Fritze et al., 2008). Loss of connection focuses on the impacts on the individual's ability to stay connected with their environment and continue to feel that they belong in their home environment. When an individual is under stress, their connection and belongingness to their home environment can be negatively impacted (Albercht,

2009; Fritze et al., 2008). Intense worry focuses on the individual's state of mind regarding the uncertain future. When an individual experiences intense worry about uncertain future it can cause anxiety and impact the individual's ability to carry out his or her regular daily activities (Dohertyy & Clayton, 2011). Eating and sleeping disorders are behavioural symptoms of psychological distress and focus on the impacts of the individual's psychological distress, which can significantly impact their behaviour and ability to eat and sleep properly (Venditti et al., 1996; Moldofsky, 2001). Impacts on eating include lack of appetite and increase in appetite which both can negatively impact the health of the individual (Venditti et al., 1996). Impacts on sleeping include trouble falling or staying asleep and oversleeping, which can also negatively impact the health of the individual (Moldofsky, 2001). Figure 6 shows the percentage of male and female participants experiencing the psychological distress symptoms.

Figure 6 categorizes each psychological distress symptom into three levels of severity: low severity, medium severity and high severity. Saldaña's (2009) magnitude coding was used to determine the severities of the psychological distress symptoms (as described in the Methods Chapter under section 3.4 on Data Analysis). Figure 6 shows that about half of the total participants, both males and females, had medium severity of psychological distress in physical pain, lack of sense of security, feelings of intense worry and sleeping disorders. The results of these symptoms reflect the impacts of environmental changes on livelihood, resource access and migration. Surprisingly, only 37 percent of total participants experienced high severity in poor sense of security and only 30 percent of total participants experienced high severity in feelings of intense worry. The previous sections described the impacts of environmental changes on livelihood, resource access and migration, which indicate that the psychological distress of the fisher communities is significantly impacted. The following sections discuss each of the seven psychological symptoms and include comments from the participants.

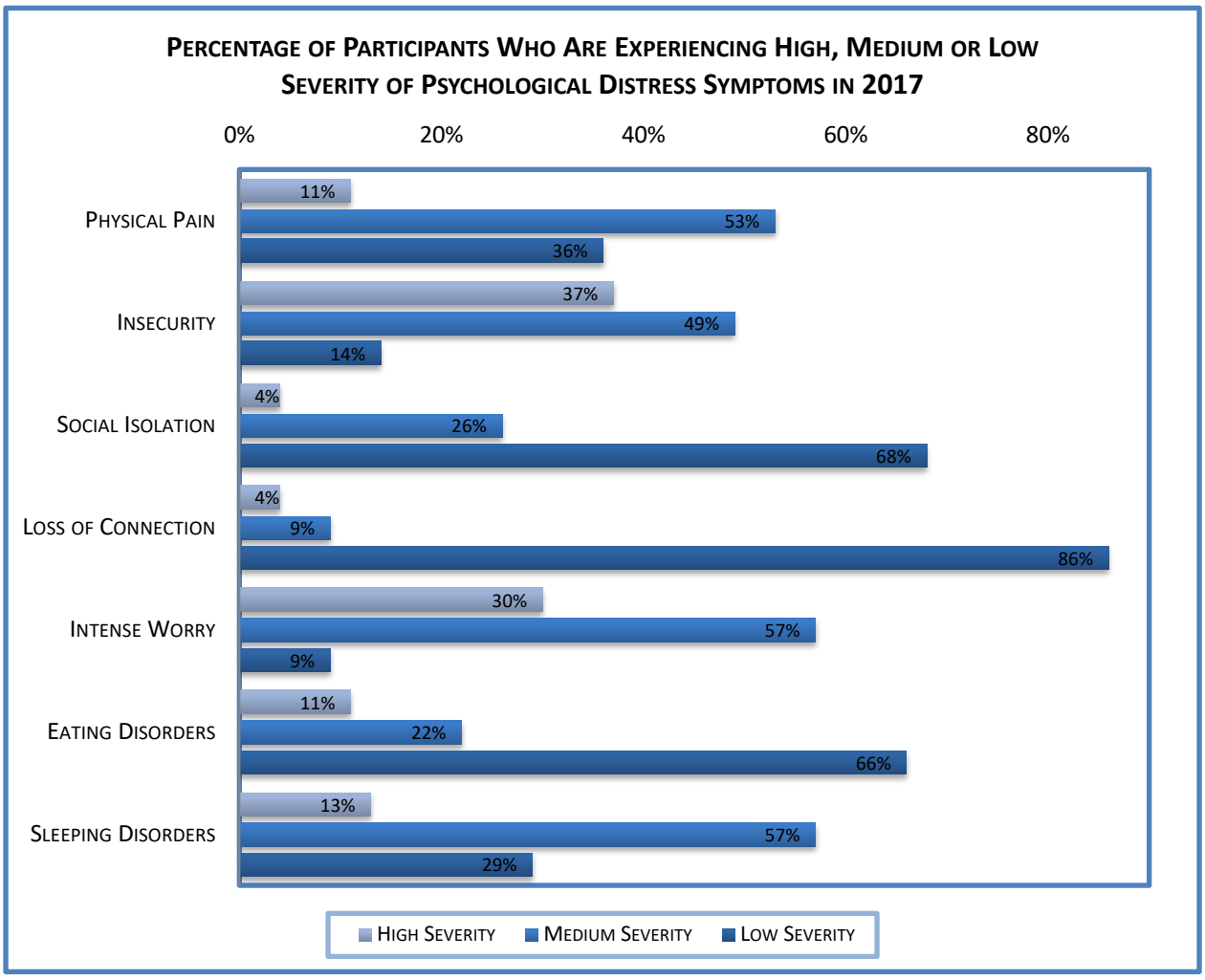

Figure 6—Percentage of Total Participants Who Experienced Psychological Distress Symptoms of Low, Medium and High Severities in Chilika Lagoon in 2017

6.2—Psychological Distress Symptom: Physical Pain

The first psychological distress symptom is physical pain which focuses on any stress related pain in the human body (as defined in the Literature Review Chapter under section 2.4). Physical pain can be any type of body ache associated with stress, including headaches, muscle aches, and chest pain. Physical symptoms from stress also include high blood pressure and trouble digesting which are associated with stress disorders. Often times, the immune system is weekend by emotional stress, which in turns weakens the body's ability to fight diseases (Hussain, 2009) Chronic psychological distress issues can cause body aches as well as digestive issues and high blood

pressure (Shukla, 2013). Since the fisher communities in Chilika Lagoon have experienced significant environmental stressors as described in Chapter 5, symptoms of physical pain are expected to be commonly found within the participants in this study.

Figure 7 indicates that the majority of the participants experienced physical pain at medium severity, which means that their physical pain is moderately significant to the individuals' overall psychological distress. The results of the psychological distress symptom for physical pain in the Results Chapter revealed that the majority of the participants from all three sectors, both males and females, experienced physical pain at medium severity. Although, very few participants experienced physical pain at high severity, the majority of the participants experienced physical pain at medium severity. These results indicate that there is some impact of environmental changes on the physiological health of the individuals. Table 28 shows some of the comments made by the participants who experienced physical pain at low, medium and high severities.

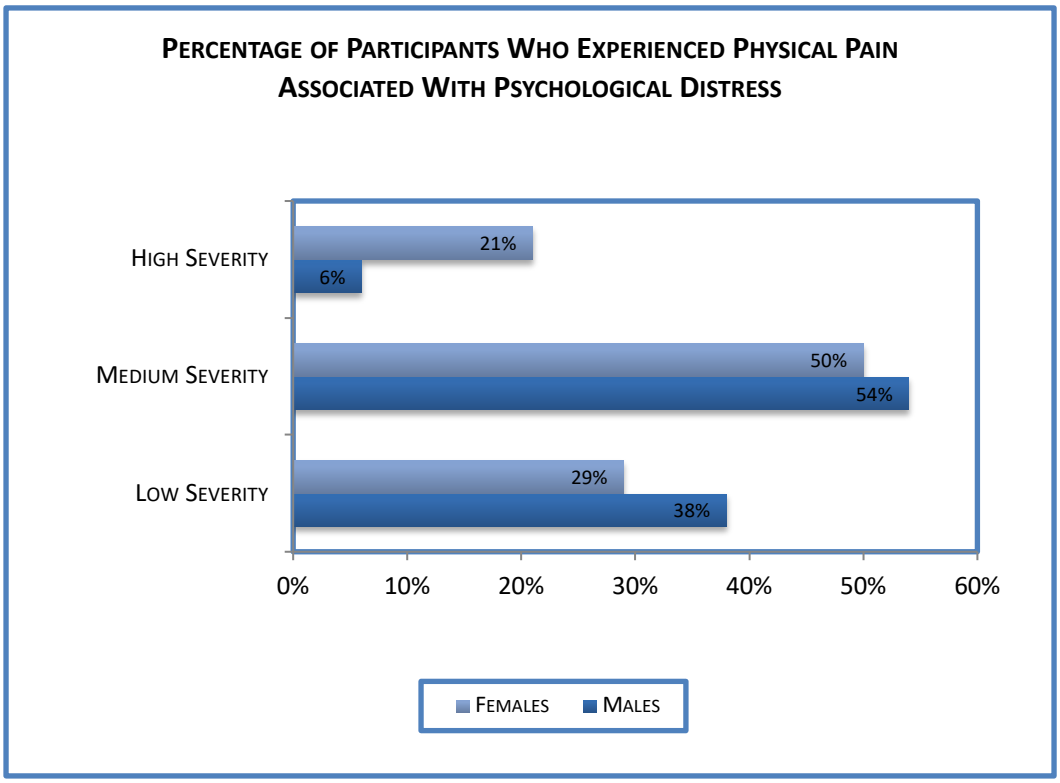

Figure 7—Percentage of Male and Female Participants Who Experienced Physical Pain Associated with Psychological Distress

Table 28 reveals the individual's experience on the psychological distress symptom of physical pain at low, medium and high severities. Participant 204's comment reveals that there is some impact on the individual's physical pain, but it is not significant enough to be considered medium or high severities when compared to other participants' experiences. Participant 802's comment reveals that the individual is experiencing some physical impact on the body through headaches. Headaches can be the result of high levels of stress, which is why it is ranked medium severity. Participant 903's comment reveals that the impacts of environmental changes of the Lagoon are directly impacting the livelihood and income of her household, which causes headaches and other physical pain. This experience is ranked high severity due to the combination of physical impacts on her body. The results and comments on physical pain indicate that the psychological distress of the fisher communities may be moderately impacted through the impacts of environmental changes on livelihood, resource access, and migration.

Table 28—Participant Comments on Symptom of Physical Pain

Participant Code	Psychological Distress Symptom: Physical Pain	
	Comment	Severity
204	I don't have physical pain but I feel stressed when I think about the lack of money if I don't earn enough to pay for my family's basic needs, then I start to feel dizzy.	Low
802	I spend a lot of time worrying about the lack of income and my family's needs. When I stress about the situation of the Lagoon, I start to feel headaches.	Medium
903	I feel high level of mental stress because I worry about the lack of income. I often feel chest pain, dizziness and weakness when my husband brings in less money from the Lagoon.	High

6.3—Psychological Distress Symptom: Insecurity

The second psychological distress symptom is insecurity, which focuses on the individual's sense of security regarding their household income (as defined in the Literature Review Chapter under section 2.4). Unstable income can cause feelings of insecurity, which in turn can decrease the individual's confidence (Fritze et al., 2008; Sepa et al., 2004). Feelings of insecurity around income are considered to be a psychological distress symptom. As the household income in fisher communities have decreased from 1980 to 2017, the sense of security is expected to have decreased as well.

Figure 8 shows that the majority of the participants experienced lack of security at medium severity. The majority of male participants experienced insecurity at medium severity, but the same number of female participants experienced insecurity at medium severity and high severity, which indicates that women experienced insecurity more than men at high severity. Additionally, the findings in the Results Chapters show that the majority of female participants who experienced insecurity at high severity are from Sector One, which indicates that women in Sector One are more insecure about their household income. Compared to Sectors Two and Three, Sector One is located in an area that is mostly secluded from tourism, which is often an alternate source of income for many fisher communities. As income from fishing decreases, many fishermen look for other sources of income and women start looking for employment to increase their household income. As Sector One is mostly secluded from tourism compared to the other sectors, women may have more difficulty in finding employment than women from other sectors. The following comments from participants reveal what insecurity is like to the individuals who feel insecurity at low, medium and high severities.

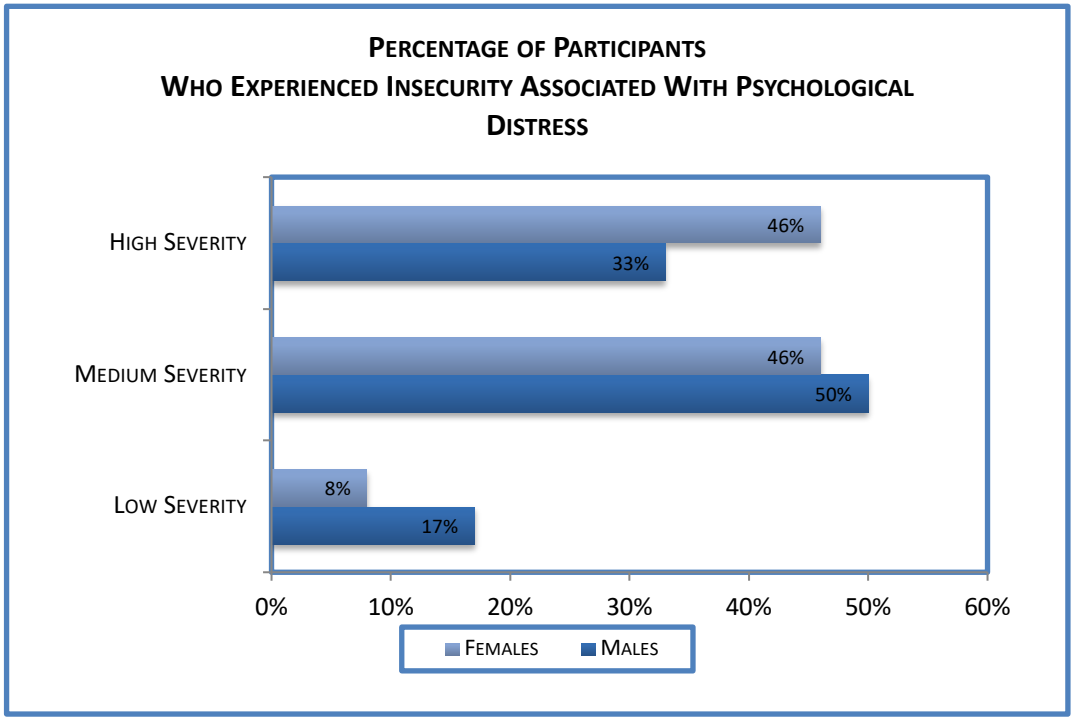

Figure 8—Percentage of Male and Female Participants Who Experienced Insecurity Associated with Psychological Distress

The participant comments on Table 29 reveal the individual experiences when feeling insecure about household income at low, medium and high severities. Participant 1201's comment indicates that the individual did not feel any lack of insecurity, which was rare as only 11 out of 76 total participants experienced low severity of insecurity. The comment also indicates that despite the individual having low severity of insecurity, he is aware that other individuals in his community generally experienced more insecurity that himself. Participant 1404's comment reveals the difficult reality of the majority of the fisher communities that had unstable income, which causes feelings of insecurity when unexpected costs arise such as health related costs. Participant 904's comment reveals the difficult reality of the individuals who had high severity of insecurity around household income. Participant 904 felt that the majority of the community is better off than his family in terms of stable income. When household income is unstable, it becomes difficult for the individuals to fully participate in society, as it often requires spending money (Marmot, 2002). As a result, unstable income can aggravate the feelings of insecurity by hindering the individual from fully participating in their community.

Table 29—Participant Comments on Insecurity Associated with Psychological Distress

Participant Code	Psychological Distress Symptom: Insecurity	
	Comment	Severity
1201	I don't feel a lack of insecurity but other people in this village do.	Low
1404	I don't have a stable income and I often wonder how I will manage my family and pay for medication costs.	Medium
904	I worry about how my family and parents get fed. I'm the oldest in the family so I always worried about the lack of income security. I also stress about the ability to participate in society. If we don't have money to spend in the community, we feel judged by other members of the community.	High

6.4—Psychological Distress Symptom: Social Isolation

The third psychological distress symptom is social isolation (as defined in the Literature Review Chapter under section 2.4). Social isolation is one of the least impacted symptoms of distress on the well-being of the fisher communities. Social isolation can occur when the individual is experiencing high levels of psychological distress (Albrecht, 2005; Fritze et al., 2008). Social

isolation occurs when an individual feels that he or she wants to be alone from others and refrains from socializing. Since the fisher communities have experienced adverse environmental changes, the impacts on the psychological distress symptom of social isolation was expected to be significant.

Figure 9 shows that more than half of male participants experienced social isolation at a low severity. Though the majority of the participants experienced low severity of social isolation, roughly half of the female participants experienced low severity and the other half experienced medium severity of social isolation, which indicates that there is some impact on the social isolation symptom of psychological distress in women. More women than men experienced medium severity of social isolation and more men than women experienced low severity of social isolation. Although the majority of the fisher communities experienced minor impacts on social isolation, women tend to experience higher impacts on social isolation than men. It is important to note that very few participants experienced high severity of social isolation, which indicates that the individuals may be managing their psychological distress effectively. The impacts of environmental changes on livelihood, resource access and migration indicate that there were significant environmental stressors, which should have negatively impacted the psychological well-being of the individuals. The results show low impacts on men's psychological distress symptom of social isolation, which indicate that the men may be coping better than women in regard to social isolation. Table 30 shows some of the comments of the participants who experienced social isolation.

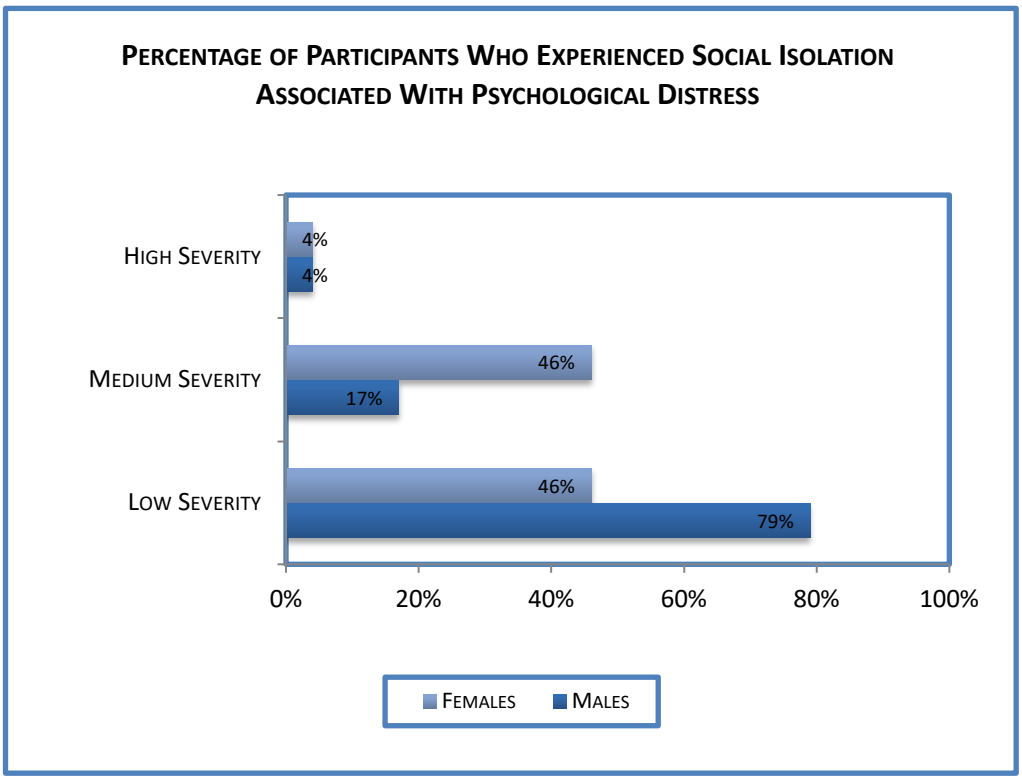

Figure 9—Percentage of Male and Female Participants Who Experienced Sleeping Social Isolation Associated with Psychological Distress

The participant comments in Table 30 reveal the experiences of the fisher communities on social isolation at low, medium and high severities. Participant 204's comment reveals the effectiveness of coping with his Participant 204's comment reveals the individual's effectiveness of his coping strategy, which helped him feel better when he felt socially isolated. This comment is a good example of how coping can effectively reduce the impacts on the individual's psychological distress. Participant 502's comment reveals the reality of the effects of social isolation. The individual often felt bothered by others when she was stressed and preferred to be alone. This is a sign that the individual is feeling socially isolated as a result of the environmental changes impacting her psychological well-being. Lastly, participant 904's comment reveals the difficult reality when the individual's social isolation becomes so difficult that it impedes him from getting work done. Additionally, crying spells that occur when the individual is feeling socially isolated indicates a severe impact on the individual's psychological well-being, which is why it is ranked high severity. Although very few participants experienced high severity of social isolation,

participant 904 is a good example of what the effects of social isolation can cause to an individual's psychological well-being when it is not effectively managed. When the effects of social isolation become this difficult, effective coping strategies are essential in order to properly manage the symptoms of psychological distress and improve the individual's psychological well-being.

Table 30—Participant Comments on Social Isolation Associated with Psychological Distress

Participant Code	Psychological Distress Symptom: Social Isolation	
	Comment	Severity
204	When I feel social isolation, I stay alone to think about my money problems and how to solve them. Then I go for a walk and I feel better.	Low
502	When I am emotionally stressed, I don't talk with anyone and I sit alone silently. I also get rigid when my children make a lot of noise.	Medium
904	When I feel emotionally stressed due to lack of income, I walk outside of the village alone and cry. When I am like this, I can't do work, I feel rigid and I don't talk politely to others.	High

6.5—Psychological Distress Symptom: Loss of Connection

The fourth symptom of psychological distress is loss of connection. Feelings of loss of connection occur when an individual feels disconnected from their environment (as defined in the Literature Review Chapter under section 2.4). When negative environment changes occur, the psychological well-being of the individuals living in the particular environment are impacted (Albrecht, 2009; Fritze et al., 2008). In the case of Chilika Lagoon, due to the adverse environmental changes, the livelihood, resource access and migration of the fisher communities are impacted, which in turn can cause the fisher communities to feel disconnected from their environment.

Figure 10 shows that the majority of the participants experienced loss of connection at low severity, which indicates that the fisher communities continue to feel connected to the environment despite the negative environmental changes occurring. Figure 6 (shown earlier in this chapter) shows that loss of connection is the least impacted symptom of psychological distress compared to the other six symptoms. Few participants experienced loss of connection at medium severity and fewer participants experienced loss of connection at high severity. It is important to note that more male participants experienced low severity and medium severity of loss of connection than female participants, while more female participants experienced high severity of loss of connection

than male participants. Although very few participants in total experienced high severity of loss of connection, women tend to be more affected than men. Table 31 shows comments from participants who experienced effects of loss of connection at low, medium and high severity.

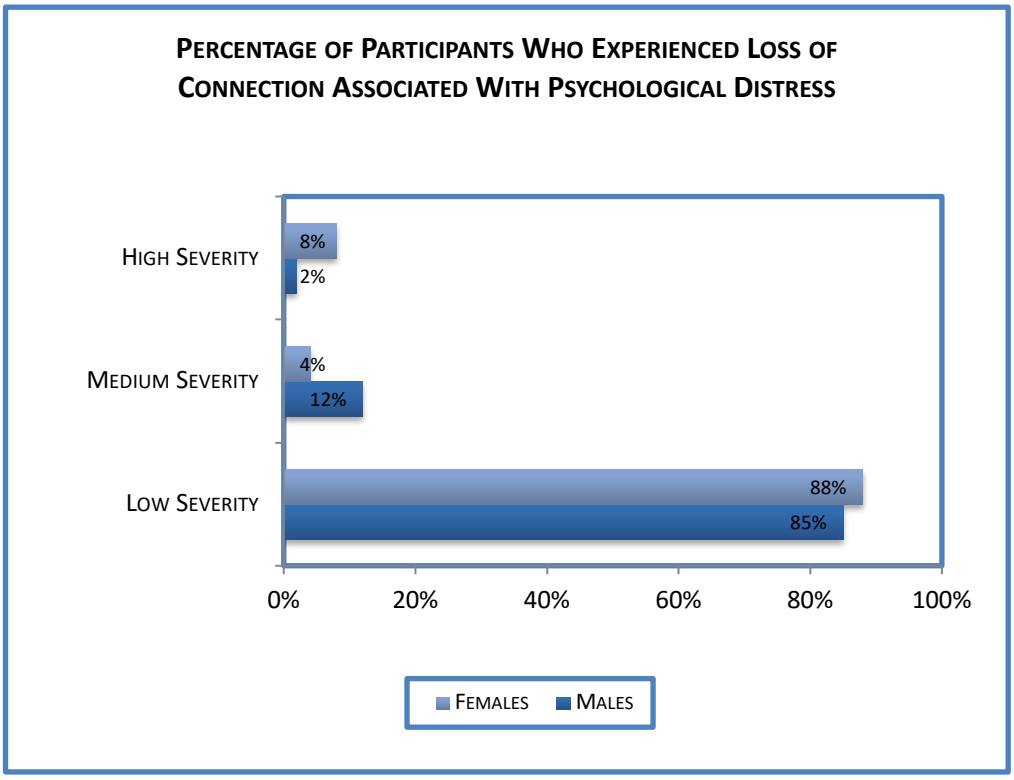

Figure 10—Percentage of Male and Female Participants Who Experienced Loss of Connection Associated with Psychological Distress

The comments from participants in Table 31 reveal their experiences with loss of connection to their environment. Participant 802's comment reveals that he felt connected to his community, despite having problems with the environment of the Lagoon. Not only he felt comfortable living in his community, but also other individuals in the community helped solve his problems. The majority of the participants experienced loss of connection at low severity, which means that most participants felt connected to their community and Lagoon. This indicates that most of the fisher communities continued to support each other and felt connected with their environment. It also indicates that fisher communities were coping effectively perhaps through socializing and supporting each other through problems associated with the environmental

changes. Participant 1504 and participant 1101's comments reveal the difficult reality that some of the participants felt since the Lagoon has been negatively impacted due to the adverse environmental changes in Chilika. Few participants experienced loss of connection at medium severity and high severity, but out of those participants, their connection to the Lagoon and community has almost diminished. Losing hope in improving one's own environment can severely impact the individual's psychological well-being (Albrecht, 2009). This study's results indicate that there are minimal impacts on the loss of connection to the environment of the fisher communities, but for those few who were impacted, there is a risk of losing hope for improving the Lagoon, which can severely impact the psychological well-being of those individuals.

Table 31—Participant Comments on Loss of Connection Associated with Psychological Distress

Participant Code	Psychological Distress Symptom: Loss of Connection	
	Comment	Severity
802	I don't feel any loss of connection to the community. I feel comfortable in my community and people help solve my problems.	Low
1504	I feel connected to my community, but I'm losing connection with the Lagoon environment. People use long nets that sit in the Lagoon permanently which contributes to my decreased income, so I feel less connected to the Lagoon.	Medium
1101	I have limited relations with my community, and I don't have any interest in making more relations. I don't have any connection to the Lagoon because the fishing is limited.	High

6.6—Psychological Distress Symptom: Intense Worry

The fifth symptom of psychological distress is intense worry (as defined in the Literature Review Chapter under section 2.4). Intense worry refers to feelings of worry about the uncertainty of future conditions of the environment of Chilika Lagoon (Dohertyy & Clayton, 2011; Stokols, 1992). When the future conditions of the environment that one lives in become unpredictable, it can cause intense worry due to the uncertainty of the future. Since the fisher communities live in Chilika Lagoon, which is located in a region with high risks of climate change impacts, such as unpredictable weather patterns, it is expected that they have experienced significant worries associated with the future environmental conditions (Senapati & Gupta, 2015). Figure 6 (shown earlier in this chapter) indicates that the effects of intense worry of the participants are the highest

compared to the other symptoms of psychological distress. The percentage of male and female participants who experienced low severity of intense worry is the lowest out of all the psychological distress symptoms for low severity. This means that more participants are experiencing intense worry at medium severity and high severity compared to the rest of the symptoms.

Figure 11 shows that 60 percent of male participants and 50 percent of female participants experienced feelings of intense worry at medium severity, which is one of the highest percentages of participants experiencing any of the psychological distress symptoms at medium severity. The percentage of male and female participants experiencing intense worry at low, medium and high severities are similar, but more females than males experienced high severity of intense worry and more males than females experienced medium severity of intense worry. This indicates that women experienced high severity of intense worry more than men. Women tend to internalize their stress through emotions, while men tend to show their impacts on stress through behaviour (Matud, 2004). This is an important insight as it helps explain why more women than men experienced intense worry, even though women spend less time inside the Lagoon compared to men. Furthermore, Figure 6 (shown earlier in this chapter) indicates that the percentage of total participants experiencing high severity of intense worry is the second largest percentage out of all of the seven symptoms. The highest percentage of high severity of all the psychological distress symptoms is insecurity. These results indicate that both psychological distress symptoms of insecurity and intense worry are the most severe symptoms out of the total participants. Table 32 shows comments of participants that experienced intense worry at low, medium and high severities.

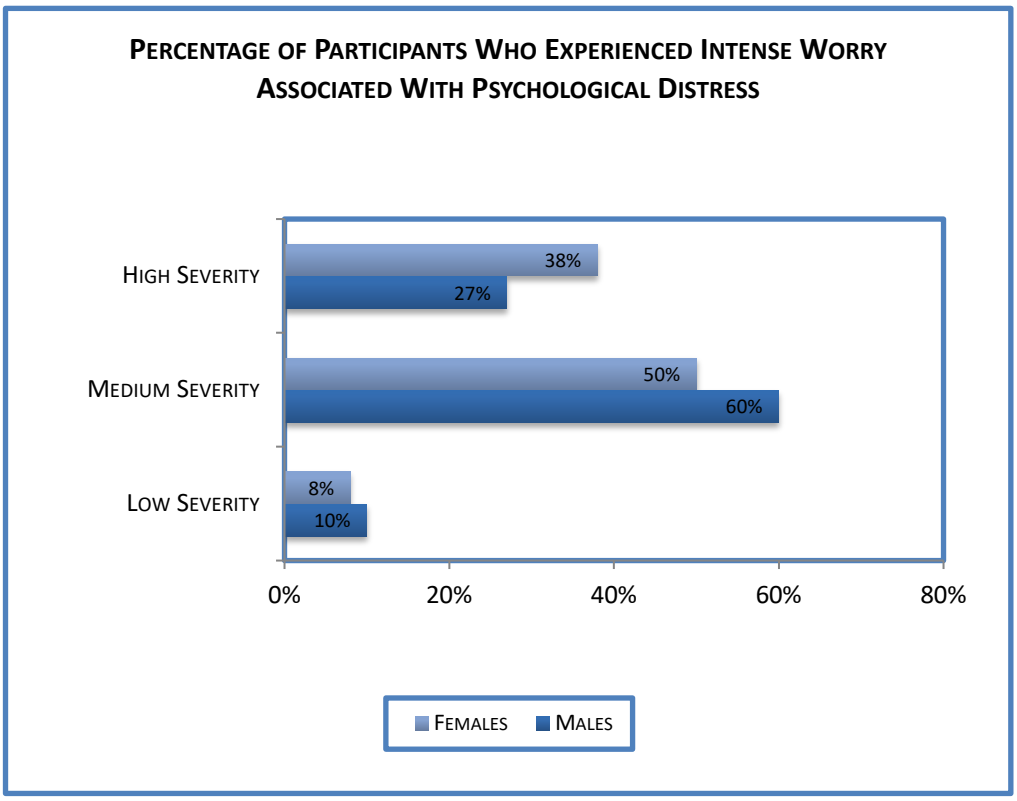

Figure 11—Percentage of Male and Female Participants Who Experienced Intense Worry Associated with Psychological Distress

The comments from participants in Table 32 reveal the effects of intense worry on the psychological well-being of the individuals. Intense worry refers to negative feelings towards the uncertainty of the Lagoon environment as well as the household conditions. Few participants experienced intense worry at low severity. Participant 205's comment reveals the mindset of one of the few participants who had limited feelings of intense worry. The individual worries about the weather but only to a limited extent, because he does not worry about the future of the Lagoon environment and instead lets the future unravel as it is. That said, the majority of the participants felt moderately worried about the future environment of the Lagoon and they worry about the impacts on their livelihood. Participant 301's comment reveals the difficult reality that the majority of the fisher communities face regarding the future of the Lagoon environment. As the environmental changes continue to negatively impact the lives of the fisher communities, they feared that they would need to look for other source of income, which may require migration.

Many of the participants experienced severe intense worry because the weather is frequently severe and causes safety concerns for the fishermen. Participant 1302's comment reveals the difficulty that many fishermen have as the only source of income is fishing. Despite the risks of safety when fishing inside the Lagoon, the fishermen continued to fish because they did not have any other sources of income. Conflict between fisher and non-fisher castes also contributes to the safety risks in fishing, which many of the participants indicated to be a significant source of intense worry. Thus, there are a few factors that contribute to intense worry about the future of Chilika Lagoon, which include environmental changes, safety and conflict. The impacts on intense worry about the future of the environment indicate that the psychological well-being of the fisher communities may be significantly impacted.

Table 32—Participant Comments on Intense Worry Associated with Psychological Distress

Participant Code	Psychological Distress Symptom: Intense Worry	
	Comment	Severity
205	I worry about the weather damaging my fishing equipment as the Lagoon has changed in the past 15 years. I don't worry about the future though. Whatever happens to the Lagoon happens.	Low
301	I worry about the Lagoon because I don't believe it will get any better. I worry that I will be forced to look for new employment. If I look for new employment, I will have to work for someone and lose my independence.	Medium
1302	I fear that I could die in the Lagoon due to severe weather conditions. My children also worry about my safety in the Lagoon. Unfortunately, I don't have any other income, so I continue to fish in the Lagoon.	High

6.7—Psychological Distress Symptom: Eating Disorders

The sixth symptom of psychological distress symptom is eating disorders (as defined in the Literature Review Chapter under section 2.4). Eating disorders are a behavioural symptom of psychological distress because it impacts the individual's ability to properly take care of his or her body. Studies show that when an individual experiences high levels of stress, he or she may show signs of poor self-care, which includes eating unhealthily, such as eating less or overeating (Patrick et al., 2011; Venditti et al., 1996). Figure 12 shows the percentage of participants who experienced eating disorders associated with the adverse environmental changes in Chilika Lagoon.

Figure 12 shows that the majority of the participants experienced low severity in eating disorders. That said, about 21 percent of male participants and 25 percent of female participants experienced eating disorders at medium severity, which indicates that there is some impact on eating disorders of the fisher communities. Very few participants experienced severe eating disorders, but it is important to note that women are more affected than men. The percentage of women whose eating habits were severely impacted is almost double the amount of men. It is also important to note that the findings in the Results Chapter indicate that none of the male or female participants from Sector Three experienced eating disorders at high severity. Table 33 shows some of the comments from the participants who experienced eating disorders at low, medium and high severities.

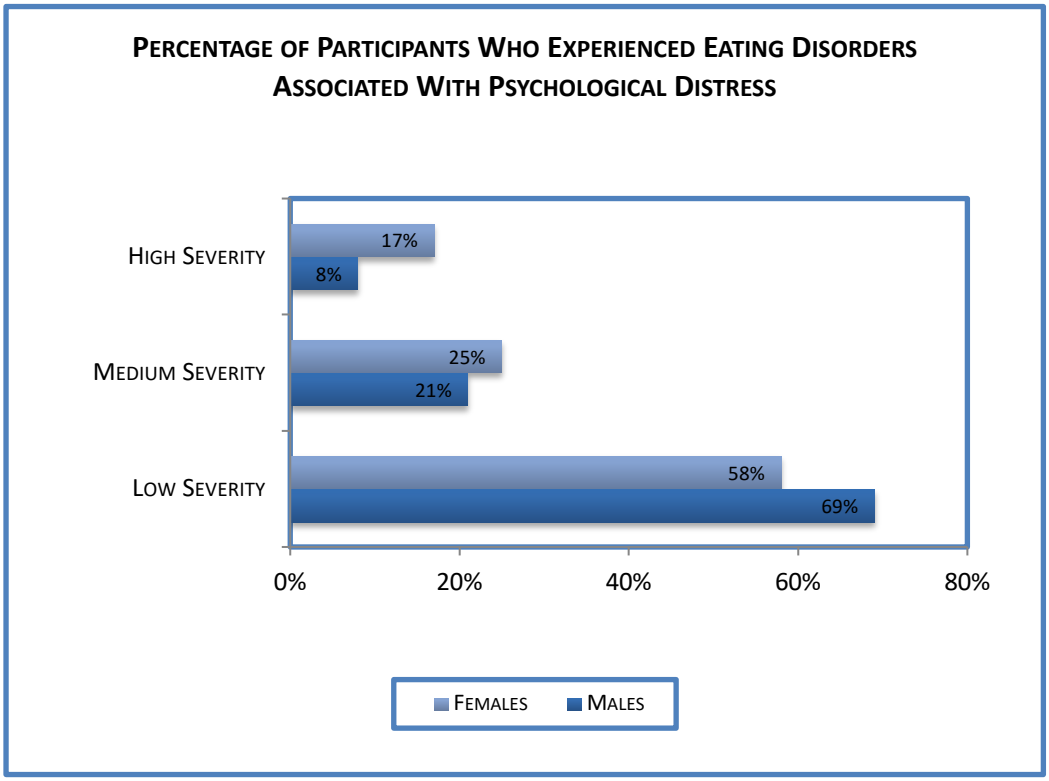

Figure 12—Percentage of Male and Female Participants Who Experienced Eating Disorders Associated with Psychological Distress

The comments from participants in Table 33 reveal the effects of eating disorders on the psychological well-being of the individuals. Eating disorders includes lack of appetite that results

in decreased numbers of meals or decreased amounts of food due to high levels of stress that is not managed effectively (Patrick et al., 2011). Eating disorders also include overeating as a coping strategy, which can result from experiencing high levels of stress (Venditti et al., 1996). Overeating is considered to be an ineffective way of coping with stress because it negatively impacts the health of the individual (Patrick et al., 2011). Participant 1204's comment reveals that her appetite is occasionally affected from the environmental changes that impact her livelihood. Compared to the other participants, she is only experiencing a limited impact on her appetite, which is why the severity of her eating disorder is ranked low. Participant 605's comment reveals that his eating disorder is chronic but does not occur often enough to be ranked severe. On the other hand, participant 402 has experienced a chronic eating disorder that occurs significantly often, which is why it is ranked severe. The majority of the participants experienced chronic eating disorders that occur a few times per month, which indicates that there are some significant impacts on the psychological well-being of the fisher communities.

Table 33—Participant Comments on Eating Disorders Associated with Psychological Distress

Participant Code	Psychological Distress Symptom: Eating Disorders	
	Comment	Severity
1204	When I argue with my husband, I don't have any appetite. It happens about 3-4 times a month.	Low
605	When I worry about money and overthink, I don't eat. It doesn't happen too often, but it started around the year 2010.	Medium
402	In the last 15 years, I have had a lack of appetite in the morning almost everyday because I worry about being able to feed my children. It happens 15-20 times per month.	High

6.8—Psychological Distress Symptom: Sleeping Disorders

The seventh and last symptom of psychological distress is sleeping disorders (as defined in the Literature Review Chapter under section 2.4). Sleeping disorders are also a behavioural symptom of psychological distress because it impacts the individual's ability to care for his or her body. Sleeping disorders can be harmful to the individual because lack of sleep increases the inability to manage stress and can increase the individual's exposure to stress (Seun-Fadipe & Mosaku, 2017). On the other hand, oversleeping can cause the individual to avoid managing his or her stress and eventually leave problems unresolved, which in turn increases the stress (Ridsdale et al., 1994;

Moldofsky, 2001). Figure 6 (shown earlier in this chapter) shows that the results for sleeping disorders are similar to the results for intense worry. This indicates that intense worry and sleeping disorders are impacted similarly, because the same number of participants experienced sleeping disorders at medium severity and intense worry at medium severity. Stress can severely impact the quality of sleep, especially decreasing the amount of sleep, such as trouble falling asleep and staying asleep (Seun-Fadipe & Mosaku, 2017; Moldofsky, 2001). That said, more participants experienced sleeping disorders at low severity than high severity, while more participants experienced intense worry at high severity than low severity. More participants experienced severe intense worry than severe sleeping disorders. This indicates that some of the participants who experienced severe intense worry were managing their stress effectively, which reduces the impacts on sleeping.

Figure 13 shows the percentage of participants who have experienced sleeping disorders associated with the adverse environmental changes in Chilika Lagoon. More males than females have experienced medium severity of sleeping disorders and more females than males have experienced low severity of sleeping disorders. This indicates that males are more impacted than females in regard to sleeping disorders associated with psychological distress. That said, more males and females experience medium severity than low severity, which indicates that the majority of the participants experienced moderate impacts on their quality of sleep due to psychological distress associated with the environmental changes. Table 34 shows some of the comments from participants who experienced sleeping disorders at low, medium and high severities.

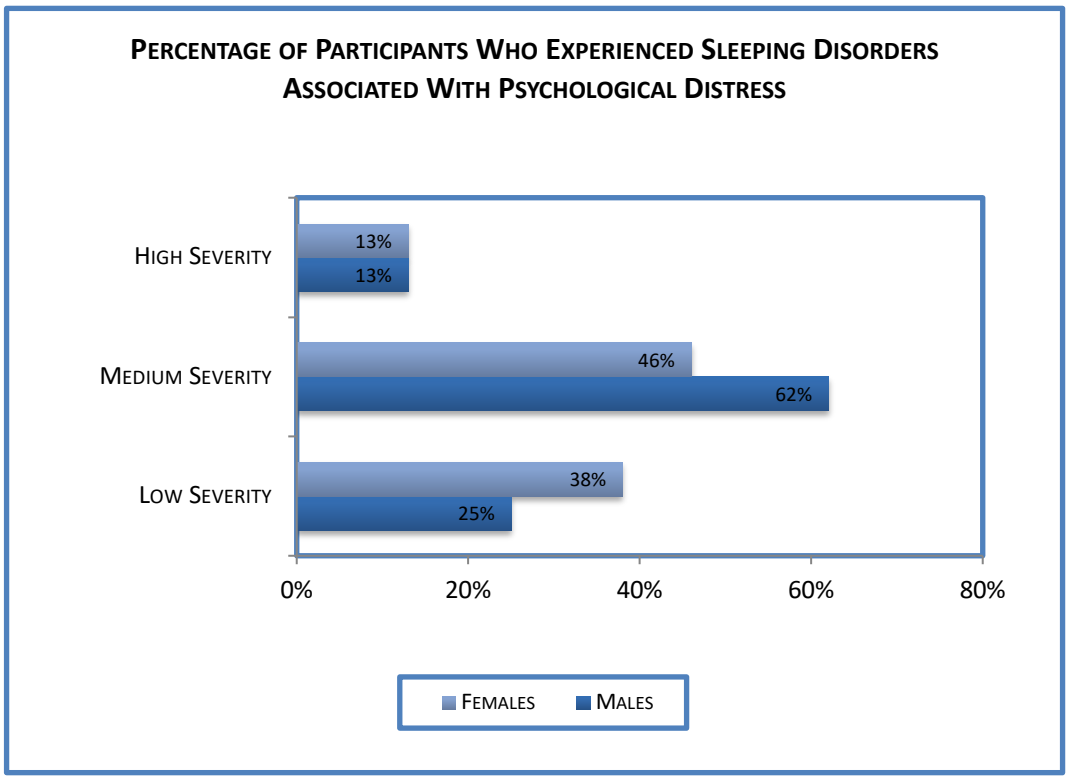

Figure 13—Percentage of Male and Female Participants Who Experienced Sleeping Disorders Associated with Psychological Distress

The comments from participants in Table 34 reveal the effects of sleeping disorders on the psychological well-being of the individuals. Severe sleeping disorders are a sign of psychological distress, which include lack of sleeping or oversleeping (Seun-Fadipe & Mosaku, 2017; Moldofsky, 2001). Lack of sleeping includes trouble falling asleep or trouble staying asleep, while oversleeping includes sleeping more than usual or trouble getting out of bed (Ridsdale et al., 1994; Moldofsky, 2001). Participant 1105 experienced stress which impacts her sleep but not often enough to impact her life which is why it is ranked low severity. Many participants experienced limited impacts of stress on their sleep, but the majority of the participants experienced only some difficulty in sleeping due to high levels of stress. For example, participant 107's comment reveals the difficulty in sleeping when she experienced stress. She has trouble falling asleep for three to four hours when she is stressed which means that her sleep is heavily impacted, but it only occurs one or two times per month which is not often enough to be considered a severe sleeping disorder. Few participants indicated severe problems with sleeping. Participant 1104's comment reveals the

difficult reality of the few participants who had severe sleeping disorders. The majority of the participants had only some significant sleeping issues, which indicates that the psychological distress of the fisher communities is moderately impacted.

Table 34—Participant Comments on Sleeping Disorders Associated with Psychological Distress

Participant Code	Psychological Distress Symptom: Sleeping Disorders	
	Comment	Severity
1105	When I'm stressed, I don't feel sleepy and I wake up late the next day, but it doesn't happen often, and it doesn't impact my life.	Low
107	I occasionally have trouble falling asleep when I am emotionally stressed. It takes about 3-4 hours to fall asleep. It happens 1-2 times per month.	Medium
1104	I worry about my troubles with sleeping. I have trouble falling asleep every night since around the year 2010.	High

6.9—Objective Three: Coping Strategies in Managing Psychological Distress Symptoms

Objective Three:

To determine the current coping strategies of the fisher communities and how effective or ineffective the strategies are against psychological stressors and wellbeing.

The first purpose of Objective Three is to determine the coping strategies used by the participants to cope with their psychological distress symptoms and to also examine the effectiveness of their coping strategies. The second purpose of Objective Three is to determine the sources of social support that the participants received. Each participant is asked what they do to cope with their psychological distress symptoms and if they received social support and from whom or where they received it. Through qualitative analysis, the coping strategies of the population sample are examined and categorized into major categories. Subsequently, a similar qualitative analysis is conducted to examine the sources of social support, which are then organized into main categories. Essentially, the intent of Objective Three is to determine if there are any coping strategies and if they are effective. The coping strategies include any strategies used by the participant to cope with the psychological distress symptoms that the participant claims to have experienced. Sources of social support includes anyone that provided support to the participant who is coping with

psychological distress symptoms and includes any spiritual sources such as praying to God and meditating.

6.10—Types of Coping Strategies Used to Manage Psychological Distress

The common types of coping strategies include medication, socializing, and spiritual. Medication is an effective way of coping with stress as it can relive physical pain. Socializing is another effective way to cope with stress but requires more effort from the individual. Most participants mentioned using either medication to cope with their psychological distress or socializing, such as talking to their neighbours or other community members, which relives some of the psychological distress (Taormina, 2001). Studies indicate that socializing is more effective in women than men (Ptacek et al. 1992; Gloria, 2006). Medication on the other hand, can relive psychological distress by increasing serotonin and dopamine levels, which in turn reduces the pain caused by the psychological distress (Borg-Stein & Simons, 2002). Many of the participants mentioned using both socializing and spiritual coping strategies together to cope with psychological distress. The spiritual coping strategy is effective as engaging in spiritual prayer helps cope with distress and improves the well-being of the individual (Levine, 2009; Graham et al., 2001). Psychosocial interventions are not only helpful in coping with physical pain but also helps treat diseases and reduces the need for medication (Sobel, 1995). Psychosocial refers to the influence that social environmental factors have on an individual's mind or behaviour (Ahearn, 2000). Social isolation can be treated effectively when both friends and family are included in psychosocial interventions of coping with psychological distress (Spiegel, 1990). Additionally, substance use indicates that the individual faces barriers to effective coping methods to manage psychological distress symptoms (Ouimette et al., 1998). Figure 14 shows the percentage of participants using the coping strategies. Many of the participants have indicated more than one coping strategy, which is why the percentages of participants overlap (Figure 14).

The categories of coping strategies that were mentioned in the interviews are medication, socialize, spiritual, hobbies, substance use, homemade remedies, nature, resting and exercise. It is important to note that all 76 participants interviewed mentioned using at least one category of coping strategies. Figure 14 shows the percentage of total participants who practiced the coping strategies. Many participants used more than one coping strategy, which increases the chances of

effectively managing the individual's psychological distress. According to the participants, medication is used when physical pain is present, which includes headaches, muscle aches, chest pain, and joint pain. Socializing also helps cope with distress, as well as coping with physical disorders such as diseases. Taking medication and socializing are the two most common types of coping strategies that both male and female participants in this study use, which are both effective ways of coping with psychological distress (Taormina, 2001). Spiritual coping strategy is the third most commonly used among male and female participants. Medication, socializing and spiritual activities are considered the most important strategies in this study. Substance use is an indication that the individual faced some barriers to effective coping strategies and turned to substance use to cope with psychological distress, which is not effective and may cause more harm to the individual (Ouimette et al., 1998; Dougherty et al., 2000). Substance use includes alcohol, tobacco and cannabis. Table 35 shows some of the comments made by the participants regarding their coping strategies. Only 15 percent of male participants and zero percent of female participants claimed to use alcohol or recreational drugs to cope with their psychological distress. This result suggests that females were using more effective coping strategies than men and thus, reduces their overall psychological distress more than men. Women used medication and resting as coping strategies than men to help manage their psychological, which are effective coping strategies.

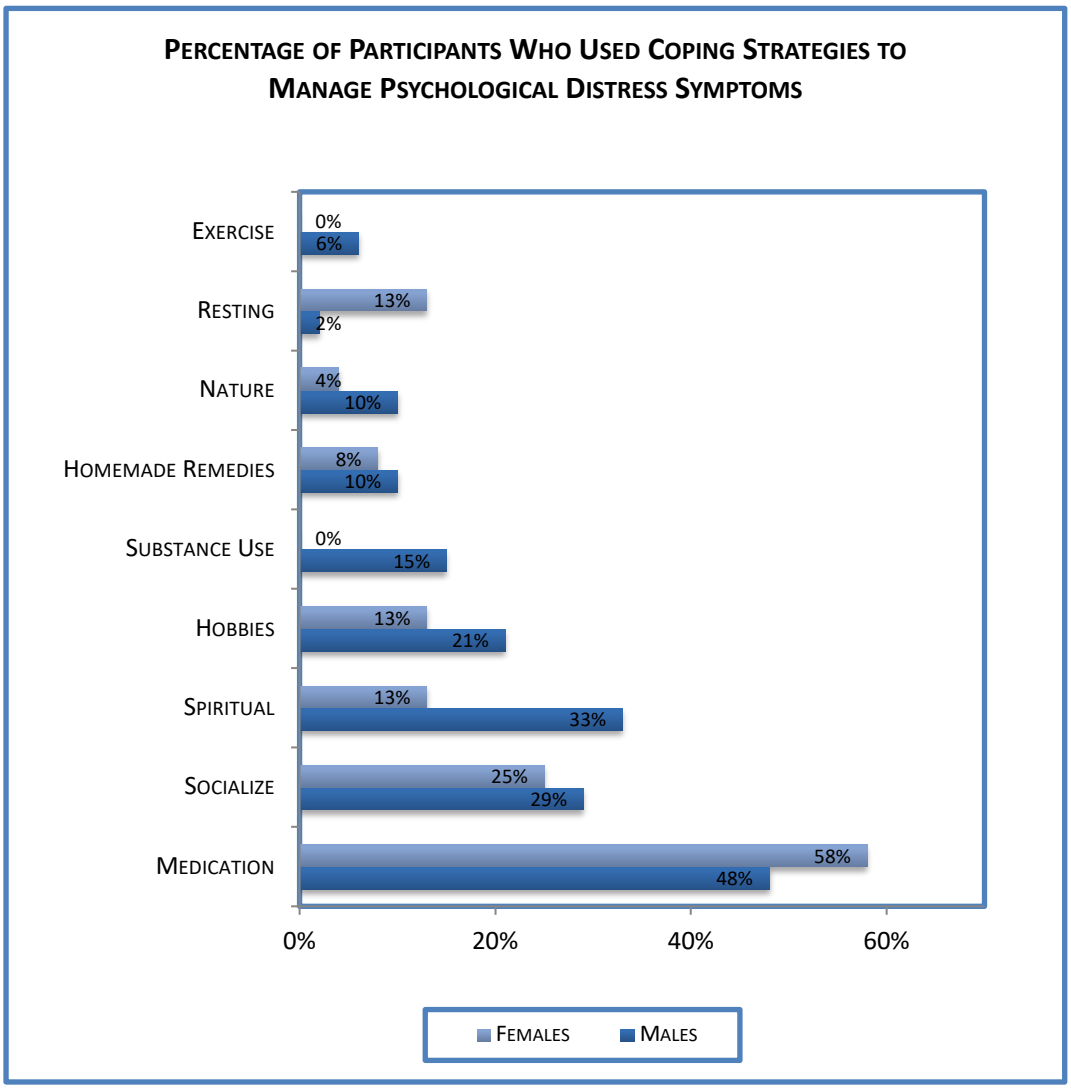

Figure 14—Percentage of Male and Female Participants Using Coping Strategies to Manage Physiological Distress

Table 35 shows some of the comments of the participants who use coping strategies, including medication, socializing, nature and spiritual. Participant 802's comment reveals how taking medication has helped him cope with his physical pain. Physical pain is a common symptom of psychological distress in this study, which explain why using medication to cope with stress is popular. Medication is the most commonly used coping strategy, which is effective in managing distress and it is effective in both men and women (Borg-Stein & Simons, 2002; Flaten, 2014; Gu et al., 2012). Participant 102's comment reveals how socializing has helped him cope with stress

because he felt better after socializing with his friends. He also indicated that the use of cannabis is popular in his community, but he did not take any. This comment indicates that other members of his community used cannabis as a form of coping with stress. From the interviews conducted, only males claimed to use substances, such as cannabis, tobacco and alcohol, to cope with their stress. Participant 1103's comment reveals how spending time outside in nature as well as praying to God has helped him cope with his stress. Spending time outside and praying to God can reduce the impacts on stress (Barton & Pretty, 2010; Levine, 2009; Graham et al., 2001). More men than women spend time outside to cope with stress, perhaps due to the social norms of men and women in Chilika. Men spend more time outside fishing, while women spend more time at home doing household chores. In summary, all male and female participants in this study indicated at least one coping strategy that helped manage their psychological distress. Given that the impacts of environmental changes on livelihood, resource access and migration are compelling, it suggests that the psychological distress of the fisher communities should be significantly impacted. The results on the symptoms of psychological distress indicate that the impacts are significant, but not major, which suggests that the coping strategies used are effective to some extent.

Table 35—Comments on Coping Strategies Used to Manage Psychological Distress

Participant Code	Comment	Coping Strategy
802	I take medication for physical pain such as headaches, chest and joints.	Medication
102	To cope, I socialize with friends, which makes me feel better. I don't take marijuana even though many people in my village take it.	Socializing
1103	When I am emotionally and physically stressed, I don't talk to my husband and I stare around the house. When I am outside in the nature, I feel better. I also like to pray to God when I am home alone doing household work.	Nature, Spiritual

6.11—Sources of Social Support that Helped Manage Psychological Distress

In addition to coping strategies, Objective Three also examined the sources of social support of the participants. The purpose of examining the sources of social support is to determine the effectiveness of the coping strategies. Studies show that when an individual is experiencing high levels of stress, the need for social support, such as family and friends, is an essential part of the

coping process (Greenglass, 1993). Studies show that people who have social support manage their psychological distress better than people who do not have social support (Comijs et al., 1999). Social support includes connecting with a loved one, such as a spouse, on an emotional level, which results in the individual receiving emotional support (Rosenbaum & Cohen, 1999). Through qualitative analysis, Objective Three determined that there are five major sources of social support, which are: family, community, spiritual, friends and professionals. Figure 15 displays the five major sources of social support and the percentage of participants that claimed to receive them.

Figure 15 shows the percentage of male and female participants who received social support from family, community, spiritual, friends and professionals. The figure highlights that females did not receive any social support through spiritual activities and friends, but received some social support through professionals. The majority of females received social support through their family and community. Males did not receive any social support through professionals, but received some social support from spiritual activities and friends. Perhaps this is because females would spend more time inside their homes and socialize less with friends than males did. Although many of the participants practiced spiritual activities, it is not a common source of social support, perhaps because the participants received adequate social support from their family and community.

Figure 15 indicates that family and community are important sources of social support. Strong connection to family and community can help cope with psychological distress. It is important to note that providing continuous emotional and physical support can be stressful for the giver even though it is beneficial to the receiver (Strazdins & Broom, 2007). On the other hand, providing emotional support through a companionship reduces the stress on the giver (Strazdins & Broom, 2007). This is an important insight as it helps understand why family and community are both common sources of social support for the participants in this study. Figure 15 indicates that the majority of the participants interviewed in this study received effective support from their communities. Community support improves the quality of psychological sense of community, which in turn can help cope with psychological distress (Barrera Jr., 2000). The findings of this study indicate that the participants in Chilika live in communities in which the community

members are well connected with each other. As a result, the participants received effective social support from one another, which helped cope with psychological distress (Barrera Jr., 2000).

The three most common coping strategies used among participants are medication, socializing and spiritual, which helps reduce the psychological distress of the participants. This may help explain why the participants in this study are exposed to significant stressful triggers caused by the negative impacts of environmental changes on their livelihood, resource access and migration, yet the psychological distress symptoms are mostly moderate. The number of participants struggling with severe psychological distress symptoms is surprisingly low. These results indicate that the effective coping strategies shown in Figure 15 may be reducing the impacts on the psychological distress. Despite the significant impacts of environmental changes on livelihood, resource access and migration, the participants claimed to have effective coping strategies and social support from both family and community, which in turn decreases the psychological impacts. Table 36 shows some of the comments made by the participants regarding family, community and spiritual sources of social support, which is also referred to emotional support and physical support in the comments.

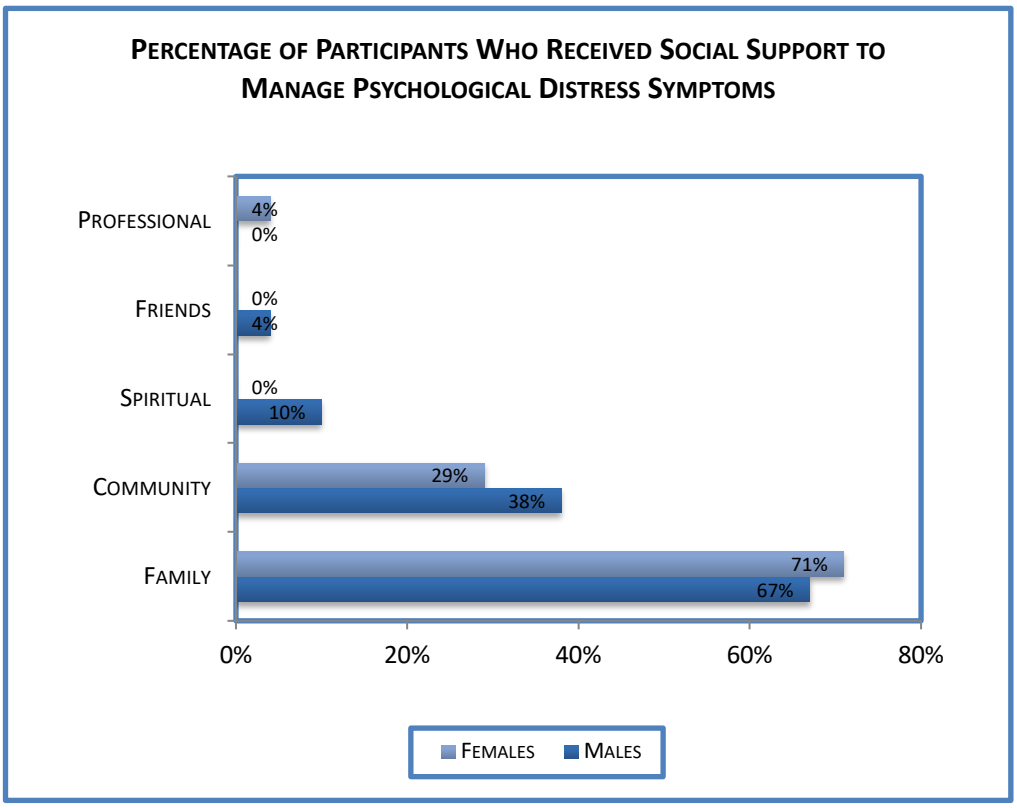

Figure 15—Percentage of Male and Female Participants Receiving Social Support to Help Manage Psychological Distress

The comments of participants in Table 36 reveal how they received social support. The five major sources of social support are: family, community, spiritual, friends and professionals. Participant 705's comment reveals she received physical support from her household members, including her children and her husband. Her household is a good example of how family members support each other in managing their work together. It is also a good example of additional sources of income that fisher households are seeking. Since fishing bring less income to the household, additional sources of income become important in order to maintain stable household income. Participant 604's comment reveals that support groups in the community helped provide social support to individuals. Money pools are collected from female members of the community and are given to whoever in the community needs to borrow the money during a financial downturn. Support groups that assemble money pools for financial needs are an effective source of social support and effective way to cope with the lack of stable income and relieve some of the stress of

the individuals who needs to borrow money (Neighbors & Laveist, 1989). Praying to God and practicing spiritual activities is also an effective source of social support. Participant 1504's comment reveals the social support that he received when he prays to the Goddess of Kaliji regarding work matter and Goddess Nvamahami (Yamuna) regarding household matter. Prayers help cope with stress because it allows the mind to organize the distress thoughts in such a way that it can be managed (Levine, 2009; Graham et al., 2001). Although prayers are an effective way to cope with stress few participants claimed to use spiritual sources of social support. It is important to note that only five men out of the total participants claimed that spiritual practices helped them cope with their psychological distress. Perhaps this is due to the significant amount of social support from families and communities, which are effective sources that help cope with psychological distress.

Table 36—Comments on Sources of Social Support that Helped Manage Psychological Distress

Participant Code	Comment	Source of Social Support
705	I receive support from my children in household work. I also receive support from my husband in managing our family-owned local shop. We take turns running the shop, while my husband fishes and I do household work.	Family
604	I receive support from the community. We have a women's group that collects pools of money and can be borrowed by any of the members with interest. Using this type of financial aid is helpful to cope with my emotional stress.	Community
1504	I receive emotional support from Goddess Kaliji regarding fishing and from Goddess Nvamahami [Yamuna] regarding household.	Spiritual

6.12—Conclusions: Severity Psychological Distress and Coping Strategies That Helped Manage Psychological Distress Symptoms

The purpose of determining the coping strategies is to examine the effectiveness of the coping strategies. The results show that some coping strategies are more effective than others, such as taking medication and socializing over substance use. Medication and socializing are more effective than substance use. Substance use is an indication that the individual is facing barriers to effective coping strategies. The results show that substance use is not a common coping strategy,

which indicates that the participants are using effective coping strategies. The results show that effective coping strategies are favoured over less effective ones, which is a sign that the participants are managing their psychological distress effectively.

The psychological distress symptoms of the men and women in the fisher communities that were documented are physical pain, insecurity, social isolation, loss of connection, intense worry, eating disorders and sleeping disorders (as defined in the Literature Review Chapter under section 2.4). The results for Objective Two reveal that over half of the total participants experienced impacts on their psychological distress through symptoms of physical pain, insecurity, intense worry and sleeping disorders. Feelings of severe insecurity and intense worry about the future of the environmental conditions are ranked highest out of the seven psychological distress symptoms. The percentage of women who experienced severe insecurity and intense worry is higher than the percentage of men. The percentage of men who experienced sleeping disorders is higher than the percentage of women. Women tend to internalize their stress through emotions, while men tend to show their impacts on stress through behaviour (Matud, 2004). This is an important insight as it helps understand why the results of this study show that women had more severe emotional symptoms, while men had more behavioural symptoms of distress. That said, the results for Objective Two indicate that the psychological well-being of the fisher communities is moderately impacted. Despite the exposure to high levels of stressors caused by the adverse environmental changes, the psychological distress symptoms of social isolation and loss of connection in both men and women indicate that there is effective coping taking place, which minimizes the impacts.

The results for Objective Three suggest that the fisher communities had effective coping strategies that helped them manage their psychological distress, which in turn decreases the impacts on the symptoms of psychological distress, such as social isolation and loss of connection to the environment. Every participant in this study has indicated that they use at least one form of effective coping strategy. There are nine major coping strategies, but the most common ones are: taking medication, socializing, and practicing spiritual activities. Perhaps taking medication is the most common type of coping strategy because taking medication not only is effective in coping with stress but also requires little effort from the individual (Flaten, 2014; Gu et al., 2012). Socializing as a form of coping with stress is the second most common type of coping strategy,

perhaps because it is more effective in women than men (Ptacek et al. 1992; Gloria, 2006). Lastly, practicing spiritual activities is the third most common type of coping which requires more effort from the individual than socializing, but can effectively improve the overall psychological well-being of the individual (Levine, 2009; Graham et al., 2001). In addition to coping strategies, most of the participants in this study indicated an effective source of social support that they received which helped them cope with their stress. The most common effective sources of social support include family, community and spiritual activities. The results show that the fisher communities had social interactions that helped them cope with their stress not only in their household environments but also within their communities. This study concludes that there are effective coping strategies in place despite the presence of environmental stressors that the fisher communities were exposed to. Perhaps improving and combining the coping strategies would minimize the psychological distress symptoms that are ranked severe, such as feelings of insecurity and intense worry about the future of the environmental condition. Additionally, strengthening the sources of social support may improve the severity of insecurity and intense worry. None of the female participants and only a few of the male participants indicated that they received social support from spiritual activities. Perhaps strengthening the social support within spiritual activities may improve the spiritual coping strategy among women and reduce the overall psychological distress.

Chapter 7

Conclusions: Impacts on the Psychological Well-being of Fisher Communities and Effective Coping Strategies

7.0—Purpose of this Study

In a world of increased environmental changes associated with climate change, it is important to study the impacts of rapid and adverse environmental changes on the psychological distress of the people who live in the affected areas. Research shows that many livelihoods of coastal fisheries in India have been impacted by climate change, which include rise in temperature, rise in sea level, change in rainfall patterns, and availability of fish (Senapati & Gupta, 2015). The impacts of climate change stresses the importance of adapting to the environmental changes, which involves managing psychological distress and maintaining the overall psychological health of individuals of the people who are directly impacted. In addition to climate change, large-scale fishing operations have contributed to the degradation of coastal environments and depletion of fish stocks.

Chilika Lagoon, India is one of the coastal regions affected by these environmental changes. The small-scale capture fisheries in Chilika have also been marginalized by intensive aquaculture operations since the 1980s, which increases the vulnerability of fisher communities (Nayak, Oliveira & Berkes, 2015). In addition to intensive aquaculture operation, Chilika has also experienced environmental issues due to the opening of a new artificial sea mouth, which altered the Lagoon's ecosystem (Nayak & Berkes, 2010). Some of the environmental impacts include changes in salinity, new invasive species, decreased fish catch and decreased fish species (Nayak, 2014). The changes in the Lagoon's ecosystem and the encroachment of customary fishing grounds has contributed to the decline in household income among the fisher communities (Nayak & Berkes, 2012). The decline in household income threatens the traditional livelihoods of the fisher communities (Nayak, Armitage & Andrachuck, 2015). As the fisher communities face impacts on their livelihood and resource access, they are forced to migrate to search for other sources of income (Nayak and Berkes, 2010). Migration poses challenges for the fisher households who migrate out of Chilika and for fisher households who remain in Chilika. Migrating to a new

environment can have serious psychological impacts due to the new stressors that the individual is exposed to (Taris, 2002). On the other hand, the fisher households who remain in Chilika face difficulties in maintaining their traditional and cultural livelihoods (Nayak & Berkes, 2012). As a result, the fisher communities in Chilika have experienced impacts of environmental changes on their livelihood, resource access and migration, which may have serious consequences on their psychological well-being.

Due to the lack of academic research on marginalized coastal fisheries and the environmental impacts on the psychological well-being, this study aims to shed light on the adverse psychological distress caused by adverse environmental changes. This study aims to answer the following question: what is the relationship between environmental health, psychological health and well-being in Chilika, India? To answer the question, this study is organized into three objectives. Objective One seeks to determine the types of environmental changes that have occurred in Chilika Lagoon and the impacts on livelihood, resource access and migration of the fisher communities. Objective Two examines the severity of the psychological distress symptoms of the fisher communities, associated with the environmental changes the impacts. Lastly, Objective Three determines the types of coping strategies and sources of social support that helped manage the psychological distress symptoms. The following sections, 7.1, 7.2 and 7.3 discuss the findings for each of the three objectives. To conclude this chapter, the last sections, 7.4 and 7.5, highlight the key findings and discuss the implications of this study.

7.1—Types of Environmental Changes in Chilika Lagoon and Impacts on Livelihood, Resource Access and Migration

The purpose of Objective One is to determine the types of adverse environmental changes in Chilika Lagoon from 1980 to 2017 and how they have affected the fisher communities by examining the impacts on livelihood, resource access and migration. The results of this study show that the quantity of fish in the Lagoon has declined significantly and the income of the fisher communities in all three sectors in this study has decreased drastically. Additionally, salinity changes in the Lagoon, severe weather, decreased size of fish and depth changes pose challenges to fishing activities of the fisher communities. The marine species were heavily impacted as invasive species have entered the Lagoon via the artificial sea mouth that opened in 2001 (Nayak

& Berkes, 2010). Consequently, not only has the salinity affected the ecosystem of the Lagoon but also impacted the fishers, as the high salinity is harsh on the skin and significantly impacted the eyes of the fishermen. Depth changes have also occurred in certain areas of the Lagoon, including Sector Three located northwest of Chilika. As a result of changes to the Lagoon's ecosystem, the depth along the Lagoon shoreline in Sector Three has decreased and become infested with tall and thick invasive plants called Nalagrass (Phragmites karka; Ministry of Environment and Forests, 2008). These invasive plants added more stress to the local fisher communities, as traveling through the invasive plants with fishing equipment has become increasingly difficult. Consequently, these environmental changes have impacted the livelihood, resource access and migration of the fisher communities.

In addition to the dredging of the artificial sea mouth to the Bay of Bengal in 2001, the increased aquaculture operations in Chilika since the 1980s has also contributed to the degradation of the Lagoon ecosystem (Nayak & Berkes, 2010; Nayak, 2014). The majority of the people who control the aquaculture operations are non-fishers meaning that they are not caste-based fishers. Additionally, the aquaculture operations have taken over 60 percent of the Lagoon area, which used to belong to caste-based fishers where they used to fish (Nayak, 2011). Moreover, the use of net enclosures, which are nets that are left inside the lagoon permanently, and the use of illegal nylon nets have also contributed to the exploitation and depletion of the fish as they disrupt the natural flow of water and captures fish eggs and juveniles (Pattanaik, 2007). Many fisher caste-based communities have lost their fishing grounds as a result of the aquaculture practices, net enclosures and nylon nets, which inflicted conflict between fisher and non-fisher castes. The conflict between the two groups poses a major concern for the safety of the fisher communities. Theft in fishing equipment and threats are commonly exchanged between fisher and non-fisher communities. Furthermore, conflict and theft contributed to the lack of access to the Lagoon, which in turn, impacts the livelihood of the fisher communities. The lack of access to the Lagoon and the decline in fish stocks has dramatically impacted the household income of the fisher communities. This has resulted in fewer children attending schools and an increase in food scarcity. Consequently, the decline in household income has forced women and children to partake in income generating activities. Additionally, alternative sources of household income through

seasonal, temporary and permanent migration have become more common among fisher communities. During off-season in fishing, many fisher households have migrated seasonally to generate additional income. Thus, the results show that the impacts of environmental changes in Chilika from 1980 to 2017 have significantly impacted the livelihood, resource access and migration of fisher communities. These impacts pose a major concern for the psychological health of the fisher communities as they face many stressors associated with the environmental changes.

7.2—Discussing the Findings on Environmental Change and Impacts on Livelihood, Resource Access and Migration

This section discusses the data collected from this study on environmental change the impacts on psychological distress. The results reveal that the most common types of environmental changes that were observed by the participants in Chilika Lagoon are: decreased quantity of fish, depth changes, decreased size of fish and severe weather occurrences. 91 percent of all the participants in this study indicated that they observed a decreased quantity of fish in the Lagoon. Changes to the Lagoon ecosystem and overfishing activities have contributed to the decline of fish, which explains why the majority of the participants observed a drastic decline in fish from 1980 to 2017. In addition, aquaculture practice and illegal fishing activities have also contributed to the decline of fish quantity, which are later described in this analysis. 57 percent of the total participants indicated that they observed depth changes in the Lagoon. Some of the impacts caused by the artificial sea mouth that was dredged in 2001 include random depth changes in the Lagoon and sand infestation near the sea mouth (Sahu, Pati & Panigrahy, 2014; Nayak and Berkes, 2010). More than half of the participants indicated that they observed depth changes to the Lagoon which are impacts associated with the new sea mouth. The third most common type of environmental change that occurred in Chilika is decreased size of fish. 54 percent of the total participants indicated that they observed a significant decline in fish size. The decline in fish size is not a surprise due to the overfishing activities and use of illegal nets that are common in Chilika. The decline in quantity of fish forced many of the fishers in Chilika to catch juveniles and use illegal nets that catch fish eggs, which impedes the growth of fish (Nayak & Berkes, 2012; Pattanaik, 2007). This explains why more than half of the total participants involved in this study observed a decline in fish size. Lastly, the fourth most common type of environmental change that was

observed in Chilika is severe weather. 53 percent of the total participants indicated that they observed severe weather occurrences, which includes an increase intensity and frequency of natural disasters such as floods and cyclones. It is not surprising that more than half of the participants observed severe weather occurrences because research indicates that coastal fisheries in India suffer significantly from the effects of climate change associated with sea level rise and change in rainfall patterns (Senapati & Gupta, 2015). The next section delves deeper into the environmental changes that occurred in each of the three sectors.

Sector One is located near the artificial sea mouth, which experienced direct impacts of the disruptions to the Lagoon ecosystem, including wetland habitat loss, salinity changes and invasive species. 94 percent of the participants in Sector One indicated that they observed significant wetland habitat loss and 84 percent indicated they observed changes in salinity of the Lagoon. This is not surprising as the communities in Sector One are located near the sea mouth which increased the intensity of the water inflow and outflow and resulted in drastic changes in water salinity (Nayak & Berkes, 2012). In addition, 84 percent of the participants in Sector One observed new invasive species, which were brought in via the artificial sea mouth. The invasive species have also contributed to the biodiversity loss of the Lagoon, which explains why the participants in Sector One have indicated that they observed negative changes in wetland habitat and invasive species at the same time.

The results show that Sector Two has the highest observations in water pollution compared to other sectors. Although only 16 percent of the participants in Sector Two indicated that they observed pollution, the observations are higher than in Sectors One and Three. Sector Two is located near major tourist hubs which may explain why this sector observed more pollution than other sectors. Boat tours for tourist purposes have significantly increased in Sector Two which contributes to the water pollution associated with motorboats (Khuntia & Mishra, 2016). As the use of motorboats have increased in Sector Two, it is expected that the fishers in this area observed more water pollution compared to other sectors.

The results from this study reveal that the majority of the participants who observed depth changes are from Sector Three. Sector Three is located northeast of Chilika Lagoon and experienced changes in the lagoon shoreline as it moved inwards away from the communities

(Ministry of Environment and Forests, 2008). This explains why 92 percent of the participants in Sector Three observed depth changes, which includes shallower depths and decreased fishing grounds as the shoreline has moved away from where the fishers used to fish.

Lastly, the results reveal that male participants observed more environmental changes than female participants. The only exception is that more females than males noticed invasive species. Perhaps this is due to the assumption that females in fisher communities spend more time partaking in household chores including cooking which would explain why females noticed more invasive species as they prepare meals for their families. In addition, males from fisher communities spend more time outside their homes partaking in fishing related activities, which explains why more male participants observed environmental changes compared to female participants, excluding invasive species.

7.2.1—Discussing the Impacts on Livelihood

The results reveal that decreased income and ability to afford all basic needs are generally affected in all three sectors, which indicates that the livelihoods of the fisher communities have been negatively impacted. That said, leisure time is affected the most in Sector One, as 60 percent of participants in this sector have indicated that their leisure time was negatively affected. Perhaps the reasoning behind this is the limited non-fishing employment opportunities found in Sector One as the communities is this sector are more secluded than the communities in other sectors. This includes limited access to transportation to reach other types of employment. As a result of the limited non-fishing employment opportunities, the fishers have continued to earn a living through fishing but have increased their work hours to increase their income, resulting in limited leisure time. Sectors Two and Three, on the other hand, have easier access to transportation and are located in areas where other types of employment opportunities are available, such as tourism, construction and retail.

Out of the total participants in this study, 54 percent of female participants and 46 percent of male participants indicated that their leisure time was negatively impacted. As women in the fisher communities have started to partake in income generating activities to increase household income, their leisure time decreased. In addition to working, women also have household

responsibilities including cooking and cleaning, which impacts their leisure time. This may explain why more female participants indicated having less leisure time than male participants.

7.2.2—Discussing the Impacts on Resource Access

88 percent of the total participants indicated that conflict occurred in their community regarding fishing grounds. The results reveal similar reporting on conflict across all three sectors which indicates that conflict occurs throughout Chilika, including conflict regarding aquaculture practice and encroachment of fishing grounds. That said, Sector One has the lowest reports on issues regarding resource access perhaps because this sector is located near the sea mouth channel where the fish are mostly concentrated. This area is significantly covered in net enclosures, which impede the fish from entering further into the Lagoon and thus this area is best for fishers to fish. This may explain why Sector One has the least reports on resource access as the fishers find more fish in this area of the Lagoon. That said, net enclosures disrupt the levels of oxygen, salinity and tidal flushing, which reduce the natural growth of fish and thus, fish catch size is a concerning problem in Sector One as it is in all sectors (Pattanaik, 2007).

As the fish catch size decreases, the use of illegal nylon nets increased, which cause a major concern as they also catch juveniles and fish eggs. The highest reporting on the use of illegal nylon nets is found in Sector Three, perhaps due to the decreased fishing grounds associated with depth changes in this area. 42 percent of the participants in Sector Three mentioned that they have used illegal nets or seen other fishers use illegal nets. As mentioned earlier, Sector Three experienced significant changes to water depths and Lagoon shrinkage, which may explain why fishers in this area have used illegal nets to catch more than regular sized fish, including juveniles and fish eggs (Pattanaik, 2007).

Sectors Two and Three have the highest reports on theft of fishing equipment. 28 percent of participants from Sector Two and 23 percent of participants from Sector Three have indicated that theft of fishing equipment occurred in their communities. Sectors Two and Three are located in commercial and touristic areas, while Sector One is more secluded. This may explain why theft occurs more in Sectors Two and Three as they are easily accessible by outsiders, assuming that theft is committed by non-fishers. That said, there is not enough data to support that theft is committed only by non-fishers.

Lastly, it is important to note that male participants from all sectors observed more issues regarding resource access than female participants. As men from fisher communities spend more time outside their homes compared to women, it is expected that males observe more impacts on resource access than females. The impacts on resource access include: conflict regarding fishing grounds, theft of fishing equipment, decreased fish catch and use of zero nets.

7.2.3—Discussing the Impacts on Migration

The results of this study reveal that 33 percent of the total participants have indicated that their household was affected by local labour jobs, which includes non-fishing related employment found within their communities, such as daily wage jobs. Results also show that 22 percent of the total participants indicated that their household was impacted by temporary migration. The results show that only 8 percent of the total participants indicated that their household was affected by permanent migration. Due to the limitations of this research, it is assumed that the data collected on permanent migration is underrepresented and thus, this study assumes that more fisher households are impacted by permanent migration, but the extent is unknown.

The results reveal limited impacts on migration in Sector One compared to other sectors and there are no reports on non-local labour jobs (work outside their community, but within Chilika). Perhaps the reasoning behind this is the limited accessibility to transportation in Sector One as the communities in this area are more secluded compared to other sectors and thus, there is limited non-fishing employment opportunities. Sector Two has the highest reports on local labour jobs (non-fishing employment within their community), perhaps because this sector is located near tourist hubs and thus there are many employment opportunities in tourism and there is limited transportation required to reach those employment opportunities.

Lastly, temporary migration is mostly affected in Sector Three. Perhaps the reasoning behind this is the qualifications that the fishers have, which are limited to fishing. The fishers have limited education and thus may not qualify for non-fishing related employment such as retail work. Sector Two is location in an area that is more commercialized compared to other sectors and there are many non-fishing related employment opportunities that the fishers are not qualified for. As a result, some of the fishers turn to temporary migration outside of Chilika to generate household income.

Out of the 8 percent of total participants who have indicated that their household was impacted by permanent migration, 17 percent are females and 4 percent are males. These results indicate that females are more impacted than males perhaps because men tend to migrate out of Chilika while women are left behind to take care of their home and children. In addition, more female than male participants indicated having a non-fishing related jobs within their community, perhaps because women have started to partake in income generating activities, which include daily wage jobs available within their communities. The impacts on the women's psychological health associated with the changes in work and migration is later discussed in the following section.

7.3—Results Reveal a Significant Impact on the Psychological Health of Fisher Communities in Chilika

The purpose of Objective Two is to examine the psychological distress symptoms of the fisher communities, which are associated with the environmental changes and impacts on livelihood resource access and migration. The psychological distress symptoms include: physical pain, insecurity, social isolation, loss of connection to the environment, intense worry about the future, eating disorders and finally, sleeping disorders. The psychological distress symptoms of each participant in this study were examined to rank its severity. The results of the psychological distress symptom for physical pain show that the majority of the participants from all three sectors, both males and females, experienced physical pain at medium severity. Although, very few participants experienced physical pain at high severity, the majority of the participants experienced physical pain at medium severity.

Out of all the female participants, 46 percent experienced insecurity at medium severity and another 46 percent experienced insecurity at high severity. The majority of male participants experienced insecurity at medium severity, but the same percentage of female participants experienced insecurity at medium severity and high severity, which indicates that women experienced insecurity more than men at high severity. Additionally, the findings show that the majority of female participants who experienced insecurity at high severity are from Sector One, which indicates that women in Sector One are more insecure about their household income, perhaps due to the lack of daily wage jobs in Sector One compared to Sector Two and Three.

Though very few participants experienced high severity of social isolation, the results indicate that more women than men experienced medium severity of social isolation and more men than women experienced low severity of social isolation. The majority of the participants experienced loss of connection at low severity, which indicates that the fisher communities continue to feel connected to the environment despite the negative environmental changes occurring. That said, more male participants experienced low severity and medium severity of loss of connection than female participants, while more female participants experienced high severity of loss of connection than male participants.

60 percent of male participants and 50 percent of female participants experienced feelings of intense worry at medium severity, which is one of the highest percentages of participants experiencing any of the psychological distress symptoms at medium severity. The percentage of male and female participants experiencing intense worry at low, medium and high severities are similar, but more females than males experienced high severity of intense worry and more males than females experienced medium severity of intense worry. This indicates that women experienced high severity of intense worry more than men.

Few participants experienced severe eating disorders, but it is important to note that women are more affected than men. The number of women whose eating habits were severely impacted is almost double the amount of men. More males than females have experienced medium severity of sleeping disorders and more females than males have experienced low severity of sleeping disorders. That said, more males and females experienced medium severity than low severity, which indicates that the majority of the participants experienced moderate impacts on their quality of sleep due to psychological distress associated with the environmental changes.

7.4—Discussing the Findings on the Psychological Distress Symptoms

There are seven psychological distress symptoms that were examined in this study and each of them were ranked in severity, which include low, medium and high. The overall results reveal that the symptoms of the total participants that were ranked low in severity are loss of connection (86%) and social isolation (68%). The results also reveal that the symptoms ranked high in severity are insecurity (37%) and intense worry (30%). That said, the results indicate that the psychological distress symptoms are significant but not severe. This is due to the lack of symptoms that are

ranked high in severity. This section delves deeper into each of the three sectors and how the psychological distress of the fisher communities was impacted as well as how men and women were affected differently.

The results in Sector One reveal that social isolation and loss of connection are the most impacted symptoms of distress among the fisher communities in this area. That said, the results show lower impacts on social isolation and loss of connection compared to other sectors. Social isolation includes isolating oneself from other community members and loss of connection refers to losing connection to the environment, including the Lagoon. The communities in Sector One are more secluded and have limited non-fishing employment opportunities compared to other sectors and thus, the fishers continue to fish in the Lagoon to make a living. This may explain why many of the fishers in this sector continue to feel connected to their environment as many fishers continue to fish. In addition, due to the communities being secluded, the community members may feel more socially integrated within their communities.

Sector Two has the highest reporting on social isolation in medium and high severities which supports the idea that the fisher communities may feel more socially isolated when their communities are located in areas that are more crowded with outsiders. As mentioned earlier, Sector Two is located near tourist hubs, which attacks many visitors and may cause feelings of social isolation among the local fishers. Moreover, loss of connection is the least impacted symptom in Sector Two, perhaps due to the continuous accessibility to the Lagoon for the fisher communities in this area. Although many of the fishers in Sector Two have been fishing less and working more in the tourist industry, they continue to spend their time inside the Lagoon, which may explain why loss of connection to the Lagoon was not significantly impacted in this area.

Sector Three has the most reporting on loss of connection compared to other sectors but has the least impacts on social isolation. This sector experienced significant changes in the Lagoon as the shoreline has moved inwards and the area that the fishers used to fish in is too shallow for boats to even float on. The drastic depth changes that occurred in Sector One from 1980 to 2017 pose concerning impacts on the fishing activities and may explain why the fishers in this area experienced loss of connection to the Lagoon. That said, social isolation is the least impacted symptom compared to other sectors, which indicates that the fisher households continued to feel

socially connected with their communities despite the loss of connection to the Lagoon. In addition, the coping strategies found among the fishers in Sector Three are unique, which are later discussed in the section on Coping and Social Support.

There are some differences between men and women on the effects on psychological distress. The results show that the female participants in this study experienced high severity in insecurity and intense worry more than male participants. 46 percent of female and 38 percent of male participants experienced high severity of insecurity. In addition, 38 percent of female and 27 percent of male participants experienced high severity of intense worry. Perhaps the reasoning behind this is that women have more responsibilities than they used to as they have started to partake in income generating activities. As a result, women continue to perform their household duties while they also work to contribute to household income which may cause a more significant impact on their psychological wellbeing compared to men. In addition, employment opportunities are limited for women as traditionally men have engaged in income generating activities more than women, which can contribute to the overall impact on the women's psychological wellbeing.

Moreover, the results indicate that women' psychological health was impacted more than men. Women have scored higher impacts on their psychological distress symptoms compared to men, except for sleeping disorders. In addition, 21 percent of female participants and 6 percent of male participants experienced significant impacts on symptoms of physical pain, which is not surprising as the data indicates that women experienced more effects on their emotional distress symptoms than men. Physical pain associated with psychological distress often occurs simultaneously with symptoms of emotional distress (Hussain, 2009; Shukla, 2013). This explains why the female participants in this study experienced more physical pain than the male participants, as they experienced emotional distress symptoms. The following section discusses how the fisher communities have been coping with their psychological distress and the differences of coping strategies and sources of social support between men and women

7.5—Coping Strategies and Sources of Social Support Among Fisher Communities in Chilika Lagoon Who Have Experienced Psychological Distress

The first purpose of Objective Three is to determine and examine the coping strategies used by the participants to cope with their psychological distress symptoms. The results of this study reveal

that there are different types of coping strategies, which include: taking medication, socializing, spiritual activities, hobbies or leisure time, substance use, homemade remedies, nature or outdoor recreation, resting and exercising. The coping strategies were examined to determine their effectiveness in managing the psychological distress symptoms. The results for Objective Three indicate that the majority of the participants used effective coping strategies.

It is important to note that all 76 participants interviewed mentioned using at least one type of coping strategies. The most commonly used coping strategies used by the participants are taking medication, socializing, spiritual activities and hobbies. Only few participants used substance use, homemade remedies, nature, resting and exercising as coping strategies to manage psychological distress. 48 percent of male and 58 percent of female participants used medication as a coping strategy. The majority of the participants indicated that they experienced physical pain as a psychological distress symptom at medium severity, which explains why many participants took medication to cope with psychological distress. 29 percent of male and 25 percent of female participants socialized to cope with psychological distress. Socializing also helps cope with distress, as well as cope with diseases (Taormina, 2001). Taking medication and socializing are the two most common types of coping strategies that are often used together to coping with psychological distress. 33 percent of male and 13 percent of female participants use spiritual practices to cope with psychological distress, which includes praying, meditating, rituals and celebrations. Lastly, 21 percent of male and 13 percent of female participants used hobbies as a way of coping with psychological distress.

The second purpose of Objective Three is to determine the sources of social support that the participants received in order to help cope with their psychological distress. The results of this study reveal that there are five major sources of social support, which include: family, community, spiritual, friends and professionals. The results for Objective Three indicate that the majority of the participants had effective sources of social support. 67 percent of male and 71 percent of female participants received social support from family. 38 percent of male and 29 percent of female participants received social support from their community. Family and community are the most common sources of social support among the participants. Spiritual, friends and professionals are the least common sources of social support. The results show that the participants had effective

coping strategies and received significant sources of social support to help manage their psychological distress.

7.6—Discussing the Findings on Coping Strategies and Social Support

This study examined how the participants have been able to cope with their psychological distress and if they had any social support to help manage their distress. The results of this study reveal that sources of social support are similar in all three sectors. That said, the coping strategies used to manage psychological distress are different in Sector Three compared to other sectors. The common types of coping strategies used to manage psychological distress are taking medication, socializing, practicing spiritual activities and partaking in leisure activities. Taking medication is the most common type of coping strategy, but it is only common in Sectors One and Two. Moreover, taking medication is the only common coping strategy in Sectors One and Two, while Sector Three has multiple common coping strategies. The most common type of coping strategy in Sector Three is socializing. As mentioned earlier, Sector Three has the lowest impacts on social isolation, which indicates that the participants in this area are strongly connected with their communities. As a result, the participants in this area are able to socialize to cope with distress, which explains why socializing is more common in Sector Three compared to other sectors.

In addition to socializing, the participants in Sector Three have also indicated using multiple coping strategies to manage their psychological distress, which include practicing spiritual activities and leisure activities. Having multiple coping strategies increases the effectiveness of coping with distress, which suggests that the participants in Sector Three were likely to cope with distress more efficiently than the participants in other sectors. Lastly, the results indicate that very few participants engaged in substance use as a form of coping with distress, which is more harmful than beneficial to the overall health of the individual. Substance use often occurs when the individual faces barriers to effectively treat his or her psychological distress (Ouimette et al., 1998). The lack of participants engaging in substance use suggest that the participants are effectively coping with their psychological distress and thus do not engage in substance use.

This section focuses on the differences in coping with distress between male and female participants. The types of coping strategies that the participants in this research indicated using

are: taking medication, socializing, practicing spiritual activities, engaging in leisure activities, engaging in substance use, using homemade remedies, spending time in nature, resting, and exercising. Results indicate that more male than female participants used all types of coping strategies, except for taking medication. Most of the coping strategies requires leaving home, which is more accessible for men since they spend more time outside their homes than women do. Moreover, it is not surprising that taking medication to cope with distress is more common among females due to the impacts on physical pain which occurs more in females than males.

The results also show that females receive social support from their families more than their community and vise versa for males. Perhaps the reasoning behind this is that men spend more time outside working in the Lagoon and often interact with other fishers and thus receiving their social support through interacting with other members of their community. On the other hand, women spend more time in their homes taking care of their house and their children and thus, receiving more social support from their families.

7.7—Key Findings of this Study

- The increased aquaculture practice since the 1980s and the opening of the artificial sea mouth in 2001 have contributed to significant changes of the Lagoon's environment including decreased access to the Lagoon.
- The fish stocks have declined, which has negatively impacted the household income of the fisher communities.
- Women had started to take daily wage jobs to help generate household income as fishermen have increasingly struggled to generate enough income for their households.
- The conflict between fisher and non-fisher communities in the Lagoon includes theft of fishing equipment, threats and safety concerns for the fisher communities, which further impacts income-generating activities.
- Forced migration has become the norm among fisher communities to generate household income and escape conflict.

- Results show significant impacts on the psychological well-being, with high severities in symptoms of insecurity and intense worry associated with psychological distress among male and female participants.
- Five out of seven psychological distress symptoms are ranked low and medium, which include: physical pain, social isolation, loss of connection, eating disorders and sleeping disorders.
- Results indicate that the participants continued to feel connected to their home environment and community despite their exposure to the stressors from the environmental changes.
- All participants had used at least one coping strategy that helped manage their psychological distress effectively.
- Majority of the participants had sources of social support that helped cope with their psychological distress.
- The lack of participants using substance use as a coping strategy, which negatively impacts the overall health of the individuals, indicates that the majority of the participants are using effective coping strategies.
- Results suggest that the participants would have shown more severe psychological distress symptoms if their coping strategies and sources of social support were not as effective.
- Due to the effective coping strategies and sources of social support, the participants were able to reduce the impact on their psychological distress and lowered the severities of five out of seven psychological distress symptoms.

7.8—Implications of this Study on Environmental Change and Psychological Distress in Coastal Fisher Communities

Coastal small-scale fisheries are often marginalized by the increased demand in fish worldwide, which increases intensive large-scale fishing operations and results in depletion of fish stocks and degradation of the environment (Nayak, Oliveira & Berkes, 2015). In addition to artificial environment impacts, climate change has also contributed to the decline in coastal small-scale fisheries (Zacharia et al., 2016; Senapati & Gupta, 2015). The caste-based fisher communities in Chilika Lagoon are no exception to the social and economic marginalization associated with the

environmental changes of natural resources. Due to the effects of marginalization, the fisher communities faced barriers in adapting to the adverse environmental changes, which includes limited access to fishing grounds and reduced household income. The results of this study reveal that the fisher communities in Chilika have faced significant environmental stressors, which would adversely impact the psychological well-being of the individuals. However, the results show that only two out of seven psychological distress symptoms are significantly severe. Five out of seven psychological distress symptoms are not significantly severe, which indicates that the fisher communities had effective coping strategies that helped reduce the impacts on the psychological well-being. The results of this study indicate that the coping strategies of the participants were effective in reducing the impacts on psychological well-being.

The commonly used coping strategies among the participants were taking medication, socializing, practicing spiritual activities and hobbies. Although medication is an effective coping strategy and the majority of the participants took medication to help manage their psychological distress, socializing, practicing spiritual activities and hobbies are also highly effective coping strategies that should be emphasized. This study concludes that strengthening effective coping strategies would help reduce the psychological distress even further. The results of this study show that few participants use spiritual activities as a coping strategy. Although the fisher communities in Chilika are mostly Hindu and partake in religious ceremonies and rituals, few participants have indicated that it helped with managing psychological distress. Perhaps strengthening the benefits of spiritual activities in coping with distress can help reduce the psychological distress symptoms even further. In addition, socializing and leisure time are also effective coping strategies that could be strengthened to reduce the impacts on psychological well-being. Although socializing is the second most commonly used coping strategy among the participants, increasing socializing would help reduce some of the stress even further and help build relationships within the community. Moreover, the results of this study show that leisure time is an effective coping strategy that is poorly used among the participants. Improving leisure time can help reduce the impacts on the psychological well-being, however, the participants have indicated that leisure time has declined drastically as decreased household income has forced men to work longer hours and women to take daily wage jobs. That said, unlike most coastal fisheries that have experienced similar impacts

on the environment and psychological distress, the results of this study show that the fisher communities in Chilika had extensive social support from families and communities, which helped manage the psychological distress symptoms. The results of this study suggest that social support, along with effective coping strategies, can help reduce the impacts on psychological distress of marginalized coastal fisheries.

This research is important because it will help maintain psychological health among distressed communities around the world. For future research recommendations, it is important to understand why the fisher communities have been able to cope with serious psychological distress despite being exposed to severe environmental stressors. Further research is needed in examining the effects of social support on managing psychological distress associated with environmental changes. Understanding how and why the fishers have coped with distress will help develop effective strategies to adapt to environmental changes, which can be implemented in other regions where communities have experienced similar environmental stressors. This study indicates that more research is needed in order to better understand the relationship between environmental health and human health. Moreover, this study suggests that environmentally induced psychological illnesses, such as psychoterratic diseases coined by Albrecht (2011), should be used with caution when diagnosing psychological conditions as more research is needed to fully understand the relationship between rapid environmental change and psychological distress.

Bibliography

Ahearn, F.L. (2000). *Psychosocial Wellness of Refugees: Issues in Qualitative and Quantitative Research*. New York: Berghahn Books.

Alam, E. (2018). *Coping and Adaptation: Coastal Communities with Disasters.* Bangladesh: AH Development Publishing House.

Albrecht, G. (2005). Solastalgia: A New Concept in Human Health and Identity. *Philosophy, Activism, Nature, 3*, pp. 41-55.

Albrecht, G. (2006). Environmental Distress as Solastalgia. *Alternatives, 32*(4-5), pp. 34-35.

Albrecht, G., Sartore, G., Connor, L., Higginbotham, N., Freeman, S., Kelly, B., Stain, H., … Pollard, G. (2007). Solastalgia: The Distress Caused by Environmental Change. *Australian Psychiatry, 15*(1).

Albrecht, G. (2011). Chronic Environmental Change: Emerging 'Psychoterratic' Syndromes. *Climate Change and Human Well-Being*, pp. 43-56.

ARCSCCB (2005). *Note on the Activites of the Office of the Assistant Register of Co-operative Societies (Fy) Chilika Circle Balugaon.* Assistant Register of Co-operative Societies (Fy) Chilika Circle Balugaon, Bhubaneswar.

Artazcoz, L., Benach, J., Borrell, C. & Cortès, I. (2004). Unemployment and Mental Health: Understanding the Interactions Among Gender, Family Roles, and Social Class. *American Journal of Public Health,* 94, pp. 82-88.

Barnett, R.C. and Brennan, R.T. (1997). Change in Job Conditions, Change in Psychological Distress, and Gender: A Longitudinal Study of Dual-earner Couples. *Journal of Organized Behavior, 18*(3), pp. 253-274.

Barrera Jr., M. (2000). Social Support Research in Community Psychology. *Handbook of Community Psychology*, 215-245.

Barton, J. and Pretty, J. (2010). What is the Best Dose of Nature and Green Exercise for Improving Mental Health? A Multi-Study Analysis. *Environmental Science and Technology, 44*(10), pp. 3947-3955.

Bhugra, D. (2003). Migration and Depression. *Acta Psychiatrica Scandinavica, 108*(418), pp. 42-72.

Bhugra, D. (2004). Migration and Mental Health. *Acta Psychiatrica Scandanavica, 109*(4), pp.243-258.

Bhugra, D. (2004). Migration, Distress and Cultural Identity. *British Medical Bulletin, 69*(1), pp. 129-141.

Bhugra, D. and Ayonrinde, O. (2004). Depression in Migrants and Ethnic Minorities. *Advances in Psychiatric Treatment, 10*(1), pp. 13-17.

Bhugra, D. and Becker, M.A. (2005). Migration, Cultural Bereavement and Cultural Identity. *World Psychiatry, 4*(1), pp. 18-24.

Bruce, S. P. (2009). Recognizing Stress and Avoiding Burnout. *Currents in Pharmacy Teaching and Learning*, 1, 57-64.

Borg-Stein, J. & Simons, D. G. (2002). Myofascial pain. *Archives of Physical Medecine and Rehabilitation, 88*, S40-S47.

Carol S. Aneshensel (1992). Social Stress: Theory and Research. *Annual Review of Sociology, 18,* 15-38.

Carver, C.S., Scheier, M.F. and Weintraub, J.K. (1989). Assessing Coping Strategies: A Theoretical Based Approach. *Journal of Personality and Social Psychology, 56*(2), 267–283.

Chakroborty, P. (2017). *Sustainable Transportation for Indian Cities: Role of Intelligent Transportation Systems*. In: Sivakumar Babu G., Saride S., Basha B. (eds) Sustainability Issues in Civil Engineering. Springer Transactions in Civil and Environmental Engineering. Singapore: Springer.

Chukwuorji, J. C**.,** Ifeagwazi, C. M., & Iorfa, S. K. (2015). Mental Health Emergency of Climate Change: Consequences and Vulnerabilities. *International Journal of Communication, 16*, 110-131.

Connell, J., O'Cathain, A. and Brazier, J. (2014). Measuring Quality of Life in Mental Health: Are We Asking the Right Questions? *Social Science and Medicine, 120*, pp. 12-20.

Comijs, H. C., Penninx, B.W., Knipscheer, K.P. and van Tilburg, W. (1999). Psychological Distress in Victims of Elder Mistreatment: The Effects of Social Support and Coping. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences, 54*(4), pp. 240-245.

Craik, K.H. (1973). Environmental Psychology. *Annual Review of Psychology, 24*, pp. 403-422.

Creswell, J.W. (2007). *Qualitative Inquiry and Research Design: Choosing Among Five Approaches (2nd.).* Thousand Oaks, CA: Sage.

Dalgard, O. S. & Tambs, K. (1995). Social Support, Negative Life Events and Mental Health. *The British Journal of Psychiatry, 166*(1), pp. 29-34.

Danasu, R., Sridevi, R. and Sangeetha, T. (2016). A Study to Evaluate the Effectiveness of Warm Mustard Oil Massage in Reduction of Back Pain Among Postnatal Mothers at Sri Manakula Vinayagar Medical College and Hospital, Puducherry. *International Journal of Information Research and Review, 3*(5), pp. 2269-2271.

Demyttenaere, K., Bruffaerts, R., Posada-Villa, J., Gasquet, I., Kovess V., Lepine J.P., … Chatterji, S. (2004). Prevalence, Severity, and Unmet need for Treatment of Mental

Disorders in the World Health Organization World Mental Health Surveys. *Europe PMC, 291*(21), p. 2581-2590.

Devlin, M.J. and Walsh, T. (1989). Eating Disorders and Depression. *Psychiatric Annals, 19*(9), pp. 473-476.

Doherty T. & Clayton, S. (2011). The Psychological Impacts of Global Climate Change. *American Psychologist, 66*(4), 265-276.

Dooley, D. (2003). Unemployment, Underemployment, and Mental Health: Conceptualizing Employment Status as a Continuum. *American Journal of Community Psychology, 32*(1-2), pp. 9-20.

Dougherty, D. M., Marsh, D. M., Moeller, F. G., Chokshi, R. V. and Rosen, V. C. (2000). Effects of Moderate and High Doses of Alcohol on Attention, Impulsivity,

Discriminability, and Response Bias in Immediate and Delayed Memory Task Performance. *Alcoholism, Clinical and Experimental Research, 24*(11), pp. 1702-1711.

Fafchamps, M. and Minten, B. (2003, August). *Theft and Rural Poverty: Results of A Natural Experiment.* Paper presented at International Association of Agricultural Economists: 2003 Annual Meeting on International Association of Agricultural Economists, Durban, South Africa. DOI: 10.22004/ag.econ.25902

Flaten, M. A. (2014). Pain-Related Negative Emotions and Placebo Analgesia. *Handbook of Experimental Phamacology, 225,* pp. 81-96.

Folkman, S. and Lazarus, R.S. (1980). An Analysis of Coping in a Middle-Aged Community Sample. *Journal of Health and Social Behavior, 21*, 219-231

Fritze, J., Blashki, G., Burke, S. & Wiseman, J. (2008). Hope, Despair and Transformation: Climate Change and the Promotion of Mental Health and Wellbeing. *International Journal of Mental Health Systems, 2*(13).

Fusch, P. & Ness, L.R. (2015). Are We There Yet? Data Saturation in Qualitative Research. *The Qualitative Report, 20*(9), p. 1408-1416.

Gerrig, R., Zimbardo, P. (2010). *Psychology and Life, 19th Edition*. London, England: Pearson

Ghosh, A. K., Pattnaik, A. K. & Ballatoire, T. (2006). Chilika Lagoon: Restoring Ecological Balance and Livelihoods through re-salinization. *Lakes & Reservoirs: Research & Management, 11(*4), pp. 201-308.

Gloria, G. M., Jose, P. M., Isabel, R. and Esther, R. G. (2006). Coping and Distress in Organizations: The Role of Gender in Work Stress. *International Journal of Stress Management, 13(*2), 228–248

Graham, S., Furr, S., Flowers, C. and Burke, M. T. (2001). Reseatch and Theory and Spirituality in Coping with Stress. *Counselling and Values, 46*(1), pp. 2-13.

Greenglass, E.R. (1993). The Contribution of Social Support to Coping Strategies. *Applied Psychology, 42*(4), pp. 323-340.

Gu, H., Tang, C. and Yang, Y. (2012). Psychological Stress, Immune Response, and *Atherosclerosis, 223*(1), pp. 69-77.

Heintzman, P. and Mannell, R. C. (2003). Spiritual Functions of Leisure and Spiritual Well-Being: Coping with Time Pressure. *Leisure Sciences, 25*(2-3), pp. 207-230.

Hill, T.D., Burdette, A.M. and Hale, L. (2009). Neighborhood Disorder, Sleep Quality, and Psychological Distress: Testing a Model of Structural Amplification. *Health & Place, 15*(4), pp.1006-1013.

Hofsten, C. and Backman, L. (Eds.). (2002). *Psychology at the Turn of the Millennium*. New York, NY: Psychology Press.

Hurwitz, E. L., Morgenstern, H. and Chiao, C. (2011). Effects of Recreational Physical Activity and Back Exercises on Low Back Pain and Psychological Distress: Findings from the UCLA Low Back Pain Study. *American Journal of Public Health, 95*(10), pp. 1817-1824.

Hussain, D. (2009). Stress, Immunity, and Health: Research Findings and Implication. *International Journal of Psychosocial Rehabilitation, 15*, pp. 94-100.

Iwasaki, S. (2016). Estimation of Demographic Changes in Fishing Population for Fisheries Management in Chilika Lagoon, India: A Micro-Demographic Approach. *Oceanorgraphy & Fisheries Open Access Journal, 1(*1).

Iwasaki, S. Razafindrabe, B. H. N. & Shaw R. (2009). Fishery Livelihoods and Adaptation to a Climate Change Case Study of Chilika Lagoon, India. *Mitigation and Adaptation Strategies for Global Change, 14*(4), pp. 339-355.

JICA-CDA Technical Cooperation Project (2009). *Data Book of Socio-economic Survey of Fishers in Chilika Lagoon*. Chilika Development Authority, Bhubaneswar.

Kawachi, I. & Berkman, L. F. (2001). Social Ties and Mental Health. *Journal of Urban Health, 78(*3), pp. 458-467.

Khuntia, N. and Mishra, J.M. (2016). The Barriers of Community Participation in Tourism Development in Chilika Lake, Odisha India. *Journal of Tourism, 17*(2), pp. 83-93.

Kondo, M., Jacoby, S. F. and South, E. C. (2018). Does Spending Time Outdoors Reduce Stress? A Review of Real-time Stress Response to Outdoor Environments. *Health Place, 51*, pp. 136-150.

Krischer, M. M., Penney, L. M. and Hunter, E.M. (2010). Can Counterproductive Work Behaviors be Productive? CWB as Emotion-focused Coping. *Journal of Occupation Health Psychology, 15*(2), pp. 154-156.

Leopold, A. (1970). *A Sand County Almanac with Essays on Conservation from Round River*. New York, NY: Ballantine Books.

Levine, M. (2009). Prayer as Coping: A Psychological Analysis. *Journal of Health Care Chaplaincy, 15*(2).

Lorant, V, Croux, C., Weich, C., Deliège, D., Mackenbach, J. and Ansseau, M. (2007). Depression and Socio-Economic Risk Factors: 7-Year Longitudinal Population Study. *The British Journal of Psychiatry, 190*(4), 293-298.

Lu, Y. (2010). Mental Health and Risk Behaviors of Rural-urban Migrants: Longitudinal Evidence from Indonesia. *US National Library of Medicine National Institutes of Health, 64*(2), 147-163.

MacSubhne, S. (2009). What Makes "A Mental Illness?" What Makes "A New Mental Illness"?: The Cases of Solastalgia and Hubris Syndrome. *Cosmos and History: The Journal of Natural and Social Philosophy, 5*(2).

Marmot, M. (2002). The Influence of Income on Health: Views of An Epidemiologist. *Health Affairs, 21*(2), pp. 31-46.

Matud, M.P. (2004). Gender Differences in Stress and Coping Styles. *Personality and Individual Differences, 37*(7), pp. 1401-1415.

Ministry of Environment and Forests (2008). *Report on Visit to Chilika Lake, Orissa, a Wetland Included Under the National Wetland Conservation and Management Programme of the Ministry of Environment and Forests*. Retrieved from http://planningcommission.nic.in/reports/E_F/ChilikaLake.pdf

Mitchell, E. (1946). *Soil and Civilization*. Sydney, Australia: Halstead Press Pty Limited

Moldofsky, H. (2001). Sleep and Pain. *Sleep Medicine Reviews, 5*(5), pp. 385-396.

Morrison, V. & Bennett, P. (2009). *An Introduction to Health Psychology 2nd Edition*. London, England: Pearson Education Limited.

Nayak, P. K. (2014). The Chilika Lagoon Social-Ecological System: An Historical Analysis.

Ecology and Society 19(1), 1.

Nayak, P. K. and Berkes, F. (2010). Whose Marginalisation? Politics Around Environmental Injustices in India's Chilika Lagoon. *Local Environment 15*(6), 553-567.

Nayak, P. K. and Berkes, F. (2011). Commonisation and Decommonisation: Understanding the Processes of Change in the Chilika Lagoon. *India Conservation and Society 9*(2), 132-145.

Nayak, P. K. and Berkes, F. (2012). Linking Global Drivers with Local and Regional Change: A Social-Ecological System Approach in Chilika Lagoon, Bay of Bengal. *Springer-Verlag Berlin Heidelberg*.

Nayak, P. K., Oliveira, L.E. & Berkes, F. (2014). Resource Degradation, Marginalization, and Poverty in Small-scale Fisheries: Threats to Social-ecological Resilience in India and Brazil. *Ecology and Society 19*(2), 73.

Neighbors, H.W. and Laveist, T.A. (1989). Socioeconomic Status and Psychological Distress: The Impact of Financial Aid on Economic Problem Severity. *Journal of Primary Prevention, 10(*2), pp. 149-165.

Nesdale, D., Rooney, R. and Smith, L. (1997). Migrant Ethnic Identity and Psychological Distress. *Journal of Cross-Cultural Psychology, 28*(5), pp. 569-588.

Ouimette, P. C., Brown, P. J. and Najavits, L. M. (1998). Course and Treatment of Patients with Both Substance Use and Posttraumatic Stress Disorders. Addictive *Behaviors, 23*(6), pp. 785-795.

Padhy, S. K., Sakar, S., Panigrahi, M. & Paul, S. (2015). Mental Health Effects of Climate Change. *Indian Journal of Occupational and Environmental Medicine, 19*(1), 3-7.

Paital, B. & Chainy G. B. N. (2011). Modulation of Expression of SOD Isoenzymes in Mud Crab (*Scylla serrata*): Effects of Inhibitors, Salinity and Season. J*ournal of Enzyme Inhibition and Medicinal Chemistry, 28(*1), pp. 195-204.

Panda, U. S. & Mohanty, P. K. (2008). Monitoring and Modeling of Chilika Environment Using Remote Sensing Data. *The 12th World Lake Conference*, pp. 617-638.

Patrick, J. H., Stahl, S.T. and Sundaram, M. (2011). Disordered Eating and Psychological Distress Among Adults. *International Journal of Aging and Human Development, 73*(3), pp. 209-226.

Pattnaik, A.K. (2003). *Phytodiversity of Chilika Lake, Orissa, India*. Dissertation. Utkal University, Bhubaneswar, India.

Pattanaik, S. (2007). Conservation of Environment and Protection of Marginalized Fishing Communities of Lake Chilika in Orissa, India. *Human Ecology, 22*(4), 291-302.

Pilkington, K., Kirkwood, G., Rampes, H. and Richardson, J. (2005). Yoga for Depression: The Research Evidence. *Journal of Affective Disorders, 89*(1-3), pp.13-24.

Ptacek, J. T., Smith, R. E. and Zanas, J. (1992). Gender, Appraisal, and Coping: A Longitudinal Analysis. *Journal of Personality, 60*(4), pp. 747-770.

Rapport, D., Fyfe, W., Costanza, R., Spiegel, J., Yassi, A., Böhm, G., … Horwitz, P. (2011). Ecosystem Health: Definitions, Assessment, and Case Studies. *Ecology, 2*.

Ridsdale, L., Evans, A., Jerrett, W., Mandalia, S., Osler, K. and Vora, H. (1994). Patients who Consult with Tiredness: Frequency of Consultation, Perceived Causes of Tiredness and its Association with Psychological Distress. *British Journal of General Practice, 44*(386), pp. 413-416.

Robson, J. P. and Nayak, P. K. (2010). Rural Out-Migration and Resource-Dependent Communities in Mexico and India. *Population and Environment 32*, 263-284.

Rosenbaum, M. and Cohen, E. (1999). Equalitarian Marriages, Spousal Support, Resourcefulness, and Psychological Distress among Israeli Working Women. *Journal of Vocational Behaviour, 54*(1), pp. 102-113.

Sahu, B.K., Pati, P. and Panigrahy, R.C. (2014). Environmental Conditions of Chilika Lake During Pre and Post Hydrological Intervention: An Overview. *Journal of Coastal Conservation, 18*, 285-297.

Saldaña, J. (2009). *The Coding Manual for Qualitative Researchers*. Thousand Oaks, CA: Sage.

Saxena, S., Thornicroft, G., Knapp, M. and Whiteford, H. (2007). Resources for mental health: scarcity, inequity, and inefficiency. *The Lancet, 370*(9590), pp. 878-889.

Schweitzer, R. D., Brough, M. & Vromans, L. (2011). Mental Health of Newly Arrived Burmese Refugees in Australia: Contributions of Pre-Migration and Post-Migration Experience. *Australian & New Zealand Journal of Psychiatry, 45*(4).

Selye, H. (1936). A Syndrome Produced by Diverse Nocuous Agents. *Nature, 138* (32).

Selye, H. (1946). The General Adaptation Syndrome and the Diseases of Adaptation. *Journal of Clinical Endocrinology 6*, 117-231.

Senapati, N. and Kuanr, D.C. (1977). *Orissa District Gazetteers Puri.* Gazetteers Unit Department of Revenue Government of Orissa, Cuttack.

Senapati, S. and Gupta, V., (2015). Climate Change and Fishing: Analysing Fishermen's Viewpoint. *International Journal of Ecological Economics and Statistics, 36*(4).

Sepa, A., Frodi, A. and Ludvigsson, J. (2004). Psychosocial Correlates of Parenting Stress, Lack of Support and Lack of Confidence/Security. *Scandinavian Journal of Psychology, 45*(2), pp. 169-179.

Seun-Fadipe, C.T. and Mosaku, K.S. (2017). Sleep Quality and Psychological Distress Among Undergraduate Students of a Nigerian University. *Sleep Health, 3*(3), pp. 190-194.

Shukla, J. (2013). *Extreme Weather Events and Mental Health: Tackling the Psychosocial Challenge.* Lucknow, India: Hindawi Publishing Corporation. Doi: 10.1155/2013/127365

Sobel, D.S. (1995). Rethinking Medicine: Improving Health Outcomes with Cost-Effective Psychosocial Interventions. *Psychosomatic Medicine, 57*(3), 234-244.

Speiser, M. (2014, June 10). Climate Change Will Have Broad Psychological Effects, Report Finds. *American Psychological Association*. Retrieved from http://www.apa.org/news/press/releases/2014/06/climate-change.aspx

Spiegel, D. (1990). Facilitating Emotional Coping During Treatment. *American Cancer Society, 66(*S14), 1422-1426.

Strazdins, L. & Broom, D. H. (2007). The Mental Health Costs and Benefits of Giving Social Support. *International Journal of Stress Management, 14*(4), 370-385.

Stokols, D. (1992). Establishing and Maintaining Healthy Environments. *American Psychologist, 47*(1), 6-22.

Swartz, K.L., Pratt, L.A. and Armenian, H.K. (2000). Mental Disorders and the Incidence of Migraine Headaches in a Community Sample: Results from the Baltimore Epidemiologic Catchment Area Follow-up Study. *Arch General Psychiatry, 57*(10), pp. 945-950.

Taormina, R.J. (2001). Approaches to Preventing Burnout: The Effects of Personal Stress Management and Organizational Socialization. *Journal of Nursing Management, 9*(2), 89-99.

Taris, T.W. (2002). Unemployment and Mental Health: A Longitudinal Perspective. *International Journal of Stress Management, 9*(43).

Tashakkori, A. & Teddlie, C. (1998). Mixed Methodology: Combining Qualitative and Quantitative Approaches. *Applied Social Research Methods, 46*.

TED. (2010, June 1). *Glenn Albrecht: Environment Change, Distress & Human Emotion Solastalgia* [video file]. Retrieved from https://www.youtube.com/watch?v=-GUGW8rOpLY

Thomas, D. S. G. and Twyman, C. (2004). Equity and Justice in Climate Change Adaptation Amongst Natural-Resource-Dependent Societies. *Global Environmental Change, 15*(2), pp. 115-124.

Tsuno, N., Besset, A., and Ritchie, K. (2005). Sleep and Depression. *The Journal of Clinical Psychiatry, 66*(10), pp. 1254–1269.

University of Waterloo (n.d.). Research with Human Participants. Retrieved from https://uwaterloo.ca/research/office-research-ethics/research-human-participants/

Van der Watt, G., Laugharne, J. and Janca, A. (2008). Complementary and Alternative Medicine in the Treatment of Anxiety and Depression. *Current Opinion in Psychiatry, 21*(1), pp. 37-42.

Venditti, E.M., Wing, R.R., Jakicic, J.M., Butler, B.A. and Marcus, M.D. (1996). Weight Cycling, Psychological Health, and Binge Eating in Obese Women. *Journal of Consulting and Clinical Psychology, 64*(2), pp.400-405.

Warsini, S., Mills J. & Usher, K. (2014). Solastalgia: Living with the Environmental Damage Caused by Natural Disasters. *Prehosp Disaster Med, 29*(1), 1-4.

Wilkinson, S. (2014). How Nurses Can Cope with Stress and Avoid Burnout. *Emergency Nurse, 22*(7), pp. 27-31.

Xiaoming, L., Fang, X., Lin, D., Mao, R., Wang, J., Cottrell, L., Harris, C. and Stanton, B. (2004). HIV/STD Risk Behaviours and Perceptions Among Rural-to-Urban Migrants in China. *Guilford Press, 16*(6), pp. 538-556.

Yin, R.K. (2009). *Case Study Research Design and Methods (2nd).* Thousand Oaks, CA: Sage.

Zacharia, P.U., Gopalakrishnan, A., George, G., Muralidhar, M., and Vijayan, K.K. (2016, December). *Climate Change Impact on Coastal Fisheries and Aquaculture in India*. Paper presented at SAARC Agriculture Centre: SAC Regional Expert Consultation on Climate Change Impact on Coastal Fisheries and Aquaculture in South Asia, Dhaka, Bangladesh. Bangladesh: SAARC Agriculture Centre.

Appendix

Environmental Change Questions

1. What physical changes have you noticed of the lagoon since 1980?
2. Have you noticed any changes in fish in the lagoon since 1980?
3. Have you noticed new species in the lagoon since 1980? Such as jellyfish and barnacles.
4. Have you noticed any changes in salinity of the water since 1980?
5. Have you noticed any wetland habitat loss?
6. What are the sources of conflict in Chilika lagoon?
7. How would you feel if you had to move from the lagoon in order to find employment?
8. What is your main source of income?
9. What comes to mind when you think about Chilika lagoon?

Impacts on Livelihood

1. How has the livelihood and income change in your household since 1980?
2. What were your rights in terms of livelihood in Chilika lagoon over the years?
3. Has the lack of fishing made you feel limited in achieving your household goals? Such as meals, education, family leisure time.

Impacts on Resource Access

1. What does your household consider the lagoon as an important environmental resource?
2. How has your household been impacted by the lack of access to the lagoon or fishing?

Impacts on Migration

1. Is your household affected by migration? If yes, why?
2. If yes:
    - Has migration affected the culture in the community due to different income methods?

- How has the family situation changed since the household or household member migrated?

Psychological Distress Questions

Physical Symptoms

1. Do you have high stress levels related to the changes in income, access to the lagoon and out migration?
2. Have you been treated for high levels of glucose or cardiovascular diseases or any aches, muscle pain, joint pain?

Emotional Symptoms

3. Have you felt a decrease of sense of security?
4. Have you felt an increase in social isolation?
5. Have you experienced an increase in difficulty to manage your emotions?
6. Have you experienced any loss of connection or sense of belonging (loss of connection) to the environment and other members of the community?
7. Do you constantly feel worried about uncertain future environmental stress of the lagoon?

Behavioural Symptoms

8. Have you felt an increase in sleeplessness or oversleeping?
9. Have you experienced a loss of appetite, increase in appetite or nutrition deficiencies?

Coping and Sources of Social Support Questions

1. How does your distress (if any) limit your daily activities?
2. Does your emotional or physical stress make it difficult to do your daily activities, such as cooking, cleaning, and hobbies?

Do you practice any coping strategies to manage your emotional or physical stress?