COVID-19 footprints and post pandemic visualization of small-scale fisheries: Case study of Chilika lagoon in India

by

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AUTHOR'S DECLARATION

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

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

ABSTRACT

Small-scale fisheries and local communities reflect a way of life, and provide critical contributions to nutrition and food security, poverty alleviation and livelihoods, and local and national economies. Fisherfolk suffer various vulnerabilities due to several natural and anthropogenic drivers, which impact their livelihood and wellbeing. With the vulnerability posed by virus SARS-CoV-2' or COVID-19 or coronavirus infection, coupled with social, economic, political, and environmental crises created havoc among small-scale fisheries (SSF) and local communities globally. The global catastrophe caused by the COVID-19 pandemic has resulted in severe challenges for the fisherfolk who were already suffering from various vulnerabilities and resulting impacts on their livelihood and wellbeing.

This study largely followed a conceptual understanding of the multilevel drivers causing vulnerabilities and the pathway for the viability of fisherfolk. The main objectives that guided this research are: 1) to assess the existing vulnerabilities and the vulnerabilities triggered by COVID-19 pandemic, 2) the short-term coping measures taken by small-scale fisheries (SSF) individuals, government, and other institutions; 3) post pandemic plans and measures for the long-term viability. The research focuses on in-depth case study of SSF communities residing in Chilika Lagoon, India. The research used a mixed method approach, which gives a better understanding of ground reality from all means. A total of 50 household surveys were conducted for the data collection with semi-structured questions.

Overall, this could be stated that new drivers increase the vulnerabilities in SSF by exacerbating the existing vulnerabilities. The results indicate that understanding existing and new vulnerabilities can provide insights into the targeted management of vulnerabilities by focusing on the short-term coping responses.

The research opens a pathway for a thorough demographic research in the future. Research on coping measures for long-term viability of fisherfolk post pandemic would be insightful as well.

Keywords: COVID-19, Pandemic, Small Scale Fisheries, Fisherfolk, Vulnerability, Viability, Governance

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ASHA – Accredited social health activists

ASNs - Alternative seafood networks

BOP – Bottom of the Pyramid

ES – Ecosystem Services

FAO – Food and Agricultural Organization of the United Nations

LR – Literature Review

NGOs – Non-Governmental Organizations

OECD – Organization for Economic Cooperation and Development

OLM – Odisha livelihoods mission

PES – Payment for Ecosystem Services

RCDC – Regional Centre for Development Cooperation

SHG – Self-Help Group

SSF – Small-Scale Fisheries

SSHRC – Social Sciences and Humanities Research Council

TPDS- Targeted Public Distribution System

USD – United States Dollar

V2V – Vulnerability to Viability

WHO – World Health Organization

Chapter 1

Introduction

1.1 Background

People living at the Bottom (or base) of the Pyramid (BOP) (Hammond et al., 2007; Prahalad, 2005; Prahalad and Hammond, 2002; Prahalad and Hart, 2002) are more directly dependent on ecologically sensible areas such as agriculture and fishery. They rely on their ecological environment because they are highly vulnerable and thus cannot react appropriately to changes (Stern 2007 pp. 104-133; The World Bank, 2002, pp. 7-20). The BOP refers to the bottom-tier of the world income pyramid and illustrates the large share of people living in extreme and moderate poverty (Hahn 2009). Small-Scale Fisheries (SSF) and local communities are one of the BOP people. Small-scale fisheries are frequently characterized as ‘‘the occupation of last resort’’ and fisherfolk as ‘‘the poorest of the poor’’ (Pauly 1997; Panayotou 1982; Christy 1986; Pollnac 1991).

Globally, there are an estimated 32 million people directly employed as small-scale fishers (SSF), an additional 76 million employed in post-harvest jobs, and 81% of catch is used for local human consumption (The World Bank 2012). While SSF varies substantially by region and country, some defining characteristics include smaller vessels and engines, simpler or more traditional gears, proximity to the coast, smaller crews, family or local ownership, and importance for local livelihoods and subsistence (Kittinger 2013; Smith and Basurto 2019).

Fisheries are considered as an important part of the food chain and essential diet. Fish and other aquatic foods in diets have a crucial role in nourishing nations and addressing food and nutrition security (Bennett et al. 2020). Fisheries provide food to more than three billion people worldwide, with trade volumes exceeding USD 160 billion per year (FAO 2020a). On a continent with a net deficit of fish

production, fisheries could alleviate this deficit problem; so that farming, harvesting, and processing would increase the shelf life of foods, create jobs, and feed a hungry population.

Social scientists have recently drawn attention to another aspect of fisherfolk that has a bearing on conservation, namely that many small-scale fishers lead vulnerable lives and are extremely susceptible to misfortune (Béné and Friend, 2011; Jentoft and Eide, 2011; Allison et al., 2011). The origins of these vulnerabilities, however, are often found outside the fishery itself, and are related to basic human needs such as access to drinking water, health facilities or schools for their children, or simply a need for political recognition. These vulnerabilities are caused due to multiple drivers which could be natural or anthropogenic.

Vulnerabilities impact both physical and mental health of fisherfolk leading to economic instability. According to the World Health Organization (WHO), health is a "state of complete physical, mental, and social wellbeing and not merely the absence of disease or infirmity" (1946). Hoddinott and Quisumbing (2010) found that every 10% decline in individuals' health level leads to a 6% increase in their vulnerability to poverty. Low- and middle-income countries, including developed countries are affected by poverty caused by illness (Wagstaff 2017). More recently, scholars have investigated how diseases cause poverty in families (Whitehead 2001). The concept of the disease poverty trap, which is also named iatrogenic poverty (Meessen 2003) or the disease-driven poverty trap (Bonds 2009), was developed to describe the disease-causing-poverty phenomenon. Bruno reported that disease could lead to poverty by two major pathways: the death or disability of a household income earner due to disease and high medical-related costs related to disease treatment (Meessen 2003). One such type of vulnerabilities causing viral disease COVID-19 is highlighted in this thesis in the context of small-scale fishers. The global crisis caused by COVID-19 has resulted in significant challenges to sustainability dimensions.

1.2 Problem Statement and Research Objectives

Over two years since COVID-19 was declared a pandemic on March 11, 2020, by World Health Organization (WHO), the deadly SARS-CoV-2 virus continued to disrupt public life worldwide**.** The spread of virus 'SARS-CoV-2' or COVID-19 infection has made both Northern and Southern hemispheres struggle with the pandemic. Since the virus has spread to almost all countries, leading to millions of cases and thousands of deaths (JHU 2020). Most countries implemented the social distancing measures, or more stringent lockdowns, in efforts to slow the spread of the virus and "flatten the curve" of hospitalizations and deaths (IMF 2020). National economies had taken a major hit, and unemployment numbers had soared – with dire predictions that the economic effects could be as bad as the Great Depression (IMF 2020).

The sudden rise in coronavirus pandemic added several new vulnerabilities which impacted the regular activities of fisherfolk. The fishing sector was already dealing with challenges such as environmental degradation, climatic uncertainties, and impacts of largescale development projects. These challenges were exacerbated due to the pandemic. According to Marschke et al. (2020), three key impacts were found impacting the SSFs vulnerable, i.e., employment disruptions due to seafood system instabilities; mobility restrictions due to COVID-19 management practices; and limits on access to services such as health care or social programs.

In the year 2021, the second wave of COVID-19 created more severity and casualties. While nations are taking extensive measures to accelerate the vaccination drive in order to control the pandemic at the earliest, a public health challenge has appeared due to mutations of the SARS-CoV-2 virus, which make it highly contagious. There is no clear evidence of the severity of the new mutations (Davies et al. 2021), however, the challenge is to prepare for health response, especially when the number of infections is exceedingly large. With the spread of the virus in remote and rural areas, an effective administrative intervention is required to minimize the impact of the pandemic.

This research will explore local resilience to COVID-19 vulnerability in small-scale fisheries (SSF) and a way out for new normal. More specifically, it will help to understand the nature of vulnerabilities caused during coronavirus pandemic & way of dealing with these vulnerabilities through following objectives and sub-questions.

Box 1.1: **Following three objectives guide this research**

Objective 1	To understand the nature of vulnerabilities in fishing communities under the impact of the Covid-19 global driver 1) What are the existing vulnerabilities? 2) What are the new vulnerabilities emerged due to pandemic?
Objective 2	To examine the various coping responses by the fishing communities to the impacts of the Covid-19 global driver 1) What are the coping measures adopted by SSF & coastal communities? 2) How other actors like government, NGOs, civil societies responded?
Objective 3	Assessing possible governance arrangements for ensuring viability of the SSF during and post – Covid time, 1) How is governance mechanism working for the viability of SSF coastal communities? 2) Are there any plans or policies which ensures viability post COVID time?

1.3 Literature review

Relevant areas of literature are discussed in chapters 4 and 5. This section includes a synthesis of all relevant literature in order to justify a conceptual understanding used in this thesis. The three areas of literature that guides this thesis are stated as follows:

1) Small Scale Fisheries communities and drivers causing vulnerability –

an overview;

2) COVID-19 pandemic as a major driver;
3) Coping responses and viability

1.4 Methods and Methodology

The methodology of this research embraces a mixed-method approach based on a literature review (LR), and household survey. LR technique is used to obtain journal articles from online databases by using key words to be adopted from the objectives and research questions. Achievement of the research objectives entails primary data collection in the form of semi-structured household surveys (50 surveys) to be carried out in the study area itself.

During the initial data collection stage, the researcher was involved in several informal engagements and participant observations to gain a foundational understanding of community and vulnerabilities and build viability. Semi-structured interviews were preferred over structured and unstructured interviews because this method provides a balance of structure and the freedom to explore emerging themes by using a series of predetermined but open & closed-ended questions. They were conducted as a telephonic conversation between the interviewer and the interviewee, unfolding in an informal and conversational manner. Using preliminary data garnered from semi-structured interviews, shared knowledge that made it easier for the researcher to identify the linkages between existing vulnerabilities, new vulnerabilities due to COVID-19, drivers of vulnerabilities, and viability notions. Moreover, the discussions created a ground for participants to share their concerns and suggestions to the current community problems.

Results were analyzed using a descriptive research design, chosen due to its ability to systematically describe the facts and characteristics of persons and discover associations or relationships between the selected variables, including key drivers,

vulnerabilities, and facets of wellbeing. The data goes under a thematic analysis using qualitative analysis in MS Excel application. The literature review was a continuing component throughout the research, and fieldwork occurred throughout December 2021.

1.5 Significance and relevance of the study

This study is significant for three reasons: vulnerabilities, viabilities, and governance during the COVID-19 pandemic. The tough times of the COVID-19 pandemic have taught us that SSF vulnerable require the solutions for sustainable living and resilience during the pandemic. Transitioning from vulnerability to viability (V2V) is a crucial area of study that requires further attention. The Covid-19 crisis is a new type of unfolding disaster, for which short-term relief measures and longer-term adaptation and rehabilitation are required. (Ranjan et al. 2021).

Key considerations for all organizations and individuals aiming to support appropriate and effective responses include: ensuring we are not placing additional burdens or risks on these groups; engaging and prioritizing the voices of local SSF and communities in designing responses; providing specific support to vulnerable and often neglected groups; ensuring that responses respect and do not undermine Indigenous and local people's rights to harvest, consume and sell fish from their waters (WCS 2020), and ensuring reforms are not oversimplified solutions based on pre-existing agendas or worldviews that do not align with local contexts.

Government agencies have an important role to play in advising the fishing communities during the pandemic and after the resumption of their economic activities (fishing and tourism) in a safe way, without neglecting sustainability. However, the general strategies for the new normal are needed to integrate environmental issues (e.g., adaptation to climate change, sustainable practices) and challenges arising from the pandemic (e.g., solid waste and contaminants; eco-crimes). Lastly, it will be important to consider the medium and long-term impacts

of short-term responses. In the long run, cross-sectoral action will be needed to help rebuild the capacity and resilience of SSF and coastal fishing communities (Nathan 2020).

1.6 Thesis Overview

This thesis presents an empirical investigation of the vulnerabilities, livelihood, and wellbeing of fisherfolk residing in the Chilika lagoon. The thesis comprises six chapters in total – (1) Introduction, (2) Literature Review, (3) Methods, (4) and (5) Results, and (6) Conclusion.

Chapter 1 describes the background of the study, purpose, objectives and research questions, methods and methodology, and significance. It also provides a roadmap to the thesis.

Chapter 2 defines the key concepts, terms, and theories of the thesis work. It is a review of literature found on online databases regarding the vulnerabilities and viability from a social, ecological, political, and economic perspective. It also describes the various parameters of vulnerability, wellbeing, capitals, resilience, and their connection with the coping measures shown by the fishermen communities and institutions and government during the pandemic.

Chapter 3 depicts the methods and methodology used for the research work. The case study context is expanded, and the methodological approach and methods used to obtain information and conduct the research have been outlined.

Chapters 4 and 5 are the results and discussion of the key findings of research on existing vulnerabilities and new vulnerabilities added by the COVID-19 pandemic among fisherfolk, coping measures fishers took to survive and how institutions/organizations and government supported them. Chapter 4 deals with objective one (1) whereas chapter 5 focuses on objective two (2) and three (3).

Chapter 6 draws on the findings and discussions presented throughout the thesis to suggest which responses can help move the SSF or fisherfolk from Vulnerability to Viability (V2V).

Chapter 2

Vulnerability and viability of fisherfolk: Literature review

2.1 Introduction

With the surge in COVID-19 cases, the world was preparing to combat the pandemic by applying various measures. The major immediate response adopted worldwide was strict lockdown. Consequently, the lockdown obstructed the global economy and made the marginalised (daily wagers, fishers) suffer. The challenging (pre-pandemic) livelihood of marginalised communities, including small-scale fishers deteriorated during the pandemic. Therefore, this chapter (literature review) talks about the COVID-19 pandemic as a major driver causing vulnerabilities among fisherfolk and a way out to *new normal* as part of governance.

There are many important works both practical and academic in nature, which have informed this research and given it a strong foundation from which to examine the objectives. Three literature areas, in particular, provide conceptual direction to this research: (1) Small Scale Fisheries communities and drivers causing vulnerability – an overview; (2) COVID-19 pandemic as a major driver; and (3) Coping responses and viability. This chapter presents a literature review about vulnerability and viability, examining how the concepts have been conceived as areas of study and which methods are commonly employed to examine them, particularly in coastal small-scale fishing communities.

These literature areas are selected for the thesis from the objectives and research questions that guides not only the problem statement but also serve the purpose of the research. They also are individual topics by themselves with numerous definitions that will require some elaboration. The next section will focus on the SSF communities and will aim to describe the worldwide scenario. Other sections of this chapter will touch on the notions of moving from V2V, which is a fairly new

concept in the world of SSF. The parameters of 'V2V' – wellbeing, capitals, and resilience will also be discussed in this chapter. These literature areas were used as keywords for SLR, which is the method used for this chapter as well as chapters 4 and 5.

2.2 Small-Scale Fisheries (SSF) communities and fisherfolk

John Cordell (1989) captured the nature of SSFs in the title of his book – 'a sea of small boats'. This heading highlights two of the key attributes of SSFs: the small size of the units operating in the sector and also their sheer numbers and variety. These aspects colour the views on what constitutes the sector (Misund et al., 2002; Mills et al., 2011). I will use the FAO (2012) definition of small-scale and artisanal fishing:

"Fishing households [as opposed to commercial companies], using relatively small amount of capital and energy, relatively small fishing vessels [if any], making short fishing trips, close to shore." (Figure 2.1)

Figure 2.1: Showing small-scale fisher fishing using traditional equipment ***(***Bene 2009)

Thus, the most common attributes are households with limited range of operation, dependency on local resources, and low capital investment. Yet, in view of their numbers and distribution throughout the world, SSFs are by no means 'small.' Nearly 90% of the world's ca.120 million full-time or part-time fishers are estimated to derive their livelihood from the small-scale sector. They are estimated to contribute 70% of the total world catch (inland fisheries included) which is used primarily for domestic human consumption (BNP, 2008; Mills et al., 2011). An additional 200-300 million people – many of whom are women – are projected to be employed in the value chain, mostly through informal arrangements. These figures, however, are most likely under-estimates as they derive from official statistics where SSFs are rarely well accounted for (Mills et al., 2011). SSFs are, therefore an important but underrated source of employment, food security, and income (Béné et al., 2010; Jentoft and Eide, 2011), particularly in the developing world and in rural areas (Béné, 2006; Béné et al., 2009a).

2.2.1 Coastal communities, livelihood, and uncertainties

Coastal communities around the world have relied on marine resources as a mainstay of their livelihoods for several decades. It is widely recognized that these resources make multiple contributions to societies, cultures, and the economy, especially in terms of employment, food security, income, and revenues (Allison et al. 2001; Allison et al. 2009; Zeller et al. 2006; Béné 2006; Teh et al. 2011; Belhabib et al. 2015). In terms of conservation, Pauly (2011) states that small-scale fisheries have the potential to be the fisheries of the future. As coastal communities are connected with their natural resources and therefore hold a sense of belonging, it is suggested that they will employ less-destructive fishing practices. Although benefits from small-scale fisheries far exceed those from large-scale industrialized fisheries (Pauly 2006), they are frequently overlooked and neglected in mainstream policy worldwide (Chuenpagdee 2011; Thorpe 2004; Zeller et al. 2006).

Coastal communities commonly face uncertainties due to resource fluctuation, financial uncertainty, and environmental risk. The poor health of the oceans creates hardship for resource dependent fishers, thus changing behaviours like moving to other fishing grounds or venturing further offshore (Salas et al. 2004; Saldaña et al. 2017; Naranjo-Madrigal and Bystrom 2019). In these circumstances, enduring threats to meet basic needs become difficult for fishing people, making them vulnerable. In some cases, coastal fishing households are able to diversify livelihood activities (IMM et al. 2005; Frangoudes 2011). In other cases, people adopt migration as a livelihood strategy to reduce their vulnerability, moving either within the country or beyond (Islam 2011; Kheang 2013) as a response to economic opportunities offered in other places, acting as a 'pull factor' (Islam and Herbeck 2013).

The following section explains the role and types of vulnerability causing drivers among small-scale fishers. Drivers may impact the sustainability of small-scale fisheries at local and regional (sub-national) levels, and these changes, in turn, may impact sustainability or viability at higher levels.

2.2.2 Role of multi-level drivers causing vulnerability

Global change drivers affect all the various productive systems in the world and create problems that have no easy solution (Chuenpagdee 2011). Drivers of change is a concept employed in many disciplines like agriculture, architecture, engineering, environment, business, management, economic and human development (Arlett et al. 2010; Assessment 2005; Booth et al. 2006; Geist & Lambin 2002; Grumbine et al. 2012; Hameri & Hintsa 2009; Hazell & Wood 2008; Kirsch et al. 2011; Lead et al. 2005; Nayak & Armitage 2018; O'donnell et al. 2001; Vecchiato & Roveda 2010; Wise 2002). A single driver can potentially have an impact on a cross-section of aspects within the social- ecological system, i.e., social, economic, political, cultural, institutional, biophysical, and environmental, with perceivable variations in the intensity of impact on the different components

of the social-ecological system (Nayak 2014). A combination of different drivers can also have similar impacts: an economic or ecological driver will not only have an impact on the economic or the biophysical components of the system, respectively. Thus, a global economic driver, such as globalization or international market shifts, can potentially influence other aspects of the system, including the ecosystem. The following table (2.1) congregation of different types of drivers is adopted from the paper by Nayak & Armitage (2018).

Drivers can be classified as natural and anthropogenic, based on source of occurrence (Galatowitsch 2018). (Table 2.1).

Table 2.1: Description of types of Drivers of Change (Nayak & Armitage 2018)

Type	Definition
Natural	A change occurring in the SES that is induced by nature or driven by natural pressures that are unavoidable and unstoppable. Example – Natural disasters, geo-hydrological disturbances
Anthropogenic	A change that is occurring due to human influence on the environment which has significant impacts on the social, economic, and ecological components of nature. Example – Opening of artificial sea mouth in Chilika Lagoon, India; Extensive shrimp aquaculture in Tam Gang Lagoon, Vietnam.

Several people are involved in fishing activities as capture fisheries are the major contributor to the state's economic development. These are now being lost at an alarming rate because of anthropogenic factors (clearing of forests for aquaculture and agriculture, harvesting for construction materials, paper pulp, fuelwood) and

natural drivers (recurrent storms, erosion, sea level rise) (Chacraverti, 2014; Rivillas-Ospina et al., 2014; Ouyang et al., 2017; Prosser et al., 2018).

These factors affect the SSF communities by increased occurrences of migration, overfishing, occupational displacement, human-wildlife conflict, and lack of livelihood alternatives (Abdullah-Al-Mamun et al. 2017; Guha & Roy 2016; M. M. Islam & Chuenpagdee 2013; Loucks et al. 2009; Ortolano et al. 2017; Vivekananda et al. 2014). People have been shifting to extensive aquaculture to obtain foreign exchange earnings, reduce poverty, promote economic growth and development, and increase food security (Chacraverti 2014). Industrial aquaculture has been able to meet the increasing global demands for marine products (Thomas et al. 2017). Due to all these factors, SSF communities have been pushed towards vulnerability. Some of the major drivers of change are outlined in Table 2.2 below.

Table 2.2: Natural and Anthropogenic drivers of change

Drivers	**Examples**	**Source**
Natural	Cyclones, Flooding, Salinization, Erosion, Sea-level rise, Geohydrological changes	(Blythe et al. 2014; Hossain et al. 2018; Lara et al. 2009; Malakar et al. 2018; Mendelsohn et al. 2012; Moniruzzaman et al. 2018; Paul 2009; Thomas et al. 2017)
Anthropogenic	Conversion of lands for Aquaculture, Agriculture, Coastal Development, Unsustainable Development Practices, Deforestation, Pollution, Tourism	(Aburto-Oropeza et al., 2008; Banerjee et al., 2012; S. K. Chakraborty, 2011; Knowler et al., 2009; Kumar, 2012; Lotze et al., 2006; Osland et al., 2017; Primavera, 2000; Salunke et al., 2020; Worm et al., 2006)

2.2.2.1. Natural drivers –

Increased incidences of cyclones, flooding, salinization, erosion, sea-level rise in the coastal areas have been studied by scholars worldwide, who defined these

occurrences as natural disasters caused by extreme weather events, climate change, and global warming. Accordingly, this thesis will refer to them as natural disasters. This is because they occur naturally, and no action of humans directly drives it.

Cyclones and Flooding – Blythe et al. (2014) stated that cyclones have become more prevalent along the coasts of Mozambique, which made the local people vulnerable to future droughts and inland flooding, eventually causing more than 800 casualties. Occurrence of this kind causes extreme occupational hazards during fishing along the coasts of Maharashtra (Malakar et al., 2018). Most of the damages caused by tropical cyclones are concentrated in North America, East Asia, and the Caribbean which is an impact of global climate change with the potential to increase in specific oceans and their basins (Mendelsohn et al., 2012).

Flooding is natural on coasts, but when the water does not recede, it causes rotting of mangroves, health issues for coastal communities, and reverses geohydrology. Along with ecological and economic damage, they also hamper the livelihoods dependent on fisheries as the storms destroy their houses, boats, and other fishing gear (Sen, 2020). This, in turn leads to a disconnect between the fisheries sector and the people urging them to migrate in search of a safer and financially promising place (Moniruzzaman et al., 2018).

Salinization and Erosion – The rivers draining into their subsequent coasts have the ability to drag down sediments, salts, and silt to the deltas causing sedimentation (Elliot, 2002). These contribute to the ecosystem dynamics as well as to the geomorphology and hydrology of the region, which naturally causes the salinity gradient to increase. Similarly, other drivers like cyclones and flooding lead to an increase in the salinity of the soil, pond, and drinking water (Hossain et al., 2018). Salinization is also a direct impact of cyclones and flooding which changes the pH balance of the water, causing death of vegetation, certain fish, and crustaceans. It also affects the health and sanitation of the SSF communities dependent on these

waters (Lara et al., 2009). Ultimately, it leads to the displacement of the SSF communities (Hossain et al., 2018).

2.2.2.1 Anthropogenic drivers

The coastal development has led to the degradation of the ecosystem of Chilika which consequently is impacting the fishing communities. Extensive aquaculture, tourism, pollution, and hunting are the known contributors for the vulnerabilities among fisherfolk. Because these drivers are a result of human action, they are called anthropogenic (Banerjee et al., 2012).

Aquaculture - Shrimp aquaculture is a widespread practice in India (Banerjee et al., 2012; Manoj & Vasudevan, 2009). It is considered a somewhat traditional practice that changed with the advent of commercial aquaculture in India, especially in Kerala and West Bengal (Salunke et al., 2020). Suddenly, in the 1990s, there was an increasing demand for brackish water shrimp and its production skyrocketed from 3868 tons in 1980 to 130,805 tons in 2005, making India the world's fourth largest producer (FAO, 2005). Knowler et al., (2009) find that West Bengal contributes to 34% of the potential shrimp cultivation lands in the Indian Subcontinent, attracting developmental projects and large-scale fisheries for aquaculture.

SSFs have been unrecognized and unregistered by management agencies as they lack a universal definition due to their incidental description (Berkes et al., 2000; Chuenpagdee & Jentoft, 2009). Although these communities are found worldwide, 'small-scale' still is a clear descriptor of this group of fishing communities unified by social, structural, and institutional characteristics, thereby affecting their governance (Eriksson et al., 2015).

2.3 COVID-19 as a global driver

The vulnerabilities among fisherfolk can be caused due to any driver at any level. One such current global driver is impacting the universe from the year 2020. On

31st December 2019, the Country Office of the World Health Organization (WHO) in the People's Republic of China picked up a media statement by the Wuhan Municipal Health Commission on cases of "viral pneumonia" in Wuhan, People's Republic of China. Later, on 5th January 2020 the first Disease Outbreak News Report was issued by WHO that significantly highlighted "WHO"s recommendations on public health measures and surveillance of influenza and severe acute respiratory infections still apply"; it was followed by the official confirmation on Novel Coronavirus being the cause of outbreak on 9th January 2020. Later on, 11th March 2020, COVID-19 was characterized as a Pandemic by WHO (WHO, 2020). Till now, COVID-19 has caused tremendous apathy across the globe, with total 15.4 million confirmed cases and a death tally of 620 thousand worldwide. In the Indian context, the figures for confirmed cases and death tally have touched 1.24 million and 29 thousand, respectively (till 23rd July 2020).

Since the virus has spread to almost all countries, leading to millions of cases and thousands of deaths (JHU 2020). Most countries implemented the social distancing measures, or more stringent lockdowns, in efforts to slow the spread of the virus and "flatten the curve" of hospitalizations and deaths (IMF 2020). National economies had taken a major hit and unemployment numbers had soared – with dire predictions that the economic effects could be as bad as the Great Depression (IMF 2020). Unfortunately, beyond the discourse of infection curve, mortality rate and measures to contain the spread, there lies a grey area that deals with a socio-economic aspect of COVID-19 and lockdown. Global analysts have already suggested that, for many developing countries, the economic consequences could be more crippling and devastating than the disease itself. Considering the uncertainty attached to the magnitude of COVID- 19 further, an accurate assessment of the impact of COVID-19 on the economy is still not possible. But unarguably, there is and will be an economic downturn expected at the global level; trickling down to developing economies, this economic downturn can further

exacerbate existing food insecurity, livelihood insecurity and vulnerability (Beltrami, 2020).

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In the year 2021, the second wave of COVID-19 created more severity and casualties. While nations were taking extensive measures to accelerate the vaccination drive in order to control the pandemic at the earliest, a public health challenge had appeared due to mutations of the SARS-CoV-2 virus which made it highly contagious. There was no clear evidence of the severity of the new mutations (Davies et al. 2021), however, the challenge was to prepare for health response especially when the number of infections was exceedingly large. The second COVID-19 wave in India, which began on February 11, 2021, presented a grim situation as the number of cases crossed 0.29 million a day on April 20, 2021. The data suggested that the virus was much more infectious than the first wave, but the number of daily deaths per infection was lower. However, with an inordinate increase in the number of cases and an over-stretched healthcare system, the daily death count may increase substantially (Ranjan et al. 2021).

2.3.1 Consequences of pandemic – an overview

Many fisheries faced complete shutdowns at the onset of social distancing restrictions as if they were not considered vital to national food supply systems (e.g., Namibia (Immanuel 2020)). Such indiscriminate lockdowns on fishing activities arguably reveal a pre-existing tendency to underplay the role of fish in food systems (Béné et al. 2015). In India, for example, fisheries were entirely closed down initially (contrary to farming), and only after significant pressure from civil society pointing to their vital role in food provisioning was fishing allowed to continue operations within some bounds (Mohan 2020). Even where fishing is deemed an essential service, social distancing measures have precluded many small-scale fishers from going fishing due to vessel size or trading in close quarters in local markets (Orlowski 2020).

Knock-on economic effects from market disruptions have further impacted small-scale fishers' ability to pursue their livelihoods through 'twin disasters' of reduced demand and attendant collapse of prices. Export-oriented SSFs have faced a vast reduction in demand (particularly from Asia, the United States, and Europe), port closures, loss of access to cold storage, and cessation of shipping and air freight (Orlowski 2020).

Fishers, processors, and sellers also faced risks of COVID-19 spread and infection and thus have made difficult decisions – feeding their families or risking exposure. Fishing communities and ports could potentially become "hotspots" for rapid infection due to the migratory nature of fishers and the frequency of international visitors (FAO 2020). For migrant fish workers, COVID-19 has added another layer of vulnerabilities to this often-invisible worker population. Their working and living conditions render them vulnerable to transmission of the virus. Racism and marginality have heightened the fear and suspicion that they might be a source of infection. Travel restrictions have also increased vulnerability to exploitation, abuse, and mental health problems, and their precarious legal status and isolation at sea and in ports, combined with language barriers, undermine access to health care and emergency social security (Marschke et al. 2020).

Existing vulnerabilities of some groups or individual, related to global structural, social, and economic inequality exacerbated the health, economic, and other impacts of COVID-19. For example, migrant fishers faced combined stress from lost income, inability to support families, shortage of basic necessities, and exclusion from government relief schemes. Reports from India indicated many migrants were stranded on vessels or in harbours, unable to return home, living in cramped living conditions without adequate water or food (Pandey 2020).

Also, the children were vulnerable to increased rates of child labor and abuse, as schools closed, formal economies were restricted, and parents fell ill (Kundu 2020;

Harvey 2020). Rural and isolated Indigenous communities were particularly at risk as they may have reduced immunity and access to healthcare. More than a dozen Indigenous groups have confirmed COVID-19 cases across the Americas, and many have opted to close access to their reservations (Turkewitz 2020). Access to health services in rural fishing communities is difficult even under normal circumstances (Orlowski 2020), and thus these locations likely had a harder time accessing testing, treatments, and sanitation supplies needed to adequately address COVID-19 spread and infection (CFFA 2020a).

A study conducted by Schippers 2020 calculated the side-effects of the COVID-19 pandemic from various perspectives. The following table 2.3 provides a general outline on the side and ripple effects of the pandemic estimated globally.

Table 2.3: Showing non-exhaustive overview of the effects of the pandemic and related lockdown measures

Side Effect	***References***
Physical Health	
Estimated 100 million casualties in low and middle-income countries, as an indirect effect of the virus, and the lockdown measures (early estimate).	Zetzsche, 2020
138 million people face starvation as economies and livelihoods are interrupted by the pandemic (updated estimate).	Kennedy et al., 2020
COVID-19 likely to lead to increased maternal and child mortality indirectly, via disrupted healthcare, decreased food access, health system and economic collapse.	Roberton et al., 2020
Access to other forms of healthcare may be limited, as doctors are redirected, and people fear seeking care, leading to worse health outcomes in the long run. Risk of many deaths from health problems not related to covid-19.	Heath, 2020 Gorvett, 2020
There has been a significant increase in the number of major amputations during lockdown as patients wait longer to seek medical care for non-covid-19 illnesses.	Schuivens et al., 2020
Quarantine stress increases the risk of cardiovascular health problems.	Mattioli et al., 2020

Access to reproductive healthcare during lockdowns is limited which leaves some women without access to care they need.	Quell, 2020 Kibira, 2020
Mental Health	
The pandemic could lead to a significant rise in suicide mortality in the coming months.	Mark et al., 2020 Lennon, 2020
Worsening mental health concerns as stress, depression, and anxiety increases.	Fiorillo and Gorwood, 2020
Current decrease in access to mental healthcare may result in worsening mental health of the general population, with people with existing conditions being most at risk.	Torales et al., 2020
Those with pre-existing mental health conditions are most at risk of having increased mental health issues due to the pandemic. Pandemic triples anxiety and depression symptoms in new mothers.	Druss, 2020
A significant increase in rates of insomnia may worsen stress, anxiety, and other existing mental health issues, especially in frontline workers.	Davenport et al., 2020
Mandatory lockdowns or quarantines may have an especially large negative effect on individuals suffering from social anxiety.	Lin et al., 2020 Morin and Carrier, 2020
Economic Effects	
The total worldwide economic cost of the pandemic could reach $8.8 trillion.	Zheng et al., 2020
The pandemic coupled with government relief packages being put into place could result in a worldwide deficit of $30 trillion by 2030.	Takagawa, 2020
Half of world's workers 'at immediate risk of losing livelihood due to coronavirus.	Assi et al., 2020
Despite efforts to minimize layoffs, 60 million EU jobs are at risk, and mass layoffs are predicted for the near future.	Inman, 2020
Over 54 million Americans have applied for unemployment aid for the first time.	Riley, 2020 Alderman, 2020
The lockdown is likely to have a disproportionately large effect on young workers, who make up the majority of industries highly affected by layoffs (service industry etc.).	Jones C., 2020
Social Effects	

The physical and mental health of frontline workers like healthcare workers, and those working in food distribution may be at risk.	Kang et al., 2020 Greenberg et al., 2020
Domestic violence deaths have more than doubled from this period in previous years.	Grierson, 2020 Bradbury-Jones and Isham, 2020
Homeless and refuge population left at risk as lockdown limits access to help resources and leaves them unable to shelter in place.	Sharma, 2020 Limam, 2020
Increase in gun purchases and gun violence in the USA since the beginning of the pandemic.	Schleimer et al., 2020
The pandemic will likely result in an additional 30 years to close the gender pay gap in Britain.	Hunt, 2020
Effects on Children	
UNICEF warns 1.2 million children could die malaria, pneumonia, and diarrhoea during the lockdowns in developing countries.	Newey, 2020
The pandemic is likely to leave a lasting influence of the mental health of children and adolescents.	Fegert et al., 2020
368 million children missing out on meals at school and school closures overly affects children from poorer communities.	de Jong, 2020 Van Lancker and Parolin, 2020
Children from pooper communities likely to suffer the most as education moves online for many communities, and nearly half the world still doesn't have ready access to the internet.	COVID-19's Devastating Impact on Children, 2020

(Source: *Schippers 2020)*

Natural catastrophes have also aggravated the condition of SSF. Tropical Cyclone Harold (category 4–5), hitting the Solomon Islands, Vanuatu, Fiji, and Tonga in April 2020, had raised issues related to the opening of evacuation centres without adequate sanitation or social distancing capacity (Du Parc and Spieth 2020) and access to international aid with closed borders (Gunia 2020). There were also likely reverberating impacts on the marine environment. Decreased human observer coverage and lapses in monitoring and enforcement lead to increased occurrence of Illegal, Unreported and Unregulated (IUU) fishing and incursions into areas used by SSF (Thomson 2020; CFFA 2020c). During this stretch, it was also observed

that worldwide, attention towards social (with an emphasis on health) and economic issues, had left environmental issues in second place. For instance, the most commonly available masks were found commonly dumped anywhere. The improper disposal of masks increased the risk of the spread of the virus, which has become a burning issue.

A study conducted in 2020 as a Global Human Confinement Experiment identified positive and negative effects of human presence and mobility on a range of natural systems, including wildlife, and protected areas, and to study processes regulating biodiversity and ecosystems. In Figure 2.2 below, effects are positive (solid line) or negative (dotted line) where color identifies the causal mechanism of the proposed change, and the arrowhead indicates directionality. Numbers identify examples (legend) of proposed inter- actions (Bates et al. 2020).

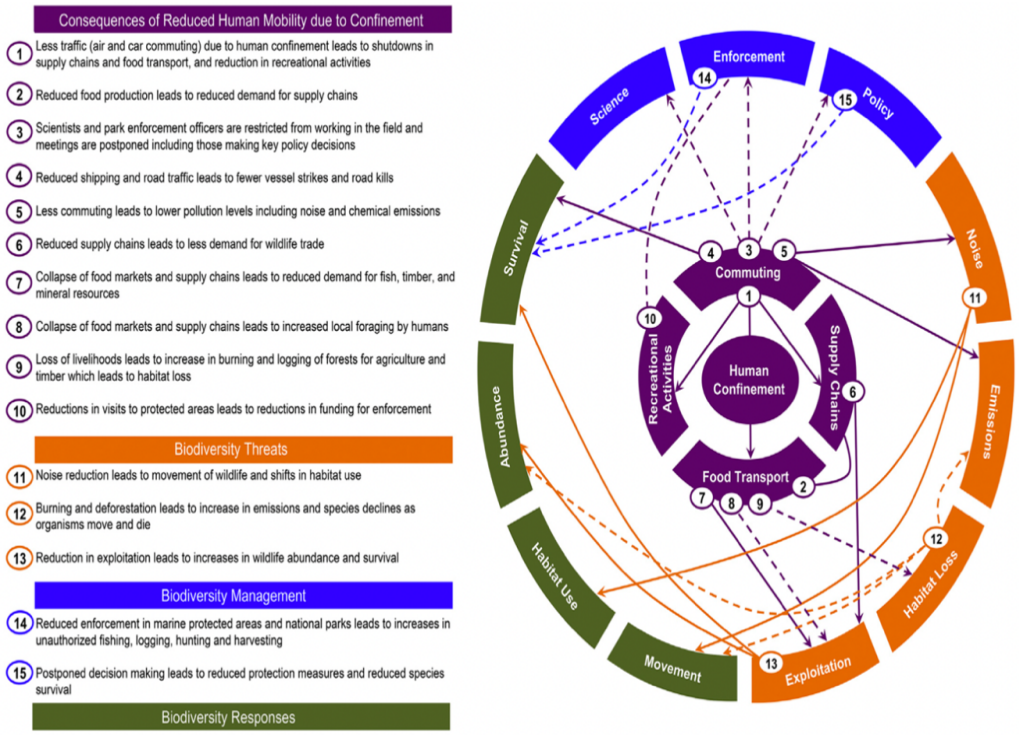

Figure 2.2: Emerging examples of cascading effects arising from the large-scale confinement of humans (Source: Bates et al. 2020)

Human confinement (Human Confinement: Fig. 2.2) resulted in reduced air, land, and water travel (Commuting: Fig. 2.2), with some initial effects on biodiversity being positive. For example, in many places, manufacturing and commercial exploitation of natural resources (e.g., fish and timber) subsequently decreased. As a result, air and water quality improved, noise pollution declined (Muhammad et al., 2020; Zambrano-Monserrate et al., 2020), while in some places, the exploitation of natural resources declined. Most notably, daily global CO_2 emissions have abruptly decreased by 17% in the initial months of the lockdown (Le Quéré et al., 2020, Emissions: Fig. 2.2). Presumably, fewer animals are being killed in the sea by ships and by vehicles on roads (Biodiversity Responses: Fig. 2.2), and sightings of animals in areas otherwise under heavy human influence, such as harbours and cities, have been attributed to lowered pollution (e.g., Noise: Fig. 2.2) and human activities in protected areas. A decline in manufacturing, the service and retail industries (Supply Chains: Fig. 2.2, e.g., Gray, 2020), and the production and transport of food (Food Transport: Fig. 2.2) have led to reductions (in some cases) in logging activity, wildlife trade and commercial fishing. Some conservation effects of the global human confinement may be transient and disappear soon after confinement relaxes, while others may be long-lasting (Casale and Heppell, 2016), such as strong recruitment success of long-lived, endangered marine species. For instance, anecdotes suggest marked recruitment success of the critically endangered Olive Ridley Sea turtles in India due to reduced human activity (fishing and vehicle traffic) on their nesting beaches (B.C. Choudhry, pers. comm.).

Restrictions on human mobility also created negative direct and indirect impacts through changes to enforcement, science and policy (Fig. 2.2). Lack of mobility has exacerbated unemployment and economic insecurity, which may explain reports in remote and rural areas of increasing wildlife foraging, illegal fishing, habitat conversion for agriculture, and other resource extraction activities that support livelihoods but also pose biodiversity threats (Fig. 2.2, e.g., Buckley, 2020). For example, in certain tropical areas of the world, increased cutting and burning of forests is reducing habitat (Habitat Loss: Fig. 2.2). In many places, decreased

conservation enforcement because of the pandemic lockdown is facilitating poaching and illegal fishing (Buckley, 2020). Temporary declines in ecotourism to national parks and other protected areas (Recreational Activities: Fig. 2.2) may influence local revenue, park staffing and funding for anti-poaching and wildlife management programs (Buckley, 2020). In many areas, restoration projects have been postponed or may even be discontinued, which may result in a failure to reach conservation targets. Management programs to control pests may be suspended, leading to outbreaks. For example, the large-scale up- surge of desert locusts in the Greater Horn of Africa and Yemen are being attributed (in part) to the lockdown and the disruption of control efforts (Amir Ayali, pers. comm.), exacerbating food shortages for tens of millions of people and extensive environmental damage (FAO, 2020a).

This framework later helped in developing the original framework of the thesis by providing insights on positive and negative impacts of pandemic. It provided a broad notion on the wellbeing and livelihood worldwide – which were studied as vulnerabilities under objective 1 in case of SSF.

2.4 Viability studies to deal with vulnerabilities

The SSF sector remains vulnerable to shocks. The COVID-19 breakout that happened in the year 2020 presented major challenges causing economic instability, social and health degradation. To deal with the COVID-19 vulnerabilities (explained in section 2.3) and also with the existing vulnerabilities which continued during pandemic, there is a need to look at the solutions for the viability of fishers.

Research into vulnerability and viability has provided visibility to small-scale fisheries for the last two decades. Vulnerability and viability are concepts that include multiple parameters – wellbeing, livelihood capitals, resilience, coping and adaptive responses – to indicate the state of the system or community at a certain

time of risk and the ability of the same to survive given the unfavorable conditions (Nayak & Berkes, 2019). According to Chuenpagdee and Jentoft (2018), SSF vulnerability can be perceived as "multidimensional, complex, highly dynamic and relational". Individually, these disciplines provide a 'tunnel vision' look at vulnerability (Brown, 2014; Faulkner, Brown, & Quinn, 2018; Aguilar-Perreraet al., 2017). It is a state of susceptibility resulting from a lack of livelihood assets – ecological, human, physical, social, and financial (Fischer, 2014; Béné et al., 2011). There are a number of vulnerability indices that have been used for examining the measure of exposure of the environment or society to any type of hazards (Edmonds et al., 2020; Flanagan et al., 2011; Wolkin et al., 2015). These indices have numerous indicators that have a numerical value and are considered for a quantitative research approach.

Viability can be defined as a state when the communities develop resiliency towards potential risks, obtain satisfactory livelihood capitals, and move forward to achieve social wellbeing disregarding vulnerabilities and externalities. Vulnerability is used as an umbrella term that encompasses individual concepts of wellbeing, livelihood capitals and resilience. To analyze the multidimensional vulnerabilities and examine the pathways to viability, this thesis draws concepts from wellbeing (Armitage et al., 2012; McGregor, 2008; Weeratunge et al., 2014), livelihood capitals (Chen et al., 2013), resilience (Berkes et al., 2000; Berkes & Turner, 2006; Holling, 1973) and coping and adaptive responses (Nayak, 2017; Walker et al., 2004).

2.4.1 Wellbeing

Wellbeing is defined more of a social behavior concept as it is "*a state of being with others, where human needs are met, where one can act meaningfully to pursue one's goals and where one enjoys a satisfactory quality of life*" (McGregor, 2008, p3). It has three dimensions – material, relational, and subjective- influencing the level of vulnerability and viability within a specific context (Andrews et al., 2021;

McGregor, 2008; Weeratunge et al., 2014). Each of the parameters used to define wellbeing is connected to the livelihood assets, community and ecosystem resilience. Wellbeing is understood as an outcome that is attributable to the parameters of vulnerability. It can also be used as a comprehensive method to address the issues of livelihoods of SSF communities from a SES's perspective (Charles et al., 2012).

The MEA (2005) examined human wellbeing by considering its structure based on basic materials needed for a good life, health, good social relations, security, and freedom of choice and action. 'Social wellbeing' has emerged as one distinct interpretation of wellbeing approach, summarized by three dimensions: material (e.g., resources, income, assets), relational (e.g., access to markets, institutions, social capital), and subjective (e.g., self-identity, aspirations, happiness) (Figure 2.3) (White, 2009a, 2009b). The arrows shown in the figure suggest the inter-relationship and co-constitution of the various dimensions of wellbeing (White, 2009a). This analytical structure in the social wellbeing approach is latent in its definition of wellbeing (McGregor, 2008): "A state of being with others and the natural environment that arises where human needs are met, where individuals and groups can act meaningfully to pursue their goals, and where they are satisfied with their way of life" (Armitage et al., 2012, p. 3; Breslow et al., 2016, p. 2).

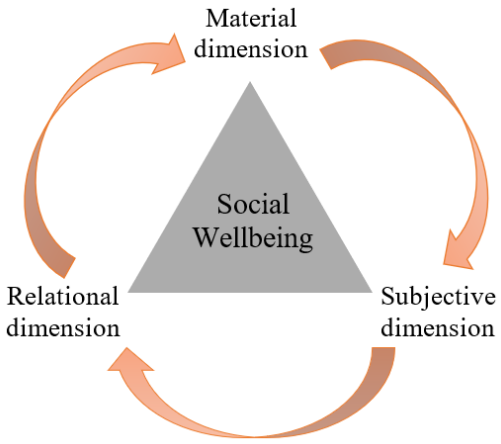

Figure 2.3: Visualization of the three dimensions of social wellbeing

Note. Adapted from White (2009b).

2.4.1.1 Social Wellbeing in Small-scale Fishing Communities

The "wellbeing of communities is an essential precondition for the wellbeing of individuals" (Wiseman & Brasher, 2008, p. 355). This statement finds support in the 2016 report of the Organization for Economic Cooperation and Development (OECD), which states, "people's happiness depends to a large extent on the circumstances of the broader community they are part of and their relationship to it" (OECD, 2006, p. 34). The epitome of wellbeing in a community is one in which "the needs, values, and norms of different community segments" (McCrea et al., 2014) are met. Therefore, the promotion of community wellbeing can play a significant role in improving the mental and emotional wellbeing of individuals.

Coulthard (2012a) suggests that the social wellbeing lens may offer a means for in-depth social impact assessments. When a wellbeing lens is applied to the context of small-scale fishing communities, it captures certain outcomes beneficial to fishers, including material goals like economic yield, food source, and employment; and non-material goals such as work safety, equitable working conditions; or the preservation of ecological values in their marine and coastal environments (Allison et al., 2012; Coulthard et al., 2011). The application of a wellbeing lens, encompassing all three dimensions, facilitates a better

understanding of the multifaceted reality that fishing communities live in. It provides an analysis of both the improvements and trade-offs that fishers experience and can contribute to governance approaches by providing the basis for fishery management measures. Previously available fisheries literature placed a large emphasis on a narrow single objective viewpoint of wellbeing (see Anderson, 1987 as an example). This perspective confines individual and community wellbeing in fisheries context solely to monetary constituents, without giving due consideration to the intangible relational and subjective dimensions of wellbeing. As fisheries are multi-scaled and involve a multitude of objectives, all three dimensions (material, relational and subjective) should, therefore, be equally considered in governance-related decision-making.

The material dimension of wellbeing is concerned with the resources a community has and the degree to which they meet the community's needs. It also encompasses practical welfare and standards of living (for example, income, wealth, assets, environmental quality, physical health and livelihood concerns, among others). In academic circles, small-scale fisheries remain understated worldwide because the majority of research is often guilty of evaluating them just in terms of material dimension and not the other dimensions (i.e., relational and subjective) which existed in the sector and are equally important as material dimension. Indeed, the social wellbeing framework could help the researchers and policy makers to better understand the challenges that fishing communities face by recognizing its objective, relational, and subjective components in an integrated way.

The relational dimension of wellbeing is rooted in as how rich a community's social capital, which allows individuals to steer themselves within their community's social hierarchy and enter social networks. Social capital is defined by Weeratunge et al. (201“) as "features of social organizations, such as networks, norms, and trust that facilitate action and cooperation for mutual benefit" (p. 266). Having a diversity of social relationship for "dependency, obligation, support, receptivity and collective action in fishing communities can determine both a person's wellbeing

outcomes and fisher behavior" (Coulthard, 2012a, p. 361). The relational dimension also highlights that what we value in our environment materially (material wellbeing) and how we perceive how we are doing (subjective wellbeing) depends on our relationships with others and with the ideas that frame our social relations (Coulthard et al., 2011; Deneulin & McGregor, 2010; White & Ellison, 2007).

The subjective dimension of wellbeing relates to the importance of perceiving fishing as a 'way of life' and job satisfaction of fishers (Allison et al., 2012). A core concept of this dimension of wellbeing is identity, embodied as one's fears, hopes and aspirations (Weeratunge et al., 2014). Many fishers associate their occupation with their identity, taking great pride and high devotion to the fishing way of life. McGoodwin (2001) states that "the fishing occupation often confers not only important markers of self-identity and individual pride among fishers but a 'satisfaction bonus', which could not be measured on economic grounds alone" (p. 14). Most fishers perceive fishing not only as a means to accrue income but also as an "intrinsically rewarding activity in its own right - a desirable and meaningful way of spending one's life" (McGoodwin, 2001, p. 14). The fishery is seen as a means of self-actualization, with strong occupational attachment driven by adventure and challenge. In most coastal communities like Sagar Island (study area of this research), fishing is an interwoven component of society, highly influencing cultural, economic and political facets. Further, what is required is an approach that highlights an almost quantifiable assessment of the positives that small-scale fisheries have to offer globally (Pauly, 2006; Thomson, 1980). The social wellbeing approach frames such analysis, as its theory meets these criteria because it is interested in it the diverse and multi-dimensional needs and aspirations that characterize what it is to live well for particular people in particular times and places (Agarwala et al., 2014).

2.4.1.2 Social Wellbeing Indicators

Wellbeing literature offers a multitude of indicators with which to measure and quantify the state of an individual's and community's wellbeing. The literature reflects a general usage of social wellbeing as a blanket term for good social relations, a category of human wellbeing (MEA, 2005), and social welfare (see Abunge et al., 2013; England, 1998; Porter, 2012). As different communities' preferences may vary depending on the culture and society they belong, the literature argues that a single or universal objective of wellbeing should not be followed (Lee et al., 2015). For the scope of this research, relevant indicators of social wellbeing, as conceptualized by White (2009a), are indicated in table 2.4. These indicators provided a foundation for wellbeing-related data analysis and were chosen for their relevance to small-scale fishing communities as also backed by existing literature.

Table 2.4: Social wellbeing indicators and examples

Dimensions	***Indicators***	**Examples**
Material	Raw material resources	Access to provisioning ecosystem services, species and natural materials targeted for fishing or collection
	Other material resources	Access to fishing boats and nets, income, assets, level of consumption, social welfare provision, housing quality, public infrastructure, health services, availability of food and water, sanitation, land, money, credit, shops
	Social support network	Information, goods and services, status within society, emergency access system
	Human resources	Age, life experience, source of livelihood and diversity, job security, formal and informal education, marital status, physical health
Relational	Organizational belonging	Social, political, cultural affiliations (e.g., religious groups), fisher groups (e.g., co-ops, networks), perceived position in household and in community, regional and national

		institutions, global markets and international institutions
	Societal infrastructure	Laws and policy, political autonomy, employment and livelihood opportunities, access to public goods, schools, colleges, clinics, hospitals, places of worship
	Social capital	Support networks, personal relationships, community and family cohesion, strength and diversity of social ties, class, religion and caste relations, equity, leadership, kinship, love and care
Subjective	Identity	Social, political, cultural identity (e.g., ideologies influenced by caste, gender, religion, race, ethnicity, age, disability), mental health, sense of place
	Perceived quality of life	Aspiration gap (i.e., people's interpretation of whether they have achieved their goals), beliefs, values, norms, satisfaction (i.e., the gap between ideal and actual reality), hopes, fears

Note. Adapted from Armitage et al. (2012a); Britton & Coulthard (2013); Weeratunge et al. (2014); White (2009a).

2.4.2. Livelihood capitals

Livelihood capitals includes human, social, natural, physical, and financial capital (Chen et al., 2013) thoroughly evaluated livelihood capitals in China's community-based co-management projects for commons governance. The paper also puts forth the indicators of each of the capitals, which are discussed in table 2.5. It was estimated from a study on fishing communities in Sri Lanka, that better education and literacy rates help in the capacity building of these capitals (Silva & Yamao, 2007).

Table 2.5: Indicators of livelihood assets (Chen et al., 2013)

Capitals	Indicators
Physical	Household fixed assets, durable goods, access to benefits
Natural	Management of the wetlands and fisheries
Human	Skills and knowledge regarding fisheries
Financial	Income and Expenditures
Social	Family decisions, community participation and membership, social networking

These capitals are linked to the variables affecting vulnerability, local institutions and governance linked to collective action whose effects vary with the indicators of social capital (Mwakubo & Obare, 2009). If there is any change in the natural capitals, it is likely related to the positive approach of ecosystem sustainability. While capacity building and skill development boosts human capitals in effective management of fisheries. Mwakubo & Obare (2009) linked these capitals with the variables observed in Lake Victoria, Tanzania, which were floods, droughts, and diseases. Chen, et al., (2013) argued that income and expenditure as financial capitals are key components of social wellbeing. Regardless, each of the indicators of the livelihood assets is related to the wellbeing of SSF communities in one way or another (table 2.5).

2.4.3. Resilience

In a broad sense, 'resilience' is about the capacity of systems to adapt to shocks, recognizing that disturbance and change are integral components of complex systems. More formally, resilience analysis proposes to focus on mechanisms and processes that help systems absorb perturbations and shocks and cope with uncertainty and risks. Defined in such a way, the concept of resilience thus appears particularly useful for the management of small-scale fisheries. While the resilience

concept is appealing, particularly in the face of the failure of current management approaches, the danger is that it remains largely academic and theoretical and not of great help in effectively improving the way natural resources are managed on the ground (Bene 2008).

Under the resilience approach, management is not about looking for the unique, or 'fair' solution; it is about negotiating a set of acceptable configurations and agreeing on interventions, incentives, or constraints to stakeholder behaviors to ensure that the system stays within these negotiated and accepted configurations (Bene 2008).

A livelihood approach recognizes that each fishery participant needs to generate their livelihood one way or another, and resilience is enhanced if those livelihoods can be achieved from a diversity of sources, rather than having each individual relying on just one fish stock or set of stocks. Within the fishery, it is, therefore, useful to encourage multi-species fishing, in which fishers utilize a range of fish resources, and avoid policies that lead to specialization of fishers in single-species fisheries. Diversifying across sources of fish lets the individual fisher reduce risks and at the same time, gives management greater flexibility to reduce harvesting of particularly vulnerable stocks. Still focusing on fishers but looking beyond the fishery per se, the existence of 'occupational pluralism' – fishers holding other jobs during non-fishing times – is to be encouraged so that fishers avoid total reliance on fishing for their income. This reduces the pressure they would otherwise face to obtain a livelihood entirely from the fishery, and thus also reduces pressure on the fish stocks. Encouraging such multiple sources of livelihood for fishers, and by implication, discouraging excessive specialization in the fishery may boost the system's overall resilience (Swan and Gréboval 2005).

2.5 COVID-19 and governance insights for viability

2.5.1 Coping and adaptation

SSF communities respond to certain threats with a variety of actions that can lead them to viability. An adaptive response is defined as the immediate response to a rising problem in a manner that alleviates or resolves the stressor (Nayak, 2017). Adaptive responses are the coping responses when practiced for a duration of time or general responses that have become the usual reaction for any problem (Nayak, 2017). These responses, when practiced following the appropriate guidelines, may become the pathways to viability from vulnerability. Adaptive capacity of the local communities often depends on factors such as response diversity, collaborative capacity, connectivity, reserves, and learning capacity (Kerner and Thomas, 2014, Tompkins and Adger, 2004). It is based on this adaptive capacity that a system can either foster resilience or push boundaries and transform into another stable state.

Response diversity: Response diversity refers to the number of options with which a function or a taskwithin a social-ecological system can be accomplished in different ways, with different resources available, either in the face of change or while withstanding a stressor in order to allow continuity of various functions within a system (Kerner and Thomas, 2014; Walker et al., 2006; Holling, 1973).

Collaborative capacity: Collaborative capacity refers to the potential of system stakeholders such as local community members, community leaders, the village head, and local government to work cooperatively to ensure system function (Kerner and Thomas, 2014). It is the capacity to act in a coordinated manner (Stokols et al., 2013; Thomas, 2011; Berkes, 2007; Walker et al., 2006). This involves engaging linkages within the community such as relationships, authorities, or permissions and roles in a timely manner that ensures the functionality of a system (Carpenter et al., 2012). Engaging these links requires a

shared understanding of the objectives of the collaboration amongst the actors involved.

Connectivity: Connectivity within a social system is measured by determining how readily resources and information can be exchanged to ensure continued functionality (Kerner and Thomas, 2014; Carpenter et al., 2012). Connectivity can range from strong to weak depending on the human actors and their horizontal and vertical involvement and interactions within a system (Thrush et al., 2009).

Abundance/reserves: Reserves refer to the ready to use a surplus of capital available in a system in the form of natural capital, economic capital and social capital, etc., upon which community members rely on when faced with change or stressful situations (Kerner and Thomas, 2014; Ferrara et al., 2016). Awareness surrounding these reserves within a system is just as important as the reserves itself (Carpenter et al., 2012). These reserves play an important role in managing vulnerability by supporting variety, redundancy, and preparedness in a system (Resilience Alliance, 2019).

Learning Capacity: Learning capacity in terms of adaptability of a system refers to "the ability to acquire, through training, experience, or observation, the knowledge, skills, and capabilities needed to ensure system functionality" (Kerner and Thomas, 2014). Learning capacity can be studied at an individual or household level to highlight any inequity issues (Ostrom, 2005; Berkes, 2007).

As described by Shaffril et al., (2017), the adaptation responses in SSF communities can be linked with the improvisation in "*fishing routines, strengthening social relationships, managing fishermen's climate change knowledge, facilitating the community's learning of alternative skills, involving fishermen in climate change adaptation planning, and enhancing fishermen's access to credit*". Strategies can be modified accordingly, with the help of stakeholders. The primary step for increasing coping and adaptive response

capacity is to enable and enhance the knowledge of fishermen on natural changes, along with learning and strengthening alternative skills (Shaffril et al., 2017).

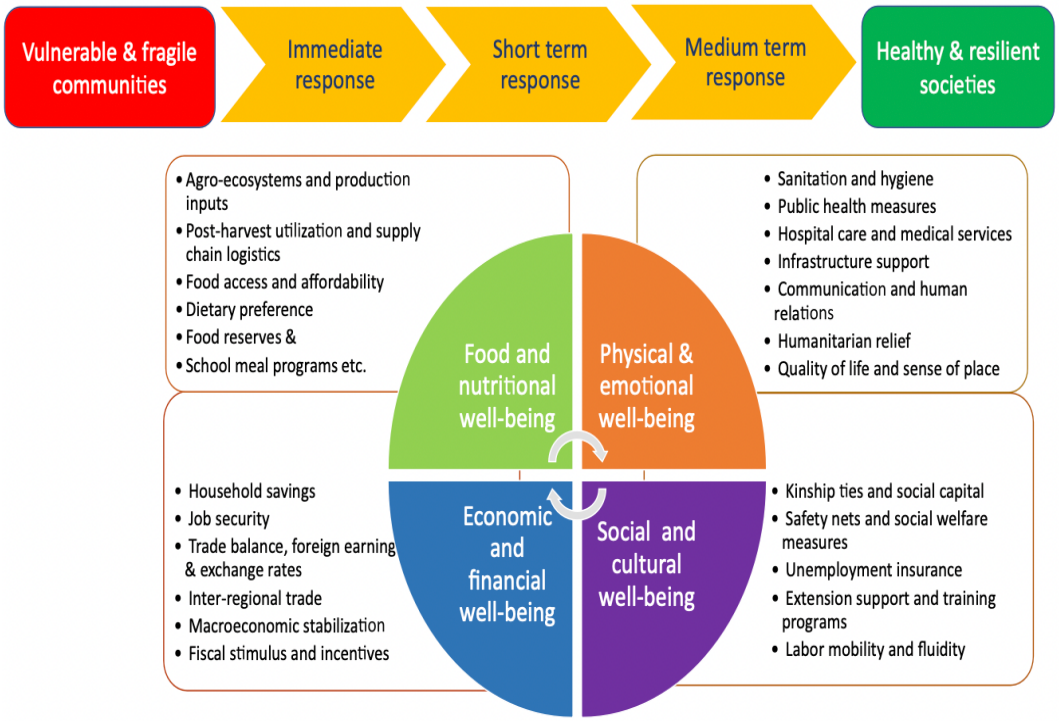

Figure 2.4: Policy entry points for targeted and integrated responses to COVID-19 impacts *(Khan et al. 2021)*

Additionally, periodical assessment, capacity building, and skill development trainings on sustainable aquaculture and related activities would make the fishers more resilient (Shaffril et al., 2017).

2.5.2 Proposed response strategies globally

This section explains some response strategies which have been considered to deal with the impacts of pandemics globally. Several researchers suggested certain plans which could be useful to keep the fisheries value chain sustained during pandemic. Thus, the following framework helped in developing the original framework of the thesis – focussing on viability of SSF.

Khan et al. 2021 explored some policy entry points and targeting the interventions for the COVID-19 pandemic. According to that policy, "wellbeing" is the most appropriate entry point for dietary and value chain interventions on COVID-19 given its multiple domains of influence. This includes food and nutrition security, physical and emotional health, social and cultural ties, and economic and financial domains. Hence, direct food assistance that includes canned or cured fish is imperative, in addition, to support to local supply chain actors and facilitating regional food corridors to the most vulnerable and undernourished could be part of immediate to short-term dietary responses (Fig. 2.4: top left quadrant).

Accordingly, food and nutrition security and wellbeing are strongly linked to materiality (income and household assets), relational ties (union support, cooperatives and fisher associations), and subjective wellbeing, including a sense of place and aspirations (Coulthard et al. 2011). Fiscal support through loans and grants, trade debt repayments, and budget support can contribute to the response through macroeconomic stabilization and long-term economic recovery (Fig. 2.4: lower left quadrant). Similarly, safety nets and kinship ties are crucial for building social capital during shocks, as well as securing livelihoods through social protection measures (Fig. 2.4: bottom right quadrant). However, policy responses may depend on geographical location, resource endowment, production and supply chain networks, human capital, gender inequality, and institutional capacity.

Immediate and medium-term strategies are required for fish production from capture fisheries in addition to processing, curing, and cold storage infrastructure. It also requires facilitating women's control over these fish production assets and resources. Here, solar panels and the FAO-Thiaroye fish processing technique (FTT-Thiaroye) could be easily deployed to address post-harvest loss for women's SMEs, increasing the quantity of fish to feed local households, supply regional markets, and improve overall wellbeing. Looking into the future, novel policy entry points should focus on (i) strengthening the regulatory environment to circumvent

production and trade flow disruption during crisis; (ii) promote policies that rely on digital technologies to improve information systems and e-commerce.

With COVID-19 impacting export restrictions and supply chain disruptions, a new food price spike is predicted. Integrated responses can be implemented during this pandemic to augment public health interventions and to nourish nations (Table 2.6).

Table 2.6: Response strategies for artisanal fisheries

	Harvest and culture stages	**Value chain activities**	**Retail and consumption**
Support to small-scale artisanal, marine, and inland fisheries	Provide access rights and community quotas and provision of storage infrastructure, ice on boats or at landing depots. (Including for women groups)	Provide solar powered ice making machine and storage, refrigerated trucks	Pre-paid scheme of fish delivery at homes with ice, fresh or frozen and through refrigerated trucks and cold room depots
	Provide sanitation equipment, masks, gloves, and gels for fishermen to go on fishing trips and women processors and traders	Open the existing regional fish trade corridors and develop health passes and sanitation protocols for refrigerated trucks	Strengthening capacity for value chain coordination through cooperatives, fisher associations with rural financing schemes
	Policy reform to prioritize fisheries in national food security plans and nutrition strategies	Support e-insurance schemes and social protection measures	

Note: This table is a modification from Khan et al. 2021

COVID-19 has highlighted how interconnected our health and local food systems are, especially in building resilience through aquatic food systems (Bolton et al. 2021). Aquatic food systems that promote healthy diets play an important role in preventing all forms of malnutrition and in building immunity and physical

wellbeing (Thilsted et al. 2016; Hicks et al. 2019). For the SSF sub-sector, immediate and short-term responses seem ideal in meeting food and nutritional security (Bennett et al. 2020). Such can be achieved through the increased harvest of sustainable and nutrition sensitive marine species. Such support measures could include boosting output infrastructure and marketing technologies for reducing post-harvest loss and increasing value and competitiveness. Also important is securing catch quotas within sustainable harvest strategies and access to local markets. Moreover, e-commerce provides an opportunity for access to fish products through online platforms such as Facebook and retail home delivery during public health measures (Khan 2021).

2.6 Conceptual framework

The application of a conceptual framework is useful in any field of research and is generally employed to determine what will and will not be included in the study. The conceptual framework used for the purposes of this study is depicted in figure 2.5, visualizing the research constructs and the connections between them. The figures 2.2, 2.3 and 2.4 discussed in respective sections helped in developing the research framework by providing deep understanding about the topic. For instance, the figure 2.2 explored various positive and negative impacts of human confinement on ecology and environment during pandemic, subsequently connected with vulnerability (such as unemployment, economic insecurity, increasing, illegal fishing) and viability (such as lowered pollution) of environment and humans including SSF sector. The figure 2.3 described the interconnection of three types of wellbeing. Figure 2.4 focused on the wellbeing for the resilience and viability of fisherfolk. Overall, a comprehensive scenario on types of vulnerability and viability was studied - which further inspired to have this study in social, economic and environmental dimensions – considering the impacts on wellbeing, capitals and resilience.

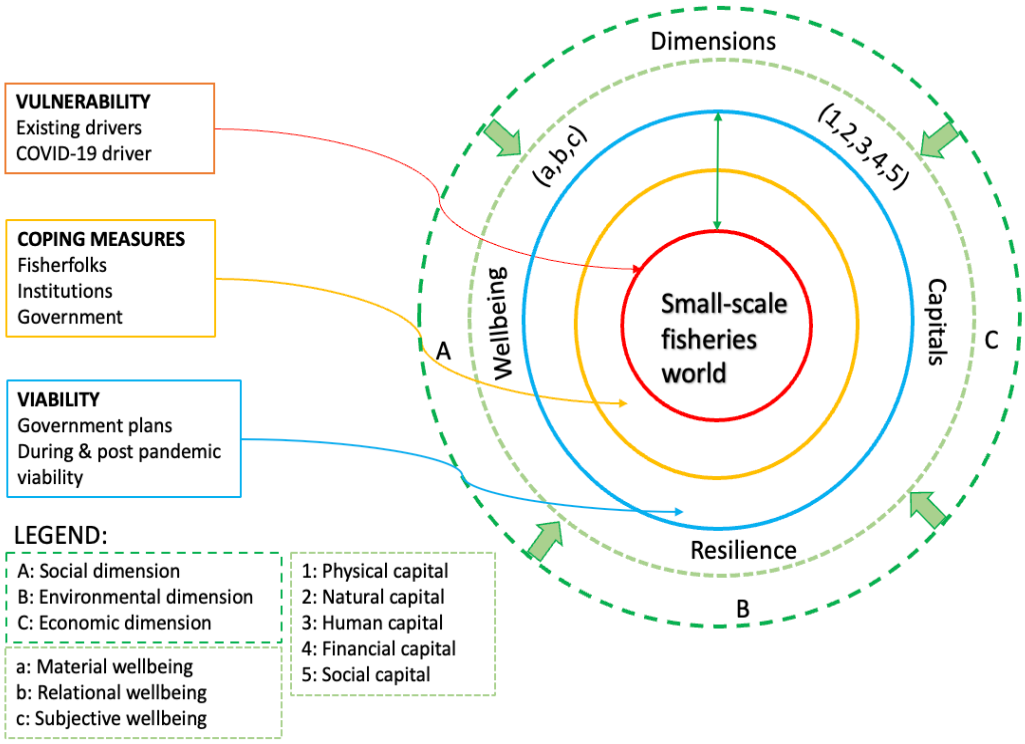

Figure 2.5: Conceptual framework

The three research objectives (Box 2.1) are color-coded in the framework, represented in red, orange, blue, and green, respectively. Red denotes the vulnerability among the small-scale fisheries, including fisherfolk, due to various existing drivers and new global driver COVID-19 pandemic. The orange color represents the coping measures taken at the personal, institutional, and government levels. The viability of the coastal world is shown in blue color which focuses on the plans or policies of the government for the resilience of fishers during and post pandemic. The two-sided arrow line signifies the transition from vulnerability to viability of coastal world or SSF. The dotted dark green color circle indicates the dimensions studied in this research, i.e., social, environmental and economic. The dotted light green circle shows wellbeing: material, relational, subjective; Capitals: physical, natural, human, financial, social; and Resilience are interconnected with the vulnerability and viability of fisherfolk.

The three research objectives of this thesis are presented in Box 2.1.

Box 2.1 Review of research objectives

⇒ Understanding the nature of vulnerabilities in fishing communities under the impact of Covid-19 global driver.

1. What are the existing vulnerabilities?
2. What are the new vulnerabilities emerged due to pandemic?

⇒ To examine the various coping responses by the fishing communities to the impacts of Covid-19 global driver.

1. What are the coping measures adopted by SSF & coastal communities?
2. How other actors like government, NGOs, civil societies responded?

⇒ Possible governance arrangements for ensuring viability of the SSF during –and post - Covid time.

1. How is governance mechanism working for the viability of SSF coastal communities?
2. Are there any plans or policies which ensures viability post COVID time?

Vulnerability of small-scale fishing communities is linked to their high dependence on natural resources and strong attachment to coastal areas (Allison et al. 2006; Islam 2011; Salas et al. 2011; Chuenpagdee et al. 2019). Multiple sources of vulnerability, such as disruption of marketing systems, fish declines, and bad climate conditions, affect both fishers and processors alike since post-harvest activities depend entirely on harvest activities (Tindall and Holvoet 2008; Pedroza and Salas 2011). Concerning small-scale fisheries, viability goes beyond economic benefits since being viable implies that good socio-economic conditions are always paired with achieving social wellbeing. Therefore, there are several benefits in engaging communities in determining both vulnerability and solutions for viability given that they can become real actors in working towards better livelihoods, as opposed to being seen only as a problem (Chuenpagdee 2011a).

Chapter 3

Methodology and research methods

3.1 Summary of research approach

This chapter defines the methodology and data collection methods employed to execute the research study, including the role of the researcher and the types of sampling used. Details regarding justifications and limitations in research methods are also included. This research will use mixed-method approach to tackle the objectives stated for this thesis. The initial phase of the research involves observing the study location, followed by data collection methods and then data analysis. The findings are triangulated to ensure accuracy.

3.1.1 Case study: Chilika Lagoon, India

A case study is "a research approach used to generate an in-depth, multi-faceted understanding of complex issues in its real-life context" (Crowe et al., 2011). Case studies can be used to explain, describe, or explore phenomena in the everyday contexts in which they occur, as compared to setting up an experimental design to reach conclusions (Yin, 2009).

The case study for this research is Chilika lagoon, India. Chilika lagoon, also called Chilika Lake, is the largest lagoon in India and one of the largest in Asia, with an area of 1165 km^2. It is in Orissa State on the east coast of India on the Bay of Bengal, south of Kolkata (Calcutta). Connected to the Bay of Bengal in the south, with the Eastern Ghats Mountain ranges forming most of its catchment in the north and the west, Chilika is a Ramsar Site of international conservation importance and a biodiversity hotspot (Fig. 3.6). Some rare, vulnerable, and endangered species listed on the International Union for the Conservation of Nature's (IUCN) Red List of threatened animals inhabit the lagoon. It is the largest wintering ground for migratory waterfowl found anywhere on the Indian subcontinent and home to

Irrawaddy dolphins (Orcaella brevirostris) (Nayak 2014). It is a productive area with fish fauna adapted to a mix of freshwater and seawater that characterizes lagoon ecosystems (Nayak and Fikret 2010). Its beauty attracts many bird watchers, tourists, and ecologists. Chilika's biodiversity is also an integral part of sustaining the culture and livelihoods of about 400,000 fishers and their families, who belong to specific caste groups and live in more than 150 villages (Nayak 2014).

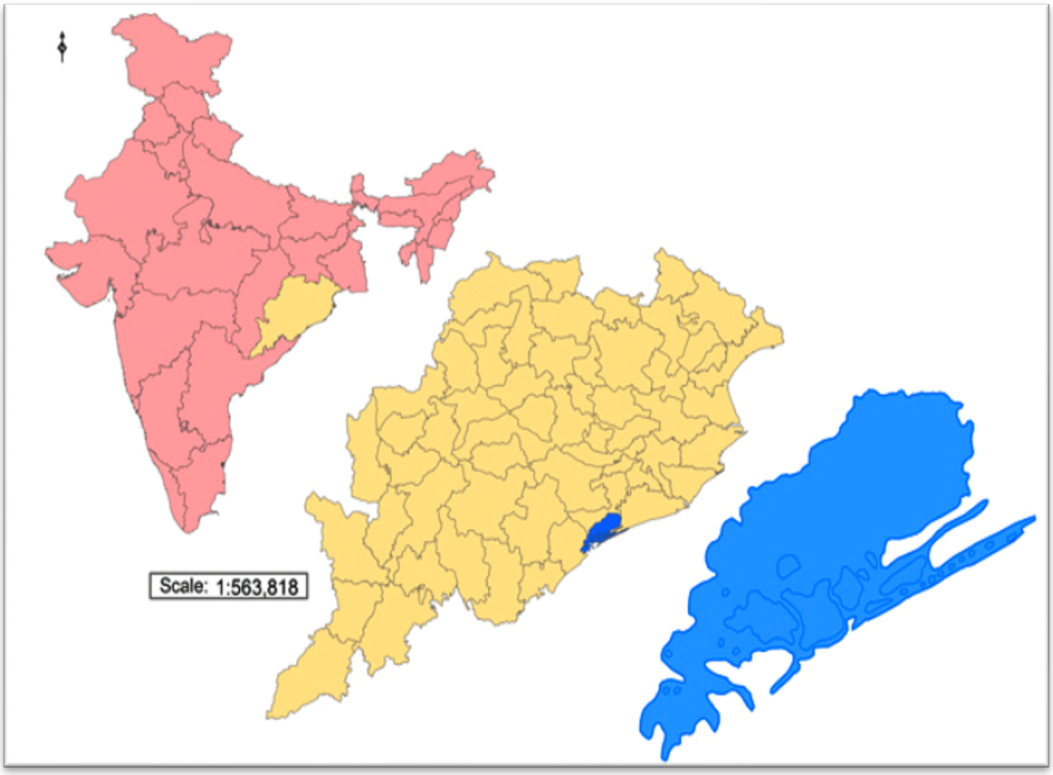

Figure 3.6: Location of Chilika Lagoon, Odisha, India (Source: Nayak 2014)

Chilika Lagoon provides the main livelihood to over 200,000 fishers across 150 fishing villages located around the lagoon (Nayak 2014; Nayak & Berkes 2010). Fishing has become the main livelihood for local community members in Chilika, with many locals changing their occupations to fish since it was a very profitable livelihood option (D'Lima 2014). Prior to 1980, fishing in Chilika was mainly based on capture fisheries, and traditional fishers were allowed to extract resources

from the lagoon (Nayak, 2014). However, after 1980 due to the growth of the international tiger prawn market, fishing in the lagoon became even more profitable, which led to the development of prawn aquaculture, and consequently, the fishing culture in Chilika shifted from capture to culture (D'Lima, 2014; Nayak, 2014). The encroachment of traditional fishing areas by non-traditional fishers was challenged by traditional fisher cooperatives, leading to the ban of shrimp aquaculture in 1997 (D'Lima, 2014). However, illegal shrimp aquaculture continues in Chilika and has led to the marginalization of traditional fishers as well as the "decommonisation" of Chilika Lagoon (D'Lima, 2014; Nayak, 2014; Nayak & Berkes, 2010).

3.2 Research design

Research design, is the *plan or proposal to conduct research*, involves the intersection of philosophy, strategies of inquiry, and specific methods. The Philosophical Worldview means "a basic set of beliefs that guide action" (Guba, 1990, p. 17). The research embraces a pragmatic worldview as it is more problem-centred and focuses on real world practice (Creswell & Creswell, 2017). For the mixed methods researcher, pragmatism opens the door to multiple methods, different worldviews, and different assumptions, as well as different forms of data collection and analysis. While predominantly pragmatic, this study also has traces of constructivism as the study seeks understanding of the world in which fishers live and work. The goal of my research is to rely as much as possible on the participants' views of the situation being studied. The questions asked in the questionnaire are broad and general so that the participants can construct the meaning of a situation, typically forged in discussions or interactions with other persons. The more open-ended the questioning, the better, as the researcher listens carefully to what people say or do in their life settings (Creswell and Creswell 2008).

Mixed method strategies were transformative in which the researcher uses a theoretical lens as an overarching perspective within a design that contains both quantitative and qualitative data. This lens provides a framework for topics of

interest, methods for collecting data, and outcomes or changes anticipated by the study. In this research the theoretical framework focused on is the vulnerabilities of fisherfolk, vulnerabilities causing drivers and impacts on the concepts of wellbeing, capital, and livelihood through the three dimensions of vulnerability i.e., social, economic and environmental.

The research method used is mixed methods: collection of primary data from the research area with the help of survey questionnaires for a quantitative analysis to follow. A mixed methods design is useful when either the quantitative or qualitative approach by itself is inadequate to best understand a research problem, or the strengths of both quantitative and qualitative research can provide the best understanding. Collecting both closed-ended quantitative data and open-ended qualitative data proves advantageous (Creswell and Creswell 2008). The section 3.3 describes the data collection methods I used in the research.

The following sections explain the typology of mixed method sampling design used in this study:

Sampling is a crucial step in both the qualitative and quantitative research process. However, sampling is even more important in the mixed methods research process because of its increased complexity arising from the fact that the quantitative and qualitative components bring into the setting their own problems of representation, legitimation, integration, and politics. Selecting a sampling design involves making a series of decisions not only about how many individuals to include in a study and how to select these individuals, but also about conditions under which this selection will take place (Onwuegbuzie 2007). These decisions are extremely important and, as stated by Curtis et al. (2000), "It seems essential to be explicit about these [decisions], rather than leaving them hidden, and to consider the implications of the choice for the way that the...study can be interpreted" (p. 1012).

Sampling: Sampling, which is the process of selecting "a portion, piece, or segment that is representative of a whole" (The American Heritage College Dictionary, 1993,

p. 1206), is a key step in the research process because it helps to inform the quality of inferences made by the researcher that stem from the underlying findings. In both quantitative and qualitative studies, researchers must decide the number of participants to select (i.e., sample size) and how to select these sample members (i.e., sampling scheme). Studies that combine or mix qualitative and quantitative research techniques fall into a class of research that are appropriately called mixed methods research or mixed research. Sampling decisions typically are more complicated in mixed methods research because sampling schemes must be designed for both the qualitative and quantitative research components of these studies (Onwuegbuzie 2007).

Random Sampling: If the objective of the study is to generalize the quantitative and/or qualitative findings to the population from which the sample was drawn (i.e., make inferences), then the researcher should attempt to select a sample for that component that is random. Homogenous sampling scheme focuses on choosing the settings, groups, and/or individuals based on similar or specific characteristics (Onwuegbuzie 2007). Fisherfolk engaged in small-scale fisheries related activities were chosen as homogenous random sampling. Snowball/Chain sampling was also considered, where participants were asked to recruit individuals to join the study.

Sample size: The choice of sample size is as important as is the choice of sampling scheme because it also determines the extent to which the researcher can make statistical and/or analytic generalizations. The size of the sample should be informed primarily by the research objective, research question(s), and, subsequently, the research design (Onwuegbuzie 2007). Research design chosen for the study to decide sample size was 'Ethnography,' where 1 cultural group (Creswell, 2002) can be studied, and 30-50 interviews (Morse, 1994) can be conducted.

However, most mixed method designs utilize time orientation dimension as its base. Time orientation refers to whether the qualitative and quantitative phases of the study occur at approximately the same point in time such that they are independent of one

another (i.e., concurrent) or whether these two components occur one after the other such that the latter phase is dependent, to some degree, on the former phase (i.e., sequential). Sequential design was preferred for the study because the purpose of the mixed method research is development, such that the findings from the first method inform the use of the second method (Onwuegbuzie 2007). Research involved a sequential design using identical samples for both qualitative and quantitative components of the study. Fisherfolk residing in Chilika and engaged in fishing activities were asked questions on both qualitative and quantitative components.

3.3 Data collection methods

In this research, three types of methods were utilized, including literature review, case studies, household survey.

3.3.1 Literature review

Examining available knowledge and theory, including up to date information about the relevant topic, is common in both quantitative and qualitative research (Elliott and Timulak, 2005). "A systematic literature review (SLR) is a method/process/protocol in which a body of literature is aggregated, reviewed and assessed while utilizing pre-specified and standardized techniques" (Štrukelj, 2018) In this process, the purpose, objectives, methodology and significance of the research work has to be decided beforehand to reduce bias during the review process. It is different from a regular literature review as it focuses on the "existing evidence concerning a clearly defined problem" as opposed to starting from a broad overview of the issues that is eventually narrowed down (Štrukelj, 2018). Overall, a SLR helps examine diverse findings and identify concepts and theories that require further research.

A preliminary literature review was conducted to obtain a conceptual and theoretical understanding of previous research conducted on three fundamental areas of interest, namely small-scale fisheries communities or fisherfolk, drivers, COVID-19 as a global driver, and viability studies. The literature review deliberates scholarly

articles, books, thesis dissertations, and other secondary sources relevant to the three areas of research. It allowed for a structured theoretical understanding, which allowed the researcher to practice gap spotting, and problematization to justify the need for further research. A literature review allowed for a thorough understanding of existing theories related to rapid change, its impacts, and its responses. The literature review for this study was conducted through various secondary sources of information such as Google Scholar, SCOPUS, JSTOR, and several other websites. The data I reviewed included book chapters, journal articles, magazine articles, grey literature, government reports, proceedings of a regional symposium, and online news materials. I searched my data using broad keywords such as Chilika, Small-Scale Fisheries, Fisherfolk, Fishers, Drivers, Vulnerability, Viability, Wellbeing, Resilience, Capitals, Governance, Management, Adaptation, Coping, COVID-19, Pandemic. To limit the total number of journals found through each keyword search, I searched 16 keywords. These were then sorted into different combinations to get the desired papers. For example: COVID-19 + Small-scale fisheries, COVID-19 + Small-scale fisheries + Chilika, Small-scale fisheries + Vulnerability + Viability + Chilika and so on.

3.3.2 Household surveys

It is a process of collecting and analysing data to help us understand the general situation and specific characteristics of individual household or all households in the population (UNESCO 2019. What constitutes a household? A household is a person or group of persons related or not, residing in the same homestead or compound but not necessarily in the same dwelling unit, have same cooking arrangement, and are answerable to the same household head (GoK 2009). It is a basic residential unit in which economic production, consumption, inheritance, child rearing and shelter are organized and carried out (UNESCO 2019).

A typical household survey selects a sample of households from a frame which is the population of interest for the research. In many cases, the frame is a census, and

the sample is representative of a geographic area, although this need not be the case. The simplest sampling strategy randomly selects households from the frame. In practice, most household surveys follow a two-stage (or multi-stage) sampling design in which clusters are selected and then households are selected from those clusters (Thomas 2007). Survey technique involves the personal interviews or the telephonic interviews.

Interview: The interview is an important data gathering technique involving verbal communication between the researcher and the participant. Interviews are commonly used in survey designs and in exploratory and descriptive studies. There is a range of approaches to interviewing, from completely unstructured in which the participant is allowed to talk freely about whatever they wish, to highly structured in which the participant responses are limited to answering direct questions. The quality of the data collected in an interview will depend on both the interview design and on the skill of the interviewer (Fox 2007). Semi-structured interviews are similar to structured interviews in that the topics or questions to be asked are planned in advance, but instead of using closed questions, semi-structured interviews are based on open-ended questions.

For this study, geographical location chosen was Chilika lagoon, India, and the households residing in the villages in Chilika engaged with fishing activities were surveyed. Surveys helped in capturing the livelihood and wellbeing of fisherfolk. Surveys seek to create meaning just as interviews do; however, they involve standardization procedures which restrict interviewee responses (Kelley-Quon, 2018). This allowed for the surveys to be completed with a wider range of participants and took less time compared to interviews. Surveys can take place with interviewers; however, they are not allowed to influence answers in any way and are given standardized questions they need to follow exactly (Sue & Ritter, 2011). Semi-structured one-to-one interviews were conducted with respondents. The closed-ended questions asked in the questionnaire were followed by open-ended answers to understand the scenario in depth.

Due to pandemic related travel restrictions, all surveys took place through community researchers hired through the V2V Global Partnership. Community researchers taking part in the questionnaire went through two rounds of training. They were trained remotely by the lead researcher (me) on methodology as well as the goal of the research and questionnaire. Each question was examined, creating a clear understanding of its intended purpose. The answer options were created by the main researcher based on information learned from the literature review as well as the insights of the community researchers. Community researchers also participated in mock surveys to find any discrepancies or issues with the questionnaire and its delivery. The community researchers were also responsible for translating questionnaire data into the local language after it was recorded for interpretation by the lead researcher.

Survey participants were sampled from SSF local community households using random sampling techniques. Random sampling was utilized by choosing phone numbers from a curated list provided by the V2V Global Partnership when selecting individual respondents. Snowball sampling was also used through fisher taking advantage of any connections with useful knowledge on vulnerabilities and coping responses. Criteria for survey participants included anyone having small-scale fisheries as their primary occupation. Participants selected have been fishing in the area for ten years or more (or have historical knowledge through other family members) as the purpose of this research is to investigate existing vulnerabilities in this occupation.

The study targeted 50 fishers survey residing in the villages based on random and snowball sampling techniques. The number of participants who responded about demographic information was 50. The participants who showed further interest and actively participated in the survey were 48. Both closed and open-ended questions were used; however, notes were taken on more in-depth answers to collect both quantitative and qualitative data.

3.4 Data analysis

LeCompte and Schensul (1999) define analysis as the process a researcher uses to reduce data to a story and its interpretation. Data analysis is the process of reducing substantial amounts of collected data to make sense of them. Patton (1987) indicates that three things occur during analysis: data are organized, data are reduced through summarization, and patterns and themes in the data are identified and linked. LeCompte and Schensul (1999) suggest that data analysis be done as data are collected in the field, as soon as possible after the data have been collected. This section explains how the data collected using the methods described in previous sections was analyzed. Due to the COVID pandemic and not being able to travel, the quantitative and qualitative data based is analyzed based on knowledge acquired from the household survey.

Quantitative data analysis is a systematic process of both collecting and evaluating measurable and verifiable data. It contains a statistical mechanism of assessing or analysing quantitative data (Creswell, 2007). The quantitative approach to a phenomenon mostly entails two important advantages. First, it enables a researcher to systematically categorize, sum up, and illustrate observations. All these mechanisms and techniques are called descriptive statistics. Second, it also makes it possible for a researcher to understand and conclude a phenomenon (a sample) that is studied in an identified, narrow group. The sample is always taken systematically from a much larger group in a way that the derived conclusions may be generalized to the whole of population (Cowles, 2005). To put it in much more precise terms, this process paves the way for a researcher to draw the conclusions through inductive reasoning. Qualitative data analysis is a "dynamic and creative process of inductive reasoning, thinking and theory" (Basit, 2003). LeCompte and Schensul (1999) suggest looking at the theoretical framework - the theoretical underpinning provides the lens through which the data are viewed and helps the researcher to situate the results in the theory, which helps to facilitate the understanding of the data within that theoretical perspective.

3.4.1 Household survey analysis

While conducting household surveys, the community researchers provided insights and updates regarding the surveys taking place. Survey data results were organized using Microsoft Excel spreadsheet. In this study, a total of 50 participants were randomly selected residing in Chilika. The response rate was 100% for demographic questions as all respondents voluntarily participated in the questionnaire interview session, which consisted of male and female respondents (100%). For the questions based on research objectives, the rate of response was 96%, with voluntary participation of both male and female respondents. The representative ratio of gender is 80% male participants and 20% female participants (table 3.7). The focus of the study was to conduct a study on fisherfolk fishing at Chilika for more than 10 years despite of any gender, income level and education.

Table 3.7: Showing ratio of male and female participants

Row labels	**Gender distribution (%)**
Male	80
Female	20
Grand total	100

Quantitative data analysis: When survey data was received, the answers provided by survey participants for closed -ended questions were calculated into percentages using Microsoft Excel spreadsheet according to the category chosen. The community researchers documented the categories of answers chosen by each survey participant. Additional notes were also taken during surveys to capture any in-depth responses not captured by the response options. Calculating percentages of responses for each survey question helped analyse the data and reveal patterns in responses from all survey participants. Tables and charts were prepared to highlight the quantitative data.

Qualitative data analysis: The open-ended questions were also analysed in Microsoft Excel spreadsheet to better explain the closed-ended answers. Survey results provided descriptive statistics (used in the form of quotes) regarding fishers' livelihood and limitations they faced during the pandemic, and their coping suggestions to the government. Conducting the survey added a quantitative and qualitative element to this research leading to the depth and validity of the results from in-depth interviews. Further, qualitative data was represented in the forms of quotes and themes.

3.4.2 Insight on institutions mentioned by fisherfolk

During the survey, fishers mentioned various institutions (government and non-government) which helped them survive through the tough times of the pandemic. The aid included ration supplies, masks, sanitizers, and money. The institutions were:

Government institutions

Government: The office, authority or function of governing. Governing: having control, or rule over oneself. Governance: the activity of governing. Accordingly, governance is a set of decisions and processes made to reflect social expectations through the management or leadership of the government (by extension, under liberal democratic ideals, the will of 'the people' as they rule themselves) (Fasenfest 2010). In June 1997, the Government of India launched the Targeted Public Distribution System (TPDS) with a focus on the poor. The Department of Food and Public Distribution is responsible for the management of the food economy of the nation. It undertakes various activities, such as procurement of food items, storage, movement, and delivery to the distributing agencies. This section provides requisite information pertaining to the Central, State Government Departments and various other institutions handling the public distribution system. Information related to the commodities, consumer affairs, consumer cooperatives, and schemes is also available in this section (Website: India.gov.in).

Panchayat: Panchayat is the name of the local government system in India. Panchayat means a “group of "Five” Persons". In simple words, a Panchayat is a council of elders representing a village. The Panchayat system covers the village level (Gram Panchayat), clusters of villages (block Panchayat), and the district level (District Panchayat). Village level Panchayat is a local body working for the welfare of the village (Website: Ministry of minority affairs).

Accredited Social Health Activists (ASHA): The Government of India has decided to launch a National Rural Health Mission (NRHM) to address the health needs of the rural population, especially the vulnerable sections of society. ASHA is a health activist in the community who will create awareness of health and its social determinants and mobilize the community towards local health planning and increased utilization and accountability of the existing health services. She is a promoter of good health practices (Website: nhm.gov.in).

Village Development Committee (VDC): A Village Development Association (VDA) is established in each programme village. VDAs established a Village Development Committee (VDC) as its executive body responsible for the implementation of natural resource management and livelihood related activities.

Self-help Groups (SHG): Self Help Groups are groups of 10 to 20 women or men who want to improve their living conditions by setting up their own savings and loan fund. The fund is owned by the group and consists of the savings of the members. The fund is used to make short-term loans with interest to members.

Odisha Livelihoods Mission (OLM): An autonomous society under the aegis of the Department of Mission Shakti, under the guidance of the Government of Odisha. OLM has put in place a dedicated and sensitive support structure to take the rural poor households out of the poverty line through capacity building, financial assistance, and self-reliant institutions. Odisha Livelihoods Mission

commenced its functioning in the year 2012. (Website: https://odishalivelihoodsmission.in/).

Non- Government institutions/organizations

Save the children: Save the Children is India's leading independent child rights Non-Government Organization. The pioneering programs address children's unique needs, giving them a healthy start, an opportunity to learn as well as protection from harm.

Jeevan Rekha Parishad (JRP): is an independent, secular and Non - Governmental Organisation (NGO) working for peace, solidarity, human rights, and sustainable development issues in the Odisha state of India for rural, tribal and slum poor women, vulnerable children, underprivileged youth and abandoned senior citizens. (Website: http://jrpsai.org/).

Regional Centre for Development Cooperation (RCDC): Working since 1993, focused on natural resource management and livelihoods for the development of Odisha. (Website: https://rcdcindia.org/about-us/overview/).

3.5 Limitations

The research took place during the COVID-19 pandemic, which has impacted the data collection and the results. The limitations of this study include sampling, biases, and other limitations of qualitative techniques. The research was conducted through the researcher residing in the Chilika lagoon and has also suffered from the COVID-19 pandemic impacts.

In qualitative research, wherein study-specific questions are used for in-depth interviews, the interviewer becomes an instrument through which data for their studies are collected or generated (Poggenpoel and Myburgh, 2003). This could lead to a researcher bias where the researcher or the interviewer conducting the interviews possibly influences the results. This bias is especially prevalent where

the researcher holds a strong affinity for the participants being studied or is a member of the population (Chenail, 2011).

Chilika lagoon is a common research/study site for local students, researchers, fisheries, and main tourist location. The community is also aware of the lack of reciprocity regarding benefits to the local communities despite their ongoing cooperation with research efforts. Response bias is another limitation that factors in the use of semi-structured interviews. Participants may have deceived or misled the researcher based on expected answers rather than giving their authentic responses. To combat such biases, the researcher went through a phase of initial scoping and observation to build a relationship with the local community.

In this research, triangulation was conducted to mitigate any effects of researcher bias using surveys.

3.6 Ethics

This research project received full ethics clearance from the University of Waterloo Office of Research Ethics under ORE #43511 on September 20, 2021 (Appendix B).

3.7 Researcher's reflection

Due to COVID-19 pandemic travel restrictions, I was unable to work in the field and feel the essence of field work. Working remotely made me feel disconnected from the research, as I could not experience the liveliness of–Chilika - what researchers usually observe and explore while conducting surveys. I believe that onsite research help in practically understanding the scenario in the field as well as helps in connecting with the environment intellectually and emotionally, which I felt lacking due to not being present there physically.

No doubt, the community researchers did their best in conducting the research smoothly and the participants were also comfortable interacting with the researcher. It could be because language was not a barrier for the participants; they clearly and concisely delivered the responses and elaborated the stories. Being the main researcher, I lacked experience in conducting research, acknowledging the rich culture, values and environmental beauty of Chilika, but with the help of a community researcher I got the field updates throughout the research. As our common language is 'Hindi,' I could somewhat understand the ground scenario.

Overall, it was difficult for me, as the main researcher, to feel connected to the Chilika fishers since I could not interact with them directly in the field. Nevertheless, I believe that due to the perseverance and diligent work of community researchers, the quality of this study and its results improved.

Chapter 4
COVID-19 and vulnerabilities in fishing communities

4.1 Introduction

Small-scale fisheries are often vulnerable because fishers associated with them are geographically isolated, economically deprived, politically voiceless, and are considered culturally low class (Islam, 2011; Rahman et al., 2002). Even in academic circles, small-scale fisheries remain understated worldwide because the majority of researchers are often limited to the economic aspect. Fisheries go way beyond by providing important social and cultural values to the people involved (Johnson et al., 2018). It means fishing is a 'way of life' (Gatewood & McCay, 1990; Onyango, 2011), and many fishers choose to stay in fishing not for economic benefits alone but for multi-faceted reasons that lead to job and life satisfaction (Pollnac & Poggie, 2008; Pollnac et al., 2001).

Many fishing communities around the world face several challenges in maintaining their livelihoods, including limited access to resources, poor resource availability, overfishing, degradation of the marine environment, poor governance, climate phenomena, competition with industrial fisheries, globalized markets, and marginalization (Allison et al. 2005; Andrew et al. 2007a; Chuenpagdee 2011b; Schuhbauer and Sumaila 2016; Song et al. 2018; Stoll et al. 2018; Bavinck et al. 2018; Chuenpagdee et al. 2019). These issues directly affect small-scale fishers' ability to sustain their livelihoods and respond to changing conditions. For small-scale fisheries to deliver their full benefits to society, sources of vulnerability must be understood at the individual and community levels (Adger 1999; Andrew et al. 2007; Salas et al. 2019). Drivers present at any level are the any natural or human-induced factor that directly or indirectly causes a change (MEA 2003, 2005) and leads to vulnerability. Similarly, a new global driver, COVID-19, triggered the existing vulnerabilities and also added new vulnerabilities among fisherfolk.

In this chapter, the finding for objective one of the thesis has been presented by understanding the existing vulnerabilities and the nature of new vulnerabilities in fishing communities under the impact of the Covid-19 global driver. The chapter argues that by studying the vulnerabilities in small fishing communities, it could be understood that the COVID-19 pandemic triggered the existing vulnerabilities and impacted the wellbeing of fisherfolk during the pandemic. The chapter explores that by studying the diverse vulnerabilities, we could understand that there have been various drivers which cause vulnerabilities among them, and the COVID-19 pandemic worsened the situation by causing more vulnerabilities.

The following sections present data collected on responses to the general lifestyle of fisherfolk to understand the background of fishers living in Chilika; shows their lifestyle, members in their family, engagement with the fisheries sector, and their annual income. The chapter further explains the existing vulnerabilities, the vulnerability causing drivers, and the new vulnerabilities added by global driver COVID-19. The data presented was collected using semi-structured household survey.

4.2 Lifestyle of Chilika fishing community

This section shows the general demographic analysis of surveyed fisherfolk. Fishing communities residing near the Bay of Bengal, India, are based in the villages nearby. Based on household survey samples collected in Chilika Lagoon, their families have been living in these villages for quite a long time. People of their communities have also migrated in search of better livelihood and to find the means to cope with economic crisis.

During the household surveys, households were asked questions regarding the total number of members, dependent parents, males, females, and children in their families to understand the general demography pattern of the families. Below are the graphs explained with demographic data of members of respondents' families.

The total number of members in a family varied from 3 to 9 members (refer to figure 4.7). Around 4% families had 3 members in their families. Majorly 28% families had 4 members, 18% had 5 members and 32% had 6 members in their families. Nearly 10% families had 7 members. Very less families, 6% had 8 members and only 2% had 9 members in their families. (Figure 4.7)

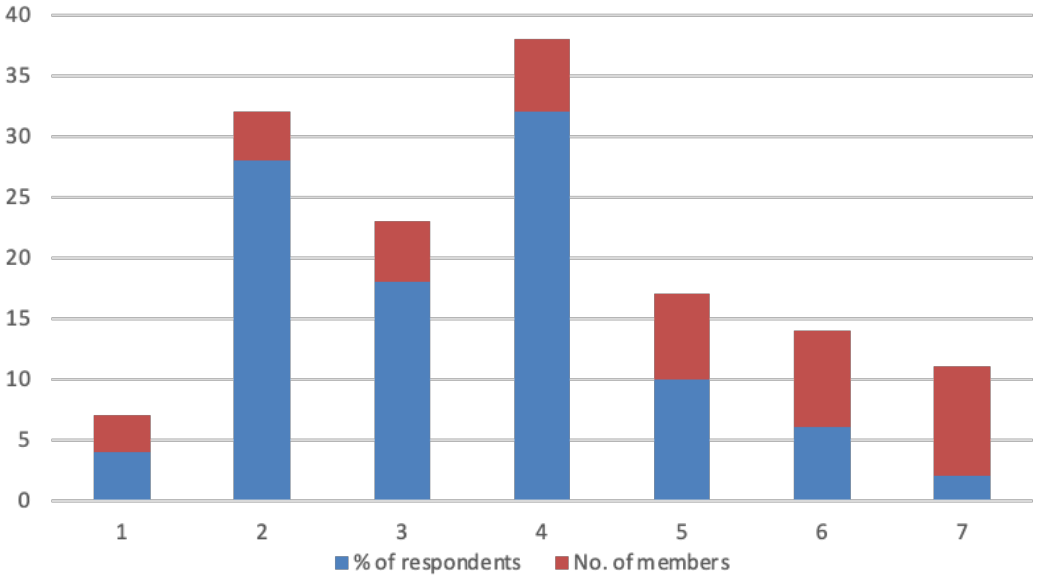

Figure 4.7: Showing frequency of family members in the families of respondents (N=50)

Following figure 4.8 shows that 69% respondents had dependent parents in their family. Rest 31% were not having dependent parents. In that case, in some families one of the parents was helping their sons in fishing or other occupations and some also had no parent in their family. A local male respondent said, "My father supports me in fishing; we go for fishing twice or thrice in a day" (Respondent 49).

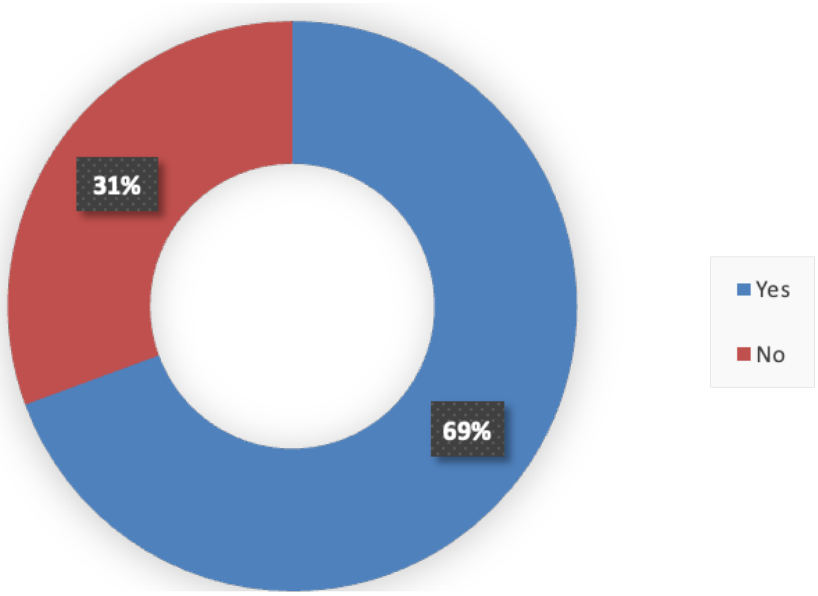

Figure 4.8: Showing percentage of dependent parents in the families of respondents (N=50)

The count showed that each family had 2 – 3 female members (table 4.8). Around 10% families had only one female member in their family. Major respondents 34% said two (2) females, 36% said 3 females and 14% mentioned 4 females in their families. In some families, only 2% had 5 – 6 females in their families. In most of the families, there were 2 – 3 male members (table 4.1). Around 14% families had one (1) male member, 36% had 2, 22% had 3 and 18% had 4 male members in their families. Rare families, 6% had 5 and 2% had 6 male members in their families. The male members of the family bore the major financial burden and other responsibilities.

Table 4.8: Frequency of female and male members in families of respondents (N=50*)*

Respondent (%)	Total females	Respondent (%)	Total males
10	1	14	1
34	2	36	2
36	3	22	3
14	4	18	4
2	5	6	5
2	6	2	6

Some of the families had children in the age group 1 – 5. Around 25% children are of the age 1 and the rest are of 2-3 in families of 13% respondents. Children in this age require proper nourishment. Analysing the members of age group 6–17-year-old children, it was found that almost all families had school going children. About 27% families had 10%, 42% families had 20%, 4% families had 30% and 4% families had 40% school going children. All children were going to school and studying well. Some children were also helping their parents with daily work. Folks in the age group of 18-60 years spend their time in higher education, fishing, and other secondary occupations. Around 24% families had 7%, 22% had 11%, 33% had 15%, 13% had 19%, 4% had 22% and 2% had 26% members of age group 18-60 years in their families. There were 3% families who had 33% and 2% families who had 67% members above the age group 60 (Table 4.9).

Table 4.9: Age group of people living in a family (N=50)

Respondent (%)	1-5 years	Respondent (%)	6-17 years	Respondent (%)	18-60 years	Respondent (%)	60 years
11	1	27	1	24	2	3	1
2	3	42	2	22	3	2	2
		4	3	33	4		
		4	4	13	5		
				4	6		
				2	7		

It was established that the villagers/ fishers were educated. The level of education varied from class 5 to higher education. Out of the total informants, 55% respondents were educated below the matriculation, and 23% were matriculation or matric passed. The 8% respondents were intermediate passed, 12% had completed undergraduate (UG) and 2% of them had completed or were pursuing post-graduation (PG) (figure 4.10).

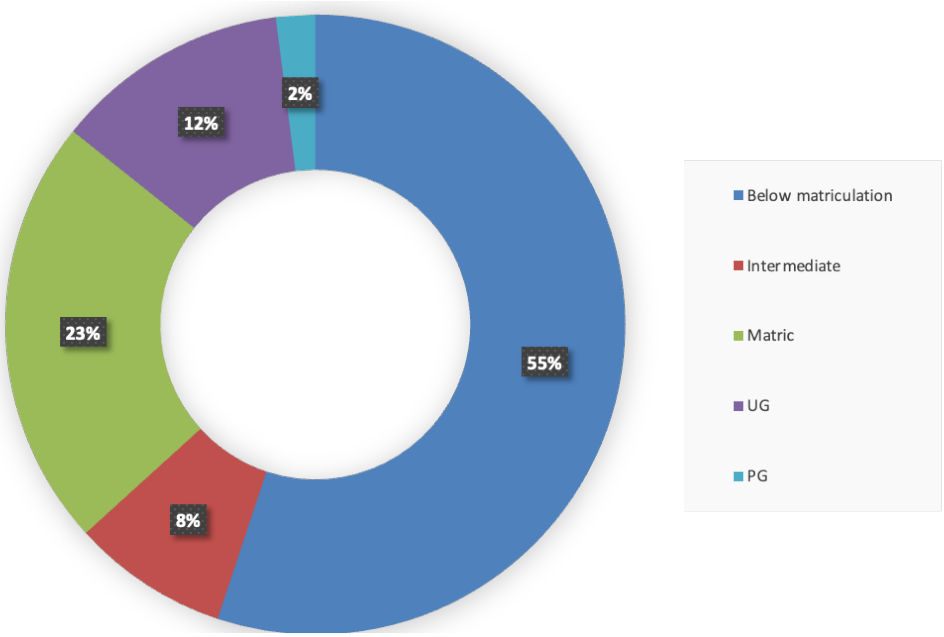

Figure 4.9: Education level of respondents (N=50)

Fisherfolk were engaged in fishing at Chilika for more than 20 years (figure 4.11). Around 20% of fisherfolk were fishing for 40 years. Their only and primary occupation was fishing, even till today. Fishers also carried this occupation forward because they could not get their chance in other sectors. A local male respondent said, "*I have been fishing in Chilika since 1998. Before this, I was studying, after study completion, since I did not get government service, joined in our occupation that is fishing*" (Respondent 30). Villagers who were not engaged in fishing earlier and were doing other professions, changed their professions and joined fishing.

According to a local female respondent, "*My husband has been fishing from Chilika since last 15 years long. Before we were selling dried prawns*" (Respondent 42).

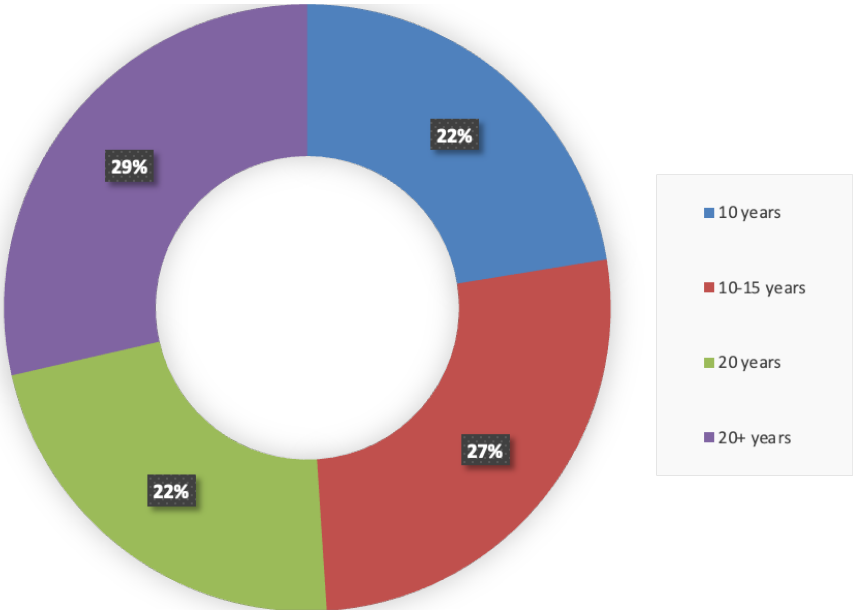

Figure 4.10: Average time span of respondents working at Chilika Lagoon (N=50)

About 94% respondents said that they are only engaged in fishing. Members in the family majorly were not engaged in any other work, except fishing. While fishing, most of the fisherfolk were accompanied by their family members such as wives, brothers, and fathers. A local respondent (20) said, "*My brother joins me two times (morning and evening) in a day*."

Few of those fishers (around 6%) were engaged in other works for daily wages (figure 4.12). As per a local respondent, "*I have been fishing since 1992. I also cultivate paddy, ground nut and have cows*" (Respondent 47). Some of them were doing other fishing related businesses, such as transportation, selling or agriculture. A female respondent (45) mentioned, "*My husband has been fishing in Chilika since last 40 years. He does the fishing and has some land given on share crop too*." Some respondents had themselves and their families engaged in the farming

and vegetable cultivation as their secondary occupation. As per a local respondent (44), "*We do farm also, because whatever income comes from fishing, is not sufficient to manage a family.*" Since these are fishers by caste, who have for generations not done anything else other than fishing, they tend to lack the necessary skills and resources in order to adopt alternative livelihood activities. Even though locally available options for livelihood are limited, what is available does not fit the existing skill levels of the fisher households. This makes the diversification of livelihood activities outside the fishing sector, or not linked to Lagoon fishing, difficult.

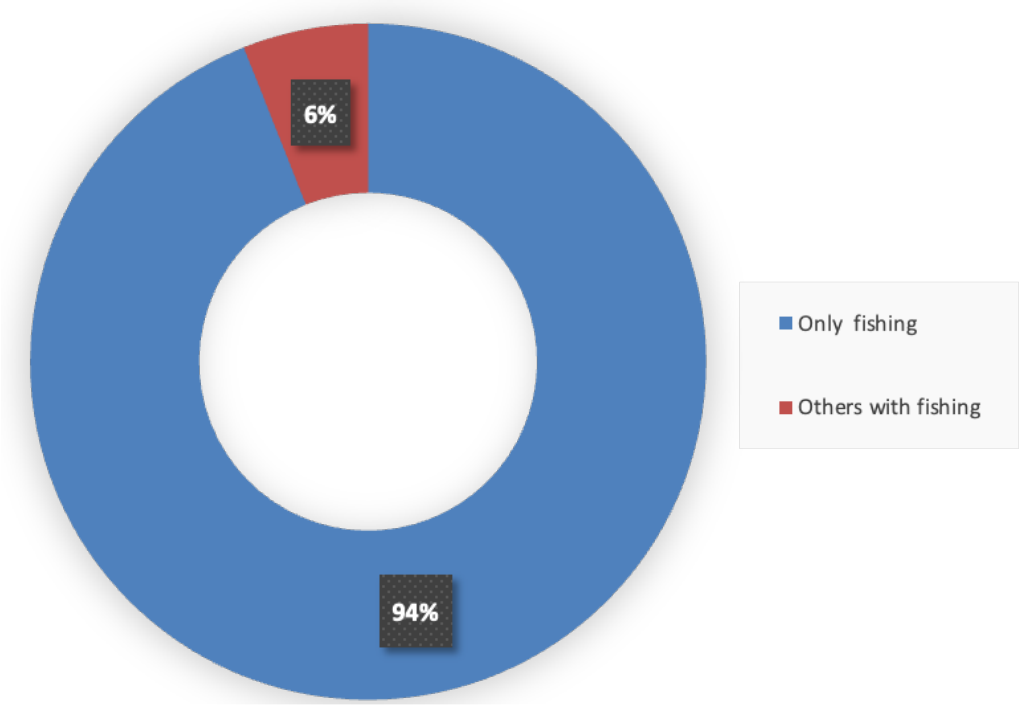

Figure 4.11: Fishing as primary occupation for respondents (N=50)

The approximate annual income of fisherfolk fluctuated between INR 30000 – 60000 (USD 396.65 -793.31). Out of total respondents, 10% had their income ranging from INR 30K to 40K (USD 396.65 -528.87) annually. Remaining 90% had their annual income varying from 50K to 60K (USD 661.09 -793.31). (Figure 4.13)

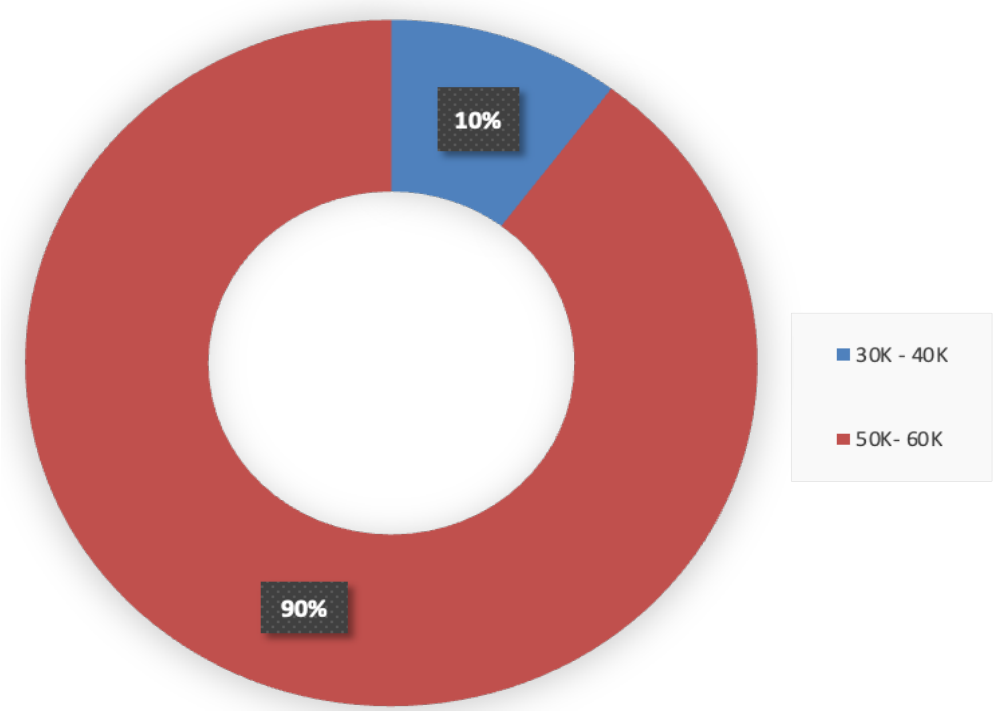

Figure 4.12: Showing approximate annual income of respondents in INR (N=50)

4.3 Livelihood of fisherfolk and existing vulnerabilities

Changes occur due to a range of factors. These factors could be natural or anthropogenic. The most significant changes that have occurred in the fishing tenure of Chilika fishers during the past ten years have been negative in nature. Fisherfolk lost their livelihoods, wellbeing, and suffered financial and environmental crises. This section highlights the vulnerabilities which fisherfolk had been facing due to various drivers persisted in the Chilika lagoon.

4.3.1 Assessment of vulnerabilities

The following table 4.10 explores the vulnerabilities based on data collected during the household surveys in terms of social, environmental and economic perspectives. The responses were analyzed to determine change and sensitivity to change. The respondents were small-scale fishers residing in the Chilika lagoon.

Table 4.10: Showing vulnerabilities concerns occurred before COVID-19 (N=48)

Dimensions	Existing vulnerabilities	Respondent (%)
Social	Livelihood mismanaged	100
	School drops out; exploitation of Children	96
	Children who were studying	2
Economic	Less fish rearing and harvesting	58
	No sell	18
	Unfair price if sold	81
Environmental	Eco-crime (hunting, killing dolphins)	15
	Natural disaster impacts	71
	Adverse impacts of prawn culture	56

Note: Questions allowed for multiple responses

4.3.1.1 Social dimension

The livelihood of fishing communities was mismanaged. They were barely managing their livelihood. The parents were unable to afford school education of their children, hence dropped out the school, said 96% of fishers. Their children were helping them in fishing and other fisheries related work. This supported families of fishers economically. However, this practice also engaged the children who were below the age 10. Such types of engagements exploit the health, student life, education, mental and physical development, and growth of children. It had been noted that some of the families (around 2%) were able to make their children study despite their tough livelihood. The children enjoyed mid-day meals in the schools. The food is usually prepared considering the nutrition level, making it healthy for growing children. The children were physically and mentally healthy due to being with friends and away from the pressure of working outside and earning money. "*They were very happy, studying, playing with friends, taking nutritious food in school*" (Respondent 43).

4.3.1.2 Economic dimension

The fish market had experienced fluctuating prices. "*The market situation was not constant, if today price is INR 50 (USD 0.66) and tomorrow it could be INR.5 (USD 0.066)*" (Respondent 24). Around 58% of respondents said that there was less fish rearing, harvesting, and selling which led to lower income. "*Fish production was very less, but rate was not fair*" (Respondent 25). The 18% respondents mentioned about high fish rearing, harvesting, and selling, ending in a good income just during high waves days, and this occurs rarely. "*Generally, we had an income of INR.150 to 200 (USD 1.98- 2.64) per day and INR.500 (USD 6.61) during high wave*" (Respondent 6). Fishing communities also suffered from the unfair price for the sale, 81% respondents reported. Storage and, commuting issues were some of the reasons for less price. According to (Respondent 7), "T*here is no ice factory, fish traders did not come to purchase fish at a fair rate*". "Since there was a travel communication problem, we did not get fair price of fish" (Respondent 9). Table 4.11 shows the price in INR & USD of different varieties of species that were sold commonly.

Table 4.11: Showing price of the species sold commonly

Types of fish	Common names of fish	Price in INR (per kgs)	Price in USD (per kgs)
Khainga fish	Large scale mullet *[Mugil cephalus* (Big size)]	110 – 250	1.46 – 3.32
Kabala fish	*Mugil cephalus* (Small size)	100 - –20	1.33 - 1.59
Sorada fish	*Liza borneensis*	90	1.19
Panu fish	Kadal shrimp *(Metapenaeus dobsoni)*	60	0.8
Small prawn	Juvenile prawn	150	1.99
Bagada prawn	Giant tiger prawn *(Penaeus* s–p.*)*	250 - –00	3.32 - 6.64

Panu Marada prawn	Speckled shrimp *(Metapenaeus monoceros)*	6–-80	0.8 - 1.06

4.3.1.3 Environmental dimension

Fisherfolk were prone to various natural and anthropogenic disasters. Around 15% of respondents mentioned several types of eco-crimes such as hunting migratory birds, using zero mesh nets to catch prawn juveniles, killing dolphins, and other types of eco-crimes. Majorly, 71% respondents stated natural disasters as a big challenge. Natural disasters resulted in ecological changes affecting the fishing due to closure or opening of mouths, loss of shelter/property, loss or damage of fishing boats and gears, suspension of fishing activity, decreased availability of catch, and many more. A respondent (30) mentioned, "*During Fani cyclone, we did fish prawn very less. Boats, nets of almost all people were damaged. Later, we, fishers bought these taking loan and did fishing again in Chilika*." Around 56% stated that currently growing prawn culture is a challenge for them. Prawn culture left numerous adverse impacts like contamination of lagoon water, blocking of natural flows, encroachment of capture fishery area, and many other negative effects. Thus, "*fishers faced financial problems due to the increased distance in coastlines*" (Respondent 27). Fishers were also aware about the benefits of having dolphins in the Lagoon. They do not kill Dolphins or birds, but rather worship (Respondent 13, 30). Respondent 47 said," *No one kills dolphin, small fishes in fear come into our net on the arrival of dolphins, now dolphin number has been decreased*". Another respondent (26) mentioned, "*No one kills dolphin, dolphin is like Laxmi, it helps us fishing small fishes, tourists come to see dolphin, dolphin helps us in our income*".

4.3.1.4 Vulnerabilities described on basis of sample quotes

This section explains the vulnerabilities on the basis of the sample quotes collected from the responses of fishers to the questions asked during the survey. The household survey results revealed that the non-fishers were encroaching wetland sites of Chilika and forcefully pulled back fisher's rights. The fishers felt deprived

of their rights in the situation, where their one and only occupation 'fishing' was being stolen by the non-fishers. As a result of the encroachment by non-fishers, fish production in Chilika decreased day by day. An increase in illegal prawn *gheries*[1] leads to the reduction in coastlines. This also impacted the ecology & environment of Chilika. Fishers had to travel far from their regular place to catch the fishes. Fish catch was also not in adequate amount due to the use of large fishing nets and catching the fish juveniles; this led to the less fish available for sustenance and livelihoods. Ultimately, this resulted in the migration of fishers from Chilika to different sites and some moved to other cities in search of work other than fisheries.

Financial conditions and livelihoods of fisherfolk worsened due to the climate change as well. Every year natural calamities such as cyclones *Fani*, *Phailin*, *Titli*, and all the related nomenclatures of cyclones cause detrimental losses to their livelihoods. The floods damaged their houses, boats, took away fishing equipment, and reduced fish catch. Pollution specifically water pollution was also a major concern for Chilika locals. Tourists visiting Chilika lagoon used mechanised boats, which made a lot of noise and released oil in the water, increasing pollution in the lagoon water. The vulnerabilities caused due to changes and key drivers mentioned in table 4.12 weakened the economic status and livelihood of fishers.

[1] *Gheries* are areas encroached for illegal prawn cultivation inside the wetland area.

Table 4.12: Sample quotes stating key objectives in face of change observed

Key driver(s) of change	Change(s) observed	Quotes from fisherfolk
Political driver	1) Deprived of rights due to encroachment	*1) The fishers are deprived of their rights by the government, non-fishers are fishing by encroaching Chilika, climate change causes continuous flood and cyclone and our boats, nets are being damaged, for this the government does not provide us compensation* *2) Illegal prawn gheries being increased in Chilika, our rights are being minimized gradually, encroaching Chilika's wetland site non-fishers are fishing forcefully, people from all castes are fishing now. We are fishing less than before, so our family cannot live rightfully* *3) We, fishers were fishing earlier from Chilika, but now all people irrespective of caste are fishing from Chilika by encroaching its wetland sites. The fish produce is being reduced by increasing of prawn gheries in Chilika*
Environmental driver	1) No compensation of damage caused 2) Water pollution due to tourism	*4) Chilika Barunei Society has 2222-acre area, non-fishers have already encroached our 1100-acre area, facing problem while tourist boats are being used, due to oil floating fish produce is getting smaller, more loss for increase of prawn gheries, no one is following the government's rules* *5) Earlier there were more fishes in Chilika, in year 2000, due to development of new coastlines, use of machine-operated boats for tourist, fish quantity has been decreased. Every year natural calamities like Fani, Phailin damaged a lot.*
Advanced fishing	1) Use of linen nets 2)	*6) Manual (Khadi) nets were used before, now linen nets are being used, use of machine-operated boats, polyethene caused Chilika fish to be decreased.*

	Mechanized boats	
Migration	1) Fishing at distant places	*7) At first, we were fishing as fishers, now non-fishers are fishing forcefully. Fish production is being lessened day to day' Chilika's wetland is being reduced because of increase of prawn gheries and fish juveniles catching. We have to go to distance area of Chilika for fishing.*

The sample quotes given in above table 4.11 revealed the changes caused due to various drivers. Collectively, all drivers impact the economic wellbeing of fishers, which makes them further vulnerable to managing their livelihood. The major social and economic vulnerabilities noticed are that 1) fishers feel deprived of rights of fishing at Chilika caused due to political drivers. Non-traditional fishing, ultimately resulting in encroachment by non-fishers is given more importance than the traditional fishers. This situation impacts them mentally as there is harm to their social wellbeing. 2) They do not get compensation for the damage they face due to natural calamities. This makes them economically weak. 3) Due to advanced fishing practices in Chilika by non-fishers, the traditional fishers have to migrate to distant places. This weakens their livelihood and makes them stay away from families, which ultimately adversely affects their social and economic status.

4.3.1.5 Existing vulnerabilities analyzed from secondary sources

In this section, the vulnerabilities are analysed from the secondary sources of data. Social vulnerabilities sources among small scale fishers at individual and community levels, were: 1) weakening of the joint family system, which worked as a social insurance at times of crisis, 2) isolation of individual family members due to migration by some, 3) increased conflict, and violence, 4) a gradual loss of fishing skills and knowledge, 5) a lack of education through dropping out, a sense of disconnection from Chilika as 'mother', 6) a personal sense of fear or harm from powerful non-fishers, 7) a lack of capacity to go back to fishing, and deteriorating

mental and physical health, 8) collapse of fish cooperatives as the institutional foundation of small-scale fisheries, 9) loss of access due to encroachment of fishing areas, 10) competition over shrinking resource base, 11) loss of fishing rights due to migration-related absences, further loss of political voice and power).

The types of economic vulnerabilities reported, were: 1) loss of fishery-based income, 2) increase in levels of debt, 3) food insecurity, 4) financial implications of conflicts, and court cases, 5) declining fish stock, 6) inability to retain assets. At the environmental level, the types of vulnerabilities include 1) breakdown of fishery infrastructure, 2) loss of access to fishing grounds, 3) occupational displacement leading to migration (Nayak & Berkes 2019a).

4.3.2 Understanding the nature of existing vulnerabilities

This section analyses the nature of existing vulnerabilities in small-scale fisheries on the basis of data collected through the household survey and the secondary data study. The following table 4.13 outlines the dimensions of vulnerability that Chilika small-scale fishers are currently being exposed to by linking those vulnerabilities to global change drivers, access to capitals, community wellbeing, and resilience (Nayak and Berkes, 2019a). Drivers could be natural or anthropogenic. Anthropogenic drivers could be present at any level- local, regional, national or global. Vulnerabilities caused are interconnected. If there is a vulnerability caused due to a driver, it will impact the wellbeing in all dimensions (in this case study: social, economic and environmental). The following table provides details on the vulnerabilities (section 4.3.1) experienced in the small-scale fisheries sector of Chilika lagoon in the material, relational, and subjective wellbeing aspects of fishers' lives.

Table 4.13: Discussion on vulnerabilities from perspectives of wellbeing, capital and resilience

Absence of wellbeing	Lack of access to capitals	Loss of resilience	Dimensions	Resulting vulnerabilities
Material	Natural	Lack capacity to absorb disturbance and reorganize while undergoing change	Environmental problems	*Breakdown of fishery infrastructure* *Loss of income* *Climate change: Cyclone, flood, damage*
	Financial			*Increase in illegal prawn gheries & fish juveniles catching*
			Economic crisis	*Use of machine boats cause pollution* *Less fishing*
	Physical		Physical resources	*Tourist are deteriorating environment* *Use of polybags*
Relational	Human		Social crisis	*Feel deprived of their rights* *People from other castes doing fishing using machine boats*
		Lack capability for self-organization, learning and adaptation	Political issues	*Encroachment by non-fishers* *No compensation for the loss*
	Social		Economic issues	*Travel to distant areas for fishing* *Lack of education in children*
Subjective	Human		Individual and community level	*Fear of losing right to fishing*

	Social			*Sense of disconnect from Chilika Migration*

Source: Adapted from Nayak and Berkes (2019a).

4.3.2.1 Material level

At the *material* level (which includes natural, financial, and physical capitals), there are serious environmental problems noticed (e.g., climate change, cyclones, floods, pollution due to machine boats), economic crises due to damage caused by environmental problems, and deficiencies in physical resources (e.g., declining fish stock, inability to retain assets, breakdown of fishery infrastructure, loss of access to fishing grounds, and occupational displacement leading to migration) (section 4.3.1.5). Climate change is also a driver for causing vulnerabilities. The frequency of occurrence and severity of cyclones and floods has increased. Along with that, the non-fishers' community has a profound influence in Chilika. They are excessively engaged in fishing by practicing non-traditional fishing methods. They use linen nets to catch fish, which also catches fish juveniles too, leading to a decrease in the fish count and then fishers have to travel to distant places for fishing. There is an escalation in illegal prawn harvesting happening in the Chilika area, due to which fishers feel deprived of traditional fishing. Tourism is also another factor that is deteriorating Chilika's environment, although tourism is economically beneficial to the fishers. The usage of machine boats creates noise pollution which is harmful to the fishes. Motorboats also release oil in the sea, polluting the water as a result. Tourists also do not pay attention to managing their dry waste. They leave polythene bags, bottles and other pollutants on the shores, which then mix with the seawater. Consequently, such activities create hindrance to fish thriving, cause pollution, make the environment look tedious, reduce the aesthetic value of the shore, and cause disturbances while fishing (table 4.12; section 4.3.1.4 & 4.3.1.5).

4.3.2.2 Relational level

At the *relational* level (which includes human and social capitals), cyclones and floods cause damage to their boats, and houses, and reduce the catch. This leads to economic loss and eventually livelihood loss. However, the fisher community seeks compensation from the government for the loss they face caused by natural drivers. They suffer from social crises when non fishers encroach on the Chilika for fishing. By caste, only Chilika fishers' community has the right to do fishing there. However, now people from other castes are doing fishing there. Their non-traditional way of fishing is a reason for the decrease in the fish count. Thus, Traditional fishers have to move to distant places for the catch. Travelling to distant places puts pressure on their finances. Managing the transport is also a big challenge for them. There are no facilities available, as such & if available it is beyond their approach. Such issues have been a cause of migration among them. They migrate in search of better earnings but sometimes end up with bad experiences at migrated places (section 4.3.1.4 & 4.3.1.5).

Under social crises, children are also sufferers. In case of the Chilika, children, instead of going to school, engage with their parents in fishing related work. They become part of the fisheries mismanagement trap. Fisherfolk believe that engaging other family members including children helps them improve their economic crises. However, in fact, engagement of children in fisheries is leading them towards a pathway of uneducated fishers (section 4.3.1.1).

4.3.2.3 Subjective level

At the *subjective* level (which includes social and human capitals) natural calamities and encroachment related impacts have caused vulnerabilities at individual and community levels. For example, fishers believe that they are deprived of their rights to fishing at Chilika. Due to encroachment by non-fishers and the 'prawn mafia' at Chilika, fishers are unable to do fishing, and thus looking for secondary sources of income (section 4.3.1.4). Ecological, social, and economic

disintegration, and unsupportive political decisions initiated a process of disconnect from Chilika Lagoon among fishers. Also, growing resource degradation (loss of biodiversity and fish productivity) aggravated fishers disconnect by promoting out-migration (Nayak and Berkes, 2011).

Outmigration generally means moving away, whereas migrant workers retain homes in the community and return on a regular basis (Barbara Neis, pers. com.). As such, Robson and Nayak (2010) have used the term "circular migration" and/or "temporary migration" to explain this short-term nature of fishers‟ work related movements (migrant work) and the term "permanent migration" to denote what is referred to as "out migration" or "moving away". In addition to the important criteria of (1) whether retaining homes/families and (2) returning on a regular basis they also used the criteria of (3) whether the migrant fishers have been able to maintain their affiliations with the village fishery institution and (4) their livelihood linkages with the resource to determine the nature of migration either as circular / temporary or permanent. In other words, if a migrant fisher does both (3) and (4), in addition to (1) and (2), then it indicates a level of disconnection denoting some sense of "moving away" (hence "out- migration"). This understanding would mean that Chilika case has both migrant workers (circular or temporary migration) and out-migration (permanent migration).

Not all households are able to afford out-migration; households with many adult men are in an advantageous position compared to those with fewer adult men. As out-migration often involves traveling thousands of miles outside the state boundary for unspecified periods of time, many households with single men find it difficult to opt for it as a livelihood strategy. However, households with many young men tend to rely more on out-migration as a livelihood strategy when compared to households with older men. There was no instance of migration by women or, except for one or two cases, migration with family members in both the villages. Households that are part of an extended family were found to be more out-migration dependant than households consisting of nuclear families.

Although only men migrated, the cost and effect of their migration on sending families were profound. In the absence of men, the household stopped fishing because culturally it was only men who fished. Consequently, women in the household also discontinued their fish processing chores. Thus, out-migration by men also contributed to the disconnection of those family members who stayed behind, from their customary Lagoon resources (Nayak 2011).

At the *subjective* wellbeing level, Chilika lagoon was a particularly fitting arena for investigating such impacts and the process of 'marginalisation' of the people dependent on the capture fishery sector (Nayak & Berkes 2010). The major elements in Chilika fishers' marginalization include food shortages at the household level, cycles of indebtedness at interest rates as high as 120% per annum, selling of fishing gear and other possessions, and taking children out of school. The livelihood crisis has led to the displacement (as of 2009) of about one-third of the fisher population. About one-half of the former fishers and their wives have become local wage labourer, and the other one-half has migrated out of the region. Prawn culture has adverse impacts. It contaminates lagoon water and blocks the natural flow of the water as well (impact on *relative* wellbeing).

Nayak and Berkes 2010 mentioned indicators of marginalization in social and economic dimensions as outcome of multi-impacts. Such as-

- Disappearance of large fish and shift of the fishery to small and immature fish
- Some fisher families eating fish twice in 4 months indicate lack of fish availability and inability of fishers to buy fish
- Fishers eating chicken instead of fish signifies the presence of more chickens than fish in fishing villages, a shift in livelihoods
- Reduced numbers of actual fishing days due to continuous failure of catch

- Large-scale out-migration and shift to local wage labour mean occupational and physical displacement of fishers
- High-interest loans leading to a vicious cycle of indebtedness and a form of social trap
- High rates of school dropouts can potentially lead to further exclusion of fishers
- Changes in fish taste, hinting at the growing pollution in the lagoon and local belief that fish are unhappy

4.4 Comprehending the scenario during COVID-19 pandemic

This section presents data related to the onset of lockdown in India and the impacts brought by COVID-19 pandemic. Further it discusses the types of vulnerabilities that emerged due to global driver COVID-19 among small scale fisheries. The responses were analyzed to determine perceived exposure and sensitivity to change.

4.4.1 COVID-19 lockdown, impacts on economy and livelihood in context of India

On 24th March 2020 first phase of 21 days lockdown started in India (Pulla 2020). Due to this lock down, mobility in grocery and pharmacy, recreation and retail, transit to the station, visits to parks, and workplaces were reduced. India went under four phases of lockdown extensions and entered its fifth phase on 8 June, where regions deemed safe, called "green zones," had more liberty in movements and business operations, whereas dangerous "red" zones continued strict travel and trade restrictions (MHA 2020). However, limited domestic air travel and railway travel with appropriate safety precautions for citizens in necessity resumed on 25 May and 1 June 2020, respectively. An "unlock" phase coincided with the fifth lockdown to restart selected businesses, educational institutions, and local public transport, while maintaining distance and hygiene (WHO India 2020; MHA 2020).

The lockdown had a disastrous impact on small, medium, and large enterprises in the country, which led to no jobs and an economic downturn condition (Sharma 2020). The tourism sector is also expected to have 70% job losses (The Hindu 2020). Likewise, India has an economy where a large section of people depends on the daily wages, e.g., autorickshaw drivers, carpenters, delivery boys, domestic laborers, scrap or waste collectors, tea girls, vegetable vendors, and waiters. The unemployment rate increased to 19% after a month of lockdown and overall unemployment was 26% acros[s] India by 24th April (Ghosh et al. 2020).

Additionally, sudden lockdown enforcement on 24th March 2020 forced millions of migrant workers to undergo an uncertain future without family, food, and job. Usually, more than 50 million people migrate from Assam, Bihar, Madhya Pradesh, Odisha, Punjab, Rajasthan, Uttar Pradesh, and West Bengal to Maharashtra and Delhi for work. Due to the lockdown, these people were forced to move out of their cities and return to their homes in the countryside (Ranscombe 2020). In the absence of transport facilities, workers with infants, pregnant women, and the elderly were forced to walk on foot (Mukhra 2020). Hence, India experienced the second-largest reverse mass in its history after the Partition of India in 1947. Prominent psychosocial issues were expected among migrants for pandemic COVID-19 and lockdown [MHFW 2020; Choudhari 2020)].

In a parallel situation, the education system was also at a halt due to COVID-19 in India. During this lockdown period, the educational institutions were closed which hampered the overall teaching-learning process and education system due to the unavailability of online and computer systems among all the students in rural India owing to the disparity of economic conditions. However, accessibility of android mobile and 4G connection, mobile phones in the urban sector of India (Kapasaia 2020), resulted in running schools online, where rural sections remained deprived of education.

Medical facilities faced a critical time in India. Under the normal scenario, available beds per 10,000 people were 3.2 for rural and 11.9 for urban (Mampatta 2020; Kumar 2020), which had to increase to accommodate COVID-19 patients. Because of the busy schedule for COVID-19 cases, some disruption and discrepancies were observed for the other treatments. Isolation, fear, uncertainty, economic turmoil were namely a few issues that caused psychological distress among humans due to COVID-19 (Kocchar 2020). In India poverty, starvation, hunger is still an issue that escalated due to COVID-19. Mass unemployment creates frustration and drives people to chronic stress, anxiety, depression, alcohol dependence, and self-harm. From 19th March to 2nd May, 338 deaths were reported due to lockdown which included suicides arising due to fear of corona, self-isolation, starvation, and financial distress (The Economic Times 2020; Dsouza 2020).

4.4.2 Impact of COVID-19 on small-scale fisheries in context of Chilika lagoon

The major sources of the news about COVID-19 spread for fishing communities were newspapers, television and other local groups. A local respondent (27) mentioned, "*In 2019, we came to know from TV and Newspaper', government's announcements*". A female respondent (44) said, "*In 2019, we came to know from TV, Newspapers, Mission Shakti, OLM, Mahila Mahasangha meeting*".

The conducted household surveys have shown that families of fishing communities were safe during COVID-19 pandemic. Nobody among their families tested positive for COVID-19. All of them were fully vaccinated (taken both the shots) and mentioned that the first dose was easily available to everyone. Most respondents, i.e., 81% cited that vaccination was not mandatory for them and other members of their family to go out on shores for livelihoods, such as fishing tourism and other recreational activities. However, 19% respondents said that full vaccination was compulsory for them to continue livelihood activities. It was

interesting to note that around 2% respondents took the COVID-19 vaccine jab out of the fear of the pandemic (refer figure 4.14).

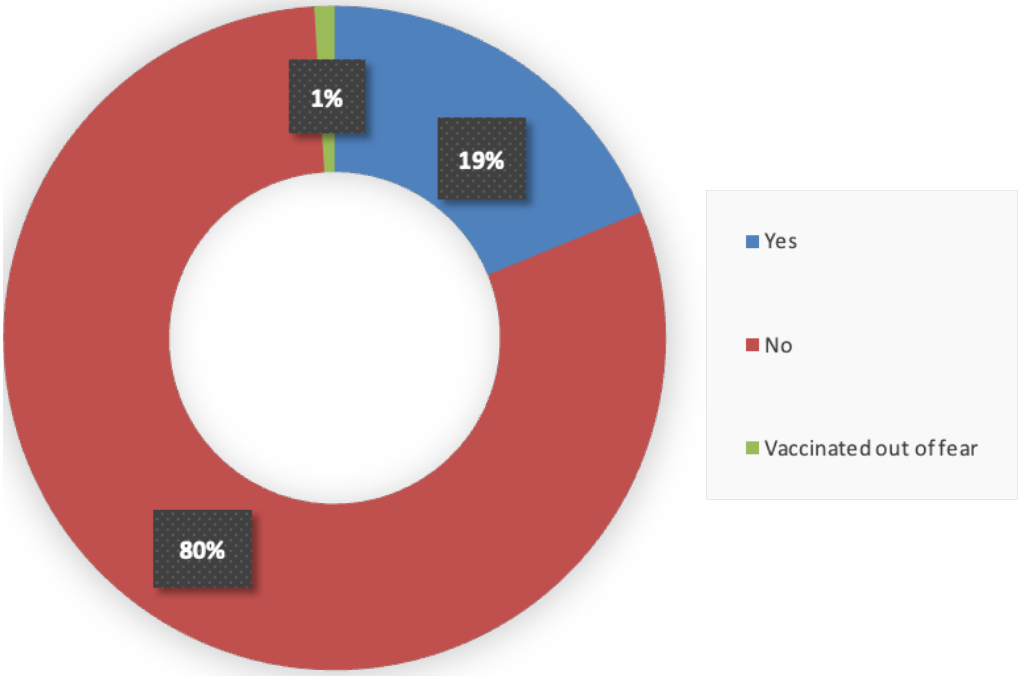

Figure 4.13: Showing vaccination compulsory for fisheries respondents (N=50)

The worse impacts of the pandemic can be seen among the weaker sections of the society such as in small-scale fishers' communities. It increased the vulnerabilities among those who were already suffering from susceptibilities (table 4.14).

Table 4.14: Showing vulnerability concerns occurred during pandemic (N=48)

Dimensions	**COVID-19 vulnerabilities**	**Respondents (%)**
Social	Difficulty in managing livelihood & wellbeing	73
	Not much problem; life & livelihood managed	2

	Limited regular activities & increased social gaps	8
	No school, no studies	98
	Online studies	2
	Impact on psychological wellbeing of children	44
	Accessible medical services	2
	Hard to access affordable medical services	98
	Meeting increased demand	2
Economic	Significantly decreased fish rearing, harvesting, and selling	50
	Sold at low price or did not sell	48
	Increased fish rearing, harvesting, and selling	2
Environmental	Eco- crime	10
	Natural disaster impacts	23
	Previous challenges minimized; lagoon environment has become clean & peaceful	75

Note: Questions allowed for multiple responses

4.4.2.1 Social dimension

From the beginning of lockdown (March 2020) and imposing restrictions, 73% of respondents felt difficulties managing their livelihood and wellbeing. For 8% of them, the pandemic was like an unexpected health crisis that limited the regular activities and increased the social gaps. "*No one could go to anywhere; Government and villagers' rules were being implemented strictly*" (Respondent 48). Only 2% said that they did not face much problem and managed their livelihood somehow like before. Children's education was negatively impacted; 98% respondents stated that schools were closed during pandemic and students also stopped studying. Only around 2% respondents could afford the online classes for their children, and the remaining 98% could not afford the online classes. They said, "*Since we are poor people, our children did not have mobiles and we could not afford them to purchase a big mobile*" (Respondent 24). Playing outside, gathering was restricted for children as well due to the pandemic impacts. This adversely affected their psychological wellbeing; 44% informants responded. "*The children and village*

people were in fear" (Respondent 21). Medical challenges also persisted during this time; 98% of respondents cited that it was hard for them to access affordable medical services. "*No pharmacy is in our area, it is 5km away from our village, doctors did not see the patients properly.* They were not able to get medicines on time." (Respondent 28). "*There is no pharmacy near our village, so people did not get medicines in time*" (Respondent 30). Around 2% of respondents stated accessible medical services were available for them. "*We were given proper treatment*" (Respondent 24). Nearly 2% of respondents mentioned that they saw fulfilling of increased demands of isolation rooms/centres required during the pandemic. "*A quarantine center at school had been opened in support of villagers*" (Respondent 46).

4.4.2.2 Economic dimension

The fish market changed drastically during the pandemic. There was a significant decrease in fish rearing, harvesting, and selling, reported 50% of respondents. Around 48% of respondents said that they faced challenges in selling the catch. Either they sold it at a low price or did not sell even after increase in fishing, said 2% respondents. A male respondent (5) mentioned, "*The fish traders were purchasing fish at throw away price, due to Corona pandemic, we were forced to sell*". Overall, they faced more economic crises during the pandemic. (Table 4.15) shows the new price of fish market during pandemic. The prices during the pandemic were low and exploitative in nature. Also, due to the lack of transportation facilities, improper storage facilities and strict restrictions, fishers could not go out to sell the catch on their own in the market.

***Table 4.15: Showing difference in price of fish before and during COVID-19* pandemic**

Types of fish	Common names of fish	Price (in USD) before COVID-19	Price (in USD) during COVID-19
Khainga fish	Large scale mullet *[Mugil cephalus* (Big size)]	1.46 - 3.32	1.86
Kabala fish	*Mugil cephalus* (small size)	1.33 - 1.59	1.33
Sorada fish	*Liza borneensis*	1.19	1.19
Panu fish	Kadal shrimp *(Metapenaeus dobsoi)*	0.8	0.40 - 0.53
Small prawn	Juvenile prawn	1.99	-
Bagada prawn	Giant tiger prawn *(Penaeu–* spp.)	3.32 - 6.64	1.33
Panu Marada prawn	Speckled shrimp *(Metapenaeus mo–oceros)*	0.8 - 1.06	0.53

4.4.2.3 Environmental dimension

Most of the environmental and ecological issues continued during the pandemic, such as eco-crimes. The 10% respondents said that eco-crimes persisted during COVID-19 such as hunting migratory birds, using zero mesh nets to catch prawn juveniles, and killing dolphins. Most of the respondents mentioned about using zero mesh nets to catch juvenile prawns. It was found that 23% respondents felt natural disaster impacts worsened during the COVID- 19 situation, especially during lockdown. A respondent said, "*Before this pandemic (COVID-19), there was Fani cyclone, nets and boats were damaged, somehow, we were just managing that situation going through financial crisis, then pandemic arrived, we faced a vast hazardous situation. Family income was within INR 50 to 100 (USD 0.66-1.32)*" (Respondent 42). "*During pandemic, we did the fishing, but no fish trader came to purchase, did fasting for 5 days after taking food in a day. "Less fish in Chilika because of the cyclone, fish could not be sold for Corona pandemic*" (Respondent

30). Some of the previous challenges were minimized during lockdown. The Lagoon environment had become clean & peaceful. Around 75% of informants reported that some previous challenges were minimized during the lockdown due to the absence of humans. A male respondent (28) mentioned, "*During pandemic, tourists did not come, machine boat use were stopped, since fish remained unsold, people did not go for fishing. Chilika environment became peaceful and cleaned*." It was also noticed that during the surveys was that they took care of dolphins and birds in the lagoon area. The following information has been recorded from respondents during the survey- 1) "*No one kills birds, dolphins. People do have beliefs that 'dolphin is 'Sadhab Ghar Bohu*[2]*'*. 2) *No one kills dolphins. The tourists do come to see dolphins, we get income from that and also dolphins help us in fishing small fishes*."

4.4.2.4 Limitations faced by fishing communities during pandemic

This section highlights the limitations that fisherfolk faced during covid in managing their livelihood. These limitations were related to financial loss, livelihood, and wellbeing etc. It is true that money cannot buy happiness, but it is also true that money is a source to afford a better livelihood which becomes a reason for happiness. During the pandemic, it was tough for small scale fishing communities to be able to fulfil their needs.

As they were already burdened with the loans and were also out of money during pandemic, the pandemic made them overburdened with the loans. They could not afford things required for daily necessity such as food, clothes for themselves and their children, protective equipment required for COVID-19, and medicines. Respondent (4) said, "*Financial problem caused us to struggle, could not purchase food, dress for children, more sanitizers & masks. We stayed at home in fear of*

[2] Fisherman mentioned red velvet mites here. People in Chilika believe that red velvet mite is a rare species and similarly dolphin is.

Corona pandemic, we could go for fishing and repay our debt." Some said that they would have been debt free by fishing. But they could not go for fishing and could not pay their debt. A local respondent said, "*We had no money. We could repay our last year's debt with income from fishing, but that could not be possible. Even we could not purchase monthly ration and medicine also*" (Respondent 12). Respondents majorly faced an economic crisis which led them to live a miserable life during pandemic. Table 4.16 highlights the quotes mentioned by fisherfolk during the household surveys.

Table 4.16: Showing fisherfolk responses on limitations they faced during pandemic

Key system impacted	***Limitations faced***	***Quotes***
Economic	1) No income 2) Unavailable to afford food 3) Could not buy clothes 4) No festival celebration	*1) I had no money at all or could not get income from fishing, failed to afford two times food to my family members, we took only rice with fish curry only. We could not purchase clothes for children and celebrate several festivals.* *2) Due to not having money, we could not afford nutritious food to our children, mobile for their online class, clothes, faced food insecurity, did not get health facilities, could not celebrate festivals as it should be.*
Economic ***Social***	1) Could not purchase daily necessity items 2) PPE such as masks and sanitizers 3) Could not afford health services 4) Had to opt herbal treatment instead proper medication	*1) Due to having financial crisis, it was difficult to manage my family, could not purchase soap for handwash, more mask and could not repay our debt.* *2) Due to having financial difficulties, my family could not be able to get proper health care and purchase ration, the fishes remained unsold, we could not repay our debt.* *3) Financial crisis did not allow us purchase masks, medicines. Did herbal treatment, faced problem for food, went through the difficulties, nor having mobile,*

		children could not study *4) We faced problems due to not having money, otherwise we would have been maintaining a healthy and relaxed life*
Economic	1) Want own house 2) Could not sell fish 3) Could not repay debt 4) Loan burdened 5) Financially weak 6) More loan burdened	*1) Whatever I wanted to do like a house to be in, repayment of debt, purchase a vehicle for fish selling, tourist boat for more income but could not do all these due to financial problem* *2) Due to having financial crisis, we struggled a lot to get food, medicine. We had a plan to repay our debt by fishing, but we could not repay our debt since we had no income at all.* *3) We had planning to pay back our debt, but it became more loan burden. We could not afford to purchase a smart phone for our children, they could not study. Due to having financial problem, our all works were affected* *4)Financial resource became more weak, due to financial crisis, we are now in loan burden".* *5)Due to having financial problem, we could not purchase masks and sanitizers, we had decided to repay our debt from fishing income, but fish could not be sold, and debt burden added more* *6) Due to financial crisis, 1) I could not purchase ration for 6 months, sanitizers, masks, 2) could not go for fishing and became more loan burdened* *7) We had no money, fish could not be sold, we struggled a lot for our livelihood, even did not get food for months long, could do nothing for our family*

Social ***Economic***	1) Children could not study 2) Afraid of children's future	*1) Did fishing, but that could not be sold, fish traders did not come, it was difficult for us to manage family, children could not study, children go to distance area school, since not having school in the village* *2) Our children could have studied, if they were given a mobile, did not get health treatment facility, we lived our life through difficulties due to financial problem* *3) We were concerned about our children's study but could do nothing. We faced more loan burden for not going for fishing. Could not afford the family food, clothes properly. 'Our children's future has been in dark*
Economic	1) Had to go out for drinking water, ration 2) Lack food and water supply in houses	*1) We would have not gone outside, financial problem forced us to go out to purchase ration, for drinking water, not having mobile, children could not study online, not having sanitizers we could not sanitize ourselves properly during work. After fishing from Chilika, we could not sell it* *2) If we had food and water facilities in our houses, we could have confronted to Corona virus staying at home, not having sanitizers, we could not be sanitized* *3) If we had food and water facilities in our houses, we could have confronted to Corona virus staying at home, not having sanitizers, we could not be sanitized*
Social ***Economic***	1) Could not opt secondary sources of income	*1) Not having mobile, children could not study online, fishing stopped, even could not do coconut business that we planned to do* *2) We planned to produce our own food items but could not do that. We wanted to have kitchen garden to manage food system of our family, but that could not be possible since we could not go out to arrange seeds or plants*

The quotes described in this table show that fishers were impacted economically and socially. They felt limited in terms of money which stopped them from having a normal peaceful life. The type of life in which they could fulfil all necessities of

family and children. They were so helpless that they could not even opt for other sources of income to support them financially. Overall, the economic un-wellbeing of fisherfolk impacted their social life, and health.

4.5 COVID-19 as a key driver exacerbating existing vulnerabilities

This section shows how COVID-19 is linked with the existing sources of vulnerability in Chilika and how it aggravated the vulnerabilities. The following table 4.9 explains the scenario at Chilika lagoon before and during COVID-19 pandemic. Along with, it highlights the significant vulnerabilities based on the existing vulnerabilities (refer section 4.3) and the vulnerabilities that emerged during pandemic (refer section 4.4). Vulnerabilities are discussed from the perspective of social, environmental, and economic dimensions of sustainability. The following table 4.17 shows a comparative study between the existing vulnerabilities (before pandemic) and the during pandemic vulnerabilities. It displays how these vulnerabilities gave rise to a significant type of vulnerabilities and how those vulnerabilities impacted the wellbeing and capitals.

Table 4.17: Showing a comparative analysis between existing and new vulnerabilities with absence of wellbeing

Sustainability Dimensions	Wellbeing & capitals	Pre COVID-19 scenario	During COVID-19 scenario	Significant Vulnerabilities
Social	**Subjective** (Human and Social Capitals)	Livelihood managed somehow	Difficulty in managing livelihood	Weakening of livelihood
		Happy children, playing with friends	Limited the regular activities	Increasing social gaps
		Proper studies, had nutritious food in school	Schools were closed during pandemic and students also stopped studying	Loss of education & development

		Unavailability & affordability of medical services	No medical facilities available	Adverse impacts on physical & mental health
		Children helped their parents in work	Restrictions implemented strictly	Disturbed wellbeing
Environmental	**Material** (Natural, Financial and Physical Capitals)	Recreational activities leading to income	No recreational activities possible due to pandemic	Financial loss
		Eco-crimes	Eco-crimes persisted	Ecological destruction
		Adverse impacts of natural disasters	Pandemic worsened the situation after cyclone '*Fani'*	Weakening of livelihood and financial structure
		Increase in illegal prawn *gheries*; encroachment	Increase in illegal prawn *gheries*; encroachment	Adverse impacts on lagoon
		High pollution	Less pollution	Less human interference, less destruction
Economic	**Relational** (Human and Social Capitals)	Ups & downs in the fish market prices	Decrease in fish rearing, harvesting, and selling	No sell
		Unfair price of the sell	Sold fish at any price	Difference in catch price
		Storage issues due to no ice factory in the area	Faced more economic crisis during pandemic	Storage issues
				Reverse migration

		Can't commute to sell the catch due to limited transportation	Issues in commuting due to transport unavailability	Commuting issues
		Took loan, have debt	Took loan, sold properties	In debt

Source: Adapted from Nayak and Berkes (2019)

4.5.1 Social dimension

Looking at the *subjective* aspects of wellbeing, despite several difficulties, fisherfolk were surviving some way and being happy before the pandemic. They were trying to live a contented life at the individual and community level within the given resources. Their children enjoyed the school environment, playing with friends, and having nutritious food at school. At *relational* wellbeing level, it could be noticed that sometimes children helped their parents with work at home and fishing.

On the other end, during COVID-19 pandemic, the vulnerabilities increased. Fisherfolk consider pandemic as an unexpected health crisis that limits their regular activities such as going out fishing, meeting neighbours, relatives, or other close ones, meeting at community centres, doing recreational activities in groups, as well as shopping, disturbing their *relational* wellbeing. Social gaps were increased due to the pandemic. Schools were also closed since the beginning of the first lockdown in March 2020. Children could not go to schools and could not even take online classes due to the unavailability of smart phones at home due to financial issues (lack of *material* wellbeing). Their studies and overall growth were impacted badly. Overall, livelihood weakened during pandemic, showing an impact on their *subjective* wellbeing.

At *material* wellbeing level, in the village, there are fewer medical facilities available. So, when the pandemic was at its peak and fisherfolk required medical

services, they could not avail affordable medical diagnosis and treatment. There were several reasons: 1) no transport available; 2) unavailability of health centres in the village; 3) unaffordable diagnoses and treatment. Fisherfolk faced adverse physical and mental health conditions, impact on *subjective* wellbeing. As the schools were closed due to pandemic, they were converted into quarantine centres for the people who were coming from outside and required to quarantine. This seems to be a good step as during pandemic there was a shortage of the health centres for increasing COVID-19 infection cases. Inclusively, looking at the lack of *wellbeing*, the villagers lived a fearful and miserable life during pandemic, impacting social and human capitals. Though strict COVID-19 restrictions saved many lives, these restrictions made fisherfolk survival tougher.

4.5.2 Environmental dimension

At *material* wellbeing level, Chilika had a high footfall of tourists due to various kinds of recreational activities before COVID-19. The main center of attraction for tourists is the dolphins. Tourists use mechanical boats to roam. Usage of machine boats spill oil into the sea water, causing water pollution. Also, machine boats create noise pollution which is harmful to the aquatic species. Tourists throw rubbish here and there on the beach making the surroundings dirty & untidy. However, due to COVID-19 restrictions, all recreational activities such as fishing and tourism were stopped. Without tourists Chilika lagoon environment looked clean and tidy (*relative* wellbeing).

At *material* wellbeing level, there have been some other serious issues that were continued before pandemic. Those issues impacted the *subjective* and *relational* wellbeing of fisherfolk. The following explained the types of ecological destructions that happened at Chilika lagoon:

1) Natural calamities such as cyclones and floods cause vulnerabilities among them. fisherfolk face damage to *material* wellbeing, impacting the natural, financial and physical capitals. Flood cause closure or opening of mouths (impacting natural capital); damage fishing equipment such as nets, boats (impacting physical capital);

ultimately fishers are not able to do fishing without equipment. They invest in arranging new equipment or travel to distant places for fishing, this causes them financial loss (impact on *relative* wellbeing). However, the situation worsened during the pandemic. In Chilika, cyclone '*Fani'* hit in May 2019. Cyclone '*Amphan'* hit Chilika amidst of COVID-19 pandemic in May 2020. Cyclone *Amphan* and extreme flooding were an indication of the things to come, impacting wellbeing of fisherfolk.

Fishers were already vulnerable due to the cyclones which created four new mouths in Lake Chilika. According to the Chilika Development Authority, this could make the lake water more saline, thus affecting marine life (The WIRE 2019). Effect on marine life would lead to less fishing at Chilika and hence livelihood loss. Sea mouths are an important feature of coastal lagoons (Nayak & Berkes 2019). In Chilika, oral history records about seven sea and river mouths that helped create the distinctive character of the lagoon in which marine, freshwater, and brackish water environments are found in different locations. Sea mouths do close down naturally, and Chilika had lost most of its sea mouths by the twentieth century. Bengal District Gazetteers, in 1908, refer to a single functional mouth into the Bay of Bengal (O'Malley 1908). Post-1970, this sea mouth was not sufficiently functional to facilitate the flushing of sediments and silt from the lagoon into the Bay of Bengal, resulting in the need for a more functional opening with the sea, and so a new mouth was dredged in 2001 (Nayak 2014).

2) Non-fishers play a major role in changing the lagoon environment. They practice more advanced techniques of fish rearing and harvesting which involve the usage of mechanical support instead of the traditional methods which fisher community have been using for a long time. Initially, Chilika lagoon was the area known for artisanal fishing only. But now, it has changed, since the non-fishers encroached the area and have started prawn culture or aquaculture. The international market for shrimp and prawn developed in the 1970s; prawn in India that had little value previously now became "pink gold" (Kurien 1992). Intensive

shrimp aquaculture started in the late 1970s in India and gained momentum in the mid-1980s, putting India among the leading shrimp exporting countries in the world. The total value of export earnings from shrimp in the year 2004 was US$715 million (FAO 2006) and has risen since then. Aquaculture has developed explosively in the last 50 years, and some of this development has empowered small producers (De Silva and Davy 2010). But aquaculture enthusiasts seem to forget that much of the expansion has been at the expense of small-scale capture fisheries that previously occupied the areas into which aquaculture has expanded, sometimes with serious impacts on the previous resource users (lack of *relative* wellbeing. The shallow and sheltered waters of the lagoon are also suitable for aquaculture, especially for the intensive production of the lucrative tiger prawn (*Penaeus monodon*) that naturally occurs in these waters.

3) Fishers and dolphins in Chilika Lagoon share a mutually positive relationship; where fishers perceive dolphins to help them catch fish, and dolphins benefit by feeding at fisher nets (DLima et al 2014). Chilika fisher–dolphin interaction is comparable to other dolphin–fisher relationships and is equally important from the perspective of dolphin conservation. Although fishers and dolphins in the Chilika lagoon appear to have a mutually positive interaction, conservation of the dolphins is a challenge in practice. The population of Irrawaddy dolphins at Chilika lagoon is likely ‘‘critically endangered’’ and decreasing (Sutaria and Marsh 2011). In addition, a small gill-net fishery occasionally operates in the lagoon, sometimes resulting in dolphin bycatch mortality (Figure 4.15). There is thus an urgent need to formulate management strategies if this population is to be conserved. Along with this, dolphins are the major tourist attractions leading to a good income for the fishers.

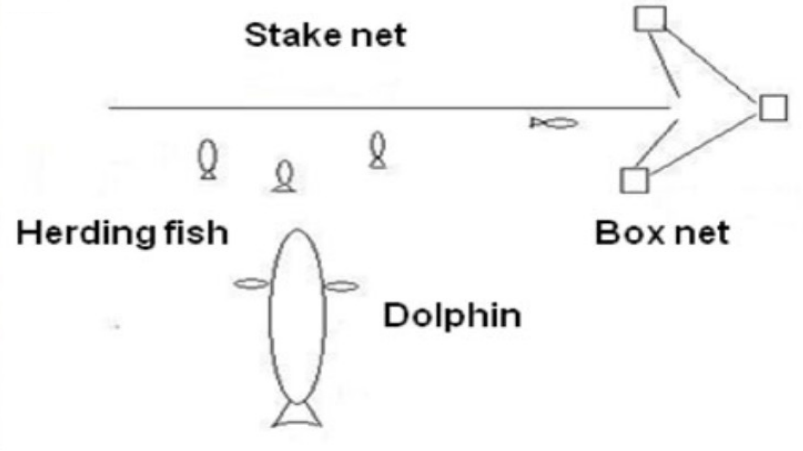

Figure 4.14: An illustration of how Irrawaddy dolphins herd fish towards stake nets during stake nets barrier-foraging *(*Source*:* DLima al 2014)

4) Hunting of migratory birds is a matter of concern at Chilika lagoon. Chilika lake is the largest home to migratory birds. Migratory birds such as northern pintail, gadwall, shovelers and common coot. It is the largest wintering ground for migratory birds on the Indian sub-continent and is home to several threatened species of plants and animals. Migratory birds are important as they play several essential and indispensable roles in the ecosystems through symbiotic association. As laid out in Down to Earth's article (2021):

- Such birds raising broods end up acting as pest control agents by devouring insects and other organisms that harm the environment and crops.
- Locust attack is one such disasters that stem from the absence of birds. Migratory birds help in dispersal of seeds, leading to maintenance of biodiversity along their routes.
- Ducks can transport fish eggs in their guts to new water bodies. The droppings of birds, also known as guano, are rich in nitrogen and act as organic fertilizers. Egg shells can add calcium and other minerals.

- Migratory birds form both prey and predator bases in ecosystems seasonally and can, therefore, have an ecological impact. Prevalence of migratory birds helps analyse the state of environment in an area.
- According to an article published by Orissa Post (2018), there have been reports that affluent people indulge in bird poaching to please their palate without giving any consideration to environmental consequences. Killing of birds disturbs the food chain and ecosystem. Given in Orissa post article the way poachers hunt them is that – some lay nets to catch species, some others focus a kind of bright light onto them, making their vision blurred. Thereafter they hit them on their beaks with a stick to catch them. Yet another group of hunters use a kind of sedative that is injected into the pods of flowers or in their food. Since the meat of migratory birds are in high demand among the non-vegetarian people in the nearby towns, the poachers hunt them to meet the demand and earn extra money. Tourists visit Chilika to see migratory birds during the season, poaching of birds negatively impacts the tourism industry, leading to financial loss to fishers.

4.5.3 Economic dimension

At *material* wellbeing level, fisherfolk worship dolphins and do not kill them. Fishers have a firm belief that dolphins are the source of income for them as these help in catching small fish and a big centre of attraction for tourists as well. This trend continued before the pandemic. Due to COVID-19 restrictions, tourists did not come to see dolphins and to engage in other recreational activities such as fishing. This impacted fishers economically. However, after the lift in strict restrictions during pandemic, economic activities resumed at Chilika.

At *relative* wellbeing level, fish market was unstable before the pandemic. The price of the catch varied as per the fish trader's or middlemen's demand. Even if the prices were high, fishers had to sell the catch to those middlemen only. Please refer table 4.15 for the rates of fish before pandemic. There were several reasons for selling the catch to fish traders at their expected price (*material* wellbeing): 1)

Due to lack of transportation facility in the village, fisherfolk were not able to travel to fish market to sell the catch on their own; 2) fisherfolk were also unable to store the catch as there was no cold storage facility available in the village. Ultimately, fishers ended up in taking loans and advance money from the fish traders for their survival (*subjective* wellbeing).

During COVID-19, fishers faced more economic crisis than before. Fisherfolk were unable to go out for fishing due to strict restrictions. Those who still did the fishing somehow, they could not sell the catch because of the closure of fish markets. No fish trader visited them to buy the catch, especially during the first six months of lockdown (*relative* wellbeing). The fish traders who agreed to buy the catch from fishers, demanded unreasonable prices to sell the catch. Fishers had no other option except accepting their offers. This made them financially weak.

Fisherfolk sold their properties, spent their savings, and took loans for their survival & livelihood. The major sources for taking the loans were from fish traders, and government. Fishers can get a limited amount of loan from the government, so, the fish traders were there for their help. But taking help from fish traders is like becoming a part of 'never ending slavery cycle.' Fishers provide them loan and in return they take advantage of their situation. There is livelihood and wellbeing loss due to taking loans from middlemen, fish traders, fish vendors or agents. This is explained below:

- Middlemen give loans to the fishers. Now, there is a kind of agreement between the middlemen and fishers that fisherfolk cannot sell their catch to anybody else. In this situation fisherfolk seem to be sold to the agents. It is an impact on their *relational* as well as *material* wellbeing because no other agent would buy from them even if they want to sell.
- Interest rates on the given loans is not fixed. It varies from agent to agent, and which is generally high. Fisherfolk keep paying the interest amount

only and unable to pay the principal amount. Thus, it is impossible for them to come out of this trap (impact on *subjective* wellbeing).

- Sometimes, fishers take advance money from the agents. The price of that advance money is also determined by the middlemen. Fishers are now bound to sell the catch on the same price which was fixed by the agents while giving the money. Even if the price in the market is high, fishers have to sell on the same fixed price. Therefore, they cannot take the benefits of the fish market (loss of *subjective* and *material* wellbeing).
- Family of fisherfolk also get involved into this cycle. The son of a fisherman will become fisherman and he can also sell to the same agent from whom his father has taken the money (loss of *subjective* wellbeing).
- Fisherfolk also put up their jewelry, property, fishing equipment as collateral to *sahukars* for the money (loss of *material* and *subjective* wellbeing). Generally, because of less income, fishers are unable to repay their debt.

Looking at the above points on taking loan from agents, it seems better to take loan from the banks. The rate of interest while taking loan from bank would be lesser than the agents. But it also appears difficult for fisherfolk to approach the banks. It could be due to lack of transport, less knowledge, and lack of awareness. Due to these reasons, it is easy for them to take loan or money from the agents and then get trapped in the vicious cycle.

Fishers also mentioned about the people who migrated from the village in search of better employment and livelihood. Migration happens at both individual and community levels and occurs due to multiple reasons such as the lookout for better job opportunities, improved living conditions and for enhanced productivity and thereby greater income (Raj, 1981; Shahare, 2020). There are about 100 million internal migrant workers in India, and most of them are daily-wage labourers who have travelled out from different states like Uttar Pradesh, Bihar, Jharkhand,

Odisha, West Bengal, and other states to other states in search of unskilled or semi-skilled jobs (Hazarika, 2020). When the lockdown was implemented, there was no work for them in cities. These migrants too were trapped in the lockdown with no jobs and no money, and facing major economic setbacks, besides being isolated from their families due to the sudden lockdown (Mishra and Sayeed, 2020). Even though, the lockdown situation affected the community at large, and people were obliged to stay at home, the migrants could not even be in the comfort of being locked in with their families; instead, they were destined to be stuck in a migrant land with no means to survive (Kumar et al., 2020). Therefore, this community had to endure more appalling hardships than anyone else, not only financially but also socially and mentally (Aragona et al., 2020; Singh, 2020a, 2020b, 2020c).

Table 4.18: Shows the major psychological impacts

⇒ Loneliness
⇒ Decrease in social connectedness
⇒ Fear of death
⇒ Frustration and tension
⇒ Depression and stress

The findings from a study (Kumar et al., 2020) on the psychological impact of the pandemic on the migrants, revealed that the migrants underwent loneliness, felt that there was a decrease in their social connectedness, experienced fear of death, experienced frustration and tension and some of them were diagnosed with depression. The migrants either faced loss of pay or a reduction in their salary (Shahare, 2020). International Labour Organization (ILO) estimated a decline of 22.6% in the wages of migrant workers post lockdown (Gothoskar, 2021). As a result of unemployment during pandemic in migrated cities, migrant fishers had to move back to their homes in Chilika. There were high chances of migrants being infected with virus. A local respondent mentioned, "*If we could have been given work for our income generation here in Odisha by the government, our people*

would not have migrated to outside and infected by virus" (Respondent 48) (impact on human and social wellbeing).

4.6 Conclusions and chapter summary

The findings of vulnerabilities described in this chapter are based on primary and secondary data study. The major systems focused on this study are social, environmental, and economic. Several drivers have contributed to the marginalization of fishers in Chilika. Drivers generally refer to any natural or human-induced factor that directly or indirectly causes a change (MEA 2003), some of them natural and others human induced. The influence of these drivers came from different levels of social and political organization from the local to the international (Nayak & Berkes 2010). The impacts caused by natural factors such as cyclones and floods damage house, fishing boats and take away fishing gears. To go out for fishing again, they need to buy new gears for which they either have to take loans or advance money from middlemen or panchayat. They do not even receive any kind of compensation for their loss from government. This impacts not just their livelihood but make them financially weak. The amount they borrow keeps adding up as they are unable to pay back within a short period of time by doing fishing only. Thus, the main debt remains.

To manage their financial instability, fishers engage their school drop-out children in fisheries related work, without realizing that they are dragging their children in the vicious cycle of fishing world, which causes some of the younger children to be trapped in this cycle. This not only steals their childhood but also harm the mental and physical growth of children. Loring et al. 2019 mentioned that employment types describe how a worker is employed. For example, the international labour organization's (ILO) classifications of employment are: Employees, employers, own-account workers, members or producer cooperatives, contributing family workers, workers not classifiable by status. These can be adjusted to fisheries (e.g., boat owner, paid by catch share, employed by a

company/cooperative). Employment is considered part of the socioeconomic dimension, showing how many people depend on fisheries for their work and livelihoods. The number of people employed in a fishery and the number of dependents accounted for here can be direct and indirect. Direct employment includes all people who fish, this includes men, women, and children, as well as encompassing all fishing activities, whether they happen from the shore, for example, collecting invertebrates, or fishing from a boat. Indirect employment includes people engaged in the post-harvest sector, any processing and selling of the catch. The more people employed in the sector the better it is for economic viability. According to FAO, fishing is possibly one of the most hazardous occupations in the world, and while child labour in fisheries occurs in all regions, it is most widespread in Africa and Asia. Children engage in activities that range from active fishing, cooking on boats, diving for reef fish or to free snagged nets, herding fish into nets, peeling shrimp or cleaning fish and crabs, repairing nets, sorting, unloading, and transporting catches, and processing or selling fish. As said by Mr. Willmann:

> *"Child labour often reinforces a vicious cycle of poverty, has a negative impact on literacy rates and school attendance and limits children's mental and physical health and development.*"

The anthropogenic factors such as encroachment by non-fishers and prawn culture is not only impacting the fishers' livelihood but also damaging the lagoon environment. Non-fishers use advance methods for fishing which pollutes the environment and harms the other aquatic species. They catch the juvenile prawns to sell. The caste-based fishers (traditional fishers) feel left out and deprived of their rights for fishing there. Hence, they are unable to earn money by fishing at Chilika and cannot also engage themselves in other works due to unavailability of secondary source of income in Chilika. This leads the fishers to migrate in search of work and income to different cities. Life after migrating is still challenging. They

remain away from the family missing psychological and emotional support. They face various challenges as part of 'reverse migration' during pandemic.

Even during the pandemic, anthropogenic & natural factors exaggerated the tough times of COVID-19. Fishers were economically stressed during the pandemic. The COVID-19 pandemic has imposed challenges to the fisheries and market governing system (Haas et al., 2020). The effects on small-scale fisheries are likely higher than large-scale fisheries due to their vulnerability, as suggested in recent studies, such as Love et al. (2020) Campbell et al. (2020), Giannakis et al. (2020). A large number of fisherfolk have a high dependency on fish as food and income, and as a result, the lack of organization and poor infrastructure for the supply chain, contribute to making small-scale fisheries vulnerable to the COVID-19 pandemic, with high risk reported in some African countries and the Small-Island States (Stokes et al., 2020; Aura et al., 2020; Kaewnuratchadasorn et al., 2020). The consequences of this may make small-scale fishers susceptible to 'poverty traps' (Allison and Seeley, 2004), which is the main concern expressed by FAO (2020c).

Lastly, small-scale fishers throughout the world are being dispossessed of their livelihoods through the impacts of various driving forces, such as the expansion of large-scale fisheries, growth of aquaculture and protected areas, and the re-allocation of coastal resources to other uses such as urban and industrial areas, as well as recreation and tourism (Nayak & Berkes 2010). The multiple levels and types of vulnerabilities in Chilika have impacted resilience in the small-scale fishery system of the lagoon. Its ability to deal with pressures of multiple drivers and strength to respond to change has been adversely affected. Changes experienced have eroded solidarity among fishers and the ability for collective action, hence the capacity for self-organisation and adaptation. Overall, the Chilika small-scale fishery system continues to remain vulnerable to ongoing processes of global change (Nayak and Berkes 2010, 2014, 2019).

Chapter 5

Analysing multilevel coping responses for viability

5.1 Introduction

Chambers and Conway (1992:6) suggested that "a livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities, assets and entitlements, while not undermining the natural resource base." Allison and Horemans (2006:759) state that "a livelihood is sustainable if people are able to maintain or improve their standard of living related to wellbeing and income or other human development goals, reduce their vulnerability to external shocks and trends, and ensure their activities are compatible with maintaining the natural resource.

Fishing is a job that is capital intensive and that demands them to invest a lot before going for a catch (Melake, 1989). In 2002, FAO estimated that 5.8 million small-scale fishers were under the poverty line (FAO 2002). Indian artisanal fisherfolk fall under the category of Below Poverty Line (New Indian Express, 2018). Poverty has struck this group since they are unorganized and lacking basic infrastructure to live. The vulnerabilities fishers have been suffering are described in section 4.3. To support their livelihood, Indian government evolved the Public Distribution System (PDS) as an important part of Government's policy for management of food economy in the country. Under this policy, government provided free/subsidized ration to the below poverty line ration card holders. Thus, fishers were being provided with 5kg ration per person per month. They did not get any monetary support from the government such as giving cash under this scheme.

During COVID-19 pandemic, the vulnerabilities among small scale fisheries exacerbated. It has become a stressor as it has affected people's lives in different aspects. It impacted fishing communities physically and psychologically. The COVID-19 pandemic restrictions were implied on a short notice giving less or no

time to people to prepare. Fisher's community which was already dealing with existing vulnerabilities felt helpless during the situation. Thus, to survive in the tough times of pandemic, fishers adopted certain short-term coping responses, which were required on urgent basis. Government and other institutions also took some possible measures to support their livelihood during the pandemic.

This chapter aims to address the measures taken during the pandemic by fisherfolk, institutions and government. The second objective understand the various short-term coping responses taken by coastal communities with their understanding. This objective also focuses on how other actors such as institutions, civil societies and government responded for the survival of small-scale fishers during the pandemic. The third objective focuses on how governance mechanism is working for the viability of coastal communities. It also discusses the plans or policies taken by government and suggested by small scale fishers on the basis of their experience and response for the viability during the post COVID period.

5.2 Coping responses by fishers to the impacts of COVID-19

Species adapt themselves to survive the situations. Likewise, when the COVID-19 pandemic spread, the fishing communities found out their own way to adapt themselves in that situation. With the onset of the pandemic in 2020, things came to an abrupt halt. People reduced gathering in due to lockdown orders. Fish markets were closed in Chilika. Thus, the domestic markets and tourism industry have also been directly affected by the restrictive health measures, for example, in India (Narasimhan, 2020). The closure of hotels, restaurants, cruise ships, and casinos, and the fall of tourism, further led to poor buy and sell volumes in the domestic markets for fish and fisheries products (Orlowski, 2020). Since most of the catch is sold at local fish markets, the impact of COVID-19 pandemic on income and livelihoods of fishers is considerable. With a decrease in overall demand for fish, and closure of market along with travel restrictions, the sale of fish dropped,

affecting the fisherfolk economically. Without income fisherfolk faced various challenges to maintain their livelihood status like before the pandemic (section 4.4).

Thus, to survive during pandemic times, fisherfolk adapted several measures which helped them survive physically and mentally. The following table 5.19 explains the coping measures adopted by fisherfolk as a short-term response to the pandemic. With these they were able to survive the challenges of the pandemic. However, some of the short-term responses make them vulnerable for long term. The section 4.5.3 explains the consequences of taking loans from the middlemen.

Table 5.19: Shows the coping measures tailored by respondents (N=48)

Dimensions	Coping Responses	Respondent (%)
Social	Maintained social harmony, peace & unity	77
	Food sharing & contribution	33
	No caring & sharing (negative response)	2
	Being aware of COVID-19 guidelines	87
	Cleanliness & hygiene of surroundings	42
	Support to institutions in arranging separate isolation rooms	2
Economic	Sold property & spent savings	15
	Loan from any source	100
Environmental	Clean shores or beaches & water	50
	Controlled pollution	29
	No specific activities (negative response)	25

Note: Question allowed for multiple responses

Around 77% respondents said that they maintained peace, social harmony and unity during the tough times. They cared about each other during the pandemic. Men and women all contributed to saving each other's lives. Women of Self-Help Groups (SHG) also played a main role in this. Some of them shared and contributed food among each other, stated 33% informants. As stated by female respondent 28, "*We*

women SHG members-imposed lock down in the village, did not allow outsiders to enter our village and villagers to outside, did sanitize the village". Another local respondent 12 said, "*We did rally to aware people on Corona virus pandemic, hand wash, distributed masks, provided rice, sugar to some people of the area*" (Respondent 13). Only 2% respondents showed no care and food sharing during COVID-19. They maintained their health and wellness by keeping themselves aware of COVID-19 guidelines and protocols. A male respondent 31 said, "*Imposing lock down, we did not allow outsiders to enter our village. We sanitized our village, educated people to use masks, collectively we fought against Corona virus*." Around 42% said that they took care of cleanliness and hygiene of surroundings. A respondent said, "I did spray phenyl in surroundings of our house, clean with soap and sanitizers, handwash." Another local respondent 48 mentioned' "*Did 3 times hand wash per day, maintained social distance, did not 'o to any one's house in fear of virus*". Villagers arranged separate isolation rooms for COVID-19 positives, 2% household informants cited. "*Quarantine centre was arranged at the school for the people coming from outside*" (Respondent 46).

To manage their financial crisis during the lockdown, they spent their savings, and sold their properties, and this was cited by 15% of household informants. Almost all the respondents (100%) took loans for their survival from relatives, neighbours, fish traders, government, and any other source they could get from. A local respondent 30 said, "*We sold land in INR.70000 (USD 925.20), saving was INR.20000 (USD 264.34) all I spent for family livelihood, did loan INR.15000 (USD 198.26) from SHG, paid back INR.3000 (USD 39.65) against loan*". Local respondent 28 mentioned, "*Lock down was imposed on Saturday and Sunday, fishing was totally banned. We were selling our fish and prawn to fish traders between 7 am to 8 am, did loan of INR.30000 (USD 396.51)*". Local respondent 44 mentioned, "*Took loan of INR.50000 (USD660.86) from Panchayat Mahila Mahasangha, made dry fish from prawn and fish*". Local respondent 30 cited, "*Did loan of INR.10000 (USD 132.17) from relatives, INR.15000 (USD 198.26) from*

traders". Respondent 26 said, *"Did loan of INR.2 Lacs (USD 2631.71),'spent on son's health*". They could not opt the secondary source of income such as agriculture. A respondent 46 said, "*Farming is damaged by jungle animals, loan is INR.80000 (USD1097.37) (approx.), out of that INR.12000 to 15000 (USD 158.61-198.26) has been paid back*".

Communities also contributed to managing the environment. About 50% of informants said they cleaned shores or the beaches. The following are the types of contribution household informants listed during the survey: 1) *We cleaned the sea beach by setting fire on plastic bottles and polyethene collected from there* (Respondent 28). 2) *We, 50 women from Mahila Samiti, Gan Kalyan Samiti (GKS) collectively cleaned pond, pondside, wastage, village surroundings putting bleach* (Respondent 30). 3) *Did sea beach cleaning work, did polythene free area for two times. Particularly the village youths took these steps* (Respondent 48). 4) *Women of SHG members organized meetings to aware the people about cleanliness and hygienic* (Respondent 41). 5) *We cleaned near pond, tube-well surroundings from where people get drinking water, that cleaning work is still continued* (Respondent 46). 29% of respondents cited that they focused on controlling the water pollution. Respondent 2 said, "*I did control pollution using manual boat instead of motor operator boat that used for tourist*".

Around 25% of informants said that they did not do such specific activities. The possible reasons for not engaging could be: 1) they were not aware about what steps they can take; 2) afraid of connecting with people through any medium; 3) they had no interest in any activity; 4) maybe they were suffering from psychological consequences due to isolation. Various research described the psychological impacts of pandemic. Prolonged isolation can adversely affect physical and emotional health, altering sleep and nutritional rhythms, as well as reducing opportunities for movement (Cacioppo and Hawkley, 2003). As a result, the natural channels of human expression and pleasure become depressive, with attendant impacts on mood

and subjective wellbeing (Nardone and Speciani, 2015). To date, more and more people are avoiding social relations, no longer by imposition, but as a choice.

5.3 Coping responses by institutions

5.3.1 Institutional response

During the pandemic, some local institutions and government supported the villagers for their survival during the pandemic. The following table 5.20 shows the discussion on arrangements done by various local or national institutions for the fishing communities. The institutions involved are described in section 3.4.2.

Table 5.20: Showing institutional responses during pandemic (N=48)

Institutional responses during pandemic		Respondents (%)
Institutions involved	Fisherfolk society	2
	Government institutions	35
	Non-government institutions	67
	No support	4
Connected through	Social media	6
	Personal visits	77
	Telephonic contacts	18
Livelihood	Free/subsidized ration supply	8
	Supply of health care materials/ medical aid	79
	Nobody helped for medical services (negative response)	15
Respondents' awareness	Yes	100

There were several institutions involved locally to support the villagers or the fisherfolk community during the pandemic. The 2% of respondents said they got some support from the Fisherman Society. 35% of respondents also mentioned that

the Village Development Committee also provided sustenance to them. A major number of respondents i.e., 67% said that they received help from other non-government organizations (NGO) such as 'Save The Children, Bhubaneswar, RCDC, Reliance Foundation. The respondents described the types of help they got from different NGOs: 1) RCDC has provided ration to a few people. 2) With Save The Children, NGO, Bhubaneswar, we did roadblocks for people not to bring outsiders into our village. 3) We were provided masks and sanitizers. RCDC, NGO has helped some people. There were also some people who did not get any kind of support during pandemic, as reported by 4% of informants. Respondents were not provided any cash/money related support by these organizations.

Nowadays, social media is said to be a good way to keep people connected. Around 6% informants mentioned said that institutions were connected through social media with them. A high number of informants i.e., 77% said that they were connected through personal visits of the institution members such as with Save The Children, NGO, Bhubaneswar and other local organizations such as Jeevan Rekha Parishd also distributed masks. Some respondents (18%) said they were connected to institutions over telephone. These organizations collected information from fisherfolk through these mediums and further informed government during pandemic. Thus, government at state level stayed informed with COVID-19 situation in the Chilika and also supported them through required survival (livelihood) necessities.

For their livelihood survival, 8% respondents said they were given free/subsidized ration supply. Respondent 26 said, "*RCDC has provided us a few packages*". Institutions provided medical aid, added 79% of respondents. Following are the types of medical aid institutions provided- 1) Distribution of ration by RCDC, masks by Reliance Foundation, masks & handwash soap by Anganwadi center, masks and sanitizers by SHG. 2) Reliance company and OLM organization distributed masks. 3) Save The Children distributed sanitizers and masks. Around

15% of informants said that nobody helped them for medical services. They were not provided with any health care material.

5.3.1.1 Institutional responses described on the basis of sample quotes

All respondents said yes when they were asked about their awareness level regarding the plans and actions that other institutions or their village heads took for their survival during and after the pandemic. Some said initially villagers followed all the rules, but later nobody cared. The following table 5.21 shows the plans and actions mentioned by household informants during the survey.

Table 5.21: Showing plans and actions of local institutions

Dimension	Institutional response	Quotes
Social (livelihood & wellbeing)	1) Barricaded the roads 2) Made quarantine compulsory for outsiders 3) Imposed fine of INR 1000 -200– (USD 13.32 - 26.43) for not following COVID-19 protocols in the village 4) This was continued strictly till first 6 months of lockdown 5) Those who broke the rule were not supplied water, ration and woods for fire as the punishment. 5) Women also supported in spreading awareness among people	*1) The village leaders blocked the village roads, did not allow outsiders to enter the village. Those were coming from other town or state, they stayed at quarantine shelter, imposed fine of INR 1000 (USD 13.32) who broke this rule* *2) Village leaders in support of SHG members blocked village roads with bamboo and wooden fencing and did not allow outsiders to enter the village and villagers to outside. Imposed fine of INR.1000 – 2000 (USD 13.22-26.43) who broke the rule. This rule continued till 6 months* *3) Yes, we, women SHG members did aware to villagers, village leaders blocked the village roads and made rule for outsiders not to enter the village and instructed the villagers do not visit outside* *4) We, the villagers lived following*

		the government rules, there were restrictions in the village, be punished not following the rules, who broke the rule, they were cornered and water, ration, fire stopped to them
	1) Provided food, masks, sanitizers	*1) Save The Children provided food, masks, sanitizers and necessary supplies for adolescent girls. Our village people-imposed lock down for not to allow outsiders to enter our village. All our villagers are used masks and sanitizers when they went out*

The sample quotes showed that the institutional plans and actions were mostly devoted towards the safe livelihood and wellbeing of the villagers. Both governmental and non-governmental institutional (refer section 3.4.2 for detail) played a major role in supporting fisherfolk by helping them in implementing COVID-19 pandemic related regulations, following the advisory, and providing required protective equipment.

5.3.2 Governmental response

Along with the institutions, state and national governments also supported them through various services. The following table 5.22 shows Government arrangements for Chilika Lagoon villagers during the pandemic.

Table 5.22: Government arrangements (N=48)

Government arrangements during pandemic		***Respondents (%)***
Connected through	Social media	92
	Personal visits	2
	Telephonic contacts	2

Livelihood	Free/subsidized ration supply	100
	Cash support	96
	Supply of health care materials	6
	Free mobile testing & vaccination facilities	10
Respondents' awareness	Yes	100

Around 92% respondents mentioned the government was connected to them primarily through social media. Fishers were restricted from the fishing operation during pandemic. But their cooperatives were still active, and there were several other institutions like the panchayat office to communicate the government decision with them. The media and the administration had spread the awareness, and the fishers carried it forward in one way or the other through the help of institutions and organizations. Some (2%) said that they were in contact through personal visits such as ASHA workers. Telephonic contact was also a medium to stay connected with villagers, mentioned 2% of respondents. A local male respondent mentioned, "Government contacted us through Sarpanch and telephone" (Respondent 48). One major source to stay in contact with government was social media, as reported by 92% of informants. Only 2% said that they were being contacted through personal visits such as Panchayat members, and ASHA workers (explained in methods). Some of them (2%) were contacted through phones.

All the respondents (100%) said that they were provided with more free rations than normal days during the pandemic lockdown. This service was provided mainly during the first six months of the pandemic. 96% of informants also responded that they were also provided with cash INR 2000 (USD 26.43) per household during the lockdown. Respondents mentioned: 1) *We received free ration of State and Central government and cash support of INR 2000 (USD 26.43)* (Respondent 9).

2) *We were given cash support of INR 2000 (USD 26.43), free ration for 6 months and women SHG had given 2 Nos. of masks each* (Respondent 27). 3) *The government provided free ration per card for 6 months, cash support of INR 2000 (USD 26.43) and Anganwadi centre distributed sanitizers and masks* (Respondent 28). 4) *We were provided cash support of INR 2000 (USD 26.43) and 5kg. ration of state and central government per head* (Respondent 48). 5) *We have received free ration, cash INR .2000 (USD 26.43), vaccines, and INR 1500 (USD 19.83) under Labor Card* (Respondent 24). 6) *We were given free ration for 6 months, cash support of INR.2000 (USD 26.43)* (Respondent 50).

Fishers were not given free medical services during the early COVID-19 period. A respondent (44) mentioned, "*Free mobile health service has not been done*". Though 6% respondents said that government supplied health care materials during the pandemic. All respondents responded (100%) yes for free vaccination facility. "*Only the government has arranged free vaccination facilities*," said local respondent (1).

5.3.2.1 Government response described on basis of sample quotes

All respondents (100%) said yes when they were asked about their awareness level regarding the plans and actions that the government took for the survival during and after the pandemic. Table 5.23 shows the plans and actions informed by respondents during the survey.

Table 5.23: Showing plans and action of government taken during pandemic

Dimension	Government response	Quotes
Social Economic	1) Free ration supply 2) Cash distribution 3) Free vaccination facility 4) Lockdown	*1) Free ration, cash distribution, free vaccination, imposition of lock down, shut down and maintain social distance.* *2) Did vaccination, imposed lock down,*

	restrictions 5) Distributed sanitizers and masks	*punishment for breaking the rules; new guidelines for treatment facility, distribution of sanitizers and masks, free ration and cash support.* *3) Planning was for distribution of free ration, cash support, vaccination facility and Policies were imposing lock down, maintain social distance, no one can travel without vaccination.*

The sample quotes showed how government acted to save the livelihood and wellbeing of the villagers during pandemic. Government's services related to supply of food, money and free vaccination drive proved like a boon in the initial days of pandemic.

5.4 Multilevel coping responses

In this section the discussion is on the coping measures taken by SSF communities, various institutions, and government authority (table 5.24). Global change drivers affect all the various productive systems in the world and create problems that have no easy solution (Chuenpagdee 2011). Small-scale fisheries will remain vulnerable to multiple challenges, as in the Chilika case; however, they also have certain strengths that help make them viable. Many small-scale fisheries are by necessity flexible, adaptable, and able to respond to change, if given a chance – otherwise they would have disappeared long ago (Berkes 2015).

Table 5.24: Shows list of potential responses taken during pandemic by SSF communities, institutions, and government

Dimensions	Wellbeing and capital	Vulnerabilities	Response of fishers	Institutional role	Government arrangement
Social	**Relational**	Weakening of livelihood	Maintained peace & harmony	In person visits in village	Connected through phone calls, in person visits

	(Human and Social Capitals)	Increasing social gaps	Did awareness campaigns	Free ration supply	Free ration supply
		Loss of political voice	Implemented COVID-19 guidelines	Supported villagers in implementing COVID-19 guidelines	Implemented COVID-19 guidelines
		High dropout from school	Arranged quarantine centres	Provided medical aid	Free vaccination facilities
		Adverse mental and physical health conditions		Provided masks and sanitizers	Distributed masks & other PPE
Economic	**Material** (Natural, Financial and Physical Capitals)	Migration – income is not financially rewarding	Could not opt secondary sources of income		Cash support
		Lack of asset holding	Sold property, spent savings		
		Financial loss	Took loan		
		Migration – no other work opportunities			
Environmental	**Subjective** (Human and Social Capitals)	Encroachment – lack of access to fish stock and fishing grounds	Cleaned the beach and potable water resources		Allowed traditional fishing methods
		Pollution and adverse ecological changes	Used manual boats		
		Shrinkage in lagoon fishing area and fish diversity			

Source: Bebbington (1997), Gough and McGregor (2007), Walker et al. (2004), Weeratunge et al. (2014), Nayak and Berkes (2014, 2019) and Nayak (2017)

5.4.1 Social dimension

At the *relational* level, small scale fisher communities did their best to save their social and human capitals. They maintained peace and harmony among themselves. With the help of different institutions, they did awareness rallies against the pandemic, awaking people about following COVID-19 guidelines and restrictions.

Several organizations such as Save The Children, GRP, RCDC and Jiban Rekha Parishad were connected with fisherfolk through various sources i.e., through phone calls and in-person visits. Government authorities such as village *panchayat* people were in contact with the villagers through phone calls and in-person visits as well.

At *material* level, fisherfolk arranged quarantine centres in the schools as there were less health centres available in the village. Also, schools were closed during lockdown. The people who were coming back to their homes during COVID-19 lockdown, were isolating in the schools as per the rules. Many people migrated due to less income sources in Chilika. Those people migrated back to home when everything and every kind of work was shut down during the pandemic and there was no source of income left for them. The organizations provided free masks and sanitizers to the villagers during the first lockdown for their safety. Government also provided masks and PPE kits to the fishers. Vaccination being a way to flatten the curve of COVID-19 pandemic, villagers were given free vaccines after the availability of vaccines in the market. With the ease in COVID-19 restrictions, the fish market and other recreational activities were opening gradually.

At *subjective* level, villagers imposed a strict lockdown in the village and maintained the social distancing. In this way, they supported the COVID-19 protocols. These organizations provided medical aid to the villagers during pandemic. Organizations also supported them in blocking the roads during pandemic and sanitizing the village area. For the livelihood of villagers, organizations along with government provided free rations to the villagers during first lockdown period (up to 6 months).

5.4.2 Economic dimension

At *material* level, they could not opt for secondary sources of income. So, for their survival during the pandemic, they sold their properties, and spent what they had saved. They took loans from the fish traders (the middlemen) and from government

such as *panchayat* or *sahukars*. They put up their jewelleries, property, fishing equipment, and other material means as the collateral for the loans. Taking the loans somehow saved their livelihood during the pandemic but made them fall into a never-ending cycle of slavery. This cycle keeps them bounded with the fish agents for the years, impacting their *subjective* and *relational* wellbeing. Villagers who did fishing and were not able to sell due to restrictions or increased rate of fish traders, dried up the fish and prawn for selling later or sold them out at fair price. At *subjective* level, government provided them some cash support for the initial months of pandemic, majorly during six months. Though this financial support was not enough for them to meet the daily necessities.

5.4.3 Environmental dimension

At *subjective* level, before the pandemic, encroachment was happening due to aquaculture. Pollution due to tourism and other practices was at a high level. Adverse ecological breaches were happening due to IUU. There were also reported cases of lagoon area shrinking. But during the pandemic the scenario was opposite. Due to less interaction at the lagoon, the village people decided to clean the lagoon environment. They picked up all the litter caused due to recreational activities at the beach. They also cleaned the surrounding areas of their drinking water sources such as tube wells and ponds. Their major contribution in controlling the pollution was usage of manual boats instead of motorboats. They took these measures on their own during the pandemic. Such efforts showed the strengthening of *relational* wellbeing, where they all contributed together, willingly, for a good cause. Also, government supported them by allowing traditional fishing methods only, where they could use manual boats and nets.

5.5 Viability notions and positive coping during and post pandemic

This section deals with the discussion on viability of fishers during and post pandemic. It talks about what measures government took and what limitations fisherfolk faced socially and economically and how their wellbeing and capital was impacted. Later, discussed the views of fisherfolk for their viability during

pandemic.

5.5.1. Discussion on government measures and limitations faced by fisherfolk

The outbreak of COVID-19 pandemic was an unexpected crisis added to the livelihood of fisherfolk. It impacted them from all the dimensions of sustainability. Also, there are no confirmed signs till how long this pandemic will stay in the world. Therefore, it's better to learn to live with the COVID-19 pandemic. Fisherfolk have to adapt measures and government should also take steps to save their livelihood and wellbeing during and post pandemic. Table 5.25 highlights the measures government can take so that fisherfolk do not face the limitations for their survival during and after pandemic. There are several potential conceptions discussed for the viability of fisherfolk and to improve the quality of life during the post pandemic times.

Table 5.25: Government measures and limitations of fisherfolk during pandemic

Dimensions	Wellbeing and capital	Government measures	Limitations faced
Social	**Relational** (Human and Social Capitals)	Immediate/early vaccination	Food insecurity
		Support for alternative and safe livelihood	Unable to fulfil daily necessities
		Free medical services	Reduction in social interaction
	Subjective (Human and Social Capitals)	Importance to children's education and wellbeing	Struggle for medical services
			Effect on wellbeing of children
			Psychological impacts

Economic	**Material** (Natural, Financial and Physical Capitals)	More cash support Facilities for fish, prawn selling Secondary income sources More loan by government	Could not get income from fishing Could not repay debt Could not sell the catch Less tourism

5.5.1.1 Social dimension

At *relational* level, villagers felt that early vaccination should have been provided to them as it was the best way to flatten the pandemic curve. It was true that vaccines were not available in the early stage of the pandemic. Trials were still going on. Villagers' responses on immediate vaccination shows their lack of awareness, lack of information and how much panic they were. They were losing their livelihood, wellbeing and their source of income which depends on fisheries due to the COVID-19 pandemic lockdown and restrictions (impact on *subjective* wellbeing). When they were not able to fish in early days of lockdown, they were dependent on government's rations. Even after the first lockdown when stringent restrictions were slightly lifted and fishers were able to go out for fishing, they could not sell the catch, could not earn any money and hence were unable to feed family. Thus, they sought government's rations, which supplies were to be provided until one year at least.

At *material* level, as they were unable to earn money, villagers faced various limitations during the pandemic when they were unable to fulfil daily necessities of the family, they could not celebrate festivals, there was a struggle for medical treatment, their children were not able to study due to unavailability of smartphones at home. Villagers required that government should pay attention on alternatives for safe livelihood by introducing secondary sources of income in the village. Villagers were also concerned about the people who migrated because of less job opportunities. During lockdown they returned to homes but some of them were

COVID-19 positive. Villagers believe that if there were job opportunities in the villages, they would not have migrated.

COVID-19 is a physical disease. As such, public attention has been placed more on the numbers of infected cases and death tolls as well as physical health complications arising from the disease. While it is crucial to focus on the physical wellbeing consequences of COVID-19, looking at other aspects of wellbeing under COVID-19 is equally important. In the medical and allied professionals, it is commonly argued that there are four domains of health, including physical, psychological, social, and spiritual domains. Besides the physical consequences of COVID-19, we need to understand the psychological consequences of the pandemic, such as depression and post-traumatic stress disorders. Most importantly, it is vital to understand how different psychological resources such as adversity quotient (AQ), emotional quotient (EQ), and coping resources may help individuals cope with stress arising from COVID-19 (Shek 2021).

Regarding social health, there are several areas of concern. First, as mentioned above, there are positive and negative consequences of COVID-19 on families. Hence, how to maintain family health and promote family resilience is an important question to be addressed. One argument that should be considered is that the promotion of family social capital is an attractive option for the family with a reduction in the financial capital of the family under COVID-19. Second, with city lockdown, social interaction drops. As social support is a protective factor of adversity, reduction in social interaction is a threat. Undoubtedly, with Internet technology, it is possible to maintain social contact with others. The same social well-being challenge exists for young people. But in the case of Chilika, fisherfolk were unavailable to afford smart phones with latest technology or some of them are still using 2G phones. Due to unavailability of smartphones, children could not study online. Finally, relative to studies on physical wellbeing, comparatively fewer studies have been conducted to examine spiritual wellbeing under COVID-19. Focus on spiritual well-being is essential for two reasons. First, finding meaning in

suffering under COVID-19 is vital. Second, spiritual resources such as seeking help from God and having positive beliefs about resilience (such as positive cultural beliefs about adversity) are important for positive coping (Shek 2021).

Being health centres far from the village, unavailability of transport and high cost, villagers could not afford medical treatments. Throughout the pandemic, they faced challenges in COVID-19 related diagnoses and treatments. Balanced diet plays an important role in the nourishment of mother and child. According to the villagers, while sharing rations, government should pay attention to provide nutritious food especially to those women who are expecting and have infants. So that they can have healthy food (important for *subjective* and *relational* wellbeing).

5.5.1.2 Economic dimension

At *material* level, when fishers were unable to go out for fishing, they were being supported by some cash given by government. But that amount was not enough for the survival. That support was provided till the first lockdown (initial 6 months of pandemic). In fact, they seek more cash support as even after the lift in the restrictions, they were unable to earn money. They were unable to sell the catch, and fish traders were not buying fish from them. Thus, they could not repay their debt instead they ended up taking more loans from government or fish traders. Taking loans from the government is better than taking from the middlemen.

Because they were unable to share catch due to market shut down, villages seek restructure in the fish market i.e., facilities for selling fish and prawn so that they do not face any such kind of traumatic situation further. COVID-19 pandemic is still there, and India is preparing to stand in the 4th wave. Restructure in the fish market could lead to online selling or home deliveries but even for this transformation, fishers require equipment such as mobile phones. Also, the folks want the government to stop migration by introducing secondary and better sources of income for them.

Reduction in recreational activities at Chilika by the tourists, had negative impacts on the fisherfolk. Tourism is a source of income for them. However, one unintended consequence of COVID-19 is that it provides us a golden opportunity to re-think the issue of consumption versus environmental protection. With city lockdown and substantial reduction of travel, COVID-19 has brought some good news for environmental protection. Shakil et al. (2020) summarized the impact of COVID-19 on the environment: while lowered air and sound pollution, temperature, and humidity were related to COVID-19, medical and domestic wastes increased. Arora et al. (2020) asserted that with the shutdown of diverse types of activities, "nature takes the advantages and showed improvement in the quality of air, cleaner rivers, less noise pollution, undisturbed and calm wildlife" (p.1). They even concluded that "although coronavirus vaccine is not available, coronavirus itself is earth's vaccine and us humans are the virus" (p. 1).

Fisherfolk in Chilika faced various adverse mental and health conditions during pandemic due to weakening of livelihood and economic status. The pandemic has created two issues for the general public. The first one is prevention, such as keeping personal hygiene by wearing masks as well as using sanitizers. In the market, various products are available (ranging from surgical masks to N95 masks), and it depends on how much financial resource one has. This is an additional financial burden for people experiencing economic disadvantage. The second one is on treatment if one has been infected. There are variations in the medical treatment people can receive, such as using expensive drugs and staying in private wards (Shek 2021).

Psychologically, unemployment creates increased stress and mental health problems for unemployed persons. Such problems will spill over to marital quality, which would further adversely affect family processes such as parenting and family functioning processes. For communities with a large number of low-income families, community cohesion is typically not high, and there are many social problems such as crime and health issues. Hence, minimizing poverty arising from

COVID-19 is an important policy priority. Relevant services supporting unemployed people and their families should also be considered. Sumner et al. (2020) estimated the impact of COVID-19 on poverty indexed by per capita household income and consumption and concluded that COVID-19 could increase global poverty and constitute obstacles to attaining the goal of eliminating poverty by 2030. Assuming consumption contraction of 20%, they also estimated an increase of 420–580 million poor people compared to the 2018 figures. Buheji et al. (2020) also remarked that COVID-19 is a "new source" of poverty that has a negative economic impact on developed and under-developed economies. As such, Pak et al. (2020) argued for the "epidemic preparedness" concerning the economic consequences of pandemic.

5.5.2 Views of fisherfolk for governing bodies for their viability

Respondents were asked about their thoughts on the measures that should be or should have been taken by the authorities to minimize the adverse impacts of the pandemic on fishing communities. It was found that they suffered mainly in social and economic terms. Free ration, cash support, mask and sanitizers distribution were enough for their survival during lockdown period from March – August 2020. There was no solution for fishers after the lockdown period and fishers had to survive on their own. They spent all their savings, could not earn much due to the less selling of catch. The respondents mentioned some measures that could be taken to lessen the pandemic impacts on them (table 5.26).

Table 5.26: Fisherfolk responses for authorities (N=48)

Sustainability Dimensions	Measures that could be taken	Respondents (%)
Social	Early vaccination	19
	Free ration	35
	Medical health	33
	Alternatives for safe livelihood	15

	Children education	6
Economic	More cash	66
	Facility for fish, prawn selling	15
	Government loan	25

5.5.2.1 Social dimension

According to respondents, government arranged almost everything for them, but still those arrangements could have been done in a better way. The government's scheme was not enough. During the lockdown period, government provided ration supply to each household, mentioned 19% respondents, nevertheless this was sufficient for them to survive during the initial days of pandemic. Villagers sought for more help after the lockdown period. Respondents informed that for their livelihood, they looked for more ration supply and other essential things from the governing bodies. A local male respondent 10 said, "*It would have been beneficial for us if we could have been provided free rations for one year and implemented early vaccination programme by government*". The government implemented some programs for their wellbeing as well such as free vaccination, mobile testing, and isolation facilities. Fishing communities understood that if the vaccination either was the solution to flatten the curve of pandemic and was also the solution for them to go out an continue their fishing activities. Thus, 19% of respondents said that vaccination should have been implemented at an early stage. It seems that they were suffering from psychological and behavioral impacts of COVID-19, mentioned 33% respondents. According to them, there should be hospitals opened in every block with COVID-19 diagnosis and treatment facilities. A local respondent (9) said, "*It would have been beneficial, if the government officials could have taken initiatives to alert the villagers more on health issues*".

Around 15% of fishers mentioned about alternatives for safe livelihood for them, as well as 6% of respondents mentioned that children's education should also be considered. Due to less income and natural disasters, respondents/fisherfolk were not able to afford house, clothes, and other essential things. They were seeking

government help in this regard. A respondent said, "*It would have been helpful to us, if the government would have given us loans and a house*" (Respondent 15). Respondents sought help for the supply of nutritious food for the pregnant women and the mothers who just gave birth. Children were also the sufferers of pandemic. Their health and education suffered. They could not study online due to the unavailability of smartphones at home. Through a drive, government could have provided smartphones to continue their children's education. Respondent (44) mentioned, "*If we could have been provided masks, ration with daily used items, more financial support, government support for selling fish in time, more importance to children's study and health, nutritious food for mother and child by the government that could have given us a better life to live*". Respondent (43) said, "*It would have been helpful to us if we could have been provided masks, more ration, more financial support for family management, facility for selling fish properly, mobile facility for children's online study by the government*". Some respondents talked about their migration from Chilika. Migration has been related to the lower opportunities in Chilika for a better livelihood and wellbeing. People who migrated caught the COVID-19 infection. A male respondent (48) said, "*If we could have been given work for our income generation here in Odisha by the government, our people would not have migrated to outside and be infected by the virus*".

5.5.2.2 Economic dimension

The fishing communities suffered from financial crisis before and during pandemic. During lockdown period, they were provided with cash by the government, but that support was not enough for those who were already in debt and were struggling to work more to pay off their debt. Due to COVID-19, they could not go for fishing or sell their catch and even if they did, fish was sold at low prices. This was not enough for their survival. They took a loan from different sources. Around 25% of respondents were seeking loan facilities from the government and not from other parties. Looking at the social perspective from the view of a respondent, "*It would have been helpful to us if the government should have provided loans to fishers.*

The government does not take any initiative for fishers' promotion" (Respondent 11). It could be understood that in fishing communities there has been a custom going on till now that the son of a fisherman would be a fisherman. However, as per the data collected, respondents asked for their promotions and alternate income sources. They are not fisherfolk by choice, situations turned them to be.

5.5.2.2 Views of fisherfolk described on basis of sample quotes on governance

Fisherfolk looked for government support during pandemic. The support they were receiving (explained in section 5.3.2) was not enough for them to survive. Respondents mentioned that it could have been better for them if 1) government could have provided them with more loan facilities; 2) alternative income sources; 3) ways for selling the catch. A respondent (15) mentioned, "*It would have been helpful for us, if the government should have taken initiative for early vaccination, provided more ration and made alternative income source for our livelihood*". Another local respondent (29) said, "*It would have been helpful, if the government could have taken initiatives during lock down to provide us loan, prepare planning to sell fishes properly*". Following table 5.27 shows fisher's responses for the possible measures that could be taken during pandemic.

Table 5.27: Fisher's responses for the possible measures that could be taken during pandemic

Dimension	***Possible governance measures***	***Quotes***

Social	1) Ration supply for longer period 2) Schemes for safe livelihood 3) Other daily necessity items 4) Nutritious food supply 5) Health centres in every block 6) Free diagnosis and treatment 7) Focus on children's education and health 8) Support to migrated fishers 9) Early vaccination	*1) If we could have been provided masks, ration with daily used items, more financial support, government support for selling fish in time, more importance to children's study and health, nutritious food for mother and child by the government that could have given us a better life to live.* *2) It would have been helpful for us, if we could have been provided cash support more than INR.2000 (USD 26.33), more ration, whatever ration required for house, free treatment and medicines, smart phone for children's study by the government.* *3) The government should have focussed on health, quarantine system for Odias before arriving Odisha from other states, provided food and water facility for them, arranged vaccination facility soon, increased lock down days.* *4) Odia people coming from other states, should have been outside. Travel movement should have been stopped. Food, living place, facilities for health treatment for people should have been there.* *5) Government's scheme was not sufficient, if we could have been provided immediate vaccination with free ration and cash for one more year by government, that would have been beneficial for us.*

Economic	1) More monetary support for longer period 2) Secondary sources of income in Orissa 3) Alternatives for fish selling 4) Transportation facility 5) Loan facility by government	*1) If we could have been given work for our income generation here in Odisha by the government, our people would not have migrated to outside and infected by virus.* *2) Our fish could not be sold, it would have been better, if the government could have provided us schemes for income generation by taking steps how to sell our catch to the fish traders for income.* *3) We would have been benefitted by getting facilities of market and transportation for selling our fish, getting more masks, sanitizers, ration, cash support,* *4) If we could have been provided a loan of INR.50000 (USD 65.97) by the government, it would have been helpful.* *5) If we could have been provided more ration, more cash support, schemes for alternative and safe livelihood, sanitizers and masks by the government that would have been helpful to us.* *6) If we could have been provided 1) more ration, 2) more cash support, 3) facility for fish, prawn selling, 4) sanitizers and mask distribution and 5) early vaccination by the government it would have been helpful for us.* *7) It would have been helpful to us if we could have been provided ration for more 6 months, clothes, INR.10000 (USD 131.17) for daily expenditures by the government.*

The given table explains about various governing measures which could be considered during and post pandemic long-term viability of fishers.

5.6 Conclusions and chapter summary

In a nutshell, Chilika villagers have been able to build on strengths through capacity development (Bockstael 2017). Improvements in wellbeing follow increased access to capital assets – human, physical, natural, social, and financial – and increased resilience to deal with social and ecological problems thus reducing vulnerability. Though villagers are still struggling for the betterment of their wellbeing, the way they have managed within limited resources shows that it is possible to build on the strengths of small-scale fisheries through locally directed capacity development rather than the deficit model of development. This has been accomplished through good leadership, collective action, and self-organization, all of them bottom-up (rather than top-down) development factors (Nayak 2011).

Although during the pandemic, small-scale fishers did their best to save their livelihood, they need to be better organized and empowered so that they can play an effective and initiative-taking role in their own governance. Improvement in governance requires attention to what Kooiman (2003) calls the three governing orders, i.e., day-to-day decision-making (first order), institutional design and arrangement (second order), and an articulation of values, images, and principles that inform behaviours and decisions (meta order). The COVID-19 pandemic made fisherfolk work on the first order of governance, i.e., day-to-day decision-making on their own such as maintaining the peace, harmony, and unity in the village, supporting each other with food and emotionally, keeping the surroundings clean, and keeping each other aware about the infection/pandemic. The organizations and government as part of second order governance stayed connected with the fishers through phone calls, personal visits, provided free rations to them, supplied masks, sanitizers, free vaccination for them, and government also provided some monetary support to them.

The third order of governance, i.e., meta order, focuses on the articulation of values, images, and principles that inform behaviours and decisions. From the beginning of the strict lockdown and until six months of these strict restrictions, institutions and government focused on the livelihood and wellbeing of fishers. They provided fisherfolk with food, health services, monetary support, and other viable support. However, even after the lift in strict restrictions of lockdown, fishers were in fear of going out for fishing and doing other activities which could support them economically. To transpire from what they had lost (socially, physically and psychologically) during the strict lockdown restriction period, fisherfolk needed support from the higher authorities who supported them during the adverse time. Impact of pandemic among them was still there, and now they were self-restricted. This was the time when fishers sought monetary help and ration supply for more than the six months, social and psychological support.

Fisherfolk, institutions, and government could have reflected upon the experiences they faced from the first six months of the pandemic. Maintaining the positivity of life is important for arising from social and psychological impacts. There are several factors that contribute to the positive quality of life. First, an accurate understanding of COVID-19 and how to prevent it (such as maintenance of personal hygiene) can reduce the perceived stress surrounding COVID-19. Second, maintaining hope is always a key factor under adversity. One way is to look at the bright side of the pandemic (there must be some). Third, maintaining social contact provides support and assistance under the pandemic, particularly social capital generated within the family context. Fourth, finding the meaning of suffering under COVID-19 is helpful because purpose shapes attitude to the pandemic and coping repertoires. Fifth, instead of over-criticizing the governments for their inability to stop the pandemic, showing appreciation of the work done by government officials, medical and allied professionals, teachers teaching online, volunteers, and the general public who adhere to the health restriction measures can help to generate a positive community culture. Learning how to be grateful to those who have served under COVID-19 is also important. Sixth, empowerment for oneself, peers, family,

community, and society levels are helpful. Finally, having a resilient mindset (i.e., regarding pandemic as a chance for growth and development), embracing the challenges and treating them as opportunities to grow (Yamaguchi et al. 2020) can help to promote positive wellbeing under COVID-19.

The human race has encountered several pandemics in the past centuries. Successive plagues related to the Black Death in Medieval Europe (such as the Black Death Bubonic Plague from 1347 to 1351) killed many people in Europe and the near East. Almost a century ago, the Spanish flu also killed millions of people throughout the globe. In these two pandemics, human beings were very helpless and powerless. With technological advances, we are in a better position to understand the genetic makeup and properties of COVID-19 coronavirus. When effective vaccines are almost ready, it is timely to reflect on the issue of quality of life related to the pandemic (Shek 2021).

Chapter 6

Conclusions and recommendations

6.1 Thesis summary

"Vulnerability is the birthplace of innovation, creativity, and change."

-Brené Brown

It is true that vulnerability provides the opportunity to bring a change. That change could be brought through innovative ideas, planning and implementation. The innovative approach can be established either by the vulnerable communities, non-government institutions/organizations, or the government. Small-scale fishers residing in the Chilika Lagoon, India, are vulnerable to social, economic, and environmental dimensions. Various drivers including the political factor cause vulnerability among fishers. This thesis examined the types of vulnerability, drivers of vulnerability, the impact of these vulnerabilities and the coping measures adapted by fisherfolk to save their livelihood and wellbeing. The study is majorly derived by the COVID-19 pandemic as a driver, which caused new vulnerabilities and exaggerated the existing vulnerabilities among fisherfolk. In this chapter, a summary of key findings, discussions, and the area for future research is presented. The discussion includes three objectives of this thesis, thesis conclusions, and recommendations.

The three objectives guided this study. As mentioned in the above quote by Brené – that ***vulnerability*** - In year 2020, when lockdown measures were implemented due to the COVID-19 pandemic, the fisherfolk suffered the impacts. They were hopeless, depressed and felt disconnected from each other as pandemic impacted their social and economic wellbeing. Thus, objective 1 helped to understand the possible vulnerabilities caused by the pandemic. - ***is the birth of Innovation, Creativity*** - As part of objective 2, it was necessary to examine the various coping

responses taken by the fishing communities (such as maintaining social harmony, food supply, spreading awareness) and institutions to the impacts of Covid-19 global driver. This would help in determining the viability steps further. – ***and change*** - Governance is an important factor for the long-term viability of–SSF during and post-Covid time. Thus, the third objective focuses on measures ensuring viability and bringing a change by transitioning vulnerabilities to viability (V2V).

The introduction chapter of this thesis provided a background on the importance of small-scale fisheries and fisherfolk, the significance of analysing vulnerability due to the pandemic. Chapter two contained a synthesis of the literature review conducted for each objective. It highlighted the vulnerability causing multi-level drivers, the current vulnerability causing global driver COVID-19, the importance of viability and points to focus for viability such as livelihood, wellbeing, capital and resilience, and also global practices to deal with the COVID-19 pandemic. The chapter three included the methods adopted to conduct this study that included literature reviews, case studies and semi-structured household surveys. Chapters four and five explained the main research objectives on the basis of the data collected from the field. Chapter four mentioned the vulnerabilities that existed before pandemic and were caused during pandemic. Chapter five explained the innovative and creative approach of fisherfolk to deal with pandemic impacts as well as support they received from institutions and government during pandemic. This makes a pathway for their short-term and long-term viability.

6.2 Key insights

6.2.1 Objective one

> *Understanding the nature of vulnerabilities in fishing communities under the impact of Covid-19 global driver.*

The types of vulnerability explained as part of objective one is based on existing vulnerabilities and the new vulnerabilities added by the COVID-19 pandemic.

Chapter 4 in this thesis focused on identifying sources of vulnerabilities as perceived by the local community. Small-scale fishers are engaged in culturing, harvesting, and processing of fisheries, which is further consumed at local level through fish markets and also exported at global level.

Small-scale fishers who are associated with fisheries occupation for more than 40 years are being impacted by various drivers existing in this occupation from farming to harvesting, processing, and selling. The vulnerabilities identified include natural disasters, instability in family income, conflicts with middlemen and other caste-fishers, limited access to resources, deprived of rights, social and mental unwellness and possible loss of traditional fishing due to the introduction of advanced methods.

Fishers in Chilika live a miserable life. They lack associations or unions to represent their issues and concerns. Even if they are a part of a union, it is run by non-fishers who are non-traditional fishers and have good economic status. Therefore, while disclosing concerns of traditional fisherfolk further in front of local or national stakeholders, there are chances of biased exchange of information. Though fisherwomen are part of some self-help groups (SHG) for mutual support and coping.

Within the context of the pandemic, when everything was shut down due to lockdown, fishers struggled for their livelihood. They were in debt due to no income from fisheries. Their lifestyle quality and health decreased even more. Before pandemic, they were able to include fish in their meal, but during the pandemic when they needed to have nutritious food, they could not include it. Bennett et al. (2020) mentioned fisheries were even more important for their dietary and health benefits, as well as livelihood and community health. In times of crisis, where human populations were at an increased susceptibility to diseases, the role of fish as a “super food” could not be overemphasized owing to its nutritional content (Thilsted et al. 2016; Bolton et al. 2021), especially its function role in grey

matter infrastructure and boosting immune systems (AfDB 2018; Hicks et al. 2019).

Fishers suffered social, economic crisis as well as psychological impacts during the pandemic. With no social gatherings, meetings, celebrations it made them feel distant from each other and their culture. Restrictions on going outside and the closure of the fish markets deprived them of their major source of nutritious food. Banning tourism activities also impacted them economically, though it helped keep the lagoon environment clean, which was good for aquatic species to thrive. Considering the vulnerabilities due to various drivers including the COVID-19 pandemic, all impacted their social, economic and psychological wellbeing ultimately.

The impact of the pandemic is not only experienced by the fishermen and fisherwomen but also by the children of their families. The future of children is also at stake as they have to drop their school studies and the economic adversity in the family dragged children into fisheries. The vulnerabilities due to various drivers explained in chapter 4 are interrelated. For instance, economic vulnerability makes fisherfolk involve their children in the work, migrate, take loans, sell properties, put up ornaments or jewellery as collateral and make them distant from values and culture. Similarly, it gives rise to various social vulnerabilities and physical and mental ailments. Shek (2021) mentioned that psychologically, unemployment creates increased stress and mental health problems for unemployed persons.

Based on the data collected it is concluded that there is **need to assess immediate and short-term responses taken against the vulnerabilities. Furthermore, integrating the responses and implementations of policies are required for their viability**.

6.2.2 Objective two

To examine the various coping responses by the fishing communities to the impacts of Covid-19 global driver

Chapter 5 explored the coping responses (immediate and short-term responses) taken by fishers, institutions, and the government. During the pandemic, when survival was tough for fisherfolk, they adapted several coping measures for the survival of their livelihood and wellbeing. The other institutions and government also supported them in their survival. The short-term coping measures adapted could be considered as the "positive" responses looking at the need of the hour. The coping responses by fisherfolk included maintaining social harmony, caring for each other, sharing food, selling properties and valuables for money, and taking loans and collateral. Institutions and the government responded by providing them with necessities such as food, masks, and sanitizers. Government also supported them economically by providing some money during the lockdown period. The institutional and government responses continued till the first lockdown restrictions.

Change in livelihoods was witnessed as a prominent adaptive response to the ongoing vulnerabilities. However, it was noted that adaptive responses such as changes in livelihoods could possibly contribute to increased vulnerability of other components, such as selling properties, and taking loans and collateral will lead them towards economic crises in the long-term. **Given the ways of interaction by fisherfolk, a need for a continuous process of reviewing and responding to system vulnerabilities was identified.**

Five attributes of local adaptive capacity were explored, namely: response diversity, connectivity, collaborative capacity, reserves, and learning capacity. Each attribute revealed critical information to support local adaptive capacity. **Response diversity** – *accomplished in different ways, with different resources*

available. During the pandemic, everyone (fishermen, fisherwomen, children) dealt with the crisis as per their understanding. They paid more attention to social wellbeing by staying connected to each other through various mediums. Most of the fishers dealt with pandemic crises by being pessimist, thus maintaining their psychological wellbeing throughout the time. On the other hand, few of them lost their hope of survival; they lived fearful life, which affected their mental health, causing stress and depression. **Collaborative capacity**- *potential of system stakeholders such as local community members, community leaders, the village head and local government to work cooperatively to ensure system function*. Fisherfolk' collaborative steps taken with institutions in spreading awareness and following the COVID-19 related guidelines not just helped fisherfolk in their survival but also helped in maintaining social harmony and peace in Chilika. **Connectivity**- *measured by determining how readilyresources and information can be exchanged to ensure continued functionality.* Various institutions came forward to support Chilika fisherfolk. Institutions helped them follow the lockdown measures using the available sources, such as barricading the village entrance. Even to facilitate 14 days isolation mandate, schools were transformed into quarantine centres as there was the shortage of beds in health centres and also the health centres were far away from the village. **Abundance/reserves**- *use a surplus of capital available*. Institutions helped them with immediate and required resources such as the distribution of food, money masks, and sanitizers to save their social and economic wellbeing. **Learning capacity**- *ability to acquire, through training, experience, or observation, the knowledge, skills, and capabilities needed to ensure system functionality*. During the pandemic, the way fisherfolk managed their survival within limited available resources shows that if they were empowered with skills and knowledge, their survival will become easy. They would be able to opt for more job opportunities and can stand for themselves. **An increased need for local empowerment, monitoring of critical vulnerabilities, and continuous assessment was identified to foster resilience during the pandemic and the post-pandemic.**

6.2.3 Objective three

Possible governance arrangements for ensuring viability of the SSF during and post - Covid time.

Identifying vulnerabilities and sources of vulnerabilities among fisherfolk prepares system managers for appropriate governance response to ongoing changes. Moreover, the adaptive capacity of the local community was assessed to provide practical recommendations for system managers. Local responses revealed that lack of opportunities, social injustice, and unequal focus on managing the changes are the issues that make them vulnerable for long term.

It was concluded that power plays a vital role in driving a change for long term viability. Accordingly, Section 5.5 explained the viability notions provided by small-scale fishers on the basis of their experience during the pandemic. These ideas could be considered while preparing the long-term viability measures. **Governance responses, including all orders, were found to be navigating, preventing, and mitigating in nature pertaining to the ongoing pandemic**.

6.3 Contribution and recommendations

This study contributes to the literature identifying vulnerabilities that existed before the COVID-19 pandemic due to multi-level drivers and vulnerabilities during pandemic, the viability responses, and governance during the pandemic. Currently, there are only a limited number of studies that focus on studying the vulnerabilities caused due to COVID-19 pandemic and the immediate or short-term responses taken during pandemic. The significance of this research lies in acknowledging the drivers causing the vulnerabilities, specifically COVID-19 global driver and the response strategies which provides direction for viability. This section uses the data discussed in chapters 4 and 5 to provide recommendations for local management.

Studying COVID-19 as a driver, presupposes that the new drivers work synergistically with other existing drivers to create vulnerabilities in SSF. Theoretically or conceptually, linking the existing and new vulnerabilities (due to COVID-19 driver) to assess the multi-level responses research could be highlighted as a novel contribution. Practically including the short-term coping responses adapted by both fisherfolk and institutions can lead them towards short-term viability. For the long-term viability of fisherfolk during and post pandemic, some changes could be made in the small-scale fisheries related policies to withstand the sudden changes in the fisheries value chain. For instance, there is a need for a policy for the upgrade of local fish markets to resist changes in times of pandemic.

6.3.1 Recommendations

This includes the physical, intellectual, social, emotional, and moral development of fisherfolk. The recommendations discussed pertain to the viability of small-scale fishers. Practically applying the guideline, as discussed in this section, is highly dependent on the resources available and based on the objectives of local management (i.e., fostering resilience or supporting transformation). (Table 6.28).

Table 6.28: Governance recommendations for applying guidelines for local management

GUIDELINE	IMPORTANCE	RECOMMENDATION
Strengthening the fishers	Stand for their right Speak for themselves Empowerment	Improve overall adaptive capacity (including increasing connectivity, fostering learning capacity, response diversity in the form of providing alternative means of livelihoods, and supporting social reserves by providing increased access to appropriate training and resources)
Education	Education makes person confident Enlightens the power of critical thinking	Educating fishermen, fisherwomen, their children Able to read, and write

Upgrading the fish market	Awareness about market trend and price Direct contact with consumer	Alternative Seafood Networks Contribute to Systemic Resilience
Secondary income sources	Save value and culture	Motivate fishermen to do other businesses or to obtain a certain income to finance their family's life.

Source: Adapted from Kaur 2019

One main contribution of strengthening the fisherfolk is empowering them. Empowerment has been defined as the process of increasing the capacity of individuals or groups to make choices and to transform those choices into desired actions and outcomes (Bermio 2020). Fisherfolk have long been raising their voices collectively in times of crisis. In many countries, these experiences of coming together led to national fisherfolk organisations that could mobilise the community against threats. For example, the Antigua and Barbuda Fisheries Alliance was formed in the mid-1990s to oppose the threat from neighbouring countries' illegal fishing. These national organisations formed the basis for a regional network, the Caribbean Network of fisherfolk Organisations, which has empowered fisherfolk to advocate for policies to address the threats of climate change (Lay 2013). Using an understanding of feedback interactions, the vulnerabilities of social, environmental and economic dimensions can be guided into a transformed state, which perhaps supports sustainable alternative means of livelihood. Empowering the fisherfolk can help them nurture physically, emotionally, and socially.

The level of education is closely related to productivity. The higher the level of a person's education, the higher his productivity in the work. Furthermore, the lower the education, the lower the productivity in the work, which in turn can affect a person's income. In general, not being in school and being less educated may be the cause of the inadequate quality of fishermen, and their ability that is limited to small and traditional experience (Katz, 2013:900-901). They lack the ability in other fields. To do the work outside the fishing sector requires a lot of practice, so many people experience this situation as an endless cycle (Smith et al, 2014:3-33). The

education level is strongly associated with a person's quality. Low education levels, malnutrition, and other limitations might be the cause of low productivity. In addition, low levels of education lead fishermen to lag behind in adopting new technology. Lack of creativity and attempts to achieve better quality of life can lead to low productivity in business income received by farmers (Buang et al, 2011:104-109). This fact leads low-income people to be less able to repair their nutrition and public health. With better nutrition and health, poor rural people may work longer hours in a year and can improve the effectiveness of work (Akpalu, 2011:666-675). The low level of education is closely related to poverty. Poverty makes the poor unable to continue their education to a higher level, which will affect their ability and skill level required in working (Jackson, 2014:190-208; Wekke and Hamid, 2013). The low level of skill may have an effect on productivity, and in turn will influence their income. Education is essential for their intellectual and moral growth.

Local and regional seafood systems are not immune to shocks, such as those caused by extreme weather events (Marín et al., 2010) and anthropogenic catastrophes (Cockrell et al., 2019). Furthermore, these place-based systems are not fully decoupled from global seafood systems (Bronnmann et al., 2020; Farrell et al., 2020). Alternative seafood networks exist worldwide and were identified as a “bright spot” in both high- and low-income countries during the early months of the COVID-19 pandemic (Bennett et al., 2020; Gephart et al., 2020; Loring et al., 2020; O’Malley, 2020). For example, in the northeast, the United States, Smith, et al. (2021) found that 60% of the 258 fishers surveyed reported adapting to local and direct seafood sales during the pandemic. Similarly, in a survey of small-scale fisheries across Europe from more than 105 fishing organizations from 12 countries, Pita (2020) found that 48% of respondents had shifted to direct-to-consumer sales through ASNs. Even some multinational corporations pivoted towards local and direct models of seafood distribution (Cooke Aquaculture, 2020). The fisheries value chain and majorly the local fish markets in Chilika could be

restructured or upgraded by looking at the various examples from different countries.

Given the importance of fisheries, aquaculture, blue ports, and maritime trade to the Blue Economy (Bennett et al. 2019), addressing the pandemic beyond health interventions is critical for macroeconomic stabilization. They also provide unique opportunities to address the food import gap through local production and intra-regional trade. Therefore, it is vital to support functional food supply chains, especially capture fisheries and aquaculture, as part of immediate and short-term COVID-19 response strategies in regions where fish is an integral diet and as a locally traded commodity (Bolton et al. 2021) – which Chilika fishers lacked during the lockdown.

Social and cultural values play an important role in the lives of fisherfolk. They celebrate festivals with gaiety. During pandemic, they were unable to gather for celebration and did not have money to buy new clothes for their children and themselves. Western mentioned that clothing is one of human needs. It may serve as protection from the ultraviolet of the sun and as insulation from hot and cold conditions. It also functions as adornment and personal taste and style (Western, 2011:283-286). However, it is less important than the need for food. Even though good clothing is something fun for everyone, for the poor it often just becomes a dream because even to fulfil the need for food they have to work hard and toil (Pal, Chattopadhyay, and Maity, 2011:195-208). They can only buy new clothes once a year usually before a special day or event like a religious festival during holidays. In this situation fisherfolk look for other occupations such as agriculture, and day labor work. Sometimes, this leads to the migration of fisherfolk. Thus, fisherfolk should have other sources of income in the village.

Strengthening the fisherfolk economically requires working on various components such as generating other sources of income in the village, and capacity building of

fisherfolk. Economic reinforcement also includes recognizing the capability of fisherfolk and paying them for their services. For instance-

Traditional fishing practices support the conservation of biodiversity. Thus, small-scale fishers practice traditional fishing and contribute to the conservation of wildlife such as not harming dolphins and worshipping them. Dolphins help fishers in capturing the fish in their nets, in exchange fishers do not harm dolphins. Artisanal fishing practices also help in conserving the lagoon environment and water. Therefore, the government can pay attention to their approaches ultimately leading to environmental conservation. Fishers can be paid financial incentives for the provision of ecosystem services (ES). Through the Payment for ecosystem services (PES) scheme fisherfolk would be benefitted economically; they will feel more encouraged and hence contribute more. Learnings for others from their work, ultimately conserve the biodiversity and environment.

A PES mechanism requires a good governance structure, if it is to provide the accountability mechanisms to facilitate payments to the correct providers, increase transparency and reduce transaction costs (Vatn 2010; Wunder 2013). To ensure the continuity of a PES scheme, there must be a mechanism in place for financial sustainability – whether this is established through a tool that generates a constant flow of finances, for example in the form of user fees or taxes on fishing license fees, or through one that generates revenue from investments in ES provision (Bladon 2014). The PES model provides flexibility, independence from political instabilities and a medium to draw together diverse stakeholders (RedLAC 2010).

6.4 Directions for future research

This thesis has studied the various drivers (existing COVID-19 pandemic) causing vulnerabilities and their impacts on small-scale fishers living in the Chilika lagoon. Assessing the vulnerabilities helped to understand the possible immediate or short-term responses that have been taken against the COVID-19 pandemic. Further case

studies which involve fishers' perspective in finding solutions for the current and existing vulnerabilities are important. It is required to actively involve fishers in their viability. This research opens a path for further research on some major concerns which need thoughtful monitoring and analysis.

The vulnerabilities studied in this research focused on fisherfolk in general. However, there could be possibilities of certain vulnerabilities lying in the specific age group, gender, education level, and economic status of fisherfolk. The data analysed in section 4.2 of the thesis gave a broad notion about the fishers who were surveyed. However, due to time constraints, I did not consider collecting precise data on the vulnerabilities that emerged due to the COVID-19 pandemic regarding the age group, gender, education, and economic status. The analysis in the section 4.2 could be useful for future in depth research.

The research was conducted during the insensitive period of the pandemic when the survival of fisherfolk was tough. Now, when there is a decline in number of COVID-19 cases - the scenario of the cities and villages is coming back on track; a further study can help in understanding the change in livelihood after the lift in restrictions. Various alarming vulnerabilities continued during pandemic, which requires in-depth investigation, such as the involvement of middlemen in money lending and taking advantage of fisherfolk' situation. From the environment perspective and increasing economic stability of fisherfolk, recognizing the 'ecosystem services' provided by small-scale fishers could prove a better approach to conserve the biodiversity, nature and environment. The Payment for ecosystem services (PES) section needs more research in regard of small-scale fisheries.

It could be valuable to understand the coping responses after the lockdown period. This also serves as evidence that more 'bottom-up' governance approaches - in the sense that these approaches would involve all actors, and not just members of the local elite - could produce better outcomes. Government strategies must consider the long-term impacts of short-term or immediate responses. The general plans and

policies require to incorporate social, economic and environmental viability in Chilika lagoon.

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APPENDICES

APPENDIX A: Survey questionnaire

General demographic questions

1. Name
2. Age / Gender
3. Where do you live?
4. What is your place of origin? If different from current location, when/why moved here?
5. What is the highest level of education that you have achieved?
6. Family details: number of members in the family &their age group {Married/unmarried (Y/N), No. of Children, Dependent parents (Y/N)}
7. For how long have you been fishing in Chilika? What was your occupation prior to this?
8. Is fishing your primary occupation now? Do you also have any fishing related businesses (e.g., processing, trading, preserving, transporting, selling) – provide details.
9. Do members of your family join you in fishing? Which members? How often?
10. Do you and other members of your household do any other work than fishing? When, & why? Give details (fishing, agriculture, forest committee, value chain, etc.)?
11. Approx. annual household income? (*Currency INR)
12. What is the most significant change that have occurred in your fishing tenure during the past 10 years? (Positive/negative)? And why?
13. When & how did you come to know about the mass spread of COVID-19?
14. Do you consider your livelihood to be risky specially during such pandemics and disasters? If yes, why?

15. Do you or any other family member get affected by Coronavirus? (*tested positive)? If yes, how did she/he recover?
16. Are you and the other locals being vaccinated by COVID -19 vaccine?
    a) Yes (fully vaccinated/partly vaccinated)
    b) Maybe
    c) No (why? Please specify)
17. Is the vaccination mandatory for you and other community members to go out on shores for livelihood (fishing, tourism, recreational activities etc.) activities?

Questions on research objectives

Existing vulnerabilities & new vulnerabilities added

1. How was your livelihood & wellbeing status before the pandemic?
    a) Struggling livelihood with financial crisis
    b) Not much problem; life & livelihood managed somehow
    c) Good business; comfortable life
    d) Other

2. What are the main problems do you see in your community during COVID-19 generally?
    a) More difficulty in managing the livelihood and financial crisis, than before the pandemic, because of the lockdown and the restrictions imposed
    b) Not much problem; life & livelihood managed somehow as before
    c) An unexpected health crisis that limited the regular activities and increased social gaps
    d) Other

3. How has been the fish market in the past 4-5 years (before COVID-19)?

a) Less fish rearing, harvesting, and selling
b) High fish rearing, harvesting, and selling
c) No fair price for the sell
d) Other

4. How has been the fish market during the pandemic?
   a) Significantly decreased fish rearing, harvesting and selling
   b) Significantly increased fish rearing, harvesting and selling
   c) Online selling & home delivery services
   d) Other (like, traders did not turn out to purchase the catch; or no transportation facility affected the business severely, etc.)

5. How was the life of children before the pandemic?
   a) No school
   b) Proper schooling
   c) Helping parents in work/fisheries
   d) Other

6. How the pandemic impacted the children of SSF communities?
   a) No school, no studies
   b) No school, but online classes
   c) Playing out restricted, and children's psychological wellbeing adversely affected
   d) Other

7. What kind of natural, ecological& environmental challenges persisted before the pandemic?
   a) Eco- crimes (like, hunting migratory birds, using zero mesh nets to catch prawn juveniles, killing dolphins, etc.)
   b) Natural disaster impacts i.e., Cyclone (resulting in ecological changes affecting fishing due to closure or opening of mouths, loss of

shelter/property, loss or damage of fishing boats and gears, suspension of fishing activity, decreased availability of catch, etc.)

c) Adverse impacts of prawn culture (contamination of lagoon water, blocking natural flows, and encroaching capture fishery area, etc.)

d) Other

8. What natural, ecological& environmental challenges have emerged during pandemic?

a) Eco- crimes (like, hunting migratory birds, using zero mesh nets to catch prawn juveniles, killing dolphins, etc.)

b) Natural disaster impacts i.e., Cyclone (resulting in ecological changes affecting fishing due to closure or opening of mouths, loss of shelter/property, loss or damage of fishing boats and gears, suspension of fishing activity, decreased availability of catch, etc.)

c) Previous challenges minimized; lagoon environment has become clean & peaceful

d) Other

9. What have been the medical challenges during COVID-19 pandemic?

a) Increased cases of covid infection along with mental illness cases

b) Easy to access affordable medical services

c) Hard to access affordable medical services

d) Other

Responses by SSF

10. What steps you took on your own to save the livelihood & wellbeing of self & your community during the crises?

a) Maintained social harmony, peace & unity

b) Food sharing & contribution

c) No caring & sharing

d) Other

11. How did you manage financial crises during the pandemic lockdown?
    a) Sold property & spent savings
    b) Loan from any source (e.g. Relatives, neighbours, fish traders, government)
    c) Opted secondary sources of income (e.g. aquaculture, agriculture, wage labour, etc.)
    d) Other

12. Did you do any activities to save ecology & environment during the pandemic?
    a) Cleaned shores or beaches & water
    b) Controlled pollution
    c) No specific activities as such Other
    d) Other

13. How have you maintained your health & wellness during the pandemic?
    a) Being aware of following COVID-19 guidelines of the government
    b) Taking care of cleanliness & hygiene of surroundings
    c) Separate isolation rooms for COVID-19 positives
    d) Other

Role of the institutions and government

14. What are the institutions in the village which provided a considerable support to you during the pandemic?
    a) Fishermen society
    b) Fishermen association
    c) Village Development Committee /Gan Kalyan Samiti
    d) Other

15. How was the government connected with you during pandemic?

a) Social media
b) Personal visits
c) Telephonic contacts
d) Other

16. How was the other supporting institution(s) (please specify the name) connected with you during the pandemic?
a) Social media
b) Personal visits
c) Telephonic contacts
d) Other

17. How did the government help you during the pandemic?
a) Free/subsidized ration supply
b) Cash support
c) Supply of health care materials such as sanitizers, masks, etc.
d) Other

18. How has any other institution (pl. specify the name) helped you during the pandemic?
a) Free/subsidized ration supply
b) Cash support
c) Supply of health care materials such as sanitizers, masks, etc.
d) Other

19. What measures is the government undertaking for the safe resumption of economic activities & tackling the environmental challenges, ultimately supporting your wellbeing?
a) Allowing traditional fishing methods only
b) Awareness for keeping the lagoon environment clean

c) Imposing penalty for exploiting & littering natural resources
d) Other

20. How is the government helping you in terms of necessary medical facilities during pandemic?
a) Medical aid
b) Accessible & affordable diagnosis & treatment facilities
c) Free mobile testing & vaccination facilities
d) Other

21. How are the other institutions (please specify) helping you in terms of necessary medical facilities during COVID-19?
a) Medical aid
b) Accessible & affordable diagnosis & treatment facilities
c) Free mobile testing & vaccination facilities
d) Other

22. Are you aware of any plans, policies, and actions that government is taking for your survival during & after pandemic?
a) No
b) Don't know
c) Yes (please specify)

23. Are you aware of the plans and actions that other institutions (please specify) or your village heads taking for your survival during and after pandemic?
a) No
b) Don't know
c) Yes (please specify)

24. What measures do you think should be or should have been taken by the authorities to minimize the adverse impacts of the pandemic on people like you?

25. What measures do you think you could have better taken (but could not take because of some limitations) to minimize the adverse impacts of the pandemic on your family?

APPENDIX B: Ethics Clearance

Principal Investigator: Prateep Nayak (School of Environment, Enterprise and Development)

Student investigator: Vandana Bharti (School of Environment, Enterprise and Development)

File #: 43511

Title: COVID-19 FOOTPRINTS ON SMALL SCALE FISHERIES WORLD: CASE STUDY OF CHILIKA & SUNDARBANS, INDIA, AND A GENERAL GLOBAL ANALYSIS

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

Initial Approval Date: 09/20/21 (m/d/y)

University of Waterloo Research Ethics Boards are composed in accordance with, and carry out their functions and operate in a manner consistent with, the institution's guidelines for research with human participants, the Tri-Council Policy Statement for the Ethical Conduct for Research Involving Humans (TCPS, 2nd edition), International Conference on Harmonization: Good Clinical Practice (ICH-GCP), the Ontario Personal Health Information Protection Act (PHIPA), the applicable laws and regulations of the province of Ontario. Both Boards are registered with the U.S. Department of Health and Human Services under the Federal Wide Assurance, FWA00021410, and IRB registration number IRB00002419 (HREB) and IRB00007409 (CREB).

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

Expiry Date: 09/21/22 (m/d/y)

Multi-year research must be renewed at least once every 12 months unless a more frequent review has otherwise been specified. Studies will only be renewed if the renewal report is received and approved before the expiry date. Failure to submit renewal reports will result in the investigators being notified ethics clearance has

been suspended and Research Finance being notified the ethics clearance is no longer valid.

Level of review: Delegated Review
Signed on behalf of the Human Research Ethics Board

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

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

file:1a. Telephone recuitment_Vandana_Version1_2021.08.26.docx
file: 1b. Email recruitment (Group2) _2021.09.16docx.docx

file: 1b. Email recruitment (Group2) _2021.09.16docx.docx

file: Consent Log-1_Telephonic survey (Group1)
Vandana_Version2_2021.08.26.docx

file: 3. Participant
Feedback&AppreciationLetter_Vandana_Version2_2021.08.26.docx

file: Survey guide (HH) Group1_Vandana_Version4_20.09.2021.docx

Approved Protocol Version 6 in Research Ethics System
This is an official document. Retain for your files.

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