Understanding the Impact of COVID-19 on the Livelihood Resilience of Small-Scale Fisheries: A Comparative Analysis

by

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Author's Declaration

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

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

Abstract

Small-scale fisheries (SSFs) serve as a vital economic cornerstone in many nations, and play a pivotal role in reinforcing food security and eradicating poverty. Despite their significance, SSF systems and the communities they support remain vulnerable, marginalized, and often overlooked. The emergence of COVID-19 and the subsequent lockdowns and restrictions further exacerbated the vulnerability of these small-scale fisheries. These measures effectively halted the routine activities of fishers and traders, resulting in a sharp decline in daily catch, market disruptions, and the inability of households to secure essential food supplies. Additionally, this crisis laid bare the pre-existing vulnerabilities within small-scale fisheries, shedding light on the system's lack of adaptive capacity and resilience among its actors. This study explores the resilience of livelihoods within small-scale fisheries, utilizing the pandemic impacts as a critical stressor pushing the system's actors to their threshold. The aim of this study is to understand the impact of COVID-19 on the livelihood resilience of small-scale fisheries, and to identify the key adaptive responses and factors leading to their successful implementation.

To achieve this aim, I assess the impact of COVID-19 on the livelihood resilience of small-scale fisheries communities employing a comparative analysis of six case studies. These case studies feature six countries that experienced substantial impact on their SSFs, namely Malaysia, India, Bangladesh, South Africa, Senegal, and Canada, all of which are integral components of the Vulnerability to Viability (V2V) Global Partnership Research Project funded by SSHRC. The case study analysis was grounded in the Social-Ecological Regime Shifts Analytical Framework. This framework consists of six elements that are essential to address when analyzing a social-ecological system experiencing a regime shift due to an external stressor. The outcomes of the comparative analysis offer an in-depth understanding of how COVID-19 has impacted the various actors within SSF value chains and their responses to this unprecedented disruption. Additionally, the analysis helps determine the scales within the system that reached critical thresholds, providing valuable insights for suggested interventions to mitigate these impacts. Furthermore, the analysis identifies the actual scales of intervention tackled by governments and communities.

By comparing the suggested and the actual scales of intervention, the study identifies the five key adaptive responses that have been most effective, namely, consumer-base shift in fish marketing, Alternative Seafood Networks (ASNs), Government aid, sensitive regulations, and community-based

approaches. Moreover, the study identified factors leading to the success or failure of these strategies. These factors facilitate long-term interventions such as adaptability, alternatives, knowledge, and tools. These findings contribute to the best practices in governance, coping, and adaptation strategies that can bolster the adaptive capacity of Small-Scale Fisheries. Furthermore, the outcomes inform policymakers, stakeholders, and governments of the essential factors to transform to adaptive governance. This research enhances our understanding of the vulnerabilities exposed by the pandemic and what contributes to the resilience and sustainability of these vital systems and the communities that depend on them.

Keywords: SSFs, COVID-19, Value Chain, SESs, Adaptive Governance, Livelihood Resilience

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I thank Allah, the Merciful, and Graceful, for granting me the strength and knowledge to complete this work, guiding me through the challenges and uncertainties, and fulfilling my journey.

Dedication

I dedicate this thesis to the loving memory of my father, Mahmoud Sobhy Abdelbaset, who passed away in 2016 after a battle with illness. His support and boundless pride in my accomplishments have been a driving force throughout my academic journey. This achievement is a humble gesture of gratitude and a heartfelt "thank you" to the man whose belief in me knew no bounds. My dedication of this thesis to his memory is a tribute to his enduring influence on my life and an acknowledgement of his profound impact on shaping who I am today.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

ASNs	Alternative Seafood Networks
CERB	Canada Emergency Response Benefit
CSF	Community Supported Fishery
DFFE	The South African Department of Forestry, Fisheries, and the Environment
EPF	Employment Provident Fund
FAO	the Food and Agriculture Organization
JB	Johor Bahru
HDI	Human Development Index
HORECA	Hotel, Restaurant, and Catering
ICAR	The Indian Council for Agricultural Research
ICTs	Information and Communication Technologies
IUU Fishing	Illegal, unreported, and unregulated (IUU) fishing
LHDN	The Inland Revenue Board
MCO	Movement Control Order
MLRA	the Marine Living Resources Act
MoFL	Ministry of Fisheries and Livestock
myKP	myFisheries Community Program
PMGKY	The government's Pradhan Mantri Garib Kalyan Yojana
PMMSY	Pradhan Mantri Matsya Sampada Yojana (the Fisheries Development Scheme)
SEPs	Socio-Ecological Practices
SESs	Social-Ecological Systems
SERS	Social-Ecological Regime Shift
SO	Skipper Otto
SOCSO	the Social Security Organization
SSFs	Small-Scale Fisheries
SSHRC	Social Science and Humanities Research Canada
SSN	Social Safety Net Program
VGF	Vulnerable Group Feeding Program
V2V	Vulnerability to Viability

Chapter 1
Introduction

1.1 Background of the research problem

Small-scale fisheries (SSFs) play an essential economic role in developing countries (Asante et al., 2021; Bennett et al., 2020). They provide cheap and nutritious food (Chanrachkij et al., 2020; Mukherjee et al., 2020), help in the growth of many secondary industries, are the source of foreign currency for their communities (Aura et al., 2020) and develop local job opportunities (Bennett et al., 2020). The Food and Agriculture Organization (FAO) indicates that SSFs provide jobs even more than industrial fishing and are a key player in local food security, supporting around 120 million people worldwide (Das et al., 2022). In Bangladesh, the aquaculture and fisheries sector contributes significantly to the country's welfare, which supports the livelihood of 18 million people (Islam et al., 2021). Thailand, consisting of more than 2,500 rural fishing villages in coastal areas, is one of the biggest fish producers and exporters worldwide (Chanrachkij et al., 2020). Even in developed countries like Canada, fish exports comprise 75% of the country's seafood and fish production (Asante et al., 2021). Regardless of the importance of small-scale fisheries in various aspects, inadequate care has been given to them, especially amidst the global crisis of COVID-19. This negligence is a result of underestimating the role of SSFs in food security (Bennett et al., 2020) and the limited availability of the economic contribution of this sector (Campbell et al., 2020)

Small-scale fisheries were drastically affected by the COVID-19 lockdowns and restrictions due to poverty, marginalization and lack of resources to help them cope with sudden stressors (Islam et al., 2021). This tragedy uncovered the vulnerability of dependent communities despite the growing recognition of SSFs to the economy and the livelihood of people in many countries. Safety measures and restrictions that cause damage to the livelihood of SSF communities include disrupted transportation system, social distancing; reduced hours for fishing trips and fish market, shortages of laborers due to infection or downsizing, mobility restrictions; closure of conservation areas that consist of fisheries; prohibition on travel for seasonal migrants fishers; and curfews (Bassett et al., 2021; Das et al., 2022; Islam et al., 2021; Kaewnuratchadasorn et al., 2020; Nyiawung et al., 2022; Rosales et al., 2017; Sowman et al., 2021; Sunny, Sazzad, et al., 2021).

This set of regulations was implemented strictly for a short time, and then governments loosened them to alleviate the preventive measures associated with the pandemic spread containment.

However, the prolonged periods of alleviated restrictions may have caused more severe damage to the SSF livelihood resilience (Aura et al., 2020; Bassett et al., 2021, 2022; Belton et al., 2021; Das et al., 2022; Islam et al., 2021; Kaewnuratchadasorn et al., 2020; Laapo et al., 2021; Nyiawung et al., 2022; Pimenta et al., 2022; Rosales et al., 2017; Sowman et al., 2021; Sunny, Sazzad, et al., 2021).

In Asia, the disrupted transportation system increased transportation costs, prohibiting fishers and traders from resuming their usual activities (Kaewnuratchadasorn et al., 2020). Consequently, it caused another problem: the cancellation of foreign orders due to fear of being unable to deliver, resulting in less demand for fish and failure of the fish market prices. Also, social distancing prohibited fishers from fishing groups, which resulted in an overall decrease in the daily catch (Mukherjee et al., 2020). These new circumstances also contributed to the market disturbance and the inability of households to secure their food. Additionally, reducing working hours in fish feed factories resulted in shortages in laborers due to downsizing, resulting in scarcity and increasing fish feed prices (Bassett et al., 2022).

In Africa, nearly the same impacts as in Asia were reported, but the situation was induced by injustice, inequality and population epidemic problems. For example, they imposed unfair fines, arrests, lack of access to fresh water, and social protection (Aura et al., 2020; Sowman et al., 2021). In countries such as South Africa, the population suffers from high rates of malnutrition, tuberculosis and HIV/Aids, besides the lack of adequate access to health care and social protection (Sowman et al., 2021). Additionally, the SSF communities suffer from social injustice, aggravating their vulnerability to disasters, shocks and stressors (Sowman et al., 2021).

All these restrictions and subsequent impacts affected the entire network of the SSFs' value chain. The impacts reverberated throughout the value chain, and the consequences acted in synergy (See Figure 1). For example, the halt in international trade affected the exports, and consequently, it affected the fishers and processors by decreasing their income. Another example is the restriction on mobility as it affected several actors in the value chain including intermediary sellers, whole sellers, and fish market resulting in loss of income, debt accumulation and pushing fishers to sell their assets as fishing gear or spending their savings for sustenance. As a result, the impacts on the value chain actors were compound and complex. Consequently, a need for an intricate solution is crucial.

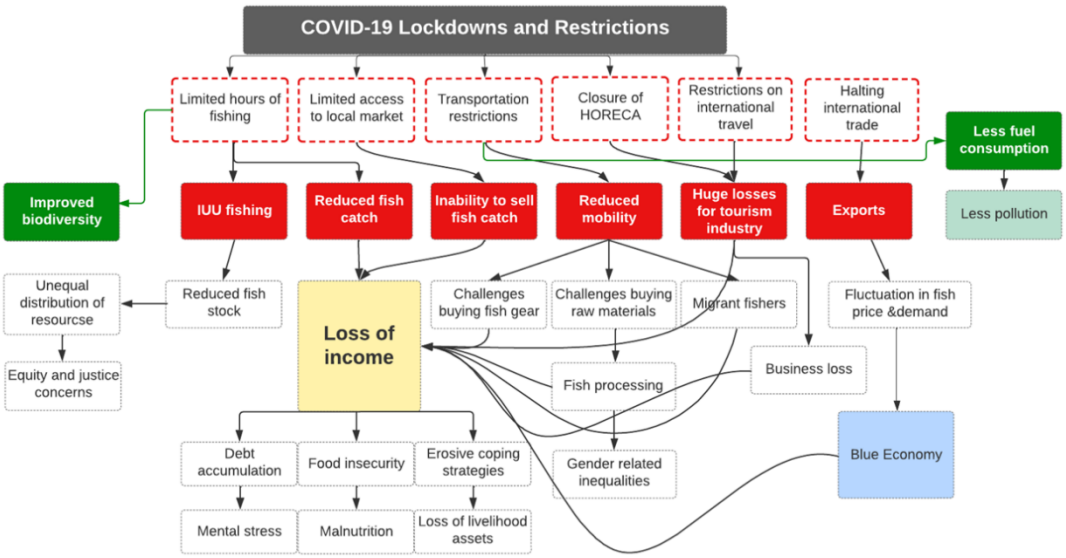


Figure 1: COVID-19 imposed restrictions, and subsequent impacts on SSFs' value chain.

1.2 Studies addressing the research problem

The literature investigating the impact of COVID-19 on small-scale fisheries' livelihood, including the system and the dependent communities, is emerging and extensive. This emerging literature describes how the pandemic disrupted the relationships of all the SSF value chain actors, from fishers and traders to consumers. Consequently, it negatively affected the fish market and trade, resulting in a worsened livelihood of SSFs (Bassett et al., 2022; Islam et al., 2021; Lau et al., 2021). The words 'emerging' and 'unfolding' are continuously observed in the literature on this topic (Lau et al., 2021), which implicates the need for continuous review and evaluation as represented in this research study.

Das et al. describe the effect of COVID-19 restrictions as "rippling" to highlight the resonating consequences of this significant health-related crisis on the social and ecological aspects (Das et al., 2022). Several articles mention the broader impacts of COVID-19 on the food crisis and nutrition security, which pinpoints the importance of SSFs in securing food for billions of people worldwide (Bassett et al., 2021; Belton et al., 2021; Sunny, Sazzad, et al., 2021). The importance of small-scale fisheries to food security versus the negligence of their livelihood (Sunny, Sazzad, et al., 2021) becomes a critical question that needs to be addressed in scholarly work and praxis.

Many studies confirm the importance of assessing the value chain of SSFs to reform and fortify them. Analyses on this topic question the resiliency in the SSF sector and how COVID-19 uncovered

the lack of its capacity to adapt to a sudden shock (Bassett et al., 2021; Belton et al., 2021; Pimenta et al., 2022). Bassett et al. (2022) present some important questions: 1) how resilient have different SSF supply chains been to COVID-19 impacts? 2) what do these initial outcomes indicate about the role of distribution strategies in determining the vulnerability of SSF supply chains to macroeconomic shocks?; and 3) What key factors have shaped this vulnerability?

1.3 Gaps in current studies

The review of the literature on the research topic identified three main gap areas:

1. The literature discussing the impact of COVID-19 on small-scale fisheries' livelihood is still emerging and needs continuous evaluation and synthesis. This aspect is evident through the publishing date of the scholarly articles on the research topic and the continuous usage of terms such as emerging, unfolding, recently, and immediate.
2. The vulnerability of small-scale fisheries is still a prominent yet neglected issue despite the essential role of SSFs in food security and poverty eradication (Bassett et al., 2021). Therefore, innovative and integrated approaches to solve this problem are required, especially since COVID-19 uncovered the pre-existing vulnerability of SSFs and governments' failure to support their dependent communities in this challenging time (Lau et al., 2021).
3. The discussion of pandemics in adaptive governance and risk management of social-ecological systems is absent or limited (Aura et al., 2020; Nyiawung et al., 2022), while they currently focus mainly on climate change problems, ecosystems and natural disasters. The addition of pandemics to disaster preparedness programs adds more variables to the equation, thus enhancing the livelihood resilience of SSFs. Most of the literature discussing the research topic advocates the need for preparedness and recovery plans to be able to withstand the consequences of disturbances should they occur in the future (Bassett et al., 2021; Islam et al., 2021; Pimenta et al., 2022; Sowman & Sunde, 2021). Also, there is a crucial need for research that facilitates and guides policy and innovative interventions (Aura et al., 2020; Laapo et al., 2021; Nyiawung et al., 2022; Sowman & Sunde, 2021).

1.4 Problem statement

SSF communities are undergoing drastic changes due to COVID-19 lockdowns and restrictions affecting their livelihood and resilience (Campbell et al., 2020; Kaewnuratchadasorn et al., 2020; Mukherjee et al., 2020; Nyiawung et al., 2022). Those problems existed before the pandemic, but COVID-19 uncovered and augmented them (Bennett et al., 2020; Mukherjee et al., 2020; Sunny, Sazzad, et al., 2021). The COVID-19 breakout pushed governments to announce restrictions on movement, gatherings and work habits (Campbell et al., 2020; Mukherjee et al., 2020). Consequently, the livelihood of SSFs and dependent communities was affected (Bassett et al., 2022; Islam et al., 2021; Lau et al., 2021; Mukherjee et al., 2020). At first, full lockdowns and curfews imposed for short periods were harsh but manageable as they were temporary. However, the prolonged restrictions such as social distancing and reduced fishing or market hours worsened the SSFs' livelihood even more (Das et al., 2022).

Fishermen reported in the literature the following impacts: Increased prices of transportation and maintenance costs; less demand for fish leading to a decrease in their price; increase in the price of fish food used in aquacultures; shortage of labor due to factories shutting down; cancellation of orders by foreign buyers rising debt due to the decrease of cash flow; and fishers inability to pay for their loan instalments (Bassett et al., 2022; Bennett et al., 2020; Islam et al., 2021; Mukherjee et al., 2020). In South Africa, the impact was profound due to social injustice, unfair fines and arrests, malnutrition and endemics (Bennett et al., 2020; Sowman et al., 2021). In East Africa and Bangladesh, flooding and cyclones damaged the roads, uprooted trees, damaged crops, and killed people, and the COVID-19 breakout exacerbated the problem and worsened the SSFs' living conditions (Aura et al., 2020; Islam et al., 2021).

The government interventions, coping and adaptation strategies practiced by SSF communities during COVID-19 were massive. However, due to emerging and existing drivers coupled with equity, justice and power dynamics, those efforts were minimally effective. Therefore, this study calls for understanding those dynamics in the SSF value chain amidst the pandemic.

1.5 Research objectives and questions

The primary purpose of this study is to understand and examine the impacts of COVID-19 on the livelihood resilience of Small-Scale Fisheries (SSFs), and to identify and delineate the vulnerabilities inherent within SSF livelihoods when confronted with a stressor as profound as the COVID-19

pandemic. To achieve this, I employ the Social-Ecological Regime Shift (SERS) analytical framework developed by Nayak and Armitage (2018) to assess the impacts of the pandemic on the SSF value chain on six SSF case studies and understand how SSFs transition from their vulnerabilities to being robust, resilient and viable by enhancing adaptive capacity. The transition in question is informed by an in-depth analysis of the SSFs' during COVID-19 and using its value chain as a context of evaluation. Additionally, I identify five key elements of adaptive responses and associated factors leading to their successful implementation, namely, consumer-base shift in fish marketing, Alternative Seafood Networks (ASNs), Government aid, sensitive regulations, and community-based approaches, which serve as best practices of adaptive responses during crises. Accordingly, the objectives of this research are to:

1. Understand the impact of COVID-19 on the livelihood resilience of Small-Scale Fisheries employing the Social-Ecological Regime Shift (SERS) Analytical Framework and a comparative analysis of six case studies.
2. Identify key factors shaping adaptive responses under pressure from COVID-19 and factors of successful implementation and how they can inform policymakers, governments, community and other stakeholders in transforming SSFs management to adaptive governance for long-term livelihood resilience.

To achieve the objectives of this research, I must answer the following questions and related sub-questions:

1. What are the impacts of COVID-19 on SSFs as a social-ecological system?
   - What are the existing and emerging drivers of this regime shift?
   - How did the value chain respond to the impact of COVID-19? Which components reached the threshold?
   - What are the equity, justice concerns, and power dynamics that shape this regime shift?
   - What are the possible scales of intervention to mitigate the impact of a stressor, such as COVID-19, on SSF communities?
2. What are the key adaptive responses shaping the adaptive capacity of SSFs during COVID-19?

- What are the coping and adaptation strategies practiced by those communities during COVID-19?
- How did the government support the small-scale fisheries communities during the COVID-19?
- What is the relevancy between the actual and suggested scales of intervention ?
- What are the most effective strategies employed and factors contributing to their success or failure?

1.6 Research scope

This research study primarily focuses on small-scale fisheries (SSFs) and fishers who operate small to medium-sized boats or vessels utilizing the non-intensive fishing gear. It is important to note that this research excludes all forms of industrial fishing from its purview. The rationale for this exclusion is rooted in the recognition that vulnerabilities are more pronounced within small-scale fisheries communities. While vulnerabilities do indeed exist among the workforce in industrial fishing, these concerns are inherently covered within the scope of small-scale fisheries. Consequently, the research aims to draw generalized findings applicable to fisheries workforce.

This study includes six countries: Canada, Malaysia, India, Bangladesh, South Africa, and Senegal. These countries have been selected based on the availability of published research, the significance of impacts and governance strategies, the timeframe of the study, and their Human Development Index (HDI) rankings. HDI categorize the case studies according to their level of socio-economic development. This selection assumes that HDI influences how each country coped with systemic changes during the COVID-19 pandemic. Despite its vulnerabilities, Canada has been chosen as an example of best practices. This decision stems from Canada's demonstrated ability to effectively cope with, adapt to, navigate, and rebound from the challenges posed by COVID-19. The lessons learned from Canada's experience and the cross learning between the cases studied in this research offer valuable insights to informing policy and practice. The selected countries represent diverse regions of the world, exhibit different HDI levels, possess significant fisheries economies, and have a substantial body of research published on the topic under consideration.

This research study draws upon a wide range of published literature. This range encompasses journal articles, student theses, grey literature such as working papers, online news articles, and reports. To further enrich the study's findings, primary data were collected through online semi-

structured interviews with experts in the field from the selected countries (see Chapter 3). These experts were carefully chosen from the V2V partnership members to complement, confirm and validate the findings from existing published research. The interviews confirm or fill gaps in the existing literature and provide insights drawn from the experts' firsthand experiences in small-scale fisheries in their respective countries. Additionally, the interviews explore significant pre-existing vulnerabilities that may have exacerbated the impact of COVID-19 on the livelihood resilience of small-scale fisheries.

1.7 Research significance and contributions

I aim to comprehensively understand how small-scale fisheries have responded to the challenges posed by the COVID-19 pandemic. Ultimately, my goal is to enhance their adaptive capacity and resilience, ensuring the resilience of these vital systems and the communities that depend on them. Firstly, this study contributes to SSF knowledge by providing an in-depth understanding of the research on the impacts of COVID-19. The literature on this topic is emerging and fast-developing, so an extensive analysis and synthesis are crucial. Additionally, it adds to the literature addressing transformation of systems (Figure 2) (Evans et al., 2023), specifically social-ecological systems, their adaptive capacity and resilience (Evans et al., 2023; Folke et al., 2005; Schipper & Langston, 2015).

Secondly, the research contributes to enhancing small-scale fisheries' livelihood resilience by providing the key adaptive responses and factors leading to their successful implementation. Those responses and factors are extracted and analyzed by comparing certain aspects among the selected countries using the SERS framework.

Thirdly, this study is meant to draw the attention of governments, policymakers and stakeholders to the diverse actors that may impact systems on multilevel scales and with different magnitudes (Ciurean et al., 2013). This contribution is important because livelihood resilience and adaptive governance literature always address hazards in the context of climate change and natural disasters, where pandemics are somehow missing as they are an emerging threat. Therefore, COVID-19 brings new and different challenges that those marginalized and underrepresented communities of the SSFs face.

Lastly, this research guides informed decisions and help policymakers, NGOs, and governments transform SSFs' management to adaptive governance, thus advancing policy and practice.

1.8 Thesis outline

In the introduction chapter, I embarked on a global exploration of the impact of COVID-19 on Small-Scale Fisheries (SSFs). The escalating significance of SSFs in economies and food security makes understanding their vulnerabilities and resilience strategies paramount, particularly in the face of unexpected stressors like COVID-19. Additionally, the background of the research problem sheds light on the context, highlighting the challenges SSFs face. I then analyze existing studies, identifying gaps and deficiencies, setting the stage for our focused study.

Chapter 2 acts as the foundational pillar of this study. Here, I define the conceptual framework, including the intricate system of small-scale fisheries, the disruptive impact of COVID-19 and pandemics, the value chain, and the complex dynamics of social-ecological systems (SESs), the Social Ecological Regime Shift (SERS) Framework, livelihood resilience, and adaptive governance. Understanding these concepts is pivotal to grasping the nuanced vulnerabilities and resilience strategies exhibited by SSFs during unprecedented events like the COVID-19 pandemic.

Then, I explain our methodological approach in Chapter 3. I outline the research design, providing a roadmap for our study. Delving into the statement of purpose, I clarify the type of study conducted. The section on data collection and analysis methods elucidates how I gathered and processed information, ensuring a rigorous and systematic study. Addressing limitations, delimitations, ethical considerations, and funding, I provide a transparent view of our research process, establishing the foundation for the subsequent chapters.

The core of the study, chapter 4, is dedicated to presenting and discussing research findings. Through a detailed examination of COVID-19 restrictions, and a deep analysis of the drivers of regime shift, including existing and emerging factors, equity concerns, power dynamics, and governance strategies, I decode the intricate puzzle of SSFs' resilience during the pandemic. This chapter offers a comprehensive synthesis of findings, drawing out key adaptive responses and factors of their successful implementation crucial for policymakers, researchers, and practitioners in the field.

Finally, the concluding chapter summarizes key insights, offering actionable recommendations and future research opportunities. By exploring the intersections of SSFs, pandemics, and societal systems, this study contribute valuable knowledge to the broader discourse on resilient and adaptive fisheries.

Chapter 2
Literature Review

2.1 Small-Scale Fisheries (SSFs)

Food and Agriculture Organization (FAO) 2004 defined small-scale fisheries as a dynamic and constantly evolving sector that heavily relies on labor for harvesting, processing, and distributing marine and inland fishery resources (Béné, 2006). Approximately 32 million individuals are employed as small-scale fishers worldwide, and an additional 76 million are engaged in post-harvest roles (Bennett et al., 2020). Individuals engaged in this sub-sector supply fish and fishery products to local and domestic markets, as well as for subsistence consumption (Béné, 2006). This means that fisheries are vital in numerous rural areas of the developing world (Béné, 2006).

Small-scale fisheries (SSFs) exhibit diverse traits across regions and countries, but some key features include the use of smaller vessels and engines, simple or traditional fishing gear, proximity to coastal areas, smaller crew sizes, ownership by families or locals, and their significant role in supporting local livelihoods and subsistence (Bennett et al., 2020). Additionally, ancillary activities like net-making, boat-building, engine repair, and maintenance can provide supplementary employment and income opportunities in both marine and inland fishing communities (Béné, 2006). The organizational structure of small-scale fisheries varies widely and is not uniform, ranging from self-employed individuals to informal microenterprises and formal sector businesses (Béné, 2006).

Over the past one to two decades, there has been an increase in export-oriented production in many small-scale fisheries due to greater market integration and globalization (Béné, 2006). Although SSFs play a fundamental role in food security and poverty alleviation, it's acknowledged that poverty exists in fishing communities (Béné, 2006). This poverty results from various factors beyond the availability of resources or catch levels (Béné, 2006). These factors, such as inadequate public services, limited education, political marginalization, and vulnerability, contribute to the multidimensional nature of poverty in these communities (Béné, 2006). This evolving perspective recognizes that socio-institutional constraints play a significant role in poverty among small-scale fishing communities (Béné, 2006)

2.2 COVID-19

At the start of social distancing restrictions, numerous fisheries experienced complete shutdowns unless they were deemed essential for national food supply systems (Bennett et al., 2020). For instance, in India, fishing was initially halted entirely, unlike farming, and it was only after significant pressure from civil society highlighting its crucial role in food provision that fishing was allowed to resume within certain limits (Bennett et al., 2020). Even when fishing was categorized as an essential service, social distancing measures have prevented many small-scale fishers from engaging in their work due to factors like proximity during trade in local markets (Bennett et al., 2020).

The global spread of the COVID-19 pandemic particularly affected the fisheries and aquaculture sector, primarily because of the perishable nature of the products involved (Alam et al., 2022). Fishing communities and ports could become infection "hotspots" due to fishers' mobility and international visitors' presence (Bennett et al., 2020). Also, COVID-19 has disproportionately affected developing nations more than their developed counterparts due to their limited resources, expertise, and technological capabilities (Alam et al., 2022). For example, access to healthcare services in rural fishing communities is already challenging under normal circumstances, making it even more difficult to access testing, treatment, and sanitation supplies needed to combat COVID-19 spread and infection (Bennett et al., 2020).

Market disruptions have had a cascading impact on small-scale fishers, resulting in what can be termed 'twin disasters' marked by decreased demand and plummeting prices (Bennett et al., 2020). Those disruptions were seen across the SSFs' value chain actors. For example, export-oriented small-scale fisheries have witnessed a sharp decline in demand, particularly from Asia, the United States, and Europe, alongside challenges like port closures and the loss of access to cold storage and transportation (Bennett et al., 2020). In the Philippines, reduced demand from local restaurants and hotels has led to significant price reductions, severely affecting fishing activity, with factories operating at diminished capacity (Bennett et al., 2020). Additionally, in Fiji, the temporary closure of inter-island ferry transport, although limiting disease spread, has cut off access to urban and semi-urban markets for some people (Bennett et al., 2020). Moreover, fishers, processors, and sellers grapple with the difficult choice between providing for their families and risking exposure to COVID-19 (Bennett et al., 2020).

2.3 Value Chain of Small-Scale Fisheries

Small-scale fisheries are expansive networks of supply and trade, creating significant value and generating crucial employment opportunities throughout the value chain (Rosales et al., 2017). This complex system can mediate and buffer against fluctuations in supply and source locations, which enhance the resilience and adaptive capabilities of fishers and their households, but it is also vulnerable to direct impacts (Rosales et al., 2017). Rosales defines value chains of small-scale fisheries as the relationship and linkages between different actors in the system and calls to assess the value chain and factors affecting its stability upon a direct impact as they comprise different drivers that act collectively (Rosales et al., 2017).

According to the literature reviewed, there is no definite method to assess the value chain of small-scale fisheries, and the analysis should follow the intent of the study performed. However, Rosales et al. (2017) states that the assessment methodology must address the point of entry for value chain analysis, mapping value chains (actors, product flow, volume, geographic flow, knowledge and information), product segments, how producers access final markets, governance (coordination, regulation, control); relationships, linkages and trust; upgrading in value chains; and costs and margins; distributional (income and employment) (Rosales et al., 2017). The value chain perspective is essential as it reveals insights that may be overlooked in studies focused on individual economic agents or specific fisheries policies (Rosales et al., 2017). Also, it can shed light on the challenges the sector faces due to various drivers of change, including issues like weak governance and market access, as well as the competitiveness of small firms and fishers in evolving markets (Rosales et al., 2017).

COVID-19 had a rippling effect throughout the SSF value chain. For example, in Cameroon and Liberia, social and movement restrictions, including transportation, have affected fishing activities (Nyiawung et al., 2022). As fishing requires close contact with different actors, those restrictions prohibited each entity from conducting its primary role in the value chain (Nyiawung et al., 2022). The first dominating impact of restrictions was reducing the fish catch; consequently, it affected fish prices and fish traders' businesses, as fish prices are seasonal and depend on the supply and demand rates (Nyiawung et al., 2022). The impact was economic, but it also affected household food consumption as fish catches contribute to food security (Nyiawung et al., 2022). Picturing how the impact has a rippling effect reduced fish consumption. It also affected the neighbouring villages, as

they depend on SSFs for daily consumption and trading as middlemen or fishmongers (Nyiawung et al., 2022). The SSF value chain in Southeast Asia suffered the same consequences (Kaewnuratchadasorn et al., 2020). However, the tourism and hospitality sector was affected the most due to the supply disruption of fish products to HORECA (HOtels, REstaurants & CAtering) (Kaewnuratchadasorn et al., 2020). Restrictions and impacts are almost similar in both regions; however, the damage to each actor differs according to their level of vulnerability or resilience.

Figure 2 shows a general value chain of SSFs representing different actors and connections between them. This visualization of the value chain was understood from the literature reviewed. Fishers connected to fishing inputs such as gear and feed and to the resource which is fish stocks. Fishers harvest fish and they sell it to processors, intermediaries, and part of their catch goes to their household. Sometimes, fishers have the opportunity to sell their fish catch in wet markets too. After that the fish as a product is sold in retail or for exports. This explanation is general, however, in chapter 4, I will represent contextualized value chains for each country case stemming from the data collected for this research.

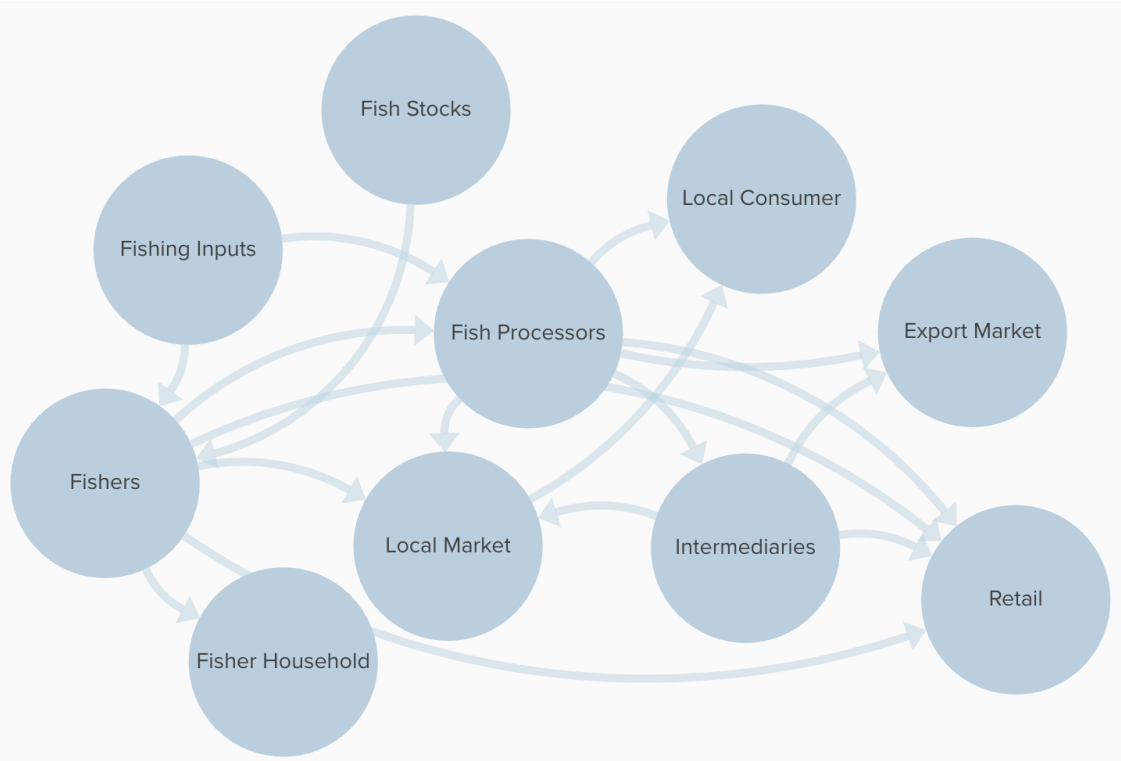


Figure 2: General value chain of small-scale fisheries.

2.4 Social-Ecological Systems (SESs)

The intricate interactions between humans and nature are most effectively understood through the Social-Ecological Systems (SES) framework (Salgueiro-Otero & Ojea, 2020). SES are considered coevolutionary, interconnected, and intricate adaptive systems comprising social and ecological dimensions (Salgueiro-Otero & Ojea, 2020). Social-ecological systems thinking acknowledges that the distinction between resource systems and their associated social systems is artificial; instead, they are intricately interlinked (Kittinger et al., 2013). They operate continuously and at various scales in the context of sustainability (Salgueiro-Otero & Ojea, 2020). Considering these connections between social and ecological aspects can provide valuable insights into potential solutions for the issues that confront small-scale fisheries (SSF) management (Kittinger et al., 2013). To address these issues more effectively, researchers and practitioners are increasingly focused on comprehending the interplay between social and ecological dynamics, commonly known as linked or coupled social-ecological systems, and how these dynamics impact the potential for sustainability (Kittinger et al., 2013).

Small-scale fisheries (SSF) are regarded as SES, yet many SSF SES studies do not fully apply the coupled theory of adaptive systems and the SES framework in their approach (Salgueiro-Otero & Ojea, 2020). Using the SSF value chain as a social-ecological system (SES) and context for the analysis rather than a system of providing a product to the consumer acknowledges that the impact of COVID-19 affects the consumers' food supply, and the livelihood of all the chain actors (Kaewnuratchadasorn et al., 2020). SES also offer insights into adaptation within complex systems (Salgueiro-Otero & Ojea, 2020). From a resilience standpoint, SES can respond to change through adaptation or transformation (Salgueiro-Otero & Ojea, 2020). In adaptation, the system can absorb, accommodate, or embrace change to deal with unforeseen shocks (Salgueiro-Otero & Ojea, 2020). In contrast, transformation involves a fundamental reorganization of the system as a response to challenges that cannot be addressed within the existing SES state or regime (Salgueiro-Otero & Ojea, 2020).

2.5 Social-Ecological Regime Shift (SERS) Analytical Framework

Various scholars emphasize understanding the SES within which livelihoods occurs, the actors' positions within the system, exploring different scenarios upon the exposure, capacities for adaptation and recovery pathways to properly analyze its resiliency (Schipper & Langston, 2015; Speranza et al.,

2014). Adger defines resilience as “the magnitude of disturbance that can be absorbed before a system changes to a radically different state” (Adger, 2006), and regime shifts are defined as “Sudden and irreversible shifts in a system, whereby a threshold is passed and the new regime's fundamentally different core functions and structure results” (Nayak & Armitage, 2018). Therefore, the SSF is the social-ecological system, and COVID-19 is the disturbance causing its disruption and transformation to a different state.

A regime shift occurs when a system crosses a critical threshold level of a controlling variable, leading to changes in the nature and strength of feedback loops, which, in turn, alter the trajectory of the system itself (Walker & Meyers, 2004). This shift arises when internal processes of the system undergo modifications, and the system's state, characterized by the quantities of state variables, starts to transition towards a different attractor (Walker & Meyers, 2004). In certain cases, surpassing this threshold triggers a sudden, substantial, and dramatic change in the values of responding state variables(Walker & Meyers, 2004). In other instances, the shift in state variables occurs more gradually (Walker & Meyers, 2004). Nevertheless, once the threshold is crossed, the feedback mechanisms change and the system dynamics shift from one basin of attraction to another (Walker & Meyers, 2004).

Ecological, social and physical environmental systems can experience a regime shift (Walker & Meyers, 2004). These transformations can give rise to different patterns or types of social behavior, and these functional shifts may either lead to or be associated with changes in the social structure (Walker & Meyers, 2004). In linked social-ecological systems (SESs), alterations in one system can create feedback effects that modify variables in the other system, potentially causing a regime shift in that respective system (Walker & Meyers, 2004). This effect may manifest as a one-way influence, resulting in a regime shift in just one of the systems, or it can involve a two-way interaction, leading to regime shifts in both the ecosystem and society (Walker & Meyers, 2004).

Accordingly, the research problem can be understood using the Social-Ecological Regime Shift (SERS) analytical framework developed by Nayak and Armitage (2018) (Figure 3). The selection of the Social-Ecological Regime Shifts (SERS) framework as the analytical tool in this study is rationalized by its inherent suitability for comprehensively examining the impact of COVID-19 on Small-Scale Fisheries (SSFs) as social-ecological systems. The SERS framework, developed by Nayak and Armitage in 2018, offers a holistic perspective, encompassing six fundamental elements

that provide a nuanced understanding of how social-ecological systems respond to stressors. These elements, including the unit of regime shift, emerging drivers, and existing drivers, align well with the complexity of SSFs. Given that SSFs exhibit intricate interdependencies among ecological, social, and economic components, the SERS framework provides a structured approach to assess the transformative dynamics induced by the COVID-19 shock. This framework works on understanding the following points: 1) Differentiating between the underlying versus immediate drivers causing the rapid change; 2) Considering appropriate scales of intervention; 3) The appropriate unit(s); 4) Reflecting on equity and justice concerns; 5) Assessing the power dynamics framing regime shifts; and 6) Clarifying the role of governance in such context of rapid change (Nayak & Armitage, 2018).

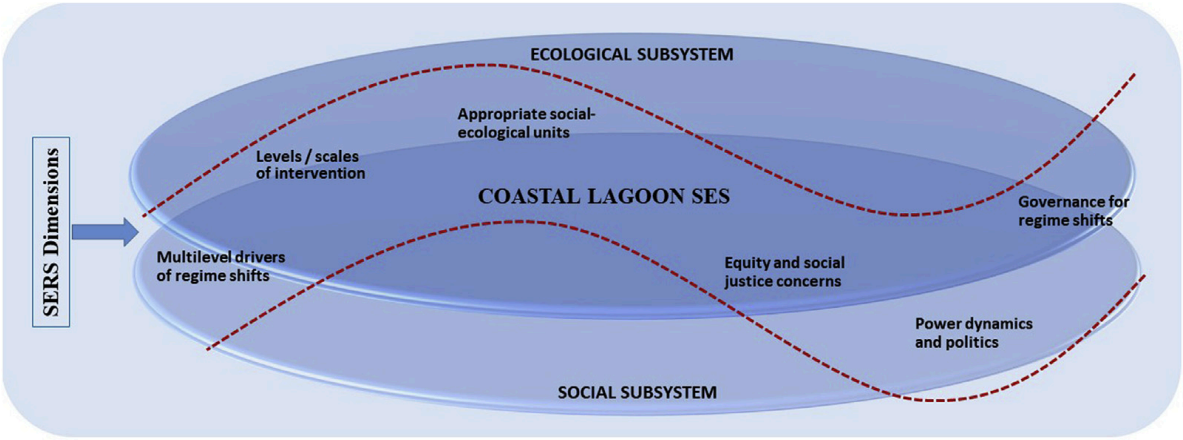


Figure 3: Social-Ecological Regime Shift (SERS) Framework (Nayak & Armitage, 2018).

The first component of the framework is "Differentiating drivers of regime shift." According to Nayak and Armitage, 2018, drivers cause change to social-ecological systems, and they may be natural or human-induced. Also, proximate and underlying causes of regime shift help fully understand how systems change after experiencing a stressful event. To differentiate regime shift drivers, the proximate causes, underlying forces and their directionality must be identified (Nayak & Armitage, 2018). In this study, proximate causes were the COVID-19 health crisis, an anthropogenic cause, and the associated immediate actions at a local level, such as restrictions imposed by governments, social distancing, transportation restrictions, and reduced fishing and market hours. The following analysis uses the term "Emerging Drivers" to identify proximate causes of regime shift. The underlying forces are the drivers underpinning the proximate causes, which can help us tackle the uncertainty and complexity of social-ecological systems (Nayak & Armitage, 2018). In this study, I

refer to underlying forces as the “Existing Drivers”, which identify the existing vulnerabilities in the SSF system and exacerbate the impact of the emerging driver.

The second component in the SERS framework is “Levels and scales of occurrences and intervention”. According to Nayak and Armitage, 2018, when a regime shift occurs, components of the SES reach threshold at varying points (Nayak & Armitage, 2018). This variance happens because each system component has a different resilience and flexibility. Accordingly, those differences should be analyzed and studied to address an appropriate approach to intervention (Nayak & Armitage, 2018). The analysis should address different scales and levels of an SES. In this study, I refer to this component as “Scales reaching threshold and scales of intervention”, basically the fragile points in the SSF value chain reaching a threshold due to the impact of multiple drivers (Emerging and Existing). Consequently, scales of interventions would be critical points for governments, policymakers, and institutions to intervene and mitigate the adverse impacts of the pandemic on the SSF communities. Those interventions could be immediate or long-term changes (Nayak & Armitage, 2018).

The third component of the SERS framework is the “ Social-Ecological Unit or the Context of Regime Shift.” To capture most of the feedback and interactions shaping a regime shift, an SES unit for the analysis should be identified (Nayak & Armitage, 2018). In our case studies, the value chain of SSFs is the social-ecological unit of regime shift. Value chains of small-scale fisheries define the relationship and linkages between different actors in the system. It is one of the most diverse and extensive networks of supply and trade (Rosales et al., 2017). Therefore, the value chain of small-scale fisheries is the system's nucleus containing all its vital actors and relations. According to this finding and Nayak & Armitage, 2018, the value chain of SSFs is the most suitable unit of this SES to use as the context of the anaylsis because it contains the following system attributes:

a) Linkages: represented by the SSFs value chain actors and relationships
b) Feedback: represented by the impacts of multiple drivers and system dynamics
c) Nestedness: represented by the intricate organization of the SSF value chain actors
d) Subsystems: represented by social, ecological, economic, and physical aspects of the value chain
e) Scale: represented by different socio-economic and ecological clusters within the system, such as Major inputs- fishers, Fishers- households, Fishers- wet market-

consumer, Fishers- middle buyers- consumers, Fishers- wholesalers- HORECA- consumers, Fishers- wholesalers- export- consumer, Fish as a resource- fishers- household.

f) Drivers: represented by the emerging and the existing drivers

The fourth and fifth component of the SERS framework is the "Equity and justice concerns in social-ecological regime shifts." According to Nayak and Armitage, 2018, equity and justice concerns in social-ecological regime shifts are best described by winners and losers when shifts occur. Identifying those concerns is crucial to navigating the change that is happening in the system. Examples of those concerns are anticipating the impact on the poor, marginalized communities or a certain gender (Nayak & Armitage, 2018). The power dynamics and politics of change identify the different positions of the social-ecological system stakeholders and their power to implement decisions during a regime shift (Nayak & Armitage, 2018). Manipulation of the situation can occur when people in power making decisions are corrupt or have certain agendas (Nayak & Armitage, 2018). Decisions include who should benefit from a resource and what needs to be done to navigate the SES regime shift carefully considering the scale, position and place. It is a question of whose perspective will be used (Nayak & Armitage, 2018).

In this study, I collectively discuss equity, justice and power dynamics as an extended implication of the Emerging and Existing drivers. The last component of the framework is the "Governance in the Context of Social-Ecological Regime Shift." Governance in the context of regime shifts must support social learning, be flexible and adaptive to face the uncertainty of the situation, and consider multilevel arrangements (Nayak & Armitage, 2018). However, during the COVID-19 crisis, governments made decisions and initiated relief programs to alleviate the impact on fisher communities. Some of those initiatives were effective, while others were sterile or poorly implemented. This deformation in support delivery is a result of questionable governance practices. In this study, along with discussing the positive and negative governance practices during the pandemic, I also discuss the coping and adaptation strategies SSF communities practiced. Adding coping and adaptation strategies to governance analysis help us identify what those communities lack to help them face the pandemic and maintain their well-being. I am exploring both erosive and constructive coping and adaption strategies to capture the differences in the resiliency of the studied cases.

Therefore, in this study, I am suggesting the following adapted SERS framework (Figure 4). In the adapted framework, COVID-19 is the stressor impacting the SSFs. SSFs' unit of regime shift is the value chain and representing the SES which all actors and associated activities occur. The impact of COVID-19 highlights the emerging and existing impacts in the system. The equity, justice concerns, and power dynamics are implications of those drivers, compounding the impacts resulting in a regime shift. When the regime shift occurs, weaker actors and activities reach threshold. According to the new state of the system, interventions are needed to navigate this shift. Analyzing all those drivers suggests a number of scales to be tackled by governments and communities to navigate the crisis. Additionally, the analysis of the actual governance, coping and adaptation strategies helps in analyzing the deficiencies of those practices when compared to suggested scales.

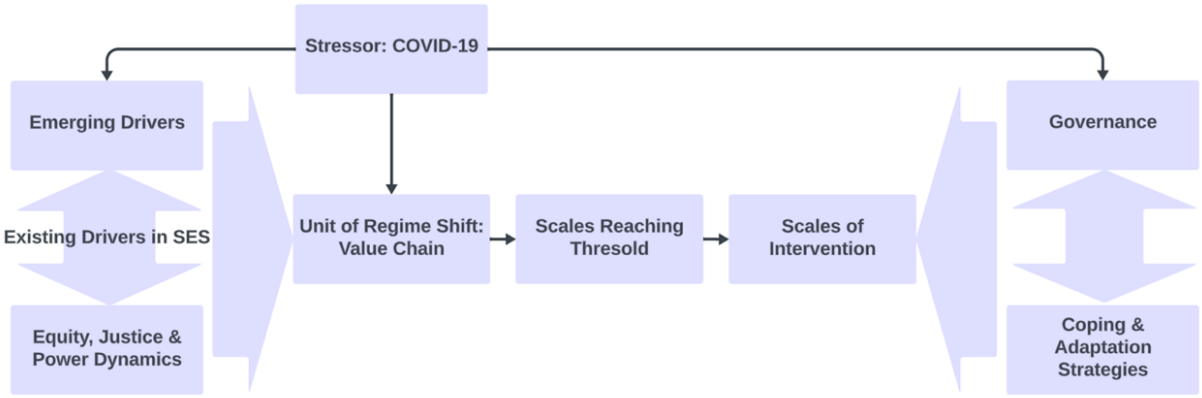


Figure 4: Social-Ecological Regime Shift Framework (SERS). Adapted from (Nayak & Armitage, 2018)

Following the adapted framework in (Figure 4) I present a table that defines the original SERS framework components and their respective definition in the adapted version of the framework (Table 1)

Table 1: The original SERS components and their respective definition and scope in the adapted framework.

Original SERS component	**Respective definition and scope in adapted SERS**
Differentiating drivers of regime shift: 1- Proximate causes 2- Underlying forces	1- Emerging drivers related to COVID-19 impacts 2- Existing drivers related to existing vulnerabilities before COVID-19

Levels and scales of occurrences and interventions	3- Suggested scales of intervention stemming from assessing value chain actors thresholds 4- Actual scales of interventions stemming from government support, coping and adaptation strategies practiced by SSF communities during COVID-19.
Context of regime shift/ social ecological unit	5- Unit of regime shift represented by the SSFs' value chain which is a social-ecological system
Equity and justice concerns	6- Implications of emerging and existing drivers in synergy with equity, justice, and power dynamics withing the SSF system
Power dynamics	
Governance during regime shift	7- Coping and adaptation strategies practiced by SSFs' communities 8- Government support to SSFs communities during COVID-19

2.6 Livelihood Resilience

The Rockefeller Foundation proposed the definition of livelihood resilience as the ability of individuals, communities, organizations, businesses, and systems to survive, adapt, and thrive after experiencing a sudden shock or stress (Ilmola-Sheppard, 2016; Speranza et al., 2014). Livelihood resiliency is only effective when you can foresee sudden shocks, prepare, respond, and recover from them (Tambe, 2022). Additionally, other sources mention the word "threshold", given that the system has a certain limit of endurance, and when this limit is exceeded, a reformation will be needed (Schipper & Langston, 2015).

To define livelihood resiliency, we must first understand what a livelihood accounts for (Sina et al., 2019). Livelihood is often misunderstood in the literature as it is always framed as the way of making a living and household income (Sina et al., 2019). However, it should be addressed in a broader socio-economic context, including food security, health, shelter, income, education, and social security (Sina et al., 2019). DasGupta and Shaw (2015) define "resilient communities" as social-ecological systems that can withstand a sudden disturbance while maintaining an acceptable status to continue performing their basic activities. Also, SES systems should be able to recover and self-organize speedily (DasGupta & Shaw, 2015). Speranza et al. also mention that system actors must have accessibility to livelihood capitals and be able to create alternative options (Speranza et al., 2014). Accordingly, livelihood resiliency is tightly connected to adaptability and not only maintaining an acceptable state of performance under a stressor (Speranza et al., 2014). Although originating from distinct conceptual foundations, resilience is frequently employed interchangeably with adaptation

and the reduction of vulnerability, which are commonly considered interconnected, when discussing efforts to mitigate risk (Schipper & Langston, 2015).

If we apply this understanding to coastal areas, usually in rural areas, we face the problem of them being the most vulnerable (Campbell et al., 2020). This vulnerability is due to their dependence on coastal ecosystem services (fisheries and agriculture), lack of supporting infrastructure (Senapati & Gupta, 2017) and high frequency of natural disasters (DasGupta & Shaw, 2015). The vulnerability of SSFs existed long ago, before the pandemic crisis. It started when the oceans' biogeochemistry changed due to climate change issues and impacted fisheries' production, distribution, and composition (Senapati & Gupta, 2017). Moreover, the irrational use of coastal ecosystem services due to human unsustainable development of coastal areas has contributed to the vulnerability of this SES (DasGupta & Shaw, 2015). However, as explained before, COVID-19 has exacerbated the existing vulnerable conditions.

COVID-19 impacts affected all economic, social and ecological aspects of coastal areas. However, rural communities depending on small-scale fisheries were more prone to COVID-19 effects (Asante et al., 2021; Bennett et al., 2020). This vulnerability is due to SSF communities mostly comprised of unregistered informal labor working with no policy or social protection (Mukherjee et al., 2020). Consequently, those communities did not receive adequate support during the crisis due to a lack of information, data and statistics (Campbell et al., 2020). Also, those communities' diverse, fragmented and decentralized nature plays a significant role in shaping their vulnerability (Campbell et al., 2020). All of those factors contributed to the problem of the government’s ability to identify and respond to the issues of SSFs in the informal sector (Campbell et al., 2020).

2.7 Adaptive Governance, Coping, and Adaptation

Governance encompasses the structures and processes through which decisions are made, and power is shared within societies (Folke et al., 2005). Governance plays a dual role, contributing to and offering solutions for intricate socio-ecological challenges and injustices (May, 2022). Addressing these issues necessitates a concerted focus on understanding the processes and results of socio-ecological practice (SEP) (May, 2022). SEPs unfold within complex socio-ecological systems (SESs) regulated by multilevel, cross-scale governance structures comprising institutions, organizations, and individuals (May, 2022).

Adapting to and influencing change is a crucial aspect of resilience within a social-ecological system (Folke et al., 2005). In a social-ecological system characterized by high adaptability, the participants possess the capability to restructure the system towards desired states in response to changing circumstances and disturbances (Folke et al., 2005). From a livelihoods perspective, the concept of adaptive capacity asserts that diversification plays a crucial role in expanding choices and adaptability when dealing with disruptions and ensuring a stable income (Nomura et al., 2022).

Recent research has emphasized the importance of understanding how communities reliant on natural resources, whose occupations also have global significance, can prepare themselves for changing social and environmental conditions resulting from factors like climate variability, climate change, or market disruptions, as multiple factors can influence a fishing community's overall susceptibility to these stressors (Nomura et al., 2022). Adger (2006) noted that vulnerability consists of 3 key elements: exposure, sensitivity to different types of exposure , and adaptive capacity (Nomura et al., 2022). Exposure relates to the extent and frequency of a disturbance, sensitivity pertains to the degree to which the system is impacted, and adaptive capacity is the capability to effectively manage stressors and mitigate their effects (Nomura et al., 2022).

Lately, the concept of adaptive management has garnered significant attention in the literature, specifically in its connection with the socio-ecological environment within which it operates (Heikkila, 2010). Folke et al. (2002, 20) define adaptive management as "a process in which institutional arrangements and ecological knowledge undergo continual testing and refinement through a dynamic, ongoing, self-organized trial-and-error process." (Heikkila, 2010). Consequently, an adaptive governance process demonstrates sensitivity to the ecosystem, comprehends its intricate nature, and possesses the capacity, determination, and authority to act harmoniously (Heikkila, 2010).

In adaptive contexts, institutional rules are subject to continuous reevaluation and adaptation to align with the complex and ever-evolving environment (Heikkila, 2010). Simultaneously, these institutions need to exhibit a degree of stability to establish enduring rules of engagement, thus earning legitimacy and trust among stakeholders (Heikkila, 2010). This process creates a paradox and a challenge for any governing system (Heikkila, 2010)

Many proponents argue that adaptive management offers a more practical and promising approach to addressing the complexity of ecosystems compared to strategies focused on optimal resource utilization and control (Folke et al., 2005). Dietz et al. introduced the concept of adaptive governance,

which extends the focus beyond the adaptive management of ecosystems to encompass the broader social contexts that facilitate ecosystem-based management (Folke et al., 2005). When we refer to governance, we mean establishing the conditions for organized regulations and collective actions or the institutions for coordinating social activities (Folke et al., 2005). Embracing an adaptive ecosystem approach, Boyle et al. propose a triad of activities, where governance involves resolving trade-offs, providing a vision, and setting a course for sustainability; management translates this vision into practical actions, and monitoring offers feedback while synthesizing observations into a narrative that explains how the situation has evolved and might develop in the future (Folke et al., 2005)

2.8 Conceptual framework

This research explored seven interrelated concepts to investigate the profound impact of the COVID-19 pandemic on the livelihood resilience of small-scale fisheries (SSFs) (See Figure 5). The conceptual framework includes the following key elements: Small-Scale Fisheries, COVID-19 Impacts, Value Chain, Livelihood Resilience, Social-Ecological Systems (SESs), Social-Ecological Regime Shift Framework (SERS), and Adaptive Governance. Firstly, I focused on Small-Scale Fisheries, acknowledging their important role in numerous economies and their critical contribution to global food security. Next, I assessed the impacts of the COVID-19 pandemic on these SSFs, which have been significantly affected by lockdowns and restrictions.

The literature review extends to the value chain of these SSFs, which represents a Social-Ecological System (SES) and is susceptible to stressors such as COVID-19. To evaluate the impacts, I employed the Social-Ecological Regime Shift Framework, which offers an analytical lens for understanding changes within SESs, such as the SSF value chain and distinguishing the dynamics of this shift. Finally, the concept of adaptive governance as an approach for enhancing the adaptive capacity of SSFs emerged from the literature reviewed. The aim of examining these interlinked concepts is to provide a conceptual framework (Figure 5) guiding this research to fulfill its objectives in understanding the impact of COVID-19 on the livelihood resilience of SSFs and identifying the key adaptive responses and factors of their successful implementation.

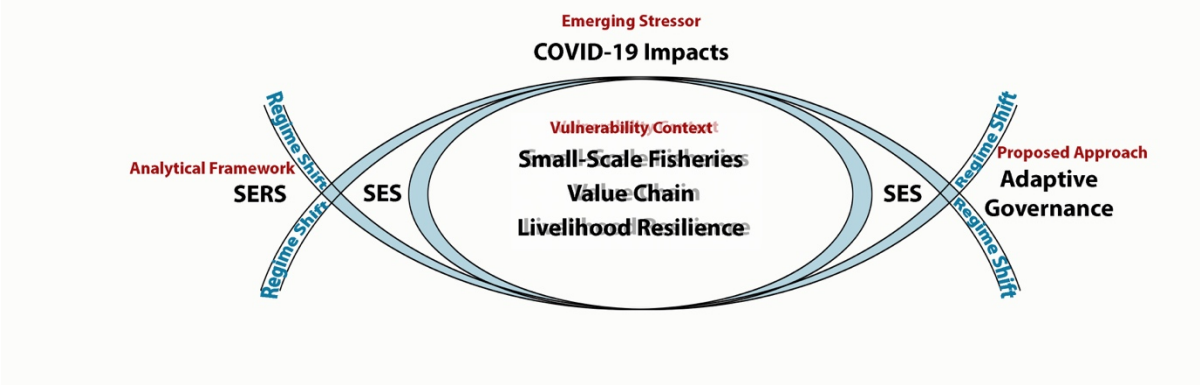


Figure 5: Conceptual framework.

2.9 Conclusion

In this section, I have presented a comprehensive conceptual framework that forms the basis of our research. This framework comprises seven interconnected concepts aimed at investigating the profound impacts of the COVID-19 pandemic on the livelihood resilience of small-scale fisheries (SSFs). These concepts include small-scale fisheries, COVID-19 Impacts, Value Chain, Livelihood Resilience, Social-Ecological Systems (SESs), Social-Ecological Regime Shift Framework (SERS), and Adaptive Governance. Each of these elements plays a crucial role in understanding the challenges and dynamics associated with SSFs in the context of the pandemic.

We commenced our exploration by emphasizing the significance of small-scale fisheries (SSFs) in various economies and their crucial role in ensuring global food security. The discussion then shifted to the impacts of the COVID-19 pandemic on these SSFs, highlighting the disruptions and vulnerabilities they faced due to lockdowns and restrictions. Our examination extended to the Value Chain of SSFs, representing a complex Social-Ecological System (SES) susceptible to stressors such as COVID-19. To assess these impacts, I employed the Social-Ecological Regime Shift Framework, providing an analytical lens to understand changes within SESs and distinguish the dynamics of these shifts.

In response to these challenges, I propose the concept of Adaptive Governance as a means to enhance the adaptive capacity of SSFs. By examining these interlinked concepts, this study provides valuable insights for policymakers, governments, and stakeholders to navigate the challenges posed by pandemic-induced disruptions in small-scale fisheries more effectively. The COVID-19 pandemic exposed the vulnerabilities within SSFs, which have long been grappling with socio-institutional

constraints, climate change-related issues, and unsustainable development. The pandemic acted as a critical disturbance that forced these systems to reorganize and adapt.

In conclusion, the conceptual framework serves as a foundational guide to delve into the complexities of small-scale fisheries and their resilience in the face of external disruptions like COVID-19. By exploring these interconnected concepts, this research aims to contribute to the understanding of how adaptive governance and resilience-building strategies can support these vital systems in times of crisis and change.

Chapter 3
Methodology

3.1 Statement of Purpose

This qualitative study aims to provide an understanding of the livelihood resilience of small-scale fisheries (SSFs) in the context of the COVID-19 pandemic through a comparative analysis of six case studies. To achieve this, this study employ an adapted version of the Social-Ecological Regime Shift (SERS) analytical framework developed by (Nayak & Armitage, 2018). By utilizing this framework, I establish the criteria against which these case studies can be evaluated, enabling us to identify key adaptive responses necessary for social-ecological systems when facing unforeseen crises. Furthermore, it identifies a set of factors essential for the successful implementation of the adaptive responses, providing a comprehensive guide to transforming SSFs from vulnerability to viability.

3.2 Research Design

A pragmatic philosophical worldview guides this research study. Pragmatism, as a worldview, emerges from actions, circumstances, and outcomes (Creswell, 2009). It places emphasis on practicality, seeking effective solutions to issues, and prioritizing the resolution of problems over rigid adherence to specific methodologies (Creswell, 2009). Researchers, in this context, prioritize the research problem and employ a diverse range of approaches to gain a comprehensive understanding of the issue at hand, rather than fixating on prescribed methods (Creswell, 2009). Similarly, this research emphasizes the problem of livelihood resilience of SSFs in the context of COVID-19 impacts and place it as the main pillar guiding this study. Additionally, diverse approaches have been utilized to understand, collect, analyze, and interpret data throughout this study. Although the comparative analysis of case studies is the main approach for analyzing the data collected, other methods, demonstrated in the following sections, were found valuable in gaining more knowledge about the research problem. Even the comparative analysis of case studies was conducted untraditionally in uniquely distinct stages.

This qualitative study started with the aim to understand the impact of COVID-19 on the livelihood resilience of small-scale fisheries. I reviewed literature on the following topics: livelihood resilience of coastal communities, COVID-19 impacts on SSFs, and the vulnerability of SSFs. This initial review provided me with key concepts and definitions, and helped me to identify the scope of my

research. Additionally, I found out that the impact of COVID-19 on SSFs varied significantly depending on the region or the context under study. Therefore, I decided to use a comparative analysis of case studies to analyze the situation and capture the differences. Then, I would relate those differences or variations to their causes to understand why the impact was different. In the first stage of the analysis, I used an adapted version of the SERS framework to analyze each case study. The result of analyzing emerging and existing drivers along with their implications on equity, justice and power dynamics was the suggested scales of intervention. Additionally, the result of analyzing the governance, coping and adaptation strategies implemented during COVID-19 was the actual scales of intervention. Using data visualization, I compared the suggested and actual scales of intervention to identify the best practices in governance and factors of successful implementation through the synthesis of findings (Figure 6).

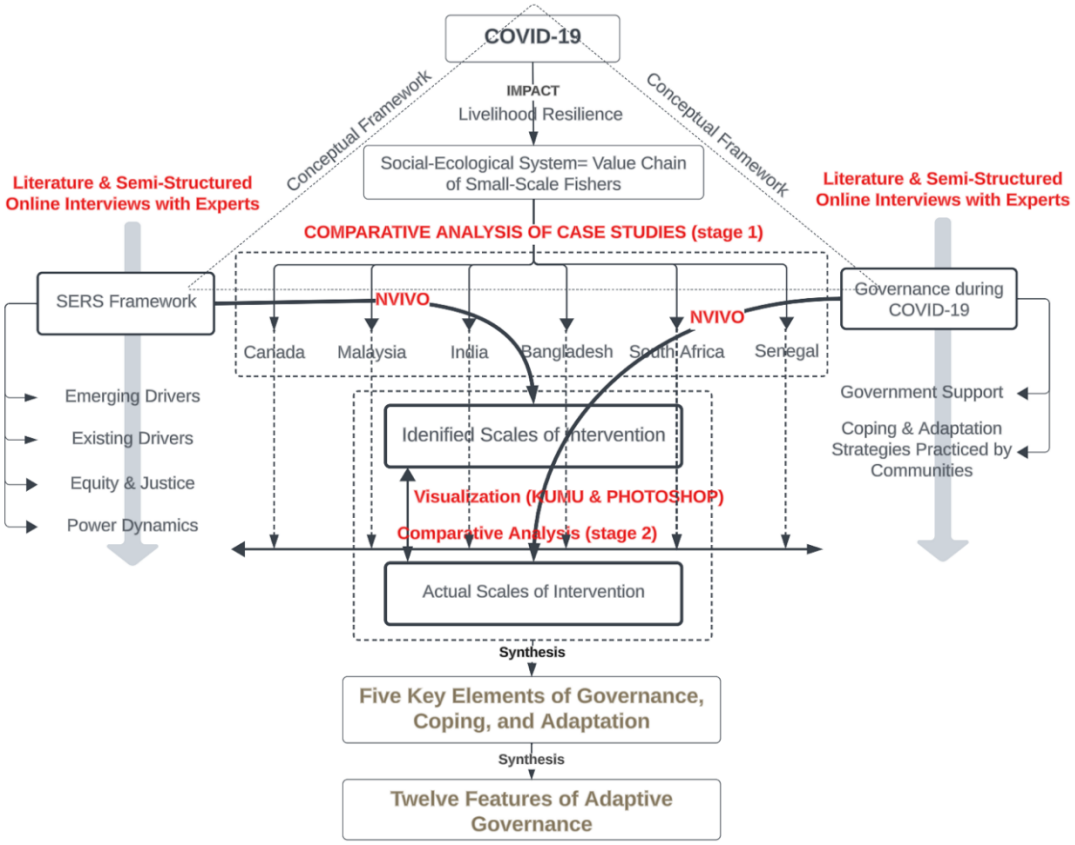


Figure 6: Research Design.

3.2.1 Data Collection:

3.2.1.1 Exploratory literature review

I conducted a comprehensive review of the existing literature, analyzing 43 peer-reviewed articles in the field, which specifically examined the impact of COVID-19 on small-scale fisheries (SSFs). To organize this vast body of work effectively, I categorized the studies by their respective regions, encompassing Southeast Asia, Southern Asia, North America, South America, East Africa, South Africa, West Africa, and Central Africa. To facilitate data extraction and maintain systematic documentation, I designed and implemented an Excel-based data extraction template. This template structured the criteria for data extraction in columns and presented countries and regions in rows. This strategic approach allowed me to gain an exploratory insight into the extent of published data available for each region or country, as well as to pinpoint prominent case studies that provided substantial insights into the impact of the pandemic on SSFs.

3.2.1.2 Case studies selection rationale:

I observed similarities between the impact of COVID-19 on SSFs within the same geographic regions. Consequently, my selection of case studies was guided by four primary considerations. First and foremost, I selected the case studies that presented significant and diverse range of impacts. For example, Canada presents significant governance, coping, and adaptation strategies during COVID-19, such as ASNs. Malaysia, had a remarkable impact by the closing of tourism activities. In India, there was a huge problem caused by the restrictions on transportation and migrant fishers. Bangladesh, had a severe impact from coinciding 65-day fishing ban with COVID-19 lockdowns that led SSF into prolonged non-fishing period. In South Africa, there is a huge influence by the informality of the SSF sector attributed to social equity and justice. Lastly, in Senegal, the importance of landing sites in the SSF value chain and the impact of insensitive regulations to the nature of fishing activity. Therefore, each case study I chose represents a unique story to tell.

The second consideration when choosing my case studies was the availability of published research on a specific case studies. Thirdly, given the confines of this study within the scope of a master's thesis, I had to be narrow my case selection. The fourth criterion was rooted in my hypothesis that the impact of COVID-19 on SSFs would exhibit variations dependent on the Human Development Index (HDI) of the respective country. This presumption is underpinned by the fact that HDI encompasses a

range of factors directly linked to livelihood resilience, including health, educational attainment, income levels, and standards of living. As such, I hypothesized that countries with higher HDI scores would demonstrate greater resilience when confronted by external shocks. With these rationales in mind, I narrowed down my selection of case studies to six countries: Canada, Malaysia, India, Bangladesh, South Africa, and Senegal. This careful selection allowed me to capture and analyze the most substantial impacts of COVID-19 on SSFs. The following (Table 2) represents the selected case studies and their respective Human Development Index (HDI). The studied locations in the table are locations that were identified in the literature reviewed and interviews conducted.

Table 2: Selected case studies, HDI (as of 2021), and studied locations emerging from literature and interviews conducted.

Country	HDI	Studied locations
Canada	0.936	Skipper Otto's in British Columbia, Newfoundland and Labrador Fisheries
Malaysia	0.803	Kota Belud in Sabah, Johor, Selangor, Mukim Tanjung Kupang, Tun Mustapha Park
South Africa	0.713	KwaZulu-Natal (Sokhulu, Empembeni and Mtwalume), Eastern Cape (Sicambeni, Ngoma and Hamburg), Western Cape (Arniston, Struisbaai and Buffeljagsbaai) and the Northern Cape (Hondeklipbaai and Port Nolloth)
Bangladesh	0.661	Sundarbans mangrove forest , Dhaka, Chittagong, Khulna, Barisal, Rajshahi, Rangpur, Sylhet, Mymensingh, Shibpur and Baghaba, Haimchar, Char Alexandar, Kawarchar and Laharhat, Palashbari, Osmaninagar, Balaganj, Cox's Bazar, Patuakhali and Barguna
India	0.633	Andhra-Pradesh, Assam, Odisha, West Bengal, Bihar, state of Gujarat, UT of Daman and Diu, The Maharashtra state government, Andaman and Nicobar Islands
Senegal	0.511	Dakar, Mbour, Hann, Ouakam, Soumbédioune, and Rufisque

3.2.1.3 Comprehensive literature search and review:

To compile relevant literature, I employed a strategic approach by using specific keywords in the search, primarily focusing on the "COVID-19 impacts on small-scale fisheries." In each of my literature searches, I tailored the keyword to include one of the countries selected for my case studies: Canada, Malaysia, India, Bangladesh, South Africa, and Senegal (Table 3). My data sources encompassed an array of materials, with a strong emphasis on peer-reviewed articles sourced from journals and university repositories containing master's and PhD theses. Additionally, I delved into

grey literature, which included working papers, reports, online articles, and local news articles. I concentrated my search on articles published from 2021 up to the present year, 2023, in consideration of the pandemic's onset and evolution. Moreover, I expanded the search to include years preceding the pandemic to capture pre-existing vulnerabilities in the selected case studies. Recognizing the dynamic nature of the pandemic, I conducted two rounds of literature searches. The first round took place between March and April 2022, while the second round occurred in May and June 2023. The rationale behind these dual rounds was the evolving nature of COVID-19 literature.

Table 3: Keywords used in literature search**.**

Fixed keywords in the literature search	Changing keywords in the literature search
COVID-19 Impact on small-scale fisheries in	1- Canada
	2- Malaysia
	3- India
	4- Bangladesh
	5- South Africa
	6- Senegal
	7- Asia
	8- Africa

In the initial phase of data collection, I used Zotero. This tool facilitated the gathering, screening, and evaluation of the identified literature. I utilized Zotero notes to methodically extract pertinent information crucial to my study. Subsequently, I organized this data using an Excel spreadsheet, categorizing it according to the specific case study it pertained to.

Within the body of literature I reviewed, an overarching theme emerged identifying small-scale fisheries (SSFs) as Social-Ecological Systems (SES). This alignment was logically grounded in the inherent attributes and dynamics of SSFs. Hence, I made the deliberate choice to employ the Social-Ecological Regime Shift analytical framework developed by Nayak and Armitage in 2018. This framework comprises six fundamental elements designed to provide a comprehensive understanding

of the changes observed within an SES following the impact of a stressor. These six elements served as my criteria for extracting information from the extensive literature I had gathered. I created an excel sheet (Figure 7) with the SERS framework elements in columns and case studies on rows for data extraction from literature.

SERS Components/ Case Study by HDI	Differentiating drivers of regime shift	Levels and scale of occurrence and intervention				Social- ecological units or the context of regime shifts	Equity and justice concerns in SERS	Power dynamics and politics of change	Governance in the context of social-ecological shifts	
	Drivers & Analysis	Components of SES	Reaching threshold	Timing	Intervention	The internal and external feedbacks and interactions	Equity and justice concerns	Whose perspective? Whose knowledge?		
GENERAL										
1. Canada (Benchmark) HDI: 0.936										
2. Malaysia HDI:0.803										
4. Bangladesh HDI: 0.661										
5. India HDI: 0.633										
6. South Sfrica HDI: 0.713										
7. Senegal HDI:0.511										

Figure 7: Excel sheet used initially for data extraction.

3.2.1.4 Semi-structured online interviews with experts from the field:

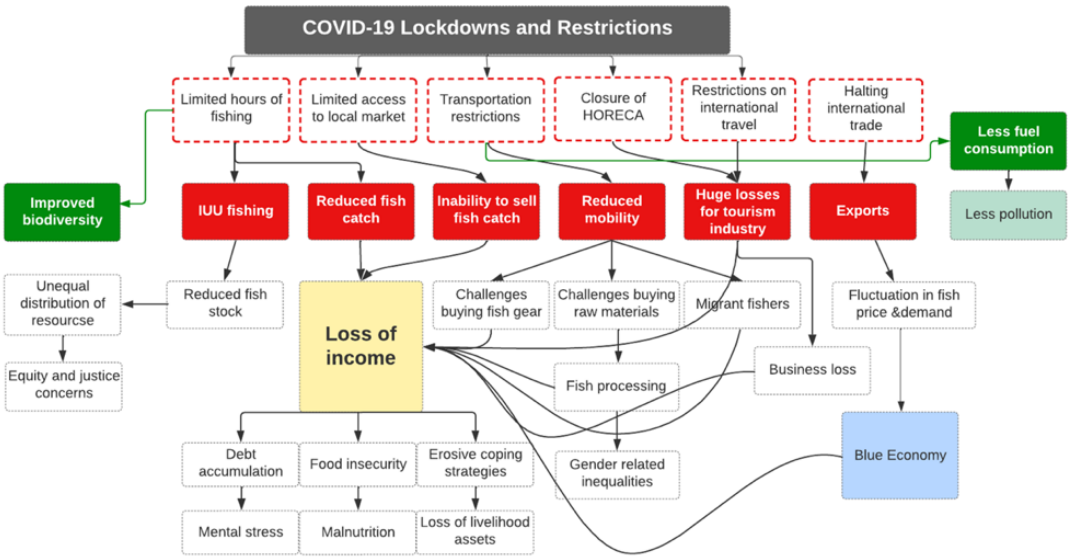
While engaged in the process of data extraction from the existing literature, I encountered several notable gaps and instances where additional information or supporting evidence was required. In some cases, I encountered conflicting information stemming from differing sources. Recognizing the importance of addressing these gaps and discrepancies, I decided to conduct online semi-structured interviews with experts in the field, each hailing from the respective countries within my study.

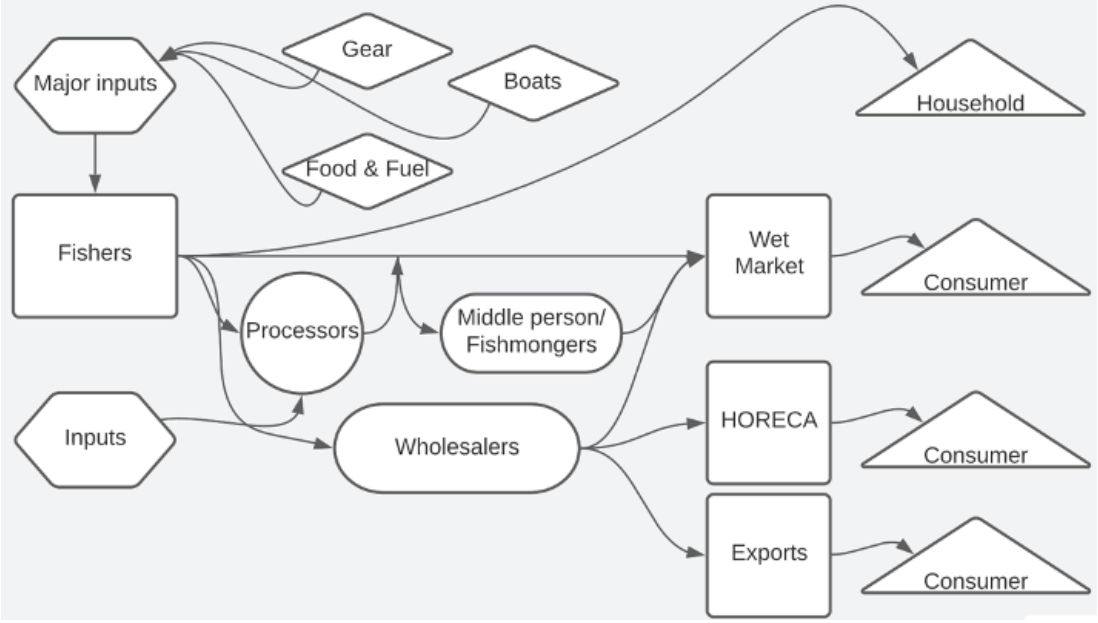
Selecting the experts for these interviews presented no significant challenges, thanks to the context of this research being part of a larger project supported by SSHRC, the V2V Global Partnership. This collaborative initiative boasts a substantial network comprising 150 individuals and 70 organizations distributed across six Asian countries (Bangladesh, India, Indonesia, Japan, Malaysia, Thailand), six African nations (Ghana, Malawi, Nigeria, Senegal, South Africa, Tanzania), Canada, and beyond. Leveraging this extensive network, I reached out to experts representing each of the chosen countries through email (See Appendix A), extending invitations for online interviews to be conducted via Microsoft Teams.

In my email invitations, I provided an introduction to the study, offering a clear overview of its objectives. Additionally, I attached a template for the semi-structured discussions that I intended to facilitate (Table 4 and Appendix B). While my initial plan aimed to conduct 15 online interviews,

practical constraints related to time and participant availability allowed me to successfully complete 9 interviews. These interviews were diligently recorded and subsequently transcribed using the Microsoft Teams platform. The information extracted from those transcripts were uploaded to NVIVO and coded according to the coding matrix presented in (Figure 8) and explained in (Sec. 3.2.2.1). The identity of interviewees were kept anonymous and their responses were referred to as "Expert no., Country name, personal communication, Date of Communication". The results of the interviews were not presented exclusively in this study, but were incorporated inclusively with other sources of data.

Table 4: Semi-structured online interview template.

	Questions
Q1	COVID-19 restrictions were nearly the same worldwide, however, there were variations identified. Could you describe how were COVID-19 restrictions different in your country with respect to small-scale fisheries? Which restrictions impacted SSFs the most? What would you add/remove/change in the below diagram? 

Q2	What do you think are the underlying/existing vulnerabilities in small-scale fisheries communities and/or value chain that contributed to its disruption during COVID-19 event?
Q3	Social-ecological units or the context of system disturbance: Could you verify the below value chain diagram? Would you add/remove a component or change a relation in this diagram with respect to small-scale fisheries in your country? 
Q4	Using the SSFs value-chain, which component(s)/ scale(s) was/were affected primarily and caused the disturbance in the system? On the contrary, which component(s) thrived during the crisis? Also, what would be the immediate and long-term interventions to tackle those issues?
Q5	What are the equity and justice concerns affecting small-scale fisheries communities during COVID-19 or existing from before and contributed and/or influenced the system disturbance in your country?
Q6	What are the power dynamics of SSFs value chain in your country (system stakeholders and their power to implement decisions during a regime shift)? Can you identify the winner and losers (as a result of decisions) during COVID-19 crisis?

Q7	What is the government, cooperative and NGOs support received/administered to SSFs and their communities during the crisis? Did all fishers receive this support? Why (if the answer is "NO")?
Q8	What are the coping and adaptation strategies practiced by SSFs' fishers and their communities during the crisis (both erosive and/or constructive)?

Table 5: Overview of the data collection methods, tools used, intent, and outcome.

Method	Tools	Intent	Outcome
Exploratory literature review	Excel, Google Scholar	Explore the published literature on the research topic	Case studies selection
Literature review search	Google scholar, Zotero, Excel	Organizing, screening, and evaluating the literature suitable for my case studies	Identified needed information, gaps, and missing evidence or conflicts
Semi-structured online interviews	Interview questions guide, Microsoft Teams	Gain experts knowledge to verify, fill gaps or clarify information	Solid body of information needed for my comparative analysis

3.2.2 Data Analysis

3.2.2.1 NVIVO for data extraction and analysis:

As I proceeded with the data extraction process, I was confronted with an immense volume of information, necessitating a more structured and systematic approach. Subsequently, I made the choice to employ NVIVO as a tool in managing extracting and interpreting data effectively. This entailed uploading all the collected literature (38 peer-reviewed articles and 22 sources from grey literature) and interview transcripts (9 transcripts) into the NVIVO platform, where I proceeded to construct a code matrix (Figure 8) for the deductive data extraction process. Each code within this matrix was strategically aligned with the elements outlined in the adapted SERS framework (Sec. 2.5). The preparatory phase for NVIVO, inclusive of data upload and code matrix establishment, spanned approximately three months. In alignment with the adaptation of the framework to suit the specific parameters of my study, I expanded the code set beyond the original six SERS elements. This augmentation culminated in the creation of a comprehensive code repertoire, totaling 16 distinct

codes (Figure 8 represented in the columns) tailored to facilitate data extraction. The outcome of this rigorous process was 1260 reference to the 16 codes, represented in Figure 8, is a reflection of the results yielded through the data extraction within the NVIVO software:

	CODES VS COUNTRIES	Canada	Malaysia	India	Bangladesh	South Africa	Senegal	Total/code
1	Common COVID restrictions	1	4	8	6	0	1	**15**
2	Severe COVID restrictions	1	2	9	12	4	3	**28**
3	Impacts of Restrictions	17	40	76	118	24	30	**248**
4	Positive impacts	1	2	9	4	1	2	**16**
5	Value Chain	1	3	4	4	5	15	**28**
6	Emerging drivers	16	33	51	82	25	23	**181**
7	Existing drivers	11	22	20	49	28	17	**114**
8	Conciding stressors	1	0	13	13	1	6	**33**
9	Equity and justice concerns	5	17	30	27	57	14	**128**
10	Power dynamics	2	4	8	8	18	9	**43**
11	Scales reaching threshold	0	0	1	2	0	2	**5**
12	Coping and adaptation (negativ	0	3	5	15	2	1	**23**
13	Coping and adaptation (positive	11	6	6	7	6	6	**25**
14	NGOs support	1	2	4	7	2	4	**17**
15	Government practices (positive)	15	16	9	19	5	5	**38**
16	Government practices (negative	1	9	11	32	18	10	**71**
	Total/case study	**84**	**163**	**264**	**405**	**196**	**148**	**1260**

Figure 8: Data coding results from NVIVO.

The next step was to run queries on NVIVO needed for my study. I ran 16 coding queries, one query for each code including the selected six case studies. I exported the results of the queries to Microsoft Word to synthesize the extracted data and write about it in my research.

3.2.2.2 The comparative analysis of case studies using the SERS framework:

The comparative analysis of case studies within the SERS framework unfolds in two distinct stages. In the initial stage, a comprehensive examination encompasses three primary elements derived from the framework: the unit of regime shift, emerging drivers, and existing drivers, each evaluated within the context of every case study. Subsequently, these three elements serve as a foundational basis for extending the discourse, delving into intricate discussions surrounding matters of equity, justice concerns, and the prevailing power dynamics that have manifested during COVID-19. The outcome of this stage is the identification of the suggested scales of intervention. These identified interventions are selected based on their significance and the influence on actors operating within a specific value chain. Moreover, the interventions take into account the extent to which these actors have impacted the resilience of SSFs during the pandemic. Collectively, these interventions serve as a commendable recommendation for both governmental bodies and SSFs' dependent communities, providing

guidance during abrupt crises to effectively mitigate the adverse impacts on the value chain's resilience.

The second stage of the comparative analysis shifts its focus towards the exploration of government support mechanisms, as well as the adaptive coping strategies practiced by SSFs' communities throughout the turbulent times brought about by COVID-19. Within this context, the objective was to identify the actual scales of interventions practiced and implemented by governments and local communities during the course of the pandemic.

3.2.2.3 Data results visualization using “KUMU” platform, and “Photoshop” software:

Throughout both stages of the analysis, I used a platform called "KUMU" to map the drivers of regime shift across each country under evaluation. In this process, I employed the "Systems" template as the foundational canvas, allowing me to comprehensively chart the intricate landscape of each country's small-scale fisheries (SSF) value chain. As the analysis unfolded, I introduced dynamic elements into the mapping equation. Initially, I incorporated arrows, referred to as "Connections," to visually articulate the intricate web of relationships that interconnect the various actors within the value chain. These connections highlighted the multifaceted interplay and dependencies inherent to this complex ecosystem.

However, the mapping exercise did not conclude here. To convey the disruptive influences and adverse impacts experienced by these value chain actors, I adjoined emerging drivers to the canvas, distinctively coloring their connections in a vivid shade of red. This visual cue effectively underscored the profound effects these emerging drivers exerted upon the actors within the value chain. Furthermore, I incorporated existing drivers into the mapping layout, situating them in areas of influence between the various value chain actors. This strategic placement illustrated the nuanced dynamics by which these drivers affected the nearby elements within the value chain.

The following (Figure 9) represents an example of those maps I created and utilized in chapter 4 results and discussions. The maps will include a legend to facilitate reading them. The representations of maps will follow a trend of layering, where in each section of the analysis I add an extra layer on the map. This layering technique is explained in (Sec. 4.4) before the comparative analysis begins.

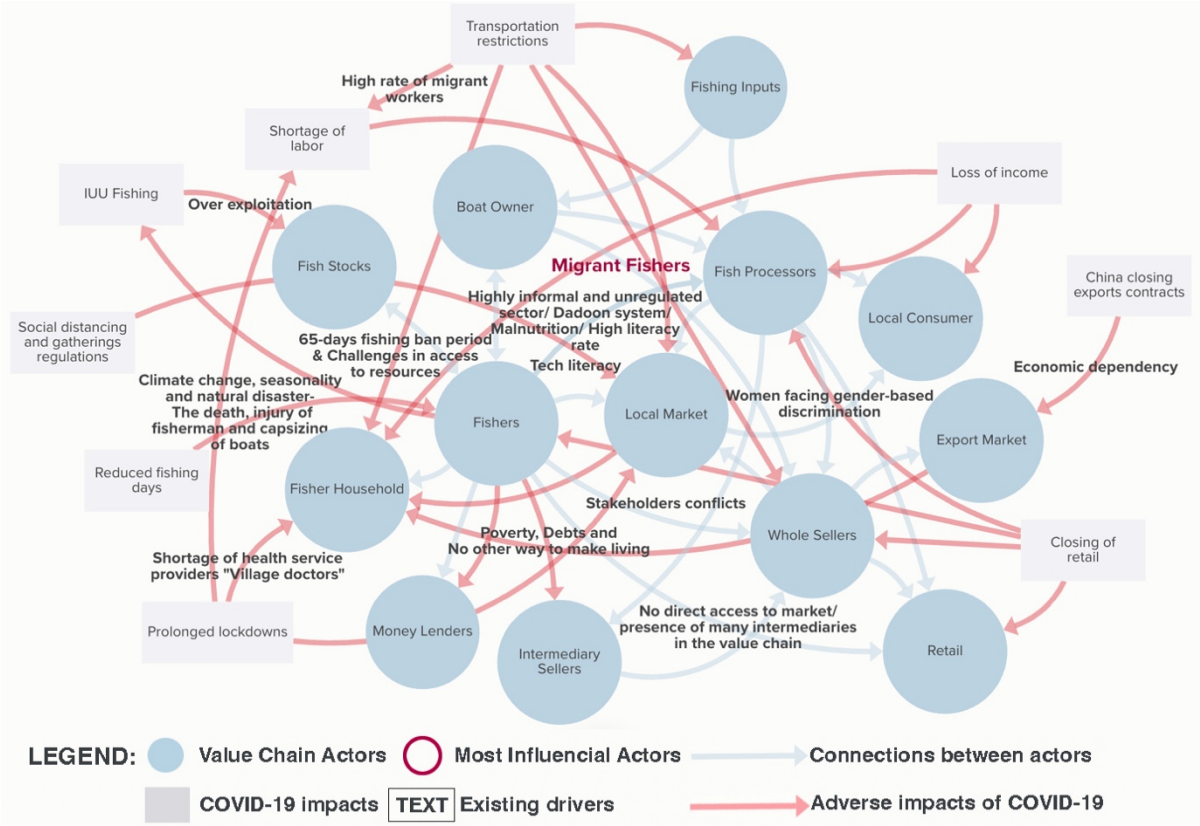


Figure 9: Example of mapping drivers of regime shift and their impact on the actors of the SSFs' value chain using "KUMU" platform.

The final step in enhancing the visual representation of the data results entailed the incorporation of two additional strata of analysis. The first layer represents the suggested scales of intervention stemming from stage 1 analysis, while the second layer conveys the actual scales of intervention resulting from stage 2. To execute this intricate process with precision, I exported the maps from KUMU into Photoshop. Within Photoshop, I introduced a layer to illustrate the stage 1 outcomes, employing a spectrum of distinctive colored loops (Figure 10 on the left). I drew the colored loops by connecting a set of value chain actors which are involved together in presenting a scale. Complementing this, a separate layer was introduced to convey the stage 2 results, presented by the fully filled colored areas (Figure 10 on the right). Each colored area represents an area which government support and coping strategies during COVID-19 have tackled. This approach served as an effective means to clearly delineate and differentiate the two stages of intervention analysis. The

rationale behind using Photoshop was the flexibility it offers in terms of colors and the seamless toggling of individual layers.

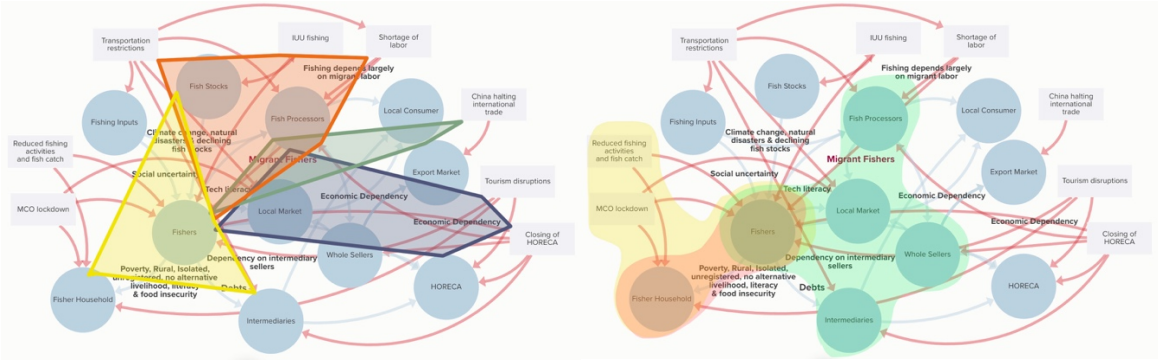


Figure 10: Example for data visualization using Photoshop software (suggested scales on the left, actual scales on the right).

3.2.2.4 The comparative analysis of scales of interventions:

The aim of the comparative analysis of the scales of intervention, both suggested and actual, is to determine the factors that either boosted the successful implementation or contributed to the failure of the government support, coping, and adaptation strategies adopted by communities to navigate the adverse impacts of the pandemic. Furthermore, the visual representations of the data results stemming from this comparative examination offer a critical point, highlighting the areas that remained unaddressed during the course of the COVID-19 pandemic. In this stage, I activated all the individual layers within Photoshop (Figure 11), allowing for a comprehensive and holistic evaluation of the efficacy of the strategies enacted by both governments and communities. This analysis serves as an invaluable tool for evaluating varied approaches employed across the six countries, thus enriching our understanding of the multifaceted responses to the challenges presented by the pandemic.

3.2.2.5 Identifying the key adaptive responses

During this phase of data analysis, I used the suggested and actual strategies in conjunction with the factors that shaped their outcomes, thus enabling me to identify the key adaptive responses during COVID-19. Moreover, I detailed the impacts of each strategy on the various stakeholders within the SSFs' value chain, concurrently elucidating the essential factors needed for their effective implementation. This analysis offered a comprehensive exploration of the intricate interplay between

strategies, their impacts, and the essential factors that underpinned their success or, conversely, contributed to their failure.

3.2.2.6 Identifying the factors of successful implementation

In the final phase of my research, I have identified the factors that underpin the efficacy of the adaptive responses during COVID-19. To illustrate the practical significance of each factor, I have incorporated pertinent examples from the case studies. Furthermore, I have contextualized my findings within the broader academic landscape, drawing insightful relevancy to prior literature, most notably the seminal works of Folke et al. (2005) and Schipper and Langstone (2015).

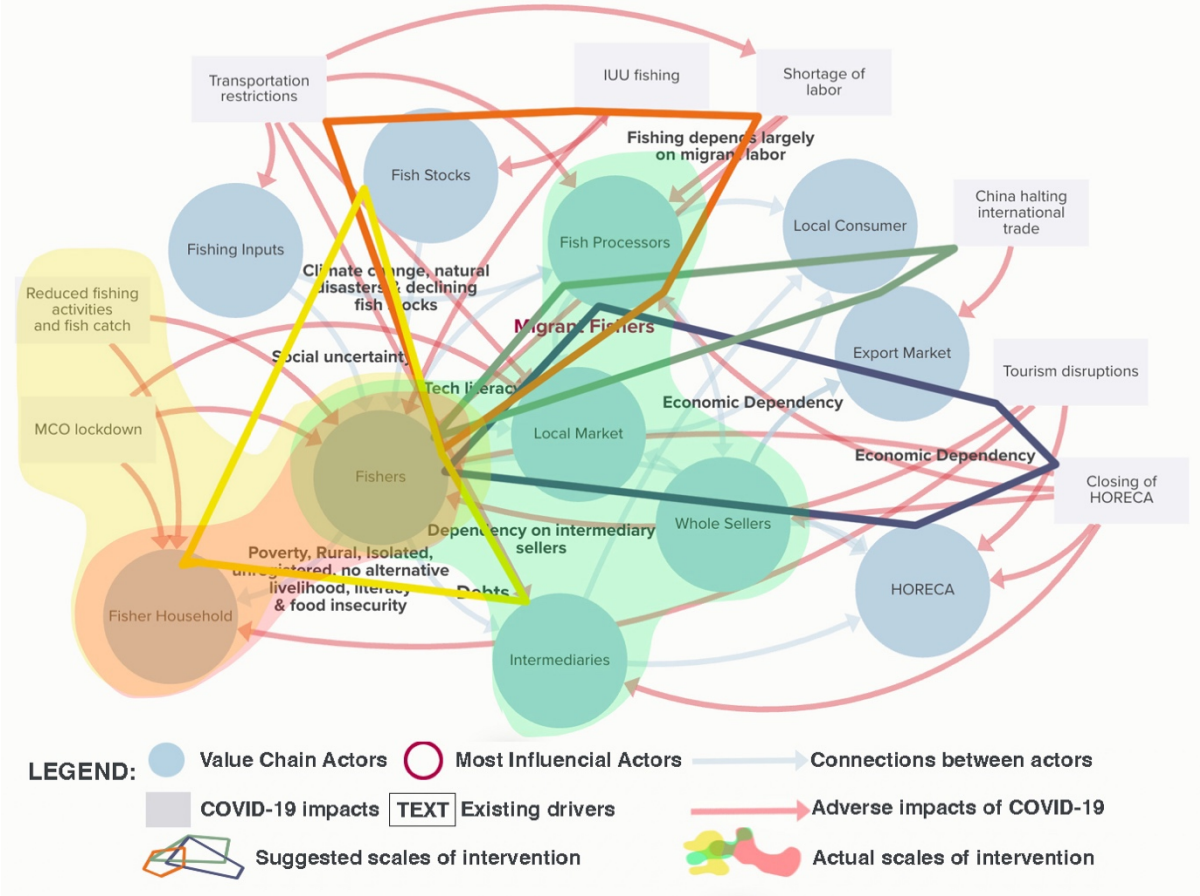


Figure 11: Example of the final map with all the layers turned on to present suggested vs actual scales of intervention within the context of regime shift of the SSFs' value chain.

Table 6: Overview of the data analysis methods, tools used, intent, and outcome.

Method	Tools	Intent	Outcome
Comparative analysis of case studies (stage 1)	KUMU for mapping drivers, NVIVO	Analyzing drivers of regime shift	Identify scales of intervention (suggested) per each case study
Comparative analysis of case studies (stage 2)	Photoshop for extra layers of analysis	Analyzing government support, coping and adaption strategies	Identify scales of intervention (Actual) per each case study
Comparative analysis of scales of interventions	Observations and synthesis	Evaluating governance approaches during COVID-19	Understand the successes and shortcomes of those strategies
Final synthesis	Observations and synthesis	Identify the key adaptive responses and associated factors	5 key adaptive responses, and 12 factors of their successful implementation

3.3 Countries' SSFs' profile (economic value and characteristics)

3.3.1 Canada

In this study, I am using two examples from Canadian small-scale fisheries. The first example is the British Columbia seafood industry, heavily reliant on exports, with a total export value of USD 1.1 billion in 2018. A significant portion of this is sent to China, Japan, and Hong Kong (Bassett et al., 2022). This export-oriented trend is not exclusive to British Columbia; Canada's fish and seafood industry exports approximately 75% of its production (Asante et al., 2021). The second example is the NL fisheries. The history of Newfoundland and Labrador is deeply intertwined with fishing, as it brought Europeans to the region, influenced settlement patterns, and played a central role in shaping society through activities like catching, drying, salting, and marketing of fish (Asante et al., 2021).

In Newfoundland and Labrador, most small-scale fishing enterprises are family-owned and situated in small, rural, and remote coastal communities with limited access to healthcare (Neis et al., 2022). Unlike many other fishing regions globally, Newfoundland and Labrador rely heavily on local labor harvesters and fishing industry workers rather than precarious, internal or international migrant labor (Neis et al., 2022). The province boasts unusually high unionization rates, with one union encompassing owner-operators, crew members, and even some offshore harvesters and seafood processing workers (Neis et al., 2022). Additionally, a multi-stakeholder fish-harvesting safety sector

association is in place, working closely with the union, safety regulators, and various agencies to ensure the wellbeing of workers in the industry (Neis et al., 2022).

In 2018, Newfoundland and Labrador's fish and seafood production reached a total value of USD 1.3 billion, and these products found their way to 40 countries worldwide (Asante et al., 2021). The industry also holds significant importance in ensuring food security in the province and providing livelihoods to coastal communities (Asante et al., 2021). Employment in Newfoundland and Labrador is deeply linked to industries like fishing, mining, and manufacturing, with over 15,000 people engaged in the fishing sector in 2019, encompassing both commercial fish harvesting and processing activities (Asante et al., 2021).

3.3.2 Malaysia

In Malaysia, small-scale fishers face economic challenges, with an average monthly income ranging from MYR 700 (USD 175) to MYR 800 (USD 200), falling below the national minimum wage of MYR 1,200 (USD 300) (Ferrer et al., 2021). Many of these fishers rely on government subsidies, receiving MYR 250 (USD 62) in monthly income support and a diesel subsidy of MYR 0.53 (USD 0.13) per liter to sustain their livelihoods (Ferrer et al., 2021). Artisanal fisherfolk, classified as inshore and nearshore fishermen, employ various fishing equipment, including fish traps, gill nets, cast nets, traditional long lines, and basic rod and line setups (Rahman, 2022). Malaysia's artisanal or small-scale fishermen, deeply intertwined with the nation's fisheries heritage, have historically played a vital role in sustaining coastal communities (Rahman, 2022). With a lengthy coastline of 4,675 km, nearshore fishing has been the cornerstone of these communities. Still, this traditional livelihood now faces the threat of decline (Rahman, 2022).

Sabah, a significant contributor to Malaysia's fisheries sector, boasts of abundant marine biodiversity and natural resources, making it a vital region for fisheries and cultural tourism (Osman et al., 2021). Coastal communities in Malaysia, especially in Sabah, primarily consist of the Bottom 40% (B40) group and heavily rely on aquaculture as their primary income source (Waiho et al., 2020). Aquaculture constitutes around 20% of Malaysia's total seafood production, experiencing steady growth over the years, reaching 1.69 million tonnes in 2017 (Waiho et al., 2020). However, despite its natural wealth, Sabah remains one of Malaysia's economically challenged states, with its fishers among the most impoverished (Asmat et al., 2021).

Tun Mustapha Park in Sabah, Malaysia, is the country's largest multiple-use marine protected area, supporting over 85,000 individuals reliant on marine resources (Jomitol et al., 2020). The tourism sector, a significant contributor to Sabah's economy, was severely impacted by COVID-19, with nearly one million tourists from China and South Korea visiting in 2019 (Jomitol et al., 2020). The pandemic has had cascading effects on tourism-related businesses and the local economy, affecting small-scale fishers and those in the tourism sector (Jomitol et al., 2020). In particular, more than 5,000 small-scale fishers in the disadvantaged districts of Kudat, Kota Marudu, and Pitas depend on marine resources for their livelihoods (Jomitol et al., 2020).

In Malaysia, the coastal fisheries exhibit distinct characteristics between the East and West Coast regions (Expert 1 Malaysia, personal communication, 2 April 2023). On the East Coast, encompassing areas like Sabah and Sarawak, vast resources are met with significant challenges, particularly in dealing with illegal fishing activities (Expert 1 Malaysia, personal communication, 2 April 2023). The presence of migratory fishers from countries like Vietnam and the Philippines engaging in prolonged illegal fishing operations poses a substantial problem (Expert 1 Malaysia, personal communication, 2 April 2023). Many of these individuals lack proper licenses, further exacerbating the issue of illegal fishing and contributing to the marginalization of local small-scale fisheries (Expert 1 Malaysia, personal communication, 2 April 2023).

Illegal floating fishing, characterized by sporadic appearances of unlicensed fishermen, is prevalent on the East Coast, exacerbating the challenges faced by small-scale fisheries (Expert 1 Malaysia, personal communication, 2 April 2023). In this context, the government holds significant control over the fisheries sector, resulting in a top-down approach to management (Expert 1 Malaysia, personal communication, 2 April 2023). While there have been attempts to adopt participatory approaches, these efforts have not yielded the desired outcomes (Expert 1 Malaysia, personal communication, 2 April 2023). As a result, the government remains the primary source of support for fisheries management, with limited involvement from other agencies or community-based initiatives (Expert 1 Malaysia, personal communication, 2 April 2023).

In summary, Malaysia's small-scale fisheries sector faces significant economic challenges, with fishers often relying on government subsidies to sustain their livelihoods. Sabah, a crucial contributor to Malaysia's fisheries sector, possesses abundant natural resources, making it a hub for fisheries and tourism. However, despite its potential, poverty persists among fishers in Sabah. Traditional fishing

practices have historically supported coastal communities, but the growth of the tourism industry has enticed the younger generation away from fishing. Malaysia's artisanal fisherfolk, steeped in the nation's fisheries heritage, now find themselves at a crossroads. Additionally, the impact of COVID-19 has reverberated through tourism-related businesses, affecting both small-scale fishers and the broader local economy. The challenges and opportunities facing Malaysia's small-scale fisheries highlight the need for sustainable development and support to ensure the wellbeing of coastal communities and preserve their traditional livelihoods.

3.3.3 India

India is the world's second-largest fish-producing nation, contributing 6.56% of the global fish production (Avtar et al., 2021; Lam, 2021). This thriving sector is a significant source of employment, engaging 14.5 million people primarily residing in rural coastal communities (Lam, 2021). This vast workforce plays a crucial role in driving the sector, which, in turn, contributes 1.1% to India's GDP, with a valuation of USD 6.7 billion in 2018-2019 (Lam, 2021; Mukherjee et al., 2020). India's dynamic and diverse inland fishery sector contributed over 8.4 million tons to total fish production in 2018-2019, representing more than 65% of the nation's total fish production (Das et al., 2022).

Chilika Lagoon, for instance, has become a cornerstone of livelihood for over 200,000 fishers across 150 fishing villages around the lagoon, with fishing emerging as the predominant source of income (Bharti, 2022). In the Andaman and Nicobar Islands (ANI), fishing families from India's east coast have been settled since 1955, forming the foundation of the region's fishing industry, which includes fishers, processors, intermediaries, local seafood vendors, and exporters (Bassett et al., 2021). This unique model of population resettlement has significantly contributed to the archipelago's fishing industry (Bassett et al., 2021).

Inland small-scale fisheries (SSF) are vital to local nutrition and food security (Das et al., 2022). Inland SSF employ more than their marine counterparts, with over 56 million people engaged, and gender diversity is evident, with women constituting nearly half of SSF workers (Avtar et al., 2021; Das et al., 2022). This sector, particularly in floodplain wetlands, is predominantly led by fisherman communities (Das et al., 2022). The sector's significance extends beyond economic contributions, encompassing food security, poverty alleviation, gender empowerment, socio-economic development for small and marginal fishers, ecosystem services, and biodiversity conservation (Das et al., 2022).

Cooperative-based management regimes govern wetland fisheries in states like West Bengal and Bihar, underscoring collaborative efforts in resource management (Das et al., 2022). These regions lease waterbodies to fisherman cooperative societies, promoting responsible and sustainable fishing practices (Das et al., 2022). In Assam, cooperative and individual management approaches coexist, offering a diverse management landscape (Das et al., 2022). Despite its importance, the fishery sector faces challenges, often overshadowed by the country's larger agro-based business network and infrastructure (Vaity, 2021). The sector is comprised of artisanal and small-scale occupational communities, which remain relatively disorganized (Vaity, 2021).

“Most of these people who are staying near the forest are very, very poor. They are small-scale fishers, and they fish with very few resources. They just have a wooden boat, and they have to pull the boat. They don't even have any kind of motorized boats available.” (Expert 1 India, personal communication, 24 April 2023)

In conclusion, India's small-scale fisheries sector is a dynamic and multifaceted cornerstone of the nation's economy, culture, and food security. As the world's second-largest fish-producing nation, it employs millions of people, particularly in rural coastal communities, and contributes significantly to India's GDP. Often overlooked, small-scale fisheries in the inland play a crucial role in local nutrition, food security, and gender empowerment. Cooperative-based management regimes promote sustainable practices, while India's seafood industry holds a prominent global position as an exporter and source of nutritional benefits. Despite facing challenges and being overshadowed by other sectors, the small-scale fisheries of India remain integral to the livelihoods of millions and the nation's economic wellbeing.

3.3.4 Bangladesh

In the coastal region of Bangladesh, migrant fishers from various parts of the country make their way to the Chittagong coast (Diba et al., 2022). These individuals usually work in fishing or agriculture in their places of origin, and they relocate due to the temporary lack of rural activities at their homes (Diba et al., 2022). This migration forms just one chapter in Bangladesh's SSF profile as one of the world’s fish-producing nations (Diba et al., 2022). Inland fisheries encompass a spectrum of capture and culture activities, encompassing rivers, estuaries, the iconic Sundarbans mangrove forest, and expansive floodplains, each serving as a habitat for over 260 freshwater species (Miah, 2021). While most of the cast in SSFs is male, the story is evolving, with an increasing number of women joining

the ranks of the fish supply chain, particularly in small-scale fisheries, primarily engaged in marketing and processing (Miah, 2021). This multifaceted story continues to unfold with the livelihoods of 17 million people, including 1.4 million women, intricately connected to inland and marine fisheries through fishing, farm management, and fish processing (Bhowmik et al., 2021).

Culturally, fish plays an indispensable role in the daily diet of Bangladesh's population, thanks to the abundance of inland open-water capture fisheries, inland closed-water culture fisheries (aquaculture), and marine fisheries (Islam et al., 2021; Sunny, Sazzad, et al., 2021). Also, an important characteristic of Bangladesh SSFs is the Hilsa fish, cherished for its cultural and traditional significance (Diba et al., 2022). Stretching the storyline beyond its shores, Bangladesh commands an extensive exclusive economic zone (EEZ) spanning 118,813 km2 in the Bay of Bengal. This maritime realm is home to 475 finfish species and 25 shrimp species, enriching the narrative with its coastal and marine offerings (Islam et al., 2021).

Economically, Bangladesh's fisheries sector, when combining small-scale and industrial components, contributes a significant 3.50% to the national GDP (Miah, 2021; Sunny, Sazzad, et al., 2021). Bangladesh is a self-sufficient nation producing fish, supplementing 60% of the population's daily animal protein intake (Miah, 2021). Bangladesh's export earnings are around $5022 million by exporting approximately 73,170 metric tons of fish and fishery products, which is vital in enhancing fish consumption and food security (Miah, 2021). Approximately 12% of Bangladesh's 160 million residents rely on aquaculture and capture fisheries-related activities for their livelihoods and income in Bangladesh (Miah, 2021).

Over the past three decades, Bangladesh SSFs witnessed remarkable growth, attributed to improved culture techniques and extension services (Islam et al., 2021; Sunny, Mithun, et al., 2021). However, this prosperity comes with challenges, as inland capture fisheries, a vital source of total fish production, face a decline due to various human-induced and natural factors, including pollution, over-exploitation, destructive fishing practices, and habitat degradation (Sunny, Mithun, et al., 2021).

However, during the annual 65-day fishing ban, many fishers take loans to meet their daily needs (Bhowmik et al., 2021). Local businessmen known as "mohajans/companies" provide fishers with boats, nets, fuel, and other supplies, but at a cost (Bhowmik et al., 2021). Fishers must work for these benefactors until their debts are repaid, often at lower wages and prices than the market dictates, leaving them bound to a complex cycle of dependency (Bhowmik et al., 2021).

In conclusion, Bangladesh's small-scale fisheries are a tale of cultural significance, economic importance, and ongoing challenges. This narrative continues to evolve, with its characters adapting to changing times while striving to balance tradition and progress in the ever-expanding world of fisheries.

3.3.5 South Africa

South Africa, with its extensive 3,000-kilometer coastline bordering both the Atlantic and Indian Oceans, possesses a diverse marine environment (Isaacs et al., 2022). Four of its provinces, KwaZulu Natal, Eastern Cape, Western Cape, and the Northern Cape, have coastlines, offering a rich maritime landscape (Isaacs et al., 2022). The Benguela ecosystem along the west coast stands out for its remarkable productivity. It is attributed to the upwelling of cold, nutrient-rich waters, making it a global hotspot for biomass production and fishery resources (Isaacs et al., 2022).

In South Africa, 147 fishing communities, comprising 28,338 fisher households and 29,233 subsistence fishers, are intricately connected to the country's fisheries sector (Isaacs et al., 2022). However, despite the wealth of marine living resources, many high-value species, such as abalone and rock lobster, face over-exploitation challenges, highlighting the need for sustainable management practices (Isaacs et al., 2022). Education levels among fishers vary across provinces, with some having only completed primary education, underscoring the importance of access to educational opportunities (Mbatha, 2021).

The structure of South Africa's fisheries sector is influenced by historical factors and legislative frameworks(Expert 1 South Africa, personal communication, 24 April 2023). Pre-1994, before the country's democratic transition, the state recognized commercial and recreational fishing, excluding small-scale fisheries, which was a matter intertwined with race issues (Expert 1 South Africa, personal communication, 24 April 2023). In 1998, the Marine Living Resources Act (MLRA) was enacted, granting recognition and rights to marine small-scale fisheries; however, the freshwater sector still lacks specific legislation for small-scale fishers, with existing regulations primarily oriented towards recreational anglers due to historical biases (Expert 1 South Africa, personal communication, 24 April 2023).

This legal gap implies that small-scale fishers in the freshwater sector are somewhat precarious, as the absence of legislative recognition equates to a lack of formal rights (Expert 1 South Africa, personal communication, 24 April 2023). Consequently, their activities often operate in a legal grey

area, emphasizing the importance of addressing this issue to ensure equitable recognition and protection for all segments of the fishing community (Expert 1 South Africa, personal communication, 24 April 2023).

In conclusion, South Africa's small-scale fisheries are deeply entwined with its extensive coastline, and while legislative strides have been made in recognizing marine small-scale fisheries, challenges persist, particularly in the freshwater sector. Addressing historical biases and legal gaps is vital to ensure all fishers' equitable treatment and protection, promoting sustainable practices and livelihoods within the country's diverse fisheries landscape.

3.3.6 Senegal

In Senegal, small-scale fishery (SSF) is deeply ingrained in the fabric of the nation's coastal communities, with diverse fishing techniques and strategies adapted to seasonal and socio-economic factors (Mbaye et al., 2022). Senegal boasts a substantial fleet of pirogues, making it a dominant player in the sub-region's fishing landscape, and SSF remains primarily in the hands of Senegalese fishers (Mbaye et al., 2022). This important sector contributes significantly to the nation's fishing activities, accounting for 81.6% of landings in 2018 (Mbaye et al., 2022). SSF in Senegal is pivotal in ensuring national food security and socio-economic stability, offering employment opportunities for fishers, fishmongers, processors, porters, retailers, and others within the supply chain (Mbaye et al., 2022).

In Senegal, SSF carries a strong ethnic and familial dimension, engaging an average of 70,041 fishers operating over 11,912 active fishing units, with a majority employing motorized vessels (Mbaye et al., 2022). Seafood, including Sardinella, is a staple food and a crucial source of animal protein (Cederstrom, 2020). It contributes significantly to the country's GDP (17%) and supports a diverse workforce, encompassing artisanal fishers, intermediaries, and small-scale fish processors (Cederstrom, 2020).

Women play a critical role in fish processing, adding value to the catch, reducing post-capture losses, and supplying affordable animal protein to Senegal and neighboring West African regions (Mbaye et al., 2022). Women-led associations, known as "femmes transformatrices," traditionally process fish, employing various techniques to prevent spoilage, such as sun-drying, braising, salting, smoking, and fermenting (Cederstrom, 2020; Expert 1 Senegal, personal communication, 2 April 2023). These women contribute substantially to the supply chain, purchasing fish from fishermen or

intermediaries and selling the processed products to traders, who distribute them within Senegal and neighboring countries (Cederstrom, 2020).

Governance of SSF in Senegal involves various stakeholders, including international groups, governmental institutions, local authorities, professional organizations, and local communities (Mbaye et al., 2022). The governance of SSF is structured around four key actors: political authorities, local communities, local partners, and external collaborators (Mbaye et al., 2022). However, there are challenges at the national level stemming from inconsistent interventions and a lack of coordination among various institutions (Mbaye et al., 2022).

In essence, SSF is a crucial economic activity and a cultural cornerstone in Senegal, empowering women, ensuring food security, and contributing significantly to the nation's GDP and export revenue. The sector's sustainability and future growth rely on addressing issues such as overfishing and enhancing governance mechanisms to foster equitable and robust development.

3.4 Limitations and Delimitations

3.4.1 Limitations

As I explained earlier, due to time constraints of this master's thesis and resources availability, I chose to perform the comparative analysis on six case studies following the assumptions explained in section (3.2.1.2). Additionally, the literature search was confined with a certain time frame, which is with the start of the pandemic breakout and ending with my time starting to analyze the data collected for my thesis. This time frame means that there might be longer-time effects caused by COVID-19 which were not captured in this study. Moreover, as a researcher, I did not have the means of collecting my primary data in-person, consequently, I depended on the published literature as the main source of information and I complemented it with the semi-structured online interviews. Furthermore, there were some instances where interviewees requested to do the interviews in French language. Unfortunately, I do not poses this skill and it resulted in cancelling some of the planned interviews.

3.4.2 Delimitations

This study is delimited to small-scale fisheries and their dependent communities. Indeed, I found impacts on fishers working on aquacultures and fishers engaged in industrial fishing, which also

suffered from poverty and being marginalized. However, for the sake of this study scope I decided to eliminate any impacts other than the ones experienced by Small-Scale fishers and the results of this research would certainly impact the rest of the community. Additionally, geographical delimitations were essential in this study and a global perspective on the problem was not feasible. This delimitation is due to the fact that SSFs are contextual, and each case study has its own set of significant attributes. By clearly specifying limitations and delimitations in my research, I would help researchers understand the boundaries and context of the study. This transparency is important for interpreting the results and understanding their applicability and potential shortcomings.

3.5 Ethical Consideration

This research project received full ethics clearance from the University of Waterloo Office of Research Ethics under ORE # 43187, Vulnerability to Viability (V2V): A Global Partnership to Build Strong small-scale fisheries Communities (See Appendix C).

3.6 Funding

This research was undertaken as part of the project Vulnerability to Viability (V2V): Global Partnership for Building Strong small-scale fisheries Communities, University of Waterloo, Canada. The V2V Global Partnership is funded by the Social Sciences and Humanities Research Council (SSHRC) of Canada (Grant Number: 895-2020-1021) under its Partnership Grants Program.

3.7 Conclusions

This qualitative study sought to understand how COVID-19 impacted the livelihood resilience of small-scale fisheries (SSFs). The initial literature review informed me of the considerable variation in COVID-19's effects on SSFs, leading to an approach of comparative case studies to dissect these differences. The comprehensive literature review analyzed 43 peer-reviewed articles, categorized by regions spanning Southeast Asia, Southern Asia, North and South America, East and West Africa. An Excel-based data extraction template streamlined this extensive data compilation.

The selection of case studies, involving Canada, Malaysia, India, Bangladesh, South Africa, and Senegal, was driven by four main considerations, including the hypothesis that COVID-19's impact correlates with a country's Human Development Index (HDI). Extensive literature searches, spanning

articles from 2021 to 2023, blended with grey literature, provided a rich pool of information for analysis. Two rounds of searches accommodated the evolving nature of COVID-19 literature.

Data extraction used Zotero, with a subsequent transition to NVIVO, a more structured tool for managing the abundance of information. The Social-Ecological Regime Shift (SERS) framework offered a comprehensive lens to dissect the collected data. To address gaps and discrepancies in the literature, interviews with experts were conducted, and these insights were transcribed and integrated into the analysis.

The comparative analysis of case studies unfolded in two stages, with a focus on the dynamics of regime shifts, emerging and existing drivers, and adaptive interventions. Visual representations using KUMU and Photoshop added depth to this exploration. The analysis identified key adaptive responses, underscoring the importance of adaptive governance in enhancing SSFs' resilience in the face of external shocks.

In conclusion, this research has unveiled the intricate dynamics of COVID-19's impact on SSFs and enriched our understanding of adaptive governance. These findings have practical implications for governments and SSFs' communities, providing guidance to mitigate future crises effectively.

Chapter 4
Results and Discussion

This chapter starts by presenting the imposed COVID-19 restriction in each country and discuss the variations among the case studies. The discussion of variations inform us on how the sensitivity and articulation of regulation to the nature of SSFs can result in a different impact on the system actors.

After that in (Sec. 4.4) I explain the SERS framework (Nayak & Armitage, 2018), demonstrating an adapted version for this study used in the comparative analysis of case studies. The adapted version contains all the aspects in the original framework, however, the application only differs. Additionally, I provide an explanation of the comparative analysis process and the layering of the results presented by the maps.

The next sections (Sec. 4.4.1 onwards) presents the analysis of case studies using the adapted SERS framework. The outcomes of this analysis are the suggested and actual scales of interventions for the government and SSF communities to mitigate the impact during crises. In (Sec. 4.5) I perform another layer of analysis by comparing the suggested and actual scales of intervention to identify the key adaptive responses and the associated factors contributing to the success or failure of their implementation (Sec.4.7).

4.1 Common and Severe COVID-19 Restrictions

With the onset of the COVID-19 pandemic, the Canadian government temporarily closed non-essential businesses and encouraged stay-at-home practices (Stoll et al., 2021). The cases were rising at a high rate, and less than two weeks later, on March 21, the Canada-US and US-Mexico borders were closed to non-essential travel (Stoll et al., 2021). The Canadian government laid out health measures such as social distancing and other public measures, which immediately altered consumer behavior, with the restaurant and food services sector particularly hard hit (Stoll et al., 2021). Unfortunately, another major outbreak occurred in February 2021 as part of the second wave of COVID-19 (Neis et al., 2022), and it triggered another lockdown of schools and businesses, lasting for several weeks (Neis et al., 2022). However, fisheries, categorized within the food industry, were designated as an essential service and allowed to operate without interruption (Bassett et al., 2021).

The outbreak of the COVID-19 virus started in Malaysia in March 2020 (Asmat et al., 2021), and the government responded by imposing the Movement Control Order (MCO) from March 18 to March 31 (Asmat et al., 2021). The MCO was then extended from April 1 to April 28 (Asmat et al., 2021; Jomitol et al., 2020). In addition, the country adopted preventive measures: strict lockdowns, working from home, online business, wearing masks, social distancing, and travel restrictions (Asmat et al., 2021). Since then, MCO has been extended several times, and the latest phase of Recovery MCO (RMCO) lasted until 31 August 2020 (Waiho et al., 2020). However, all agricultural and fisheries product supply chains were allowed to operate, including operations and logistics, under the movement control order (MCO) (Dzulkifly, 2020; Waiho et al., 2020).

The Prime Minister of India declared a nationwide lockdown on 24 March 2020 (Das et al., 2022; Mukherjee et al., 2020; Vaity, 2021) to slow the transmission rate. The restrictions were placed on the movement of people, such as air transport and inter-state or intra-state movements by road (Belton et al., 2021). Strict restrictions imposed on the transport and communication system and closure of markets were in the complete lockdown phase during the COVID-19 pandemic (Expert 2 India, personal communication, 18 April 2023). India went under four phases of lockdown extensions and entered its fifth phase on 8 June (Bharti, 2022). This countrywide lockdown lasted in different phases from 25 March to 20 August 2020 (Kumaran et al., 2021). Fishing was banned in most states until April 21st, after which it was declared an essential service (Lam, 2021). Before fishing was recognized as an essential service, fishers were restricted overnight from going to their fishing areas. Government officials were very stringent and ruthless in applying measures that were in place to ensure that these people did not enter the forest (Expert 1 India, personal communication, 24 April 2023). Although the federal government largely coordinated the policy response to the COVID-19 outbreak, states adopted additional restrictive and relief measures with different levels of enforcement and monitoring, resulting in a diverse lockdown environment and heterogeneity (Das et al., 2022). During this period, the restriction imposed on commercial and industrial activity and the ban on the movement of people and goods was deemed non-essential (Das et al., 2022). In addition, businesses and institutions such as markets and schools were severely curtailed, as were social gatherings like weddings, funerals, and religious or sports events (Belton et al., 2021). During the pandemic period, the workers faced a new form of immobility due to suddenly ceased fishing activities or the shutdown of processing plants (Mukherjee et al., 2020).

Bangladesh's government imposed a nationwide lockdown from 26 March to 04 April 2020, including restrictions on movement and closure of public and private offices (Sunny, Sazzad, et al., 2021). The initial lockdown was very strict and extended from 14 April 2021 until further notice with closing government and non-government organizations except for emergency services (Hossain et al., 2022; Sunny, Mithun, et al., 2021). However, there was an easing of restrictions on 1 June 2020 despite growing COVID-19 cases (Sunny, Mithun, et al., 2021), leading to another lockdown imposed from 1 July until further notice (Sunny, Mithun, et al., 2021). Educational institutions were closed on 17 March 2020, and the army was deployed for quarantine supervision on 19 March 2020 (Sunny, Sazzad, et al., 2021). Additionally, there was a ban on political, social, cultural, and religious gatherings (Sunny, Sazzad, et al., 2021), and a suspension of on-arrival flights from European countries on 14 March 2020 (Sunny, Mithun, et al., 2021). Fishing was banned for a period over three months, accompanied by no access to the market because of transportation restrictions (Expert 1 Bangladesh, personal communication, 20 April 2023)

The South African government acted rapidly, and before the end of March 2020, the nation went into a hard lockdown in March and April 2022 (Isaacs & Nangle, 2021; Mbatha, 2021). In addition, a wide-reaching export ban was instituted, which banned trade in high-value fish and seafood species (Isaacs & Nangle, 2021). Although small-scale fisheries were recognized as essential service providers, fishers were prevented from plying their trade by limits on the number of passengers allowed to ride in each vehicle, which made travel unaffordable, and accommodation restrictions which prevented them from staying at distant fishing sites (Isaacs & Nangle, 2021). Restaurants and schools were closed under lockdown (Isaacs & Nangle, 2021). Additionally, there were restrictions on fishing activities and mobility, closure of conservation areas, unfair fines and arrests, and loss of market access (Sowman et al., 2021). In South Africa, the Alert Level 5 lockdown or hard lockdown was said to be one of the strictest lockdowns in the world (Mbatha, 2021; Sowman et al., 2021)

In response to COVID-19, the Government of Senegal issued a State of Emergency on March 23, 2020, which remained in effect for a long time (Cederstrom, 2020). The government imposed a curfew from 8 p.m. to 6 a.m. then from 9 p.m. to 5 a.m.; restricted movement of people, vehicles, ban on intercity transport, and goods; prohibition of parades, rallies, and public demonstrations on public roadways; closure of public meeting places; and prohibition of public or private meetings (Cederstrom, 2020; Expert 1 Senegal, personal communication, 2 April 2023; Expert 2 Senegal, personal communication, 24 April 2023). Some measures were relaxed after May 11, 2020, but the

curfew remained in place, as did limitations on interregional transport (Cederstrom, 2020). Senegal's air and maritime borders were closed to neighboring countries, severely affecting the export of fish products to markets in Europe, Asia, America, and countries in the sub-region (Camara et al., 2023). The restrictions and reduction of the fishing and marketing hours took two or three months in Senegal (Expert 1 Senegal, personal communication, 2 April 2023).

4.2 Variations Between COVID-19 Restrictions Among Case Studies

As shown in (Table 7), all six countries implemented lockdown measures in response to the COVID-19 pandemic. Travel restrictions, including the closure of borders, were imposed in the six countries; however, excluding Canada, intercity or interstate travelling was also prohibited. Additionally, there were measures for social distancing public and health guidelines. Businesses, institutions, organizations, and schools were also closed. Despite key similarities in the COVID-19 restrictions across the six countries, there were significant differences, too. For example, the lockdown duration and intensity, all five countries, excluding Canada, went through prolonged strict lockdowns. In the other five countries, lockdowns were very strict to the limit of a curfew and the deployment of the army to enforce the lockdown rules.

Another significant difference is the recognition of fisheries as essential services and allowing them to operate. Except for Bangladesh, all five countries allowed fishing activities during the pandemic. However, the implementation of this exemption varied to a great extent between those five countries. Also, many factors hindered the successful implementation of such an exemption. Those factors, as (Neis et al., 2022) identified, are the mobility of fishers to or within fishing activities; essential close interactions between fishers and other actors of the value chain; crowded working and accommodations; communication and monitoring of lockdown rules by authorities; and limited access to health care, especially during prolonged stays at sea or in remote communities. All of these factors exacerbated the safety risks of fishers and their dependent communities at a time when all countries' main concern was to limit the spread of COVID-19.

Table 7: Comparison of different levels of lockdown measures in the countries under study.

Country	Common restrictions	Severe restrictions	SSFs

Canada	Closing non-essential businesses, social distancing, public and health measures, transportation restrictions, stopping non-essential travel, remote work and education, closing of restaurants and food services. All measures were temporary for a month or several weeks, measures were eased, and alternatives were offered	No severe restrictions were reported in the literature	Fisheries are designated as an essential service and allowed to operate without interruption, no mobility restrictions on value chain actors
Malaysia	work from home, online business, wearing masks, social distancing, and travel restrictions	MCO: prolonged strict lockdowns from March, then phasing out till August 2022	Restricted at the beginning of the MCO, then all agricultural and fisheries product supply chains allowed to operate
India	Restrictions on people's movement, such as air transport and inter-state or intra-state movements by road, closing the operation of businesses and institutions such as markets and schools, prohibition of social gatherings like weddings, funerals, and religious or sports events	National wide strict lockdown with four phases of extensions, with the fifth phase on 8 June phasing out in August 2022, ruthless measures enforced by officials on movement, unequal levels of enforcement	Fishing was banned in most states until April 21st, after which it was declared an essential service due to pressure from civil society
Bangladesh	Restrictions on movement, closure of public and private offices, closing of government and non-government organizations except	Strict lockdown from March to August 2022, deployment of the army for quarantine	Fishing was banned for a period over three months, accompanied by no

	for emergency services, closure of educational institutions, ban on political, social, cultural, and religious gatherings, suspension of on-arrival flights	supervision, coincided with 65-day fishing ban (Hilsa fish recovery)	access to the market because of transportation restrictions
South Africa	Restaurants forced to close, travel and accommodation restrictions, school closure, restrictions on fishing activities and mobility, closure of conservation areas	Hard lockdown (level 5) in March and April 2022, wide-reaching export ban, unfair fines and arrests	Recognized as essential service providers excluding fresh water fisheries sector
Senegal	Restricted movement of people, vehicles, and goods; prohibition of parades, rallies, and public demonstrations on public roadways; closure of public meeting places; and prohibition of public or private meetings, closure of Senegal's air and maritime borders to neighboring countries	Curfew from 8 p.m. to 6 a.m., then from 9 p.m. to 5 a.m.; the ban on intercity transport, closing of border, restrictions and reduction of the fishing, market and landing sites hours for two months or three months	Recognized as essential services

4.3 Analyzing the Case Studies Using SERS Framework

The SERS framework adapted from (Nayak & Armitage, 2018) is used for the analysis of the case studies using a comparative approach. This approach helps us understand the differences that might contribute to the vulnerability or resilience of the small-scale fisheries under study.

In this study, I am suggesting an adapted SERS framework (Figure 4). In the adapted framework, COVID-19 is the stressor impacting the SSFs. SSFs' unit of regime shift is the value chain and representing the SES which all actors and associated activities occur. The impact of COVID-19 highlights the emerging and existing impacts in the system. The equity, justice concerns, and power dynamics are implications of those drivers, compounding the impacts resulting in a regime shift. When the regime shift occurs, weaker actors and activities reach threshold. According to the new

state of the system, interventions are needed to navigate this shift. Analyzing all those drivers suggests a number of scales to be tackled by governments and communities to navigate the crisis. Additionally, the analysis of the actual governance, coping and adaptation strategies helps in analyzing the deficiencies of those practices when compared to suggested scales (Table 1).

The following analysis of the six case studies follows a layering technique where I present each component- or set of components- layer by layer on the value chain map. The first layer is the value chain of SSF in each case study with its unique features. The second layer is the emerging drivers, the third layer is existing drivers. The analysis of those three layers results in the suggested scales of intervention, which is the fourth layer. The fifth layer stems from analyzing governance during COVID-19 and results in identifying the actual scales of intervention. The five layers together help in analyzing the governance strategies essential for SSFs during crises and the factors contributing to their success or failure.

4.3.1 Canada

4.3.1.1 Unit of regime shift

Canada's small-scale fisheries sector relies heavily on exports to key markets in China, Japan, and Hong Kong. These international trade connections are crucial to the sector's value chain. The second major player in this intricate web comprises restaurants, food services, and retailers. It's important to note that this sector relies exclusively on the local fishers, fish processors, and other industry workers. Unlike some industries that employ migrant labor, the Canadian small-scale fisheries value chain is notable for its reliance on the skills of its local workforce. This close-knit collaboration between local actors ensures a streamlined value chain with minimal intermediaries, contributing to its efficient and effective operation. Figure 12 explains the Canadian SSF value chain as described above and found in the reviewed literature and interviews conducted. The red circles in figure 13 represents the most influential actors in the Canadian SSF value chain.

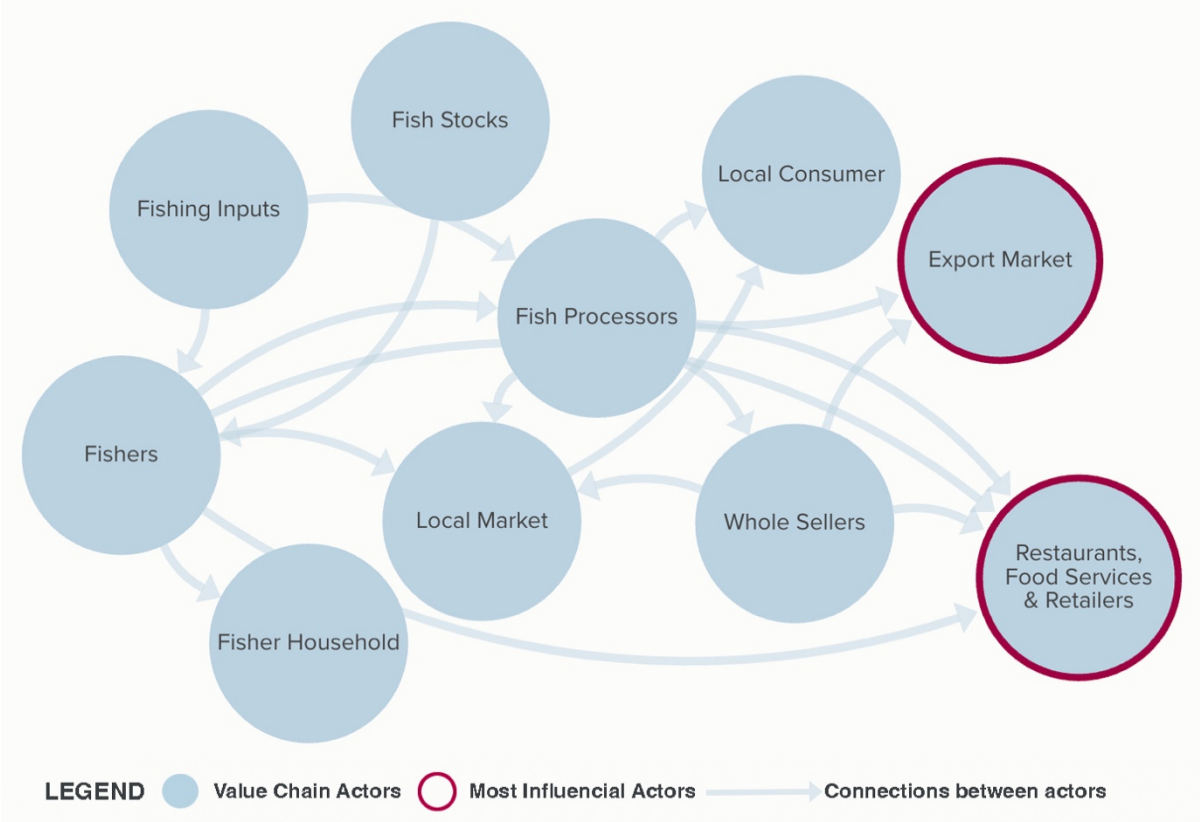


Figure 12: Canada's small-scale fisheries value chain Components.

4.3.1.2 Emerging drivers:

During the early stages of the COVID-19 pandemic, Canada's highly export-oriented fish and seafood industry encountered significant challenges. As the pandemic disrupted consumer behavior in China, the largest global seafood importer, and the United States, key export markets for Canada, seafood trade was stalled (Asante et al., 2021). This sudden closure of international markets placed immense pressure on the Canadian fish and seafood industry (Love et al., 2021). In the local markets, adapting to the altered consumer preferences and economic uncertainties was a difficult task, particularly in setting appropriate price points and addressing consumer anxieties about committing to subscription or share-based models (Stoll et al., 2021). The implications of reduced demand for fish and seafood reverberated throughout the SSF value chain, affecting the livelihoods of those reliant on seafood sales for income (Asante et al., 2021). Disruptions in international and domestic markets, including the closure of restaurants, hotels, casinos, and cruise ships, led to a sharp decline in domestic demand

for seafood and international seafood trade (Asante et al., 2021). This decline in demand resulted in price drops and a reduced market for niche seafood products (Bassett et al., 2022).

Challenges also emerged at various points along the value chain. Processing spaces faced closures or capacity limitations, posing significant challenges for small-scale seafood enterprises with no privately owned processing facilities (Stoll et al., 2021). Securing appropriate retail space, such as docks or other locations that allowed social distancing and sanitation measures, became crucial for maintaining sales (Stoll et al., 2021). Additionally, the sector struggled to recruit local employees and implement COVID-19 distancing and health safety measures, which made adaptation to new production and sales conditions more difficult (Stoll et al., 2021). The pandemic lockdowns delayed the opening of fishing seasons, which led to a loss of harvest and processing activity (Asante et al., 2021). Concerns about preventing the spread of the coronavirus in fishing communities, fleets, and processing plants, coupled with the close working conditions associated with the season, presented significant challenges in ensuring safe fisheries operations (Asante et al., 2021).

Consequently, the total landed value for all species caught by the inshore fleet witnessed a decline in 2020, adversely impacting the economic viability of the fishing enterprise (Asante et al., 2021). Moreover, the pandemic underscored existing power imbalances within the industry. Large fish export inventories and international market prices largely dictated fishing access and market prices, with investors and offshore buyers exerting significant control. This lack of autonomy left many local fishers disenfranchised and unable to decide when or what to fish in response to the emerging pandemic conditions (Lam, 2021). Figure 13 represents adding the layer of emerging drivers (grey boxes) and their adverse impacts on the value chain actors (red arrows). This figure shows how the emerging drivers reverberated throughout the SSF value chain of Canada.

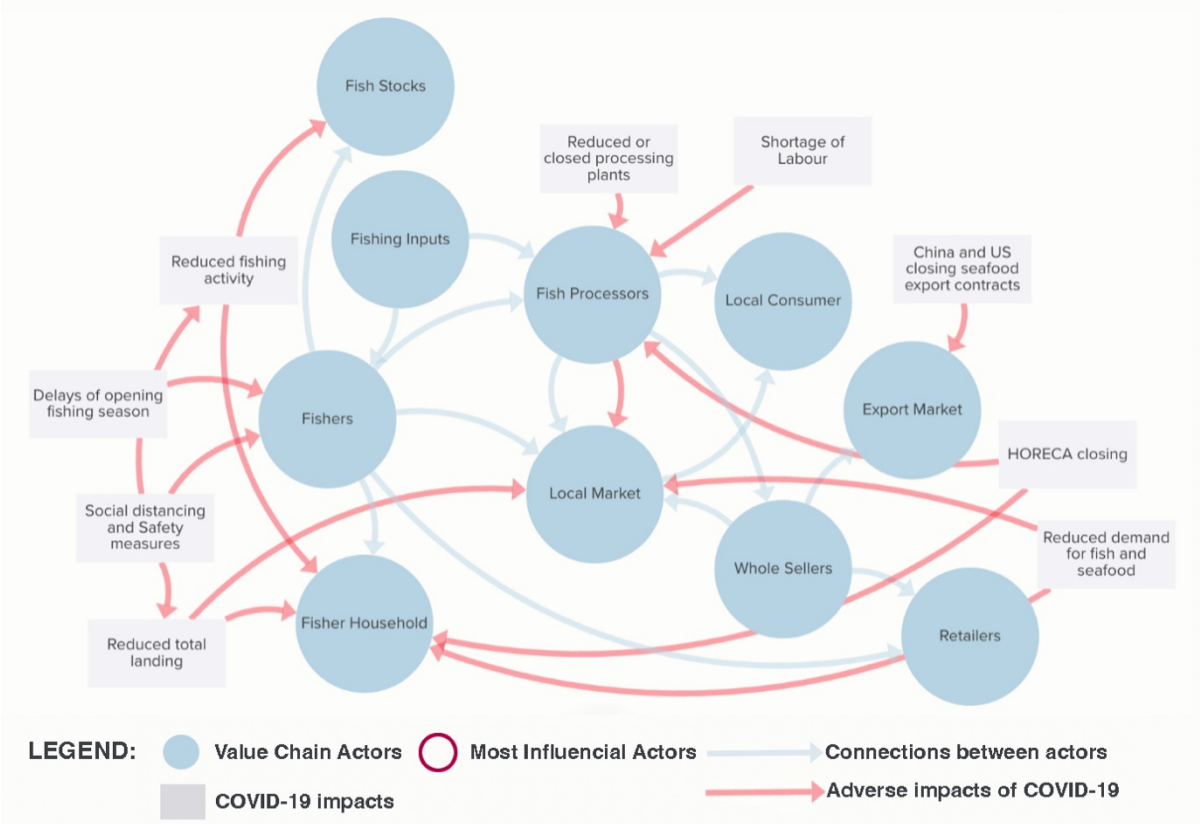


Figure 13: Mapping Canada SSFs' value chain emerging drivers of regime shift.

4.3.1.3 Existing drivers:

Various existing drivers and challenges influence the small-scale fisheries sector in Canada. The heavy reliance on export revenue, with a substantial portion going to China, Japan, and Hong Kong (Bassett et al., 2022) is one of the major drivers. This aspect was evident in the collapse of fish and seafood markets due to travel restrictions and lockdown regulations in key markets like China and the United States of America (Asante et al., 2021). The international market closure severely impacted the Canadian fish and seafood industry, which is highly export-oriented, exporting approximately 75% of its production. Another key driver is the inequitable licensing policies resulting in increased control exerted by large corporations and seafood processors, further strained Canada's small-scale fisheries sector (Bassett et al., 2022; Etchegary, 2021).

The small-scale fisheries sector in Canada suffers from ongoing competition from the oil and gas industry (Asante et al., 2021). Another example of such conflicts is Nova Scotia, which plays a

significant role in the global lobster industry, suffering from long-standing cultural identity conflicts between indigenous Mi'kmaq and non-indigenous commercial lobster fishers that disrupted the industry (Lam, 2021). Moreover, there are historical factors that contribute to this regime's vulnerability. For example, the collapse of codfish stocks in 1992 was a pivotal moment, leading to a change in the ecological structure of the fishery from groundfish to shellfish and a reduction in fish stocks (Asante et al., 2021). Lastly, Demographic factors have also come into play with an ageing workforce in Newfoundland and Labrador (Asante et al., 2021). Furthermore, limited access to healthcare in the rural and remote communities where many Newfoundland and Labrador harvesters reside has compounded the difficulties faced by small-scale fishers (Neis et al., 2022). All these problems are left unresolved because Canadian fisheries management has primarily focused on the ecological dimension of SSFs while neglecting other critical aspects (Asante et al., 2021). Figure 14 represents adding the layer of existing drivers (text in white areas) and their placement is influenced with their impact on the surrounding actors. This figure shows how the emerging drivers and existing drivers act in synergy affecting the different actors of the SSF value chain of Canada.

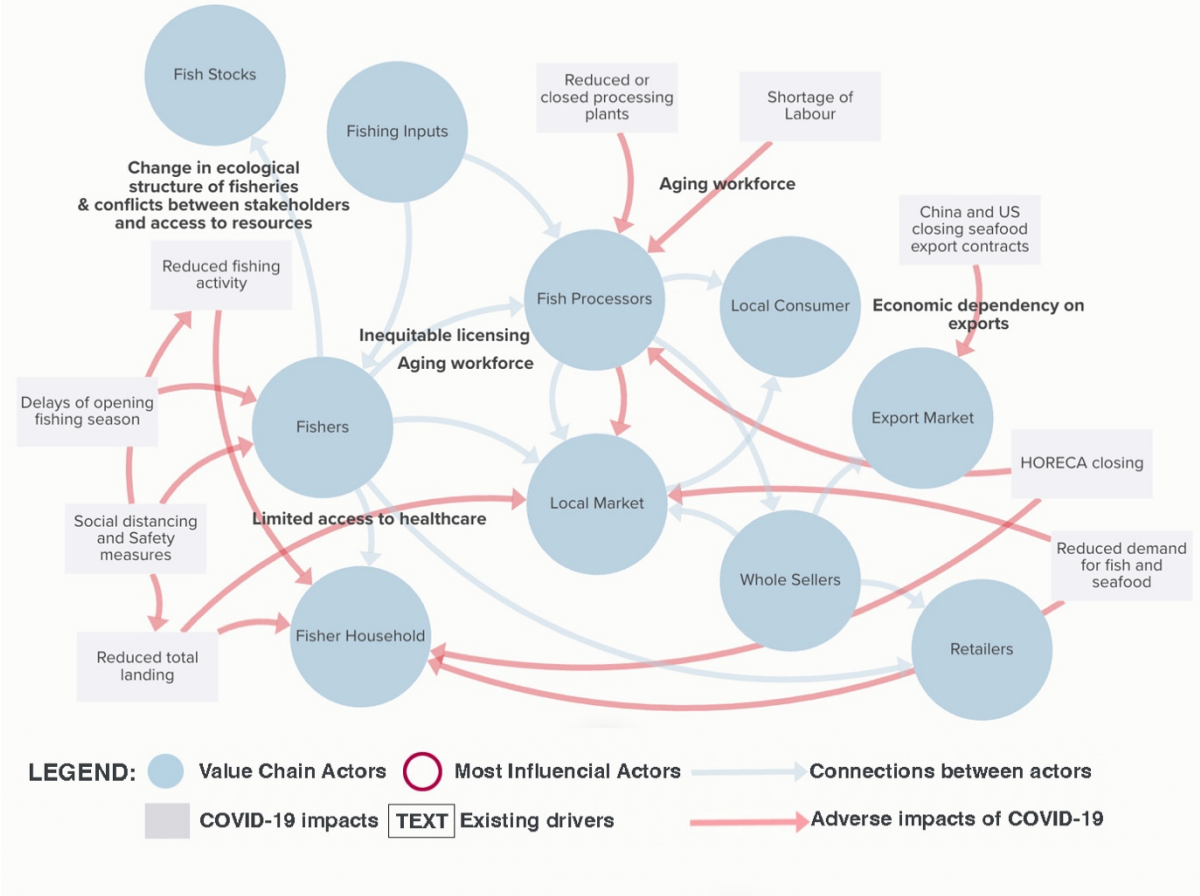


Figure 14: Mapping Canada SSFs' value chain's emerging and existing drivers of a regime shift.

4.3.1.4 Equity, Justice Concerns and Power Dynamics

This section is looking into the extended implications attributed to social equity and justice during COVID-19. The market disruptions affecting seafood trade raised concerns about the market dynamics as large export-oriented businesses dominated trade, leaving smaller local fishers vulnerable to uncertain conditions (Asante et al., 2021). Another concern is the economic impact on small-scale fishers, where reduced demand for fish and seafood resulted in price drops, negatively affecting their dependent livelihoods on fishing sales for income (Asante et al., 2021). Additionally, capacity limitations and closures of processing spaces disproportionately affected small-scale seafood enterprises that lacked privately owned processing facilities (Stoll et al., 2021). Moreover, the large export inventories and international market prices, controlled by investors and offshore buyers, left many local fishers disenfranchised and unable to make independent decisions, highlighting power

imbalances and a lack of equity (Lam, 2021). This trend of vulnerabilities highlights a significant power dynamic within the Canadian SSFs. This dynamic is attributed to the sector's high dependence on export revenues. Especially with the emerging pandemic and the imposed regulations, privileges were given to large export inventories.

4.3.1.5 Suggested scales of intervention

Looking into the Canadian small-scale fisheries value chain components and the drivers of regime shift presented above, I can identify at least three scales reaching a threshold in the value chain. The first scale is the export market, which was affected by the closure of the international market, thus affecting fishers and fish processors (presented by the Green loop). The second scale is the HORECA, which was affected by the closing of hotels, restaurants, casinos, and restaurants, thus affecting fishers and fish processors (presented by the Blue loop). The third point is the health of fishers and their dependent communities being affected by emerging pandemic and limited access to healthcare, (presented by the Orange loop). This scenario suggests that those are the critical points of government intervention to mitigate the adverse impacts of COVID-19 on small-scale fisheries in Canada. Figure 15 represents adding the layer of suggested scales of interventions, the colored loops as explained above. A loop comprises a scale where a group of actors engage together in a certain activity within the SSF value chain. Each loop or scale is affected by the emerging drivers of COVID-19 (red arrows within the loop) and the existing drivers (text in white areas within the loop).

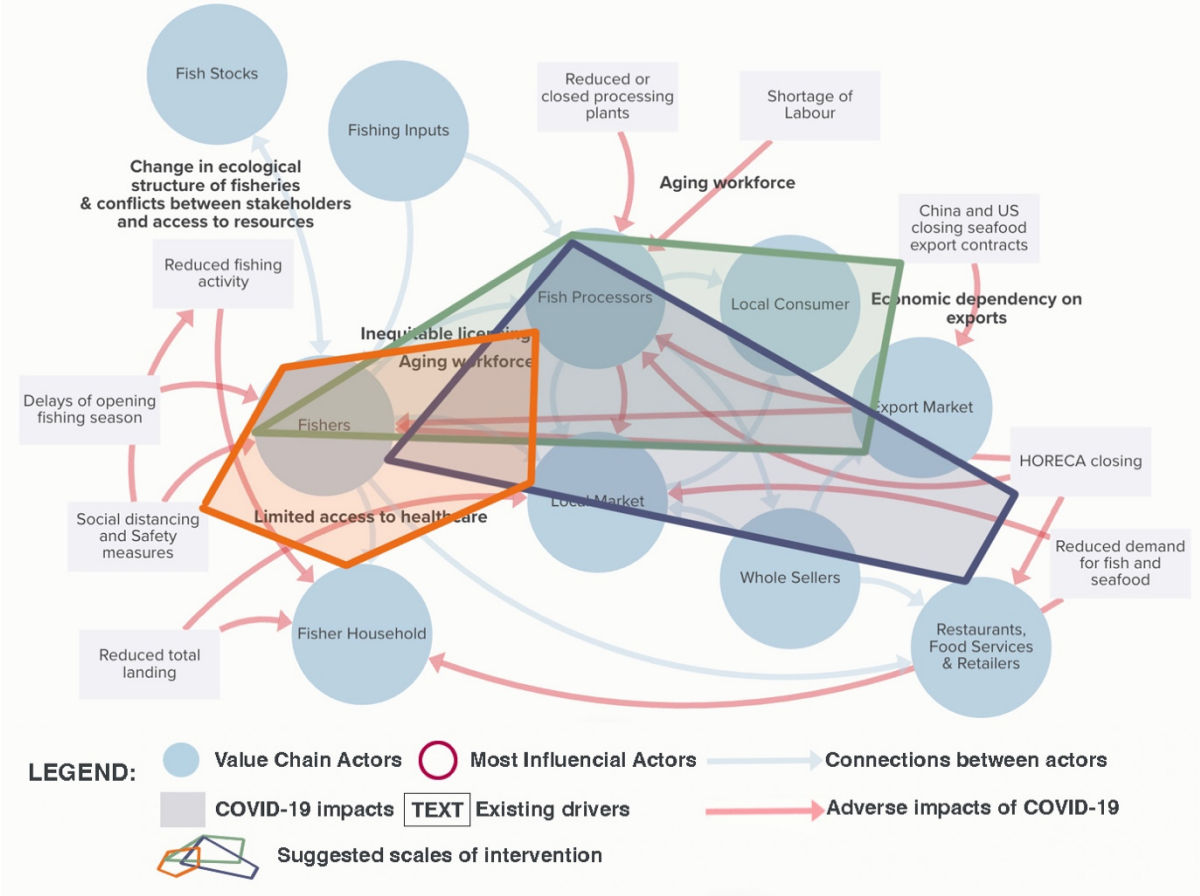


Figure 15: Suggested scales of intervention by the Canadian government to mitigate the adverse impacts of COVID-19 on SSFs.

4.3.1.6 Coping and adaptation strategies practiced by fishers and dependent communities

In seafood supply chains, Alternative Seafood Networks (ASNs) emerged as resilient models during the COVID-19 pandemic (Stoll et al., 2021). These networks, which distribute seafood directly through local marketing channels, experienced a temporary increase in demand in both the United States and Canada due to disruptions in traditional supply chains and government-imposed social protections (Stoll et al., 2021). This success is attributed to various factors that bolstered the resilience of ASNs during the early months of the pandemic (Stoll et al., 2021). ASNs faced challenges as well. The decline of the restaurant sector, a consequence of the pandemic, affected their operations (Stoll et al., 2021). While ASNs saw increased demand from individual consumers, adapting to serve these

markets incurred additional costs (Stoll et al., 2021). To survive, ASNs shifted their focus away from restaurant-based and closed retail markets, such as farmers' markets (Stoll et al., 2021).

An example of an Alternative Seafood Marketing initiative is the Community Supported Fishery (CSF), which seeks to challenge conventional fisheries structures by promoting non-market values within simplified value chains (Bassett et al., 2022). Skipper Otto's Community Supported Fishery (SO) is a notable organization that has aimed to reconfigure the seafood supply chain and financial model by facilitating direct sales from fishers to members (Bassett et al., 2022). SO members purchase a "catch share" to order seafood throughout the year, and the fees collected help fishing families buy licenses, repair gear, and prepare for the fishing season (Bassett et al., 2022). Fishers commit to selling a predetermined volume of their catch to SO, usually at rates exceeding typical market prices; SO then collects, processes, labels, and stores the seafood (Bassett et al., 2022). This effort enhances non-market values between fishers and seafood consumers within the supply chain (Bassett et al., 2022; Lam, 2021; Stoll et al., 2021). By keeping processors and transportation systems operational, SO successfully transported seafood from fishers to processors and members across Canada (Bassett et al., 2022). Fishers found a market for their products through SO, while the organization experienced a surge in new member signups and increased capital from member fees (Bassett et al., 2022). These initiatives reflect the adaptability and resilience of ASNs in challenging times, emphasizing the importance of alternative value chains and community-supported approaches in seafood distribution.

4.3.1.7 Government support during COVID-19

In response to the COVID-19 pandemic, the Canadian government introduced several measures to support the fishery and seafood industry (Asante et al., 2021; Bassett et al., 2022). These measures included allocating emergency relief funds to citizens whose income had been affected by the pandemic (Bassett et al., 2022). Furthermore, stimulus aid was provided to fishers and seafood processors to help mitigate the economic impacts of the crisis (Bassett et al., 2022). To ensure the continuity of the food supply chain, the Canadian government declared fisheries to be an essential service, allowing them to operate during the pandemic (Bassett et al., 2022). Additionally, substantial financial support was extended to the fish harvesters and the seafood sector. A USD 360 million aid package was allocated to Canadian fish harvesters. At the same time, an additional USD 80 million

was directed towards various aspects of the seafood sector, including supply, health, safety, market responsiveness, and storage (Bassett et al., 2022).

The government of Canada demonstrated a commitment to fostering innovation within the fish and seafood industry by engaging in research, collaborative efforts, and funding packages (Asante et al., 2021). The FFAW-Unifor and the Newfoundland and Labrador Department of Fisheries and Land Resources also addressed the challenges posed by the pandemic, offering recommendations and support to the fishing industry workers (Asante et al., 2021). Furthermore, employment insurance fishing beneficiaries saw their claims extended, ensuring financial support throughout the fishing season. Those whose claims had expired in early 2020 were made eligible for the Canada Emergency Response Benefit (CERB), and safeguards were put in place to prevent the claw back of CERB payments from Canada Pension Plan and Old Age Security monthly payments (Asante et al., 2021). Proposed employment extension programs and income replacement initiatives aimed to alleviate the challenges resulting from the pandemic (Asante et al., 2021). The Federal Department of Fisheries and Oceans boosted the snow crab fishery by increasing the quota for the NL region, focusing on market growth and fishery development (Asante et al., 2021). Additionally, the government of Newfoundland and Labrador introduced the Seafood Marketing and Innovation Support Program, backed by a USD 400,000 fund, to explore alternative markets for seafood products due to the closure of restaurants during the pandemic (Asante et al., 2021).

The pandemic brought about specific challenges for small-scale fisheries. The guidance provided by public health and government occupational health branches was not always suited for these operations (Neis et al., 2022). As a response, a collaborative network was formed to develop practical and effective COVID-19 safe work guidelines for fish harvesters (Neis et al., 2022). These guidelines addressed transmission risks and industry constraints and were rapidly disseminated to owner-operators and others in the industry (Neis et al., 2022). The approach included the formation of "bubbles," consisting of a home bubble and a work crew bubble, which was especially manageable for family-owned and operated fishing enterprises (Neis et al., 2022). Feedback from fish harvesters was actively sought to fine-tune the guidelines (Neis et al., 2022). The proactive efforts of Newfoundland and Labrador's Safety Association had a ripple effect, as they shared experiences and resources with other safety associations in Canadian provinces with coastal waters, aiding in developing similar guidelines (Neis et al., 2022). These collaborative initiatives played a crucial role in rapidly adapting to the challenges brought about by the pandemic in the fisheries sector.

Figure 16 represents adding the layer of actual scales of interventions, the colored-filled areas as explained above in (Sec. 4.4.1.6) and (Sec. 4.4.1.7). Each colored area represents a governance strategy and its impact on a number of actors, emerging drivers, and existing drivers. Areas that are not color-filled are areas that were not tackled by the Canadian government or the SFF communities.

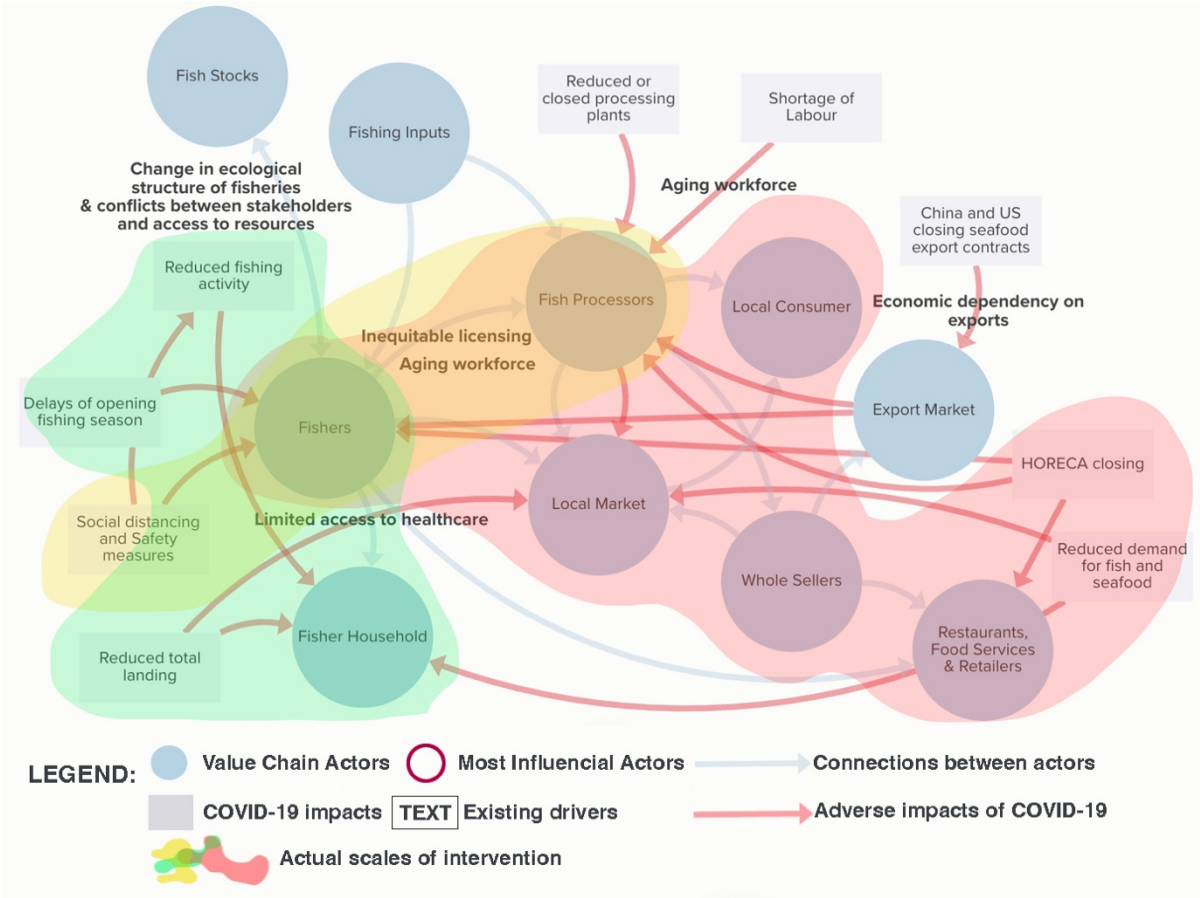


Figure 16: Actual scales of intervention tackled by SSF communities and the Canadian Government during COVID-19.

4.3.2 Malaysia

4.3.2.1 Unit of regime shift

The core of Malaysia's small-scale fisheries value chain relies on two major components for sustenance and growth: tourism and the HORECA (Hotel, Restaurant, and Catering) sector. The tourism industry in Malaysia serves as a robust foundation for the small-scale fisheries value chain

and the Malaysian economy. Tourists flock to the country's picturesque coastal destinations, creating a high demand for fresh seafood. This influx of visitors provides a steady market for local fishers and processors, driving the sector's economic viability. Another critical actor in the value chain is the export market, with China being the importer of seafood products from Malaysia. Exporting to China allows local fishers and processors to expand their market reach and increase revenue, making it an essential part of the value chain. Another distinctive feature of Malaysia's small-scale fisheries value chain is its reliance on migrant fishers from the Philippines and Indonesia. Intermediaries form a significant part of the value chain, particularly in long-distance marketing. These middlemen are pivotal in connecting local producers with international buyers, ensuring a smooth flow of products domestically within Malaysia. Figure 17 explains the Malaysian SSF value chain as described above and found in the reviewed literature and interviews conducted. The red circles in figure 18 represents the most influential actors in the Malaysian SSF value chain.

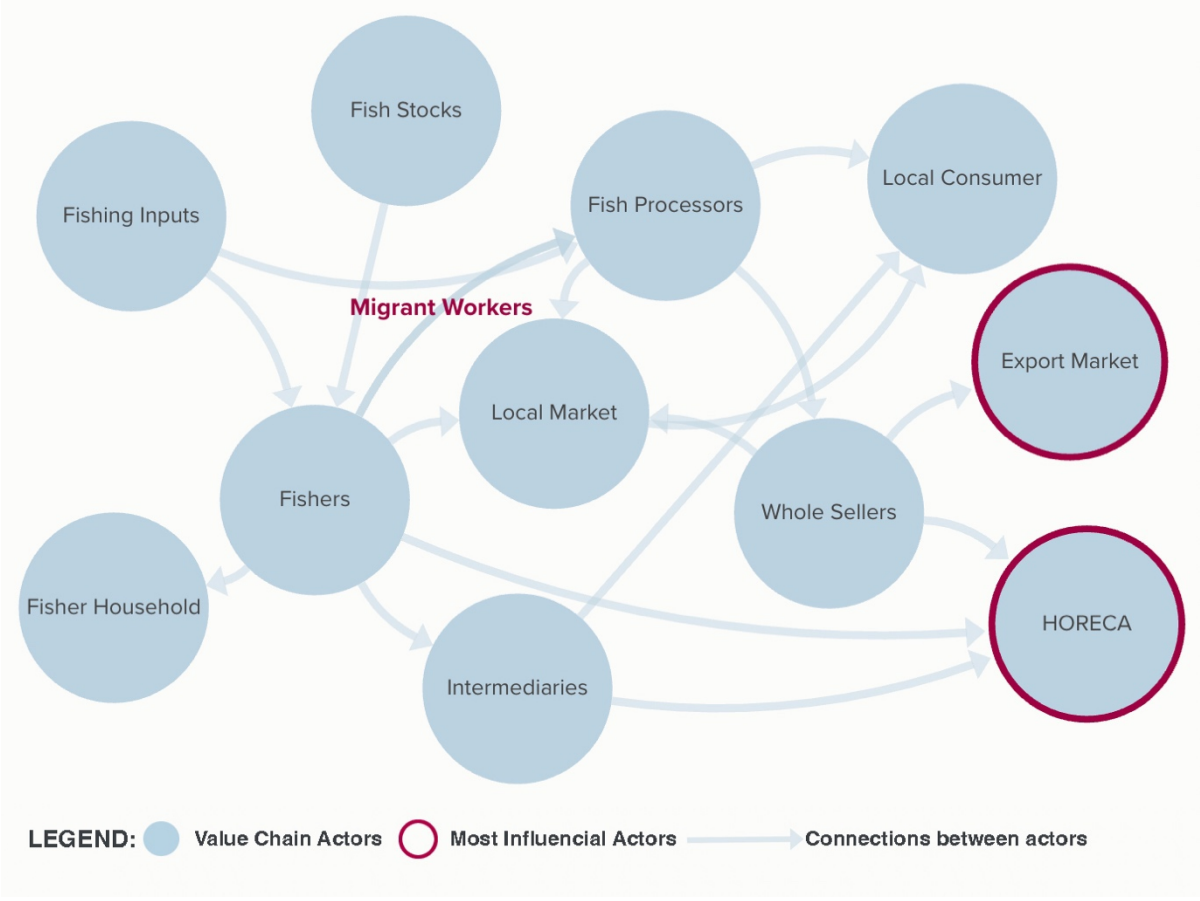


Figure 17: Malaysia's small-scale fisheries value chain components.

4.3.2.2 Emerging drivers:

The small-scale fisheries sector in Malaysia faced a multitude of emerging drivers during the COVID-19 pandemic, reshaping the dynamics of this vital industry. Due to restrictions on fishing, Illegal, unreported, and unregulated (IUU) fishing, combined with a lack of enforcement of fisheries regulations and inadequate infrastructure, posed a substantial threat to fish stocks during the pandemic (Asmat et al., 2021). Additionally, international seafood trade between Malaysia and China, a major seafood importer, dwindled as China enforced a nationwide lockdown, cancelled seafood export contracts, and selectively bought from importing countries (Waiho et al., 2020). Limitations on transportation and movements, coupled with disruptions in tourism, directly affected small-scale fisheries (Kaewnuratchadasorn et al., 2020). Moreover, the shutdown of food services along the supply chain, notably the HORECA sector (Hotels, Restaurants, and Catering), bore the brunt of the impact, leading to widespread disruptions (Asmat et al., 2021; Ferrer et al., 2021; Jomitol et al., 2020; Kaewnuratchadasorn et al., 2020).

The disruptions in fish marketing due to transport limitations and imposed curfews prevented long-distance marketing and limited local trading of catch (Asmat et al., 2021; Jomitol et al., 2020; Kaewnuratchadasorn et al., 2020; Rahman, 2022). This shift forced many fishers to consume their catch for subsistence (Expert 1 Malaysia, personal communication, 2 April 2023) or to sell their catch at reduced prices to local consumers (Asmat et al., 2021). Middlemen, who often transported fish from distant fishing communities, faced uncertainties and higher costs, leading some to cease operations to minimize business losses (Jomitol et al., 2020).

Furthermore, the pandemic significantly reduced fish catch as fishing activities faced restrictions, and numerous fishers were prohibited from venturing to sea, leading to income loss and detrimental effects on their well-being (Asmat et al., 2021; Expert 1 Malaysia, personal communication, 2 April 2023; Ferrer et al., 2021; Kaewnuratchadasorn et al., 2020). In such circumstances, waiting for government financial aid became the only option for many fishers (Jomitol et al., 2020). Preventive measures, such as movement restrictions for fish farmers and decreased consumer demand, made it more difficult to maintain the stocks of cultured commodities, as many products could not be harvested (Kaewnuratchadasorn et al., 2020). Furthermore, strict regulations and the need to establish screening facilities and preventive measures for workers had an adverse effect on overall output, potentially leading to the closure of small-scale factories (Ferrer et al., 2021). Additionally, the small-scale fisheries sector grappled with rising prices of aquaculture inputs due to limited supply, adding to

the already exorbitant cost of sustaining aquaculture operations (Kaewnuratchadasorn et al., 2020; Waiho et al., 2020). The unavailability of fishing equipment at nearby shops, the absence of fish storage, and a low supply of ice further complicated matters (Asmat et al., 2021).

The disruption also led to oversupply due to domestic travel restrictions and Malaysians' inability to access fish markets, forcing some fishermen to discard their catch at sea or give it away. In contrast, others had to sell their fish at significantly lower prices (Rahman, 2022). As a result, the pandemic induced a substantial decline in fish prices along the food supply chain, disproportionately affecting small-scale fishers, particularly those residing in islands far from significant economic activities (Jomitol et al., 2020). Figure 18 represents adding the layer of emerging drivers (grey boxes) and their adverse impacts on the value chain actors (red arrows). This figure shows how the emerging drivers reverberated throughout the SSF value chain of Malaysia.

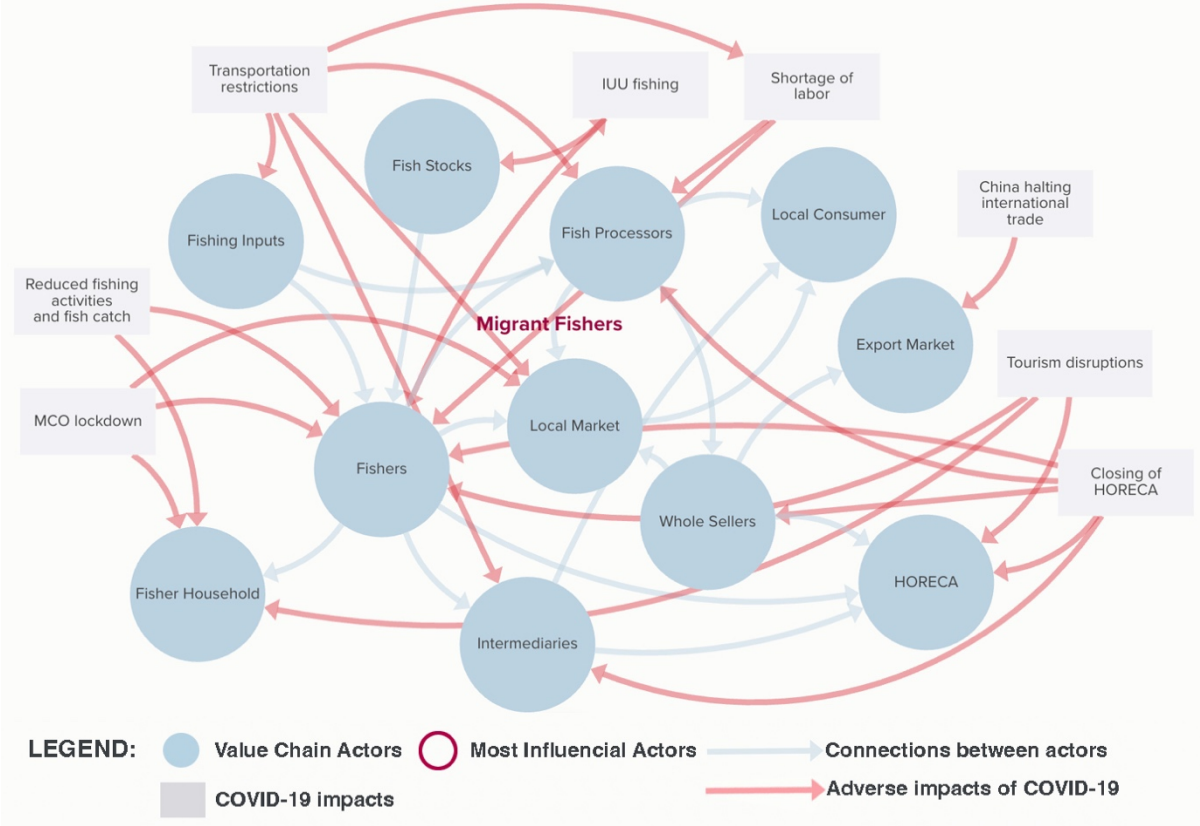


Figure 18: Mapping Malaysia SSFs' value chain's emerging drivers of regime shift.

4.3.2.3 Existing drivers

Poverty plays a central role, with many fishers belonging to the Bottom 40% (B40) group relying on government subsidies, including diesel subsidies, to access the sea and sustain their livelihoods (Ferrer et al., 2021; Jomitol et al., 2020). These impoverished communities are often geographically, socio-economically, and politically isolated, further exacerbating their vulnerability (Asmat et al., 2021; LIM, 2021). Climate change adds another layer of complexity. Rising global temperatures, extreme weather events such as floods and droughts, and rising sea levels disrupt fish species' availability and behavior (Asmat et al., 2021; Hoque et al., 2021; Osman et al., 2021). Poor coastal management practices, including wetland reclamation and mangrove deforestation for agriculture, contribute to this ecological degradation (Asmat et al., 2021). These challenges have far-reaching consequences, leading to food insecurity, economic losses, water scarcity, infectious diseases, and displacement, ultimately resulting in hunger and malnutrition (Asmat et al., 2021).

Moreover, the lack of knowledge, education and willingness to adapt to online marketing exacerbates the economic challenges faced by small-scale fishers (Asmat et al., 2021). Financial instability is pervasive, with many fishers lacking savings to weather crises and accumulating debts owed to middlemen for equipment maintenance costs (Asmat et al., 2021; Rahman, 2022). Social uncertainties related to resource control and stock depletion due to large-scale fisheries further compound the situation (Asmat et al., 2021; Rahman, 2022). Inefficiencies in the fishing licensing system have created inequities, with some license holders not actively engaging in fishing. The existing processes for issuing and renewing licenses lack transparency and need reform (Rahman, 2022). The sector heavily depends on migrant labor (G. N. Islam, personal communication, 2 April 2023), with an influx of migrants from the Philippines and Indonesia contributing to overfishing and destructive practices such as fish bombing and cyanide fishing, placing immense pressure on fisheries resources (Asmat et al., 2021). Figure 19 represents adding the layer of existing drivers (text in white areas) and their placement is influenced with their impact on the surrounding actors. This figure shows how the emerging drivers and existing drivers act in synergy affecting the different actors of the SSF value chain of Malaysia.

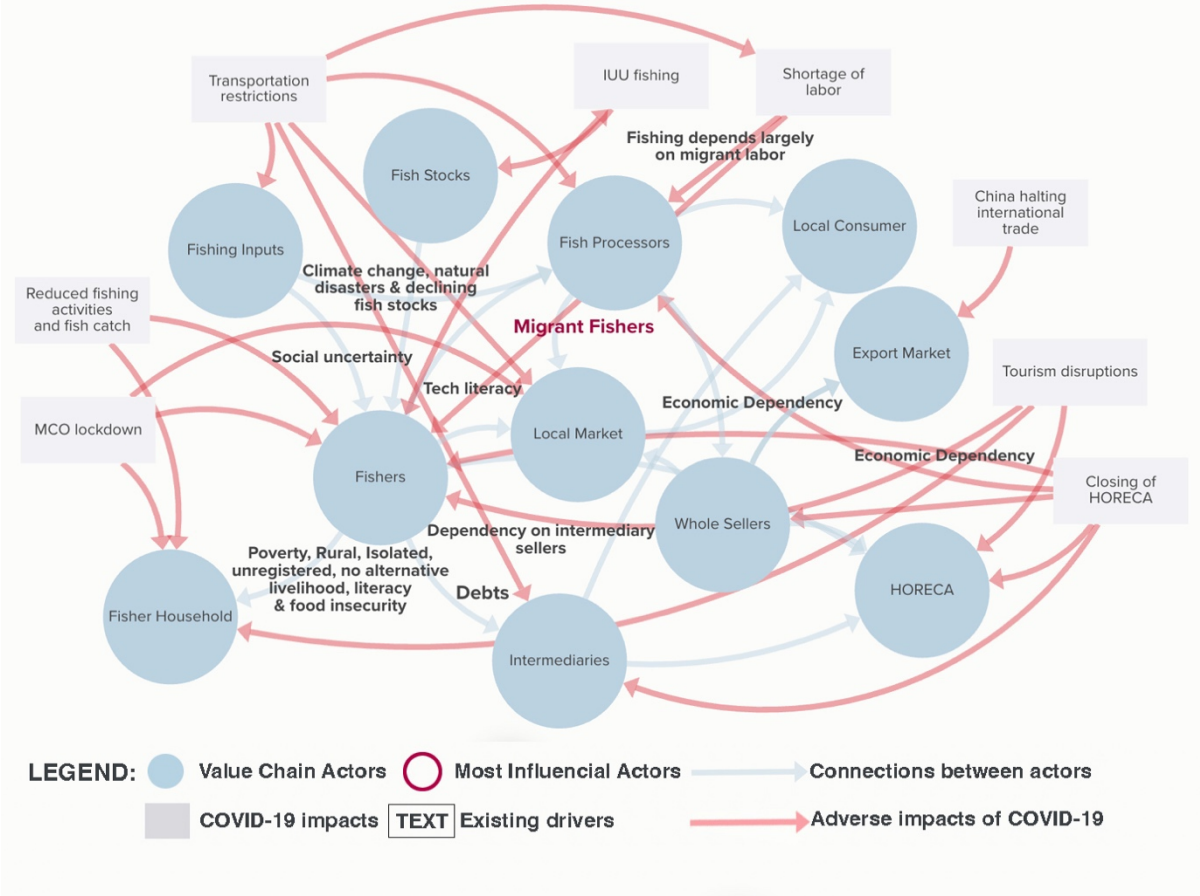


Figure 19: Mapping Malaysia SSFs' value chain's emerging and existing drivers of regime shift.

4.3.2.4 Equity, Justice Concerns and Power Dynamics

The small-scale fisheries sector in Malaysia faces social uncertainty, including land tenure and state interventions issues, creating insecurity among local fishers (Asmat et al., 2021). Additionally, many small-scale fishers are not registered under crucial social security and financial schemes, such as the Employment Provident Fund (EPF), the Social Security Organization (SOCSO), and the Inland Revenue Board (LHDN), leaving them without adequate social protection (Ferrer et al., 2021; Rahman, 2022). Fishing licenses, critical for legal fishing and access to financial assistance, are often held by influential individuals who may not actively engage in fishing, highlighting equity and power imbalances. Calls have been made for more transparent and equitable processes for license issuance and renewal (Rahman, 2022). Moreover, large-scale fisheries employing massive weighted trawl nets have led to stock depletion and severe environmental damage, with destructive methods not

distinguishing between target species and bycatch, raising concerns about ecological justice (Rahman, 2022). During the COVID-19 pandemic, disparities persisted between industrial fishing, which was allowed to resume operations, and small-scale fisheries, further underscoring power imbalances and issues of access to resources (Expert 1 Malaysia, personal communication, 2 April 2023). Furthermore, the influx of migrant fish workers carrying on illegal and destructive fishing activities, along with weak enforcement of fisheries regulations and inadequate infrastructure, disproportionately harms small-scale fisheries, emphasizing issues related to justice and enforcement (Asmat et al., 2021).

Poverty is pervasive among artisanal fisheries, leading to multi-dimensional poverty encompassing income insufficiency, limited access to education and healthcare, and human insecurity, underscoring social justice concerns (Asmat et al., 2021; Rahman, 2022). Disruptions in the supply chain during the pandemic reduced catches, affecting women workers' income in fish processing in coastal areas and raising questions about gender equity (Ferrer et al., 2021). Despite the availability of official financial aid at both state and federal levels, many fishers struggled to access these resources due to factors such as limited technological know-how, unsupportive village leaders, and challenges related to administrative processes, highlighting access and knowledge disparities (Rahman, 2022). The lack of a strong collective voice has affected the ability of small-scale fishers to advocate for their rights, particularly in matters like cross-border trade. Additionally, conflicts often arise between commercial fishing and small-scale fisheries, especially concerning resource access, revealing power dynamics within the sector (Expert 1 Malaysia, personal communication, 2 April 2023).

4.3.2.5 Suggested Scales of intervention

Looking into the Malaysian small-scale fisheries value chain components and the drivers of regime shift presented above, I can identify at least four scales reaching the threshold in the value chain. The first scale is the HORECA, which was affected by halting tourism activities, one of the biggest contributors to the Malaysian economy, and the associated closing of hotels and restaurants, thus affecting fishers and fish processors (presented by the Blue loop). The second scale is the export market, which was affected by the closure of the international market in China, thus affecting fishers and fish processors (presented by the Green loop). The third scale is around the dependency on migrant fish workers, which results in an increase in IUU fishing, thus harming fish stocks and the shortage of labor due to transportation restrictions (presented by the Orange loop). The fourth point is

the fishers themselves affected by several socio-economic factors, such as social uncertainty, poverty, literacy, lack of alternative livelihoods, and debts. Additionally, the fishers are being adversely affected by ecological factors such as climate change, natural disasters and declining fish stocks (presented by the Yellow loop). This scenario suggests that those are the critical points of government intervention to mitigate the adverse impacts of COVID-19 on small-scale fisheries in Malaysia. Figure 20 represents adding the layer of suggested scales of interventions, the colored loops as explained above. A loop comprises a scale where a group of actors engage together in a certain activity withing the SSF value chain. Each loop or scale is affected by the emerging drivers of COVID-19 (red arrows within the loop) and the existing drivers (text in white areas within the loop).

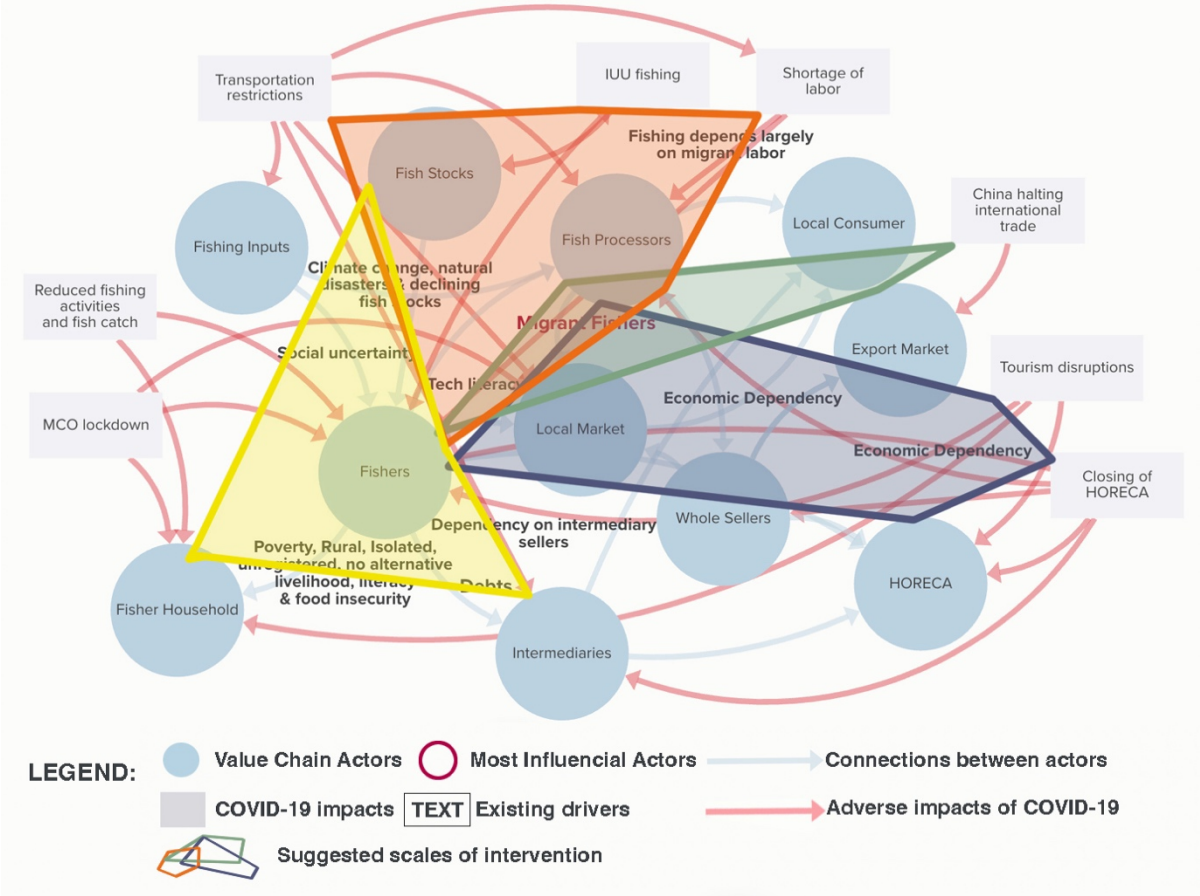


Figure 20: Suggested scales of intervention by the Malaysian government to mitigate the adverse impacts of COVID-19 on SSFs.

4.3.2.6 Coping and adaptation strategies practiced by fishers and dependent communities

Malaysian small-scale fishery (SSF) communities implemented a range of coping strategies during the COVID-19 pandemic, reflecting both negative and positive approaches. Starting with the negative strategies, some members of SSF communities chose to defy the regulations introduced during the Movement Control Order (MCO), potentially undermining efforts to control the spread of the virus (Expert 2 Malaysia, personal communication, 23 April 2023). Overall, fishing became a safety net for villagers who had lost their jobs during the Movement Control Order (Rahman, 2022). Residents in areas like Mukim Tanjung Kupang ventured out to sea to secure food and additional income. However, this added pressure to already scarce resources within these communities (Rahman, 2022).

The economic impact of the pandemic led to more severe measures among SSF community members, such as selling their productive gear and assets (Expert 1 Malaysia, personal communication, 2 April 2023). This desperation extended to stopping their children from attending school, and many respondents reported severe food shortages, reducing daily meals from three times to two (Expert 1 Malaysia, personal communication, 2 April 2023). Women were particularly affected, as they carried the dual burden of household management and childcare, resulting in significant stress (Expert 1 Malaysia, personal communication, 2 April 2023). Attempts to secure credit or loans from banks and financial institutions often proved futile, forcing them to rely more on support from relatives, neighbors, and friends (Expert 1 Malaysia, personal communication, 2 April 2023).

In response to the challenges brought about by the pandemic, SSF communities exhibited positive adaptive responses, such as engaging in direct fish marketing, online sales, and home delivery services (Ferrer et al., 2021). Several innovative approaches emerged, including the launch of online sales platforms and civil society initiatives aimed at redistributing unsold fish, helping to alleviate the hardships of the communities (Rahman, 2022). These innovations included the development of applications that facilitated online seafood and farmers' markets, with many individuals stepping forward to help rural community groups overcome technical challenges like inconsistent internet access and order processing (Rahman, 2022). On a positive note, community members still residing in coastal areas demonstrated increased mobility, often seeking employment in mainland or urban areas (Expert 1 Malaysia, personal communication, 2 April 2023). This mobility included women who expanded their mobility to secure jobs and explored online fishing businesses, specializing in selling dried fish and fish-related products popular on the East Coast (Expert 1 Malaysia, personal

communication, 2 April 2023). Many women engaged in various online businesses, collaborating with government agencies to connect with buyers, and the agencies themselves purchased their products (Expert 1 Malaysia, personal communication, 2 April 2023).

Additionally, in response to these difficulties, the seafood market "Pasar Pendekar Laut" organized fundraising efforts to support fishermen, distributing the seafood to those in need in Johor Bahru (JB) (Rahman, 2022). This collaboration among civil society groups was crucial, especially as many residents in Johor had lost their jobs due to border closures (Rahman, 2022). The seafood also reached homeless individuals who had relocated to a camp in Gunung Pulai (Rahman, 2022). This initiative provided essential protein to those in need and empowered fishermen to help others in more dire situations (Rahman, 2022).

4.3.2.7 Government support during COVID-19

The Malaysian government responded to the challenges faced by small-scale fishers (SSF) during the COVID-19 pandemic by implementing various support measures. The Malaysian federal government introduced a series of economic stimulus packages to aid vulnerable groups, particularly small-scale fishers affected by the Movement Control Order (MCO) (Ferrer et al., 2021). These packages included a significant allocation of MYR 1 billion (USD 0.25 billion) to enhance the nation's food security fund under the second stimulus package (Ferrer et al., 2021). A specific aspect of this allocation involved MYR 200,000 (USD 50,000) in special funds designated for fisher associations to develop short-term agri-food projects to ensure sufficient food production within 3 to 6 months (Ferrer et al., 2021). Furthermore, MYR 100 million (USD 25 million) was designated for developing food storage and distribution infrastructure (Ferrer et al., 2021). Additionally, the Ministry of Agriculture and Food Industry allocated MYR 1.17 million (USD 0.3 million) for the implementation of the Economic Stimulus Package under the “myFisheries Community” (myKP) program, which aimed to assist fishers in 13 areas across the country (Asmat et al., 2021; Ferrer et al., 2021). This stimulus package included provisions for fishing equipment, fish aggregating devices, and cabins at the myKP Fisheries Transformation Centre (Ferrer et al., 2021).

Moreover, under the Prihatin Supplementary Initiative Package, amounting to MYR 7 billion (USD 1.73 billion), the government initiated a one-time cash payment of MYR 1000 (USD 247) to households falling within the bottom 40 income group (monthly earning less than MYR 4000 [USD 990]), which included many fishing households (Asmat et al., 2021; Ferrer et al., 2021). Furthermore,

the Malaysian government allocated funds totaling MYR 151 million (USD 37 million) in the 2021 national budget, intending to increase the monthly living allowance for fishers from MYR 250 (USD 62) to MYR 300 (USD 74) (Ferrer et al., 2021).

However, the support provided was not without challenges and limitations. Some flood victims received relief, including RM 500 in flood assistance and RM 200 worth of food supplies distributed during the pandemic (Osman et al., 2021). While government aid related to flood disasters was reported, many recipients found the assistance insufficient (Osman et al., 2021). Additionally, the supplies distributed by the Social Welfare Department included basic groceries. Still, the assistance was relatively modest, ranging from approximately 10 USD to 25 USD per household, which might not fully address their needs (Asmat et al., 2021).

Moreover, many self-employed aquaculturists in the B40 group were not officially registered with governmental agencies, making them potentially ineligible for various forms of aid and support (Waiho et al., 2020). These individuals might have been excluded from the support measures, highlighting a gap in assistance provision (Waiho et al., 2020). Furthermore, in some cases, fishing gear replenishment faced challenges (Asmat et al., 2021). During the MCO implementation, fishing stores were not allowed to operate, resulting in a lack of new supplies and making fishing even more challenging (Asmat et al., 2021). Although financial aid was available, it was difficult for many fishermen due to insufficient information and technological know-how, unsupportive village heads, and limited means to travel to town centers to manage administrative processes (Rahman, 2022).

Additionally, many fishermen were not registered under key agencies through which COVID-19 aid was distributed, further complicating their access to assistance (Rahman, 2022). Associations representing fishermen were criticized for lacking transparency and fairness in aid distribution (Rahman, 2022). The Malaysian government implemented several measures to support SSF communities during the COVID-19 pandemic. However, aid distribution faced challenges, including limited coverage, technological barriers, and difficulty reaching specific groups within the fishing community.

Figure 21 represents adding the layer of actual scales of interventions, the colored-filled areas as explained above in (Sec. 4.4.2.6) and (Sec. 4.4.2.7). Each colored area represent a governance strategy and its impact on a number of actors, emerging drivers, and existing drivers. Areas that are not color-filled are areas that were not tackled by the Malaysian government or the SFF communities.

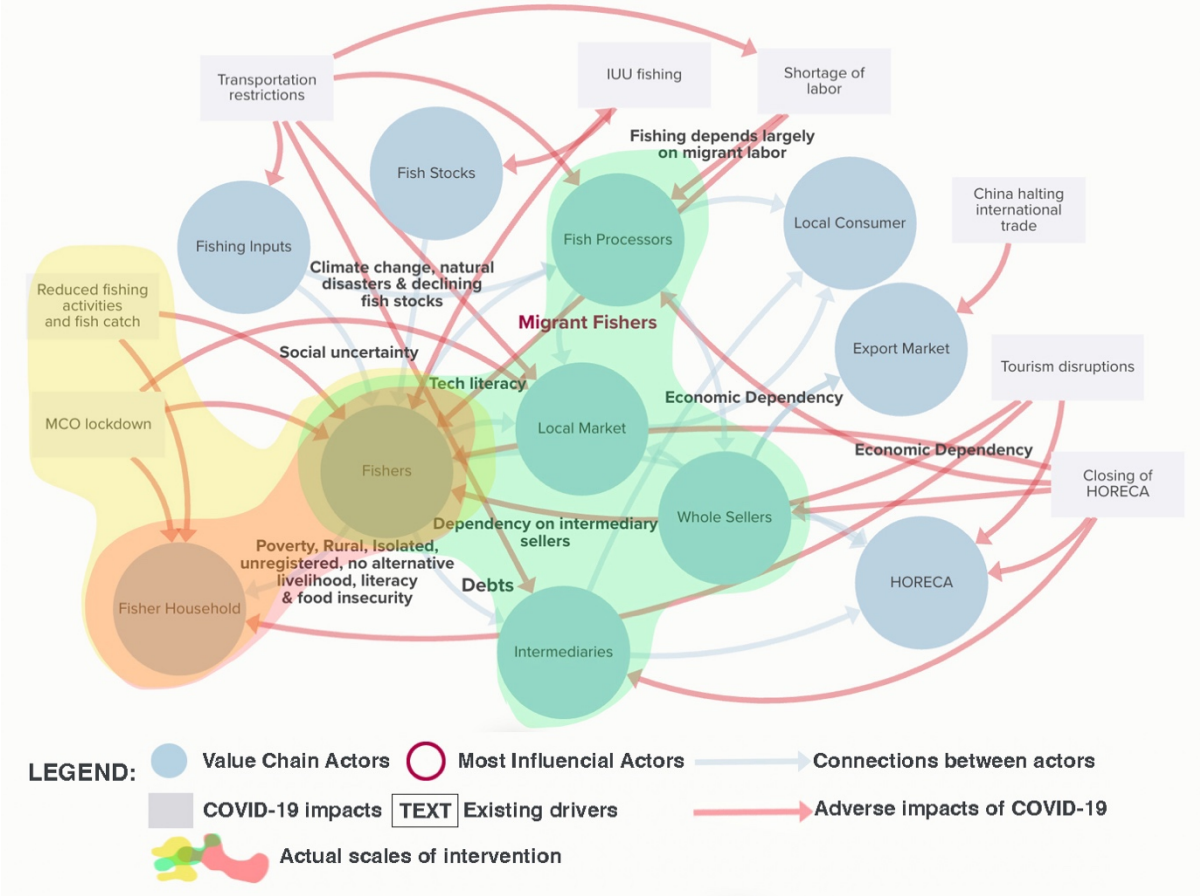


Figure 21: Actual scales of intervention tackled by SSF communities and the Malaysian Government during COVID-19.

4.3.3 India

4.3.3.1 Unit of regime shift

In India's small-scale fisheries value chain, the local market is the primary consumer base. Unlike other countries, where export markets dominate, India's small-scale fishers predominantly cater to local consumption needs. The second significant component of this value chain involves exports, particularly to countries like China and the United States. While local consumption takes precedence, the export market offers opportunities to tap into international demand for Indian seafood products. Retail is another vital player in India's small-scale fisheries value chain. They operate in bustling markets and local shops, making seafood accessible to a broad spectrum of consumers.

Additionally, migrant fishers constitute a significant part of the labor force in this value chain. Moreover, intermediaries hold a crucial role in marketing fish products. They facilitate seafood distribution from fishers and processors to retailers and sometimes even export markets. Their involvement streamlines the supply chain, ensuring fish products reach consumers effectively. One last unique aspect of the Indian small-scale fisheries value chain is the presence of boat and vessel owners. Fishers often rely on loans from these owners to maintain and operate their vessels. This financial dependency adds another layer to the value chain dynamics, as fishers work to meet their financial obligations while sustaining their livelihoods. Figure 22 explains the Indian SSF value chain as described above and found in the reviewed literature and interviews conducted. The red circles in figure 22 represents the most influential actors in the Malaysian SSF value chain.

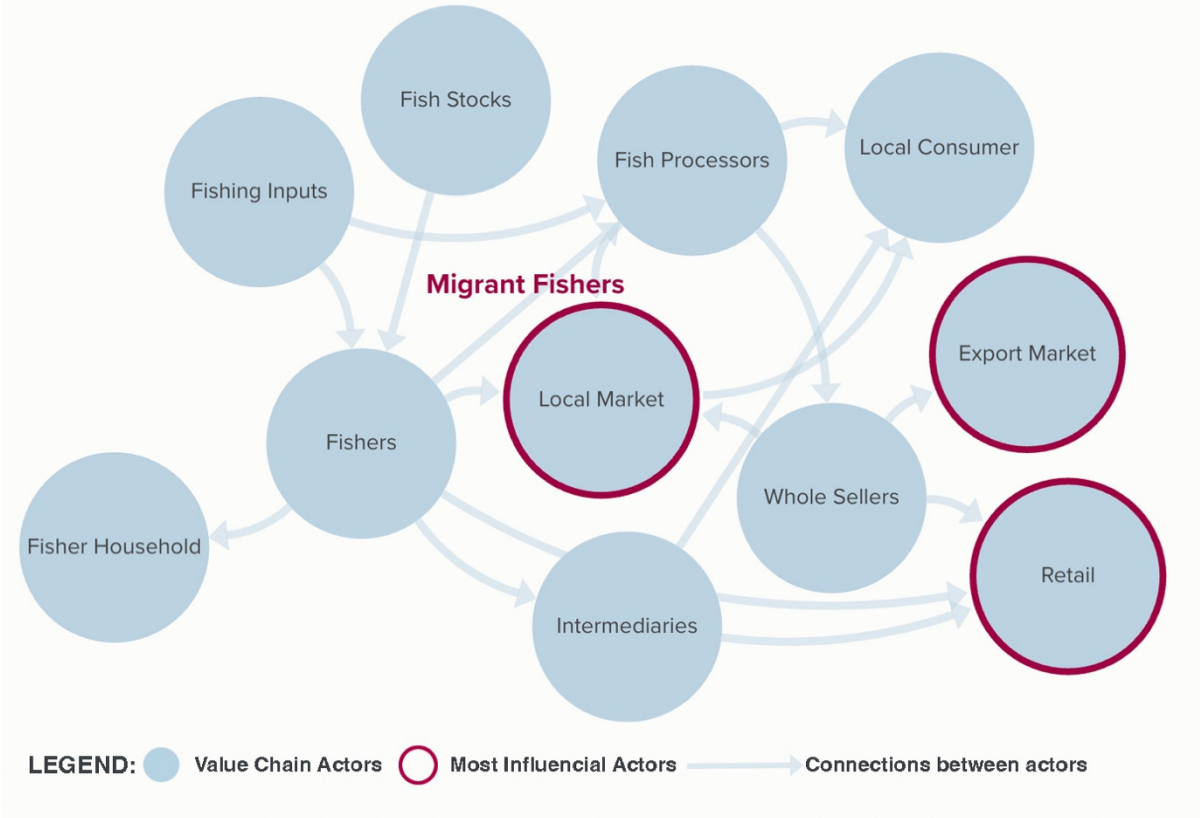


Figure 22: India's small-scale fisheries value chain components.

4.3.3.2 Emerging drivers:

The small-scale fisheries in India experienced a significant regime shift prompted by the multifaceted challenges of the COVID-19 pandemic. The traditional fish supply chain witnessed a substantial disruption, as all harvested fish were directly purchased by retailers from fishers at the farm gate level during restricted sale hours from 8 to 10 a.m. (Das et al., 2022). Local markets became non-functional (Expert 2 India, personal communication, 18 April 2023), leading to capital depletion for fishers who were compelled to sell their catch immediately, incurring substantial financial losses (Expert 1 India, personal communication, 24 April 2023). The international markets, particularly China and the United States, major consumers and producers of agricultural goods, were significantly affected by the pandemic, leading to a halt in exports and further exacerbating the crisis (Mukherjee et al., 2020; Vaity, 2021).

The repercussions of this unprecedented lockdown were felt deeply in the small-scale fisheries sector, adversely impacting fishers' employment, income, food security, and nutrition and potentially inciting social unrest (Das et al., 2022). The loss of fishing days exacerbated the situation (Das et al., 2022), and fishers found themselves ensnared in a cycle of hunger, unemployment, and debt as they turned to loans from vessel owners and local business merchants (Avtar et al., 2021). The shortage of a workforce further compounded the issue (Kumaran et al., 2021; Mukherjee et al., 2020), with workers facing immobility due to the sudden cessation of fishing activities and the shutdown of processing plants, resulting in job losses and reduced salaries (Mukherjee et al., 2020). Moreover, the financial problems of the unorganized sector finance service providers were exacerbated by the COVID-19 crisis (Vaity, 2021). The pandemic forced migrating fishers into overcrowded trucks and buses with no other options for transport (Expert 1 India, personal communication, 24 April 2023).

The fishery sector experienced adverse impacts on supply and demand, leading to disruptions in the value chain. Mobility restrictions and transport closures created a significant gap between fish supply and demand, causing an increase in fish prices due to the imbalance (Das et al., 2022; Mukherjee et al., 2020; Vaity, 2021). Consumption demand decreased due to misconceptions, non-availability, border restrictions, labor shortages, and cold storage issues (Mukherjee et al., 2020; Vaity, 2021). Production capacity decreased, and costs increased, leading to unregulated price hikes in the final product supply chain (Mukherjee et al., 2020). Transportation, ice factories, and overall logistics were severely impacted as the status of fish and fishery as essential services remained unclear at the beginning of the pandemic (Vaity, 2021). The lockdown disrupted various facets of the seafood value

chain, including ports, landing sites, ice factories, processing plants, transportation facilities, and market services, affecting diverse workers across India (Lam, 2021). The lack of recognition of small-scale fisheries (SSFs) as essential food producers and inequities in access to technology further hampered efforts to maintain local seafood supply (Lam, 2021).

In addition to the pandemic's challenges, the sector grappled with the aftermath of cyclone Amphan (Basu, 2020), exacerbating the existing difficulties. Disruptions in inter-state transportation, fare hikes, and limited train travel timings further crippled the value chain (Mukherjee et al., 2020). The shortage of essential resources like fertilizer, seeds, and feed, coupled with a lack of transport facilities for distributing seeds across farming regions, adversely affected hatcheries (Kumaran et al., 2021; Mukherjee et al., 2020). These multifaceted challenges collectively reshaped the small-scale fisheries regime in India, underscoring the need for adaptive governance and innovative solutions to navigate this complex and evolving landscape. Figure 23 represents adding the layer of emerging drivers (grey boxes) and their adverse impacts on the value chain actors (red arrows). This figure shows how the emerging drivers reverberated throughout the SSF value chain of India.

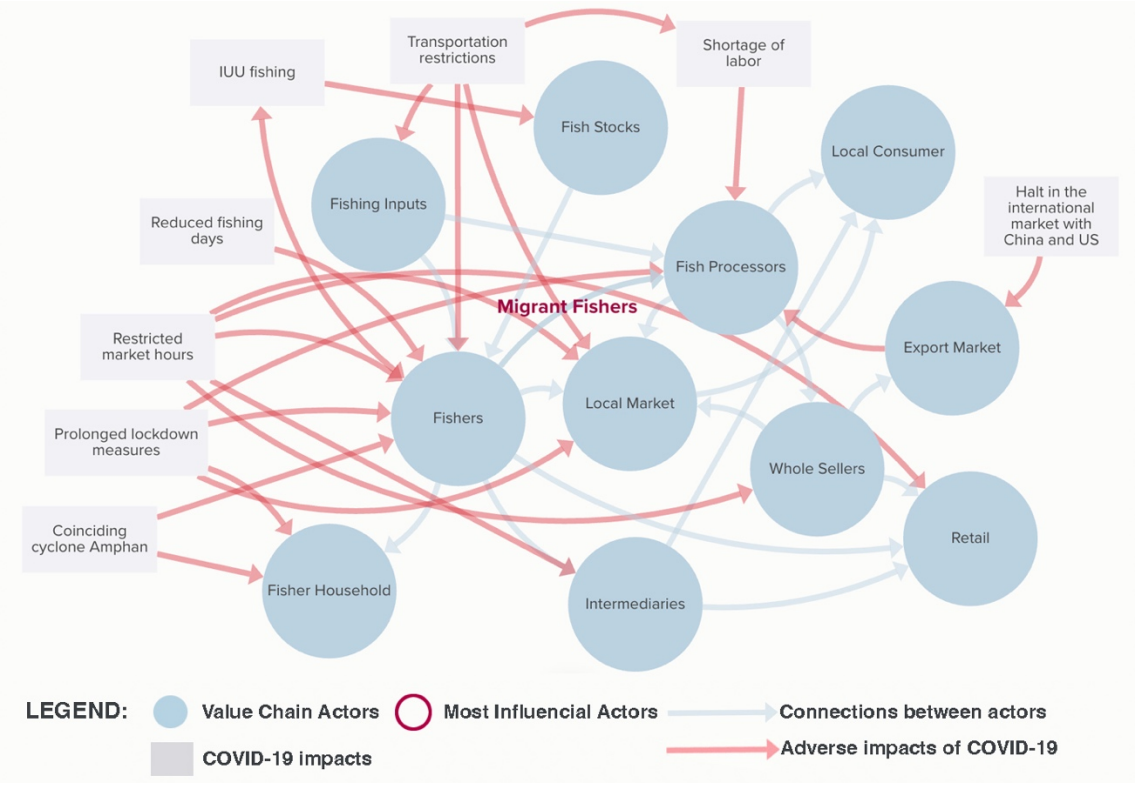


Figure 23: Mapping India SSFs' value chain's emerging drivers of regime shift.

4.3.3.3 Existing drivers:

The small-scale fisheries regime in India is undergoing a profound transformation, driven by a myriad of interconnected factors that paint a picture of both environmental challenges and socio-economic vulnerabilities. The Sundarbans, a region where a significant portion of land is submerging, and sea levels are rising, bears the brunt of ecological shifts accompanied by increased erosion and the looming threat of climate disasters (Expert 1 India, personal communication, 24 April 2023). The environment faces further pressures from eco-crimes, including the hunting and killing of dolphins, natural disasters, and the adverse impacts of prawn culture (Bharti, 2022). Climate change, characterized by continuous floods and cyclones, is taking its toll on fishers. Boats and nets are damaged, yet compensation from the government remains elusive (Bharti, 2022; Das et al., 2022). Moreover, developmental activities and natural calamities, like Cyclone Fani and Phailin, have disrupted the delicate balance of ecosystems in places like Chilika, leading to diminishing fish quantities (Bharti, 2022). The vulnerability of fishers in these regions is exacerbated by the fragile nature of their habitats (Expert 1 India, personal communication, 24 April 2023).

Livelihoods are further strained by pervasive poverty, resulting in mismanaged livelihoods, a lack of capacity to return to fishing, and deteriorating mental and physical health (Bharti, 2022). Loss of income from fisheries and escalating debt levels have dire consequences for fishers (Bharti, 2022). This poverty is particularly evident in the Sundarbans, where fishing is the sole source of income, leaving no room for alternative livelihoods (Expert 1 India, personal communication, 24 April 2023). The fisheries sector is entangled in a web of challenges. School dropouts among fisher communities, exploitation of children, and the encroachment of fishing rights by non-fishers contribute to their distress (Bharti, 2022). Conflicts, court cases, and the loss of political voice and power due to migration add to their financial distresses and insecurity (Bharti, 2022). The fishing sector, historically seen as an outcast by the agrarian-focused Indian society, remains neglected and marginalized (Vaity, 2021). It operates unorganized, with few associated with cooperative societies, whose role remains outdated (Vaity, 2021).

Migration, food insecurity, and a lack of access to education through school dropouts compound the issues faced by fishers (Bharti, 2022). Moreover, fishing in the Sundarbans is fraught with threats to life, including the peril of tiger attacks (Expert 1 India, personal communication, 24 April 2023). Inadequate access to technology, including electricity and the internet, compounds these challenges, leaving fishers in the Sundarbans disconnected from essential resources and knowledge (Expert 1

India, personal communication, 24 April 2023). In essence, India's small-scale fisheries sector faces an intricate web of environmental vulnerabilities, socio-economic hardships, and systemic neglect that necessitates holistic and targeted interventions to safeguard the livelihoods and well-being of fishing communities. Figure 24 represents adding the layer of existing drivers (text in white areas) and their placement is influenced with their impact on the surrounding actors. This figure shows how the emerging drivers and existing drivers act in synergy affecting the different actors of the SSF value chain of India.

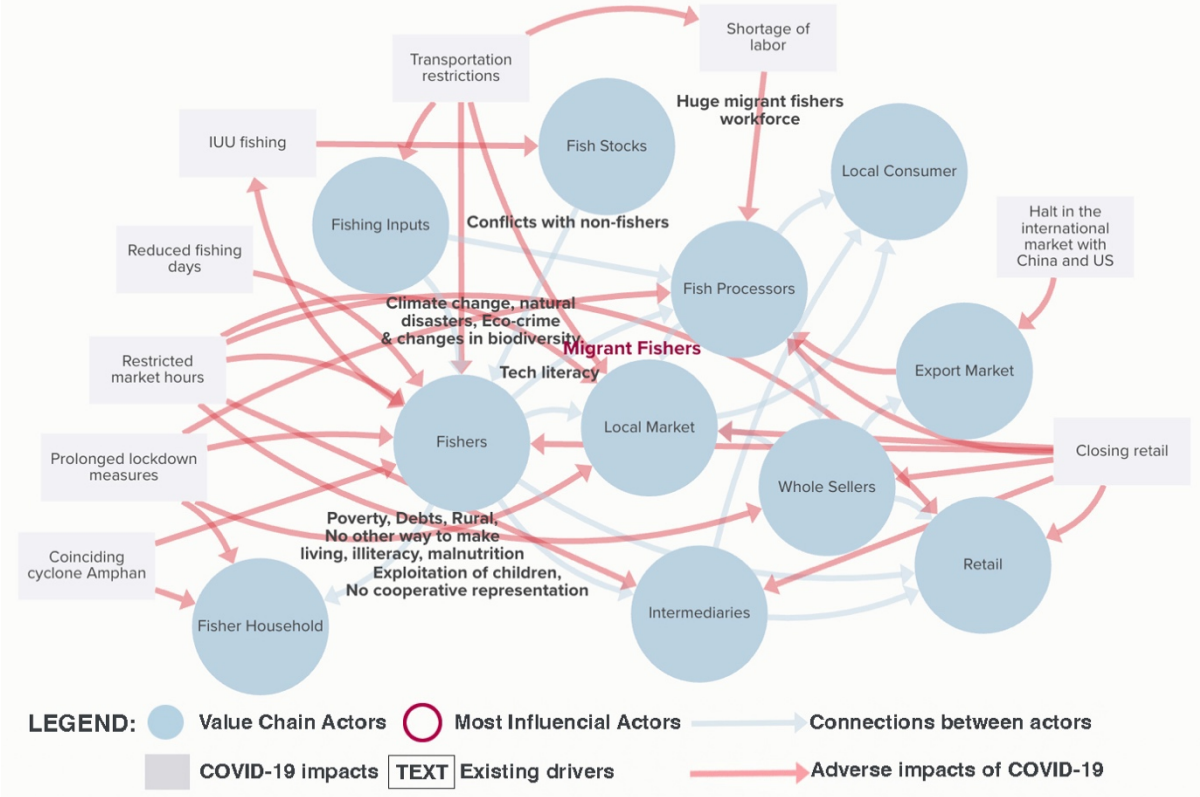


Figure 24: Mapping India SSFs' value chain's emerging and existing drivers of regime shift.

4.3.3.4 Equity, Justice Concerns and Power Dynamics

During the COVID-19 pandemic, the response to lockdown measures and relief efforts varied across Indian states, resulting in heterogeneous impacts on fishery activities, potentially creating disparities (Das et al., 2022). Consequently, the crisis disproportionately affected vulnerable groups within the small-scale fisheries sector, including migrant fishers, laborers, women involved in processing and vending, crew members, and ethnic minorities. Many of these individuals work informally without

protection of labour policy or social safety nets (Mukherjee et al., 2020). Additionally, migrant fishers faced significant challenges during lockdowns, often without notification. Some were forced to remain on fishing vessels with cramped conditions, raising concerns about their living conditions and rights (Expert 1 India, personal communication, 24 April 2023; Mukherjee et al., 2020; Purohit, 2020). As the pandemic-induced lockdowns exacerbated economic hardships for fishers who often live hand-to-mouth, fish catch, logistics, and sales came to a halt (Vaity, 2021), leaving fishers desperate for government assistance. However, the government schemes and information did not reach much unregistered fisherfolk, exacerbating their challenges (Vaity, 2021). As a result, some small-scale fishers resorted to desperate measures during lockdowns as IUU fishing, leading to offences and confiscation of their fishing gear as hunger drove them to breach COVID-19 norms (Expert 1 India, personal communication, 24 April 2023). These stresses were extended to fishers' households, leading to increased domestic violence, physical violence, and gender-based crimes as women faced abuse while confined with frustrated, alcohol-consuming husbands (Expert 1 India, personal communication, 24 April 2023). Furthermore, the fishing community faced issues like school dropouts and child exploitation, affecting the well-being of young individuals (Bharti, 2022).

Another factor that highlights the power dynamics in the Indian SSF value chain is the representation of fisherfolks in committees responsible for fishery management. Those committees favored villagers and forest officials over vulnerable and impoverished fishers, affecting decision-making and resource allocation (Expert 1 India, personal communication, 24 April 2023). Fishers struggle to assert their rights as non-fishers encroach on fishing grounds, often backed by powerful interests, which raises conflicts, loss of fishing rights, and reduced political voice and power (Bharti, 2022). Even governmental aid distribution was marred by favoritism, with local politicians channeling assistance towards favored groups with shared political interests rather than those most in need (Expert 2 India, personal communication, 18 April 2023). Therefore, the pandemic's winners were those who could "work from home" or had easy mainland access to markets and global power groups and federal authorities that influenced international markets benefited the most, while marginalized fishers and sellers suffered (Expert 2 India, personal communication, 18 April 2023).

4.3.3.5 Suggested scales of intervention

Looking into the Indian small-scale fisheries value chain components and the drivers of regime shift presented above, I can identify at least five scales reaching a threshold in the value chain. The first

scale is the local market, which was affected by restrictions on fishing activities, market hours and transportation, thus affecting fishers, fish processors, retailers, whole sellers, and intermediaries (presented by the Blue loop). The second scale is the retail sector, pivotal in the Indian seafood value chain and the main buyer for most harvested and processed products. The closing of restaurants and stores affected the local market, fishers, fish processors, wholesalers, and intermediaries (presented by the Green Loop). The third scale is attributed to a huge migrant workforce within the value chain, creating problems with resource allocation and depleting fish stocks. Also, since the value chain depends on migrant fishers, during the pandemic, with the restrictions on mobility, the value chain suffered from a shortage of labor, especially with fish processing activities (presented by the Orange loop). The fourth scale is attributed to the fishers and their household. The fishers suffer from multiple factors that add to their vulnerability, such as poverty, lack of alternative livelihoods, debts to intermediaries, illiteracy, malnutrition, domestic violence, child exploitation, and lack of accessibility to healthcare. All those factors jointly exacerbated their vulnerability during the pandemic (presented by the Yellow loop). The fifth and last scale is the export market. China and the United States are major importers of Indian seafood products, and with the cessation of international trade in both countries, the export market in India collapsed. This collapse in the international market affected fishers, fish processors, and whole sellers (presented by the Magenta loop). This scenario suggests that those are the critical points of government intervention to mitigate the adverse impacts of COVID-19 on small-scale fisheries in India. Figure 25 represents adding the layer of suggested scales of interventions, the colored loops as explained above. A loop comprises a scale where a group of actors engage together in a certain activity withing the SSF value chain. Each loop or scale is affected by the emerging drivers of COVID-19 (red arrows within the loop) and the existing drivers (text in white areas within the loop).

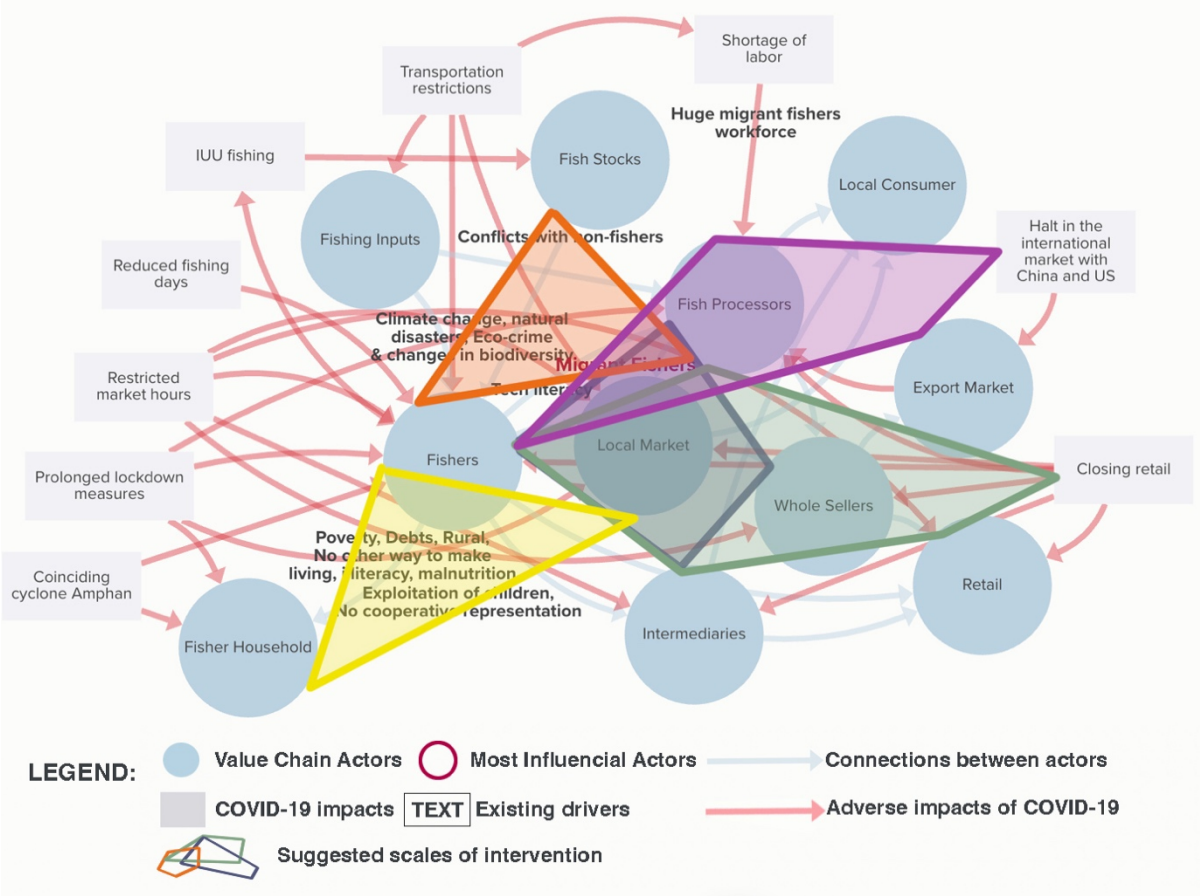


Figure 25: Suggested scales of intervention by the Indian government to mitigate the adverse impacts of COVID-19 on SSFs.

4.3.3.6 Coping and adaptation strategies practiced by fishers and dependent communities

The COVID-19 pandemic brought both negative and positive coping strategies among small-scale fisher (SSF) communities in India. On the negative side, many SSF community members faced significant economic hardships. They were compelled to sell their property, deplete their savings, and borrow money from various sources, including middlemen (Bharti, 2022; Das et al., 2022). The restrictions, including limited access to resources like forests, left some with no option but to take loans to make ends meet (Expert 1 India, personal communication, 24 April 2023). These loans added to their financial burdens, prompting some to send their children to work as laborers elsewhere to earn money and repay the debt (Expert 1 India, personal communication, 24 April 2023).

However, amid these challenges, there were also positive coping strategies employed by SSF communities. In Kerala, India, during the pandemic, local institutions, fisherfolk, cooperative officials, state administration, police, youth, and elders came together to collaborate on village-level initiatives (Lam, 2021). These collaborations resulted in new norms for fish markets, including physical distancing, weight-standardized prices, and fixed first-sale prices negotiated by a multi-stakeholder committee (Lam, 2021). Such multi-stakeholder collaborations have been instrumental in reshaping the ethical development of local fishing economies (Lam, 2021). They resemble the Community Supported Fisheries (CSF) model, aiming for a more equitable, resilient, localized fishing economy that supports local communities and domestic seafood value chains (Lam, 2021).

Moreover, SSF actors demonstrated adaptability and innovation during the pandemic (Bassett et al., 2022). They shifted their focus to local and regional distribution channels, leveraging flexibility and organization and learning to repurpose pre-existing networks and utilize technology (Bassett et al., 2022). Online fish markets gained momentum as physical markets closed, attracting both the younger generation and busy populations with schemes like 'fresh and cleaned' or 'sorted fish,' enabling direct purchases from producers (Expert 2 India, personal communication, 18 April 2023). This shift contributed to local consumption and supported SSF livelihoods.

Furthermore, despite challenges like saltwater infiltration due to natural disasters, landless fishers continued selling their daily catch within their communities (Expert 2 India, personal communication, 18 April 2023). Cyclone Amphan brought devastation, yet the SSF communities endured, waiting for monsoonal rains to remove salinity from their farmlands and ponds and rebuilding their homes with meagre resources (Expert 2 India, personal communication, 18 April 2023). Grassroots organizations and community groups provided essential support during this challenging period (Expert 2 India, personal communication, 18 April 2023). The COVID-19 pandemic led to economic hardships and innovative responses within SSF communities. While challenges like financial burdens and restricted resource access were prevalent, SSF communities in different regions demonstrated resilience through collaboration, adaptability, and innovative approaches to secure their livelihoods and support local economies.

4.3.3.7 Government support during COVID-19

On the positive side, various government initiatives demonstrated a proactive approach. The Indian Council for Agricultural Research (ICAR) introduced a GIS-based information system to monitor fish

landing centers near COVID-19 hotspots, facilitating informed decision-making and prioritizing precautionary measures (Asante et al., 2021). COVID-19 mitigation advisories were released for Indian fisheries, including fishing activities, landing sites, harbors, fish markets, and seafood processing units (Asante et al., 2021). These advisories were essential as there was significant public pressure on the government to keep fisheries operational during the pandemic (Asante et al., 2021). Additionally, different states in India displayed varied but supportive institutional responses (Das et al., 2022). In Bihar, for example, the Department of Fisheries recognized fishing as an essential activity, allowing it to continue within specified time frames (Das et al., 2022). The government's Pradhan Mantri Garib Kalyan Yojana (PMGKY) provided free food grains and pulses to households below the poverty line, serving as a safety net during the lockdown (Das et al., 2022). The relief package from the Indian government included financial support, such as cash transfers to farmers and increased wages for daily laborers (Das et al., 2022).

Furthermore, the government recognized the importance of fisheries by declaring it an essential activity and facilitating the movement of inputs and services during the pandemic (Kumaran et al., 2021). The launch of the Fisheries Development Scheme (PMMSY) with a substantial financial outlay aimed to strengthen the fishery value chain, improve income, generate employment, and ensure economic and social security for fishers and farmers, all while adhering to sustainability principles (Kumaran et al., 2021). Some state governments, such as Andhra Pradesh, negotiated minimum procurement prices for harvested shrimps to support the fishing community (Kumaran et al., 2021). Nonetheless, 67% of those surveyed indicated that the processors declined to comply with the government's set price due to concerns about the subpar quality of the harvested shrimp (Kumaran et al., 2021).

On the negative side, the reach and scale of these government programs were found to be inconsistent and often limited in terms of the amount of financial assistance disbursed (Belton et al., 2021). There were initial uncertainties regarding the categorization of fisheries as essential activities and the supply chain (Vaity, 2021). Notably, there was a communication gap, with government schemes and information not reaching many poor fishermen and women who remained unaware of fisheries' essential commodity status (Vaity, 2021). Furthermore, there were challenges in implementing relief measures at the grassroots level, as reported in the media (Bhavani, 2020). The aid distribution was occasionally marred by favoritism, where local politicians prioritized groups with shared political interests over those in greater need (Expert 2 India, personal communication, 18 April

2023). Representing vulnerable and impoverished individuals in decision-making committees was often inadequate, leading to unequal access to relief resources (Expert 1 India, personal communication, 24 April 2023). In summary, the Indian government implemented positive and negative measures to support SSF communities during the COVID-19 pandemic. While some actions demonstrated a proactive approach to safeguarding the fishing industry and vulnerable populations, others faced issues related to equitable distribution, communication gaps, and political influences at the local level. Figure 26 represents adding the layer of actual scales of interventions, the colored-filled areas as explained above in (Sec. 4.4.3.6) and (Sec. 4.4.3.7). Each colored area represent a governance strategy and its impact on a number of actors, emerging drivers, and existing drivers. Areas that are not color-filled are areas that were not tackled by the Indian government or the SFF communities.

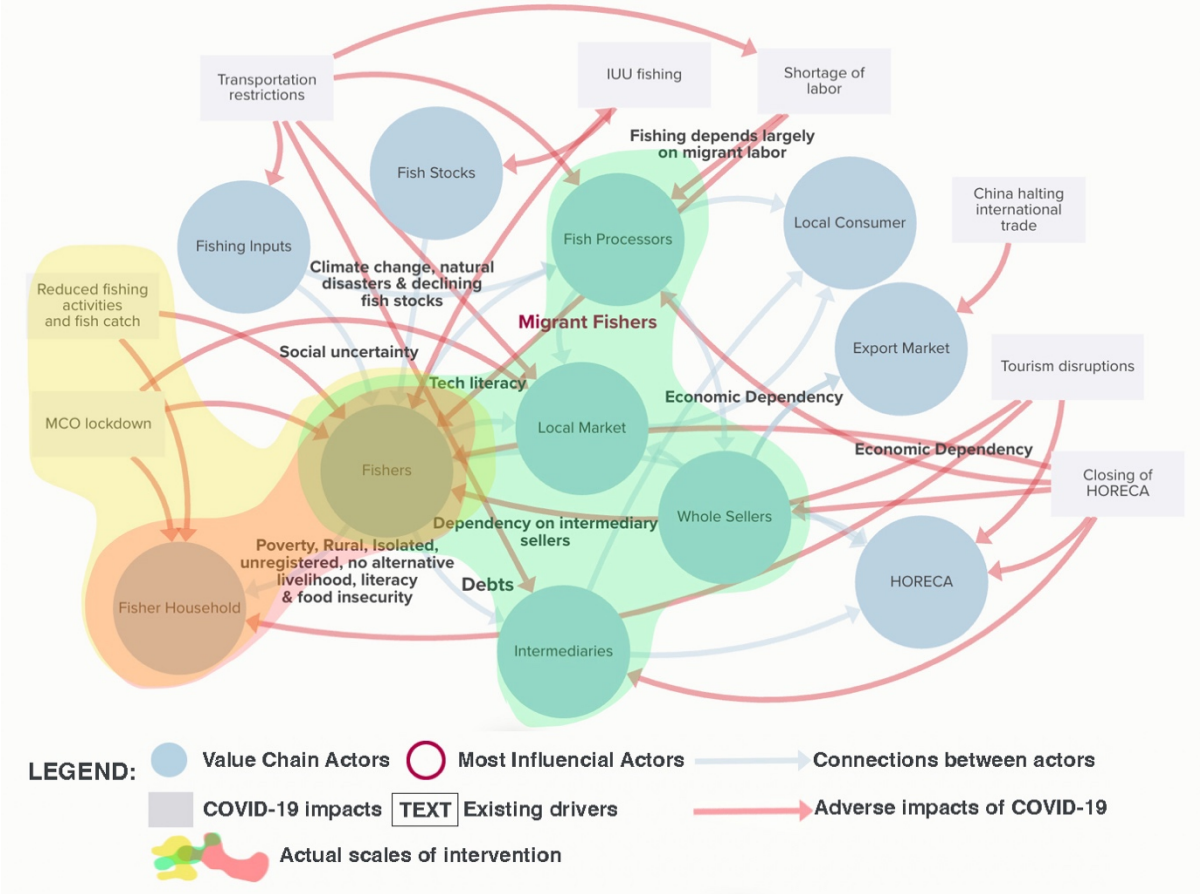


Figure 26: Actual scales of intervention tackled by SSF communities and the Indian Government during COVID-19.

4.3.4 Bangladesh

4.3.4.1 Unit of regime shift

In the value chain of Bangladesh's small-scale fisheries, several key players wield significant influence and power, shaping the dynamics of this vital sector. At the forefront of this chain are the boat owners, who play a central role in the lives of fishers. Boat owners hold substantial power as they provide essential financial support to the fishers. In many cases, these fishers rely on loans from boat owners to finance their fishing expeditions. This financial dependence creates a power dynamic where fishers are somewhat beholden to the boat owners, impacting their autonomy within the industry. Once the fishers have caught their harvest, they often sell their catch directly to the boat owners. These boat owners then step into the next stage of the value chain, acting as intermediaries between the fishers and the broader market. At this point, the boat owners become critical figures in determining the price and distribution of the seafood. Their decisions influence not only the income of the fishers but also the availability and pricing of seafood for consumers.

Then comes the Middlemen, another influential group within this value chain. They often provide loans to fishers as well, mirroring the role of the boat owners. These middlemen are responsible for purchasing fish from the fishers or boat owners, further establishing their presence in the local seafood trade. They play a pivotal role in ensuring that fishers have access to the market and, in doing so, exert a degree of control over the distribution of seafood. Moving further down the chain, whole sellers enter the scene. They buy seafood from boat owners or middlemen and serve as a bridge between the primary producers (fishers) and the retail sector. Whole sellers aggregate seafood from various sources and supply it to retail outlets. Their influence extends to the availability and pricing of seafood in local markets, making them central actors in the value chain.

The retail sector is where the seafood reaches local market shops and consumers. These retailers are responsible for making seafood accessible to the general public, and they play a crucial role in determining prices at the consumer level. The decisions made at this stage shape the availability and affordability of seafood to the average consumer. In addition to the domestic market, the export market is another significant component of Bangladesh's small-scale fisheries. Seafood exports, particularly to countries like China, contribute to the overall economic value of the sector. A notable characteristic of Bangladesh's small-scale fisheries is a substantial number of migrant fishers. These migrants often travel from different regions or neighboring countries to participate in the fisheries

sector. Figure 27 explains Bangladesh's SSF value chain as described above and found in the reviewed literature and interviews conducted. The red circles in figure 28 represents the most influential actors in Bangladesh's SSF value chain.

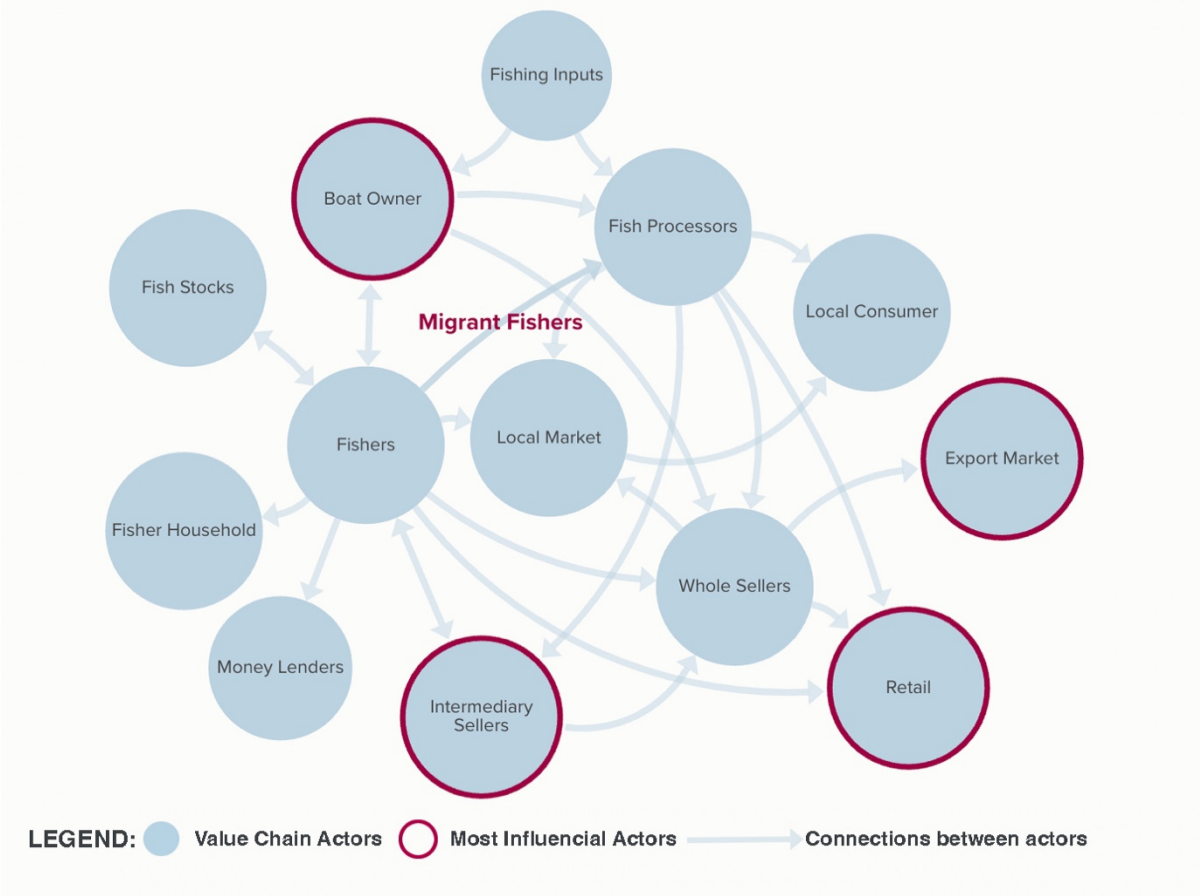


Figure 27: Bangladesh's small-scale fisheries value chain components.

4.3.4.2 Emerging drivers:

The small-scale fisheries sector in Bangladesh underwent a significant regime shift driven by a multitude of challenges brought about by the COVID-19 pandemic. With reduced patrolling and surveillance by law enforcers, illegal fishing activities surged during ban periods, exacerbating the strain on fishery resources (Islam et al., 2021). The disturbance of domestic and export market chains posed further threats to fishers' income, food security, and nutritional well-being (Miah, 2021). Export-oriented seafood processing plants faced closures due to international travel restrictions, especially in China, a major market for crabs, imposing import bans (Hossain et al., 2022; Islam et al.,

2021; Miah, 2021; Sunny, Mithun, et al., 2021; Sunny, Sazzad, et al., 2021). Additionally, government-imposed limitations on gatherings in markets led to reduced buyer presence and small-scale fishers struggling to obtain fair prices for their products (Islam et al., 2021; Miah, 2021; Rosen, 2020; Sunny, Sazzad, et al., 2021). Fish storage and marketing challenges further complicate matters (Islam et al., 2021). The pandemic reduced fishing days and permit allocation by the Bangladesh Forest Department, diminishing the duration of fishers' stay in the Shrimp Management Framework (Hossain et al., 2022).

The lockdown raised concerns about increased violence and gender discrimination (M. M. Islam et al., 2021), with densely populated areas posing significant challenges in combating COVID-19 (Sunny, Sazzad, et al., 2021). The economic hardships faced by fishers forced many to borrow from local money lenders at high-interest rates (Bhowmik et al., 2021; Diba et al., 2022). Government subsidies proved inadequate to support their families, pushing some fishers to resort to illegal fishing, breaching COVID-19 precautions (Diba et al., 2022). As job losses and income reduction spread, demand for aquatic food decreased (Islam et al., 2021; Rosen, 2020; Sunny, Sazzad, et al., 2021). Labour shortages resulting from the inability of migrant workers to travel during the lockdown exacerbated the situation (Hoque et al., 2021; Hossain et al., 2022; Islam et al., 2021; Rosen, 2020; Sunny, Mithun, et al., 2021). Fishers faced limited alternative sources of income during fishing disruptions (Bhowmik et al., 2021). COVID-19 had a detrimental impact on fish production due to input scarcity and a lack of service providers (Sunny, Sazzad, et al., 2021). Maintaining social distancing while harvesting fish became almost impossible (Islam et al., 2021). The closure of restaurants, hotels, tourist spots, and educational institutions decreased fish supply demand (Hoque et al., 2021). The entire fish business ecosystem, including wholesalers, depot owners, processors, packers, and transporters, faced challenges due to supply chain disruptions, restricted transportation, and shortages of goods (Hoque et al., 2021).

Transportation obstacles, delays, and scheduled cancellations hampered the timely supply of aquatic food items (Sunny, Mithun, et al., 2021; Sunny, Sazzad, et al., 2021). Local vehicles, like trucks and pickups, hesitated to transport fish and other materials due to lockdown-related fines, affecting fish landing centers and markets (Sunny, Mithun, et al., 2021; Sunny, Sazzad, et al., 2021). Transportation restrictions and increased transportation costs further impacted fishers, making it challenging to transport their catch (Islam et al., 2021). The lockdown coincided with fishing ban periods, resulting in prolonged non-fishing periods characterized by low fishing rates, reduced

income, lower consumer demand, and escalating debts (Bhowmik et al., 2021; Sunny, Mithun, et al., 2021; Sunny, Sazzad, et al., 2021). Cultural events, such as the surge in Hilsa fish sales during the Bengali New Year and the demand for crab during the Chinese New Year Festival, were also disrupted (Islam et al., 2021). Lastly, the supply of fishing gear became insufficient, further adding to the cost burden (Hoque et al., 2021; Rosen, 2020; Sunny, Mithun, et al., 2021). Figure 28 represents adding the layer of emerging drivers (grey boxes) and their adverse impacts on the value chain actors (red arrows). This figure shows how the emerging drivers reverberated throughout the SSF value chain of Bangladesh.

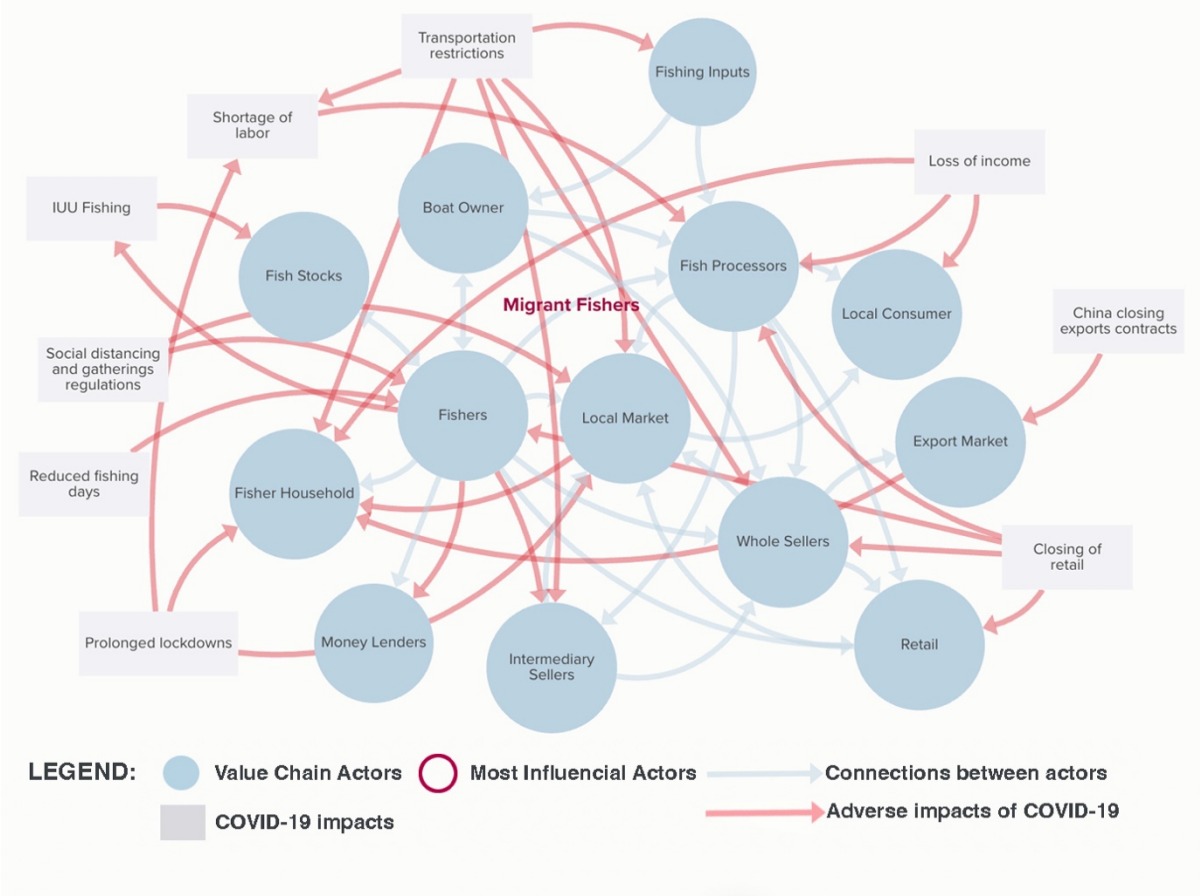


Figure 28: Mapping Bangladesh SSFs' value chain's emerging drivers of regime shift.

4.3.4.3 Existing drivers:

The small-scale fisheries sector in Bangladesh faces a complex array of challenges, central to these challenges is the relentless impact of climate change, which ushers in seasonality and natural disasters

that disrupt the delicate balance of fisheries ecosystems (Hossain et al., 2022; Islam et al., 2021; Miah, 2021; Sunny, Mithun, et al., 2021). Cyclones, tropical storms, droughts, floods, heavy rains, and river erosion ravage the coastal areas, making fishing operations perilous and restricting access to fishing grounds (Diba et al., 2022; Hossain et al., 2022; Sunny, Mithun, et al., 2021; Sunny, Sazzad, et al., 2021). Additionally, the intrusion of tidal activity further complicates matters, resulting in siltation and river erosion, leaving an indelible mark on the fisheries sector (Miah, 2021; Sunny, Mithun, et al., 2021). Overfishing, resource exploitation, and illegal fishing during the ban period have further damaged the resources, undermining its sustainability and jeopardizing fish stocks (Diba et al., 2022; Hossain et al., 2022; Miah, 2021).

The introduction of a 65-day fishing ban period, aimed at increasing the size and sustainability of the Hilsa catch, has had significant repercussions on the livelihoods of Hilsa fishers, pushing them into severe financial constraints (Diba et al., 2022; Hossain et al., 2022; Sunny, Mithun, et al., 2021). The sector operates informally, and is plagued by market fluctuations, dominated by intermediaries and commission agents (Wing, 2020). Fishers find themselves excluded from government support during times of crisis or disaster (Expert 1 Bangladesh, personal communication, 20 April 2023; Expert 2 Bangladesh, personal communication, 30 April 2023), further deepening their vulnerability. Desperation in the face of fishing bans drives fishers to sell off family properties, engage in seasonal migrations, reduce daily food intake, induce family members to seek alternative employment, and resort to high-interest loans from moneylenders and NGOs (Diba et al., 2022; Miah, 2021; Sunny, Mithun, et al., 2021). Limited access to formal credit markets due to the absence of collateral assets pushes fishers towards informal credit mechanisms like the dadon system, trapping them in cycles of debt (Diba et al., 2022; Expert 1 Bangladesh, personal communication, 20 April 2023; Hossain et al., 2022; Miah, 2021; Sunny, Mithun, et al., 2021). Inadequate income and poor housing facilities exacerbate their plight (Sunny, Mithun, et al., 2021; United Nations, n.d.), and a heavy reliance on China as the primary market for crab exports adds another layer of dependency (Sunny, Sazzad, et al., 2021).

The situation is further complicated by malnutrition (Diba et al., 2022) and high literacy rates that, paradoxically, lead to children dropping out of school (Expert 2 Bangladesh, personal communication, 30 April 2023; Hoque et al., 2021; Hossain et al., 2022; Miah, 2021; Sunny, Mithun, et al., 2021). Migration to cities or other countries is often the only recourse, as fishers lack alternative skills or knowledge for other job opportunities (Expert 1 Bangladesh, personal

communication, 20 April 2023; Hossain et al., 2022; Sunny, Mithun, et al., 2021; Sunny, Sazzad, et al., 2021; United Nations, n.d.). Healthcare shortages in rural areas, dominated by informal healthcare providers known as 'Village Doctors,' add to the sector's challenges (Hoque et al., 2021). The scarcity of regular water supply, the peril of fishing in extreme climate conditions, the lack of community-based organizations, inadequate market facilities, and a convoluted market chain further amplify the sector's distresses (Sunny, Sazzad, et al., 2021). Often engaged in processing and marketing, women face gender-based discrimination, social exclusion, poor working conditions, gender-based violence, sexual harassment, and an unpaid household workload (Miah, 2021).

Amidst these challenges, conflicts among fisheries stakeholders, political marginalization, an unsatisfactory law and order situation, and the inadequate distribution of incentives during the ban period further strain the fisheries sector (Miah, 2021; Sunny, Mithun, et al., 2021). Tensions with neighboring countries, such as India and Myanmar, due to the Rohingya crisis add geopolitical complexities to the mix (Expert 1 Bangladesh, personal communication, 20 April 2023). The fishers' voices and agency in decision-making processes around fisheries governance remain limited (Expert 2 Bangladesh, personal communication, 30 April 2023). In conclusion, Bangladesh's small-scale fisheries sector grapples with multifaceted challenges from environmental vulnerabilities, socio-economic hardships, and systemic inadequacies. Figure 29 represents adding the layer of existing drivers (text in white areas) and their placement is influenced with their impact on the surrounding actors. This figure shows how the emerging drivers and existing drivers act in synergy affecting the different actors of the SSF value chain of Bangladesh.

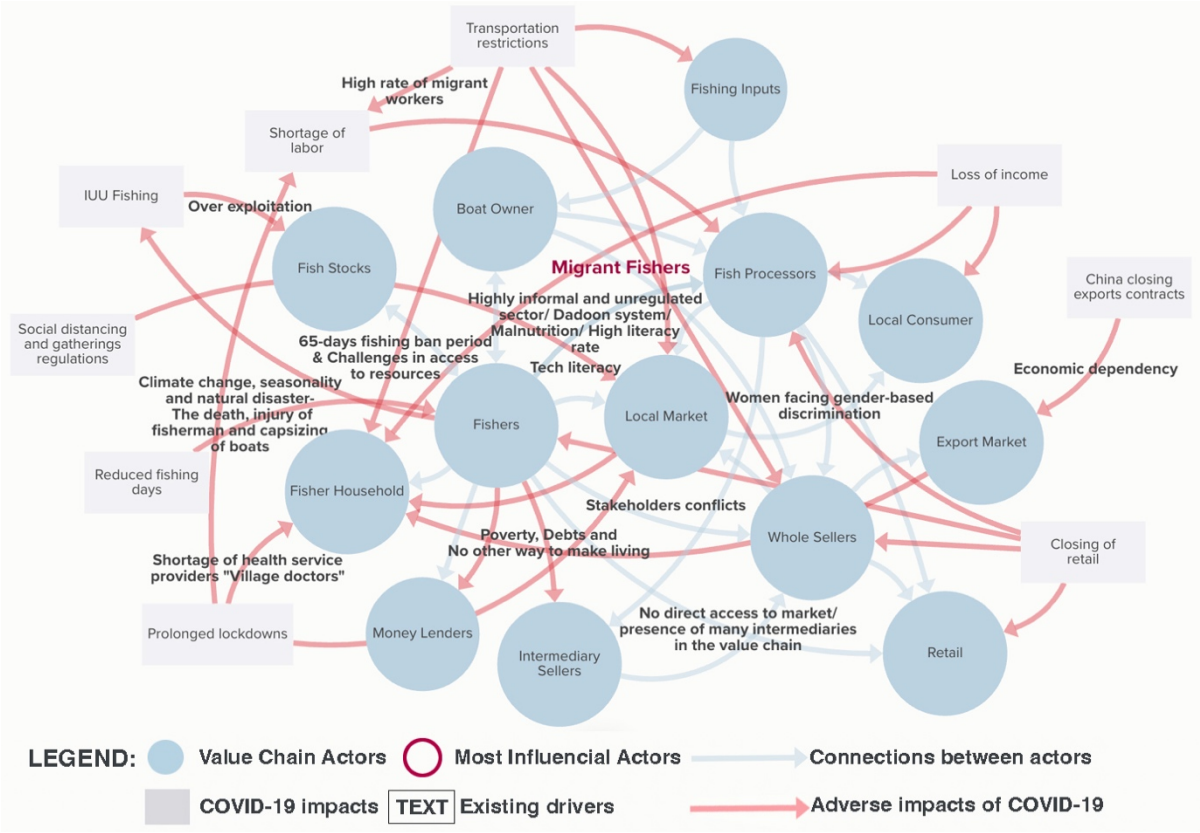


Figure 29: Mapping Bangladesh SSFs' value chain's emerging and existing drivers of regime shift.

4.3.4.4 Equity, justice concerns and Power dynamics

The COVID-19 pandemic and related lockdown measures have disproportionately affected vulnerable groups within the small-scale fisheries sector. Low-income families, children, lactating women, and adolescents faced dietary diversity crises due to restrictions on fishing and selling products, which reduced income and access to essential nutrients (Sunny, Sazzad, et al., 2021). Fishers lost income even before the regular fishing ban, but many did not receive additional relief from the government during the COVID-19 lockdown, further exacerbating their economic challenges (Bhowmik et al., 2021). Government incentive programs have faced challenges regarding timely distribution and inclusion of all eligible fishers. Corruption and mismanagement at the local level have led to favoritism in beneficiary lists (Diba et al., 2022; Sunny, Mithun, et al., 2021). Banks refused to provide loans to fishers, even after they presented the necessary documentation, resulting in a lack of financial support during these challenging times (Islam et al., 2021).

Consequently, fisherfolks sought financial support from boat owners and money lenders. They refrained from seeking loans from non-governmental organizations (NGOs) due to concerns about potential harassment if they failed to repay the loans (Bhowmik et al., 2021). Owing money to boat owners and money lenders put fishers in a vicious circle of debt. Additionally, fishers relied on indigenous knowledge-based treatments and visited village doctors due to concerns about being infected with COVID-19, which highlighted the lack of access to adequate healthcare (Hossain et al., 2022). Moreover, Women, who significantly contribute to the fisheries sector in post-harvest supply chains, are often overlooked and unrecognized in decision-making and policies (Miah, 2021).

Additionally, women have faced greater difficulties managing living expenses and gender-based violence due to reduced income during prolonged lockdowns (Islam et al., 2021). Another layer of equity, justice, and power is magnified by the fishing ban period, which the government aimed to increase the size and volume of the Hilsa fish. Questions have been raised about the transparency of decisions related to fishing bans and their scientific basis. Some stakeholders believe that research on the impacts of these bans is lacking, and there may be hidden assumptions driving policy decisions, especially since neighboring countries are fishing from the same resource all year long (Expert 1 Bangladesh, personal communication, 20 April 2023).

4.3.4.5 Suggested scales of intervention

Looking into the Bangladesh small-scale fisheries value chain components and the drivers of regime shift presented above, I can identify at least six scales reaching the threshold in the value chain. The first scale is attributed to the relationship between the fishers and the boat owners, known as the dadoon system. In this system, the fishers work for the boat owners and sell their fish catch to pay their debts, giving them less power to control their livelihood. During the pandemic, the fishers could not even go fishing, and they could not fulfill their debts to the owners (presented by the Blue loop). The second scale is attributed to the relationship between fish stocks and how the 65-day fishing ban influences them. The fishing ban coincided with the pandemic lockdowns, leaving fishers unable to resume their activities for up to five months.

Unlike the other case studies, Bangladesh was the only country where fishing was not declared as an essential service, and a total fishing ban was in place for a very long time (presented by the Green loop). The third scale is related to fishers' indirect accessibility to the market, where they have to sell their catch to the boat owner, money lenders, or other intermediaries; however, they cannot access the

local market directly. This accessibility problem has affected fishers and fish processors profoundly during the pandemic, with all those intermediaries compounding the process of selling their fish catch (presented by the Orange loop). The fourth scale is related to the livelihood of fishers and their households. These vulnerable communities are adversely impacted by climate change, with more natural disasters occurring and sometimes leading to their death. Not only this, but poverty, debts, lack of alternative livelihood, and limited access to healthcare. These factors contribute to their vulnerability during the pandemic (presented by the Yellow loop). The fifth scale is the retail sector, which buys fish and seafood products from boat owners, intermediaries, fishers, and wholesalers; they provide these products to shops and local markets. The closing of restaurants and stores affected the local market, fishers, fish processors, wholesalers, and intermediaries (presented by the Magenta loop). The sixth and last scale is the export market. China is a major importer of Bangladesh's seafood products, leading to export market collapse with the halting of international trade in both countries. This collapse in the international market affected fishers, fish processors, and whole sellers (presented by the Cyan loop). This scenario suggests that those are the critical points of government intervention to mitigate the adverse impacts of COVID-19 on small-scale fisheries in Bangladesh. Figure 30 represents adding the layer of suggested scales of interventions, the colored loops as explained above. A loop comprises a scale where a group of actors engage together in a certain activity withing the SSF value chain. Each loop or scale is affected by the emerging drivers of COVID-19 (red arrows within the loop) and the existing drivers (text in white areas within the loop).

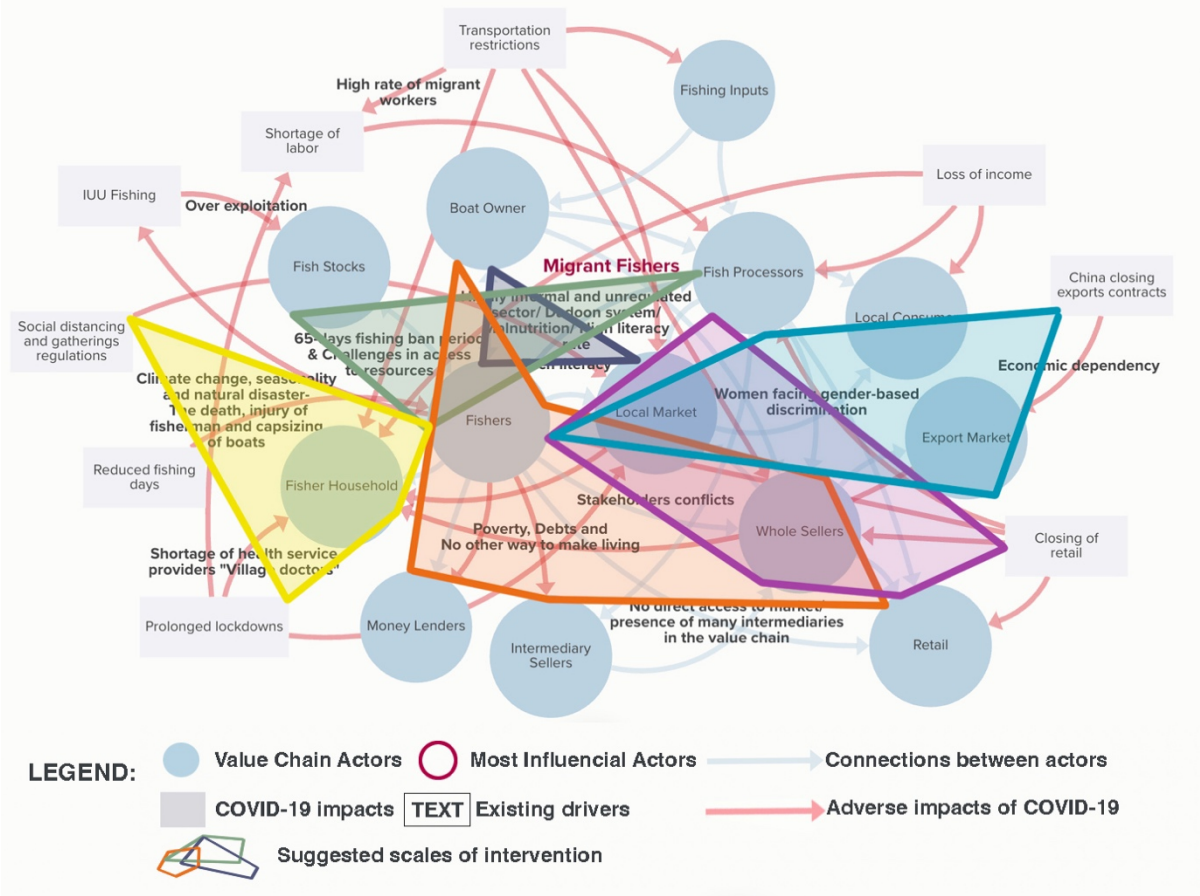


Figure 30: Suggested scales of intervention by the Bangladesh government to mitigate the adverse impacts of COVID-19 on SSFs.

4.3.4.6 Coping and adaption strategies practiced by fishers and dependent communities

During the COVID-19 pandemic, small-scale fishing communities in Bangladesh faced significant challenges. Many of these communities were compelled to make substantial adjustments to their daily lives to endure these trying times. They had to curtail their meal plans and consume more vegetables than fish or meat, leading to imbalanced diets (Miah, 2021). Additionally, they worked as day laborers in agricultural fields and borrowed money from middlemen to purchase essential food and groceries, highlighting the economic strains they endured (Bhowmik et al., 2021; Miah, 2021). Furthermore, the inability to sell their catch forced many fishers to borrow money at high interest rates from local moneylenders (Hossain et al., 2022). These borrowers couldn't secure loans from banks due to inadequate collateral (Hossain et al., 2022). As a result, they resorted to selling key

resources, such as fishing nets and boats. Some engaged in alternative occupations, while others ceased educational expenditures for their children (Hossain et al., 2022). A portion of the community even had to split their extended families, and a few were compelled to arrange marriages for their children as a strategy to alleviate the financial burden brought on by the pandemic (Hossain et al., 2022).

Amidst the challenges, there were also positive adaptations within the fishing communities. Online shopping witnessed a significant surge in popularity due to the imposed restrictions (Expert 1 Bangladesh, personal communication, 20 April 2023). Moreover, aquaculture, which existed before the pandemic but lacked enthusiasm, expanded as a coping strategy (Expert 1 Bangladesh, personal communication, 20 April 2023). Many fishers embraced aquaculture projects, allowing them to raise and sell fish at fixed prices without going to traditional markets (Expert 1 Bangladesh, personal communication, 20 April 2023). This approach offered a window for financial stability during the pandemic.

Furthermore, fisher communities and their families actively participated in alternative livelihood skills training during fishing bans (Expert 2 Bangladesh, personal communication, 30 April 2023). These initiatives included training in mending fishing nets and seeking work in other regions, such as bricklaying and brick pulling (Expert 2 Bangladesh, personal communication, 30 April 2023). Pursuing diverse skills and livelihoods helped them adapt to the challenges brought on by the pandemic (Expert 2 Bangladesh, personal communication, 30 April 2023). Families, especially those with active female members engaged in homestead gardening and other income-generating activities, proved more resilient when both partners possessed diversified skills (Expert 2 Bangladesh, personal communication, 30 April 2023).

4.3.4.7 Government support during COVID-19

Government support to small-scale fisheries (SSF) communities in Bangladesh during the COVID-19 pandemic had positive and negative aspects. On the positive side, the Ministry of Fisheries and Livestock (MoFL), in collaboration with the Division of Information and Communication Technology, took several positive steps to assist SSF communities (Miah, 2021). They launched an online fish buy-sell program, set up information booths in various regions, established helpline numbers for fishers and fish farmers to seek assistance, and introduced mobile fish-selling facilities in cities (Miah, 2021). These initiatives aim to maintain the fisheries' supply chain and helping fishers

find buyers (Miah, 2021). The central government also provided food and monetary support to poor rural people, including small-scale fishermen (Miah, 2021). However, it was acknowledged that these measures, while helpful, were insufficient for those who had lost their income during the lockdowns (Miah, 2021). Another positive aspect was implementing a 4% loan scheme for fishers and fish farmers, with instructions to all government and private banks to provide this financial support (Miah, 2021). Additionally, during the fishing ban periods, the government provided each registered fisher's family 40 kg of rice per month as part of the Vulnerable Group Feeding (VGF) and food security support activity (Miah, 2021). The country had a range of social safety net (SSN) programs, contributing significantly to poverty alleviation before the pandemic, which continued to support vulnerable groups (Bhowmik et al., 2021; Hoque et al., 2021; Islam et al., 2021).

On the downside, the government's imposition of fishing ban periods in Hilsa sanctuary areas significantly negatively impacted the livelihoods of Hilsa fishers (Diba et al., 2022). These bans, known as 'obhijan' or expeditions, placed immense financial constraints on fishers and were a source of desperation (Diba et al., 2022). While an incentive program provided 40 kg of rice per month to Hilsa fishing families during the ban, distributing these incentives was problematic (Diba et al., 2022). Fishers complained about delayed delivery, inadequate quantities, and favoritism in beneficiary selection (Diba et al., 2022). Deserving fishers were often excluded from beneficiary lists, while some non-fishers received benefits intended as incentives to refrain from fishing (Diba et al., 2022). The government subsidies provided were also deemed insufficient to maintain fishers' well-being and were hindered by issues of nepotism (Diba et al., 2022).

The pandemic coincided with the Hilsa conservation ban period, compounding the challenges faced by fishers, as they had limited alternative sources of income (Sunny, Sazzad, et al., 2021). The government's support, while well-intentioned, was often insufficient and subject to nepotism, further exacerbating the struggles of real fishers (Expert 1 Bangladesh, personal communication, 20 April 2023; Expert 2 Bangladesh, personal communication, 30 April 2023; Hossain et al., 2022; Islam et al., 2021; Sunny, Sazzad, et al., 2021). Additional issues emerged, such as mismanagement of assistance, concerns about food quantities provided to large families, inflexible management practices, and instances of violence against fishermen (Expert 1 Bangladesh, personal communication, 20 April 2023; Expert 2 Bangladesh, personal communication, 30 April 2023; Hossain et al., 2022; Islam et al., 2021; Sunny, Sazzad, et al., 2021).

The lack of manpower to enforce fishing regulations and decreased permits from the Bangladesh Forest Department also presented challenges during the pandemic (Expert 1 Bangladesh, personal communication, 20 April 2023). The government of Bangladesh took various measures to support SSF communities during the pandemic, including financial aid, launching online platforms, and introducing loan schemes. However, issues like the distribution of incentives, subsidy adequacy, favoritism, and the imposition of fishing bans brought negative aspects to this support. Figure 31 represents adding the layer of actual scales of interventions, the colored-filled areas as explained above in (Sec. 4.4.4.6) and (Sec. 4.4.4.7). Each colored area represent a governance strategy and its impact on a number of actors, emerging drivers, and existing drivers. Areas that are not color-filled are areas that were not tackled by the Bangladesh government or the SFF communities.

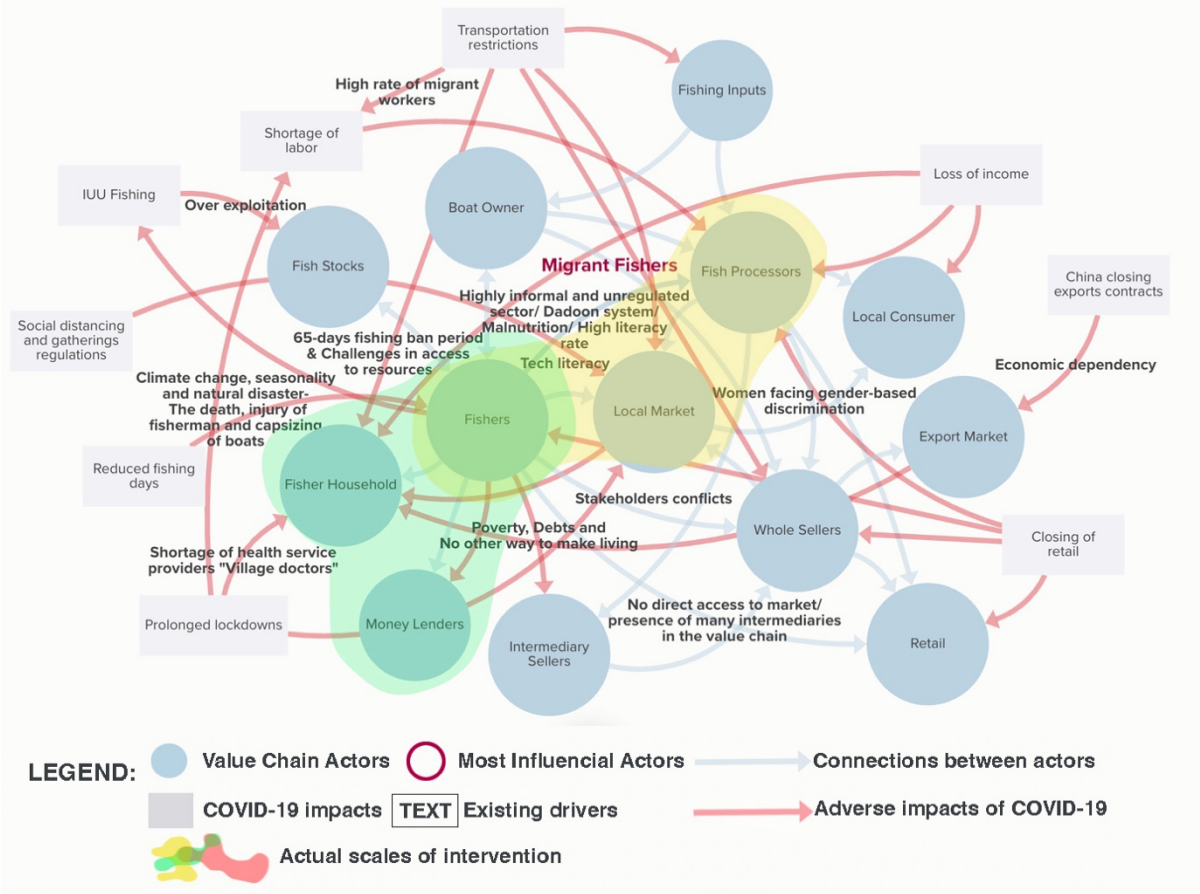


Figure 31: Actual scales of intervention tackled by SSF communities and the Bangladesh Government during COVID-19.

4.3.5 South Africa

4.3.5.1 Unit of regime shift

The local market is its central pillar in the South African small-scale fisheries value chain. The heart of this system lies in the local consumption of harvested fish, representing both sustenance and cultural heritage for many communities. However, a substantial portion of fishers find themselves excluded from this formal market grid. Due to legislative oversights, these unregistered fishers operate in the shadows, their contributions often unacknowledged. They resort to intermediary sellers or engage directly with local consumers to navigate this challenge, forming a vital informal economy. Remarkably, this dynamic isn't confined to men; many women actively participate in this local fish marketing, becoming essential figures.

Additionally, seasonal migrations add a layer of complexity to this narrative, with fishers coming from neighboring countries and towns. Moreover, South Africa's tourism industry is a significant force shaping this value chain, where South African women are involved in hospitality services. Tourism contributes to the demand for fresh seafood, stimulating the local market. Furthermore, South Africa's small-scale fisheries are not confined within national borders. The country participates in the global market through seafood exports and establishes South Africa's presence in the international seafood trade. Figure 32 explains South African SSF value chain as described above and found in the reviewed literature and interviews conducted. The red circles in figure 32 represents the most influential actors in South African SSF value chain.

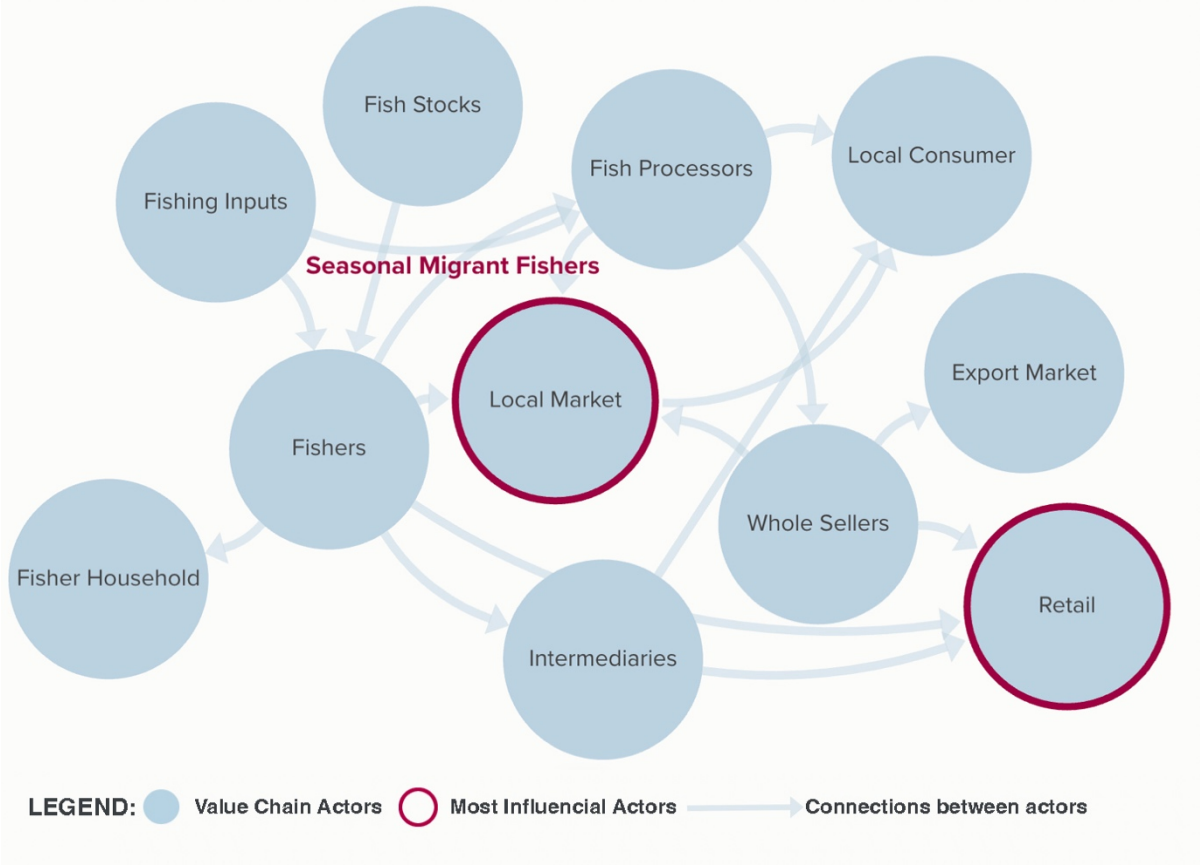


Figure 32: South Africa's small-scale fisheries value chain components.

4.3.5.2 Emerging drivers:

The small-scale fisheries sector in South Africa experienced a significant regime shift, driven by various challenges brought by the COVID-19 pandemic. One notable driver was the surge in illegal fishing activities, with individuals from outside areas exploiting fish resources without permits, often under darkness (Expert 1 South Africa, personal communication, 24 April 2023). Markets on the west and south coasts ground to a halt due to export restrictions, transportation disruptions, and plummeting prices (Isaacs et al., 2022; Isaacs & Nangle, 2021; Mbatha, 2021). The crash of international markets and the dearth of sales to local restaurants caused substantial disruptions to livelihoods and operations across the fisheries sector (Isaacs & Nangle, 2021; Mbatha, 2021; Sowman et al., 2021). The administration of marketing operations became challenging as most processes shifted online, leading to delays in sales and delivery as sector participants had to acquire new skills (Mbatha, 2021).

The pandemic significantly impacted household income, particularly for women who lost job opportunities, especially in tourist-dependent areas (Hall, 2022; Isaacs et al., 2022). Women, often employed in restaurants, guesthouses, and hotels, found themselves either out of work or with reduced hours. This problem put additional strain on fisher households, as they relied on women's income and the seasonal catch by men (Hall, 2022; Isaacs et al., 2022). The closure of schools and food programs further exacerbated the food security challenges faced by these families (Isaacs et al., 2022). Small-scale fishers, coastal or inland, faced increased risk of criminalization as COVID-19 lockdown regulations restricted their fishing ability (Isaacs et al., 2022). The loss of markets, declining incomes, and growing socio-economic insecurity added to their challenges (Isaacs et al., 2022; Isaacs & Nangle, 2021; Mbatha, 2021). This impact extended to street traders, farmers, and fishers catering to low-income consumers, who were hit hardest by income losses during the pandemic (Hall & Wegerif, 2022). Niche high-value hospitality and export markets that had previously been the focus also collapsed (Hall & Wegerif, 2022). Moreover, there was no effective contingency plan for small-scale fishers in a crisis, and the government failed to implement measures to protect their needs and interests (Isaacs & Nangle, 2021).

In the freshwater sector, small-scale fishers could not fish due to the absence of relevant legislation and exemptions (Expert 1 South Africa, personal communication, 24 April 2023). The absence of tourists and reduced demand impacted the sector, while price spikes in staple foods resulted from supply disruptions and demand fluctuations due to income losses (Hall, 2022; Mbatha, 2021). Temporary border closures and travel restrictions increased operating costs, further straining the sector (Mbatha, 2021). Fishers were also hampered by the closure of borders and travel restrictions within the country, preventing access to different fishing grounds and inland markets (Hall, 2022). For fishers reliant on seasonal migration, the prohibition on travel and closure of accommodations disrupted the traditional and culturally significant snoek run in the northern and western Cape, profoundly affecting fisheries in those regions (Sowman et al., 2021). Figure 33 represents adding the layer of emerging drivers (grey boxes) and their adverse impacts on the value chain actors (red arrows). This figure shows how the emerging drivers reverberated throughout the SSF value chain of South Africa.

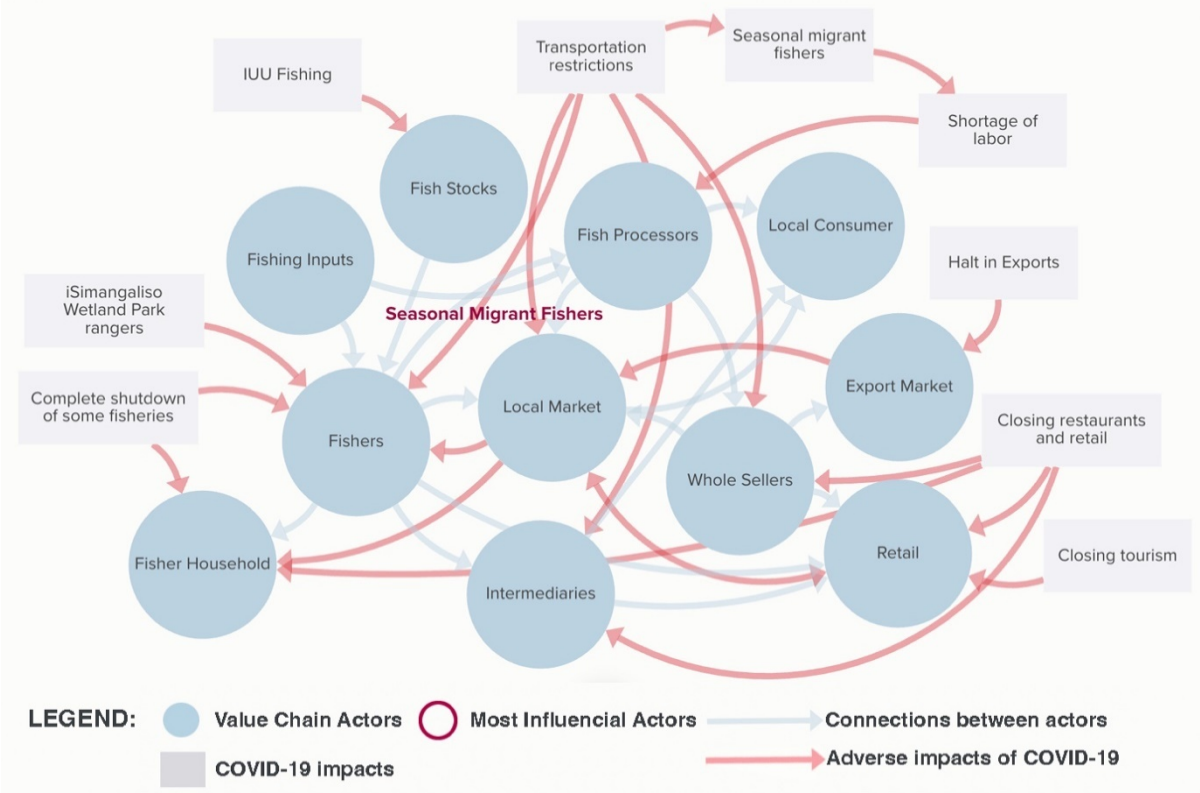


Figure 33: Mapping South Africa SSFs' value chain's emerging drivers of regime shift.

4.3.5.3 Existing drivers:

The small-scale fisheries sector in South Africa is faced by climate change impacts, which alter local socio-ecological systems, leading to fluctuations in fish availability and shifts in species distribution (Sowman et al., 2021; Sowman & Sunde, 2021). The impacts of climate change are exacerbated by the vulnerability of small-scale fishers, who face systemic marginalization, racial discrimination, and high poverty levels, compounded by a lack of access to basic services (Isaacs & Nangle, 2021; Sowman et al., 2021). With limited social protection, these fishing communities are ill-prepared to cope with sudden shocks, relying heavily on fisheries for sustenance and income (Sowman & Sunde, 2021).

Inequities in governance arrangements and resource access fuel tensions within the sector, aggravated by the government's failure to recognize small-scale fishers in the fisheries legal regime (Sowman & Sunde, 2021). The establishment of the Directorate of **s**mall-**s**cale **f**isheries Management in 2013, responsible for policy implementation, lacked a structured platform for collaboration

between government, small-scale fishers, NGOs, and researchers, leaving many fishers excluded due to information gaps and logistical constraints (Sowman & Sunde, 2021; The Conversation, 2022a). Furthermore, thousands of fishers still do not benefit from the **s**mall-**s**cale **f**isheries (SSF) Regulations, as the government's narrow interpretation of eligibility criteria and misalignment of policies continue to exclude them (Sowman & Sunde, 2021). Historical legacies, rooted in colonial and apartheid practices, persist, prioritizing recreational fishing on public 'lands' and further marginalizing rural communities (Isaacs et al., 2022; The Conversation, 2022b).

High levels of crime and drug-related issues plague SSF communities, with youth engaging in illegal fishing linked to organized crime (Sowman & Sunde, 2021). Malnutrition, tuberculosis, and HIV/AIDS are prevalent, compounded by disparities in education levels across regions (Mbatha, 2021; Sowman et al., 2021). Food insecurity, inadequate healthcare, and insecure tenure rights exacerbate the hardships faced by millions of impoverished South Africans (Sowman et al., 2021). Diminishing fish stocks, competition from foreign industrial fleets, illegal fishing, governance instability, a thriving informal economy, and inadequate infrastructure compound the challenges confronting small-scale fishers (The Conversation, 2022b).Moreover, limited access to the internet and formalized markets further hinder their prospects (Expert 1 South Africa, personal communication, 24 April 2023). In conclusion, the small-scale fisheries regime shift in South Africa is imperative to address the intersecting challenges posed by climate change, social inequities, governance deficits, and economic vulnerabilities. Figure 34 represents adding the layer of existing drivers (text in white areas) and their placement is influenced with their impact on the surrounding actors. This figure shows how the emerging drivers and existing drivers act in synergy affecting the different actors of the SSF value chain of South Africa.

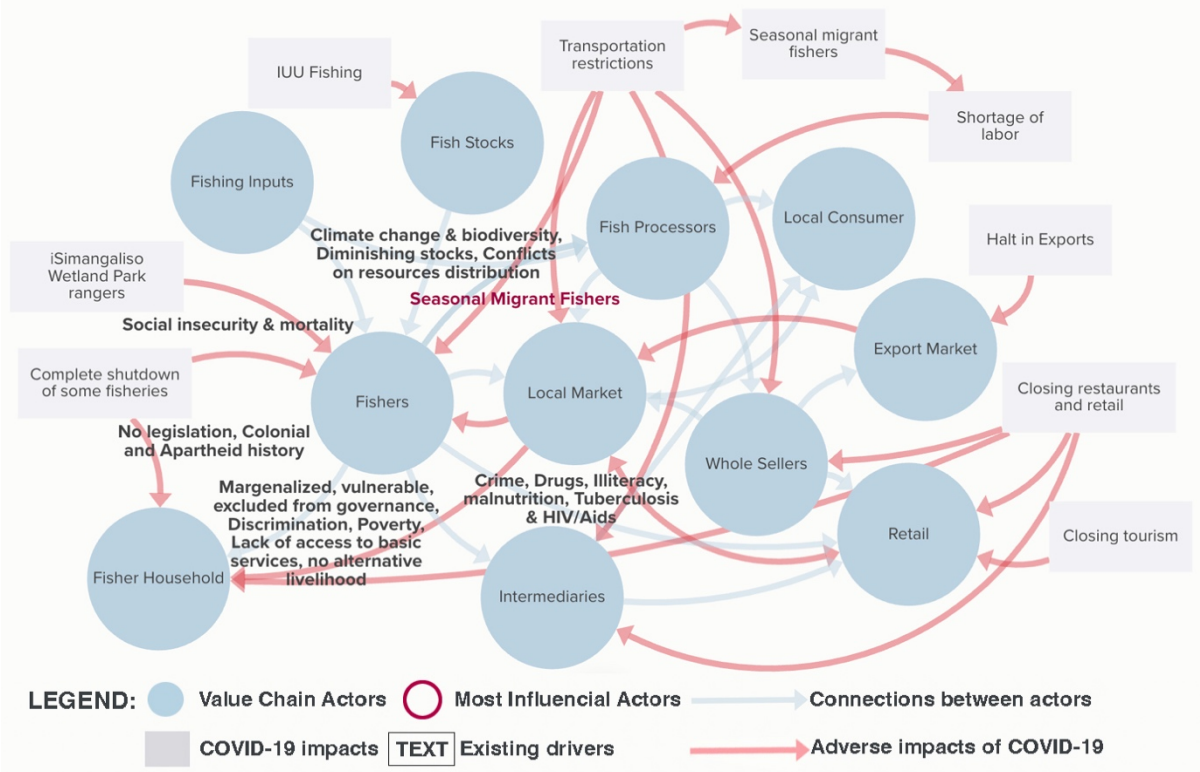


Figure 34: Mapping South Africa SSFs' value chain's emerging and existing drivers of regime shift.

4.3.5.4 Equity, Justice Concerns and Power Dynamics

Small-scale coastal and inland fishers represent a marginalized and vulnerable group. During the pandemic, lockdown regulations further restricted their ability to fish. They were unregistered fishers and were excluded from formal exemption as an essential service, forcing them to operate using recreational permits, which posed big challenges (Mbatha, 2021). This disparity has also pushed them toward breaking the lockdown rules and facing criminalization (Isaacs et al., 2022; Mbatha, 2021). Reports indicate harassment and arrests of fishers from poor rural communities during lockdowns and receiving support from scholar-activists and legal NGOs to get them out of prison or release their confiscated gear (Sowman et al., 2021). Government measures during the pandemic showed little consideration for the contributions of small-scale fishers while favoring industrial fisheries and farmers from the agriculture sector (Isaacs et al., 2022). Small-scale fishers did not receive government relief, unlike small-scale farmers, who received various support forms (Isaacs et al., 2022).

Additionally, discrepancies in aid distribution emerged, with many communities receiving little to no support, highlighting the injustices within the governance system (Mbatha, 2021). The government's decision to provide only one round of food parcels to registered small-scale fishers created conflicts, leaving many unregistered individuals without benefits (Isaacs & Nangle, 2021). Decision-making around policies and regulations often excluded small-scale fishers, leaving their interests underrepresented (Isaacs & Nangle, 2021).

Historical practices have led to the exclusion of rural communities, mostly people of color, from accessing fish resources, primarily benefiting recreational anglers (Isaacs et al., 2022). The failure of the government to recognize small-scale fishers within the fisheries' legal regime led to their exclusion and disputes over governance arrangements, resource access, and policy interpretation (Sowman & Sunde, 2021). The Directorate of Small-Scale Fisheries Management lacked a formal structure where stakeholders, including small-scale fishers, NGOs, and researchers, could collaborate on plans and implementation with a significant number of fishers excluded from formal rights allocation processes due to a lack of understanding and access to complex government-driven administrative processes (Sowman & Sunde, 2021).

Furthermore, women in the sector faced increased responsibilities, including childcare, during school closures, impacting their livelihoods and well-being (Hall, 2022). The pandemic exacerbated gender inequalities within the sector, particularly affecting women mainly employed in supporting roles in the fisheries, such as restaurants, guesthouses, and hotels (Isaacs et al., 2022). Rural women often faced heightened challenges with weaker land rights and fewer resources (Hall & Wegerif, 2022). Women involved in cleaning and marketing fish did not qualify for relief or social protection, such as unemployment benefits (Sowman et al., 2021). However, public funds and relief programs were often accessible to more formal businesses, better-educated actors, and men, sidelining others (Hall, 2022).

4.3.5.5 Suggested scales of intervention

Looking into the South African small-scale fisheries value chain components and the drivers of regime shift presented above, I can identify at least five scales reaching the threshold in the value chain. The first scale is the living conditions and livelihoods of fishers. These vulnerable communities are excluded from legislation; they lack accessibility to basic infrastructure, social security, education, and alternative livelihoods. These vulnerabilities lie deep within the society that suffers from

malnutrition, crime and diseases such as Tuberculosis and HIV/Aids. Not only this, but they also suffered from discrimination since the apartheid period (presented by the Blue loop). The second scale is fishing as a practiced profession, as fishers face problems being unregistered and unrecognized by the legislation and government. This situation made them clueless during the lockdowns because they were not exempted from fishing restrictions like other registered fishers. Also, they did not receive relief packages to alleviate financial stresses during the pandemic (presented by the Green Loop). The third scale is the implications of the transportation restrictions as all value chain intermediaries depend on it to market fish and sell it. Transportation restrictions have stopped the local market (presented by the Orange loop). The fourth scale is the halt of tourism activities, which affected the retail sector, thus affecting the local market and fishers. The impact of the tourism halt has extended to the well-being of women in the sector as they are involved in fish marketing, fish processing and hospitality (presented by the Yellow loop). The fifth scale is the export sector;. However, it is not that significant, it impacts the fishers, fish processors and intermediary sellers in the value chain (presented by the Magenta loop). This scenario suggests that those are the critical points of government intervention to mitigate the adverse impacts of COVID-19 on small-scale fisheries in South Africa. Figure 35 represents adding the layer of suggested scales of interventions, the colored loops as explained above. A loop comprises a scale where a group of actors engage together in a certain activity withing the SSF value chain. Each loop or scale is affected by the emerging drivers of COVID-19 (red arrows within the loop) and the existing drivers (text in white areas within the loop).

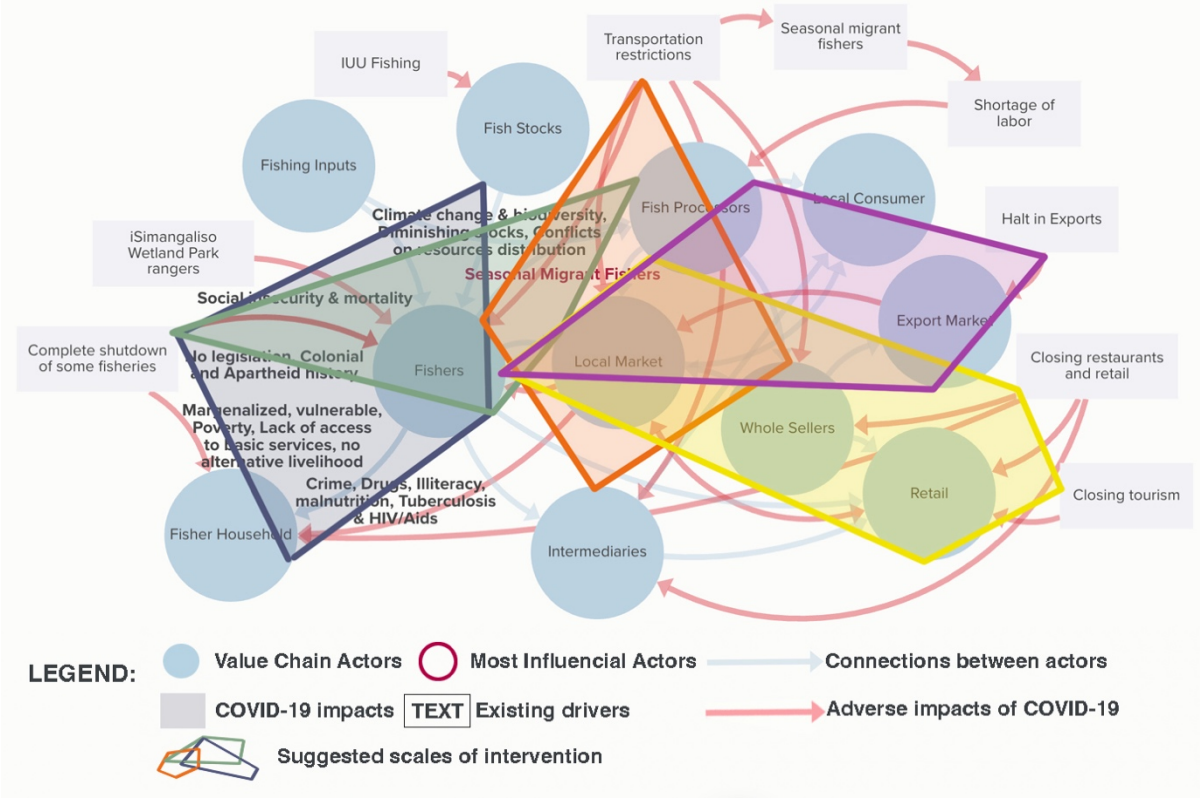


Figure 35: Suggested scales of intervention by the South African government to mitigate the adverse impacts of COVID-19 on SSFs.

4.3.5.6 Coping and adaptation strategies practiced by fishers and dependent communities

South Africa's SSF communities faced numerous challenges during the COVID-19 pandemic. There was an initial period of fear and caution in rural areas when the pandemic began (Expert 1 South Africa, personal communication, 24 April 2023). However, as the weeks passed and people began to experience hunger, they started disregarding restrictions and went fishing to sustain themselves (Expert 1 South Africa, personal communication, 24 April 2023). The economic impact of the pandemic hit the fisheries sector hard, with international markets crashing and sales to local restaurants declining significantly (Mbatha, 2021). Many in the sector had to adapt by turning to retail and online sales, which came with challenges (Mbatha, 2021). This shift to online marketing led to delays in sales and deliveries, as individuals in the sector had to acquire new skills and adapt to the changing landscape (Mbatha, 2021).

South Africa implemented several positive coping strategies, too. The reductions in worker numbers, coupled with the use of technology and innovation, allowed many to shift from wholesale markets to retail and online markets (Mbatha, 2021). This adaptability and technological shift helped mitigate some economic impacts (Mbatha, 2021). Additionally, in the small-scale fisheries sector, efforts focused on establishing food banks and mobilizing fishers to assist the more vulnerable members of their communities (Mbatha, 2021). These efforts involved sharing resources and vital information and fostering a sense of community support (Mbatha, 2021). Within the SSF communities, there was a remarkable increase in solidarity across coastal areas (Sowman et al., 2021). Fishers played a significant role in creating and supplying pop-up food kitchens, ensuring that fish was distributed to poor communities (Sowman et al., 2021). Women leaders actively lobbied fisher associations and the government to ensure that fishers could travel and that fish reached those in need (Sowman et al., 2021). Additionally, fisher projects using information and communication technologies (ICTs) empowered fishers to pivot from restaurant-based markets to local community-based fisheries, enabling cross-subsidizing sales in rural and urban areas (Sowman et al., 2021). New networks of fishers provided information, legal advice, and legal support, allowing them to challenge their exclusion and participate in online meetings (Sowman et al., 2021).

In summary, while South Africa's SSF communities faced significant challenges during the COVID-19 pandemic, they demonstrated resilience and adaptability through various positive coping strategies. These included technological shifts, community support, and empowerment through ICTs, allowing them to navigate the complex and changing landscape of the pandemic.

4.3.5.7 Government support during COVID-19

During the COVID-19 pandemic, the Food and Agriculture Organization (FAO) advocated for fishing to be considered an essential service when imposing mobility restrictions (Sowman et al., 2021). The South African Department of Forestry, Fisheries, and the Environment (DFFE) recognized this recommendation by issuing exemptions from lockdown restrictions for all commercial and SSFs with valid fishing permits under the Marine Living Resources Act (MLRA) (Sowman et al., 2021). Additionally, in some provinces like KwaZulu-Natal, the Eastern Cape, and the Western Cape, the government provided food parcels to registered small-scale fisheries during the hard lockdown, offering vital support to these communities (Mbatha, 2021). Furthermore, the government extended

support to small-scale farmers through vouchers for inputs, subsidies, and grants during the pandemic (Isaacs & Nangle, 2021).

While the government's efforts were commendable, its response had several negative aspects. Although recognized as "essential service providers" during the pandemic, travel and accommodation bans prevented small-scale fishers from earning their livelihoods, highlighting a lack of consideration for their complex role in the national food system (Isaacs & Nangle, 2021). Ironically, this essential service designation made them ineligible for unemployment insurance or COVID-19 relief funding because they are unregistered and unrecognized by state regulations (Sowman et al., 2021). The relief available to registered SSF fishers was limited to a once-off, state-funded food parcel, excluding thousands of unregistered fishers (Isaacs & Nangle, 2021). This exclusion sparked conflict within communities and underscored the inequalities and injustices in the sector's governance (Isaacs & Nangle, 2021). Additionally, government actions encouraged some small-scale fishers to sell their catch to industrial fishing companies, perpetuating economic dependence on the industrial sector (Isaacs & Nangle, 2021). The lack of cold storage facilities forced small-scale fishers to sell immediately upon landing, regardless of the price offered, revealing imbalances in the informal and formal markets (Isaacs & Nangle, 2021).

Figure 36 represents adding the layer of actual scales of interventions, the colored-filled areas as explained above in (Sec. 4.4.5.6) and (Sec. 4.4.5.7). Each colored area represent a governance strategy and its impact on a number of actors, emerging drivers, and existing drivers. Areas that are not color-filled are areas that were not tackled by the South African government or the SFF communities.

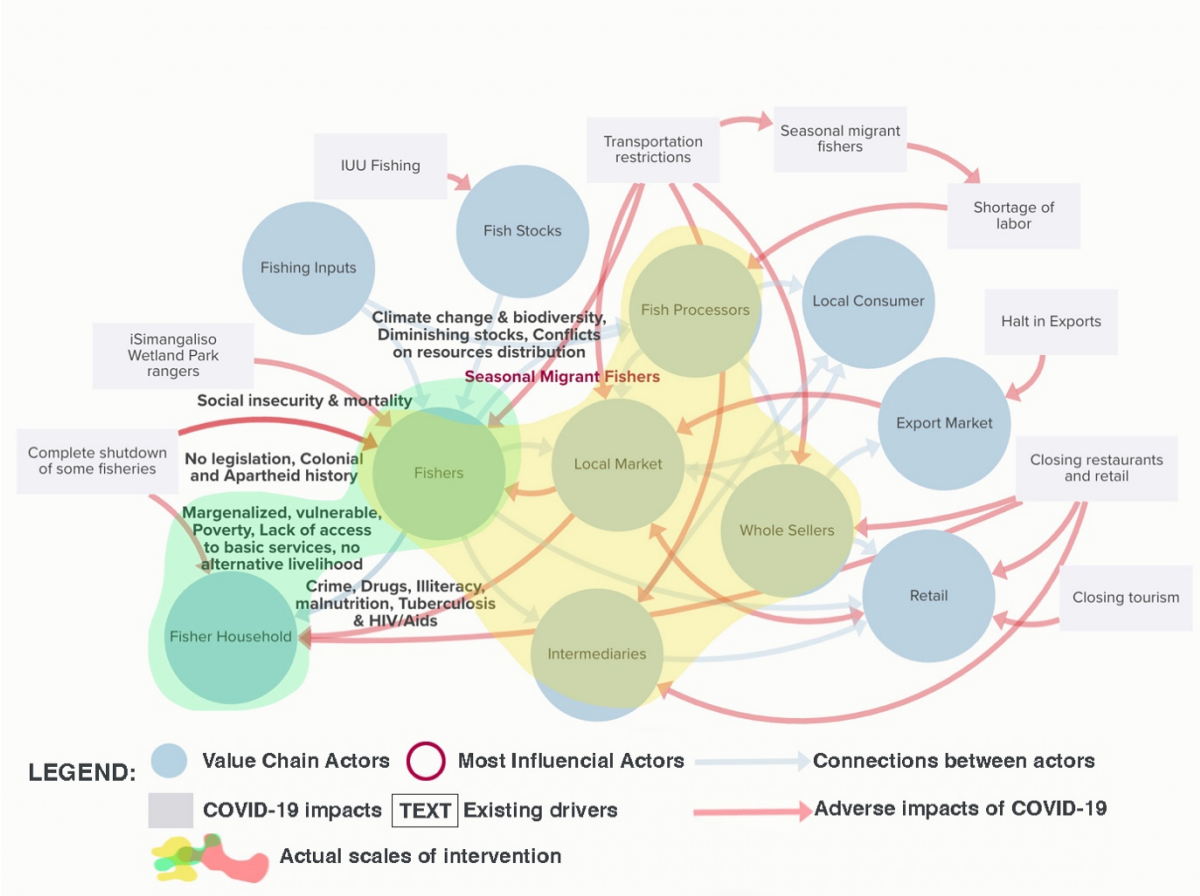


Figure 36: Actual scales of intervention tackled by SSF communities and the South African Government during COVID-19.

4.3.6 Senegal

4.3.6.1 Unit of regime shift

In Senegal, the value chain of small-scale fisheries is a dynamic and interconnected network that plays a crucial role in the country's economy and livelihoods. The landing sites are at the heart of this chain, which serve as the primary market space for selling fish. Fishmongers, local consumers, and wholesalers gather to purchase the day's fresh catch. The landing sites are a bustling activity hub, where many artisanal fishers' livelihoods are intertwined with the local market. Fishmongers are a pivotal component of Senegal's small-scale fisheries value chain. They serve as intermediaries, purchasing fish catches directly from the landing sites. These individuals play a significant role in the distribution of seafood products. They are responsible for selling to local markets and act as money

lenders to artisanal fishers, providing critical financial support to sustain fishing activities. One distinctive feature of Senegal's small-scale fisheries value chain is the prominent role of women. Women are powerful and influential actors, particularly in fish processing and marketing. They are active in various regions of the country, working diligently to transform fresh catches into processed fish products ready for sale. This involvement highlights women's economic empowerment within the sector and underscores their contribution to its success.

Wholesalers are essential players in the value chain as well. They source fish from landing sites and fishmongers, bridging the primary market and broader distribution channels. These wholesalers often supply fish to export markets, contributing to Senegal's position as a seafood exporter to neighboring countries, including Guinea, Burkina Faso, Mali, and Ghana. Retailers, another key component, purchase fish from fishmongers and wholesalers to serve local markets, shops, hotels, and restaurants. Their role ensures that fresh and processed fish products reach consumers across Senegal. The retail sector significantly contributes to meeting local demand for seafood, reflecting the diversity of the nation's culinary traditions.

Furthermore, Senegal's small-scale fisheries sector extends beyond its borders through exports. The country exports fish and seafood products to neighboring nations, strengthening regional trade ties and contributing to economic growth. This cross-border exchange underscores Senegal's significance as a seafood supplier in the West African region. Figure 37 explains Senegalese SSF value chain as described above and found in the reviewed literature and interviews conducted. The red circles in figure 37 represents the most influential actors in Senegal SSF value chain.

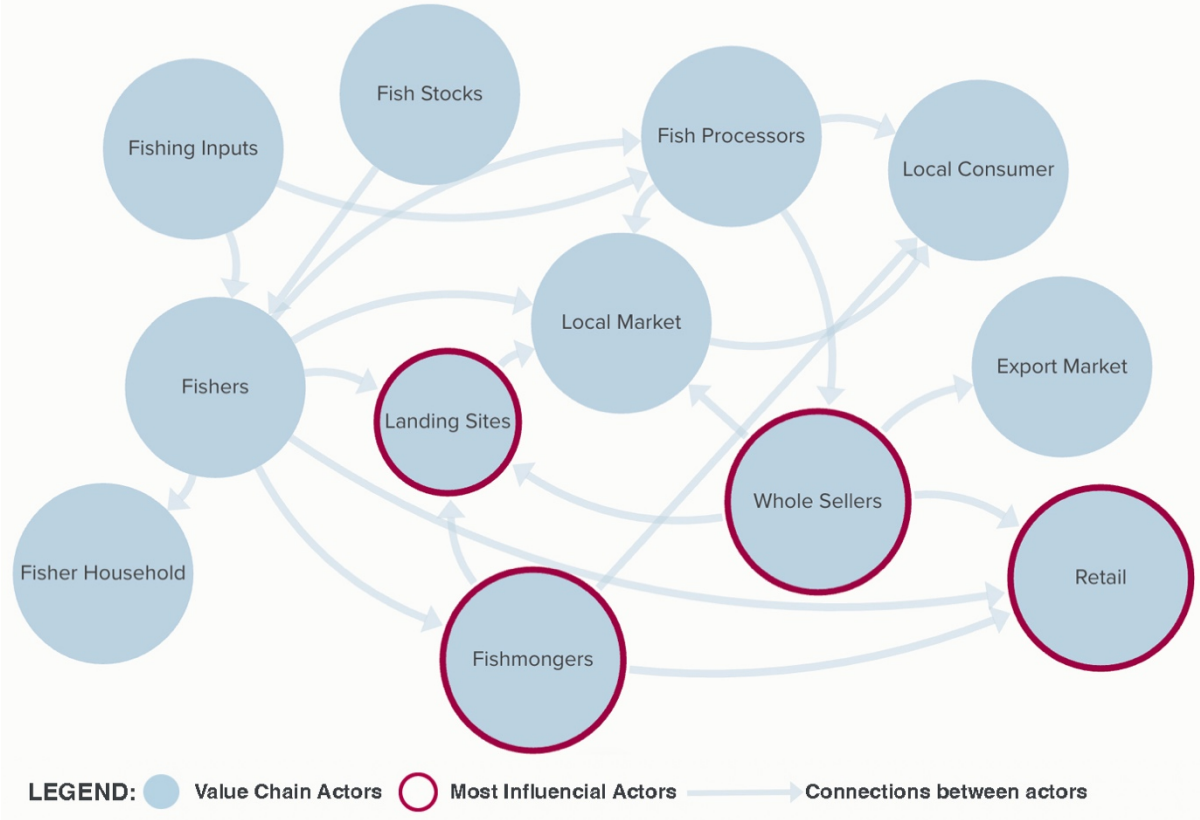


Figure 37: Senegal's small-scale fisheries value chain components.

4.3.6.2 Emerging drivers:

The small-scale fisheries sector in Senegal has witnessed a significant regime shift driven by various challenges with far-reaching consequences. One of the foremost drivers has been the difficulties in accessing fishing resources. The presence of Chinese and Russian fleets engaging in large-scale fishing has raised concerns among civil society and fishermen's organizations, as these fleets harvest substantial quantities of fish, both demersal and pelagic (Camara et al., 2023; Expert 1 Senegal, personal communication, 2 April 2023). This influx of foreign vessels has exacerbated illegal, unreported, and unregulated fishing (Pille-Schneider, 2020). The closure of borders during the pandemic froze the export circuit, severely impacting the sector (Mbaye et al., 2022). Barriers to market access further compounded the situation. Safety measures and social distancing made it challenging for fishers to interact with buyers and sell their catches (Camara et al., 2023; Expert 1 Senegal, personal communication, 2 April 2023). Additionally, alternative markets to landing sites were virtually non-existent (Expert 1 Senegal, personal communication, 2 April 2023).

This regime shift has brought about a range of socio-economic challenges. Food insecurity, job losses, and income reduction have become prevalent concerns (Camara et al., 2023; Expert 2 Senegal, personal communication, 24 April 2023). Changes in the operating hours of fishing ports, coupled with delays in landing catches, have constrained fish traders' ability to sell their products (Camara et al., 2023; Expert 1 Senegal, personal communication, 2 April 2023). Fishers have had to adapt to new work routines, adhering to curfews and limitations on their sailing distances. They are also no longer able to fish in the waters of neighboring countries (Cederstrom, 2020). This disruption has significantly reduced fishing time, with fishermen working only three days a week compared to seven before the crisis (Traore, 2020). Consumer demand has changed, and the supply of fresh fish in local markets has diminished, increasing prices, particularly for species like Sardinella (Camara et al., 2023; Cederstrom, 2020). Access to fishing areas has become increasingly challenging due to time constraints, leading to losses of surpluses intended for processing. The slowdown in the flow of fish products has impacted wholesaling, and there has been a decrease in landings due to various factors, including reduced crew sizes, fewer sea trips, and closures of maritime borders (Camara et al., 2023; Expert 2 Senegal, personal communication, 24 April 2023). Key landing areas have been closed, halting fish movement through these points (Cederstrom, 2020). Furthermore, fish trading has experienced a slowdown, with fish traders and customers withdrawing from the market, frozen exports of fresh and processed products, and a drop in commercial prices (Expert 2 Senegal, personal communication, 24 April 2023).

The curfew imposed during the pandemic has had a profound impact on the small-scale fisheries sector, disrupting fishing hours, limiting production areas, and reducing overall production, particularly during the high season (Camara et al., 2023; Expert 2 Senegal, personal communication, 24 April 2023; Mbaye et al., 2022). Notably, border closures have had the most significant impact on artisanal fishing, further exacerbating the challenges faced by the sector (Expert 2 Senegal, personal communication, 24 April 2023). Figure 38 represents adding the layer of emerging drivers (grey boxes) and their adverse impacts on the value chain actors (red arrows). This figure shows how the emerging drivers reverberated throughout the SSF value chain of Senegal.

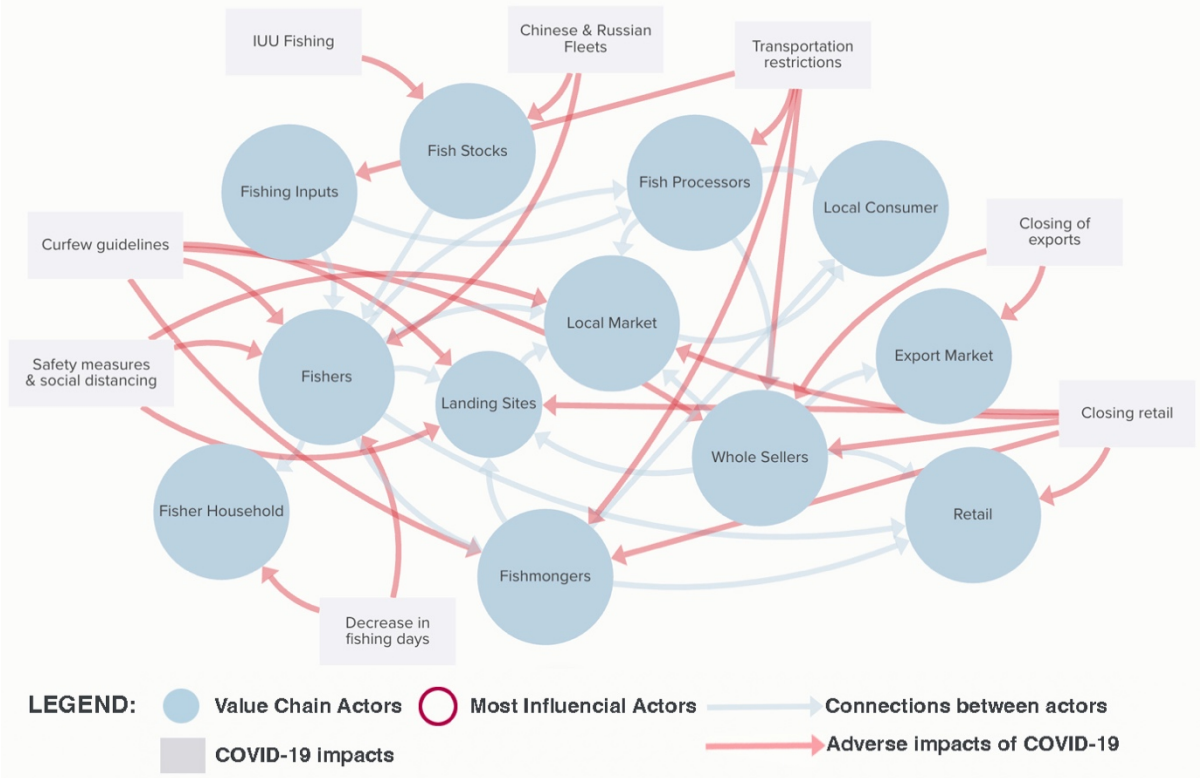


Figure 38: Mapping Senegal's value chain emerging drivers of regime shift.

4.3.6.3 Existing drivers:

One of the foremost drivers is the impact of climate change, which has led to coastal erosion, habitat degradation, the emergence of rare and endangered species, and a decline in vital mangrove areas (Mbaye et al., 2022). These environmental changes are affecting the availability and behavior of important fish species, including Sardinella Arita, which constitutes a substantial portion of the country's fishery production and is essential for the traditional processing sector, predominantly led by women (Expert 1 Senegal, personal communication, 2 April 2023). However, climate change specialists often overlook these changes' cultural and social dimensions, sometimes undermining the profound connection between fishers and the sea (Expert 1 Senegal, personal communication, 2 April 2023).

Simultaneously, the sector faces a serious challenge in the form of illegal, unreported, and unregulated (IUU) fishing, primarily perpetrated by foreign vessels that have undergone a process known as "Senegalization," enabling them to carry Senegalese flags (Bousso, 2022). This IUU

fishing, coupled with overfishing, the use of inappropriate or unregulated fishing techniques, inadequate monitoring by state authorities and fishing communities, and overexploitation of resources, have contributed to declining fish production (Expert 2 Senegal, personal communication, 24 April 2023). The distribution of fish caught by foreign vessels, particularly Chinese and Russian, for direct local consumption is controlled by large commercial companies, which create monopolies that affect the distribution of raw materials to women processors (Expert 1 Senegal, personal communication, 2 April 2023).

The governance of Senegal's small-scale fisheries is marked by the involvement of various actors and entities, creating a complex web of interactions that can complicate fisheries management efforts (Mbaye et al., 2022). Notably, there has been a gradual shift in the management of fisheries resources from state control to local communities, which presents both opportunities and challenges (Mbaye et al., 2022). Conflicts are recurring in the fishery sector, ranging from disputes over gear types to inter-community conflicts and tensions between local fishers and migrant fishers (Mbaye et al., 2022). Moreover, antagonism persists between Senegalese fishers and foreign pirate vessels, further exacerbating the challenges faced by the small-scale fisheries sector (Mbaye et al., 2022). Figure 39 represents adding the layer of existing drivers (text in white areas) and their placement is influenced with their impact on the surrounding actors. This figure shows how the emerging drivers and existing drivers act in synergy affecting the different actors of the SSF value chain of Senegal.

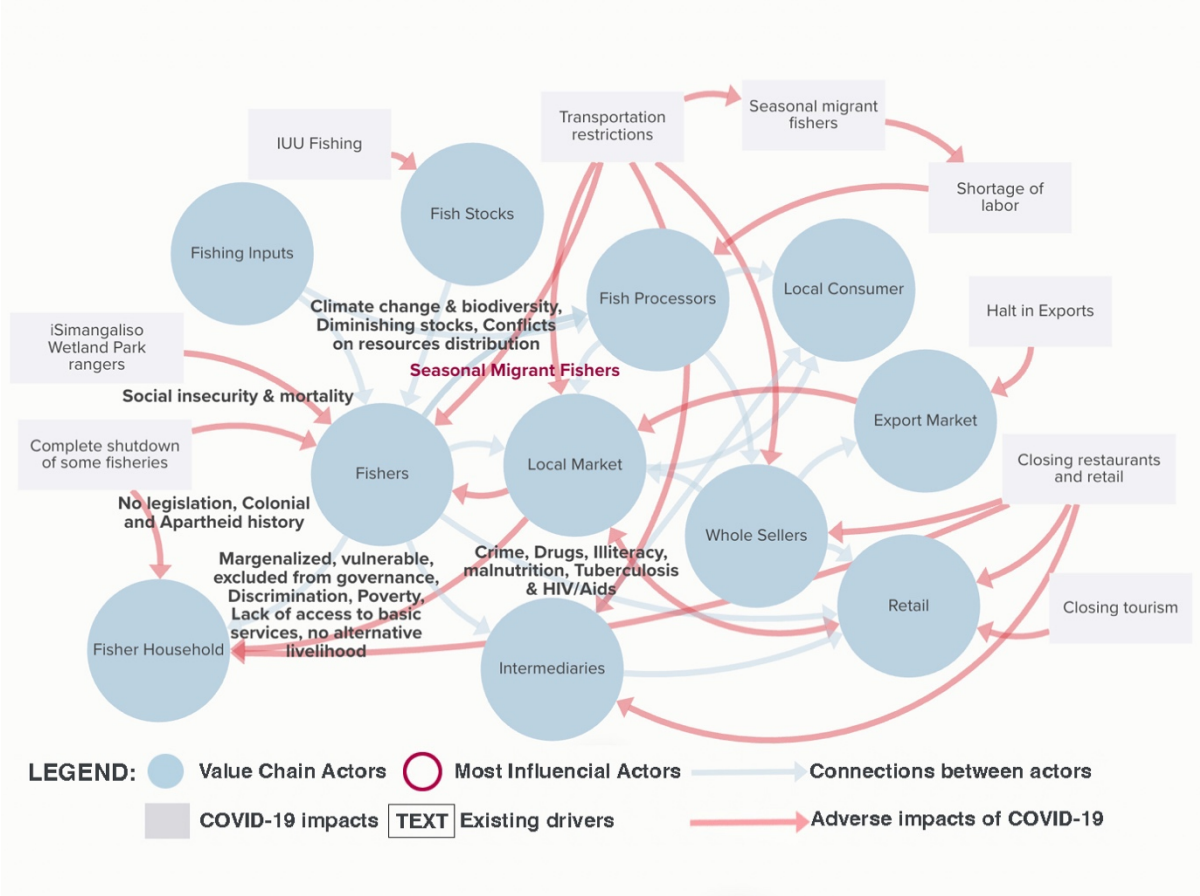


Figure 39: Mapping Senegal SSFs' value chain's emerging and existing drivers of regime shift.

4.3.6.4 Equity, Justice Concerns and Power Dynamics

In Senegal's small-scale fisheries, a complex web of equity, justice concerns, and power dynamics shapes the industry, impacting various stakeholders. Conflicts are prevalent within the sector, ranging from disputes over gear types to community tensions and clashes between fishers and gold miners (Mbaye et al., 2022). Additionally, antagonism exists on multiple fronts, including conflicts between Senegalese fishers and the Mauritanian coast guard, disputes with foreign pirate vessels, and friction between migrant and local fishers (Mbaye et al., 2022). These conflicts and antagonisms reflect power imbalances and resource access and management challenges. The vulnerability of fishery resources to climate change further complicates the situation.

Sardinella Arita, a vital species representing 80% of total fishery products in Senegal, is particularly sensitive to climate change. Women heavily rely on this species for traditional smoking

and drying processes, highlighting the intricate relationship between women and these resources (Expert 1 Senegal, personal communication, 2 April 2023). However, climate change specialists often prioritize environmental aspects over cultural and social factors, potentially neglecting the significance of the connection between fishers and the sea (Expert 1 Senegal, personal communication, 2 April 2023).

Power dynamics are evident in the distribution of pelagic fish caught by Chinese and Russian vessels (Expert 1 Senegal, personal communication, 2 April 2023). This concentration of power in distribution channels can affect market access for small-scale fishers and processors. The pandemic presented opportunities for the industrial fishery sector, particularly foreign entities like Chinese, Russians for pelagic, and Europeans for demersal species, to exploit resources with certain authorities' complicity. This issue has led to perceptions of discrimination against the small-scale fishing sector, which feels marginalized and disadvantaged (Expert 1 Senegal, personal communication, 2 April 2023).

The COVID-19 pandemic exacerbated existing inequities. While some fishermen accessed lines of credit, many were rejected, and some preferred subsidies over bank loans (Camara et al., 2023). Movement restrictions and supply scarcity of Sardinella had severe economic impacts on women-led fish processing associations (Cederstrom, 2020). While small-scale fishers faced numerous restrictions, industrial fishing vessels continued operations unhindered (Expert 1 Senegal, personal communication, 2 April 2023; Traore, 2020). The loss of mobility rights affected both male fishermen, impacting their fishing trips, and female vendors who rely on retail sales and require physical contact and mobility to access markets (Expert 1 Senegal, personal communication, 2 April 2023). Furthermore, Government support, while providing, faced criticism for lacking transparency and politicization, favoring certain political clients and giving preference to farmers over fisher communities (Expert 1 Senegal, personal communication, 2 April 2023).

4.3.6.5 Suggested scales of intervention

Looking into Senegal's small-scale fisheries value chain components and the drivers of the regime shift presented above, I can identify at least six scales reaching the threshold in the value chain. The first scale is related to the landing sites, the primary marketplace for artisanal fishers. During COVID-19, landing sites were extremely controlled by limited working hours, affecting fish catch sales. It also affected fishmongers, fish processors, whole-sellers, and retail as it is the main space for selling

fresh fish (presented by the Blue loop). The second scale is attributed to the closing of retail. The retail sector sells fish to local markets, shops, restaurants, hotels and mainly local consumers. During the pandemic, retail was mostly closed, affecting all the value chain actors (presented by the Green loop).

The third scale is the transportation restrictions and closing borders imposed by the government during the pandemic. Fishmongers and wholesalers depend on transportation to sell fish to the wider and extended actors of the value chain. Transportation restrictions affected women the most because they depended on mobility for fish marketing to neighboring towns and urban city areas (presented by the Orange loop). The fourth scale is related to fishers and their households. These vulnerable individuals suffer from poverty and malnutrition and face many issues accessing basic livelihood services. With the curfew guidelines, restrictions on landing sites, decrease in fishing days and safety measures, fishers had no alternative to landing sites to sell their fish catch (presented by the Yellow loop). The fifth scale is related to the contracts between the Chinese and Russians to fish in Senegal waters. This issue has created many inequities and conflicts between industrial and artisanal fishing. Also, during the pandemic, those fleets were still operating while small-scale fishers faced many restrictions (presented by the Magenta loop). The sixth and last scale is the closing of borders, which hindered fish exports to neighboring countries. Consequently, it affected fishers, fish processors, fishmongers and whole sellers (presented by the Cyan loop). This scenario suggests that those are the critical points of government intervention to mitigate the adverse impacts of COVID-19 on small-scale fisheries in Senegal. Figure 40 represents adding the layer of suggested scales of interventions, the colored loops as explained above. A loop comprises a scale where a group of actors engage together in a certain activity withing the SSF value chain. Each loop or scale is affected by the emerging drivers of COVID-19 (red arrows within the loop) and the existing drivers (text in white areas within the loop).

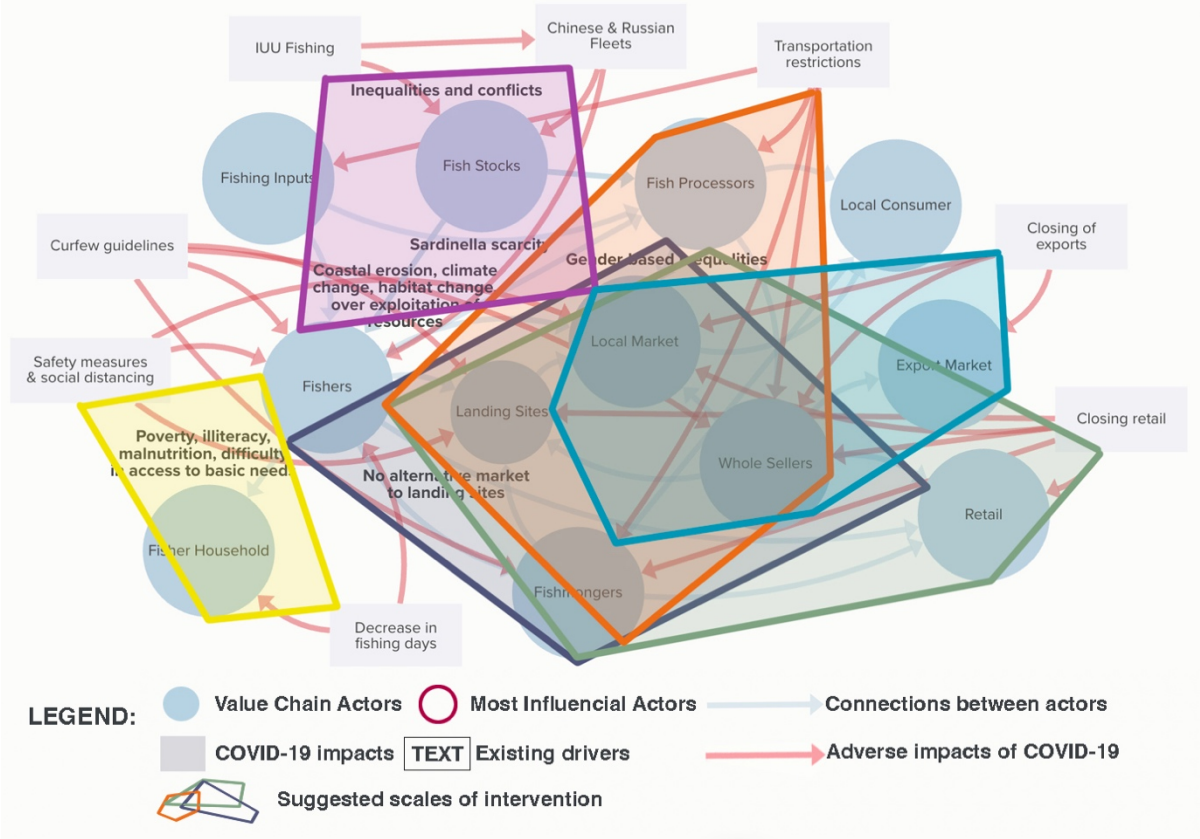


Figure 40: Suggested scales of intervention by the Senegal government to mitigate the adverse impacts of COVID-19 on SSFs.

4.3.6.6 Coping and adaptation strategies practiced by fishers and dependent communities

The COVID-19 pandemic presented several challenges to Senegal's SSF communities. Many fishers faced economic losses due to the restrictions imposed by the Senegalese government (Expert 1 Senegal, personal communication, 2 April 2023). One significant impact was the limitation on docking times, with boats required to dock by 3 p.m. and unable to resume fishing until 6 a.m. the following day (Expert 1 Senegal, personal communication, 2 April 2023). This restriction, combined with a lack of proper conservation equipment, prevented the marketing of large quantities of fish that spent the night at sea while awaiting dawn, resulting in financial losses (Expert 1 Senegal, personal communication, 2 April 2023). As a result, many fishers migrated to Gambia, a neighboring African country, because lockdown measures were less strict (Expert 1 Senegal, personal communication, 2 April 2023).

In response to the crisis, Senegal's SSF communities adopted sanitary conditions, established assistance centers, and issued numbered tickets for the embarkation of fishermen in Mbour (Camara et al., 2023). Fishermen's groups, notably "Kurel Gui," established a solidarity fund (Camara et al., 2023). Each fisherman contributed at least $7.57 weekly or according to their means to this fund(Camara et al., 2023). This financial resource was utilized for purchasing prescriptions, treating sick fishermen, and paying off their debts to fishmongers without additional fees or taxes for production factors (Camara et al., 2023). Additionally, Senegal's fisher associations grouped to reduce production costs (Expert 2 Senegal, personal communication, 24 April 2023). They shifted from fishing for export to focusing on fish intended for local consumption to navigate the challenges caused by closed borders (Expert 2 Senegal, personal communication, 24 April 2023). Moreover, motorcycle taxis, known as "Jakarta," became a valuable means of transport for women to deliver their products to customers (Expert 1 Senegal, personal communication, 2 April 2023). In a context where social distancing and physical contact became difficult, this emerging type of transportation option solved the high cost of transport during COVID-19 (Expert 1 Senegal, personal communication, 2 April 2023).

Furthermore, the widespread use of dematerialized payment through mobile phones offered a secure system for women to receive advance payments from customers, with Senegal's multiple digital payment operators facilitating this practice, enhancing financial flexibility (Expert 1 Senegal, personal communication, 2 April 2023). While these strategies showcased adaptability and resilience, some individuals attempted to diversify their activities by engaging in small-scale trade (Expert 1 Senegal, personal communication, 2 April 2023). However, this approach didn't effectively offset the losses resulting from COVID-19, primarily due to the high physical contact and cash payments prevalent in the informal sector (Expert 1 Senegal, personal communication, 2 April 2023).

4.3.6.7 Government support during COVID-19

The Senegalese government took several steps to provide support and alleviate the impact of the COVID-19 pandemic on SSF communities. The government conducted awareness campaigns at various sites in collaboration with the fishing industry, local elected officials, and youth associations (Camara et al., 2023). These campaigns involved the display of awareness posters and communication strategies such as "Takal sa mask" and "Tokk len sen keur," aimed at educating and informing the local population (Camara et al., 2023). Assistance hubs were established in response to

the evolving situation and easing lockdown regulations (Camara et al., 2023). These hubs operated under the supervision of security guards, allowing fishermen to land without constraint after the usual dock closing hours and return home safely without facing penalties due to curfew violations (Camara et al., 2023). Additionally, a revolving credit line amounting to USD 3.051 million was instituted through a partnership between the Ministry of Fishing and Maritime Economy (MFME), the General Delegation for Rapid Entrepreneurship of Women and Youth (Délégation Générale à l'Entreprenariat Rapide des Femmes et des Jeunes - DER/FJ), and the Mutual Credit of Senegal (Camara et al., 2023).

Despite the government's efforts, there were challenges in accessing support. Some fishermen had their applications for the credit line rejected, preventing them from benefiting from this financial assistance (Camara et al., 2023). Women had to finance their processing activities through contributions in multiple fishing ports, including Hann, Rufisque, and Mballing (Mbour) (Camara et al., 2023). Criticism arose regarding government policies and actions. There were concerns that instead of supporting local fishermen during the health crisis, the government contemplated granting new fishing licenses to foreign vessels heavily exploiting the marine resources. Such actions were seen as detrimental to the interests of SSF communities (Traore, 2020).

Additionally, some SSF representatives and community members expressed frustration with the government's governance and policies related to fishing agreements (Expert 1 Senegal, personal communication, 2 April 2023). They believed that the government's approach to managing fisheries lacked transparency, and decisions often appeared politicized, favoring specific political clients rather than directly addressing the needs of the communities (Expert 1 Senegal, personal communication, 2 April 2023). In summary, while the government of Senegal implemented various measures to support SSF communities during the COVID-19 pandemic, challenges related to access, governance, and transparency persisted, leading to positive and negative perceptions of government support among SSF stakeholders.

Figure 41 represents adding the layer of actual scales of interventions, the colored-filled areas as explained above in (Sec. 4.4.6.6) and (Sec. 4.4.6.7). Each colored area represent a governance strategy and its impact on a number of actors, emerging drivers, and existing drivers. Areas that are not color-filled are areas that were not tackled by the Senegalese government or the SFF communities.

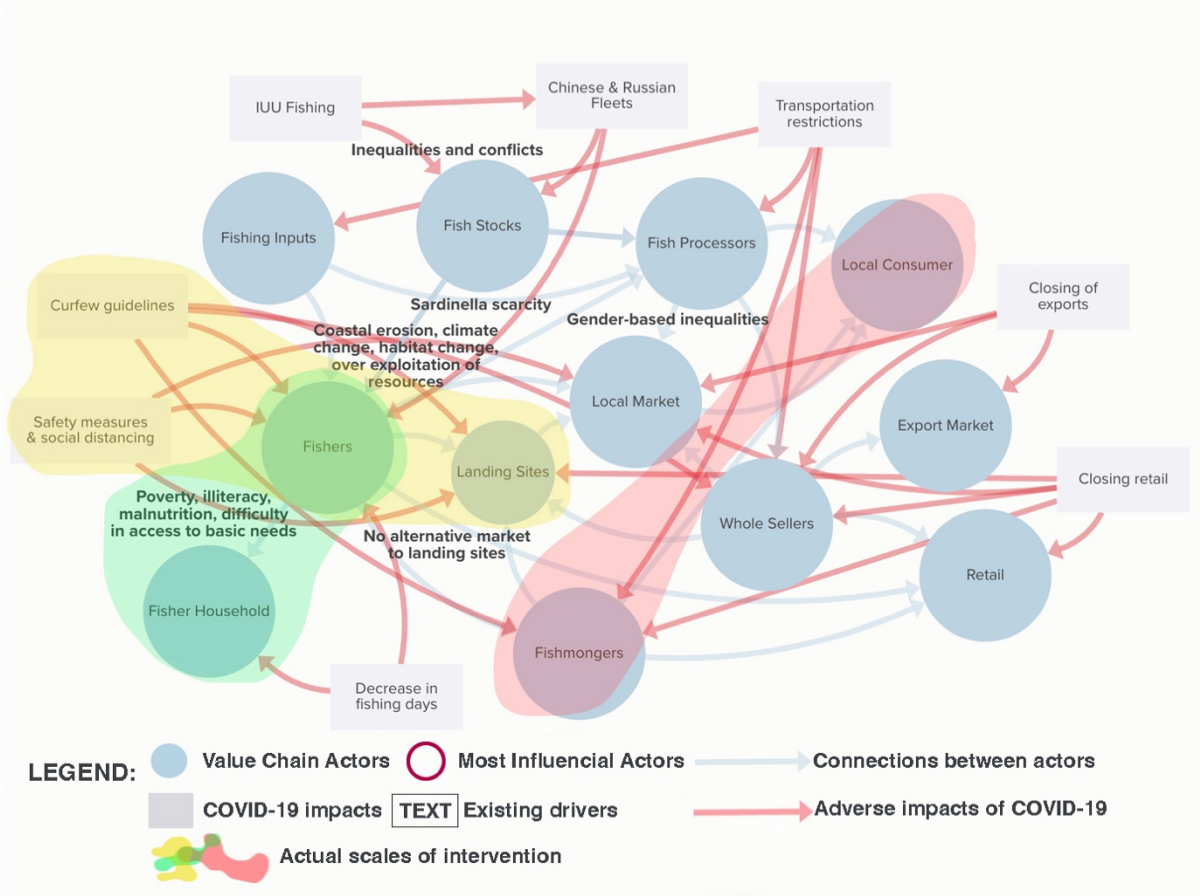


Figure 41: Actual scales of intervention tackled by SSF communities and the Senegal Government during COVID-19.

4.4 The comparative analysis of scales of intervention

In the previous section, a number of scales of intervention for each country were suggested. Those scales present areas that the governments and communities might tackle during crises to mitigate the adverse impacts of stressors on the SSF communities. Additionally, they offer a vision of long-term interventions. I must mention that those are the key areas considering the influence of value chain actors involved, and there were more areas that were not considered in this analysis. The selected areas were identified depending on how influential they are in the value chain of the SSFs. Moreover, through the analysis of governance, coping and adaptation strategies practiced during COVID-19, we identified the actual scales of intervention tackled by governments and SSF communities in each country. In this section, I am adding another layer of analysis to the case studies by comparing the

suggested and the actual scales of interventions. This comparative analysis helps in identifying effective governance strategies, factors of their success or failure and areas that have been neglected during the crisis.

Following this comparative analysis, I summarize (Table 8) actual and suggested scales of interventions and factors that contribute to the success or failure of implementing those strategies. Identifying those factors help us understand the sophisticated nature of drivers and their impact on how they act together in synergy, leading to the vulnerability or resilience of communities during a crisis. Moreover, it help us identify key adaptive responses during the pandemic.

Starting with Canada, with an SSF economy dependent on exports mainly to China, the export market was hardly hit by the closure of international trade. The halt in the export sector is an external driver that cannot be controlled or navigated within the country. In response to this problem, the SSF communities leveraged a strategy already in place before COVID-19. This strategy is Alternative Seafood Networks (ASNs), which is an approach taken by SSF associations to redirect market dynamics towards local stakeholders. The factors that contributed to the success of this strategy were first that ASNs were already established and known before the pandemic. Second, when the government of Canada recognized SSF as an essential service and exempted them from certain restrictions, they also facilitated their mobility.

Moreover, ASNs utilized online marketing and delivery of products. Implementing this strategy was not a challenge for the Canadian SSF communities because they have excellent access to internet services and the knowledge of using it, unlike the rest of the case studies. The only challenge ASNs faced was marketing and distributing seafood for local and foreign consumers. With the collapse of international trade, they had to shift their focus to local consumers only. However, this consumer-base shift happened smoothly because the strategy was already established before the pandemic. The ASN approach tackled several scales within the small-scale fisheries value chain. ASNs tackled the exports, retail, fishers, processors, and households.

Another successful aspect of the Canadian SSFs' resilience during COVID-19 is the safety associations seeking collaborative approaches to draw guidelines that meet the needs of fishers and are sensitive to the nature of the profession. Once again, an important factor that led to the success of this feature is that safety associations were already in place before the pandemic. Safety associations

were only tasked with bringing different stakeholders and listening to their thoughts. This collaborative approach was successful, and other SSFs inherited the outcome in Canada.

The last aspect is the government assistance to fishers during the pandemic. The government pandemic relief to fishers was adequate and was fairly distributed among the value chain actors. The factors leading to the success of this strategy are as follows: first, all fishers, processors, and traders in SSFs are registered individuals. Consequently, they have proper access to aid as the system recognizes them. Second, Canada is a wealthy country with adequate financial means to support their citizens. Funds were already available to distribute when the pandemic hit. They did not need time to allocate funds or decide who was more eligible.

Figure 42 represents the suggested vs actual scales of intervention. It is visually evident that the strategies discussed above tackled most of the value chain actors and the adverse impacts of COVID. However, areas of existing vulnerabilities such as conflicts over resources distribution and an aging workforce were not addressed although they affect the overall resilience of the Canadian SSF value chain.. It is logical that given the abrupt change caused by COVID-19, priority was given to problems that needed an immediate action, but they remain as issues that need to be addressed on the long term.

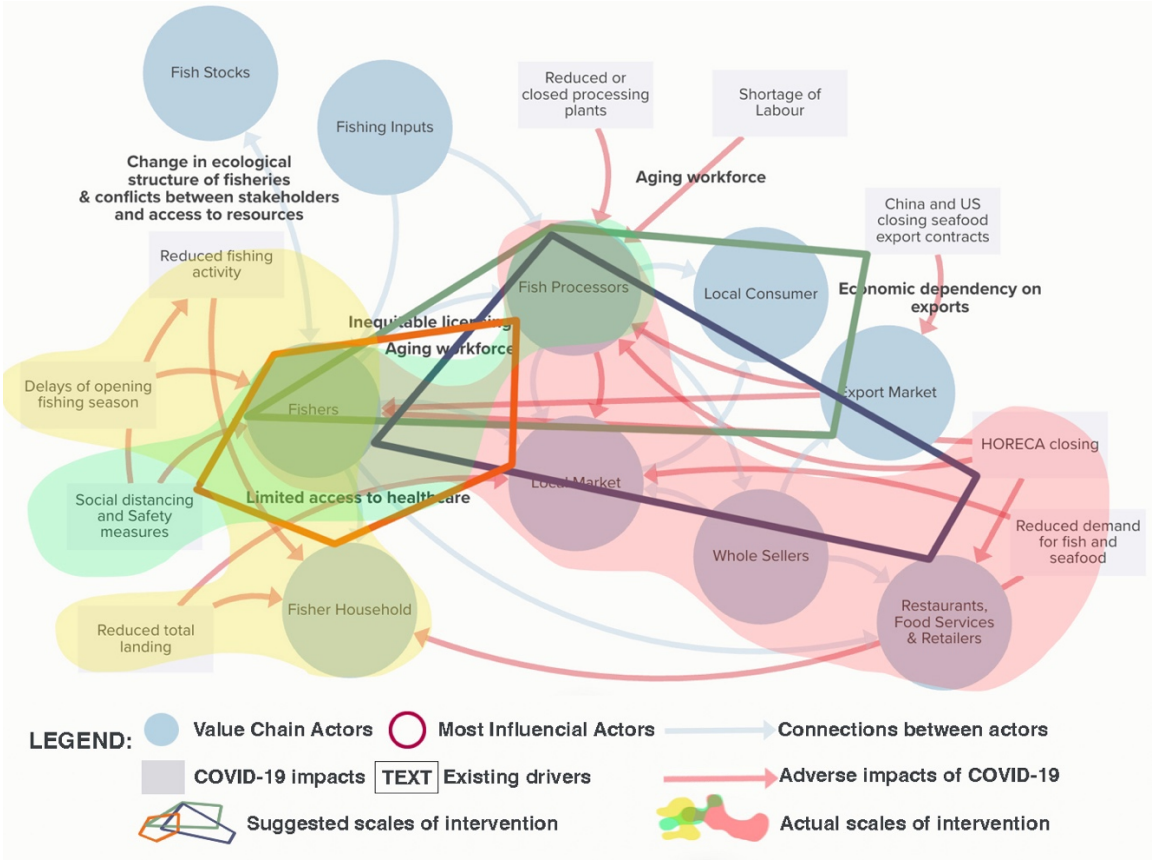


Figure 42: Suggested vs Actual interventions in Canada.

Here, I discuss Malaysia's governance, coping and adaptation strategies. With an economy highly dependent on tourism, the HORECA sector, Malaysia's major seafood market, collapsed during the pandemic. The ideal solution to this problem is finding alternative networks to market fish and seafood products as the Canadian example. The literature and interview respondents reported that there was a shift to online marketing and selling of seafood. However, this shift was challenged by many factors. Most fishing communities reside in rural communities and face problems accessing and using the Internet. Second, most SSF communities are in the B40 group, which means they are very poor and depend on government support and subsidies. Also, they have a high rate of illiteracy.

Consequently, when the market shifted to online trade, they had to acquire this skill of using online tools. In conclusion, this strategy helped some of the fishing communities cope with the new norms of the market. However, most Malaysian fishers could not leverage the benefits of online marketing because of their lack of knowledge or means.

On the other hand, government assistance to fisherfolks was significant because they utilized diverse stimulus packages to help support fishers during the pandemic. Stimulus packages and financial support to SSFs aimed to provide social safety and alleviate the financial burden caused by the disruptions of markets and decreasing their income. However, there were reports of insufficient government assistance not addressing the needs of fishers or a lack of transparency, especially to rural SSF communities.

Figure 43 represents the suggested vs actual scales of intervention. It is visually evident that the governance strategies practiced during COVID-19 have alleviated some of the adverse impacts on fishers, their households, intermediaries, and local market. However, the positive effect of those strategies was not equally distributed due to the rurality of most of the SSF communities in Malaysia. There were also some areas that were not tackled during COVID-19 and they required immediate actions such as the well-being of migrant fishers. Other areas that need to be addressed are the socioeconomic status of fishery's communities and social uncertainties, however, they require long-term efforts rather than immediate actions.

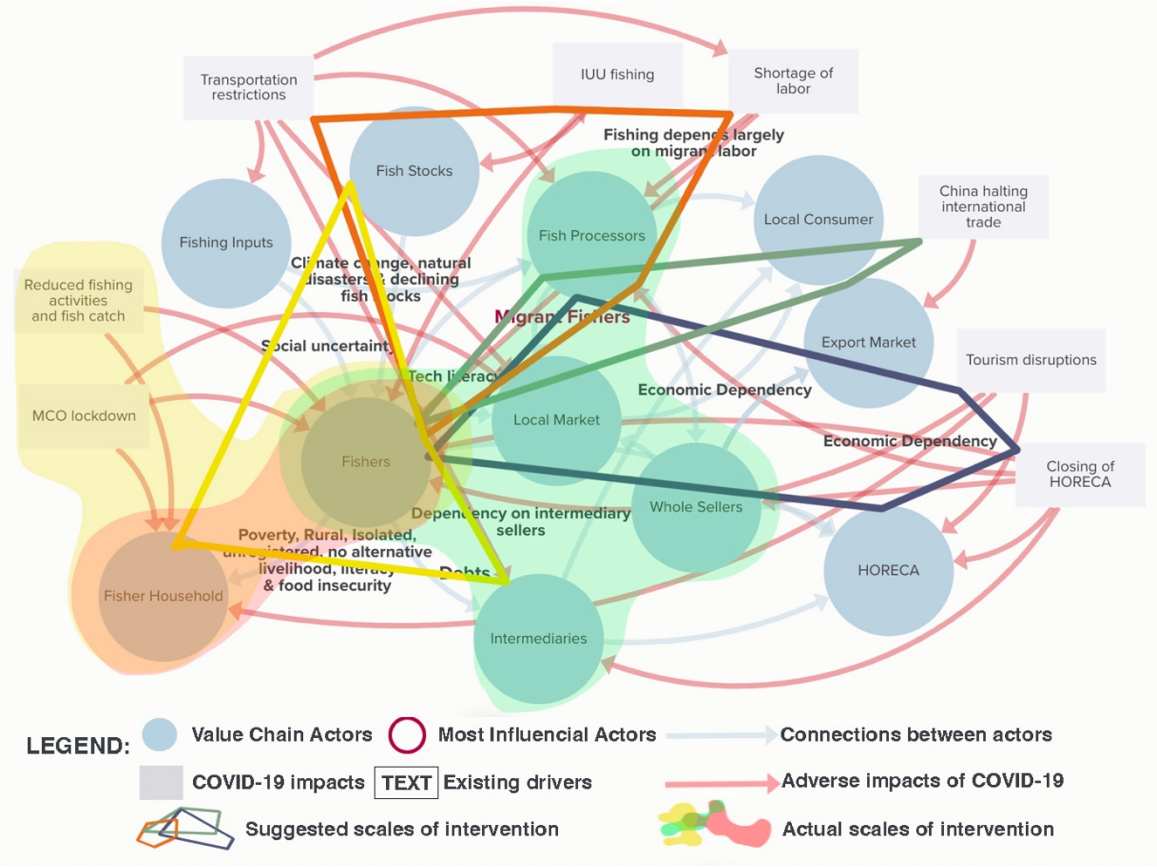


Figure 43: Suggested vs Actual interventions in Malaysia.

In India, SSF stakeholders took a collective approach to localize the market, again because of the shutdown of exports to China and the United States and the shift to local and regional consumers. The approach was rational but faced challenges imposed by transportation restrictions locally and between Indian states. Unlike the example of Canada when they announced fisheries as an essential service, they facilitated the mobility of the value chain actors. This understanding of the nature of fishing as a profession was overlooked in India and fishers struggled with transporting their catch.

The government of India distributed aid in the form of cash and food items. However, fishers faced the same problems in rural areas, and the aid did not reach all of them. This unequal distribution of government assistance during COVID-19 presents another example of authorities overlooking rural communities when they are the most vulnerable groups. Fishers also complained about the financial aid distribution marred with favoritism and power dynamics.

Figure 44 represents the suggested vs actual scales of intervention. The governance strategies practiced during COVID-19 had a positive effect on fishers, their household and the local market. However, many critical areas were left untackled such as transportation restriction affecting intermediary sellers the most, the huge migrant workforce left stranded without support or the option to return back to their homes, and the exploitation of children pushing them to leave schools and work to earn income. Additionally, there are the problems of the socioeconomic status of fishers, accessibility to services, and conflicts that were unaddressed. However, they need long term efforts rather than immediate actions.

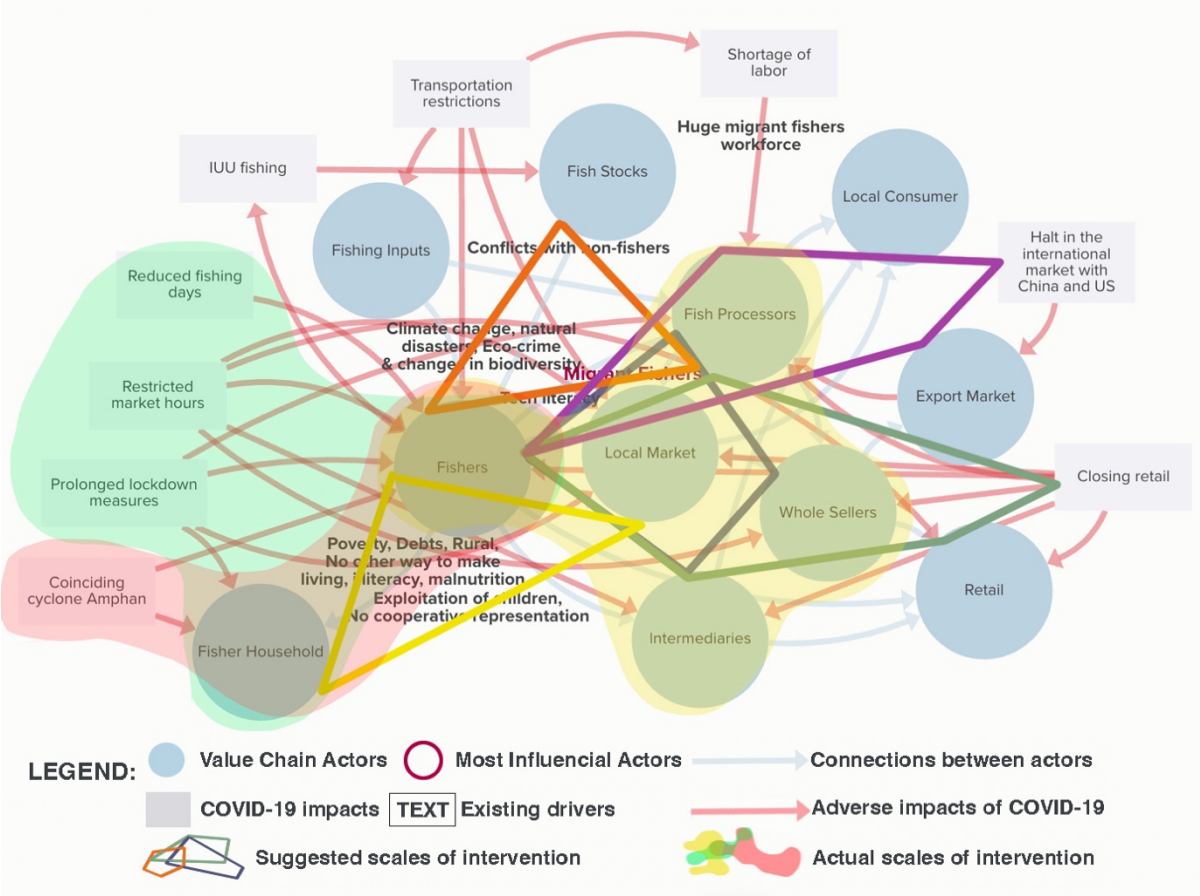


Figure 44: Suggested vs Actual interventions in India.

In Bangladesh, the situation becomes more complex. There were many efforts made by communities and governments; however, the lack of resources, means, knowledge, and embedded vulnerabilities hindered most of their efforts. For example, boat owners lent money to fishers to meet their needs, but

those loans were at very high interest rates that put them in more debt, and they could not make a living out of fishing because of the restrictions to pay those debts. NGOs had tried to train SSF communities on alternative livelihoods to fishing, but mobility restrictions and lockdowns prevented them from leveraging their diverse skills. Online marketing and delivery were booming, but not all fishers could utilize this tool because of internet access and tech illiteracy.

The Bangladesh government distributed food and cash during the pandemic, but the distribution was patchy and favored some groups. The government advised banks to give loans to fishers with low-interest rates, but banks rejected most of the applications without rational reasons. Aquaculture projects were the only strategy that gave some hope to fishers at this time. The government gave funds to fishers to start small aquaculture projects, and fishers sold their harvest at a fixed price. The price was a margin of the project's profit, but it offered a stable and reasonable income in times of uncertainty.

During the pandemic, the Bangladesh government imposed regulations insensitive to the nature of fishing and fisheries. Especially when they announced the 65-day fishing ban, which added up to the lockdown days, resulting in a huge decrease in fishing days for fishers; from all the case studies discussed in this research, Bangladesh had the longest non-fishing days.

Figure 45 represents the suggested vs actual scales of intervention. It is visually evident that the governance strategies practiced during COVID-19 were scarce comparing to the number of issues need to be addressed immediately such as the reduced fishing days, migrant fishers, shortage of health services, mobility restrictions, and accessibility to local market. Long-term issues that remain unaddressed are socioeconomic status of fishers, conflicts, the control of boat owners over fishers, and the presence of many intermediaries within the value chain.

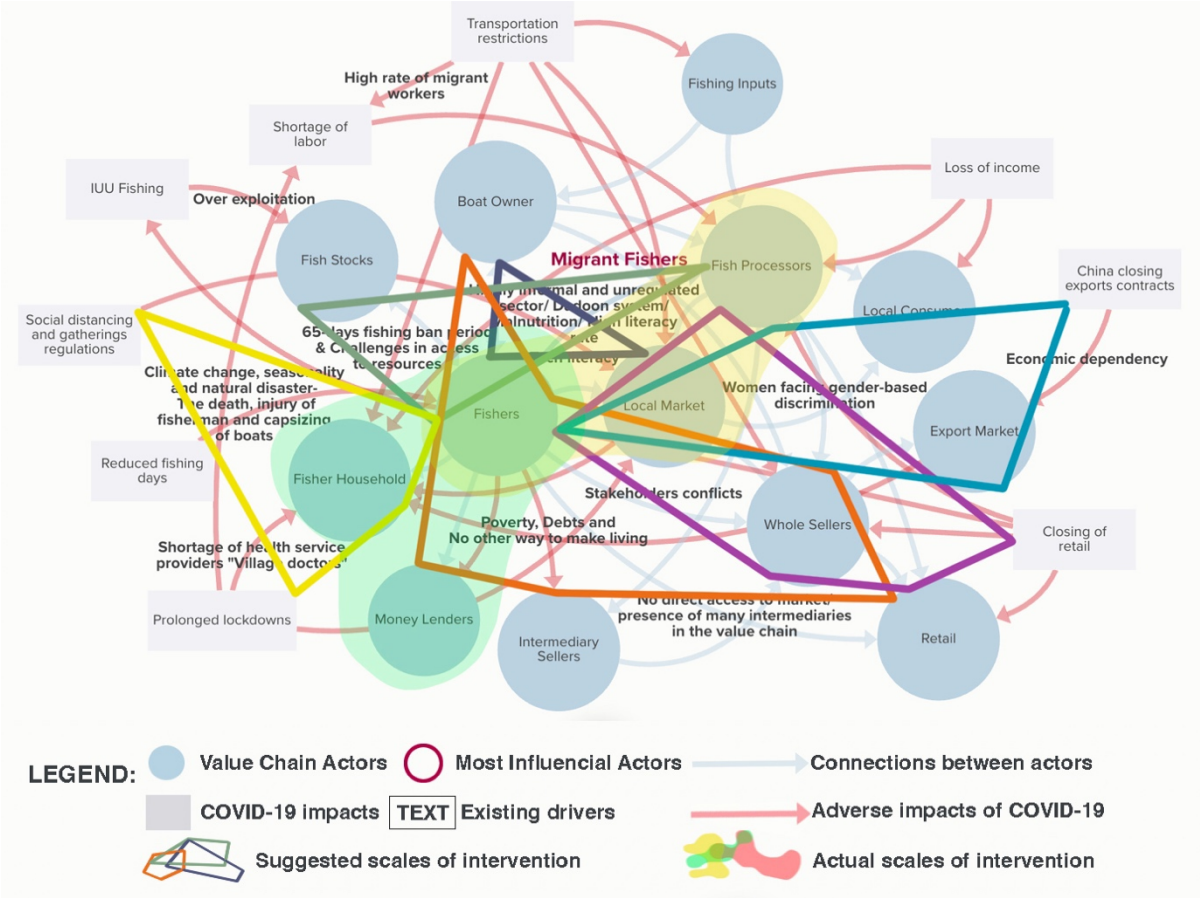


Figure 45: Suggested vs Actual interventions in Bangladesh.

The story in South Africa is different because most small-scale fishers work in an unformalized sector, meaning that the legislation or the government does not recognize fishers in freshwater sector. Consequently, most of the efforts to mitigate COVID-19 impacts on fishers were made by the communities, not the government. The government made their living worse by declaring fisheries as an essential service; thus, they are not entitled to financial aid. Their situation worsened because they could not fish as they were not registered fishers, and they had to fish illegally. As a result, fishers were not eligible for financial aid and they faced criminal charges or mortality by park rangers.

There was a shift to local consumers to mitigate the impacts of closing international trade. This shift helped a lot of fishers somehow acquire income during the pandemic. Online marketing and delivery of products were also booming, but again, not all the fisher communities leveraged this

strategy for the same reasons encountered in Malaysia, India, and Bangladesh, which is possessing the skills to use online platforms and accessibility to internet.

Figure 46 represents the suggested vs actual scales of intervention. It is visually evident that most of the adverse impacts associated with COVID-19 lockdowns and measures were not addressed. The governance practices during the pandemic minimally affected the value chain actors and more areas were left untackled such as the accessibility of unregistered fishers to government support, violence, mortality and social insecurity from park rangers. Additionally, transportation restrictions and women informally working in different activities within the value chain. Other areas that need long-term efforts are the socioeconomic status of fishers, absence of legislation to recognize SSF in freshwater sector, accessibility to basic services, discrimination, crime, drugs, and epidemics.

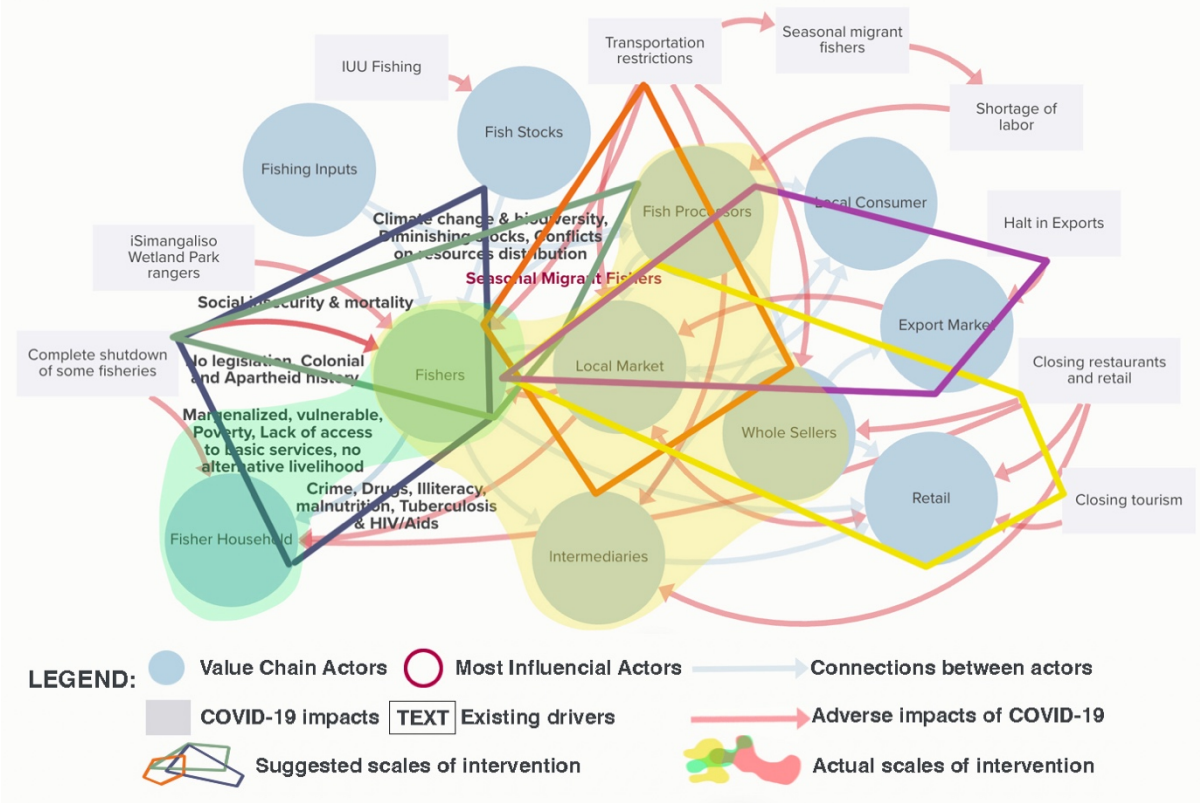


Figure 46: Suggested vs Actual interventions in South Africa.

Senegal is somehow similar to South Africa in terms of most of the efforts being made by the communities and not the government. Fisheries communities were helping each other using a solidarity fund. They utilized motorcycles to deliver orders and market their fish. The government of

Senegal showed some adaptivity in the later days of the pandemic by easing the restriction on landing sites and establishing assistance hubs to help fishers attain safety guidelines. Those efforts by the government were highly regarded. It is logical to say that the Senegalese government was probably busy with pandemic outbreak control, they overlooked the needs of those vulnerable communities. However, this is not true because the Singhalese government continued signing agreements with foreign fishing vessels to fish in their water during the pandemic, showing favoritism for industrial over artisanal fishing.

Figure 47 represents the suggested vs actual scales of intervention. It is visually evident that governance practices were minimal during COVID-19 to mitigate adverse impacts on SSF communities. One of the critical issues that remained unaddressed is the Chinese and Russian fleets fishing extensively in the Senegalese waters during COVID-19 although Small-Scale fishers were restricted to fish. Additionally, the problem of restricting hours on landing sites although it is the most important component in the value chain. Other areas that require long-term efforts are the socioeconomic status of fishers, accessibility to basic services, alternative markets, and gender-based inequalities.

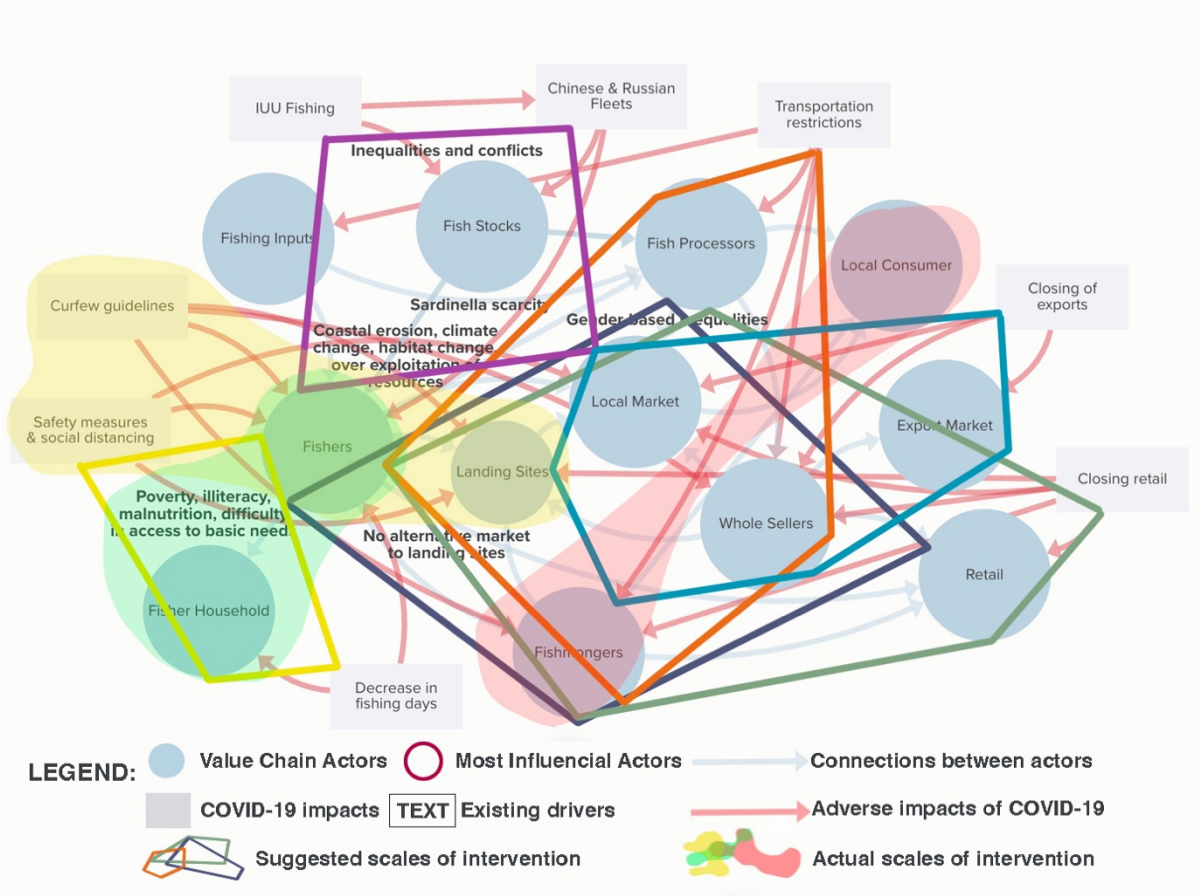


Figure 47: Suggested vs Actual interventions in Senegal.

Table 8 summarizes actual and suggested scales of interventions and factors that contribute to the success or failure of implementing those strategies based on the discussions in (Sec.4.5).

Table 8: Comparative analysis of suggested and actual scales of interventions and factors attributed to the success or failure of their implementation.

Countries	Suggested scales of intervention	Actual scales of interventions	Factors attributed to the successful implementation	Factors hindered the implementation
Canada	Exports	Pandemic relief administered by the government, Consumer-base shift	Adequate support and administration, registered fishers, proper communication	China closing international trade

	Retail	Alternative Seafood Networks (ASNs)	No mobility restrictions-collaborative approaches-adaptation to new norms ASNs were already functioning before COVID	Consumer-base shift was a challenge to ASNs
	Safety of fishers	Safety associations tailoring specific guidelines to fisheries	Research, collaborations, funds	Fear of fishers from spreading the virus
Malaysia	Retail	direct fish marketing, online sales, home delivery services, collaborating with government agencies	Some communities leveraged the benefits due to easy access to the internet and tools	Tech illiteracy, internet accessibility, poverty, rurality of some SSF communities
	Exports	Consumer-base shift		China closing international trade
	Migrant workforce	Not tackled		
	Socioeconomic	Civil society redistributing unsold fish, seeking employment in mainland or urban areas Stimulus packages (government and several agencies)	Fishers felt pride and empowerment in helping their vulnerable fellows Diversity of stimulus packages tackling different aspects of fisher's vulnerability	Government assistance was not sufficient, not adequate, unregistered fishers did not get aid, aid accessibility due to tech illiteracy, fishers associations lacked transparency and equality
India	Local market	Collaborative approaches to cope with new market norms and localizing fishing economy	Shifting focus to local and regional markets	Challenged by mobility restrictions and limited market hours
	Retail	Consumer-base shift	Shifting to local markets	Challenged by mobility restrictions and limited market hours

	Migrant workforce	Not tackled		
	Socioeconomic	Grassroot organizations and community groups supporting cyclone victims, Government distributed food and cash aid	Civil community efforts were effective in alleviating impacts on cyclone victims	Gov aid did not reach rural communities, and aid distribution was marred with favoritism, inequalities, power dynamics
	Exports	Consumer-base shift		China closing international trade
Bangladesh	Fishers- boat owners (Dadoon system)	Boat owners lending money to fishers at high interest		This adds up to fishers falling into more debts
	Fishing ban	Imposed fishing ban on increasing the volume of Hilsa fish, neighboring countries do not implement the same procedure		Insensitive regulations to fishing seasonality and socioeconomic status of fishers, Less patrolling leading to IUU, neighboring countries still fish from the same resource
	Accessibility to markets	Not tackled		The dominance of too many intermediaries in the value chain
	Socioeconomic	Aquacultures projects, Alternative livelihood training during fish bans, government Food & cash Social safety net programs, Bank loans	With aquacultures- fishers do not have to market their harvest, the training helped in gaining some income, government aid was diverse	Fishers were not able to do seasonal migration due to COVID-19, food & cash were not sufficient and are subject to nepotism, fishers could not access bank loans
	Retail	Online shopping, government launching fish buy-sell program	Online marketing gained a lot of momentum, especially among youth fishers	The majority of fishers do not know how to use it due to internet accessibility and tech illiteracy

	Exports	Consumer-base shift		China halting international trade
South Africa	Unformalized sector	Actively participating in community meetings to approve legislations		Embedded discrimination since the apartheid
	Socioeconomic	Food banks, consideration as an essential service, food parcels, vouchers, subsidies, grants	Women leadership lobbying the government to facilitate fishers' mobility	Mobility restrictions, exemption and aid only targeting registered fishers
	Local market	Shift to online and community-based markets	Gained a lot of momentum, especially among youth fishers	Shifting to the online market was slow because fishers had to acquire knowledge
	Retail	Consumer-base shift	Online marketing	Not all communities leveraged online marketing due to internet accessibility and tech illiteracy
	Exports	Consumer-base shift		China halting international trade
Senegal	Landing sites	Easing restrictions, Assistance hubs, collaborative approaches, awareness campaigns	Easing restrictions exhibits adaptive responses from the government and sensitivity to SSF nature.	The early period of lockdowns exhibits insensitive regulations to fisheries' nature
	Retail	Consumer-base shift	Motorcycle fits social distancing regulations	
	Intermediaries and mobility	Using a motorcycle (Jakarta) Mobile phone payments	Motorcycle fits social distancing regulations	Market depending on mobility and cash payments
	Socioeconomic	Migration to Gambia, Solidarity fund Gov. financial support, Revolving credit line	Solidarity fund helped poor fishers buy medicine and cope with financial difficulties	Nepotism and politicization of financial aid distribution, difficulties in accessing the credit line

	Industrial fishing	More agreements with foreign vessels		Favoring industrial fishing over artisanal fishers
	Exports	Consumer-base shift		Closing borders with neighboring countries

From the discussion above, there were community-based efforts and government assistance during the pandemic to the small-scale fisheries communities. The type of effort or assistance did not differ much between all countries. However, the implementation of those strategies differed a lot, and the socioeconomic status of the communities receiving the assistance differed. Consequently, the aid administration and the communities' socioeconomic status are major factors influencing the success or failure of governance, coping and adaption during the crisis. Another significant observation is that the issues of the migrant workforce in Malaysia, India and Bangladesh were not addressed by any means by their governments, leaving a big question of why it has not been tackled despite its importance. Additionally, gender-based inequalities with women working informally in the fisheries sector remained untackled in India, Bangladesh, South Africa, and Senegal.

From the above analysis and discussions in (Sec. 4.5), there are a set of problems that need immediate actions and others that require long-term efforts. Table 9 summarizes the immediate and long-term interventions required to enhance the livelihood resiliency of SSF communities.

Table 9: Immediate and long-term interventions that need to be addressed.

Problem	**Country**	**Type of intervention**
Environmental challenges	All case studies	Long-term
Economic dependency on exports	All case studies	Immediate and long-term
Migrant workforce	Malaysia, India, Bangladesh	Immediate and long-term
Mobility	All case studies	Immediate
Safety measures	All case studies	Immediate
Accessibility to healthcare	All case studies	Immediate
Conflicts in resources distribution	All case studies	Long-term
Socio-economic status	All case studies except Canada	Long-term
Sector formality and registration	All case studies except Canada	Immediate
Fishing bans	Bangladesh	Immediate
Accessibility to markets	Bangladesh and South Africa	Immediate
Gender-based inequalities	India, Bangladesh, Senegal, South Africa	Immediate
Social uncertainties	All case studies except Canada	Immediate and long-term
Alternative livelihoods	All case studies except Canada	Long-term

4.5 Identifying key adaptive responses

Governance, coping, and adaptation during the COVID-19 Pandemic were integral in shaping the fisheries sector's ability to navigate these challenging times. By categorizing and sorting the strategies of governance during COVID-19 in the third column in Table 8, the following five key adaptive responses emerge:

1) Consumer-Base Shift:
   The shift in consumer base was a significant adaptation strategy in the fisheries value chain. With the halt of international trade, the sector saw a notable shift in consumer preferences. Exports stopped, and a shift to the local market and retail was crucial. Adaptability was the key to cope with these changes. The ability to explore alternative markets, whether at the local or regional level, became paramount. To accomplish this shift, fishers and other stakeholders should possess the knowledge and tools to navigate the altered consumer landscape.
2) Alternative Seafood Networks (ASNs):
   ASNs were crucial in adapting to the new normal, particularly in the local market and retail sectors. The shutdown of traditional retail and the suspension of international trade significantly impacted the distribution and availability of seafood. Adaptable strategies that embraced mobility and explored online market avenues became essential. Additionally, a deep understanding of consumer behavior and preferences, driven by knowledge, was instrumental. Employing suitable tools, such as e-commerce platforms and digital marketing, allowed for the effective establishment of these alternative networks.
3) Government Aid:
   Government aid had a far-reaching impact on diverse stakeholders within the fisheries sector. It directly affected fishers, processors, intermediaries, and households. However, the impact was not uniform due to varying socioeconomic statuses and the informality prevalent within the sector. The success of government aid programs relied on accessibility, ensuring that all eligible parties could access the support. Effective administration and the absence of bureaucratic obstacles were essential. Adequacy in the aid packages, considering the unique needs of the SSF

communities, was a key determinant of success. Moreover, rigorous monitoring was vital to ensure that aid reached its intended beneficiaries and was used as intended.

4) Sensitive Regulations:

   The imposition of regulations to curb the spread of COVID-19 had significant ramifications for various stakeholders in the fisheries sector. These regulations impacted fishers, processors, intermediaries, households, and the various activities within the value chain. Enforced restrictions included curtailment of fishing activities, mandates for social distancing, mobility constraints, coinciding fishing bans, and safety measures within working spaces. Adaptive governance was essential to cope effectively with these regulations. Collaboration among stakeholders is crucial to implementing adaptive governance. It required collective efforts to adapt to new safety standards and to share best practices. Research into the most effective safety measures was indispensable. Clear communication of guidelines to all participants and raising awareness about the necessity of these measures ensured their adherence.

5) Community-Based Approaches:

   Community-based approaches to coping and adaptation were particularly successful in supporting SSF communities. Solidarity funds and collaboration with the government played a pivotal role in aiding poorer fishers in obtaining medicine and setting up assistance hubs. These approaches are intrinsically linked to the socioeconomic status of these communities. Collaboration fostered collective voices within the community, promoting unity and shared responsibility for addressing challenges. The informality inherent in the sector, where many fishers were unregistered and unrecognized by existing legislation, made these community-based approaches vital for their well-being.

By utilizing Table 8, and the five key adaptive responses identified above, I extracted the following information in Table 10. There are certain characteristics attributed to each element of governance including which actors do they impact, which drivers necessitates their implementation, and which factors are associated with their successful implementation.

Table 10: Key adaptive responses and associated characteristics.

Elements	Aspects	Characteristics
Consumer-base shift	Impact on	Exports, retail, local market
	Drivers	External factors: halt of international trade
	Factors	Adaptability, Alternative Market, Knowledge, Tools
Alternative Seafood Networks (ASNs)	Impact on	Local market, retail
	Driver	Shutdown of retail and halt of international trade
	Factors	Adaptability, Mobility, Online Market, Knowledge, Tools
Government Aid (food, cash, subsidies, loans)	Impact on	Fishers, Processors, Intermediaries, Households
	Driver	Socioeconomic Status, Rurality, Informality
	Factors	Accessibility, Administration, Adequacy, Monitoring
Sensitive Regulations	Impact on	Fishers, Processors, Intermediaries, Households, Activities
	Drivers	Imposed Restrictions, Fishing Ban, Safety Regulations
	Factors	Collaboration, Research, Communication, Awareness
Community- Based Approaches	Impact on	SSFs Communities
	Drivers	Socioeconomic status, informality
	Factors	Collective Voices, Collaboration

Using the five key adaptive responses (presented by the grey boxes in figure 49), their impact on the value chain actors (presented by the green arrows), and the associated factors leading to successful implementation (presented by the text in the white areas), I mapped them on the SSF value chain to visualize their impact on the resiliency of the system (Figure 48).

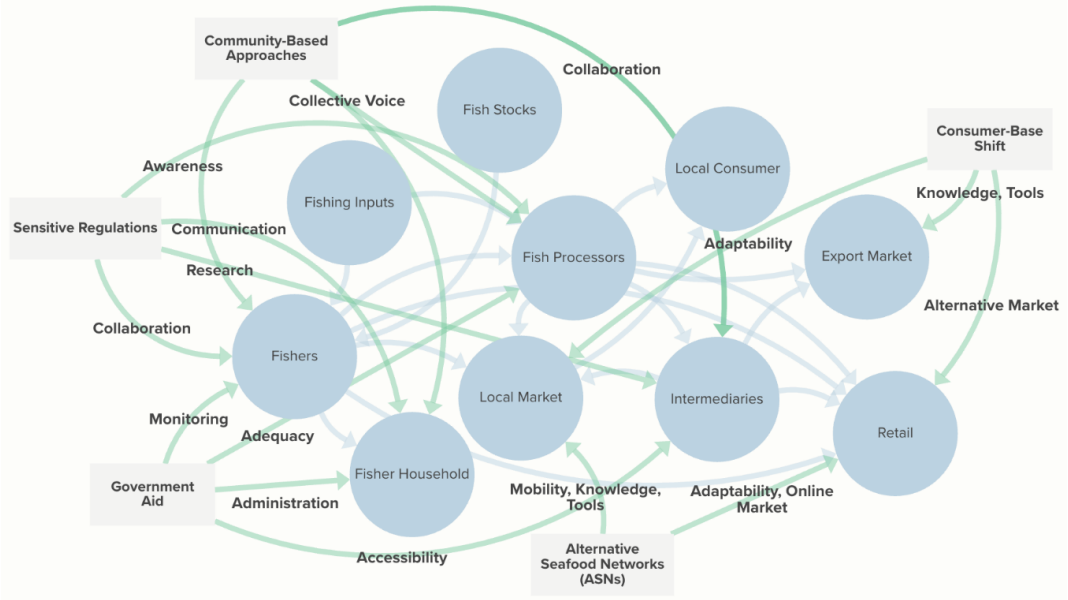


Figure 48: Mapping the key adaptive responses, and Factors of successful implementation.

4.6 Factors of Successful Implementation

In the above section, the five key adaptive responses, were identified as well as the associated factors supporting the successful implementation of the strategies. This section extends the discussion of the factors as a tool to transform SSF management into adaptive governance. Additionally, I provide a qualitative value for each factor, building on its role in successfully implementing the strategies in the case studies. The following are the identified twelve factors of successful implementation and their qualitative values from Table 8 and 9:

1) Adaptability

   It is the ability of communities, institutions, systems, and other stakeholders to change or shift to new norms after experiencing a stressor with the available resources. For example, there was a consumer base shift after halting international trade and closing hotels, restaurants, and shops. The need to shift to local or regional consumers to fill the economic gap caused by exports was crucial. Also, the shift from retail sales to online sales and delivery was essential to ensure that different actors in the Canadian value chain were gaining some income. This type of adaptability was encountered in other case studies; however, the absence of other factors hindered its successful implementation.

2) Alternatives

   Are various options available for communities once their primary preference is unavailable? For example, the Alternative Seafood Networks approach in Canada. This approach allowed the continuous fish trade with the upcoming new circumstances imposed by COVID-19 restrictions. Another example was the mini aquaculture projects in Bangladesh. Additionally, fishers utilizing online marketing and shopping for fish products using online applications.

3) Knowledge

   It is the information possessed by communities and institutions to navigate the crisis. Here, I counter-act examples to demonstrate the value of knowledge. For example, the lack of knowledge of governments about unregistered fishers hinders their inclusion in financial aid during the pandemic. Another example is the lack of knowledge of fishers about the threats of the coronavirus and misconceptions about seafood food being contaminated with the virus. Additionally, and most importantly,

the knowledge of fisheries communities about using online platforms for marketing and selling fish products.

4) Tools

   Are the executable means for implementing the strategies? For example, the online platforms, the motorcycle (Jakarta) used in Senegal by fishmongers, processing facilities, fishing inputs and cold storage.

5) Accessibility

   Is the fact that communities can access and benefit from the range of strategies offered to cope with new circumstances. For example, the line of credit loans with the low-interest rate offered by the Bangladesh government, and the fishers faced refused applications to those loans. Another example is the accessibility of rural communities in Malaysia to internet services to utilize online marketing and ordering platforms. Also, the accessibility of unregistered small-scale fishers in Malaysia, India, Bangladesh, and South Africa to government aid, subsidies and stimulus packages.

6) Equity

   It concerns the fair distribution of aid among stakeholders in the SSF value chain. For example, farmers in India and South Africa were given more aid than fishers. Other examples of nepotism in aid distribution were encountered in India, Bangladesh, South Africa, and Senegal.

7) Adequacy

   This feature concerns what the government offers as aid and the community's needs in such circumstances. For example, the government aid to small-scale fishers in Bangladesh during the 65-day fish ban coincided with COVID-19 restrictions. The amount of aid administered was insufficient with the family size and the prolonged ban duration with the pandemic.

8) Monitoring

   The aid administration needs continuous monitoring to ensure it goes to the right person. Not only the aid but also monitoring the impacts of decisions and policies on the communities and their well-being. For example, in India, **s**mall-**s**cale **f**isheries were not declared as an essential service at the beginning of the pandemic, and

fishing activities were totally stopped. However, with the growing pressure from civil society, India retracted this decision and announced fishing as an essential service, allowing fishers to resume their activities. This is a clear example of monitoring and following up on decisions and policies and their impact on respective communities.

9) Collaboration

   Collaborative approaches serve as essential success factor as it bring together different voices into one table of the decision-making process. For example, in Canada, safety associations collaborated with fishers and other stakeholders to develop safety regulations tailored to the nature of fishing activity. This sensitive decision cannot exist solely on thinking but through informed decision-making. Not only did the Canadian safety associations collaborate to shape the new regulations, but they also collaborated with safety associations in other places to transfer knowledge and ensure the safety of fishers.

10) Research

    Research is the knowledge factory that will continue providing useful information for different stakeholders and allow the process of informed decisions. The Canadian government secured funds for research related to COVID-19, especially with coping and adaptation strategies. The safety regulations released through safety associations resulted from a collaborative approach and research on best practices.

11) Communication

    Proper communication of decisions and policies is very important in adaptive governance. For example, in India and Malaysia, fishers were confused about the restrictions imposed on fishing activities. They did know when, who, or where fishing is allowed or prohibited. It took them a long time to understand what was happening and what they should or should not do.

12) Collectivity

    This feature is attributed to fishers as a collective voice and the power they can have when they gather in collective action. This was evident in many examples: the pressure by civil society and fishers on the Indian government to consider fisheries as an essential service; the power of Singhalese fishers to establish assistance hubs at

landing sites in collaboration with the authorities; and Women leadership lobbying the government to facilitate fishers mobility in South Africa.

It is important to say that those factors are interconnected. I am not saying these factors should be evident together when implementing a certain strategy, but rather, various combinations of those factors will occur.

Furthermore, I explored the relationship between those factors identified in this study and the earlier work of (Folke et al., 2005) on adaptive governance for social-ecological systems and (Schipper & Langston, 2015) on livelihood resilience. (Folke et al., 2005) in their work on features of adaptive governance they identified four features of adaptive governance as " (1) Learning to live with change and uncertainty, (2) Combining different types of knowledge for learning, (3) Creating opportunity for self-organization toward social-ecological resilience, (4) Nurturing sources of resilience for renewal and reorganization" (2005, p.452). Additionally, Schipper & Langston (2015) work on livelihood resilience, identify three key features: learning, options, and flexibility. Despite the distinct conceptual origins of adaptive capacity and resilience, resilience is frequently employed interchangeably with adaptation and vulnerability reduction when discussing risk mitigation actions (Schipper & Langston, 2015). Adaptive capacity is the capability to undergo substantial changes in structure and function when confronted with a stressor. However, resiliency describes a system inclined to uphold its regular operations with the assistance of different means, such as disaster relief and other societal maintenance strategies, in the face of future crises (Schipper & Langston, 2015).

Therefore, according to (Folke et al., 2005) and (Schipper & Langston, 2015), features of adaptive governance are learning, knowledge, options, and flexibility. However, the work of (Folke et al., 2005) was not specific to pandemics as a stressor, and they used a wide range of examples in their study; none addressed a pandemic. Also, the work of (Schipper & Langston, 2015) was on climate change and how it is affecting livelihood resilience. Since addressing adaptive governance in the context of COVID-19 as a stressor is new, the outcomes should also be different or add to existing knowledge. In Table 11, I aligned the features of adaptive governance from earlier work of (Folke et al., 2005) and (Schipper & Langston, 2015) with the factors I identified in (Sec. 4.7). The aligned factors were adaptability, knowledge, tools, alternatives, and collaboration. The new factors that this study brings to adaptive governance of SESs are, accessibility, adequacy, equity, research,

communication, monitoring, and collectivity. Consequently, the factors identified in this study brings a new dimension to adaptive governance, livelihood resilience, and risk management.

Table 11: Aligning this study findings with earlier work of (Folke et al., 2005) and (Schipper & Langston, 2015)

Features identified in earlier literature	**Aligning factors identified in this study**
Learning to live with change and uncertainty	Adaptability
Combining different types of knowledge for learning	Knowledge
Creating opportunity for self-organization toward social-ecological resilience	Alternatives
Nurturing sources of resilience for renewal and reorganization	Collaboration, tools
Learning	Knowledge
Options	Alternatives
Flexibility	Adaptability

4.7 Conclusions

In conclusion, this chapter explored and analyzed the impact of COVID-19 on small-scale fisheries (SSFs) in six countries. It is evident that all six countries implemented lockdown measures in response to the pandemic, including travel restrictions, social distancing guidelines, and closures of businesses, institutions, organizations, and schools. Despite some key similarities in the restrictions across these countries, there were significant differences in the duration and intensity of lockdowns. Canada, in particular, demonstrated adaptive capacity and offered solutions to help its population reconfigure their daily lives, which differed from the other five countries where lockdowns were more stringent.

Another noteworthy difference was the recognition of fisheries as essential services, with only Bangladesh not allowing fishing activities during the pandemic. The implementation of this exemption varied widely among the countries, and numerous factors hindered its successful implementation, including mobility, close interactions, crowded working conditions, communication and monitoring challenges, and limited access to healthcare.

The study also introduced an adapted version of the Social-Ecological Regime Shift (SERS) analytical framework to understand and compare the vulnerability and resilience of SSFs in the selected countries. This framework considered various scales of intervention in the SSF value chain.

These critical points of government intervention aimed to mitigate the adverse impacts of COVID-19 on SSFs and provide long-term strategies for resilience. The analysis revealed that governance, coping, and adaptation played essential roles during the pandemic. However, the existing vulnerabilities within the SSF value chain and the emerging impacts of COVID-19 affected the successful implementation of those strategies.

Five key adaptive responses emerged from the analysis: Consumer-Base Shift, Alternative Seafood Networks (ASNs), Government Aid, Sensitive Regulations, and Community-Based Approaches. These elements were implemented during COVID-19 by governments and communities. However, many factors influenced their success or failure. The factors influencing the successful implementation of the adaptive responses were adaptability, alternatives, knowledge, tools, accessibility, equity, adequacy, monitoring, collaboration, research, communication, and collectivity. These factors are intertwined and interconnected, suggesting that they often occurred in combinations when implementing strategies.

Furthermore, These factors extend and align with prior work on adaptive governance, livelihood resilience, and risk management, offering a new perspective on how SSFs can transform into adaptive systems in the face of stressors like the COVID-19 pandemic. In summary, this study provides valuable insights into the multifaceted challenges faced by SSFs during the pandemic and offers a framework for understanding how governance, coping, and adaptation can help enhance the resilience of these communities in the face of future crises.

Chapter 5
Conclusions and Recommendations

5.1 Conclusions

This research aims to understand the impact of COVID-19 on the livelihood resilience of small-scale fisheries and to identify the key adaptive responses and factors of their successful implementation. The outcome of this study can serve as a tool for governments, stakeholders and policymakers to transform SSF management into adaptive governance contributing to their livelihood resilience.

It analyzes the SSF value chain as a social-ecological system experiencing a shock, causing its system to change from one state to another using the SERS analytical framework. The study employed the SERS framework elements as criteria for a comparative analysis of six case studies of SSF. The case studies were selected on the following rationale: the significance of impacts or governance strategies, the availability of published research on the case study, the time constraints of the study, and the HDI of the country where this case study is located. The aim of the case study selection is to show diverse examples from which to learn. Data was collected from published research, grey literature, and semi-structured online interviews with experts from the field. I used NVIVO for data extraction and analysis, which yielded 1,260 references attributed to the six case studies and 16 codes inherited from the SERS framework. Additionally, I used the KUMU platform and Photoshop software for data results visualization and further synthesis of results.

The comparative analysis of case studies was done in two stages. The first stage was analyzing the SERS criteria against each case study. The outcomes of this stage were identifying the scales of interventions, both the suggested and the actual ones. The second stage was to compare the recommended scales to the actual ones and what factors hindered or contributed to the success of their implementation. After performing these two stages of comparison, I further synthesized the governance, coping and adaption strategies, and identified the key adaptive responses and the associated factors for successful implementation.

The five key adaptive responses, and the twelve factors of successful implementation can serve as instrumental tools to help governments, stakeholders, and policymakers transform the management of SFF into adaptive governance. These findings relate to the early work of Folke et al. (2005) on transforming SESs to adaptive governance and Schipper and Langston (2015) on the livelihood

resilience of SESs. Also, it adds to the body of literature published on transformation, specifically SESs, transformational adaptation, and resilience (Evans et al., 2023). The findings from this study are unique because SESs in this research have been studied in the context of COVID-19 impacts, while most of the existing literature discusses SESs in the context of hazards such as climate change and natural disasters.

Conducting this study was not easy due to the complexity of social-ecological systems. Additionally, the analysis of this SES, the value chain of SSF, was done for six different cases, each unique in a way. Moreover, to have an outcome from different contexts that could be used for each of them was a challenge. The synergy of different types of drivers during COVID-19 resulted in compound and complex impacts. Some of the impact can be tackled immediately and others need long-term efforts to be addressed to enhance the resiliency of SSF's systems. However, as complex as the research problem, the methodology employed to conduct this research was too. Based on my findings, I found the following instrumental points worth consideration when navigating the adverse impacts of COVID-19 by SSF:

All the cases under study employed nearly the same strategies to cope with the COVID-19 restrictions and impacts. However, what mattered was how well-prepared those communities were to face those challenges. For example, all value chains under study shifted their consumer base to local consumption to withstand the halt of international trade, especially with China. At this point, to navigate this change, SSFs had to utilize online applications for ordering and delivery of fish products to local consumers. Consequently, the communities with better access to internet services and the skills to use those online platforms navigated this change and leveraged online trade.

Another example is the exemption of SSFs from lockdown restrictions as they were declared essential services. All the countries under study exempted SSFs and allowed them to resume fishing activities. However, except for Canada, the other countries imposed restrictions that were not sensitive to fishing as an activity and a process which jeopardized the intent of the exemption. For Canada, it facilitated the mobility of all the actors in the value chain, which positively impacted the system's function. Also, Canada had safety associations that collaborated to tailor specific health and safety guidelines to ensure that resuming their activities would not impose risks on the lives of fishers or their communities. In the same trend, there are many more examples demonstrated in this study,

and the main observation is that what matters is the preparedness of the communities for the change in the system function.

It is clear that this study's outcomes focus on immediate strategies to be implemented during a crisis such as COVID-19. The five key adaptive responses are immediate strategies presented in section (4.6.). However, the twelve factors of successful implementation in section (4.7.), require longer-term efforts from governments, stakeholders, and policymakers. This conclusion means we must start now and prepare those vulnerable communities for future uncertainties.

I also have to mention that my earlier assumption of HDI being an indicator of how well a community will withstand change during a crisis and show resilience to adverse impact was not entirely validated. In Canada, this hypothesis was verified and correct. However, the rest of the case studies did not present the same trend. The reason behind the success or failure of this assumption is that communities in Canada are more homogenous when it comes to socioeconomic status. This understanding means Canada's SSF communities are at different economic levels. However, in the rest of the case studies, SSF communities are mostly poor, rural and marginalized communities. This understanding means using the HDI to indicate their resilience is obsolete. Thankfully, other factors influenced the selection of the case studies; therefore, the HDI hypothesis did not affect the study's outcomes.

5.2 Recommendations

Recommendations for future research are to explore the factors of successful implementation presented in this study and look for opportunities and actions to be done to implement them. However, this process will require exploration within a specific context for SSFs and cannot be done generally on multiple cases from different parts of the world. In other words, those factors should be contextualized to fit the profile of a specific SSF. The outcomes of this research will also help in navigating the global focus on environmental or ecological issues and expand the efforts to social aspects of the communities, which are of the same importance.

Some scales within the value chain of SSFs were not entirely addressed in the governance during COVID-19. For example, there are associated problems with the imposed restriction on mobility and the fact that migrant fishers were neglected and could not return to their home locations. Other examples were industrial fishing, the battle with SSFs over resources, and the governments allowing them to resume their activities while SSFs were prohibited simultaneously. Moreover, gender-based

inequalities associated with women working informally in the processing sector of the SSF value chains and their struggles during the pandemic. All of these points are worth consideration. However, the scope and focus of this study prevented the study from addressing them.

Recommendations to the governments include taking in consideration the nature of fishing activities when imposing regulations. Countries which demonstrated sensitivity to regulations imposed such as Canada, and Senegal in later stages of the lockdown, proved to perform better in terms of coping with COVID-19 impacts. Additionally, governments to collect data about unregistered fishers within the sector in order to insure that they will receive aid in such circumstances. The collection of data should include migrant workforce too, being an integral part of the SSF value chain in some countries. Moreover, the collection of data will help with future research concerning coastal communities and fisheries.

In spite of the importance of environmental challenges that SSFs communities face, focus to socioeconomic aspects of those communities should be taken into consideration. We have to know that the socioeconomic status of SSF communities affects the ecosystem as well as the ecosystem affect them. For example, poverty and low income push fishers to fish illegally or to overexploit resources which affect the fish stocks. At the same time fish stock depletion affects the income of fishers when imposing bans on fishing as what is happening in Bangladesh and the 65-day fish ban.

Alternative Seafood Networks (ASNs) and online marketing of fish products should be implemented in all SSF communities. It was well-evident in all the case studies that ASNs was the most effective coping strategy. Factors contributing to the success of ASNs and online marketing were possessing the skills, knowledge and tools to leverage those options. SSFs need to start now by educating their communities about those skills. Governments should facilitate the process by providing proper accessibility to the internet and collaborating with the communities to make it happen.

As this study answers the questions presented in the introduction chapter, it raises other questions that still need to be answered. The outcomes of this study provide a solid start to tackle other issues that have not yet been addressed in the governance of small-scale fisheries.

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Appendix A

Email invitation template to the semi-structured online interviews:

Dear,

Good morning.

I am Maha Abdelbaset, a member of the V2V research project and a current master's student under the supervision of Professor Prateep Nayak. I am doing my research on the livelihood resilience of small-scale fisheries in the context of COVID-19 impacts. In my study, I analyze small-scale fisheries as a social-ecological system experiencing a regime shift using a comparative analysis of 6 selected countries.

For that purpose, I am conducting a number of interviews with experts in the field to discuss the following aspects:

- COVID-19 restrictions impacted SSFs the most.
- Existing vulnerabilities contributing to regime shift.
- Positive outcomes (ecological, social, economic, political)
- Equity and justice concerns
- Government, cooperatives or NGOs support during COVID-19.
- Coping and adaptation strategies (erosive & Constructive)

I invite you to participate in the online interviews for my study. The online discussion should take no more than thirty minutes of your time and can take place at any time that is convenient for you.

If you decide to proceed with the interview, please tell me if you want me to share the questions.

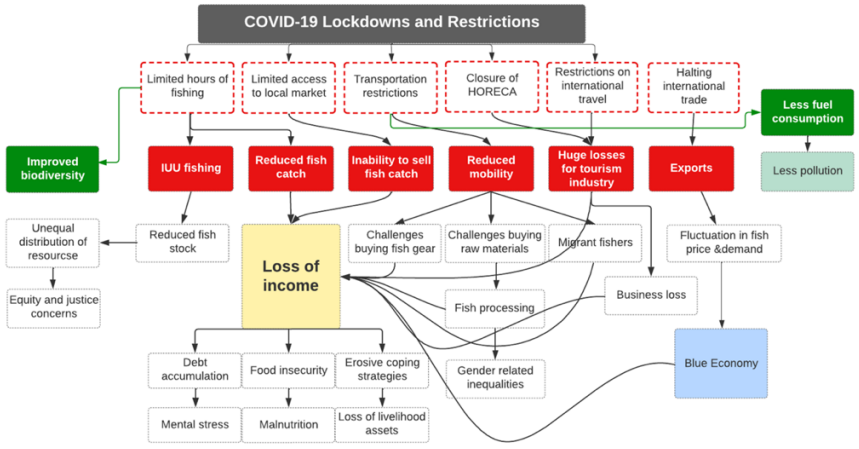
Thank you, and I am looking forward to your reply and cooperation.

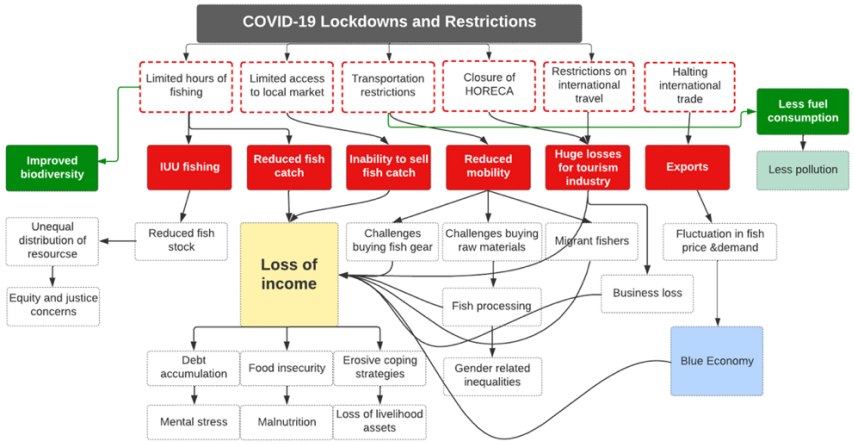
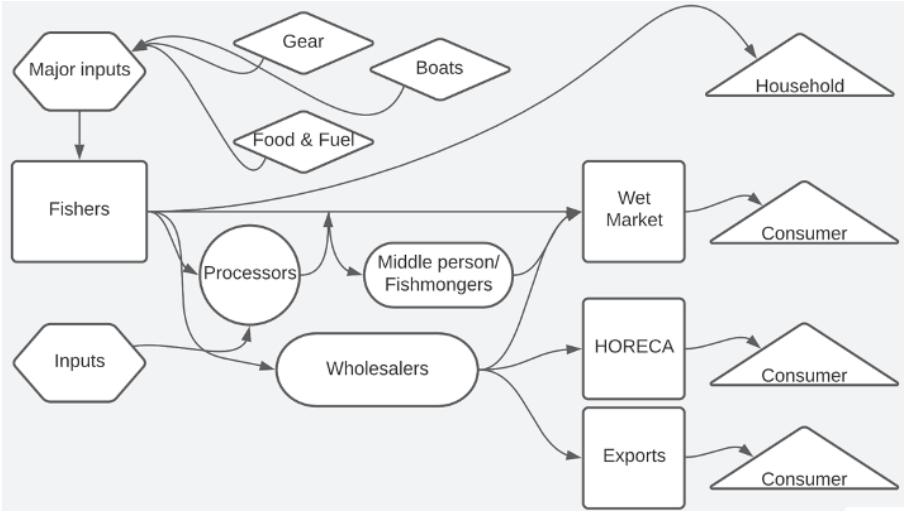
Sincerely,

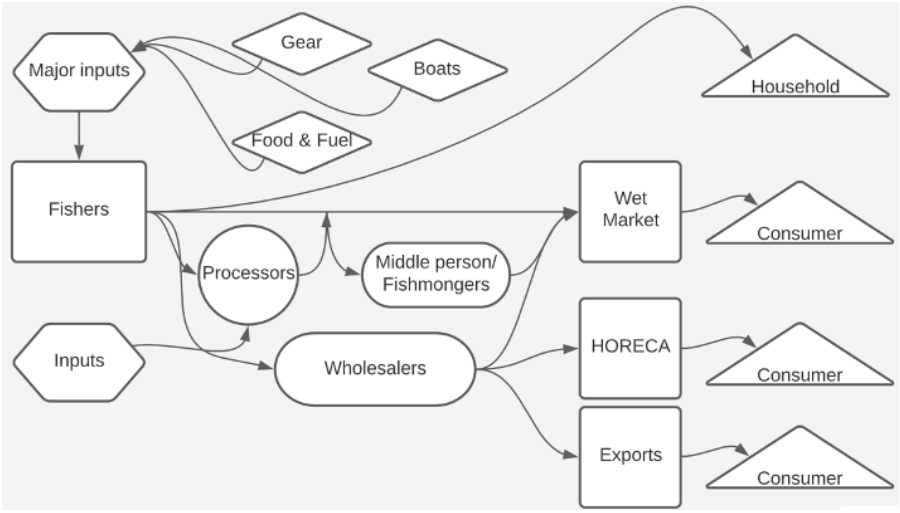
Maha Abdelbaset

Appendix B

Semi-structured online interview questions guide:

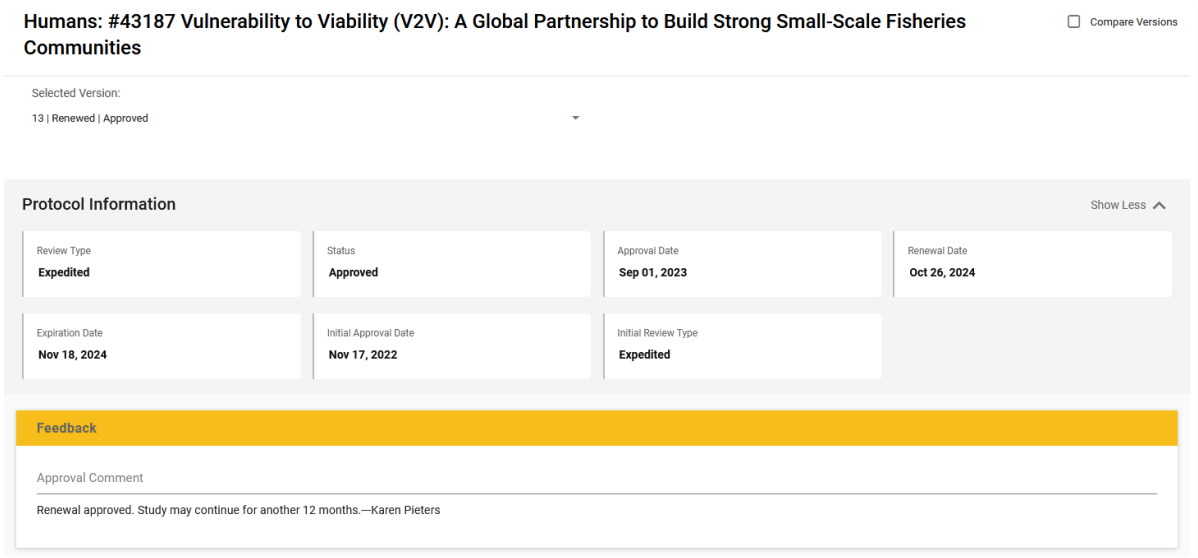
	Questions	Discussion
Q1	COVID-19 restrictions were nearly the same worldwide, however, there were variations identified. Could you describe how were COVID-19 restrictions different in your country with respect to small-scale fisheries? Which restrictions impacted SSFs the most? What would you add/remove/change in the below diagram? 	
Q2	What do you think the underlying/existing vulnerabilities in small-scale fisheries communities and/or value chain that contributed to its disruption during COVID-19 event?	

		
Q3	Social-ecological units or the context of system disturbance: Could you verify the below value chain diagram? Would you add/remove a component or change a relation in this diagram with respect to small-scale fisheries? 	
Q4	Using the following SSFs value-chain (or with your suggestions included), which component(s)/ scale(s) was/were affected primarily and caused the disturbance in the system? On the contrary, which component(s) thrived during the crisis? Also, what would be the immediate and long-term interventions to tackle those issues?	

		
Q5	What are the equity and justice concerns affecting small-scale fisheries communities during COVID-19 or existing from before and contributed and/or influenced the system disturbance in your country?	
Q6	What are the power dynamics of SSFs value chain in your country (system stakeholders and their power to implement decisions during a regime shift)? Can you identify the winner and losers (as a result of decisions) during COVID-19 crisis?	
Q7	What is the government, cooperative and NGOs support received/administered to SSFs and their communities during the crisis? Did all fishers receive this support? Why (if the answer is “NO”)?	
Q8	What are the coping and adaptation strategies practiced by SSFs' fishers and their communities during the crisis (both erosive and/or constructive)?	

Appendix C

Ethics clearance:



Subject: Research Ethics - Amendment application # 43187 has ethics clearance
From: no-reply=kuali.co@mx3.kuali.co on behalf of Kuali Notifications
To: Maha Abdelbaset

Dear Prateep Nayak and other members of the research team:

Your application has been reviewed by Delegated Reviewers. We are pleased to inform you the **Amendment application for 43187 Vulnerability to Viability (V2V): A Global Partnership to Build Strong Small-Scale Fisheries Communities** has been given ethics clearance.

This research must be conducted in accordance with the most recent version of the application in the research ethics system and the most recent versions of all supporting materials.

Ethics clearance for this study is valid until Saturday, November 18th 2023.

The research team is responsible for obtaining any additional institutional approvals that might be required to complete this Expedited study.

University of Waterloo Research Ethics Boards operate in compliance 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), Internalization Conference on Harmonization: Good Clinical Practice (ICH-GCP), the Ontario Personal Health Information Protection Act (PHIPA), and 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 (Human Research Ethics Board) and IRB00007409 (Clinical Research Ethics Board).

Renewal: Multi-year research must be renewed at least once every 12 months unless a more frequent review has been specified on the notification of ethics clearance. This is a requirement as outlined in Article 6.14 of the Tri-Council Policy Statement for the Ethical Conduct for Research Involving Humans (TCPS2, 2014). The annual renewal report/application must receive ethics clearance before Thursday, October 26th 2023. Failure to receive ethics clearance for a study renewal will result in suspension of ethics clearance and the researchers must cease conducting the study. Research Finance will be notified ethics clearance is no longer valid.

Amendment: Changes to this study are to be submitted by initiating the amendment procedure in the research ethics system and may only be implemented once the proposed changes have received ethics clearance.

Adverse event: Events that adversely affect a study participant must be reported as soon as possible, but no later than 24 hours following the event, by contacting the Director, Research Ethics. Submission of an adverse event form is to follow the next business day.

Deviation: Unanticipated deviations from the approved study protocol or approved documentation or procedures are to be reported within 7 days of the occurrence using a protocol deviation form.

Incidental finding: Anticipated or unanticipated incidental findings are to be reported as soon as possible by contacting the Director, Research Ethics. Submission of the incidental findings form is to follow within 3 days of learning of the finding. Participants may not be contacted regarding incidental findings until after clearance has been received from a Research Ethics Board to contact participants to disclose these findings.

Study closure: Report the end of this study by submitting a study closure report through the research ethics system.

Coordinated Reviews: If your application was reviewed in conjunction with Wilfrid Laurier University, Conestoga College, Western University or the Tri-Hospital Research Ethics Board, note the following: 1) Amendments must receive prior ethics clearance through both REBs before the changes are put in place, 2) PI must submit the required annual renewal report to both REBs and failure to complete the necessary annual reporting

requirements may result in Research Finance being notified at both institutions, 3) In the event that there is an unanticipated event involving a participant that adversely affects them, the PI must report this to both REBs within 24 hours of the event taking place and any unanticipated or unintentional changes which may impact the research protocol shall be reported within seven days of the deviation to both REBs.

Initial application ethics clearance notification: Your clearance notification will be added to the record within 24 hours. Go to "Admin Notes and Files" in the research ethics system (right-hand side) to print a copy of the initial application ethics clearance notification.

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Best wishes for success with this study.

If you have any questions concerning this notification, please contact the Research Ethics Office or email researchethics@uwaterloo.ca.

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