

Examining the Canadian Shellfish Sanitation Program in Nova Scotia Through a Food
Security Lens: Management for Subsistence Shellfish Harvest

By

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Submitted in partial fulfillment of the requirements for the degree

of

Master of Marine Management

at

Dalhousie University

Halifax, Nova Scotia

December 2023

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Table of Contents

List of Tables	iii
List of Figures	iii
List of Boxes	iii
Abstract	iv
List of Abbreviations	v
Acknowledgements	vi
CHAPTER 1. BACKGROUND	1
CHAPTER 2. INTRODUCTION	5
2.1. The Shellfish Industry	5
2.2. Shellfish from an Environmental Sustainability Perspective	6
2.3. Food Security	7
2.3.1. Food Security in Canada and Nova Scotia	9
2.3.2. Food Security and Shellfish	10
2.4. The Canadian Shellfish Sanitation Program: Structure, Governance, and Current Challenges	12
2.4.1. Structure: CSSP Mandate and Roles of the Partners	12
2.4.2. Regional Considerations	14
2.4.3. CSSP Governance	15
2.4.4. Current Challenges	17
CHAPTER 3. METHODS	19
3.1. Changes to the Methods	21
3.2. Eligibility Criteria: Why Government Staff?	22
CHAPTER 4. RESULTS	24
4.1. Results of Thematic Analysis	25
4.2. Impacts of Non-Delivery	27
4.2.1. Restriction of Access	27
4.2.2. Socio-Cultural Food Security	28
4.2.3. Idle Capacity	29
4.3. Harvest Safety Risks	30
4.3.1. Public Unawareness	31
4.3.2. Public Skepticism	32
4.3.3. Indirect Food Security	32
4.4. Indigenous Rights	33
4.5. Organizational Dysfunction	34

4.5.1. Decline in Resourcing.....	34
4.5.2. Interpretation of Mandate.....	35
4.5.3. Misalignment of Priorities	36
4.5.4. National/Regional	37
4.5.5. Lack of Consultation.....	38
4.5.6. Staff Turnover.....	38
4.6. Solutions	39
4.6.1. Alternate Program.....	39
4.7. Non-CSSP Considerations.....	40
CHAPTER 5. DISCUSSION.....	41
5.1. Proposed Solutions.....	46
5.2. Recommendations.....	48
5.3. Limitations and Directions for Future Research	49
CHAPTER 6. CONCLUSION.....	51
REFERENCES	53
APPENDIX A. Recruitment email	61
APPENDIX B. Consent Form	62
APPENDIX C. Interview Guide	65
APPENDIX D.....	68
Supplementary Information	73

List of Tables

Table 1. Roles and responsibilities of the three federal CSSP partner departments.	13
Table 2. Mention of food security pillars in participants' definitions of food security. Green cells signify mention, yellow signify omission.	24
Table 3. Data for main themes and sub-themes.	26

List of Figures

Figure 1. Map of DFO Maritimes region.	14
Figure 2. Governance structure of the CSSP.	16
Figure 3. Thematic map; blue is research question 1, green is research question 2.	25

List of Boxes

Box 1. Details on CSSP classifications and temporary closures.	2
Box 2. Important dates for the NS shellfish industry.	15

Williamson, A., 2023. Examining the Canadian Shellfish Sanitation Program in Nova Scotia Through a Food Security Lens: Management for Subsistence Shellfish Harvest [graduate project]. Halifax, NS: Dalhousie University.

Abstract

Defined as molluscan bivalves, shellfish are an important source of protein for subsistence harvesters in Canada. Due to health risks associated with consuming contaminated shellfish, routine monitoring of the coast is required. This responsibility falls to a federal program called the Canadian Shellfish Sanitation Program (CSSP). Although the CSSP is the sole authority for shellfish safety, its core mandate prioritizes delivery for commercial shellfish producers and its resources have not increased proportionately with costs, prompting program downsizing in Nova Scotia (NS). The purpose of this project is to analyze the CSSP from a food security lens. It aims to determine the impacts of CSSP on subsistence food security in NS, and whether the federal CSSP model is structured to meet food security needs. This project used thematic coding to analyze semi-structured interviews with federal and provincial government staff, resulting in the identification of four main themes and 13 sub-themes. Findings show that the CSSP decreases access for subsistence harvesters and increases health risks as it struggles to deliver testing, leaving large stretches of coastline unavailable for food and limiting Indigenous harvest rights. The program's mandate is not structured to meet the needs of subsistence harvesters, and governance inefficiencies combined with resource shortages prevent adaptation. A commitment to drastic institutional change to address the underlying governance challenges of the CSSP is recommended. A federal program efficiency exercise and a comprehensive engagement project in NS should be conducted to determine how the program can deliver better outcomes for Canadians in the interim.

Keywords: CSSP; Food Security; Shellfish; Subsistence Harvest; Governance; Nova Scotia

List of Abbreviations

ARISC – Atlantic Regional Interdepartmental Shellfish Committee

ASP – Amnesic Shellfish Poisoning

BC – British Columbia

CFIA – Canadian Food Inspection Agency

CSSP – Canadian Shellfish Sanitation Program

DFO – Department of Fisheries and Oceans

DSP – Diarrhetic Shellfish Poisoning

ECCC – Environmental and Climate Change Canada

FSC – Food, Social and Ceremonial

HAB – Harmful Algae Bloom

MOU – Memorandum of Understanding

MSX – Multinucleated Sphere Unknown

NB – New Brunswick

NISC – National Interdepartmental Shellfish Committee

NL – Newfoundland and Labrador

NS – Nova Scotia

NSDFA – Nova Scotia Department of Fisheries and Aquaculture

PEI – Prince Edward Island

PSP – Paralytic Shellfish Poisoning

RISC – Regional Interdepartmental Shellfish Committee

USFDA – United States Food and Drug Administration

Acknowledgements

For her enthusiasm, tireless guidance, patience in keeping me on track, and incredibly quick and helpful feedback, I thank my supervisor, Dr. Suzanne Dobson. I also thank my second reader Dr. Ramón Filgueira.

Much of this project was done during my internship and subsequent casual employment with the Department of Fisheries and Oceans, Aquaculture Management. As such, I would like to extend my thanks to my colleagues with the Aquaculture Management team for their conceptual help with this project and for always being willing to listen to my ideas.

A big thanks to all the research participants for lending their valuable time and insightful knowledge, it is my hope that I did their participation justice throughout my analysis.

No small gratitude is owed to my wonderful partner, Sydney, for her steady, affectionate support and admirable patience when I occasionally struggled to find the motivation to do my work.

CHAPTER 1. BACKGROUND

This project focused on various management aspects of shellfish as a food source in Nova Scotia. The term ‘shellfish’ refers to molluscan bivalve species commonly grown and consumed in Canada, such as blue mussels (*Mytilus edulis*), Eastern oysters (*Crassostrea virginica*), and a variety of clam species. While nutritious and relatively available, shellfish are filter feeders, making their management for consumption especially important. As filter feeders, shellfish have gill-like structures that sift for phytoplankton and organic particles, trapping both food and contaminants suspended in the water, making them particularly unsafe to consume if grown in polluted areas (Potasman et al. 2002). As a result, food safety programs have been established to focus specifically on bivalve shellfish, rather than crab, lobster or shrimp that do not filter feed and are therefore less vulnerable to pollutants in the water.

Contamination of shellfish occurs most frequently in waters polluted by fecal coliform bacteria from land-based runoff and sewage contamination (Potasman et al 2002). Marine biotoxins produced by harmful algae species are also cause for great concern and are not easily detectable by sight or smell. Shellfish contaminated by marine biotoxins can cause serious illness or death when consumed (McKenzie et al. 2021). For example, a 1987 incident saw approximately 150 illnesses and three deaths in Prince Edward Island (PEI) due to consumption of mussels contaminated by a biotoxin derived from the diatom *Pseudo-nitzschia multiseries* called domoic acid (McKenzie et al. 2021). The illness caused by domoic acid is referred to as amnesic shellfish poisoning (ASP), and the incident in PEI was the world’s first ever recorded. Other illnesses caused by biotoxins include paralytic shellfish poisoning (PSP) and diarrhetic shellfish poisoning (DSP), both of which are also caused by harmful algae (McKenzie et al. 2021). Biotoxin events can be challenging for industry to manage due to unexpected closures and/or reduced growth or quality of shellfish product (some forms of algae damage shellfish tissues), not to mention that events can be reputationally damaging when poisonings occur (McIntyre et al. 2013). These management and food safety challenges, such as the one in PEI, highlight the need for testing protocols and procedures to ensure the safety of shellfish products.

In Canada, the federal Canadian Shellfish Sanitation Program (CSSSP) is responsible for water quality and shellstock (shell and flesh of shellfish) testing to ensure that shellfish products are safe to consume. Initially, a classification must be established in each area to Box 1. Details on CSSSP classifications and temporary closures (DFO, 2023a).

CSSSP Classifications:

- Approved – no contaminants present above regulated levels, area is open to shellfish farming and harvesting.
- Conditionally approved – area meets requirements for approval for a defined and predictable time period. For example, fecal coliforms from migrating birds contaminate shellfish only during a specific time of the year.
- Restricted – water quality is not good enough to harvest or grow shellfish without first decontaminating them through depuration (filtering shellfish with clean water on land) or relay (moving shellfish to a cleaner area at sea).
- Conditionally restricted – area meets conditions for restriction for a defined and predictable time period. For example, an area prone to periodic contamination from boating activities may only be open in times when boating is minimal, or there may be restrictions for certain shellfish species.
- Prohibited – no shellfish harvest for consumption allowed, area is located in closer proximity to contamination sources or the water is too contaminated to allow for depuration or relay of shellfish product.

If the CSSSP either never monitored in an area or stops monitoring an area, it has a status of unclassified, meaning it is neither approved nor restricted or prohibited, and wild shellfish can be collected at the harvester’s own risk. Areas that are approved, under conditional status, or unclassified can be temporarily closed due to contamination events. A common example of temporary prohibitions are rainfall closures; when a certain pre-regulated threshold of rainfall is passed in a 24-hour period, the coastline is closed for three weeks to prevent sicknesses caused by runoff contaminants. Chemical or oil spills are also cause for temporary closures.

determine if contaminants are present in unacceptable levels. Contaminants can be from point sources, such as wastewater treatment plants, or non-point sources, such as urban, agricultural or industrial runoff (DFO, 2023a). The range of possible CSSSP classifications is explained in Box 1.

At present, the CSSSP is experiencing long standing resource constraints coupled with increasing international demands for testing, causing the program to struggle to fulfill its core duties and leaving large stretches of Canada’s coast unmonitored and/or unclassified (DFO, 2022). As this project is written, the lack of resources for testing has forced the CSSSP to consider declassification of harvest areas which could result in large stretches of

coastline becoming unavailable for commercial shellfish development or safe shellfish harvest.

The impacts of the current CSSP challenges are felt directly and indirectly by Canadians as they can result in a lack of opportunities for industry growth, potential infringement on Indigenous harvesting rights, and increased food-safety risks for anyone who harvests shellfish as part of their diets (DFO, 2022). The latter point touches specifically on food security and is the focal point of this project as declines in CSSP program delivery have the potential to reduce access to safe shellfish for those who depend on it. As one of the most food-insecure provinces in the country (PROOF, 2023), Nova Scotia is not in a position to lose an available food source and would benefit from increased access to safe wild shellfish.

In this project, people who harvest shellfish as part of their diets are referred to as ‘subsistence’ harvesters. According to the United Nations, a subsistence fishery is: “where the fish caught are shared and consumed directly by the families and kin of the fishers rather than being bought by intermediaries and sold at the next larger market.” (UN, 2016). It is important to note that the Government of Canada categorizes wild shellfish harvest into commercial (mostly clam harvesters), recreational, and for Indigenous harvesters, Food, Social, and Ceremonial (FSC) (DFO, 2023a). However, there is a considerable global gap in understanding of subsistence fisheries, as it is often lumped in with recreational fisheries, and the literature is not always clear on what ‘subsistence’ actually means (Ebbin, 2017).

The use of the term ‘subsistence’ is not meant to reduce social processes, cultural expressions and spiritual relationships to modes of nourishment; it is a pragmatic term intended to distinguish those who harvest shellfish as a direct contribution to their food security versus those who harvest for other reasons, i.e. commercially or for sport. In the case of FSC harvest, the food security aspect will be rolled into the term ‘subsistence’, and differentiated as required. It was observed that when the participants of this project discussed subsistence harvest, they generally referred to both Indigenous and non-Indigenous harvesters, and would add specific comments concerning Indigenous harvesters

when salient. That said, this project will still examine the cultural aspect of food security as it pertains to wild shellfish harvest to ensure that important cultural context is not lost.

CHAPTER 2. INTRODUCTION

To provide relevant context for this project and its objectives a wider literature review was completed on the shellfish industry, local harvesting, aspects of food security and the structure and functioning of the CSSP. The literature review will address the economic, environmental and social dimensions of shellfish and food consumption in place before examining the related governance structure and recognized challenges within Canadian Shellfish Sanitation Program (CSSP).

2.1. The Shellfish Industry

Globally, the shellfish industry is commonly divided according to its cultivation and harvesting type and is either considered aquaculture or wild capture. Aquaculture accounts for the great majority of bivalve production globally, with only 11% from wild capture (Wijsman et al. 2018). Shellfish aquaculture is the deliberate cultivation and harvesting of mollusks, mostly bivalves and has globally increased over the last three decades, reaching a total live-weight production of 17.7 million tonnes in 2020, worth USD 29.9 billion (FAO, 2022). China dominates this market, producing more marine bivalves than the rest of the world combined (FAO, 2022). Although a strong market for shellfish exists in Asia, the rest of the world lags far behind and finfish aquaculture greatly outweighs shellfish in global importance, capturing 66% of total global aquaculture production (FAO, 2022). In Canada, total aquaculture production in 2021 was worth CAD \$1.3 billion with shellfish representing CAD \$122 million of the total (DFO, 2023b). The majority of Canadian shellfish comes from Prince Edward Island, British Columbia, and New Brunswick, with Nova Scotia accounting for only CAD \$11 million in 2021 (DFO, 2023b).

Much of the wild-captured shellfish comes from North America, as the United States and Canada have large clam and deep-sea scallop fisheries (Wijsman et al. 2018). Quantifying the value of ‘recreationally’ harvested wild shellfish is quite difficult and involves determining the ‘willingness to pay’ for otherwise freely harvested shellfish. Many studies have attempted to do this in various countries, often using the number of harvesting trips per harvester per year to estimate the demand for wild shellfish (Anderson & Plummer, 2017 and references within), however a direct valuation of non-commercial shellfish harvest remains elusive.

2.2. Shellfish from an Environmental Sustainability Perspective

Speaking from an aquaculture perspective, shellfish are valuable both as nutritious food and for the positive interactions they have with their environment, leading to a recognition of the potential benefits of shellfish (Naylor et al. 2021). With the world population projected to grow to approximately 9.7 billion by 2050 (United Nations, 2022), developing environmentally sustainable sources of protein that can meet nutritional needs is becoming increasingly important. Shellfish are rich in vitamin B-12, omega-3 fatty acids, iron, zinc, and selenium (Wright et al. 2018) and can be grown vertically in the water column and without input of feed, fertilizers or pesticides (Willer et al. 2021). As the demand for seafood grows at twice the pace of global population growth, shellfish are a largely underdeveloped opportunity to fill the gap with a sustainable option (Willer et al. 2021).

Beyond food provisioning, both wild and farmed shellfish are useful as a sustainable and more effective alternative to traditional ‘hard’ shoreline infrastructure such as breakwaters and bulkheads that often negatively alter hydrodynamics and increase erosion (Prosser et al. 2018). For example, suspended mussel lines have been shown to reduce wave energy and perform well in rising sea level scenarios in the context of climate change (Zhu et al. 2020). With respect to climate mitigation, shellfish are not likely a significant sink of atmospheric carbon, but represent an overall low-emission alternative to other animal proteins (Zavell et al. 2023).

One of the key advantages of dense assemblages of shellfish is their ability to remove excess nitrogen from the marine environment, improving water quality and clarity and reducing eutrophication. Excess nutrient loading from agricultural runoff and waste-water effluent can be mitigated by shellfish aquaculture sites (Guyondet et al. 2022). Compared to estuaries without bivalve farms, those with large concentrations of blue mussel (*Mytilus edulis*) farms in particular contain far less nitrogen (Guyondet et al. 2022).

Either in wild assemblages or through aquaculture, some species of shellfish are themselves habitat for a diversity of other marine organisms. Oysters and mussels in particular form highly heterogeneous habitat structures that act as forage, refuge, and nurseries for finfishes, invertebrates and marine plants (zu Ermgassen et al. 2020). There is also strong evidence that biogenic bivalve habitats support the thriving of other commercially valuable species,

supporting prosperity across multiple fisheries (zu Ermgassen et al. 2020). Research concerning the ecological benefits of shellfish aquaculture also demonstrates that shellfish farms can support healthy marine ecosystems, however biodiversity gains diminish with increasing intensity of human activity within aquaculture sites, making them comparatively less ecologically valuable than natural or restored shellfish habitats (Theuerkauf et al. 2021).

While many of the large-scale sustainability benefits of shellfish are extolled from an aquaculture perspective, intuitively they apply to wild populations of shellfish. The ecosystem and societal benefits of wild shellfish habitat should not be overshadowed by the potential for economic growth from aquaculture. For example, when permitted to grow undisturbed by intensive commercial harvest, wild oyster-reefs are an exceptionally effective buffer for wave energy and storm surge, for which much effort has been placed in restoring natural oyster reefs on the east coast of the United States (zu Ermgassen et al. 2020).

Despite the potential side benefits of shellfish, economic gain and food provision are unmistakably the primary motivations for farming shellfish. From a food provision perspective, the benefits of ensuring access and availability of wild shellfish for harvest have often been overlooked, but for rural and local communities cannot be ignored. Although perhaps limited in potential for large-scale food provision as compared with aquaculture, wild-harvested shellfish are an important subsistence protein in the diets of many people within range of the world's coasts. The food-security perspective of wild-shellfish harvest will be further explored in the following subsections.

2.3. Food Security

The term 'food security' was first introduced in the 1970's to quantify food supply as the total availability of calories as required by a population from domestic production and import (Jones et al. 2013). Definitions of food security have developed in recent decades in an effort to recognize the importance of equitable distribution of food resources, moving from a basic interpretation of caloric availability to more inclusive definitions that incorporate stable access, nutritional requirements, and social-cultural appropriateness for all members of society (Pinstrup-Anderson, 2009). Today, there remain a variety of

definitions of food (in)security and other terms used semi-synonymously, such as undernourishment, nutrition insecurity, food insufficiency, and hunger (Jones et al. 2013). Inter-use or use of these terms to measure or conceptualize different things can lead to confusion; nutrition insecurity is a looser term that involves hygiene and access to quality health services, while undernourishment and food insufficiency are generally understood as extreme forms of food insecurity, although the latter term is now seen as outdated (Jones et al. 2013). There is also some ambiguousness between chronic and transitory food insecurity, the latter simply defined as periodic; the duration and frequency of food-insecurity that classifies one as ‘chronic’ is not clear (Jones et al. 2013). For the purpose of this article, ‘chronic’ will be assumed to mean ‘permanent’, while the term ‘food security’ will be used over its counterparts and will be characterized using the commonly accepted definition from the United Nations Food and Agriculture Organization (FAO).

The FAO defines food security as “when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 2006). The inclusion of “at all times”, “safe and nutritious” and “food preferences” makes this definition more useful for the level of food insecurity that is most contextually applicable to this project; food security that is ostensibly impacted by sanitary practices and not necessarily chronic – more on this later. It should be clarified that “food preferences” refers to culturally, religiously or ethically acceptable foods rather than individual preferences (Pinstrup-Anderson, 2009).

Through the FAO’s definition, four pillars of food security can be identified:

- 1) *Availability* refers the physical existence of sufficient quantities of food to meet energy requirements.
- 2) *Access* is the ability to acquire available foods, i.e. to have “physical and economic access”.
- 3) *Utilization* necessitates food that is “safe and nutritious”; it involves the quality, preparation, sanitary condition, and nutrient value/absorption of food.
- 4) *Stability* is the reliability of having enough safe, nutritious food “at all times.”

Discussions of food security involve scale; food security is often thought of from a national, regional, or global perspective and assesses the availability of food in a country or area for the sum of its population, not necessarily for each individual (Pinstруп-Anderson, 2009). In the early 1980s, the FAO amended its definition of food security to explicitly include household and individual scales, providing a more complete picture of food insecurity and its impacts (FAO, 2006). Notwithstanding this commonly accepted FAO definition, there remain countless conceptualizations of food (in)security and many different metrics for measuring it; food insecurity can be measured as a function of food price volatility, or prevalence of malnutrition, or by using the Global Food Security Index (GSFI), in addition to numerous other measures (Jones et al. 2013). Use of the proper measure is highly context specific, and using the wrong measure can generate false or misleading results. For example, consumer price index can give an idea of what a population is facing broadly over time, but would not be a suitable metric to assess place-based needs. This project does not quantitatively measure food security using such metrics, and builds anecdotally on pre-existing knowledge of food insecurity in Nova Scotia.

2.3.1. Food Security in Canada and Nova Scotia

Despite being an affluent country, food security remains a serious issue in Canada. Largely as a result of the COVID-19 pandemic and associated inflation (Charlebois et al. 2023), food insecurity in Canada has been increasing since 2019. Based on data from Statistics Canada surveys, 18.4% of Canadians, or 6.9 million people were living in food insecure households in 2022, largely represented by visible minorities and Indigenous people (PROOF, 2023). Nationally, 2022 saw a 10.3% increase in the average cost of food, with another 7% total increase projected for 2023 (Charlebois et al. 2023). The severity of food insecurity is high in the country; ~70% of the total food insecure people in the ten provinces were classified as moderately to severely food insecure (moderate is defined as experiencing low quality/quantity of food due to lack of money, and severe is missing meals every day and reduced overall food intake) (PROOF, 2023). As the cost of living increases, these numbers are likely to get worse in the absence of adequate government intervention (PROOF, 2023).

Nova Scotia is one of the most food insecure provinces in the country. 2022 saw 22% of Nova Scotian households classified as food insecure, steadily rising from 20.9% in 2019

(PROOF, 2023). January and February of 2023 saw a 27% increase in the use of food banks in the province, causing alarm in the media (Currie, 2023; Welland, 2023). In response to the high prevalence of food insecurity in the province, food initiatives have been established such as the Halifax JustFOOD Action Plan (Smillie et al. 2023), and funds from the federal Surplus Food Rescue Program recently allocated \$1,491,072 to Clearwater Foods to purchase 150,000 pounds of surplus scallops for distribution to Mi'kmaq families across Nova Scotia (Agriculture and Agri-Food Canada, 2020). Although these measures help, they are not nearly enough; Nova Scotia's rising food insecurity is largely due to its high rate of poverty, low minimum wage and meagre labor standards (Frank & Saulnier, 2023). Tackling issues of poverty is the key to improving food security and will require broad policy action by provincial and federal governments (Frank & Saulnier, 2023), however there are also opportunities to increase the food security value of wild foods, including shellfish.

2.3.2. Food Security and Shellfish

Shellfish can be an important contributor to food security. Shellfish aquaculture provides large quantities of nutritious, environmentally sustainable food and is projected to be a major asset for feeding future populations globally (Azra et al. 2021; Willer et al. 2021). While far less volume is possible from wild harvest, it remains an important aspect of coastal people's diets where wild shellfish is typically used as a supplementary protein. Strong traditions of wild shellfish harvest have been studied around the globe, often pointing to a need for improved management of shellfish resources to ensure food safety. For example, a survey in New Zealand determined that 72% of shellfish consumers harvested their shellfish recreationally, highlighting a need for local resource managers to allocate sufficient resources to testing for non-commercial purposes (Guy et al. 2021).

In Caraguatatuba Bay, Brazil despite the common cultural practice of harvesting clams off sandy beaches for personal consumption, locals are largely unaware of the pollution risks from oil spills and sewage discharge in an area that has no testing or regulation, clearly emphasizing a need for education and pollution management (Turra et al. 2016). In Alaska, both rural and urban residents harvest wild clams for subsistence and socio-cultural purposes, despite the state government not exercising monitoring of potential contaminants and advising the mostly Indigenous harvesters not to eat wild shellfish except at their own

risk (Harrison & Loring, 2016). Similar situations highlighting both the importance of wild shellfish to coastal life and the risks associated with consuming wild shellfish can be found in South Africa, France, the United States (Washington State, Connecticut), and Portugal (Kyle et al. 1997; Picot et al. 2012; Anderson & Plummer, 2017; Ebbin, 2017; Sordo et al. 2023; respectively), to name a few.

In Canada, shellfish harvest is important for local and Indigenous communities on all coasts. A key historical feature on the West coast is the clam garden. Clam gardens are rock-walled enclosures constructed in the intertidal zones of beaches to expand and enhance the available habitat for clams and can be found along the West coast of North America stretching from Alaska to Washington State (Groesbeck et al. 2014). These clam gardens are resilient, highly productive forms of mariculture used by Indigenous peoples for many centuries before European contact; even in ancient, untended gardens, clam abundance and density remains higher than in unmodified beaches (Groesbeck et al. 2014; Jackley et al. 2016). In Canada's Arctic, subsistence harvesting of shellfish is common; blue mussels, softshell clams, and Iceland scallops provide important supplementary protein for much of the year (Rapinski et al. 2018). Despite the high frequency of (often raw) consumption of these mollusks, no food safety testing occurs in Canada's North and very little literature exists concerning the food security contributions of mollusks in Arctic Indigenous communities (Rapinski et al. 2018).

On Canada's Atlantic coast, Indigenous communities have also harvested shellfish for thousands of years. The traditional prevalence of shellfish consumption is recorded through Mi'kmaw traditional knowledge (Denny et al. 2016) and marked by shell-bearing archeological sites scattered throughout the North-East of the continent, called shell middens (Betts & Hrynicky, 2017). The Bras d'Or Lake in Cape Breton, Nova Scotia is a potent example of the traditional importance of oysters to Mi'kmaw people, where oysters were once a staple of local communities before the decline of the oyster population following the introduction of the parasite MSX in 2002 (Denny et al. 2016). In Nova Scotia and elsewhere, shellfish have and will continue to play a role as an important food source for Indigenous communities. This is an important consideration, given that Indigenous people in Canada face considerable and unique food insecurity challenges stemming from

colonial practices that eroded traditional food systems over generations and continue to prevent communities from achieving food security through control of their own resources (Batal et al. 2021; Shafiee et al. 2022). The next section will help to put the current state of shellfish management in Canada into perspective by reviewing the structure, governance, and current challenges within the CSSP.

2.4. The Canadian Shellfish Sanitation Program: Structure, Governance, and Current Challenges

To properly analyze the CSSP and its impacts on subsistence food security, it is essential to understand how the program operates and where the recognized issues are creating challenges. This section will explain the overall structure of the program and the roles of the partners prior to describing the key findings of an official program evaluation undertaken in 2022.

2.4.1. Structure: CSSP Mandate and Roles of the Partners

Created in 1925, following a deadly outbreak of typhoid fever from contaminated oysters in the US, the CSSP's mandate was established to prevent illnesses and deaths from similar shellfish contamination events, and ensure the safety of exported products (CFIA, 2007). The emphasis on exported products was formalized in a 1948 bilateral agreement between the US and Canada to increase the sanitation measures of shellfish exported between the two nations. Since then the core mandate has remained unchanged.

Originally, the CSSP was composed of the federal Department of National Health and Welfare and the Department of Fisheries. In 1971, Environment Canada (EC) took over most of the program, with Health and Welfare Canada retaining only a small testing role. The roles were switched again in 1979 with the formation of DFO, which took over responsibly for shellfish fishery management, while EC retained responsibility for water quality testing and Health and Welfare Canada retained its biotoxin testing role (this too was transferred to DFO in 1988) (CFIA, 2007). Today the program is operated and administered by the Canadian Food Inspection Agency (CFIA), Environmental and Climate Change Canada, (ECCC), and Fisheries and Oceans Canada (DFO), with CFIA being included in 1997 following its inception as a federal agency. The three federal agencies are mandated to communicate and cooperate with each other to achieve program

goals under a Memorandum of Understanding (MOU) signed in 2000 that outlines the responsibilities of each partner (Table 1., adapted from DFO, 2023a).

Table 1. Roles and responsibilities of the three federal CSSP partner departments.

Department	Roles/Responsibilities
CFIA	<ul style="list-style-type: none"> • Marine biotoxin testing • Managing, regulating the handling and processing of shellfish • Matters of international and interprovincial shellfish export • Shellfish area classification recommendations
ECCC	<ul style="list-style-type: none"> • Bacteriological monitoring • Sanitary assessment of shellfish areas • Shellfish area classification recommendations
DFO	<ul style="list-style-type: none"> • Rights and stakeholder notification of opening/closing of shellfish areas • Enaction and enforcement of shellfish area classifications • Shellfish fishery licencing and management

Of the three federal partners, CFIA and ECCC are responsible for testing. CFIA tests shellstock (the shell and flesh of live shellfish) for marine biotoxins and is responsible for all details concerning the handling, processing, and sale of shellfish internationally and interprovincially. ECCC is responsible for water quality testing and monitoring for harmful bacteria in shellfish harvest areas and recommending area classifications by assessing sanitary conditions; point source inputs of contaminants, such as sewage, and non-point source contaminants, such as urban runoff are evaluated to inform the classification recommendation of any given area. DFO is responsible for shellfish fishery management, licensing, enforcement of classification decisions, and enacting the classification recommendations of the other two partners.

2.4.2. Regional Considerations

In CFIA and ECCC's structure, the CSSP is split into three management regions nationally; Pacific (British Columbia), Quebec, and Atlantic, which is further divided into four smaller sub-regions by province. Confusingly for the program, DFO organizes the Atlantic region differently, splitting it into three sub-regions called Maritimes (Figure. 1), Gulf (including PEI), and Newfoundland and Labrador (excluding Labrador, since the program is not delivered there) (DFO, 2023a). The program is not delivered in Canada's North. Another key difference is that DFO has executive managers at the regional level, while the other partners only have executives at the national level, making regionally-responsive decisions challenging (DFO, 2022).

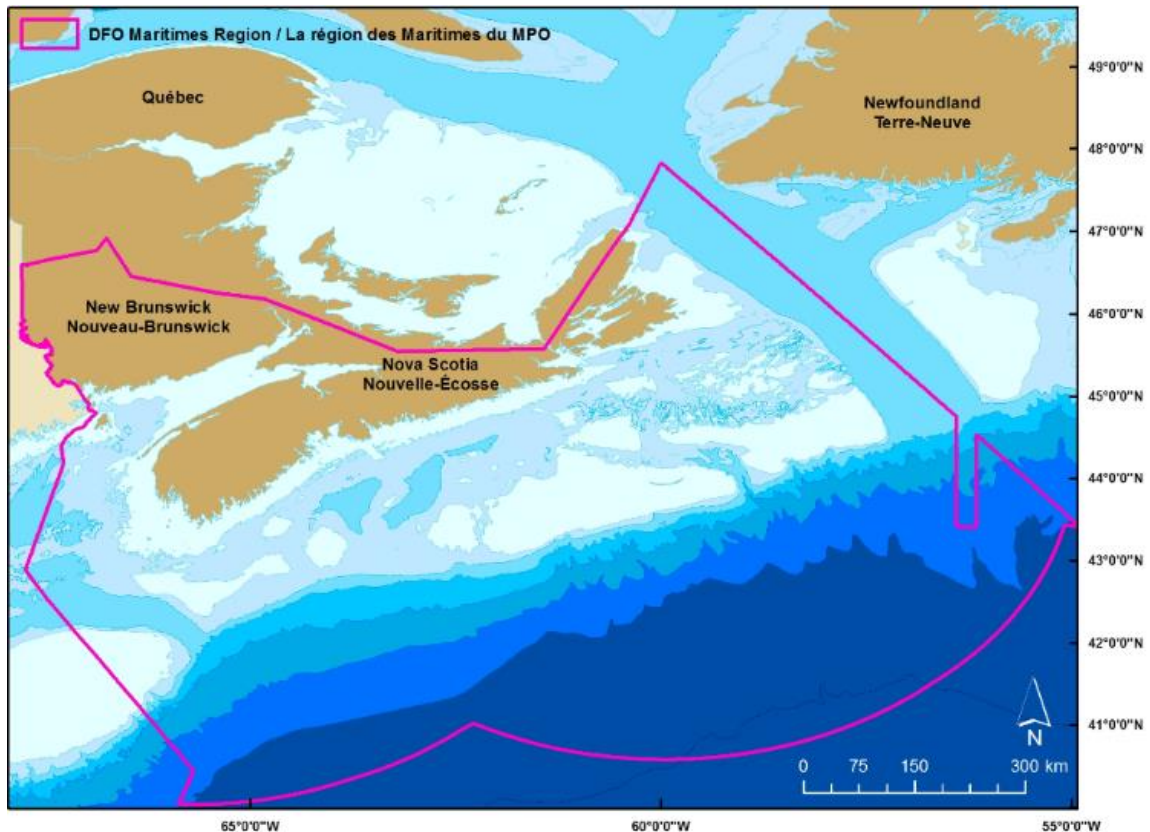


Figure 1. Map of DFO Maritimes region (from: DFO, 2021)

Despite being a national program, the issues with the CSSP are not shared equally by all regions; NS in particular has struggled over the past two decades as its shellfish industry has developed uniquely and slower due to a variety of reasons (Box 2.). Coupled with a provincial moratorium placed on development of the shellfish industry in 2013, from

2000-2013 several species of invasive tunicates infiltrated NS waters, negatively impacting shellfish industry (Kraly, 2019).

Box 2. Important dates for the NS shellfish industry

- 1972s-early 80s: oyster and mussel farming begins in the province (Kraly, 2019).
- 2002: thriving oyster industry in the Bras d'Or Lake in Cape Breton is mostly wiped out by oyster parasite MSX. Most lucrative shellfish area is lost (Denny et al. 2016).
- 2009: US Food and Drug Administration (USFDA) audits CSSP, increases testing requirements for export, tripling testing burden (DFO, 2022).
- 2013: Federal government imposes budget cuts, impacting ECCC (then Environment Canada) in particular (Nelson, 2013).
- 2013: NS government places moratorium on all new shellfish and finfish

Box 2. shows that a weakened NS shellfish industry roughly coincided with the CSSP's diminishing resources in 2013, followed by a provincial aquaculture moratorium that lasted three years. This resulted in a stunted industry. Since the program's mandate is largely commercial and export focused, NS became a low priority for very limited testing resources. This made NS a prime candidate in later cost saving discussions as CSSP was forced to reduce its coverage due to resource constraints.

2.4.3. CSSP Governance

The governance of the program as been highlighted as a challenge by the recent federal evaluation (DFO, 2022) due to its many levels and inconsistencies in staffing hierarchies by federal departments and regions. It currently follows a hierarchical structure in which regional committees report to a national committee headquartered in Ottawa, which reports to senior management committees that are intended to direct the program and provide strategic oversight (Figure 2.).

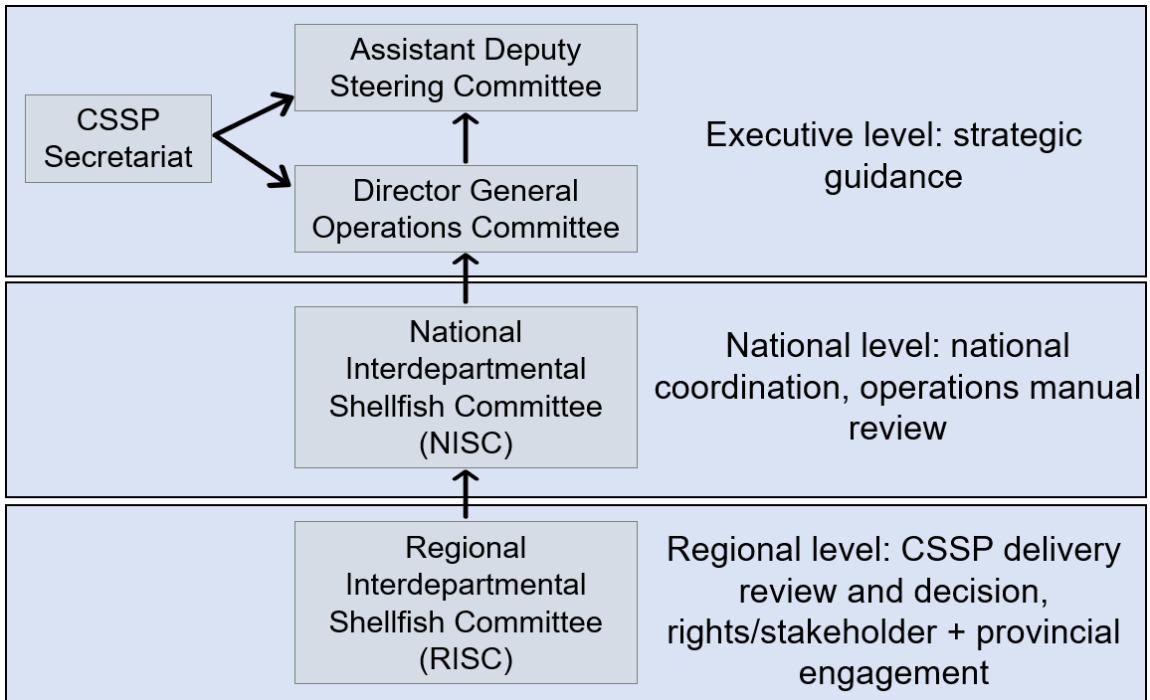


Figure 2. Governance structure of the CSSP (adapted from: DFO, 2023a and DFO, 2022)

At the base level of governance, there is one Regional Interdepartmental Shellfish Committee (RISC) for each CSSP region; for Nova Scotia, it is ARISC (Atlantic RISC), meaning that all four Atlantic provinces share one RISC, making it difficult to communicate provincial challenges to senior management in Ottawa.

RISCs are responsible for acting as an official vehicle for interdepartmental communication, priority alignment, and issue identification and are composed of representatives from each partner agency. They review requests and make decisions for CSSP testing expansion/declassification and manage regional issues within the program, advising National Headquarters on items of national interest. RISCs are also composed of provincial representatives, rights holders and invited stakeholders to observe and provide input. One level higher is the National Interdepartmental Shellfish Committee which acts as a liaison between the RISCs and upper management, and reviews amendments to the CSSP operation manual, which provides guidance for the conduct of CSSP activities. The overarching goal of the NISC is to coordinate CSSP across the country as efficiently as possible. Another level up, NISC reports to the Director General Operations Committee, which is composed of Director Generals (DGs) and Executive Directors (EDs) from all

three partner agencies and provides strategic oversight and direction for the whole program. In conjunction with this role, the highest level in the CSSP is the Assistant Deputy Minister Steering Committee, which cooperates with the DGs and EDs to strategically direct the program nationally, and is composed of Assistant Deputy Ministers (ADMs) and Vice Presidents (VPs) of the three partner agencies. A one-person CSSP Secretariat role is responsible for coordinating communication between the DG/ED level and the ADM/VP level. The complex and relatively fragmented governance structure of the CSSP has been identified as a weakness that leads to incoherent goals and lack of a shared vision, which will be discussed in the next section.

2.4.4. Current Challenges

As the CSSP struggles to deliver in currently monitored areas, much less consider an expansion in its coverage, attempts have been made to identify the key challenges and recommend solutions. A cursory evaluation of the program's challenges would conclude that a lack of resources is the root cause for its dysfunctionality. While this is partly true, the roots of the associated issues are less conspicuous. A Horizontal Evaluation of the CSSP conducted by DFO staff in 2022 noted governance issues at the core of the program's shortcomings, and that the program clearly prioritizes commercial testing over other considerations (DFO, 2022). Many of these issues are longstanding; the Horizontal Evaluation noted governance issues identified in the 2007 evaluation that still have not been addressed. The program is still lacking strong strategic guidance from senior management levels. The under-resourcing of the program has worsened in the last two decades, since funding has not been increased since 2001 and has not changed proportionally with costs. While governance at the regional level (RISCs) appears to be functional, national level governance (NSIC, DG/ED, and ADM/VP) has been struggling for years. The Horizontal Evaluation recommended changes primarily at this level in addition to increased resources, focusing on clarification of departmental roles and a stronger commitment to strategic guidance.

While the Horizontal Evaluation provided important insights, it neglected to emphasize the real-life impacts of CSSP delivery (or non-delivery) on Canadians. It focused on governance shortcomings and said relatively little about the impacts of the program on subsistence shellfish harvesters. That said, some of the results of this project will echo those

in the Horizontal Evaluation, however with a focus on food security and subsistence harvesting. Crossover between the results of the texts should be taken as reinforcement of the severity of the program's challenges, and as a re-articulation of what is already known to underscore the current and potential importance of the program to the food security of subsistence harvesters. Nonetheless, this project aims to expose the program itself in a new light, one that is not commonly considered by decision makers given the known priorities of the program.

CHAPTER 3. METHODS

Semi-structured interviews with federal and provincial government staff were conducted to learn about the food-security impacts of the CSSP on subsistence shellfish harvesters in Nova Scotia, and interview transcripts were thematically analyzed. The details of these interviews will be discussed at length, however it is important to first establish the paradigm through which this research was conducted. This research takes a constructivist approach to understanding and interpreting the data. The working assumption is that participant knowledge and the author's interpretations of participant knowledge are constructed within a sociocultural environment, allowing for a more latent understanding of the data while acknowledging that the information shared, and the way it is interpreted by the author, is influenced by the sociocultural context of everyone involved (Braun & Clarke, 2006; Kiger & Varpio, 2020).

The methodological approach was a thematic analysis that aimed to go past a description and/or categorization of the data, to finding, understanding and contrasting of recurring patterns and their shared (or differing) meanings in context. The research, in and of itself, shares the basic assumptions of grounded theory in that we can develop new understandings of our research questions and data as the research progresses. This approach stops before generating new theories, as such an end goal is beyond the scope of this work.

This project took an *inductive* approach, pulling themes directly from the data to explore meaning therein. It also integrated a *deductive* aspect geared towards directly addressing the project's research questions and goals; how the program impacts the food security of subsistence harvesters, and if the program is structured to meet food security needs with respect to the four pillars of food security as defined by the FAO.

Participants were recruited by email (Appendix A.). A consent form was sent in the initial recruitment email to inform the participant of their role in the project, assurances of confidentiality, and risks of participation (Appendix B.). The consent form included a brief purpose statement and description of the project, the researcher's contact information, and other general information concerning the roles and responsibilities of each party. This project used a snowball-sampling method for recruiting participants; after carefully choosing two key informants to identify four initial participants with CSSP-specific

knowledge, each participant was interviewed and asked for names of other potentially knowledgeable candidates. Initially, new participants were randomly selected from names provided after each interview to account for intra-agency bias; there was concern that participants within the government might be siloed in their knowledge of the program, and suggest a narrow selection of potential participants (this became impractical/unnecessary as the research progressed, see Section 3.1.). A total of eight interviews were conducted. Interviews were all virtual except for one, and typically lasted 30-45 minutes. Participants were asked questions loosely following the structure of the interview guide in Appendix C., however significant deviations were allowed if the participant or interviewer felt it merited further discussion. The loosely-structured nature of the interviews allowed for the exploration of unanticipated or unplanned-for knowledge and sharing of differing perspectives, expanding the overall results of the project.

While participants were ideally selected based on their knowledge of the CSSP, it was not assumed that the participants were knowledgeable; direct mention of the CSSP in the recruitment email and consent form was avoided, and the program itself was directly discussed during interviews only after participants mentioned it themselves. This was partly due to the snowball sampling method; participants may unintentionally suggest individuals who do not have experience with the program. It was also done to give participants room to discuss aspects of ‘shellfish management in Nova Scotia’ that they were most familiar with; it may have been an interesting result that participants were not concerned with the CSSP at all. The structure of the interview guide accounted for the fact that mentioning the program by name could have led the results away from such an outcome.

Interview transcripts were taken using the Microsoft Teams transcription function and edited/deidentified manually on password-protected Word documents. Transcripts were thematically analyzed with NVivo 14 qualitative data analysis software using the six-phase process initially described by Braun & Clarke (2006) and expanded on by Kiger & Varpio (2020). Briefly, the six-phase process is as follows:

- 1) Familiarization with data – it is suggested that transcribing one’s own data would be an effective means of doing this.

- 2) Generation of initial codes – systematic establishment of basic descriptive codes that can be used to begin the process of analysis and interpretation.
- 3) Search for themes – initial phase of collating and combining codes to interpret underlying patterns and meanings; themes are not descriptors of the data and do not necessarily ‘emerge’ from the data, but can be deductively guided by theoretical frameworks or research questions, or inductively determined from the data itself. This project employs both approaches. This stage begins the creation of a ‘thematic map’ that visualizes the narrative of the project.
- 4) Review of themes – codes in each theme are checked and cross-examined, weeding themes with insufficient data and determining whether themes are sufficiently distinct while still conforming to an overall research narrative. This process can also involve a re-reading or coding of the entire dataset once themes have been refined. The thematic map is revised and narrowed.
- 5) Definition and naming of themes – this stage further analyses the narrative and gives descriptive names to themes that ‘tell a story’ relevant to the research questions and/or goals. By this stage, there should be a thematic map that presents themes coherently, identifying sub-themes that add context and depth to the overall narrative, or story of the research.
- 6) Production of report – a compelling, concise, and clear story constructed using a demonstrably rigorous and valid interpretation of themes and their meaning in relation to the research questions and/or goals.

Information from phases 2-4 can be found in Appendix D., including initial codes and themes, review of themes, and miscellaneous notes made by during the process. Notes were kept throughout the process to keep a methodological trail to increase the validity of the project. Phase 5 is represented throughout the Results section. See Supplementary Information for the data contained in all codes.

3.1. Changes to the Methods

The methods remained mostly unchanged throughout the project, however several details concerning the limitations of the project should be mentioned. For one, participants were

initially to be drawn from all government departments with a direct role in managing shellfish in Nova Scotia; ECCC, DFO, CFIA, and NSDFA. Representing a balanced contribution from each of these departments proved difficult. ECCC had comparatively very few staff involved in the CSSP for NS specifically, resulting in only one participant from that department. CFIA staff refused to participate at all, omitting the potentially valuable CFIA perspective from the results. Two participants were from NSDFA. Many participants suggested names of people who could not be contacted given the eligibility criteria and limitations of the project; those who could not be contacted were mainly individuals from industry, or those with knowledge specific to other provinces, or executive-level government staff (See Section 3.2.).

Second, the random-selection of names provided through snowball sampling had to be abandoned in the second half of the project due to a lack of eligible participants and refusal of participation from eligible participants. It was realized that the pool of government staff with Nova Scotia-specific CSSP knowledge was smaller than initially thought when the random-selection process was planned. Due to this departure from random selection, several participants later in the project had to be carefully selected with the help of the key informants with similar considerations to the first round of participants before the snowballing had begun.

3.2. Eligibility Criteria: Why Government Staff?

Government staff were selected as the target group for participation in the project mainly due to their subject-matter expertise, but also because of several limitations. The federal and provincial staff we interviewed had operational experience in managing the CSSP and the issues therein, making them an ideal source of highly detailed, place-specific knowledge. Proceeding from this, it was decided that only working-level staff (non-executive level) should be contacted for participation. This is because one of the goals of the project is to inform senior management of the food-security concerns stemming from the CSSP, framing it from a perspective that is not commonly considered. Also, senior, executive-level managers are less likely to have operational expertise with the CSSP or the time to participate in the project.

Several limitations were acknowledged early on that constrained the project's ability to widen the diversity/knowledge base of the participants. Time was the most difficult limitation as the length of the project was predefined by the author's educational parameters, allowing for only a few months to schedule and complete the interviews. The relatively short timeline did not allow for in-depth relationship building with community members that could have added an additional layer of insight. Should this research be continued, additional perspectives should be sought from Indigenous and local communities over a more significant time period.

CHAPTER 4. RESULTS

This section reviews the results of the thematic analysis with respect to the research questions: One, how does the CSSP impact subsistence food security in NS? Two, is the CSSP structured to meet the food security needs of subsistence harvesters? Before examining this, to control for assumptions concerning the participants' awareness of food security as a concept, each interview began with asking participants to define food security as they understood it (See Appendix C.). Their responses were assessed for knowledge using the FAO's four pillars of food security: availability, access, utilization, and stability. In Table 2., cells are green for participant definitions that mentioned or alluded to respective pillars, and yellow for pillars that were left out. Participants were generally knowledgeable and each referenced at least two pillars; it should be noted that Availability refers to the presence of enough food to fulfill caloric needs, which could be implied by any of the participants' definitions. It is believed that all participants displayed an adequate understanding of food security to ensure the validity of interview answers. In other words, the interviewer and interviewees generally shared an understanding of what 'food security' means.

Table 2. Mention of food security pillars in participants' definitions of food security. Green cells signify mention, yellow signify omission.

Participants	Availability	Access	Utilization	Stability
1	Green	Green	Green	Yellow
2	Yellow	Green	Green	Yellow
3	Yellow	Green	Yellow	Green
4	Green	Yellow	Green	Yellow
5	Green	Green	Yellow	Green
6	Yellow	Green	Green	Yellow
7	Green	Green	Yellow	Green
8	Yellow	Green	Green	Yellow

To further control for the researcher's assumption that participants would be knowledgeable about a key aspect of the study, participants were asked if they have professional or personal knowledge of people harvesting shellfish in Nova Scotia that would contribute to their food security. Responses were mostly in the positive, ranging

from Participant 6’s enthusiastic answer: “Yes, very common. Just from me being in my position, every spring I receive multiple phone calls from individuals asking when the recreational harvesting of soft-shell clams is permitted”, to Participant 5’s non-committal answer: “Although I wouldn’t doubt that it exists, I am personally not aware of any instance where someone would say that they do this, you know, every day or every week as an important supply of food for them.”

Of the eight participants, five reported that subsistence shellfish harvest was common and important in NS; two were unable to verify the frequency of harvest, and one was able to comment only on NB shellfish harvest, where it is said to be common. Two participants also mentioned the special importance of shellfish for certain First Nations communities. It is very important to keep in mind that although three participants did not have *personal* knowledge of subsistence harvest in NS, this did not preclude their ability to comment on the program more generally and contribute valuable insights.

4.1. Results of Thematic Analysis

To answer our research questions, four main themes were identified, with 13 additional sub-themes to support the main themes (Figure 3.). Themes were not necessarily identified based on the number of references or their frequency across interview transcripts. They were identified for their relevance to the research questions and the level of insight they provided.

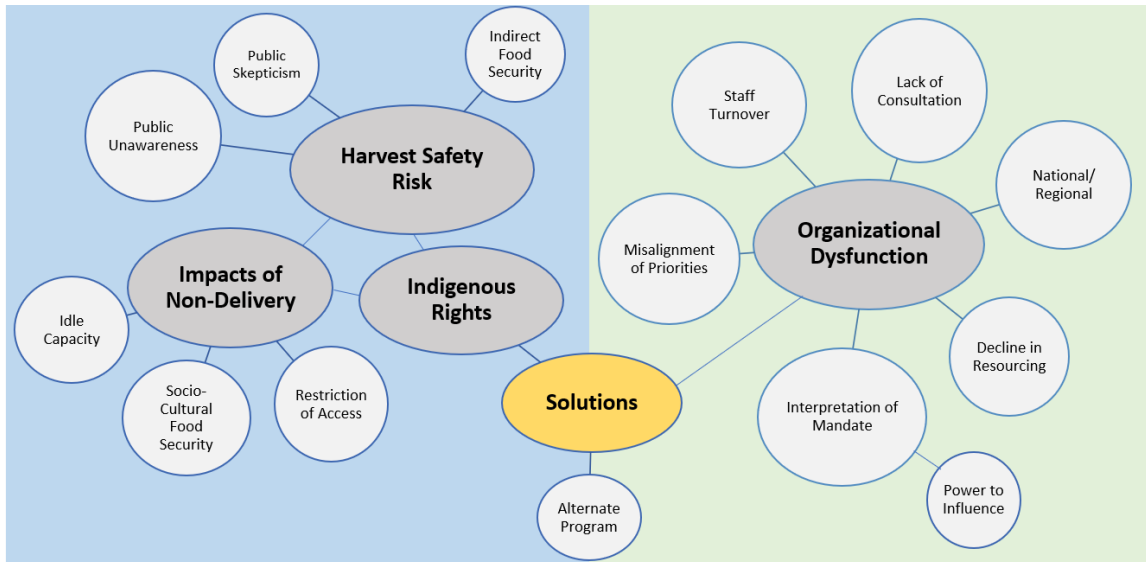


Figure 3. Thematic map; blue is research question 1, green is research question 2.

In addition, thematic categories were created for suggested solutions to issues within the program, and other, non-CSSP related considerations that could impact subsistence food security (not on Figure 3.). Some themes did not have many references, but hit on particularly salient point that could not be absorbed by other themes and needed to stand alone. The themes and sub-themes of Figure 3. are represented alongside their frequency and the number of transcripts in which they occur (Files) in Table 3., along with the same data for non-CSSP considerations.

Table 3. Data for main themes and sub-themes.

Main Themes	Sub-Themes	# References	Files
Impacts of Non-Delivery (Research question 1)	Restriction of Access	11	6
	Socio-Cultural Food Security	5	3
	Idle Capacity	9	5
		Total: 25	
Harvest Safety Risk (Research question 1)		16	4
	Public Unawareness	5	4
	Public Skepticism	7	3
	Indirect Food Security	1	1
		Total: 29	
Indigenous Rights (Research question 1)	NA	14	6
Organizational Dysfunction (Research question 2)	Decline in Resourcing	19	7
	Interpretation of Mandate: - Power to Influence	13	4
		2	2
	Misalignment of Priorities	12	6
	National/Regional	3	3
	Lack of Consultation	7	3
	Staff Turnover	1	1
		Total: 57	
Solutions		9	4
	Alternate Program:	19	6
		Total: 28	

Non-CSSP Considerations	NA	5	4
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As an overarching answer to the research questions, the data indicated that the CSSP impacts subsistence food security negatively, and the program’s structural elements are the root cause. To unpack this, this section starts by considering the first research question: what are the impacts of the CSSP on subsistence shellfish harvesters? The corresponding themes identified for question one are shown in Figure 3., and will be examined in the following sections before addressing the second research question: is the federal CSSP model structured to meet the needs of subsistence harvesters? More specifically, sections 4.2-4.4 address the first research question, and section 4.5 addresses the second.

Although both research questions are interrelated, they allow for a differing analysis by altering the viewpoint into the program; the first focuses on direct outputs of the program and the second focuses on the structure of the program itself. Each section represents the main points raised by participants, supported by direct quotes that capture the core meaning of the section. As a point of interest, some of the themes identified for research question one are directly related to the four pillars of food security. This will be mentioned where applicable.

4.2. Impacts of Non-Delivery

This theme was formed as a response to recurring ideas in the interview transcripts concerning barriers to subsistence shellfish harvest and the long-term impacts to food security. To begin this discussion, one of the key sub-themes that emerged was *restriction of access*. It is here where the direct impacts of the program’s decline overtime becomes evident.

4.2.1. Restriction of Access

CSSP delivery has been declining in NS. Participants 1 and 4 both noted that the program is not and cannot be delivered in NS at historical levels, which has resulted in large closures that prevent harvesters from collecting shellfish resources, clearly implicating the Access pillar of food security. Citing their personal experiences in managing the CSSP, Participants 1 and 6 noted that many harvesters would call government offices to complain about the prevalence of closures in their preferred harvest areas, demonstrating that restriction of access is a problem directly experienced by harvesters.

Participant 3 gave an indication of why shellfish harvest is important to rural people, “But in rural areas there is, I think a lot of hidden poverty there, people might own their own homes but barely be able to cover the property taxes, right?” Participant 8’s comment underpinned this sentiment, “Access to harvesting shellfish doesn’t cost as much (as groceries) for the amount of food they can obtain with modest equipment and really no money required to go harvest shellfish.” When people are less able to provide for themselves through other means, shellfish harvest can become a useful supplementary food source, provided local harvesting spots are not closed to access.

It is important to note that many of the closures referenced by the participants were due to poor sanitary conditions from historic rainfall events that should have defaulted back to approved status after 21 days – as per CSSP operational guidelines, but remained closed instead due to a lack of resources to retest. This was a risk-based management decision made in the absence of enough scientific data to ensure the safety of an area post-contamination, meaning that closures meant to last three weeks lasted for years and are currently still closed. The decreasing access to shellfish harvest also limited people’s expressions of socio-cultural practices engrained by generations of using shellfish to supplement diets, which will be examined in the next section.

4.2.2. Socio-Cultural Food Security

An element in participants’ characterizations of the impacts of declining CSSP services was the disruption of traditional practices that contribute to food security. While this does not imply a specific pillar of food security, it does involve the “food preferences” aspect of the FAO definition (See Section 2.2.), which refers to the cultural aspect of food security. This sub-theme should not be confused with Indigenous Rights; this sub-theme represents how non-Indigenous harvesters are also impacted in cultural ways, however without respect to harvesting rights. Participant 7 summed the sentiment of this sub-theme well:

It’s been culturally done. And for subsistence, for a quality food source, they’ve (rural Nova Scotians) always harvested it in these areas. Sometimes it’s for social reasons too, to get together..

Participant 6 also noted how the traditional aspect of shellfish harvest interacts with its value as a free food source, telling how clam harvesting is a tradition especially in

Southwest NS where it is done for individual consumption. Taken in conjunction with the previous section that demonstrates the diminishing access to shellfish, the socio-cultural use of shellfish as a source of subsistence protein is negatively impacted. Participant 7 also pointed to a rising demand from some rural areas for more CSSP coverage, “We've heard recently from down around Shelburne and Barrington area, those are areas that are very keen on recreational harvest and I know they'd love to have access to more area down that way specifically.”

Up until now, we have considered only the impacts of CSSP decline; what is being lost, and how is it affecting food security. However, implied by the impacts of program non-delivery are the losses of not having what *could* be; the potential for benefits that are not being realized, rather than only those being lost right now. This will be the focus of the next section.

4.2.3. Idle Capacity

As the program declines in NS, there is a huge amount of potentially usable coastline that lies unclassified or closed, ostensibly unavailable for safe shellfish harvest. This massive amount of unused area, or idle capacity, presents both an opportunity and a challenge; there is real potential to increase the food security in Nova Scotian communities by allowing for and promoting wild harvest, however the program has been and remains a significant barrier. This implies both the Access pillar and the Stability pillar, since the idle coastline represents a missed opportunity to provide long-term food security for local communities. Participant 2 gave a clear summation of this missed opportunity:

When some areas are closed, we close them because we want to be on the safe side, so we err on the side of caution as opposed to knowing for sure if it is contaminated water, and then what is happening there is you have a whole section of food for people that could contribute to food security that is not there and is just closed and that food is going to waste.

Many areas are closed out of an abundance of caution despite there being no recent data to suggest contamination. The idle capacity in NS is a result of insufficient resources to test or retest areas that either have never been tested, or have been closed for contamination reasons:

If there's a diesel spill or something in a working harbour, obviously you don't want to be eating shellfish... the feds, and this would be not so much DFO, but ECCC, federally, are not having the resources to test an area enough to safely say that yes, the water quality is safe... in those instances, you could have closed areas be perfectly good areas, but they just don't test it, don't have the resources to test it. (Participant 5).

The unfortunate reality is that a significant portion of NS's coastline is likely not contaminated but is under long-term closures due to a lack of testing resulting from insufficient funding and staffing, leaving a large potential resource inaccessible for food security purposes. Participant 3 was somewhat incredulous as to how a program like the CSSP is not recognized by the government for the 'easy pickings' opportunity that it is, noting that it 'ticks all the boxes', including Blue Economy, and rural economic and food security, and would cost a fraction of some of the government's other initiatives. Now that we have established that the program is in decline and that it impacts access to shellfish and represents a major missed opportunity, the next section will focus on the risks to human health.

4.3. Harvest Safety Risks

This theme outlines the health risks associated with harvesting shellfish in unclassified or prohibited waters. The food security pillar here is Utilization, which necessitates that food is safe to consume. To begin, many participants noted the risks of harvesting in declassified waters (in these cases, *declassified* waters are areas that once had a classification but were removed from the program due to resource constraints). Participant 6 noted that "if an area is declassified, then an individual is harvesting there at their own risk." The term 'at your own risk' applies only to declassified areas, meaning the program has ceased testing and no longer certifies the safety of such areas. In normal circumstances, declassification is only supposed to occur once the program is certain there is no contamination, and that the area is not being used for commercial activity and there is low FSC and recreational use. The reality in NS is that as the program declines, declassification is becoming a response to insufficient testing resources. It is creeping into areas of use and is certainly impacting areas of potential future use. In some cases, declassification was identified as a potential solution to decreasing access caused by long term closures. For example, Participant 7 explained that harvesters would have more access to previously closed areas if they become

declassified, however harvesting these areas would be riskier to human health than harvesting in approved areas. However, the program still places occasional prohibitions in unclassified areas if officials are aware of contamination events, such as heavy rainfall, and notifies the public primarily through a website called SHELLI, which Participant 4 described as a DFO-led mapping tool primarily meant to make shellfish closures known to the public.

Although this web tool can be used to warn the public of some threats, declassification is by definition a cessation of risk control from water testing. Intuitively, the risk of sicknesses and deaths is substantially increased by the threat of undetected contamination events, such as harmful algae blooms or unreported toxic spills. This leads us to the next sub-theme.

4.3.1. Public Unawareness

This section underpins the risk to public safety posed by having harvest sites that are untested by the CSSP. Although the program closes declassified areas when contamination events are detected, there is a risk that contamination events will go unnoticed until someone becomes ill. Participant 6 explained the risk associated with declassifying sites with ongoing harvest activities: ...the only issue I see with the declassified areas is the fact that if we don't have a massive rainfall event or some other type of pollution that is detected, there could be events that may be undetected that would cause contamination, and there'd be no warning put out there to the public, whereas if we had regular testing occurring for water quality, then those tests would give us results that might be used to close the area as a precaution. (Participant 6).

Additionally, Participant 4 noted that harvesters may not even be aware of SHELLI, since awareness of the program is low. Participant 4 also explained that the high amount of rainfall this summer (2023) has led some areas to be closed that are usually open, making harvest unsafe for cottagers who are not familiar with the risks. Considering that unclassified waters are 'at your own risk', perhaps the program can be more accurately described as a barrier to *safe* access to shellfish. Undetected events are a serious threat to shellfish harvesters, however harvesters are not always in compliance with known rules or prohibitions, as will be explored in the next section.

4.3.2. Public Skepticism

Even when the public is aware of the risks, participants expressed concerns over public trust of sanitary measures and public skepticism of the legitimacy of federal decisions. First, Participants 1 and 6 both had personal knowledge of people who harvest in areas they know are closed. Participant 6 stressed that some people harvest in closed areas due to strong traditions of harvest, and do not care about government testing. There is also a certain folk wisdom surrounding shellfish harvest in the Maritimes. Speaking of a mussel farmer in Cape Breton who gets shut down by CFIA following contamination events, Participant 5 noted:

...he's so surrounded by mountains, so if there's a heavy rainfall there is quite a lot of runoff that goes into his area where he's growing. But the feeling is that there's only a risk period of about five days or so, give or take a couple days, but for the most part he is shut down for usually two weeks plus.

Participant 1 explained a widely known folk rule that people should not harvest clams in the months of June, July, August and September, and any other month is safe regardless of what the testing indicates.

It is possible that this skepticism is occasionally well placed, as in the case of areas under long-term closures where shellfish are likely safe, but the program cannot retest. However, these decisions are made in an abundance of caution with limited resources and thought to public health, therefore awareness is again a potentially important factor in limiting this risk.

4.3.3. Indirect Food Security

This sub-theme is supported by one reference that provided an interesting consideration. The comment was made about commercial clam harvest in CSSP tested and approved areas being potentially useful for subsistence harvesters:

They might be able to piggyback off the commercial harvest industry and harvest for themselves in those areas, but it is not necessarily by their choice. They would have to sort of indirectly benefit from the commercial harvest. (Participant 1).

Thus far we have focused only on the decline of access for subsistence harvesters, however the program in NS is also in decline for commercial harvesters; there is absolutely no room to increase CSSP delivery (See Section 4.5.1.) despite calls for greater coverage. The loss of commercial harvest areas may overlap with areas that are important to subsistence harvesters, also providing an opportunity for synergy between increased commercial opportunity and greater food security, should the program be revitalized. This is a consideration that merits further investigation.

4.4. Indigenous Rights

One of the key impacts of the program involves Indigenous harvesting rights. In Canada, the Indigenous right to fish for food, social, and ceremonial (FSC) purposes is listed in Section 35 of the Canadian Constitution. In NS specifically, the Peace and Friendship Treaties signed between the British Crown and the Mi'kmaq in 1725, 1752, and 1761-1763 are expressed by many Mi'kmaq today as affirmations of rights to self-determination, which would include rights to harvest their own resources (Stiegman & Pictou, 2023). As we have seen, many areas are unclassified and therefore 'at your own risk', while others are under long-term closures ostensibly enforced by DFO that are barriers to food security despite potentially being safe. The question raised during interviews essentially amounted to: do these elevated health risks and barriers to harvesting constitute as Indigenous rights infringement? Speaking on how non-Indigenous harvesters feel about shellfish harvest in contrast to Indigenous harvest rights, Participant 6 said: "not having that program fully implemented in some areas, I think definitely impacts their ability to practice their rights."

Recounting a community meeting with Indigenous representatives on the issue of shellfish harvest access, Participant 2 noted that Mi'kmaq communities have stated their inability to practice traditional shellfish harvest because the federal government does not have the testing in place. The impacts of non-delivery and health risks are relevant for both Indigenous and non-Indigenous harvesters, however the Indigenous right to harvest creates an extra layer of considerations. Again, long-term closures feature prominently in participants' comments concerning Indigenous rights:

I look at the Eastern Shore of Nova Scotia where there's a long and documented history of use and I'm surprised that there has not been more concern expressed to the regulators

about the length of time those areas have been closed and the potential impact on rights for Indigenous people. (Participant 3).

As with non-Indigenous harvesters, it is important to consider the socio-cultural connections to food as part of the food security paradigm; shellfish are important to Indigenous people culturally, and the CSSP impacts this. However, there is an important distinction to be made for Indigenous harvesters that the CSSP does not only limit access to a traditional food source, but that this limitation can be interpreted as an infringement on rights. On this point, many of this project's participants would agree.

Now that the impacts of the program on subsistence harvesters (including those with the right to harvest) has been explored, we will move on to examining the second research question: the suitability of the federal CSSP structure to meet the food-security needs of subsistence harvesters.

4.5. Organizational Dysfunction

In previous sections, it has been established that the CSSP has some negative impacts on access, safety, and Indigenous rights. This section examines themes identified in response to the second research question; it will be shown that the CSSP is not structured to meet the food security needs of subsistence harvesters and has a range of outcomes stemming from a lack of cohesion and differing priorities among the federal agencies responsible for the program. Some of the themes in this section have already been mentioned in the Introduction, such as the lack of resources to deliver the program, and will be expanded on to better understand their overall impacts.

4.5.1. Decline in Resourcing

Although this sub-theme is important and had many references from nearly all participants, it is relatively straightforward. Many of the program's challenges are underpinned by its chronic lack of resources which have been diminishing over time. Funding and staffing have decreased while demands on the program have increased; this is however most pronounced for the federal partner responsible for water quality and bacteriological testing, ECCC: "they've (ECCC) lost personnel that haven't been replaced through retirements... I've been told that they've had budgetary constraints as well". (Participant 6).

Participant 7 expressed that ECCC is past the point of considering program expansion, and is currently delivering more than it can financially, and more resources (funding and staff) would be required to do any more testing. Participant 4 explained that this limits the potential for both commercial and subsistence harvesting, and that people are often confused as to why the federal government cannot deliver the program as it did historically. Participants 7 and 8 made comments about the history of resource decline in the CSSP, explaining how audits from the US (Canada's most important shellfish trading partner) resulted in a tripling of testing requirements at roughly the same time that the Harper government cut funding to ECCC (then called Environment Canada).

These comments demonstrate that in recent decades, the CSSP has had to do more testing with fewer resources, exposing cracks in its mandate and priority structure through which subsistence food security has been falling. The 'cracks' in the mandate will be the focus of the next two sections.

4.5.2. Interpretation of Mandate

This section relates to how the CSSP mandate is put into practice, specifically that commercial interests are clearly placed before subsistence. The word 'interpretation' is used here because there is no specific piece of the official mandate that states that commercial activities must be prioritized over non-commercial, which was stated by some participants. For example, Participant 6 claimed that the mandate is not the issue, and that subsistence food security could be covered by the program if it had enough resources to deliver the mandate properly. Despite this, it was almost unanimous that the program is geared towards testing for commercial activities, with Participants 1 and 3 saying that the program does not focus on subsistence harvesting at all. Participant 6 drew from their professional experience in the CSSP to say that commercial (especially aquaculture) areas are usually tested within a week after rainfall closures, while other areas remain closed for much longer.

The program's mandate makes it responsible for preventing illnesses and deaths from the consumption of contaminated shellfish. Although this mandate does not explicitly necessitate placing commercial testing ahead of non-commercial testing, there is also no mention of ensuring access to food for subsistence purposes, and no mention of prioritizing

Indigenous rights, while there is mention of ensuring the safety of shellfish export. The program is clearly interpreted primarily as a vehicle for commercial growth. As we will see in the next section, this may be partly due to a lack of decision-making influence from shellfish harvesters.

4.5.2.1. Power to Influence

Two participants briefly made important observations stating that shellfish harvesters may not have the power to influence decisions at the federal level, causing the program to be influenced primarily by commercial interests. Participant 3 said: “recreational shellfish harvesters or isolated communities, politically they don't have a lot of power, perhaps it's a classic class issue... people making the decisions, they buy their food through the grocery store.” Here, Participant 3 is making the point that decision makers are disconnected from the impacts of their decisions. Participant 1 expressed a similar insight about anyone who harvests shellfish, including commercial clambers and non-commercial harvesters:

...a lot of the time the shellfish harvesters don't have the organizational skills to bring their concerns forward politically to get a voice. And so sometimes they get overlooked compared to some of the other industries... they don't make as much money as, say, lobster fishermen as well... they're not always a priority of government because they don't have that ability to raise their issues politically as effectively as other fisheries.

One interesting caveat to these comments and others is that participants did not always make a clear delineation between different ‘commercial’ activities; the program is geared towards commercial interests, but does this privilege aquaculture and clam harvesting equally? From the previous comment and Participant 6’s comment in the last section about aquaculture areas getting retested first following rainfall events, a hierarchy appears to be forming. First, aquaculture areas are prioritized, then commercial harvesters, then ‘recreational’ harvesters last. The differences in prioritization among CSSP partner agencies creates some conflicting ideas about what the purpose of the program should be; this is the subject of the next section.

4.5.3. Misalignment of Priorities

The title ‘misalignment of priorities’ can be defined as the occasionally uncoordinated and siloed approach that the three federal partners take to delivering the program; they do not

always have common goals or the same departmental mandates, interpreting the program only for their own roles in it, rather than as a whole. It appears that sometimes the exact roles of each partner are not clear either. For example, Participant 4 pointed out that the messaging of issues to executive management and the public is not consistent among the partners, and that there should be “one voice in, one voice out”.

Participants 7 and 8 explained how ECCC’s and DFO’s priorities in the program are different. While ECCC is primarily concerned with the scientific aspects of the program (i.e. water quality testing), DFO has a responsibility to manage fisheries. Participant 8 added that DFO’s primary mandate is to “enable access to marine resources by coastal communities and especially Indigenous communities” Participant 8 also explained that funding decisions are made by ECCC, creating a rift in how competing priorities are weighed.

Speaking on the how the program’s priorities are influenced, Participant 2 said: “I think if commercially there was a lot of push my gut is telling me that somehow we would figure out a way to test more.” These comments are not meant to single out ECCC as the cause of declining food security for subsistence harvesters, only to show that the federal partners are not necessarily aligned on why the program is important. ECCC (and perhaps CFIA) sees the program as a simple function that certifies the safety of commercial shellfish product for export, while DFO looks at the program through a fisheries management lens. Lacking consistent communication and a shared vision are evident contributors to the shortcomings of the program.

4.5.4. National/Regional

Given that the CSSP is a national program, differences in issues between NS and the rest of the country came up several times. Participant 7 said that although the whole country has been seeing funding cuts, NS experiences the lack of funding more acutely and gets less funding than other areas. Participant 4 mentioned that NS has much more coastline and is less densely populated than some other provinces, making it a lesser concern for testing. In contrast, Participant 6 felt that the problems faced by NS were primarily funding issues that other provinces, such as NL and BC have also experienced. While these comments suggest challenges in communicating regional issues in a national governance

structure and effectively managing them, the comments only begin to reveal what could be learned about regional differences in the CSSP. This is an area that requires far more exploration; comparing the issues of each region and creating place-specific management objectives could be a productive exercise for the program.

4.5.5. Lack of Consultation

Ideally, the program makes knowledge-based decisions on up-to-date scientific testing data. However, insufficient resources means that decisions must be made based on risk, which are based partly on knowledge of who is harvesting where. Who gets left out of these calculations when the program is not aware of the priority harvesting locations? Participants expressed doubts that the program is making decisions based on credible, up-to-date harvesting data. Participant 8 claimed that decisions are still being based partly on data from the last harvest survey, which is approximately 20 years old. Not undertaking consultation exercises to determine priority locations with a “boots on the ground” (Participant 8) approach was identified a key area that the program is struggling, and that although consultation is extremely challenging, the government is “not even trying”.

The relatively few references in this sub-theme should not be taken to mean that it is unimportant; quite on the contrary. The lack of consultation to determine locations of high priority for subsistence harvesters (especially for Indigenous communities) precludes the program’s ability to even consider a more equitable distribution of limited resources. A large engagement-style project that shows the risks would be a key evidence piece for garnering more program funding.

4.5.6. Staff Turnover

This sub-theme has only one reference, making it a special-interest point. Participant 4 mentioned that changing staff roles has complicated delivery of the program, and that people need to be hired with the express purpose of running the program efficiently. This was a relatively simple comment that was not made by any other participant. It shows that the program is not delivered as it once was, partly because staffing for the express purpose of running the CSSP has not been prioritized, resulting in fewer staff having to do more work with less resources.

4.6. Solutions

During the interviews, participants were asked what potential solutions they can think of or have heard discussed to address the program's shortcomings. Some participants emphasized increasing the internal capacity of the program, or optimizing existing capacity by having the federal partners "determine where can they divert funds from other programs, making cuts to fund (the CSSP)" (Participant 4). Participant 8 mentioned the need to explore innovative technological options that reduce the testing burden, particularly with respect to how water samples are collected. Making better use of existing data, such as historical contamination data to understand what locations are most likely to be safe at certain times of the year, can be used to make quicker, more informed decisions. Participant 8 also stressed increased consultation concerning local knowledge and priority locations for harvest, sharing that information with all CSSP partners. The consultation piece can also be used to spread awareness of the program as mentioned by Participant 4: "...a clear direction on processes and policies so people know how to navigate the CSSP program itself... outreach to educate people in Canada on the on the program." Finally, one of the most common suggestions to solve the issues created by the program is to deliver new models of the program itself; this will be reviewed in the next section.

4.6.1. Alternate Program

The use of different delivery models for the CSSP is not new; there already exists Alternative Service Delivery (ASD) models, which typically involves proponents paying for their own testing to allow industry growth without increasing costs on the program. This is met with some challenges. Asked if they think that ASD is a good solution, Participant 7 said: "No. It's a band aid fix to keep being able to accommodate industry's expansion, but it also increases the unlevel playing field across stakeholders because they have to pay for the work." Not only is it a temporary fix, but it is not fair that some industry members have their testing paid for while others must pay their own. Nonetheless, Participant 7 also suggested using this approach for subsistence harvesters under a community-testing model. Although it would not be a full delivery of the CSSP, there would be some level of acceptable coverage. Finding this 'acceptable' level poses a unique challenge if the idea is to save funds through a scaled-down program delivery in

communities; it could create the perception of a ‘two-tiered’ federal program that is more concerned with the safety of exported product than it is the safety of its own citizens.

Regardless, according to Participant 4, the ‘user pay’ ASD model that is usually applied to aquaculture would not work for most harvesters due to the high cost of testing. Given the high burden of user pay models, some participants suggested a more decentralized shellfish sanitation delivery model for small communities, especially Indigenous communities, that would be separate from the CSSP but still funded by the government. Participant 3 mentioned that Indigenous groups in the West that had implemented their own monitoring programs which gave them enough confidence to consume shellfish from their waters. However, Participant 3 also suggested that an alternate form of program delivery would not necessarily be the most effective or efficient way to ensure the safety of shellfish product or enable food security, and that a comprehensive CSSP would be more resource efficient than giving small sums of money to many different communities.

The idea of a completely different vehicle for program delivery in rural and Indigenous communities appears relatively novel, and further investigation into the efficiency and feasibility of such arrangements should be strongly considered.

4.7. Non-CSSP Considerations

To control for the fact that interviews primarily focused on the CSSP, participants were asked if they could think of any non-CSSP related considerations that could impact subsistence food security. Participant 3 mentioned private versus public access to the coast as a common point of conflict on the news and a potential barrier, however not necessarily a key one, since the coast is so large. Participant 2 mentioned the potential for conflict over Indigenous harvest rights: “when they (Indigenous people) are seen as getting something additional to the non-Indigenous population that sometimes causes frustrations, anger... I’ve heard it, but I don’t know if it really applies in this context (shellfish harvest).” Aside from a few other remarks regarding the provincial harvest limit or possession of the correct tools, no other non-CSSP barriers or considerations were raised. Acknowledging that participants may have been biased in their assessment of the relative impacts of the CSSP on subsistence harvesting, the data strongly suggests that the CSSP is the primary barrier to subsistence food security.

CHAPTER 5. DISCUSSION

This project aimed to answer two questions. First, what are the impacts of the CSSP on the food security of subsistence shellfish harvesters in NS? Second, is the federal CSSP model structured to meet the food security needs of subsistence harvesters? The perspectives and experiences of this project's participants tell a story about the program that builds towards answers to the questions. The CSSP is primarily a food safety program that allocates its resources based on health risks. It has traditionally been thought to be of greatest importance to control the risks associated with commercial product, which must be grown/harvested in open and approved areas. As federal resources became increasingly sparse, these commercial activities were prioritized, pushing other users to the margins. In NS's case, the relatively small shellfish industry was mistaken to reflect that areas with no commercial activities also have no users. Due to this, new resources have not been allocated to NS, resulting in large areas that are unavailable for safe harvest, limiting public access to shellfish and restraining Indigenous rights to resources. Consequently, when people are unaware of the rules or choose to ignore them to harvest the food they need, their safety is at risk. It is clear that the program is not delivering for those that have come to depend on it for food purposes, and that the problems have worsened over time.

The problems facing the Program are best described as the result of three separate federal partners sharing responsibility for different aspects of a program, without a common vision for its ultimate goal and outcome. The federal partners have come to view the program's value through the respective roles they play in its operations. ECCC and CFIA roles are first and foremost associated with testing and scientific evidence-based decision-making. Past its primary function in the CSSP as the enforcer, DFO is influenced by other key priorities within its departmental mandate related to shellfish including fisheries management, resource management, and Indigenous reconciliation. For example, when the program is only understood as a food safety mechanism, the logic of declassification and long-term closures becomes clear: if nobody can harvest, nobody can get sick. This gives the impression that the CSSP is serving its purpose as a 'food safety' program effectively, and by current indicators, it is. So long as shellfish bound for commercial sale is clean, other parts of the coastline can be closed or declassified for safety reasons, and the program has fulfilled its purpose. This is why it is insufficient to say that program non-delivery is

solely due to the current lack of resources. When indicators of food security and social wellbeing are not considered in evaluations of performance, it becomes difficult to know how non-commercial users are being impacted since they are not prioritized and lack a strong national voice, meaning current barriers that confound access to safe food for Canadians are not communicated to decision makers with the power to change course.

The impacts of the CSSP explored in this project are exemplified in the Municipality of Barrington in Shelburne County, NS, where some clam flats have been closed since 2013 due to insufficient resources to test after heavy rainfalls (Johnson, 2023). These types of closures are referred to in the CSSP as long-term rainfall closures and currently occupy a significant proportion of the NS coastline including the entire Eastern Shore. The problem with the long-term rainfall closures caused by lack of testing is that they are potentially not contaminated, but remain closed. As opposed to unclassified areas where harvest still occurs at the harvester's own risk, there is empirical evidence (albeit from other countries) that most recreational shellfish harvesters comply with health closures (Beaumais & Appéré, 2010; Anderson & Plummer, 2017), meaning that closed areas are a strong deterrent to harvesters even though the shellfish may not be contaminated. Coupled with the threat of enforcement with fines, long-term rainfall closures block access to a potentially usable resource.

This has resulted in requests by citizens for declassification of the Barrington area to allow for 'at your own risk' clam harvest to support food security (Johnson, 2023). If harvesters would rather no CSSP presence over the current situation, how is this not a failure of a program intended to keep Canadians safe from shellfish poisoning? Here we run up against the realities of dwindling financial resources and decisions being made in the absence of science. As the program currently stands, perhaps declassification is the only option for municipalities to 'reopen' rainfall closures to shellfish access, such as the Barrington area. But access to shellfish is not the same thing as access to *safe* shellfish, and the concession to declassify rather than reclassify is a decision to put human health at risk.

A discussion concerning food security and access should not be taken to suggest that safety should lose its place as the primary concern; safety is and should be of greatest concern, given the severity of shellfish poisoning. The problem is that the CSSP is the *only* official

vehicle for ensuring the safety of shellfish in Canada. If there were other recourses for communities to ensure the safety of their harvest, the commercial-leaning priority structure may not be an issue.

The lack of comprehensive CSSP delivery can be highlighted through the lens of ocean governance. National-scale, sectoral governance that lacks the flexibility to respond to local needs has been identified as a key problem in effective management of complex marine systems with intersecting economic, environmental, social, and cultural considerations (Andrée et al. 2016; Mahon & Fanning, 2019; Winther et al. 2020). The sub-theme National/Regional hints at the inability of a national program to respond to regional differences, which is more directly reviewed in Section 2.4. of this document. In addition to this problem of scale, there is evident confusion between National Headquarters and the Regions in how the program should be governed. Confused governance has led to a significant divide between national policy drivers aiming for consistency and regional operational realities influenced by place-specific characteristics. As a result, the policy drivers and their national scope are minimizing the understanding of regional realities and, as is seen clearly in NS, the local and community issues become lost as the National program attempts to modernize. This is evidenced in the federal horizontal evaluation (DFO, 2022), which focuses on the failures of and challenges to the program and omits any significant impacts on dwindling delivery to Canadians and Indigenous communities.

Other themes identified in this project are related to the ‘only vehicle’ problem, notably the lack of integration amongst CSSP partners described in the sub-themes Misalignment of Priorities and Interpretation of Mandate. Though subtly different, these themes are similar in their exposure of the skewed priority structure and lack of inter-agency cooperation and common vision for the management of a coastal resource, resulting in an inequitable distribution of benefits.

In their analysis of governance integration in marine activities on the Bay of Fundy, Eger & Courtenay (2021) note some of the same challenges, although across many different programs and initiatives. They express institutional barriers that prevent vertical and horizontal integration among federal/provincial agencies and diverse marine user groups. They identify institutional barriers that are also internally reflected in the CSSP, such as a

misalignment of goals and policies, and a ‘status quo’ attitude that reinforces siloed inter-agency relationships. This traditional form of sectoral resource management precludes strong government leadership in integrating marine user groups into the governance regime. Looking at the CSSP through a similar lens, it is the lack of integration that makes it the only vehicle for ensuring the safety of shellfish, meaning there is no redundancy or ‘safety net’ for shellfish sanitary testing. When the only layer of governance becomes impotent, some user groups are bound to be left out.

There are several management approaches that loosely describe a re-imagined ‘holistic’ management paradigm that aims to balance human and environmental needs including Marine Spatial Planning (MSP), Ecosystem-Based Management (EBM), and Integrated Coastal Zone Management (ICZM). These discourses hold the promise of integrating social, economic, environmental, and governance dimensions into comprehensive frameworks for equitable and sustainable management of the marine space. However, these frameworks have fallen short on their promises despite numerous countries attempting to implement them over three decades, causing some authors to point out the somewhat naïve initial evaluation of the governance aspect of holistic management; institutional complexities and entrenched approaches to governance have been underestimated, and it is believed they form the primary barrier in creating transformative change (Kelly et al. 2018; Alexander & Haward, 2019; Macpherson et al. 2021). Seen from this perspective, the CSSP fits well into the category of complex institutions with unintegrated, sectoral management structures, making it unfit to address the needs of all stake/rights holders and unable to adapt to changing circumstances. Take as example the recent efforts of the federal government to build the blue economy, including the development of the shellfish industry, while simultaneously having a federal program acting as an institutional barrier to accessing the resource (Government of Canada, 2022).

The question of adaptive management prompts added concerns over the program’s future, specifically without any influx of new resources. The CSSP’s capacity to adapt to shocks has been tested in the past, as mentioned by some participants. In 2009, program requirements for export were tripled as a result of US audits, seriously burdening the CSSP’s ability to test commercial areas let alone areas favored by non-commercial

harvesters. The CSSP adapted as best it could by limiting its scope to its prioritized sector, but at a cost. This leaves less and less capacity for further strains on resources, and yet a number of new challenges are developing that will be exacerbated by climate change and associated rising sea temperatures and increased rainfall, including pathogenic threats.

Pathogenic threats are on the rise and the CSSP is not in a good position to perform widespread monitoring. One key concern is the naturally-occurring bacteria of the genus *Vibrio*, which has prompted significant management efforts in the US where sea temperatures are higher and illnesses due to *Vibrio* are relatively common (Alvarez et al. 2019). *Vibrio* is projected to increase in coastal waters as the climate warms, lengthening the season in which *vibrio* is most present and bringing it to higher latitudes (Hernroth & Baden, 2018; Froelich & Daines, 2020). Other bacterial groups, along with fecal coliforms are also likely to increase in abundance and distribution as the climate warms and rainfall increases (Kijewska et al. 2023). Another concern is Norovirus, which is a common cause of illnesses from the consumption of shellfish and is most closely associated with inputs of human sewage to the marine environment (Rowan, 2023).

In addition to pathogens, biotoxins produced by blooms of harmful algae are very likely to increase with increasing ocean temperature, creating the need to test more frequently and in areas that may not have a history of biotoxin contamination (Brown et al. 2020; McKenzie et al. 2021). The increased risk of biotoxin contamination as a result of climate change has been identified as an area of special concern for Indigenous people, who are already at a higher risk of shellfish poisoning than non-Indigenous people (McIntyre et al. 2021). The potential for a climate-induced decline of traditional seafood consumption among Indigenous people on the West coast of Canada and a shift towards store-bought food was predicted by Marushka et al. (2019) to have highly negative impacts on health and therefore food security. In addition to pathogens and biotoxins, there are other threats to human safety that are still being recognized; Barboza et al. (2018) pointed to the high ingestion of microplastics through shellfish consumption, a potential long-term threat to human health.

It appears unlikely that the CSSP will be able to adapt to future threats given its current state without new funding. The rising challenges discussed here could also increase the

likelihood that the US will raise its export standards once again to account for increased risks, an outcome that could leave the CSSP in paralysis. The lack of adaptive capacity is certainly cause for concern, however there are more immediate challenges that have been reviewed here, the solutions for which were discussed by participants and will be examined in the next section.

5.1. Proposed Solutions

Before beginning a discussion of potential management recommendations, analyzing the results of participants' solutions will provide valuable insights. Participant 8 mentioned the potential for leveraging innovation to support the CSSP's activities. Currently, water samples are collected using vessels, a time-consuming and expensive burden. It has since been shown that using drones to collect water samples could significantly cut down on cost and time, with only a few small technical hurdles to jump before this method could be viable (Horricks et al. 2022). There are also analytical options for reducing the cost and improving the efficiency of biotoxin testing, such as liquid chromatography (Guy & Griffin, 2009). One participant mentioned that the program could make better use of its pre-existing data to make quicker and more informed decisions; the statistical modelling of historical fecal coliform data can be used to prioritize testing resources (Zimmer-Faust et al. 2018), and improved data management systems to harmonize data storage methods and share data across government agencies would improve program efficiency (Nelson et al. 2022).

Outreach and awareness of the program for the Canadian public was another recurring idea in the results. The lack of knowledge of this program and confusion over the rules was mentioned by some participants, and awareness of risks and limitations of the program could only help to prevent illnesses. Finally, the most common suggestion was some form of alternative program. Currently, there is such thing as Alternative Service Delivery models (ASDs), however these are in practice exclusive to industry and generally seen as a 'band-aid' solution that generates unfair outcomes. The use of community testing programs holds promise, although some participants expressed skepticism that such programs would be more efficient than a comprehensive CSSP. Currently, more would need to be known about priority areas for subsistence harvesters and the demand for community testing options.

The sub-theme Lack of Consultation is very relevant to discussions about alternate delivery models. Either in the current state of the program or a hypothetically well-resourced version of it, knowing who is harvesting where remains a critical piece of comprehensive delivery. Engagement and consultation are critical to place-specific knowledge on use and potential use. This would necessitate extensive engagement of Nova Scotian communities in either case, making possible the strategic prioritization of resources along with the potential to capitalize on synergies between desirable areas for industry and subsistence harvesters alike. An engagement project could also be used to gauge interest in community testing programs. This is especially important in the case of Indigenous communities; with the present knowledge, it would not be possible to say whether all or most communities would prefer a comprehensive CSSP, or some other vehicle to delivery sanitary testing. An engagement project would allow for the scrutinization of whether an updated program with renewed funding and a common vision will ever be the most effective and equitable form of shellfish sanitation in Indigenous communities.

Consistent with the need for food security, food sovereignty is an important factor and refers to self-determination of food systems in contrast to the prevailing system of market-controlled food access and availability. The CSSP has been identified as a barrier to Indigenous food sovereignty (Armstrong-Buisseret, 2022), and Mi'kmaw clam harvesters in NS have been disadvantaged by federal policies in the past (Pictou, 2015). Indigenous food sovereignty in NS is a strong aspect of reconciliation and the honoring of Peace and Friendship Treaties and demands the rejection of colonial control over food systems (Boulianne, 2022; Stiegman & Pictou, 2023). Again, pursuing an alternate program that supports Indigenous food sovereignty would require extensive engagement with communities. Getting into the details of what this engagement would look like is beyond the scope of this project, however any legitimate engagement project must avoid tokenism and ensure that transparent dialogue is established with real impacts on decisions (Revez et al. 2022). Eger & Courtenay (2021) also noted that engagement with marine user groups in the Bay of Fundy often occurred after decisions had been made and were more like lectures than participatory processes for decision making.

5.2. Recommendations

As far as solutions go, it would appear that ASDs, consultation, better use of information, and innovation are, at this point, band-aid solutions to a program with an outdated mandate, confused governance, misaligned science management outcomes, and a lack of resources. This precludes the program's ability to adapt to existing realities, new developments and the changing demands of Canadians. The outdated mandate marginalizes segments of the population, which has been exacerbated by a lack of funding and reduced service delivery, and now results in a lack of access to safe food. In other words, the mandate has always been flawed, and only now are the cracks showing due to resource constraints. It remains to be seen whether a new mandate with additional resources can deliver at an appropriate capacity, or if entirely new vehicles designed to work for marginalized groups are needed. However, as a beginning point, the CSSP must pursue integration to address the underlying root causes of its dysfunction. This leads to the recommendations:

1) Pursue integration among the federal partners to establish a common vision and create new goals that incorporate the food security needs of subsistence harvesters. This could even be the creation of several separate programs for food safety in Canada with more tailored visions to users and various potential federal partners. It is understood that this is a rather drastic recommendation, but, by all accounts, the CSSP is a broken program and comprehensive change may actually be required.

The pursuit of integration could take many forms that may take a long time to materialize. To harmonize governance within the CSSP would require both drastic and subtle institutional change, requiring the consideration of as many options as possible. Integration could be achieved by reducing the CSSP partnership to two or even one federal organization to reduce competing priorities, or forming stronger partnerships on the provincial level or with academia.

A restructured program could be responsible for all CSSP functions and involve a suite of community-based partnerships meant to support food security and uphold Indigenous rights to harvest. The theoretical basis here would be to decrease institutional complexity while increasing horizontal and vertical integration to provide a more robust governance regime that works at multiple scales. Of course, this is a recommendation that has been

informed by data on NS specifically and is perhaps best suited to addressing NS's unique situation. However, the recommendation itself incorporates the ability to adapt to regional/provincial needs, making it scalable nationally and applicable in other regions/provinces. Although a new governance model is a long way off, the CSSP should start with a formal commitment to structural change aimed at greater integration with sufficient resources to deliver new program priorities.

2) Institutional change would undoubtedly be a long and complicated process, and in the interim people are still in need of program delivery in NS. This necessitates stopgap measures to A) provide safe access to food and B) prevent further decline. A comprehensive engagement project is needed to understand where priority harvesting areas are located and gauge the feasibility/desirability of community partnerships, especially for Indigenous communities. Knowing who is harvesting where would also be useful to demonstrate the importance of the program's activities, helping to problematize and communicate the current situation to decision makers.

3) In line with recommendation 2, the partners in NS should conduct a strategic exercise to identify areas where they could work more effectively in the existing governance structure of the CSSP, focusing on working towards new partnerships and projects with industry, academia and communities. Again, the details of this are beyond the scope of this project, but even the recognition that the program could be more effective through increased cooperation among the federal partners and more engagement with program dependents would be a step in the right direction.

5.3. Limitations and Directions for Future Research

This project had a number of limitations, and through them we can identify areas that require more exploration and research. One limitation was that only a small number of government employees could be interviewed, possibly narrowing the diversity of responses. This however is addressed by the first and key recommendation that emphasizes the need for future engagement. Another limitation was that this project examined the food-security aspects of the CSSP and subsistence shellfish harvest, however aquaculture is also an important contributor to food security; how this interacts with the program could use further analysis. Also, this project focused only on NS; a stronger understanding of regional

and local differences within the program is required to communicate the need for integrated management to decision makers. This could potentially benefit from first conducting an in-depth examination of the CSSP with an EBM, ICZM, or MSP lens to localize exactly where integration is lacking. Furthermore, a more robust theoretical exploration of alternate governance models could help to open minds. Interpreting how the program could be delivered through a co-management model in cooperation with Indigenous communities with a special focus on food sovereignty would be an interesting start. Additionally, a consistent gray-area identified in this project was the difficulty in differentiating between recreational and subsistence harvesters; the terms are not differentiated by the federal government and appear to be used interchangeably even in the literature. In fact, there is scant literature focusing on subsistence harvesting specifically, and the lumping of subsistence with recreational harvest has led some to refer to the former as ‘invisible’ (Ebbin, 2017). An exploration of how (or if) the difference could be made more explicit in management terms would be helpful. Another key area of uncertainty is the coming impacts of climate change and associated pollution and how that may affect the delivery of the program for both commercial and non-commercial users. Aside from those identified by this project’s limitations, there are many different directions that future research could go, and any of these would help to further contextualize and problematize the CSSP for others to understand its impacts, helping to steer a course towards greater functionality for all Canadians.

CHAPTER 6. CONCLUSION

This project used semi-structured interviews with federal and provincial government staff to identify four main themes and 13 sub-themes to answer how the CSSP impacts the food security of subsistence harvesters, and whether the CSSP is even structured to meet the food security needs of subsistence harvesters. Answering the first question, the CSSP negatively impacts the food security of subsistence harvesters because it struggles to deliver testing, limiting access due to long-term closures, increasing the safety risk to harvesters, and limiting Indigenous rights to harvest. For the second question, the CSSP is not structured to meet food security needs; resource shortages and inconsistent priorities among the federal partners combine with a mandate that does not explicitly consider food security needs or Indigenous rights, creating a situation where the science-focused branch of the program (i.e. testing) can no longer provide the data needed to make knowledge-based decisions, resulting in cyclically risk-averse decision making that do not account for the needs of subsistence harvesters or the rights of Indigenous harvesters. To make matters worse, there is no adaptive mechanism in the CSSP, and regional/provincial problems are disconnected from the national governance structure. Untangling this requires solutions that target root causes rather than program outputs. As a general recommendation, the CSSP partners should commit to a long-term process of institutional change to create vertical and horizontal integration in the governance structure, allowing for adaptive capacity at national and regional/provincial scales. This must be done in a comprehensive way that supports the food security of subsistence harvesters and affirms Indigenous harvest rights. In the interim, the CSSP must work with its current realities and undergo a comprehensive engagement project with local and Indigenous communities in Nova Scotia to determine priority areas for harvest and demonstrate the importance of program delivery to decision makers, an outcome which could help to garner new resources if communicated consistently by all three partners. The federal partners in NS should also conduct an exercise to determine how the program can be made more efficient through increased collaboration with each other, and with industry, academia and communities.

The CSSP is an important, but outdated and undervalued program that has real impacts on the lives of Canadians. Not only do we have an immense opportunity to do good for rural communities and contribute meaningful, actionable measures towards Indigenous

reconciliation, we are jeopardizing people's health by not doing so. Understanding that the program's challenges are deeper than its resource shortages is foundational for moving forward, a fact that should be kept in mind when considering solutions to the current state of affairs. With respect to supporting food security, perhaps it would be most helpful to see the CSSP as an opportunity to seize rather than a hurdle to overcome.

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APPENDIX A. Recruitment email

Example email:

Dear (participant's name),

I hope this finds you well. You are being asked to participate in a research project studying the impacts of access to safe shellfish on food security in Nova Scotia. This project is led by me, Adam Williamson, and supervised by Dr. Suzanne Dobson (CC'd). I am a summer student at Fisheries and Oceans Canada from the Master of Marine Management program at Dalhousie University.

Participation is totally voluntary, and can be ended at any time during the study. Your part will involve a 45 minute – 1 hour interview (can be in person or online) where I will ask you questions concerning your knowledge of shellfish management in Nova Scotia and the potential barriers to food security created by challenges within management. Please see the attached Consent form for more information concerning the study, your role in it, and how we will protect your information.

Should you choose to participate, we can further discuss when and how to conduct our interview.

Your participation in this study would be hugely appreciated, please feel free to ask me any questions. Thank you for your time, I look forward to further correspondence.

Best regards,

Adam Williamson, Master of Marine Management Candidate, Dalhousie University

Adam.Williamson@dal.ca

(613) 408 3350

APPENDIX B. Consent Form



CONSENT FORM

Project title: Food security implications in Nova Scotia related to declining services provided by the federal Canadian Shellfish Sanitation Program: Management considerations for the Department of Fisheries and Oceans Canada

Lead researcher

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Funding provided by: Internship at Department of Fisheries and Oceans Canada

Introduction

We invite you to take part in a research project being conducted by Adam Williamson, who is a graduate student at Dalhousie University. Participating in this project is entirely your choice, and there will be no impact if you decide not to participate in the research. The information below tells you about what is involved in the research, what you will be asked to do and about any benefit, risk, inconvenience or discomfort that you might experience.

You should discuss any questions you have about this study with Adam Williamson. Feel free to ask as many questions as you like. If you have questions later, please contact Adam Williamson.

Purpose and Outline of the Research Study

The purpose of this study is to explore the barriers to food security that arise from declining access to safe shellfish in Nova Scotia.

The United Nations Food and Agriculture Organization defines food security as “when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”.

Nova Scotia is the second most food insecure province in Canada. In Nova Scotia, the harvest of wild shellfish for food is important to coastal and Indigenous communities, providing a supplemental form of healthy protein. While nutritious and easily accessible, shellfish are also at risk of becoming contaminated in unsanitary water and can cause serious and/or fatal illnesses when consumed. This necessitates routine sanitary monitoring and management of shellfish harvesting areas to ensure public safety. The monitoring in Canada tests for both water quality in which the shellfish reside and grow as well as the shell stock specifically. In recent decades, inability to ensure the safety of shellfish harvesting areas have resulted in long-standing closures and diminishing safe access.

Through interviews with federal and provincial staff, I hope to gain insights into shellfish-related food security issues in Nova Scotia and explore awareness of these issues. This will help to frame the relationship between seafood and food security while providing a narrative to senior government management that explores the food security dimension of shellfish management in Nova Scotia.

Who Can Take Part in the Research Study

You may participate in this study if you are a federal or provincial government employee in any one of the following departments:

- Department of Fisheries and Oceans Canada
- Environment and Climate Change Canada
- Canadian Food Inspection Agency
- Nova Scotia Department of Fisheries and Aquaculture

What You Will Be Asked to Do

If you decide to participate in this research, you will be asked to attend one interview either online (Microsoft Teams) or in person at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia. The interview will take approximately 45 minutes – 1 hour. During the interview, you will be asked questions regarding your knowledge, professional experiences, and perspectives on the research topics.

Regardless if online or in person, the interview **will be recorded** using Microsoft Teams, however your data will not be shared and you will be de-identified (see below for more information on privacy and confidentiality). This research also requires the use of **direct quotations**, which will also be de-identified.

Possible Risks, Discomforts and Benefits

Risks: This study is minimal risk. As with any research involving human participants, there is a potential for privacy leaks, however the present study does not require participants to divulge sensitive information. Regardless, measures have been taken to minimize the risk to privacy (see below). There is also a risk of emotional or psychological discomfort caused by the interview setting or subject matter. In this case, you will have the opportunity to end the interview at any time (see below).

Benefits: There are no direct personal benefits or compensation for participating in this study, however participants will be contributing to a potentially useful document that may help others to understand shellfish management issues in Nova Scotia and the food security concerns therein.

How your information will be protected by the lead researcher:

Privacy and confidentiality: Only members of the research team (Adam Williamson, Suzanne Dobson) will have access to the names of research participants. Correspondence with participants will be over email, and individuals not in the research team will not have access to these emails. Data from interviews will not be sent over email. All your identifying information (such as your name and contact information) will be securely stored separately from your research information. All data will be de-identified; we will use a participant number (not your name) in our computer records so that the research information we have about you contains no names. A key containing the names of participants will be stored separately in encrypted form. During the study, all electronic records will be kept secure in an encrypted file on the researcher's password-protected computer, in the secure Dalhousie University One Drive.

We will describe and share our findings at Dalhousie University and amongst the Marine Affairs Program. Your name or personal information will not be in any of our reports. This means that you will not be identified in any way through our reports.

Data retention: Once the project is over, your data will be kept electronically for a period of one year, and will then be permanently deleted.

If You Decide to Stop Participating

You are free to leave the study at any time, there are no consequences for leaving the study. If you decide to stop participating during the study, you can decide whether you want any of the information that you have provided up to that point to be removed or if you will allow us to use that information. After participating in the study, you can decide by November 2023 if you want us to remove your data. After that time, the project will be completed.

How to Obtain Results

You will be able to see the results of this project by November 2023. It will be available on the Marine Affairs Program page of the Dalhousie University website, or you can request that a copy of the final document be sent to you directly over email.

Questions

We are happy to talk with you about any questions or concerns you may have about your participation in this research study. Please contact Adam Williamson (at (613) 408 3350, adam.williamson@dal.ca) or Dr. Suzanne Dobson (at (782) 640-1139,

Suzanne.dobson@dfo-mpo.gc.ca) at any time with questions, comments, or concerns about the research study.

No signature is required. Should you choose to participate, during the interview you will first be asked to verify verbally that you have read and understand the consent form sent to your email, and that you consent to having this conversation recorded and your words potentially quoted directly under the condition of anonymity and protection of your privacy.

APPENDIX C. Interview Guide

Words in **BOLD** are not to be spoken.

Ensure Microsoft Teams is recording, and transcription function is working properly.

Welcome and thank participant for their time:

Since we did not require a signature on the consent form, can you please verify verbally that you have read and understand the consent form sent to your email, and that you consent to having this conversation recorded and your words potentially quoted directly under the condition of anonymity and protection of your privacy.

Have consent form printed to go through with participant if they have any questions.

I will reiterate, you can stop the interview any time you like. Your data is confidential and will be kept only on digital files that will be deleted following the completion of this project. You will have the opportunity to request a withdrawal of your information up to November 2023, since after then the project will be complete.

These are the same questions that all other interviewees are receiving.

They can ask questions at any time during the interview. Ask participant if they have any questions before we begin.

1) Can we start with you briefly describing your role in your department?

- Any work related to shellfish?

2) Would you say you are knowledgeable about shellfish (specifically bivalves such as...) in general?

- Do you know or have heard of anyone in Nova Scotia who relies in any way on wild shellfish as part of their diet?
- Can you briefly explain the term 'food security' as you understand it?
- What do you know about how shellfish are managed in Nova Scotia?

Participant may know about CSSP, may not. If knowledgeable:

2a) Do you think the CSSP addresses food security in local Nova Scotian communities? Why or why not?

- Is it within the mandate?
- How well is it reflected?
- Should it be more or less reflected?
- Is the program effective and/or efficient in other respects? Why or why not?
 - o Preventing people from getting sick from contaminated shellfish?
 - o Meeting the needs of the aquaculture industry?
 - o Meeting the needs of domestic and international markets?

2b) Do you think the CSSP creates barriers for people who rely on shellfish in their diets?

2c) Can you offer any insights, either through personal experience or anecdotal accounts, of how people who depend on wild shellfish might be impacted by declining CSSP services?

2d) Can you think of any other non-CSSP related potential barriers that would keep people from harvesting shellfish for subsistence consumption?

- What are they?
- Why are they barriers? What is the historical context?

If not:

2a) Do you think there are barriers that prevent people from harvesting shellfish for subsistence consumption?

- What are they?
- Why are they barriers? What is the historical context?
- Do you think the government should play a greater role in supporting food security from shellfish harvest?

2b) Can you offer any insights, either through personal experience or anecdotal accounts, of how people who depend on wild shellfish might be impacted if large parts of the coastline become unmonitored for shellfish contamination?

3) Can you offer any insights, either through personal experience or anecdotal accounts, of how stakeholders and Indigenous people or groups use shellfish in Nova Scotia?

- Do you think people or groups who depend on wild shellfish in their diets would be impacted by barriers in different ways?

4) Do you have any ideas, approaches, best practices or examples of how shellfish management in Nova Scotia could be modified to better support food security in local communities?

5) Is there anything else you would like to add before we conclude this interview?

One final thing: its ok if you would rather not answer, but can you think of any names of federal or provincial staff (in Fisheries and Oceans, Environment and Climate Change Canada, the Canadian Food Inspection Agency, or Nova Scotia Department of Fisheries and Aquaculture) that I may be able to contact for an interview?

We can also follow up about this in the future if you think of anyone else.


Thank the participant again for their time and expertise.

This research will be available through the Marine Affairs Program page on the Dalhousie University website, but would you like to have a final copy of this research sent to your email directly or otherwise made available to you in November 2023.

APPENDIX D.

Appendix D. Researcher Notes

The following appendix displays data as it developed throughout the research process and summarizes the notes and thoughts of the lead researcher. The intent of this appendix is to increase the validity of the study by demonstrating how the data was transformed into results as candidly and transparently as possible. It should be mentioned that not all questions posed in the notes were answered or remained relevant as the process evolved, and not all decisions were recorded. To begin the analysis of data, initial codes were recorded in rough-form on paper during the interview period (August-November 2023) and prior to coding in NVivo. The table below summarizes the lead researcher's preliminary thoughts, roughly corresponds to phase 2 in the 6-phase process.

Time (oldest to newest)	Potential Codes or Themes	Notes
	Scale/extent of recreational/subsistence harvest in NS	Perhaps change NS to Maritimes to reflect DFO management unit? This would include NB and exclude North-West NS.
	Food safety/health concerns	NA
	Local knowledge, specific to NS; area knowledge	Will participants be able to generalize to the whole province? Is it fair to expect them to? How will I know if they are speaking outside their expertise?
	Knowledge of food security	I sent each participant the FAO definition of food security in the consent form; I have no idea if they actually read it, so I will ask them their interpretation of the term during the interview to determine their level of knowledge.
	Acknowledgement of potential for Indigenous rights infringements	How will I make the distinction between Indigenous and non-Indigenous harvesters when I am not interviewing Indigenous people specifically to demarcate their perspectives?
	Perception of wild shellfish importance for food security	NA
	Solutions: community testing, devolution of testing responsibility	NA
	Fairness	The two-tiered system for alternative service delivery of CSSP activities is often described as unfair.
	The four pillars of food security: availability, access, utilization, and stability	What participants mean when they talk about food security, what pillars are they hitting on?
	Other notes taken during the interview process	<ul style="list-style-type: none"> Do my research questions assume that government employees know more about food security and shellfish than they do? I am being careful during interviews not to assume they do. Do I have the flexibility to switch to a solely deductive approach? The snowball method is running into difficulties with getting enough participants. Participants often claim not to know much about CSSP, then get more comfortable and

		<p>reveal relatively strong opinions of the program</p> <ul style="list-style-type: none"> The pool of participants may be smaller than initially thought.
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The following table summarizes the codes created after the first round of coding, or a continuation of phase 2 and beginning of phase 4 of the 6-phase process:

'Parent' code	'Child' code		# References
Personal knowledge			5
	NB harvest frequency		1
	NS harvest frequency		12
	Traditional harvest		1
	Spatial temporal		3
	Other		2
			Total: 24
Food security knowledge	Availability		11
	Access		5
	Utilization		6
	Stability		5
			3
			Total: 30
Research question 1: CSSP impacts			2
	Safety Indigenous impacts	Harvest risk	7; 12
		Indigenous ASD Harvest rights	12; 4
	Indirect food security Closures CSSP as barrier		3
			1
			7
			10
			Total: 58
Research question 2: CSSP structure			0
	Mandate		13; 2
	Priority structure		11
	Requirements on program		3
	Resource shortage		14
	Public confusion of regs		2
	Senior management unaware		1
	Siloing		3
	NS specific issues		3
	ASD		5
	Gov staff turnover		1
	Open unmonitored		1
	Lack of consultation		4
			Total: 61
Public contamination perceptions			2
	Public skepticism		4
	Public unaware		3
	Fear of contamination		1
Decline			1
	Historical CSSP knowledge		9
			Total: 10
Alternate program			11
	Criticism of alternate program		2
			Total: 13

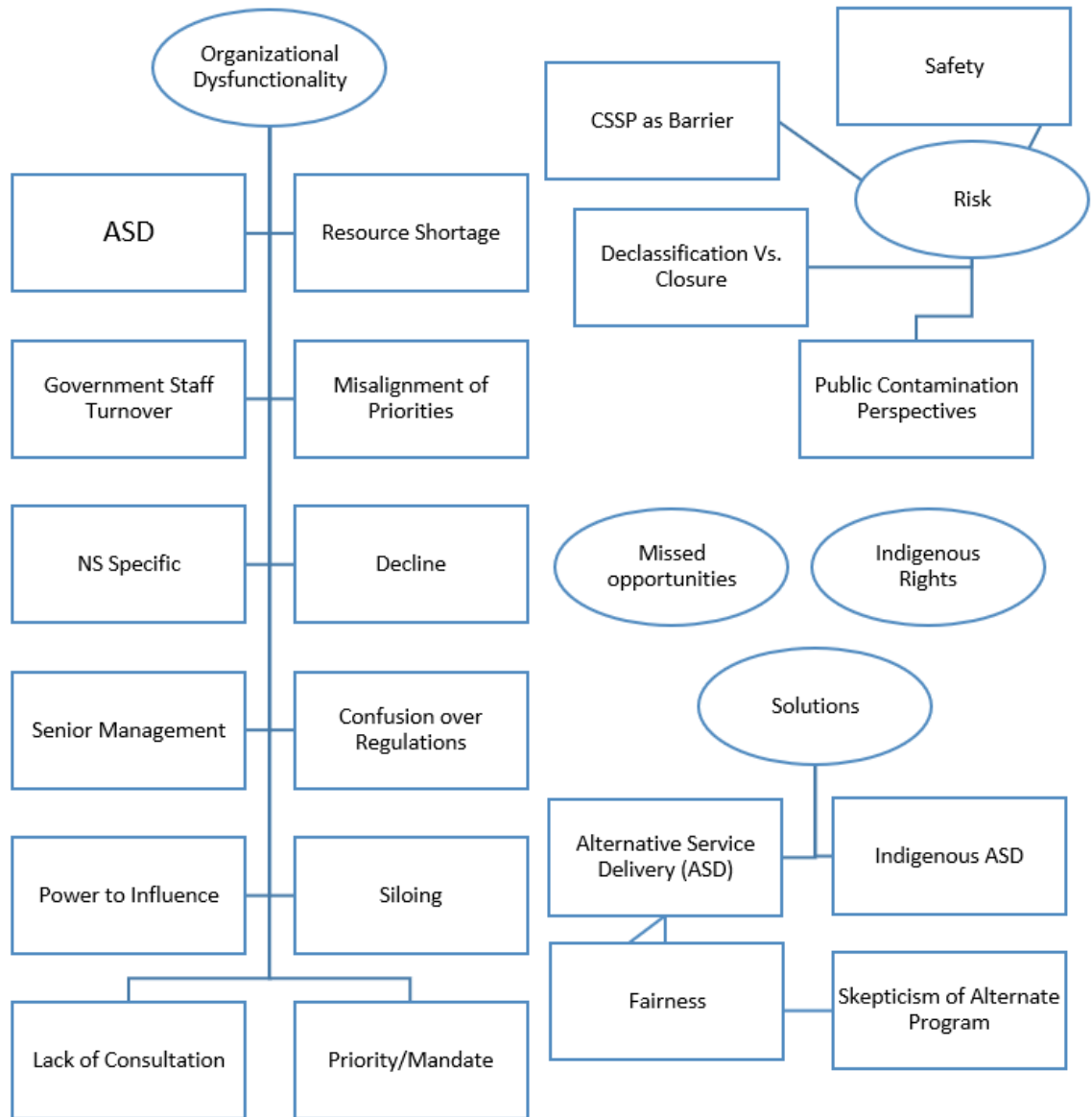
Commercial harvest	NA	5
Fairness	NA	4
Non-CSSP barriers	NA	5
Power to influence	NA	2
Missed opportunities	NA	2
Suggested solutions	NA	5

Notes:

Early themes emerging:

- Risk – safety
- Public perception of issues vs internal government perception
- Future directions – amalgamate Suggested solutions with Alternate Program with Indigenous ASD
- Mis-alignment of program goals and directions, lack of cohesion among three partners
- Mis-management of long term risk is a threat to food security
- Frustration of clear structural/governance issues within the program prevent its ability to provide for all Canadians

The following graphic is an early thematic map consistent with phase 3 – early phase 4 of the 6-phase process, where ovals represent main themes, and rectangles represent sub-themes:



Notes (some are pertaining to codes in the previous table):

- Decline should be broken down, not thematically relevant
- Commercial Harvest is not a relevant theme
- Food security knowledge can remain separate to provide validity to assumptions about participants' knowledge
- Personal Knowledge is just for validity that participants think subsistence harvest is common/important
- Frequency of references matters little for themes – level of insight should be assessed
- Eliminate Decline and Historical CSSP Knowledge all together, add to Decline in Resourcing
- Eliminated Confusion over Regulations, too similar to Lack of Consultation

- Adding Siloing to Misalignment of Priorities, too similar to remain apart
- Senior Management added to Interpretation of Mandate, not enough evidence
- Requirements on Program added to Decline in Resourcing, too similar
- Fear of Contamination was dissolved, not enough evidence and not very relevant
- Alternate Service Delivery becomes Alternate Program, more inclusive

Supplementary Information

Click [here to download a summary](#) of codes and corresponding data.

For non-Dalhousie University users, the Supplementary Information PDF file has been uploaded separately on DalSpace.