

The Opinions of BC's Public Fishers on Open Net-pen Salmon Farms

by

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“Poets talk about ‘spots of time,’ but it is really fishermen who experience eternity compressed into a moment. No one can tell what a spot of time is until suddenly the whole world is a fish and the fish is gone.”

Norman Maclean

Abstract

In British Columbia (BC), there are 176,819 active resident anglers in the jurisdiction of BC's Tidal Waters, the sport fishing industry creates revenues of \$1.1 billion and employs 9,000 workers (BC Stats, 2018; Fisheries and Oceans Canada, 2019b). The objective of my research study was to uncover the values, opinions, and beliefs this prominent stakeholder group holds about the future of salmon aquaculture-related policies and industry-related decisions impacting BC's coastal tidal waters. Using a sequential mixed-method design and purposeful sampling, my study focused on surveying and interviewing members of the Sport Fishing Institute of BC (SFI). The results reveal that the respondents are concerned about potential health risks to wild salmon due to disease and pathogen transfer from open net-pen salmon farm design, but they would support a move for BC's aquaculture industry to move to land-based tank operations.

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Finally, to my courageous parents. You raised me in the wild remotes of the most beautiful and peaceful place I have ever known. For this, and for everything else, you will always have my deepest love and gratitude.

Chapter 1: Introduction

The cultivation of Atlantic salmon in open net-pen aquaculture sites on BC's coast began in the early 1970's as a response to a dwindling global supply and rising global demand for salmon (Bocking, 2007; Galland & McDaniels, 2008; Noakes et al., 2000). Open net-pen aquaculture refers to marine-based salmon farming operations, or sea cages as they are sometimes called. Due to their mesh-like, open net design, the operations have the potential to disrupt, alter, or change the dynamic marine ecosystems within which they are sited (Galland & McDaniels, 2008; Gerwing & McDaniels, 2006; Schlag, 2010). Given the permeable characteristics of open net-pen operations, research has linked risks like disease and parasite transfer from the farmed Atlantic salmon as potential causes contributing to the endangerment of the wild Pacific salmon (Bocking, 2007; Chen & Lopez-Carr, 2015; Cohen, 2012c, 2012b, 2012a; Morton et al., 2017; Morton & Routledge, 2016; Noakes et al., 2000; Pinkerton, 1994). However, in a 2022 Canadian Federal Court ruling, Justice E. Heneghan references nine reports produced by the Canadian Science Advisory Secretariat between 2017-2020 that conclude "...aquaculture...poses no more than a minimal risk of harm to the Fraser River Sockeye.." (Mowi Canada West et. al. v. Minister of Fisheries and Oceans, 2022). The precise cause and/or causes of deteriorating wild salmon stocks on BC's coast remains undetermined; and as such, the multiple proposed theories are highly contested throughout the scientific community.

In fact, the controversial research area of salmon extinction and its related topics are so highly disputed that the on-going disagreement has become an intense, empirically data-driven debate known as the "science wars" (Ruckelshaus et al., 2002). Paths of inquiry into the reduction of wild salmon stocks typically lead to industrial pollution from resource extraction

and manufacturing industries, commercial overfishing, and climate change, which are all reasonably attributable causes for the gradual disappearance of wild salmon (Ladd, 2011). There is insufficient research and data on the impact of recreational fishing on salmon populations, so despite the calls from conservation groups to curtail recreational fishing in BC's tidal waters the Canadian government has responded with some restrictions for the stocks of concern (Baker, 2021). As Lichatowich puts it: "At every point of contact with the industrial economy, from the headwaters to the sea, the salmon have long engaged in a losing struggle for habitat" (Ladd, 2011, p. 346).

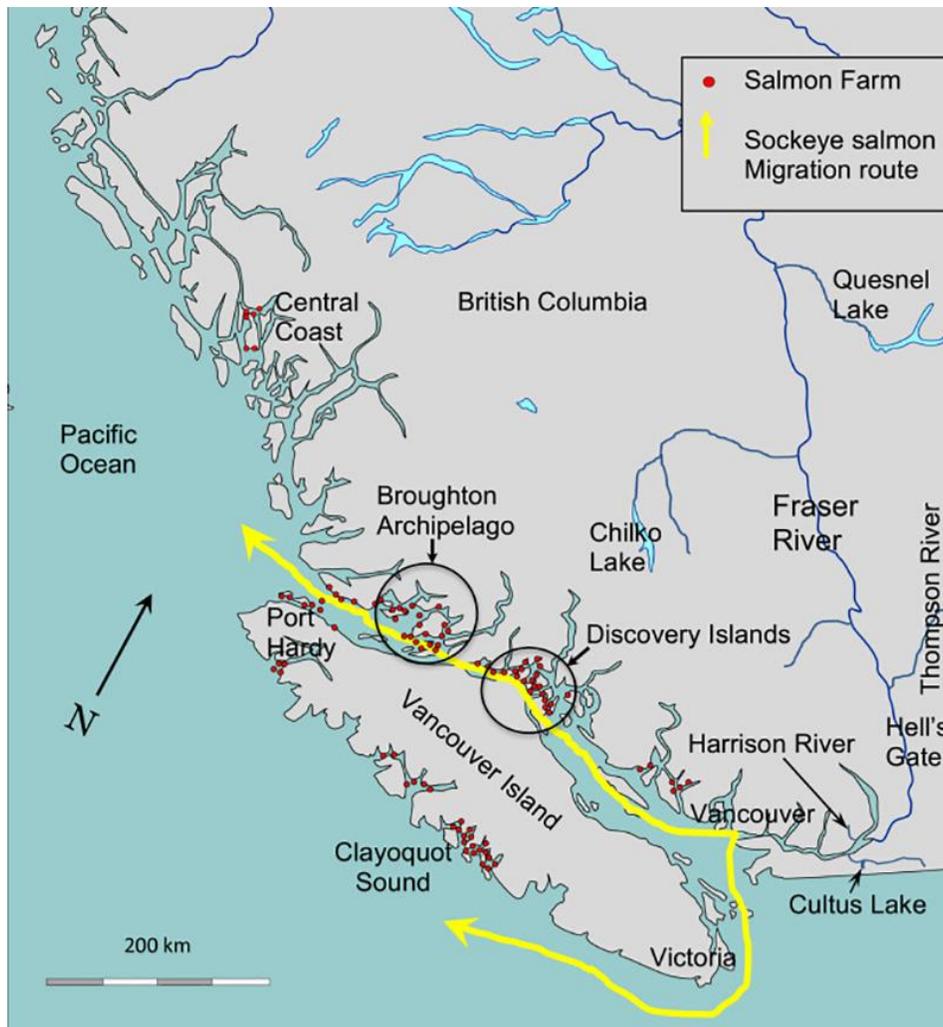


Figure 1: Migratory Sockeye Salmon Route (Morton & Routledge, 2016)

Wild salmon have been disappearing on BC's coast since the 1980s, providing a perceived need for the growth of industrialized open net-pen salmon aquaculture in order to address the global consumer supply gap (Morton & Routledge, 2016; Ruckelshaus et al., 2002). Up until 2009, the burgeoning fish farms were considered by many, but not all, as an innovative

agricultural practice, creating concentrated salmon habitat and additional salmon supply in the face of diminishing numbers of wild salmon available to the commercial capture fishery.

As BC's coastal open net-pen salmon aquaculture industry has advanced in production volumes and farm sites, so too has the scrutiny, objections, and criticisms towards the industry (Flaherty et al., 2019). The issues for scrutiny relate to potential environmental and human health risks such as industrial pollutants introduced by the fish farms, destruction of wild fish habitat, ignoring of Indigenous land rights and ownership, Atlantic salmon escapes, disease and sea lice transfer to wild fish, and the use of antibiotics and other potentially harmful chemicals during the process of open net-pen fish cultivation (Galland & McDaniels, 2008; Schlag, 2010; Weitzman & Bailey, 2019). Governments, industry alliances, scientific researchers, environmental non-governmental organizations (ENGO), capture fishery, public fishery, First Nations, coastal residents, and eco-tourism operators are the most prominent groups represented and persistently debating whether to limit or continue the growth of open net-pen salmon farming on BC's coast (Flaherty et al., 2019; Rayner & Howlett, 2007; Young & Liston, 2010). In BC, 20 First Nations have agreed to salmon farming partnerships in their territories and 20% of salmon farming jobs are held by Indigenous people (BC Salmon Farmers, 2022). Heated discourse through various media platforms have been utilized extensively on all sides to frame the industry and its issues.

My research study collected information about the perceptions, beliefs, and opinions about open net-pen salmon aquaculture on BC's coast from participants of the *public fishery*. The public fisheries, also known as the recreation or sport fisheries, "...are usually considered those where fishing is conducted by individuals for sport and leisure, with a possible secondary objective of catching fish for personal consumption" (Cooke & Cowx, 2006, p. 93). Furthermore,

many members of the public fishery are highly conscious of marine and environmental conservation issues, like the members of the Vancouver, BC-based Sport Fishing Institute (SFI), who reflect some of their core beliefs here:

There are few outdoor activities that involve as many British Columbians as do recreational fisheries and few that have the potential to connect people with the marine and aquatic environment in such a direct and meaningful way as does fishing...It can be the foundation for strengthening the connection between humans and the environment. (Sport Fishing Institute, 2021c)

The existing research on BC's public fishery is either heavily based in quantitative data or focused on policy development for fish sustainability and stewardship (BC Stats, 2018; Cohen, 2012a, 2012b, 2012c; Cooke & Cowx, 2006; Fisheries and Oceans Canada, 2019b; Sutinen & Johnston, 2003). In recent years, scholars are increasingly noting the usefulness, value, and need for more knowledge and insights regarding beliefs and perspectives held by the people in the public fishery, the inclusiveness of which leads to the stronger models of conservation (Brownscombe et al., 2014; Lancaster et al., 2015; Lewin et al., 2006; Nguyen et al., 2013; Post, 2013). To date, there has not been a study that explores the stance of the public fishery regarding open net-pen salmon farms on BC's coast.

My sequential mixed-method research study used both an on-line survey and open-ended interviews (Creswell & Clark, 2011). Working with a purposeful sample of members from the Sport Fishing Institute of BC (SFI), my research study uncovered more about the reasons and motivations behind the organization's public stance opposing open net-pen salmon farming on BC's coast (Sport Fishing Institute, 2018). Notably, although opposed to open net-pen salmon

aquaculture, the SFI supports efforts towards closed containment technology (Sport Fishing Institute, 2018) (see full statement in Appendix 1). From their website, the SFI describes its organization as follows:

The Sport Fishing Institute of BC is a non-profit society. Contributors and members are made up of a wide range of committed stakeholders including: fishing lodges, resorts, certified tidal angling guides, hotels, charter operators, manufacturers, distributors, tackle shops, dealers, boat marine manufacturers, regional airlines, individual anglers and key insurance industry organizations. Our common goals are to ensure sustainability of our natural resources and that angling opportunities are maintained and promoted. (Sport Fishing Institute, 2021a)

This is a mixed methods study working predominantly within the interpretive paradigm. The quantitative survey data carefully defines a useful sample population for 8 interviews, while providing demographic data about the SFI membership, their fishing practices, and Likert scaled value statements about open net-pen salmon farming. The open-ended interview data was collected, analyzed, and developed through grounded theory practice.

My research question is:

To what extent, and if so, why are the members of the SFI opposed to open net-pen salmon aquaculture on BC's coast?

Chapter 2: Literature Review

In order to situate this research study and its findings as useful material for the enhancement of environmental discourse specific to the fisheries of coastal BC, a sample of the existing and most current literature has been reviewed and summarized. My aim is to engage and support the future work of researchers, policymakers, governing officials, and industry officials in their work towards sustainable fisheries and wild salmon conservation. The literature reviewed 1) summarizes the history of governance of the salmon aquaculture industry in BC, 2) reviews the existing research on public or recreational fisheries in BC, and 3) identifies the opportunity for contributions resulting from the research proposed in this study.

Sources were found through academic databases and search engines including Google Scholar, references from books, scholarly journals, newspaper articles, e-books, provincial and federal government reports. Key themes, subjects and search terms include: 'open net-pen salmon aquaculture,' 'public fishery,' 'environmental discourse,' 'sport fishery,' 'recreational fishery,' 'salmon farm,' 'grounded theory,' and 'environmental activism.'

The history of governance of the salmon aquaculture industry in BC

BC's open net-pen salmon aquaculture industry

As BC's coastal open net-pen salmon aquaculture industry has advanced in technological processes and techniques, so too has its output volumes and farm sites. In 1990, BC's salmon farming industry was valued at \$75 million Canadian and by 1999 the industry had grown to \$292 million Canadian (Noakes, D.J. et al, 2003, p. 125). During approximately the same period, in 1988 BC's commercial salmon fishery was valued at \$300 million Canadian and by 2000 had declined to a value of \$25 million Canadian (Noakes, D.J. et al., 2003, p. 124). Further, by 1997

the global market contribution of farmed salmon was 1.7 million tons, equal in volume to that of capture fishery, which "...resulted in a reduction in price for all salmon" and "...resulted in farmed salmon replacing wild salmon in many traditional markets globally" (Noakes, D.J. et al., 2003, p. 124). In the course of two decades, salmon aquaculture had established efficient and lucrative methods for meeting the global demand for its product, which attracted foreign ownership to BC's open net-pen coastal industry, while increasing the number of stakeholders and increasing the scrutiny of fish farming practices.

In response to the consistent and prominent public outcry regarding its multiple environmental and human health issues, BC's salmon farming industry has faced an array of regulatory challenges. From 1995 to 2002, BC's provincial government placed a moratorium on new farm site licenses until a complete environmental assessment could be completed (Flaherty et al., 2019). The moratorium was then lifted in 2002 after BC's Ministry of Agriculture, Food and Fisheries deemed open net-pen fish farms "...a safe and environmentally responsible industry with tremendous economic potential for coastal British Columbia" (Flaherty et al., 2019, p. 12). Subsequently, in 2009 the BC Supreme Court ruled that fish farms are not agricultural but fisheries and turned over the majority of aquaculture policy and governance to the Federal Department of Fisheries and Oceans (Cloutier de Repentigny, 2015; Flaherty et al., 2019). Finally, in 2012 the Canadian government released the results, findings, and recommendations from a three-year inquiry into the decline of sockeye salmon returns to BC's Fraser River known as the Cohen Commission. The inquiry resulted in 75 recommendations, including removing salmon farms from migratory routes and placing another moratorium on

expansion of site licenses in the geographical region of BC's Discovery Islands (Cohen, 2012c, 2012b, 2012a; Flaherty et al., 2019).

Presently, BC's salmon aquaculture industry is predominantly owned and operated by multinational firms originating from Norway, with exception of CERMAQ, who since 2014 has been a subsidiary to the Japanese Mitsubishi Corporation (Mitsubishi Corporation, 2022).

Further, "Farm raised salmon is BC's...top agricultural export and generates over \$1.5 billion dollars towards the B.C economy, resulting in over 6,600 jobs" (Dawson, 2018). Overall and according to 2019 data released from Canada's Department of Fisheries and Oceans (DFO), there are 84 active open-net pen salmon aquaculture sites on the BC coast, and another 34 that are licensed yet currently fallow (Fisheries and Oceans Canada, 2019a). In 2016, a Standing Senate Committee on Fisheries and Oceans supported the doubling of Canada's aquaculture industry in the next decade as a way of supporting the economies of rural and remote communities (Senate of Canada, 2015). However, the Senate Committee also noted serious concerns with the current level of negative public perception surrounding the industry and the lack of consensus among stakeholders (Flaherty et al., 2019).

Protests: The Occupation of Swanson Island

The ecopolitical discourse surrounding "The Occupation of Swanson Island" is an example of the physical, sustained demonstrations of environmental activism against open net-pen salmon aquaculture on BC's coast. "The Occupation of Swanson Island" took place from August 2017-May 2018. For 280 consecutive days First Nations protestors remained in the remote region of Vancouver Island's Broughton Archipelago (see Figure 1) occupying the buildings and industrial property of open net-pen salmon aquaculture operations owned by the

Norwegian company MOWI (formerly Marine Harvest). Compelled by the competing scientific data regarding risks of parasite and disease transfers from the farmed Atlantic salmon to wild Pacific salmon, the activists were seeking the removal of all 20 open net-pen salmon farms from the Broughton Archipelago (Gilpin, 2017; Hernandez, 2016; Johnson, 2016; Prystupa, 2018; Rasmussen, 2018). Supporters of the occupation included famed scientist Dr. David Suzuki, marine biologist Ms. Alexander Morton and the Sea Shepherd Conservation Society.

In December 2018, 18 months after the “Occupation of Swanson Island” had commenced, and seven months following the Royal Canadian Mounted Police (RCMP) forced removal of the environmental activists from MOWI’s industrial sites, an agreement was reached between BC’s provincial government, the salmon aquaculture industry, and ’Namgis, Kwikwasut’inuxw Haxwa’mis, and Mamalilikulla First Nations (all located on the northeast side of Vancouver Island or the adjacent mainland) to transfer 17 open-net pen salmon farms out of the Broughton Archipelago and away from wild salmon migration routes by the end of 2023. The farms did not lose their licenses to operate on the BC coast, but instead were asked to move their operations to areas considered less ecologically sensitive. In response, the Swanson Island activists agreed to this compromise, but noted its shortcomings in terms of a transfer of operations as opposed to complete removal, and the group also noted the timeline for these transfers were longer than they desired (Khan, 2018; Nikiforuk, 2018).

Review of the existing research on fisheries in BC

Public fishery

In BC’s fisheries and aquaculture sector, the public fishery makes the largest economic contribution. In 2016, sport fishing accounted for 39% of the sector’s total GDP, created

revenues of \$1.1 billion, and employed 60% of the sector's workers, which is an estimated 9,000 people (BC Stats, 2018). Since 1990, the real GDP associated with sport fishing in BC has increased by 79% and the industry's revenues have increased by 93% (BC Stats, 2018). Further, DFO's Survey of Recreational Fishing in Canada states that in 2015 there were 176,819 active resident anglers in the jurisdiction of BC's Tidal Waters (Fisheries and Oceans Canada, 2019b). "This, when coupled with the fact that recreational angling removes only 15% of the halibut and 10% of the salmon, suggest that in strictly economic terms the Pacific coast recreational fishery is indeed extremely productive" (Sport Fishing Institute, 2021b).

The prevention of overfishing is a common area of focus for fisheries studies and research. To that end, many researchers choose to compare and contrast the policies and practices of the public fishery to that of the commercial capture fishery (Cooke & Cowx, 2006; Lewin et al., 2006; MacKenzie & Cox, 2013; Sutinen & Johnston, 2003). For example, Lewin et al., (2006) examined the ecological impacts of recreational fishing from a global, multi-trophic perspective, stating: "Most studies concerning fishing-related impacts on the aquatic environment deal [only] with commercial fisheries" (p. 306). Their exhaustive policy and case analysis makes recommendations for the mitigation of anthropogenic stresses to global fish stocks, like exotic species invasions, hydropower generation, pollution, habitat loss, and river fragmentation (Lewin et al., 2006, p. 306). Aspects of climate change like increasing temperature, rising sea-levels, and changing storminess also pose significant risks to health of wild salmon ecosystems (Lemmen et. al., 2016). Notably, researchers highlight the importance of the human dimension to fisheries management, stating "...social needs and perceptions drive fisheries management and the acceptability of actions" (Lewin et al., 2006, p. 327).

In fact, the importance of the aptly called human dimension to effective fisheries management is noted in the findings of multiple researchers making claims about the public fishery (Brownscombe et al., 2019; Dedual et al., 2013; Lancaster et al., 2015; Nguyen et al., 2013; Post, 2013). The researchers have noted major barriers in communication between policymakers and angler types, their motivations, behaviors, and beliefs. Further, research studies pertaining to the values, perceptions, and beliefs of recreational fishers specific to the tidal waters of BC's coast are not common, and there has been no research completed on this group's opinions regarding open net-pen salmon aquaculture. In their mixed-method study about attitudes, beliefs, and behaviours impacting anglers' catch-and-release practices of Pacific salmon based in the region of the lower Fraser River, (Nguyen et al., 2013): "Our findings also highlight, however, the need for further research on the determinants of angler beliefs and behavior in order to customize programs to build anglers' awareness and adoption of responsible fishing practices" (p. 852). Following interviews with 311 respondents, their findings indicated that the angling community's behaviours and motivations are highly heterogenous; however, DFO's conservation efforts are homogenous, which creates gaps in acceptance and understanding.

Further, in a summary of current insights and ongoing developments in recreational fisheries worldwide, (Brownscombe et al., 2019) notes the complex social, economic, and ecological systems inherent to the sector and suggest "...research, monitoring, and management must also evolve...to achieve sustainable [recreational fisheries] and environmental conservation" (p. 248). Scholarly consensus is building that fisheries management processes will benefit from considering the public fishery as a salient stakeholder when governments craft,

negotiate, and deliver policy (Brownscombe et al., 2019; Lewin et al., 2006; MacKenzie & Cox, 2013; Nguyen et al., 2012; Post, 2013). In their study about how anglers on the lower Fraser River use and gain access to fisheries related information, (Nguyen et al., 2012) citing Plate, et al., (2009) state:

Engaging informed stakeholders, such as [recreational] fishers, is relevant for fisheries around the world, especially those seeking to promote “responsible fishing.” A “responsible fishery” is conducted to benefit all the people involved in the fishery without causing unacceptable changes in fish populations and their ecosystems. (p. 249)

This concept of “responsible fishery” and engaging informed stakeholders is particularly significant when compared to the 2018 report from BC’s Minister of Agriculture’s Advisory Council on Finfish Aquaculture (MAACFA) (MAACFA, 2018). The MAACFA deliberated for 18 months about the future of finfish aquaculture in BC, and during that time the public fishery was not represented by a single seat on the Council or invited to make a presentation. Given the number of resident anglers active on BC’s tidal waters, the economic contributions of the public fishery, and the proven conservation benefits that result from engaging all sectors of fisheries, not formally including the public fishery seems somewhat of an oversight in policy development regarding fish farms. The MAACFA report begs the question about what the beliefs, perceptions and attitudes are amongst members of the public fishery regarding the existence and potential future expansion of open-net pen salmon aquaculture on BC’s coast.

Chapter 3: Methodology

Strategy and Design

This study gathered data from experienced public fishers that spend significant portions of time actively fishing BC's tidal waters. The purpose of working with this specific group of sport fishers was to narrow the field of respondents to those that fish BC's tidal waters, as opposed to those who prefer fishing in freshwater like lakes or rivers. Further, this study gathered data from BC residents as opposed to visiting recreational fishers from out of province or from outside of Canada. The reason I chose to gather data from resident fishers of BC's tidal waters is so that I could examine data from those who are the most experienced with and spend the most time interacting with BC's coastal marine environment. This study aims to uncover whether there exists a link between the opinions of BC's public fishers about open net-pen salmon farms and their cultural attachments to place.

It is important to keep in mind that this is not a study about indigenous cultural attachments or the politics of First Nations and fish. The scope of this study is specific to BC's public fishers. The reason for this choice is that I am not an indigenous person, making it inappropriate for me to effectively communicate research findings, particularly qualitative research findings on behalf of indigenous communities.

Using a sequential mixed-method design and purposeful sampling, my study begins with an on-line survey tool (SurveyMonkey) distributed to members and stakeholders of the SFI. The survey data informed the second stage of research where I then individually conducted telephone interviews with eight survey respondents who are also SFI members (Creswell, J., 2009; Creswell, J. & Clark, P., 2011). I chose to begin with a sample size of eight because initially that

was the number of respondents who self-selected on the online survey. After conducting eight interviews I concluded that I had reached a point of saturation, indicating that conducting more interviews would not elicit new data or information. The on-line surveys collected quantitative demographic information about the SFI members and stakeholders, in addition to geographical information, data about recreational fishing habits, and Likert scale statements about the SFI members' feelings regarding open net-pen salmon farms on BC's coast (see Appendix 2). The open-ended interviews collected qualitative data about informant's beliefs, opinions, and attitudes regarding the current existence and potential future growth of the open net-pen salmon aquaculture industry on BC's coast. The personal interviews were designed and conducted using the free association narrative method (See Appendix 3).

Sample and Data Collection

As noted, all research participants are members of the SFI. I did not interview paid staff members of the organization. The reason I chose to not interview the SFI's paid staff members is because I could only make a partial promise of privacy and confidentiality, and my aim was to engage participants that were willing to be as open and transparent with me as possible.

Survey

As a method of quantifying the opinions, perspectives, and attitudes held by the members of the SFI about open net-pen salmon farms operating on the coast of BC, Likert scale questions were included as part of the online survey. Considered a psychometric research technique, the Likert scale attempts to assist qualitative researchers by quantifying the complex relationship between human thoughts, feelings, and outlooks (Boone & Boone, 2012; Joshi et al., 2015). Likert scale questions offer a set of statements that ask respondents to express a metric scaled

level of agreement with a given topic. Substantiating and quantifying public fishers' attitudes towards statements about salmon farms were of particular interest, as: "An attitude can be defined as preferential ways of behaving/reacting in a specific circumstance rooted in relatively enduring organization of belief and ideas...acquired through social interactions" (Joshi et al., 2015, p. 397). Further: "Validity of Likert scale is driven by the applicability of the topic concerned; in context of respondents' understanding..." (Joshi et al., 2015, p. 399). In other words, the results of Likert scale survey questions are considered more valid and useful as a research tool when the respondents are knowledgeable and experienced about the subject matter, as is the case of this study.

The quantitative on-line survey completed two data collection aims. The survey generated a sample of candidates for personal open-ended interviews, and it collected quantitative data from the public fishers of BC's tidal waters. The categories of membership within the SFI comprise a diverse group of stakeholders within BC's public fishery, including but not limited to those that manufacture boats, sell operator's insurance, manage hotels, and own tackle shops. The intention of this thesis study was to interview eight participants of the public fishery that consistently, actively spend time in the physical space of the marine environment fishing BC's coastal tidal waters fishing for sport or recreation. As our culture, beliefs, and values are often formed and influenced by the physical spaces we occupy, my study about the future of BC's wild salmon aims to engage those public fishers' who most often occupy the BC's marine coastal environment (Stedman, 2003).

The survey concluded with the option for the respondent to self-select, or express interest in volunteering to participate in the interview portion of the study. The distribution of the surveys

was emailed to the SFI membership and stakeholders in their organizational update and posted on the SFI's social media channels.

Interview

Interviews were conducted with eight members of the SFI using the free association narrative technique. As opposed to structured, or semi-structured interviews, the free association narrative technique is "...open to development and change, depending on the narrator's experience" (Hollway & Jefferson, 2008, p. 302). When the interviewer sets the interview agenda, that interviewer is often in control not only of the flow of the information, but also in the perceived meaning of the words by framing and asking the questions. This is important as:

[T]here does not exist, and never has existed, a people without narratives; narrative is the primary form by which human experience is made meaningful...it organises human experiences into temporally meaningful episodes; thinking, perception, imagination and moral decision-making are based on narrative structure (Hollway & Jefferson, 2008, p. 303).

As this is the first known research study about the perceptions, opinions, and beliefs of members of BC's public fishery about the open net-pen salmon aquaculture industry, the significance of language is of foundational importance. As such, the narrative regarding why and to what extent BC's public fishers oppose open net-pen fish farms will be most meaningfully developed from their own stories and in their own words.

Data Analysis

Survey

The on-line survey was created and delivered in the program Survey Monkey (<https://www.surveymonkey.com/>), which is a software application complete with built-in, comprehensive analytic tools. The survey was rank ordered so to prioritize respondents that have spent the most time actively and consistently fishing on BC's coastal tidal waters in the last 12 months. The additional demographic information like location of personal residence and location of business will be applied to the analysis of the interview data. Those demographics were used to determine if, and to what extent the place of residence or the location of business influenced or impacted the analysis of the interview data.

Interview

The interviews were transcribed from recordings and then studied for coding and analysis. Using the grounded theory method and descriptive statistics, the interview data was reviewed for comparisons and relationships to the central research question: Why and to what extent are the members of the SFI opposed to open net-pen salmon aquaculture on BC's coast?

I chose grounded theory for much the same reasons as the free association narrative interview method; both to allow the space and opportunity to draw new understandings where there exist multiple factors. Grounded theory allows the researcher to develop unique theories from research grounded in their primary data as opposed to inferring a testable hypothesis from existing theories (Charmaz, 2006, p. 4). On grounded theory, Corbin & Strauss (2008) say the following: "The world is very complex. There are no simple explanations for things. Rather, events are the result of multiple factors coming together and interacting in complex and often unanticipated ways" (p. 7). Fisheries, economies, and environmental conservation are complex.

As the sample of literature reviewed indicated, there are social, political, cultural, and technological considerations that influence the experiences of BC's public fishers. An analysis of the interview data using the grounded theory method may help uncover new understandings about public fishers and their core beliefs.

Ethical Considerations

My research proposal was reviewed and approved by the Royal Roads University Ethics Board and all survey and interview respondents were provided with a disclosure about the nature of the study in which the respondents were asked to acknowledge agreement before participating. This research study was informed by both an on-line survey and interviews, which means written, informed consent was obtained before proceeding with interviews, including discussing the nature of the study with the participants. Due to the in-person interview restrictions of the Covid-19 pandemic, the interviews were conducted remotely over the telephone. The use of full names was not needed in this study, but the study does include job description, SFI member category, or affiliations to demonstrate the nature and closeness of the person's participation or influence on the outcome of the research. For that reason, there is only a partial promise of privacy and confidentiality. Personal data and information like the recordings of interviews were kept digitally on my personal laptop, which is password protected. The information was retained for as long as needed to complete my thesis study, and then disposed of by the end of 2022.

Reliability and Validity

The methodology choice of using an online survey method presents challenges to reliability and validity due to overall response rate and the possibility of incomplete responses (Merrigan et. al., 2012). I tried to mitigate these issues through the survey design and formatting

that made it as easy as possible for respondents to move through the survey quickly without the option to skip questions. I also had the supervision and peer-reviewed support of my thesis advisor Dr. Rick Kool who helped me avoid common pitfalls associated with online survey questionnaires.

Notably, one of the limitations of this study is that it only collected data from SFI members and does not engage the whole community of BC's public, sport, and recreational fishers. In addition, the timeframe of this study is limited to approximately six months, during which time the on-line survey and interview data was collected and analyzed.

Chapter 4: Findings

Results of Online Survey

The option for participation in the online survey was distributed to SFI members through the organization's July and August member's update, which is emailed to 1500 addresses and averages a 50% open rate. Additionally, the SFI posted links and a request for participation in the online survey on both their organization's Facebook and Instagram social media accounts (see Appendix Two). The survey was active for 30 days and received 63 completed survey responses in total.

Respondent Demographics

The SFI represents a wide range of fisheries-related issues and key publics as they relate to the public fisheries and marine environment of BC. As such, the online survey was designed to engage those SFI members whose sport fishing practices are most impacted by open net-pen salmon farming on the coast of BC. Further, to uncover the most salient opinions and perspectives on BC's salmon aquaculture industry relevant to this study, the questions of where the respondents lived and how often the respondents fish in BC's tidal waters during the 12 months preceding the study was given a high priority.

Survey respondents were asked to provide the postal code of their primary address, which I subsequently sorted and divided into 5 geographic regions consistent with the SFI's member directory. The percentage of those who responded from various regions of BC are as follows:

Table 1

Survey Respondents by Geographic Region (n=63)

Geographic Region	Percentage of Respondents
East Coast Vancouver Island	54%
Vancouver Coast and Mountains	28%
Central Coast	7%
Northern BC	5%
West Coast Vancouver Island	5%

Notably, the highest concentration of open net-pen salmon aquaculture sites are in the waters nearest the East Coast Vancouver Island region, and the online survey received the highest number of respondents from this region (see Figure 1).

The highest proportion of survey responses were received from sport fishers that had fished BC's tidal waters on more than 21 occasions during the 12 months preceding the thesis study, representing 27% of the respondents in total (see Figure 2). When all three of the top tiers are combined, they represent 61% of the survey respondents, indicating that on average over half of the people that responded to this survey have fished at least once a month over the year prior to the study, and most even more frequently. This is a strong indication that my data has been collected from members of the public fishery that are active and experienced on the tidal waters of BC's coast.

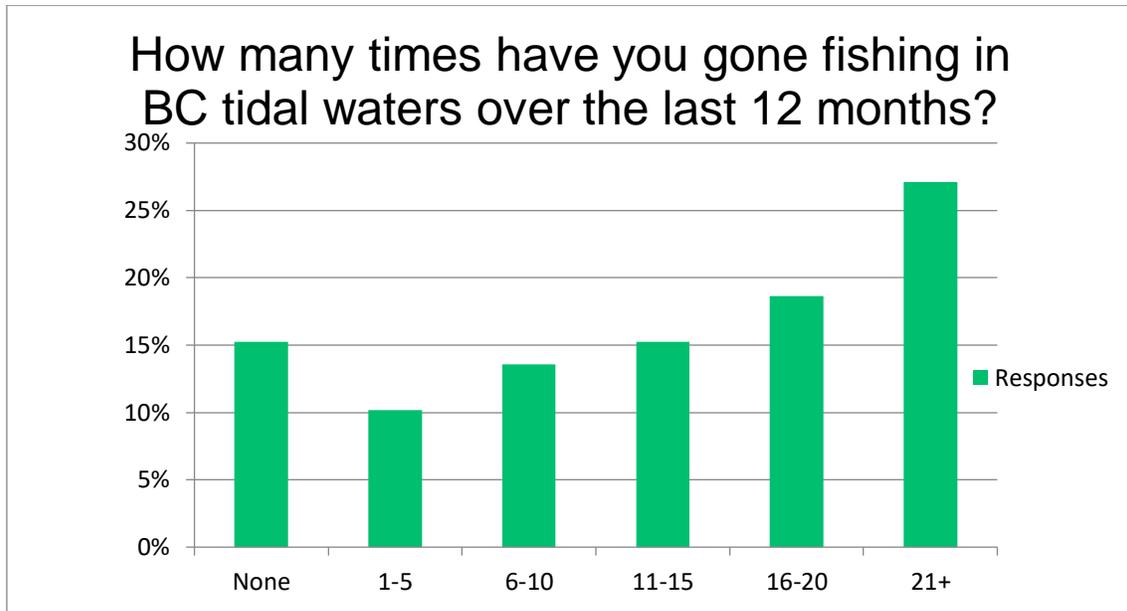


Figure 2: Number of Times Fishing BC Tidal Waters Last 12 Months (n=63)

To support the ease and safety of operations, open net-pen salmon aquaculture operations are most often located in remote, sheltered marine environments like small coves, bays, and inlets. As such, BC's coastal salmon farms are not commonly viewed by the general or travelling public. To gather data from public fishers most familiar with the site locations and possessing firsthand interactions with salmon farming operations on BC's coast, I sought to discover how many of the survey respondents had seen an open net-pen fish while out fishing BC's tidal waters. The results were as follows:

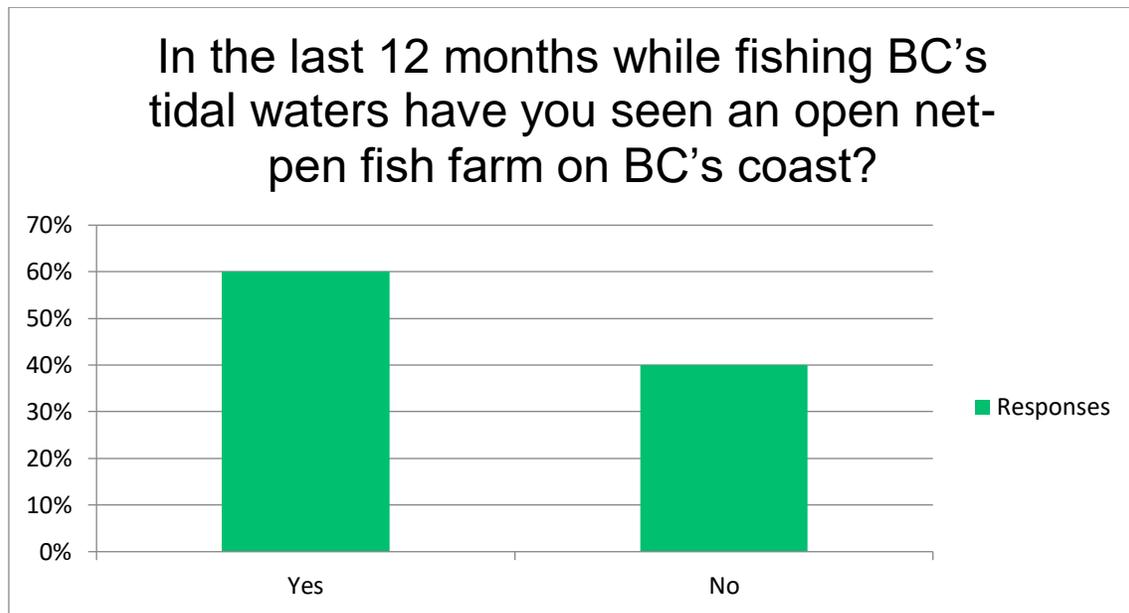


Figure 3: Percentage of Respondents Who Have Seen Open Net-Pen Salmon Farms (n=63)

Notably, 60% of the survey respondents stated they had seen an open net-pen salmon farming operation while out fishing, and 54% of respondents reside on the East Coast of Vancouver Island where the highest concentration of salmon farms exist (see Figure 1).

The survey respondents were asked to provide their opinions on seven different questions. The results are as follows (see Figures 4-10):

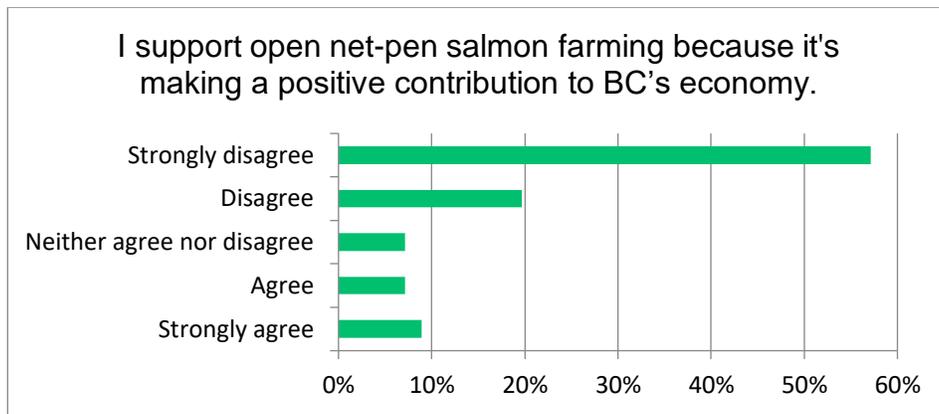


Figure 4: Likert Scale Importance of Economic Contributions (n=63)

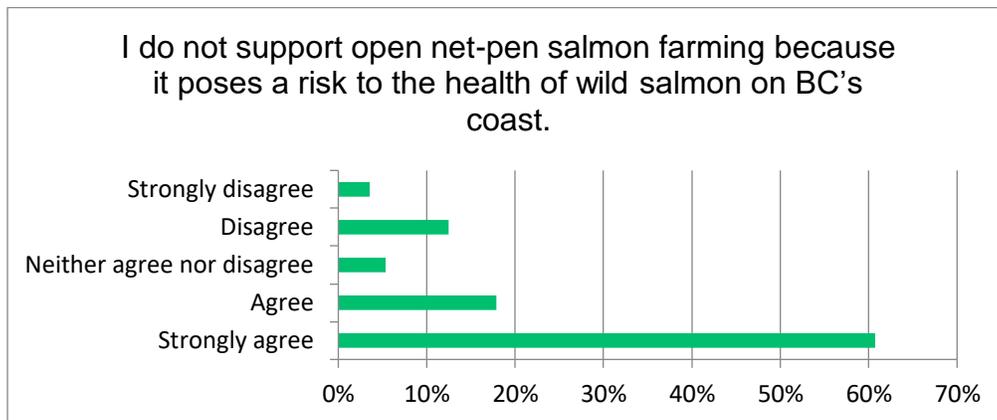


Figure 5: Likert Scale Health of Wild Salmon (n=63)

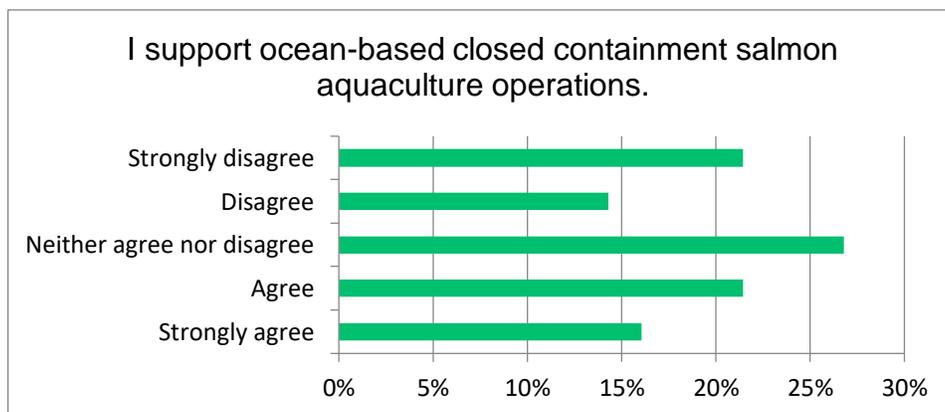


Figure 6: Likert Scale Ocean-Based Closed Containment (n=63)

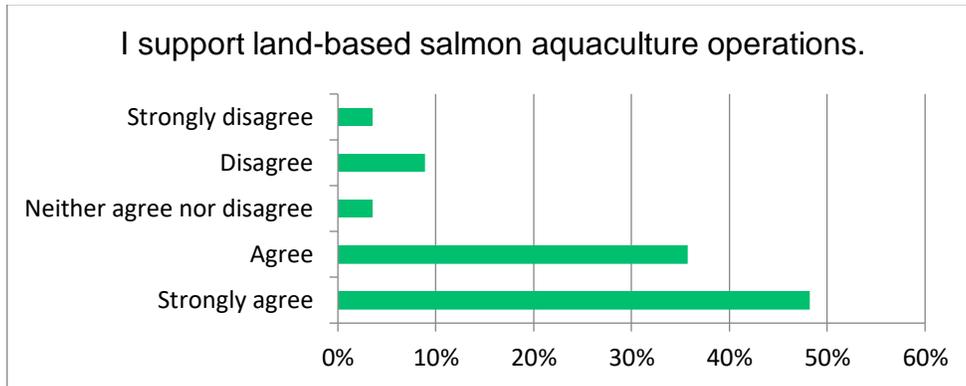


Figure 7: Likert Scale Land-Based Salmon Aquaculture Operations (n=63)

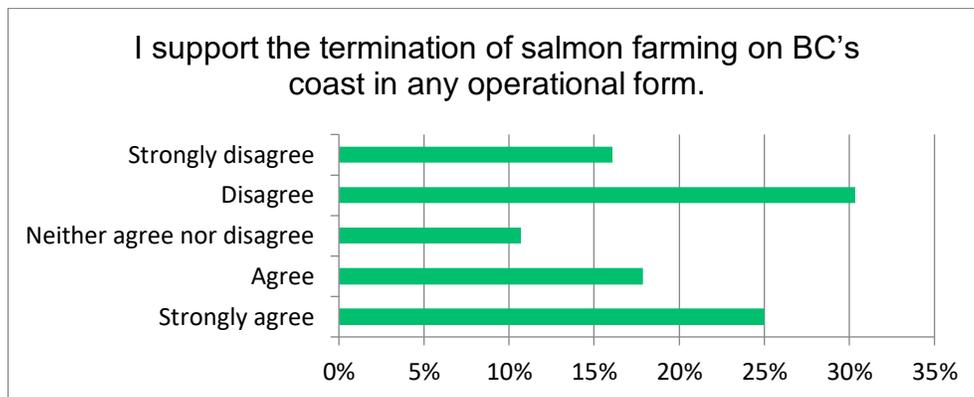


Figure 8: Likert Scale Termination of All Salmon Farming in Any Operational Form (n=63)

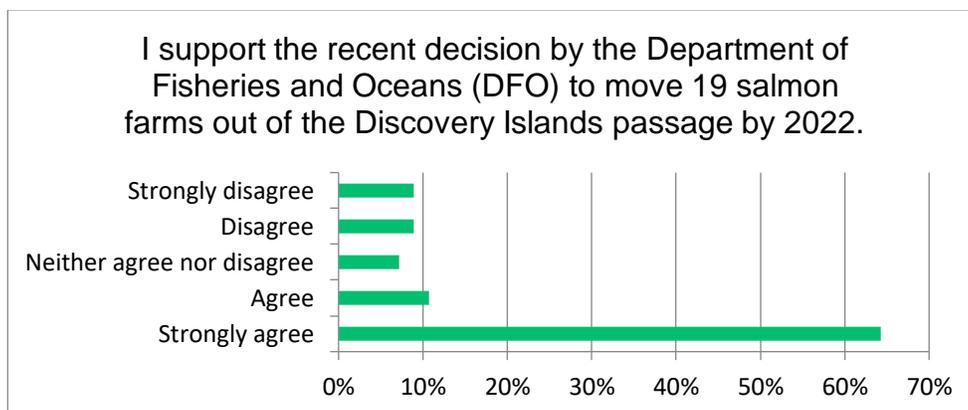


Figure 9: Likert Scale Removing Fish Farms from Discovery Islands Passage (n=63)

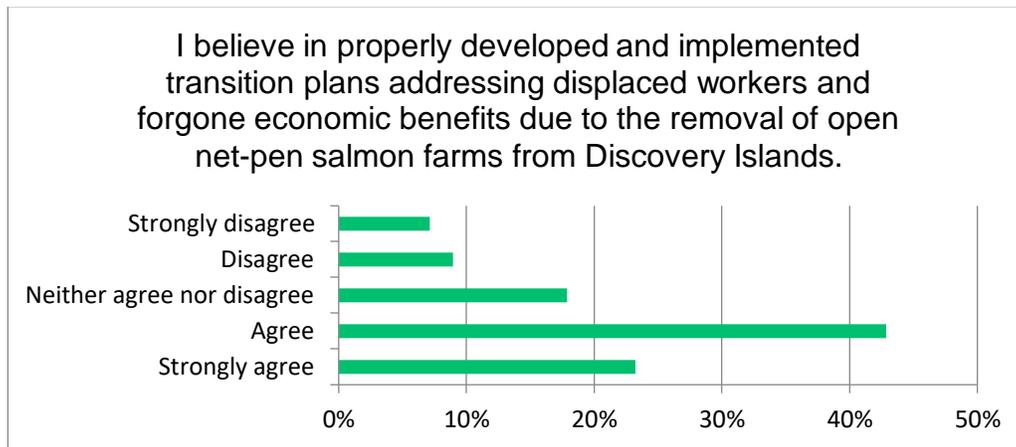


Figure 10: Likert Scale Transition Plans for Displaced Aquaculture Workers and Forgone Economic Benefits (n=63)

Based on the results of these questions, it's evident that the respondents value safeguarding the health of wild salmon from risks of disease spread from open net-pens over that of the economic contributions resulting from the industrial activities of BC's salmon aquaculture sector (see Figures 4, 5, 9). Further, I conducted a calculation of Spearman's Rank Order correlation on various sets of the online survey data. I chose this particular statistical method because it determines the strength and the direction of relationships that may exist between ranked data that is not normally distributed (VassarStats, 2021). I looked for correlations but did not find significance between these data sets: 1) where a respondent lived and the number of times that person fished in the previous 12 months, 2) whether viewing a salmon farming site was correlated to the respondent's support for terminating open-net pen operations on the coast, and 3) if the number of times a respondent fished in the previous 12 months made the health of

the wild salmon a higher priority for that person over the economic benefits of BC's salmon aquaculture industry.

However, from the Spearman Rank Order calculations I did find a significant relationship between those that believed open net-pens posed a risk to the health of wild salmon and those that supported land-based salmon aquaculture operations (Figure 11). There was a positive correlation between the two variables, $r(63) = .45, p = .0006$.

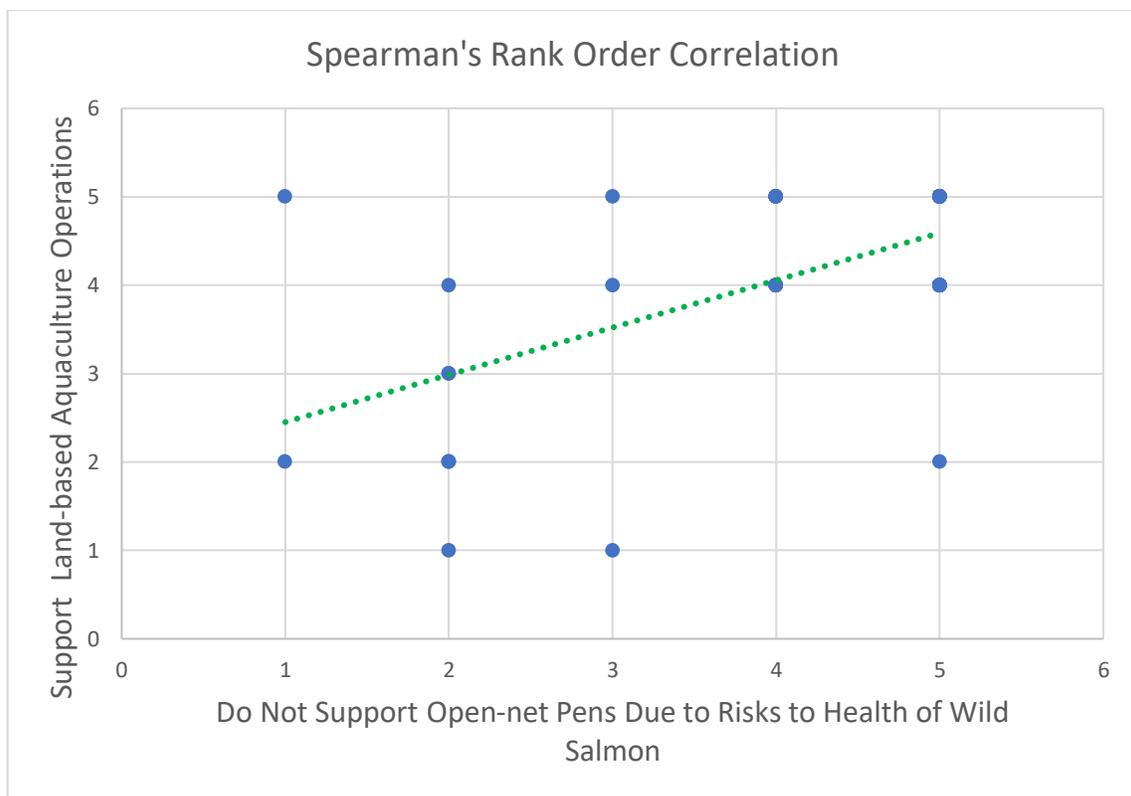


Figure 11: Spearman's Rank Order Correlation (Survey Data n=63)

The one question that showed a slight departure from the respondents' attitudes of valuing wild fish health over economics was regarding a scenario where displaced workers and forgone economic benefits from the removal of salmon farms should be addressed by properly developed and implemented transition plans (see Figure 10). In response to this question, 65% of respondents stated they either Strongly Agree or Agree that they believe there should be plans in place to address the displaced workers and forgone economic benefits.

Free association narrative interviews

The concluding question of the online survey provided an opportunity for members of the SFI to self-select volunteering their time to participate in a personal, open-ended interview with myself. In total, eight one-to-one interviews were completed with white people ranging from ages 35 to 70+. The participants shared similar financial situations in that they were either employed full time, and/or owned a business, and/or were enjoying a pensioned retirement. Seven of the eight respondents were male. Interviews of 30-60 minutes were conducted with the following informants:

1. Informant One: Boat dealer (retired), resides West Coast Vancouver Island Region
2. Informant Two: Political and fisheries consultant (PhD), resides East Coast Vancouver Island
3. Informant Three: Senior Biologist DFO (retired), former fishing guide, resides East Coast Vancouver Island
4. Informant Four: Raised living remotely on North Vancouver Island, actively fishes for sport, resides Vancouver Coast and Mountains

5. Informant Five: Owner/Operator fishing charter company (Esperanza Inlet), resides East Coast Vancouver Island
6. Informant Six: Fish Culturist (DFO), former fishing guide, resides East Coast Vancouver Island
7. Informant Seven: Fish Biologist, BC Ministry of Environment-Fish and Wildlife Branch (retired), resides Vancouver Coast and Mountains
8. Informant Eight: Business Development Manager, BC ENGO, resides Vancouver Coast and Mountains

“Hooked” for Life

All eight interview respondents stated that they had started fishing for sport in childhood and/or adolescence, and all but one of the respondents have also spent most of their professional careers working in the fisheries sector. I heard extraordinary stories of lives and imaginations swept away by vastness, beauty, and admiration for BC's rugged, remote coastline. There were many firsthand accounts and vivid descriptions from passionate people “hooked” by recreational salmon fishing early in life.

For example, when asked about memories regarding his first experience fishing on BC's coast, Informant Five, who now works as a fishing guide put it this way:

[My first fishing experience] was so memorable that I find myself in the situation where I am. The mountains are amazing. The rivers are, you know, breathtaking. The ocean is plentiful. It's one of the places where I'm as calm as I ever have been, and it's really enjoyable. And that's why I wanted to start a business to show people just that. How beautiful it is and the wildlife and the ecosystem and how important it all is together.

When asked about how recreational fishing has influenced his life, Informant Three replied by saying:

Well, it was my life. That's how I made my living, as a professional biologist, providing essential protection to watershed and, salmon bearing systems all over BC and the Yukon. That was what I did. My other occupation when I wasn't working for fishing, or for fish, I went fishing. It was what my friends and I did. We just always had boats. We always went out, and we always spent our time on the water. So it was second nature.

Consistently, the interview respondents demonstrated through personal accounts and story-telling that sport fishing was a significantly important component of their lives that they are committed to financially, culturally, and emotionally.

The interview respondents stressed the importance of sharing recreational fishing experiences with their friends and families. Remembering back to when he was four years old, Informant Six describes this memory as one of his earliest:

My grandmother had a log cabin on the lake, and I used to go up and spend summers there. I'd fish off the dock and catch coastal cutthroat, and there was a good Sockeye run in that lake, so we'd fly fish for adult Sockeye as well.

The same respondent talks about how he's passing along the same knowledge and traditions to his own family:

I also [fish] a lot with my own children. I fish a lot with them. I have two girls and they both like fishing. Particularly my youngest daughter, she really likes fishing. So yeah, it's a big part of our family and a big part of my extended family. It's a big part of my life.

During another interview, Informant Eight describes his earliest fishing memories like this:

Most of my summers were spent over at Galiano [Island] with my family as a kid. I grew-up fishing for shiners of the docks when I was 1, 2 years old. I spent my entire summers over there and did a lot for fishing for Rock Cod and Ling Cod, and definitely some salmon as I got a little bit older. When I was 10 years old, I started fishing for salmon pretty regularly in Active Pass, back when there was a lot of fish moving through Active Pass.

Informant Three describes the impact to his family due to the declining salmon returns and restricted salmon openings on BC's coast:

My son who was nuts about [tidal] fishing, but only fishes now for trout, he won't go out on boats. He says it's just wasting time because there's nothing to catch. So, I lost my son's generation because of the fisheries failing...My thought is there's going to be a lot of boats for sale. Certainly, mine will be soon because there's no reason to go fishing because there's nothing to catch.

Consistently, the interview respondents reaffirmed that the value of recreational fishing was not only about the day's catch, but an experience amplified by time spent with family and friends forging and preserving traditions.

Spawning Enhancement and Habitat Restoration

As evidence of their special knowledge and lifelong commitments to BC's salmon conservation and rehabilitation, the interviewees spoke at length about their personal contributions to stream restoration and spawning enhancements. In this account, Informant One speaks about a rare genetic strain of Chinook and work he has done to help bring its numbers back:

The Nahmint River's quite dear to me. As a young fellow my dad ran a lodge here at the lake and we had fly-in customers. They used to Steelhead fish too, and on occasion I got to fly-in with him when I was young- 8, 9, 10 years old. The Nahmint itself has quite a unique genetic strain of Chinook and I've been involved since about 2002 trying to rebuild the Nahmint... We brought the stock back somewhat, but they're logging up in that area, even in an area that was called ecologically sensitive to BC Timber Sales¹, so for all the work we do, somebody is undoing the other end of the equation.

During the interview with Informant Six, after being asked if he could think of something that worries him about the future of sport fishing on BC's coast, he responded:

I'm really worried about the Fraser, interior Fraser. It seems like every stream type that stems onto the Fraser is in peril and it's really affecting the Strait of Georgia, Juan de Fuca and onto the West Coast, Seattle, and those fisheries.... It's not just Sockeye, but every stream-type salmon in the Fraser... And then of course the Big Bar Slide² was a big issue... All of the water use, water extraction, industrialization, urban development on the Fraser is a primary concern for me or a big concern for me.

Informant Eight made this statement regarding the rehabilitation of wild salmon on BC's coast:

¹ "BC Timber Sales (BCTS) manages about 20 per cent of the province's allowable annual cut for Crown timber...operates in 33 communities directly supporting over 8,000 jobs across B.C."
<https://www2.gov.bc.ca/gov/content/industry/forestry/bc-timber-sales>

² "On June 23, 2019, a landslide in a remote and rugged canyon along the Fraser River, north of Lillooet, was reported to the B.C. government. Over 85,000 cubic metres of rock had sheared off a 125-metre-high cliff and fallen into the river. These huge pieces of rock created a five-metre waterfall, which trapped migrating salmon below the slide." <https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/fish/aquatic-habitat-management/fish-passage/big-bar-landslide-incident>

I think in order for salmon to thrive and to return to their once former glory that you need people involved in that. I think there's a big risk with shutting down the recreational fisheries. If that is one of the levers that DFO decides to invoke, you're going to lose a lot of people who are very interested in helping salmon and salmon conservation and the big donors and the volunteers that work in the hatcheries and in stream keeping groups.... I just know that there's a lot people out there that would probably not be as interested to volunteer their time and donate their money if they weren't able to go out and catch fish from time to time.

Overall, the respondents offered examples and evidence acknowledging the unique life cycle of wild salmon, and the important role members of the public fishery have made in contributing to stream keeping and spawning enhancements.

East Coast versus West Coast

Overall, the interviewees made clear their beliefs that Canadian fisheries are misgoverned through a centralization of power in Ottawa, and that BC's sector is viewed unfairly in both the House of Commons and the Senate by over-representation from leaders who reside on the east coast. As an example, Informant One said this:

I've taken two Ministers of Fisheries out fishing with me on short occasions in Alberni Inlet to show them what's going on. Gail Shea was really bad. She was from Prince Edward Island but had never been sport fishing in her life. It's really amazing that we have Ministers of Fisheries that don't understand the west coast at all.

Informant Three put it this way:

When we get an east coast minister, they don't understand west coast issues, west coast fisheries, and the economic engine and the history of what has been a world-class fishery now in spectacular decline.

In another example, Informant Four had this to say:

I'm super concerned about what's going on in Ottawa. I mean, Bernadette Jordan has zero clue. I doubt she's ever put her butt in a boat. Like, I mean, to just unilaterally shut down salmon farming without notice to these families...are you kidding me? That's politics.

Finally, Informant Five shared his feelings on what worries him most about the future of fishing on BC's coast:

Lots of things come to mind, one of which is that politicians on the east coast are making decisions about what's happening on a day-to-day on the west coast. I truly believe that federal department of fisheries needs to almost have different sectors; whereas, I have a west coast minister and an east minister, and the information can be based on science first and foremost, but secondly, not being blanketed all across the country.

The respondents articulated that the public fishery relating to BC's tidal waters is as unique in its ecology as it is in its culture; therefore, it's not a fisheries sector best governed from afar or from a figurehead position.

Mistrust Towards the Department of Fisheries and Oceans (DFO)

Throughout the interview process, the respondents demonstrated a high level of mistrust and lack of acceptance for DFO's policies, decisions, and processes. Regarding DFO, Informant Five put his views this way:

There's no going back on this. I just find it super irresponsible for the DFO and our provincial and federal governments to be implementing reasons for the Fraser Rivers stocks of concern and stopping sports fishermen from being able to, whether it's run their business or go out and catch a fish for their family to eat yet, we're allowing [open net-pen fish farms]. And we have been for a long time to just impact the wild socks, and not only the salmon but everything that's out there.

The same respondent continued with a further example:

So in Powell River to Vancouver, it's going to be shut down based on worry about the Fraser River fish, yet [DFO] allows gillnetting and the First Nations to just harvest fish right on the rivers. There's no repercussions whatsoever for by-catch and everything else. At the same token, allowing the fish farms to exist there for the wild salmon we have left, it just sort of blows my mind that they can exist, but yet we can't have a select mark fishery³ and allow the sports fisherman to run a business... what it boils down to is the sporting guys take the biggest hit, even though we have the lowest impact on the stocks of concern... It's just, it almost feels like you're being lied to.

Informant Three recounted his firsthand experience regulating open net-pen fish farms after the operations became a division of DFO's mandate:

We could see these foreign companies coming in and essentially usurping the commons, the sea, with the highest concentrations and rearing habitat and migration routes being co-opted by foreign operations. Underneath these net-pens it was an oasis of essentially

³ "Wild salmon have the adipose fin intact. Any salmon without this fin was hatchery produced".
<https://www.salmonforever.ca/mark-selective-salmon-fisheries>

excrement measured by the feet. It was ruining what was once viable habitat in these areas. Then gradually, the parasitic lice, and Slice⁴ and all of the trials and tribulations of trying to keep the animals from these concentrated pens alive became essentially a sewage pit and an embarrassment, but DFO still managed. And always every minister thereafter and director general was informed that they had to toe the line. So I've watched this as a person who would rather charge these people under the Fisheries Act for a desecration of fish habitat. We were told we couldn't... we had the strongest legislative authority to protect, but we weren't allowed to.

When asked in follow-up if any of these practices have changed in recent years, that respondent said:

No, no. It's still that way... They're not the Department of Fisheries anymore, it's the department of no fishing. And the kind of people that they have attracted are not biologists, they're computer biologists who really don't understand rivers. They don't understand fisheries. And very few of them have touched fish year in and year out. They never ever get engaged in fishing, so they don't understand the business. I know that because I've watch it for 40 years. How the population of employees within the department gradually became administrators and not familiar with fishing and what

⁴ "SLICE® (emamectin benzoate), manufactured by Schering-Plough for the control of sea lice in farmed salmon, is an avermectin compound derived synthetically from avermectins which are produced by fermentation of the soil organism *Streptomyces avermitilis*. When fed to fish emamectin benzoate is absorbed from the gut and distributed to the tissue of the fish. Emamectin benzoate is metabolized to inactive compounds and excreted slowly by fish resulting in long-lasting protection". <https://www.dfo-mpo.gc.ca/aquaculture/rp-pr/acrdp-pcrda/projects-projets/MG-06-04-004-eng.html>

makes productive watershed produce fish for fishermen. They lost touch with what they actually manage.

Informant One describes the key attribute he seeks for places to go fishing on BC's coast:

The first thing is simplicity. One of the problems we developed in the last dozen or 15 years was DFO would close an area from this latitude and that latitude, or this point and that point, or retention of one species, fin clipped, only have one other species, no fish under X centimeters, no fish over such centimeters, whether it's halibut or salmon, and it just became very, very complicated. I used to joke that, you know, along with your boat and fishing tackle you needed a cartographer, a lawyer, and a biologist on board to go fishing... The regulations change on a dime sometimes.

Informant Seven comments on DFO's decisions regarding the 2021 Pink salmon run on BC's Fraser and Thompson Rivers:

The Department of Fisheries and Oceans has an incredibly inaccurate methodology for estimating what the spawning return on Pink salmon is going to be. They started out with 3 million and we ended up with 6.5 million. They started out with a closed fishery, and then they opened up the certain parts of the Fraser River and the Thompson, but without any dialogue with the Sport Fish Advisory Board. Some of the key areas where we would be fishing for Sockeye or Pink salmon still remain closed, and some of the areas that [DFO] did open up are virtually unfishable because of canyons and stuff like that.

The same respondent provides further evidence of his lack of acceptance and trust for DFO's decision-making process:

When [DFO] decided that the Pink salmon run was large enough to have what they call a Total Allowable Catch, so a recreational catch, they opened it up in areas below Mission, which is the tidal portion of the Fraser River. They opened that up to four fish a day without any kind of dialogue with the Sport Fish Advisory, people with the sport fish and fishermen. But [DFO] left it closed above Mission for no reason. I mean, scientifically there was no reason to close. If you could catch four fish below Mission there was no reason that you couldn't keep fishing up to Hope, or in fact, all the way up to Lillooet. Just no scientific reason. But someone made a decision, and it wasn't with dialogue.

The interview respondents provided clear examples and evidence through personal accounts showing how they felt misinformed and misled by what they viewed as contradictory and oppositional policies from the DFO.

Beliefs About Open Net-pen Fish Farms

The purpose of engaging the free association narrative interview technique for this thesis study was to gain insights as to why, and to what extent the members of the SFI are opposed to open net-pen salmon farms on BC's coast. The respondents demonstrated that they are a group of people that possess a strong cultural attachment to BC's coastal marine environment, and that they are members of the public fishery who have dedicated significant portions of their lives to the conservation of fish habitat and wild Pacific salmon. As such, their views, opinions, and beliefs about open net-pen fish farms on BC's coast are delivered from firsthand experiences developed over decades of observation and practice.

When asked if the presence of fish farms has made an impact on his fishing habits, or the fish he catches, Informant Three replied this way:

Well, of course it has. All of the impact areas are where the migration routes of all the fish, if they have to leave the Fraser, or the Cowichan, or any of the Georgia Straight rivers, they have to move north, and these are juveniles. They move through the archipelagos, and they're basically parasitized by sea lice... They have no chance of survival. But when you think of all the wild fish that have got to go through that gauntlet, of course it affects everybody's fisheries... All salmon migrate, they go out and they come back. If they have to go through a gauntlet that reduces their survivability it affects their returns.

When asked about the recent decision regarding the removal of fish farms from BC's Discovery Islands Passage, the same respondent shared this opinion:

At the least the minister of the day has tried to remove the most egregious concentration in Discovery Passage. But, you know a judicial judge says, well, there's too much [economic] impact up in the Campbell River area, and it has tried to prevent it because of economic consequences. The whole thing circles around the fact that all of this is free use of Canadian commons, for profit of foreign companies, mostly Norwegian. And I think, you know, we've lost a bet here. It should have been containment.

In a different interview, I asked Informant One whether there were fish farms near the locations where he most often fishes. The respondent replied:

The only two fish farms that are still [near Port Alberni] are in the back of San Mateo Bay. It's not a highly travelled area for out-migrating Chinook, or Coho, or Sockeye... so we haven't made too much of a fuss about it. Just north of us in Clayoquot Sound, there

are 22 active fish farms, 27 sites, and they're having a heck of a time rebuilding any of their streams there.

In follow-up, I asked if the respondent or any of his fellow members of the public fishery are avoiding fishing Clayoquot Sound because of the fish farms. The respondent put it this way:

They are, well, there's a lot of restrictions and closures there because there are no returning or very few returning natural fish. So in Clayoquot and out of Tofino you've got to fish outside a certain line and outside of a whole bunch of terminal areas because of that, which is kind of sad.... closed containment is just the only answer.

Informant Five put his opinion of open net-pen salmon farming operations this way:

I think they are not only a gigantic eyesore, I've witnessed midnight offloads of these fish. I'm only assuming that they go to dog and cat food, or maybe fish oils some of them, but from what my eyes are seeing they do not look like anything that's going to hit a table for public consumption. Now I could be totally wrong. Once they cut them open and filet them...I'm not even sure what grocery stores those [fish] are hitting, but from what I see it's pretty disappointing really...I don't see the positive that brings for...let's call it mankind.

In the interview with Informant Eight, I asked whether having a fish farm nearby has any impact on the types of fish he catches or on a spot he would normally visit to fish. The respondent answered like this:

I would never put a fishing rod anywhere near where I've got a fish farm being viewed, so to that extent I'm not going to go fish anywhere near a fish farm. It's just an unsightly thing to look at when I'm out there to try to find a peaceful part of the world to just enjoy

the view. I will always cruise by a fish farm until it's out of sight before I go fishing at any spot.

In follow-up, I asked if it was only the view of the fish farm that worried that respondent. He responded like this:

No, no. It's not pretty picture inside every farm. I would prefer them first off, not to be around. Second, if I'm going to go fishing in the same region they're in, I'll definitely make sure they're at least out of sight, if not further...I feel pretty strongly about moving fish farms onto land-based closed containment facilities.

In a final follow-up regarding the respondent's opinions on moving open net-pen salmon farms to land-based, closed containment fish farming operations, I asked what made him feel this way.

The respondent shared this personal experience with me:

The biggest thing for me is the potential kind of harm to wild salmon with regards to transfers of pathogens, diseases, sea lice⁵, and all of that stuff. I work pretty closely with some pretty knowledgeable people on this subject...that have been following the file for a long, long time now and finding a whole bunch of novel pathogens and diseases. The more they look, the more stuff they find, and the more they feel that it's having a negative impact on wild fish. I'd say I'm pretty intimately involved with the top scientists working on salmon farming related issues and diseases... I get to hear them candidly behind the scenes, as opposed to in front of a microphone or in print. They all basically

⁵ "Sea lice are parasites that have lived in BC's coastal waters for thousands of years. Farmed fish are free of sea lice when they enter the ocean but can pick them up in the marine environment... Sea lice generally do not harm adult Pacific salmon, but can harm small juvenile salmon". <https://www.dfo-mpo.gc.ca/about-notre-sujet/publications/infographics-infographies/lice-pou-eng.html>

say it's not a good scene for wild salmon. It's a risk. It's a risk we can do something about.

In one of the final interviews I conducted, I spoke to a professional fish culturist who shared this perspective about BC's open net-pen salmon farms. Informant Six had this to say:

I have a hard time when people say: "If we just got rid of salmon farming, you'd have abundant wild fish." I'm not so sure about that. It worries me more than anything because the whole issue around wild salmon is very complex and there's a whole bunch of different layers and different issues going on at the same time. I think people are looking for a simplistic answer to make things better... They lose focus on all the other issues that are really impacting [salmon] like over-harvest and habitat variation... My experience is that usually when you look at a complex issue, it's never usually a silver bullet or just one thing that's impacting. It's death by a thousand cuts, and I think that's what's going on with our wild salmon.

During the same interview, the respondent provided further evidence for his opinion on the current condition of wild salmon stocks and how the returning fish stocks relate to BC's open net-pen salmon farming industry:

We've had many, many Royal Commissions into disappearing salmon and missing salmon going back for a long time. This isn't something new. It's not like this new thing that all of a sudden, the salmon have disappeared. We've been exploiting these fish for hundreds of years... and the fact that we still have any wild salmon left really is a testament to their resiliency more than the fact we've done anything right... This isn't just something that's happened since 2000, or since 2010.

All the interview respondents shared a high level of concern for BC's disappearing wild salmon. The majority felt that the potential for disease and pathogen transfer from open-net pens was too great a risk for either the Province of BC or DFO to continue to safely endorse.

Notably, I closed every interview with the same question before asking the respondent if he or she had any questions or information they would like to share with me before we signed-off and ended the interview. The last pre-prepared question I asked was always: "In the past, have you ever been asked to participate in research regarding the salmon farming industry on BC's coast?" Resoundingly, seven out of eight interview respondents replied with a very simple, one word answer:

"No."

Chapter 5: Discussion and Recommendations

Why Opposition to Open Net-pen Salmon Farms?

The Human Dimension

My findings are consistent with the studies cited in the literature review noting the significance of attitudes, behaviours, and beliefs when approaching fisheries-related issues (Brownscombe et al., 2019; Dedual et al., 2013; Lancaster et al., 2015; Nguyen et al., 2013; Post, 2013). In particular, the interview data reflects a group of respondents who have spent significant time as members of the public fishery researching, conserving, and working for the enhancement of the wild salmon populations on BC's coast. To these respondents, any risk to the health of juvenile, migratory, or spawning wild Pacific salmon from disease or pathogen transfer from open net-pens is too great for a species already at-risk. For the interviewees, pushing wild salmon further into the threat of extinction represents not only losing their life's work, but cutting-off access to one of their greatest sources of pride and happiness.

There can be serious emotional and psychosocial impacts when one is threatened by the fear of loss, as is evidenced in my research with many participants who shared fears about the possible extinction of Pacific wild salmon. "Psychosocial health refers to psychological and social wellbeing" (Hayes, Berry, & Ebi, 2019, p.1583). Researchers Hayes, Berry & Ebi (2019) studied the psychosocial impacts of losses associated to Canada's changing climate, and report that environmental losses can "...change the way people think, act, feel, and interact" (p.1583). Research by Norgaard (2011) states that emotions are core to the social processes that form responses to environmental losses, and that engaging an audience through emotion leads to a

higher level of motivation than a detached, scientific approach (Salama & Aboukoura, 2018). It's this kind of scientific approach that is used in DFO communications, and my study shows evidence that it's not resonating with BC's public fishers; this stakeholder group is feeling a lack of care and attention from DFO, while often not trusting or understanding DFO's policies.

Lack of Consultation

My findings are also consistent with studies cited in the literature review that emphasized the importance of dialogue and participation with all majority stakeholder groups (Brownscombe et al., 2019; Lewin et al., 2006; MacKenzie & Cox, 2013; Nguyen et al., 2012; Post, 2013). My data shows that the respondents in this study feel that they have not been given the opportunity to adequately express their opinions about the future of BC's salmon farming industry, specifically the extent to which they feel the open net-pens are negatively impacting the future of the public salmon fishery. As such, the participants feel that their concerns are not heard or handled effectively, which is increasing an already high level of mistrust and frustration towards DFO's decisions and policies.

Opposition To What Extent?

Land-based Operations

The data reveals that the respondents are in support of salmon aquaculture operations that are contained in tanks on land (see Figure 7). This result is consistent with the respondent's prioritization on protecting wild fish health by minimizing any potential exposures to disease or pathogen transfer from farmed to wild fish through open net-pen design.

Ocean-based Closed Containment

The question of ocean-based closed containment salmon farming operations received a mixed-response, with no strong indication of agreement or disagreement (see Figure 6). The same mixed response was received in response to the question regarding terminating salmon farming on BC's coast in all operational forms, that being net-pens, ocean-based closed containment, and land-based (see Figure 8).

Recommendations

1. Consultation: Increase consultation between DFO and members of the SFI regarding the impacts the open net-pen salmon farming industry is having on the BC recreational fishing sector, and the future stocks of Pacific wild salmon. This stakeholder group is comprised of multi-generational public fishers holding a lifetime of experience, many with professional degrees and credentials in biology, environment, and/or fisheries. Their collective wealth of knowledge and experience could contribute to the conservation of this species and should be formally engaged to its fullest potential.
2. A Psychosocial Approach to Environmental Losses and Change: The disappearing wild salmon on BC's coast is a highly emotional and contentious issue. It is comparable to environmental losses experienced in other geographical regions from various forms of over industrialization and/or climate change. The problem of BC's diminishing salmon population would benefit from a communications approach that begins prioritizing the psychosocial implications associated with the endangerment of this species (Adger, 2016; Adger et al., 2013; Hayes et al., 2019; Panu, 2020; Salama & Aboukoura, 2018).
Communications tactics with a psychosocial emphasis will focus and prioritize: 1) social

capital, 2) sense of community, 3) government assistance, 4) access to resources, 5) community preparedness, 6) intersectoral/transdisciplinary collaboration, 7) vulnerability and adaptation assessments, 8) communication and outreach, 9) mental health literacy, and 10) culturally relevant resources (Hayes et al., 2019).

Chapter 6: Conclusion

The members of the SFI are a dedicated group of marine stewards and conservationists who demonstrate serious concern for the future of wild salmon on BC's coast. As a group they represent a significant economic contribution to the fisheries sector in BC and are considered a majority stakeholder group. My thesis revealed that the SFI members feel that open net-pen designs are too great a risk for the health of BC's already endangered wild salmon; however, a move towards land-based operations would be supported.

Opportunities for Further Study

1. Ocean-based Closed Containment: Unlike the Likert scale questions that received a strong response in one clear direction of support, the question regarding ocean-based closed containment received a mixed response. This may represent an opportunity for further investigation, increased communication efforts, and possible efforts towards public education on the topics (see Figures 6).
2. Psychosocial Research: Further research emphasizing the psychosocial attributes of BC's public fishers would enhance more useful and salient communications with this stakeholder group.

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APPENDIX ONE: SFI STATEMENT ON OPEN NET-PEN FISH FARMS**April 2018**

The Sport Fishing Institute of BC is a named supporter of [Wild First](#), an organization dedicated to helping ensure the survival and restoration of wild salmon.

Please see the [Wild First campaign website](#) for more information and please consider adding your name and voice in support.

There is an increasing volume of science on the concerns around open net farming. While we will post anticipated papers as they become available, the following is a link to an informative document compiled and produced by Tony Allard, Wild Salmon Forever and Good Hope Cannery, [A Case for Caution](#).

The following news pieces on findings as detailed in the [CTV news story](#) and footage by Tavish Campbell in this [clip](#). Both clips provide graphic visuals of risks inherent in processing farmed fish and the open net pen farms themselves.

More than ever DFO must be urged to, at the very least, adopt the precautionary principle when it comes to assessing fish farm and related activities in open waters. The precautionary principle, which should halt any questionable or potentially damaging practices, is employed for different fisheries and in many situations when DFO makes management decisions. However, and inexplicably in this case, where there is so much at stake and evidence to suggest that harm is very likely occurring due to open net pen practices, the principle is ignored. Why is that? Wild salmon stocks and juvenile salmon must be protected. Whether it be for the longevity and sustainability of the species or to help in the recovery of Southern Resident Killer Whales, strong and healthy populations of salmon in our oceans must be our collective objective.

In light of evidence such as provided in the story above and the escape of several hundred thousand Atlantic Salmon from a net pen in Washington State waters in late summer of 2017, the level of concern among anglers, those in the environmental community and First Nations about the federal government's plans to maintain or even allow the establishment of new salmon farms in BC is building and evidence of serious consequences to wild salmon stocks continues to mount.

We've discussed this over the years and have encouraged participation in petitions urging the province to block plans and the federal government to acknowledge and address the issues.

The SFI has traditionally focused its advocacy efforts on issues regarding fisheries access, allocation, licensing and science. While our members oppose expanded net-pen salmon farming, we've made a decision to follow the work of the many groups who are primarily focused on salmon farming and support and endorse rather than duplicate efforts.

- The SFI board of directors adopted a formal policy in 2003, urging the federal and provincial governments to adopt the precautionary principle and ensure that they were not licensing fish farming activities that could impact wild fish stocks. We continue to communicate this view to federal and provincial politicians and senior civil servants in writing and during our frequent meetings with them.
- We made a formal presentation to the provincial legislature's special committee reviewing finfish aquaculture and urged the committee to establish a clear scientific consensus on the issue and provide recreational anglers with assurances that wild stocks were not being placed at risk by fish farming activities.
- We've supported the development of closed containment technology aimed at eliminating the threat of disease and/or lice transfer between farmed and wild fish stocks. While there are some challenges, financial and practical, with closed containment, evidence and experience makes clear that it is the way to sustainably farm salmon that poses the least threat to wild salmon stocks and the environment.

Our interest is to see decisions for expansion or continued operation of fish farms to be made on careful review of all of the facts and science available. There are studies that shed definitive information on the risks, threats, and impacts of open net pen fish farming in coastal environments around the world and along the BC coast.

The federal government's failure to act to address public concerns about the impacts of salmon farming on wild stocks is spurring a call to action among a variety of BC groups. While activism on salmon farming has largely been limited to ENGOs and First Nations, we would also like reiterate the issue, in voicing concern about the government's actions on the subject.

By moving to act on some of the key recommendations of the Cohen Commission, government can have a meaningful impact on wild salmon stocks and demonstrate leadership on a mainstream environmental/conservation issue in British Columbia.

As opportunity to voice our concerns about open-net-pen salmon farming appear we will keep you apprised. We plan to continue with the approach that both as an organization, and as individuals who

care passionately about sport fishing and our marine resources, we will add our voices to those calling for the protection of our wild salmon stocks.

APPENDIX TWO: ONLINE SURVEY

My name is Tanya Crowell and this research project is part of the requirement for a Master of Arts in Professional Communications at Royal Roads University. My credentials with Royal Roads can be established by contacting my thesis advisor Dr. Richard Kool at rick.kool@royalroads.ca

My research project is entitled: **The Opinions of BC's Public Fishers on Open Net-pen Salmon Farms.**

All members of the Sport Fishing Institute of BC have been invited to participate in this research study. We would like to explore your opinions about salmon farming on BC's coast.

Your participation in this research is voluntary. The online survey takes 3-5 minutes to complete. No identifying information about participants will be collected.

The survey data is being collected anonymously; no identifying information about participants will be collected.

You can withdraw at any time: if the browser is closed prior to the final submit button, the responses will not be stored.

Data will be stored in a locked cabinet and/or password protected servers/computers in Canada. Please note that data may be stored on or accessible by servers in the United States, and may be subject to examination by government or law enforcement under the Patriot Act. While this likelihood is small, I am required to let you know this possible risk.

In addition to submitting my final report to Royal Roads University in partial fulfillment for a Master of Professional Communications degree, I will also be sharing my research findings with the Sport Fishing Institute of BC.

This research has been approved by the Research Ethics Board of Royal Roads University.

If you have questions, concerns, or complaints about your rights as a research subject or about research related injury, please contact the Royal Roads Research Ethics Office at (250) 391-2600, ext. 4425, or ethicalreview@royalroads.ca.

Submitting a completed survey is taken as your informed consent to participate.

1. Are you and/or your business a member of the Sport Fishing Institute? (if no, skips to Q 5)

2. How do you participate as an SFI member? (Dropdown options)

Individual Member (skips to personal postal code, Q 5)
 Certified Tidal Angling Guide (CTAG)
 Charters & Guides
 Marinas & Boat Rentals
 Marine Retail or Boat Dealer
 Resorts & Lodges
 Tackle Retail
 Trade & Manufacturing
 Other:

3. What is the postal code of business address? (type answer)

4. In BC, where does your business operate? (Tick all that apply)

Vancouver Coast & Mountains
 West Coast Vancouver Island
 East Coast Vancouver Island
 Central Coast
 Haida Gwaii
 Northern BC

5. What is the postal code of your personal residence? (type answer)

6. How many times have you personally gone fishing in BC tidal waters over the last 12 months? (multiple choice) (if none, skips to Q12)

None
 1-5
 6-10
 11-15
 16-20
 21+

7. In the last 12 months while fishing personally in BC's tidal waters have you seen an open net-pen fish farm on BC's coast?

“[Open net-pen] salmon aquaculture sites vary in size, but they typically consist of a series of 6 to 24 floating, mesh cage-like structures made of plastic, steel and/or aluminum. Salmon farms are usually located in sheltered bays and fjords where they will be protected from extreme currents and storms, and are anchored to the ocean floor to keep them in place.” Definition from: Canadian House of Commons, Standing Committee on Fisheries and Oceans, 2013

Yes or No

(If no, skip to Q11)

8. When you encountered the open net-pen fish farm, what was your impression of the salmon aquaculture operation(s)?

- a. As I knew or expected, it was occupying a productive fishing location and that annoyed me
- b. It seemed harmless and I moved-on
- c. I was happy to see industry and people working
- d. It's an environmental and wild fish hazard and I would like to see it removed
- e. Other:

9. Do you know a person(s) employed by fisheries in BC? Check all that apply. (if no, skips to Q14)

- Aquaculture
- Commercial capture fishery
- Fish and seafood processing
- Government and regulation
- International trade
- Sport fishing
- Other: (write answer)

10. What are your most trusted and/or most useful media sources about topics relating to BC's fisheries? (click all that apply)

- CBC
- CTV
- Facebook
- Global
- Instagram
- Organizational newsletters and/or updates (option to describe)
- Redditt
- Twitter
- Other:

11. I support open net-pen salmon farming because it makes a positive contribution to BC's economy. (slide scale)
12. I do not support open net-pen salmon farming because it poses a risk to the health of wild salmon on BC's coast. (slide scale)
13. I support marine-based closed containment salmon aquaculture operations. (slide scale)

"Ocean-based solid-wall containment systems consist of solid-walled fibre and foam composite tanks ranging in size from 3000 m³ to 10,000 m³ that float at the surface of the water...Waste feed and feces are filtered out via a drain at the bottom of the tank and pumped away with the expectation that it could be treated for disposal on land as a fertilizer..." Definition from: Canadian House of Commons, Standing Committee on Fisheries and Oceans, 2013

14. I support land-based salmon aquaculture operations. (slide scale)

"Land-based Recirculating Aquaculture Systems (RAS) use large, circular concrete tanks arranged in modules on land. Because the tanks are land-based, they must be located in proximity to an adequate supply of either groundwater or seawater. Water is pumped into the tank and continually recirculated; water quality is maintained through various means, including mechanical filtration, UV irradiation, CO₂ strippers and ozone injection. Solid wastes are drained out the bottom of the tank and removed to a settling basin, and can ultimately be treated to be used as compost or fertilizer." Definition from: Canadian House of Commons, Standing Committee on Fisheries and Oceans, 2013

15. I support the termination of salmon farming on BC's coast in any operational form. (slide scale)
16. I support the recent decision by the Department of Fisheries and Oceans to move 19 salmon farms out of the Discovery Islands passage by 2022. (slide scale)
17. I believe a stronger transition plan addressing the employment of displaced workers due to the removal of open net pen salmon farms from Discovery Islands or elsewhere is: (Not important at all scaling to particularly important and must be addressed)

Submit

Thank you for completing this survey about BC's fisheries sector.

Are you interested in participating in a personal interview with the researcher about your beliefs and opinions regarding the future of BC's salmon aquaculture industry? (option to self-select)

APPENDIX THREE: INTERVIEW QUESTIONS

My research question is:

Why and to what extent are the members of the SFI opposed to open net-pen salmon aquaculture on BC's coast?

Potential questions for participants:

- 1) Can you tell me about your personal history and fishing experience on the coast of BC?
- 2) Over the last year, where do you most often go fishing? Has that changed from years past? Why?
- 3) What are some of the attributes of your best fishing spots?
- 4) Are you aware of any salmon farms located near where you like to fish?
- 5) Can you tell me about how salmon farming has impacted your fishing habits or the fish you catch?
- 6) Can you tell me about how recreational fishing influences your life?
- 7) Can you tell me what it was like the first time you experienced fishing for sport on the coast of British Columbia?
- 8) Can you think of something you've read, seen, or heard about recently that makes you worry about the future of recreational fishing on BC's coast?
- 9) Have you ever been asked to participate in research regarding the salmon farming industry on BC's coast in the past?