CATCHING THE RELEASED: CONSERVATION AND AQUACULTURE'S SHARED COLONIAL LINEAGES IN NEWFOUNDLAND AND LABRADOR

By

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ABSTRACT

Aquaculture is a booming industry in the province of Newfoundland and Labrador. Industrial salmon farming has potential to provide employment and generate economic activity in a region previously devastated by the collapse of northern cod stocks. However, the aquaculture industry, which was once heavily supported by conservation groups and thought to alleviate pressure on wild salmon stocks, is now a suspected contributor to the decline of wild salmon. After decades of operation, it has become clear that the practice of commercial salmon farming has many shortcomings. Although salmon anglers and aquaculturists appear to be in diametrically opposed conflict on the question of further aquaculture development in the province, these groups share a common colonial lineage in the province of Newfoundland and Labrador. Left out of this discussion are the voices of the Mi'kmaw salmon anglers of Miawpukek First Nation who have been profoundly impacted by the decline of wild Atlantic salmon, a fish of historical, economic and cultural importance. The differing perspectives among the loudest settler voices represented by the salmonid industry and salmonid conservation groups, and the mostly silenced voices of the Mi'kmaw, stem from epistemological and ontological differences in what fish are understood to be and have been heavily influenced by settler colonial relations. In this thesis, I focus on understanding the apparent conflict between the salmonid aquaculture industry and salmonid conservation groups in Newfoundland and Labrador. Through an analysis of their shared settler colonial lineage, I find that these groups come together in their promotion of the science and technology of closed containment

aquaculture and in their singular focus on understanding fish as resources and capital. While disputes between salmonid aquaculture developers and conservationists on the island of Newfoundland have become the dominant voices, Mi'kmaw salmon anglers belonging to Miawpukek First Nation know and relate to salmonids differently outside the colonial lineage of settler anglers and aquaculturalists.

GENERAL SUMMARY

Aquaculture has boomed in Newfoundland over the past forty years. As aquaculture activity has increased wild salmon populations have decreased. The aquaculture industry has been blamed by conservation groups and other environmental organizations for the decreases in wild salmon populations. As the public discourse between the rival groups has unfolded in the media and elsewhere, Newfoundland salmon anglers have experienced catching escaped farmed salmonids on wild Newfoundland rivers. Among these anglers, are Indigenous people. Notably, Indigenous people have been left out of the discourse regarding the future of wild salmon in Newfoundland. This thesis describes the shared settler colonial roots of the aquaculture industry and salmonid conservation movement and suggests that they come together in their understanding of salmon as capital and their shared reliance upon technological solutions. However, Indigenous people, such as the Miawpukek First Nation, understand salmon in ways different from settler anglers and aquaculturists.

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TABLE OF CONTENTS

Abstract ii
General Summary iii
Land Acknowledgement iii
Acknowledgements iv
Table of Contents vi
List of Figures viii
List of Abbreviations ix
Chapter One. Introduction 1
Chapter Two. Methodological Considerations: Fishing for perspectives 13
The Research Process 14
The Literature and Conceptual Framework 19
Synthetic Bait, Fish and Rivers 24
Chapter Three. Angling and Fish Culture – Entangled Colonial Projects 28
Government and Industry Initiatives in Aquaculture and their Opposition since 2015 29
Fish for Kings and Fish for Paupers: The British Colonial Origins of the Sport of Angling 35
A Brief History of Aquaculture in England 41
The Imperial and Colonial History of Angling in the Dominion of Newfoundland 45
A Brief History of Fish Hatcheries in Newfoundland and Labrador 50
Angling Enhancement: A continuation of colonial practices 52
Exploits River Enhancements 56
Rennie's River Enhancements 58
Angling Enhancement: a double-edged sword 61
Conflict between the aquaculture industry and angling groups 67
Chapter Four. The Development of the Aquaculture Industry in the Province of Newfoundland and Labrador 75
The Growth of Aquaculture in Canada 75
Salmonid Aquaculture: ranching salmon 78
The Growth of Aquaculture in Newfoundland 81
Newfoundland Provincial Aquaculture strategies 85
Chapter Five. Lost Inventory and Catching the Released 92
A Note on Rainbow Trout 93

Rainbow Trout Interactions with Wild Ecosystems and Salmonids 97
Escaped Farmed Fish: A Threat or Lost Opportunity? 98
Farmed-Salmon Escapees: the case of Norway 104
The Problem of Escapees is as Old as the Industry Itself 106
No Nets Could Hold Back the *Pink Sludge* 113
Chapter Six. Techno-fixes: Engineering Problems and Solutions 116
Recirculating Aquaculture Systems (RAS) or How Angling and Aquaculture Got Back Together 120
The Triploid Salmon as Techno-Fix 127
Techno-Fixes: Engineering solutions 129
Public Concern is Not Mollified 136
Chapter Seven. Toward a conclusion 138
Appendix A: Interview Questions: 177
Appendix B: MUN ICEHR Ethics Approval: 179
Appendix C: Miawpukek Research Approval: 180
Appendix D: Miawpukek Research Presentation Powerpoint: 181
Appendix E: Miawpukek Research Report: 185
Appendix F: SAEN Recruitment Email 198

LIST OF FIGURES

Fig. 1. Map of salmon rivers of Newfoundland (Palmer, 1928/2005)..... 3

Fig. 2. Map of Mi'kmaw territory (Wolastoq, 2020).....7

Fig. 3. Conceptual Framework.....22

Fig. 4. Range of introduced and native trout species (Del Vecchio, 2013) 39

Fig. 5. Rennie's River smolt fence (Salmonid Association of Eastern Newfoundland (SAEN,2020)

.....60

Fig. 6. Environmental Resource Management Association (ERMA) logo at the Salmonid Interpretation Centre, Grand Falls Windsor, NL, Canada, 2016 64

Fig. 7. Conne River small salmon returns 1987-2012, and Newfoundland salmonid aquaculture production (1986-2012). Data obtained through Department of Fisheries and Oceans (DFO) 104

Fig. 8. Norwegian Angling Guide displaying the differences between *Villaks* (wild salmon), *Oppdrettslaks* (farmed salmon), *Sjoorret* (sea trout), and *Regnbueorret* (rainbow trout) image from the *Trondheim Omland Fiskeadministrasjon* [Trondheim and the surrounding area Fisheries Administration] (TOFA, 2014) 106

Fig. 9. Online participant responses regarding the reputation of the salmonid and mussel aquaculture industries in Newfoundland and Labrador (DFA, 2013b, p.7)

.....124

Fig. 10. The Aquabounty AquAdvantage salmon® (Aquabounty, 2010) 131

Fig. 11. Market performance of Aquabounty salmon (Aquabounty, 2020) 132

LIST OF ABBREVIATIONS

ACOA	Atlantic Canada Opportunities Agency
ACEP	Aquaculture Capital Equity Program
AWCLGP	Aquaculture Working Capital Loan Guarantee Program
ASF	Atlantic Salmon Federation
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DEC	Department of Environment and Conservation
DEEFA	Department of Environment and Conservation, Fisheries and Aquaculture
DFA	Newfoundland Labrador Department of Fisheries and Aquaculture
DFO	Department of Fisheries and Oceans
ERMA	Environmental Management Resource Association
FDA	US Food and Drug Administration
FFAW	Fish, Food and Allied Workers Union
JHNA	Journals of the Newfoundland House of Assembly
MI	Marine Institute (Memorial University)
MUN	Memorial University of Newfoundland
NAIA	Newfoundland Aquaculture Industry Association
NL-CAR	Newfoundland and Labrador Coalition for Aquaculture Reform
NALCOR	Newfoundland Provincial Energy Corporation
NADA	New Animal Drug Application
NLASP	Newfoundland and Labrador Aquaculture Strategic Plan

NOAA	National Oceanic and Atmospheric Administration
PPP	Public-Private Partnership
RAS	Recirculating Aquaculture Systems
SAEN	Salmonid Association of Eastern Newfoundland
SPAWN	Salmonid Preservation Association of Western Newfoundland
STEM	Science, Technology, Engineering and Math
TOFA	*Trondheim Omland Fiskeadministrasjon* [Trondheim and the surrounding area Fisheries Administration]
UNDRIP	United Nations Declaration On The Rights Of Indigenous Peoples

Chapter One. Introduction

The island of Newfoundland forms part of the Canadian province of Newfoundland and Labrador and contains the eastern-most point of North America (see Fig. 1). Indigenous people had been living on the island for at least 6000 years prior to European contact, with three or more different ethnic groups of people previously present (Duggan et al. 2017). When Norse explorers arrived in approximately 1000 A.D., the Beothuk people were living on the island (Baker, 2003 p. 3). The Beothuk people were an Indigenous group that spoke an Algonkian language and lived as hunter gatherers (Baker, 2003, p.3). Fish, including salmon, were an integral component of the Beothuk people's diet (Heritage Newfoundland and Labrador, 2020c). The Beothuk were not alone in their reliance upon wild fish for nutrition; eating salmon has also been a key aspect of the Mi'kmaw culture on the Gander River for centuries (Daniels, 2014, p. 142).

Modern European contact was initiated when Giovanni Caboto, popularly known as John Cabot, landed on Newfoundland's shores near the present-day community of Bonavista and claimed the island for England in the year 1497 (Baker, 2003, p. 3). Newfoundland was rich in natural resources, and Cabot described it as having a "bottomless supply of codfish" (CBC, 2001). European activity was scant in the 1500s and linked to the profits made by extracting abundant sea mammals and fish; seasonal occupation came slowly and, later, beginning in the 16th century permanent settlement attempts began (Heritage

Newfoundland and Labrador, 2020a). Historical accounts of contact with the Beothuk people during early settlement are poorly documented (Holly, 2000, p. 80). There is evidence however of conflict for subsistence resources between settlers and the Indigenous Beothuk; European settlers likely seized productive fishing areas and dragged nets across river mouths to deny the Beothuk access to fish (Holly, 2008, p.179), forcing them to depend on insufficient food sources such as caribou. By the early 19th century, settler colonialism in Newfoundland contributed to the disappearance of the Beothuk due to disease and violent interactions with European settlers (Holly, 2000, p. 82-3).

In both modern and past French-ruled times, the island portion of the province has been and remains predominantly populated by British Isles-descended people and people of North American descent (Statistics Canada, 2016).[1] There are relatively smaller populations of Indigenous people (mainly Mi'kmaw), living on the island portion of the province (Zhai et al., 2015). As of February 2020, there were approximately 3060 Mi'kmaw people registered with the (Miawpukek) First Nation (Cape Breton University, 2020) and the Mi'kmaw Qalipu First Nation has a membership of approximately 20,000 members (Qalipu First Nation, 2019).

Newfoundland is also home to a diverse collection of northern biomes filled with unique wild flora and fauna and is an international hotspot for

[1] According to Statistics Canada (2016), of 512,520 respondents to the 2016 census in Newfoundland and Labrador, 58,550 individuals responded as being of "North American Aboriginal origins", while 280,640 individuals responded as being of "Other North American origins". Additionally, 259,460 individuals responded as being of "British Isles origins".

sightseeing, angling and ecotourism (Newfoundland and Labrador Tourism, 2020).

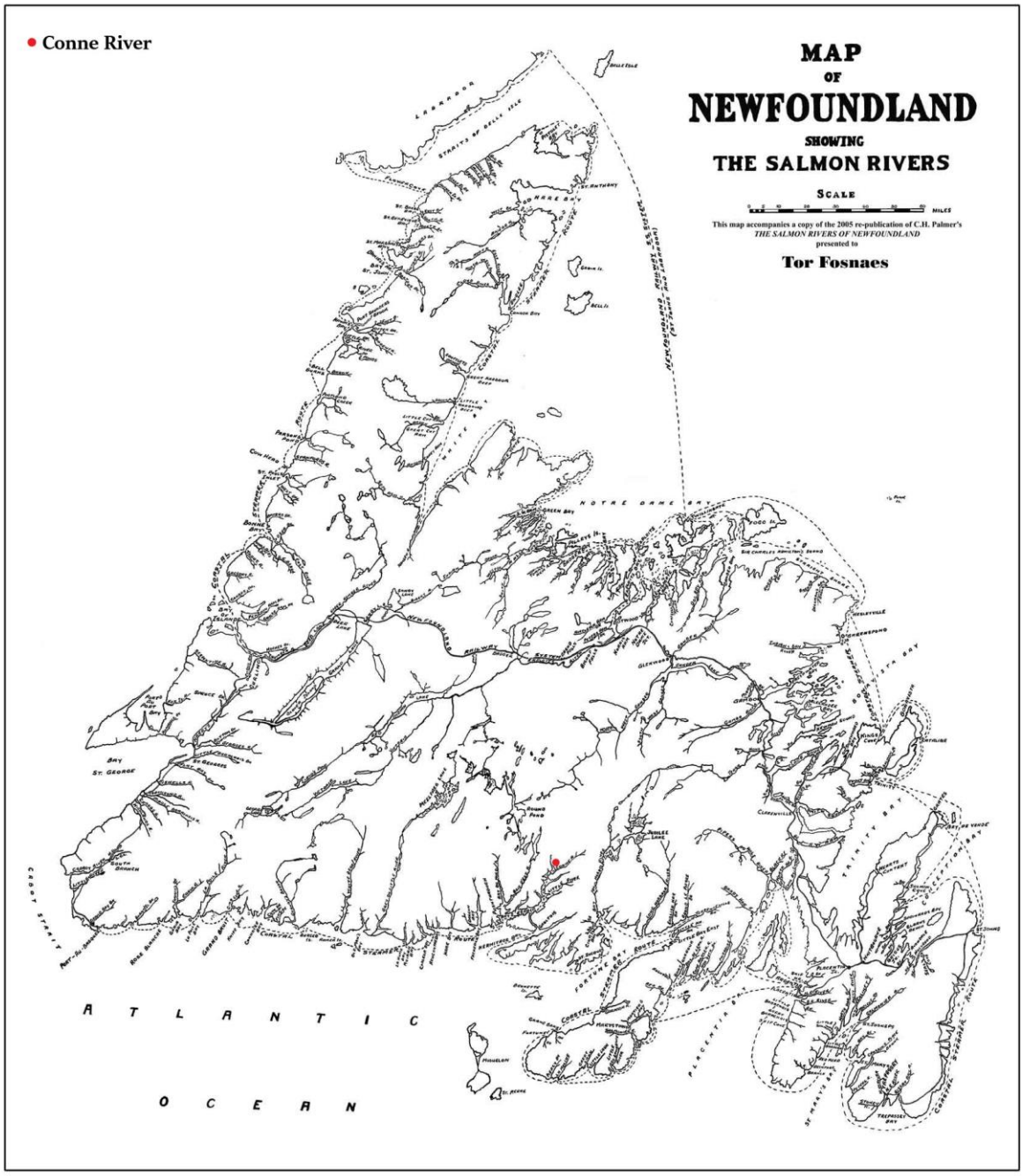

Fig. 1. Map of salmon rivers of Newfoundland. Palmer (1928/2005)

The island also attracts natural resource investment, particularly in oil, timber, and fish. Because of the richness and abundance of natural resources, most of the island of Newfoundland's economy remains centred around their exploitation, be it through tourism, production, or primary-resource extraction (Hillier and Harris, 2019). Government policies in Newfoundland historically placed emphasis and significant investment toward capitalizing and growing industries such as tourism, offshore oil, and most recently aquaculture. Aquaculture is the "farming of fish, shellfish and aquatic plants in fresh or salt water" (DFO, 2021)[2]. Such investments were largely a government response to the decline and subsequent collapse of North Atlantic cod which took place in the early 1990s. Within the context of fisheries, investment led to the growth and development of two industries simultaneously: angling tourism and commercial aquaculture.[3] Growth in the aquaculture industry coincided with a decline in the population of wild Atlantic salmon and as a result much debate has taken place in the public sphere, mainly between representatives of recreational angling conservation groups and salmon aquaculture industries on what caused the decline. Despite declines in wild fish populations, recreational angling tourism remains popular and economically significant at present.

[2] It should be noted, that "aquaculture implies the individual ownership or corporate ownership of the venue" (Bavington and Banoub, 2016, p.39).
[3] Aquaculture exports in the Coast of Bays region of Newfoundland tripled between 2003 and 2016 (DFO, 2016), while between 1995 and 2005 the number of recreational anglers in Newfoundland and Labrador grew by 7% (Hoffman, 2009). Resident Canadian anglers declined from 2010 by 3% while the number of non-resident anglers increased nationally by 9% (DFO, 2016).

Little research has been conducted on recreational angling in Newfoundland and Labrador. This is an unusual oversight given that recreational angling is the most common form of fishing conducted in North America (Arlinghaus, 2005). According to Wiber, Young, and Wilson (2012), recreational angling may serve as a potential form of local knowledge which can provide crucial insights into the health of ecosystems. Annually, thousands of recreational anglers venture onto the rivers of Newfoundland and Labrador in pursuit of the elusive and prestigious wild Atlantic salmon (Adams and Cote, 2010). Enthusiastic anglers annually returning to the rivers to go salmon fishing ensure that recreational angling in the province of Newfoundland and Labrador remains a strong economic generator. The Atlantic Salmon Federation[4] (ASF) recognizes this, and sponsored the Gardner Pinfold Report in 2012, a comprehensive study on the economic spinoffs created from Atlantic salmon angling in Eastern Canada. According to the report, salmon-fishing-related spending contributed approximately $165 million to the Canadian economy and employed over 3,800 people in Atlantic Canada (Pinfold, 2011). The high economic value and popularity of rod-based salmon angling was likely due to the fact that a moratorium was enacted on commercial salmon fishing in 1992 (Adams and Cote, 2010). Governmental regulatory measures, which threaten severe punishment for non-compliance, have been established to protect salmon and

[4] The ASF was established in the late 1940s by recreational anglers in Canada. Headquartered in Montreal, it aims to represent the views of salmon anglers in Canada and the United States and is a powerful lobby group (Daniels and Mather, 2017B).

trout stocks and have stifled subsistence fishing and also formed fault lines between subsistence and sport anglers (Fife, 2014, p.111). The fault lines between rural subsistence anglers and urban elite sport anglers have remained present as the recreational angling industry has devfeloped. This growth of the recreational angling industry and aquaculture has led to the emergence of lobby groups which seek to advance the interests of the mainly European descended clients they represent.

On one hand, the Newfoundland Aquaculture Industry association (NAIA), which formed in 1999, advocates on behalf of aquaculture industries (not just salmon producers, but also for producers of mussels, rainbow trout and other fish for export). On the other hand, conservation groups including the Salmonid Association of Eastern Newfoundland (SAEN), the Atlantic Salmon Federation (ASF), and the Salmonid Preservation Association of Western Newfoundland (SPAWN) advocate on behalf of recreational anglers and the outfitting industry.[5] Salmonid conservation groups argue that the aquaculture industry contributes to the decline of wild salmon stocks while the leaders of the aquaculture industry claim that fish farming is harmed through wild fish stocks that introduce diseases and parasites to domesticated fish. In between the two opposing groups, there lies a third group, the Indigenous people of Newfoundland. From my research, I learned that many, though not all, Indigenous people who live adjacent to salmon

[5] Salmonid refers to the Salmonidae, or elongate bony fishes. This includes both salmon and trout.

rivers are concerned that the salmonid aquaculture industry has contributed to the decline of wild Atlantic salmon within the region.

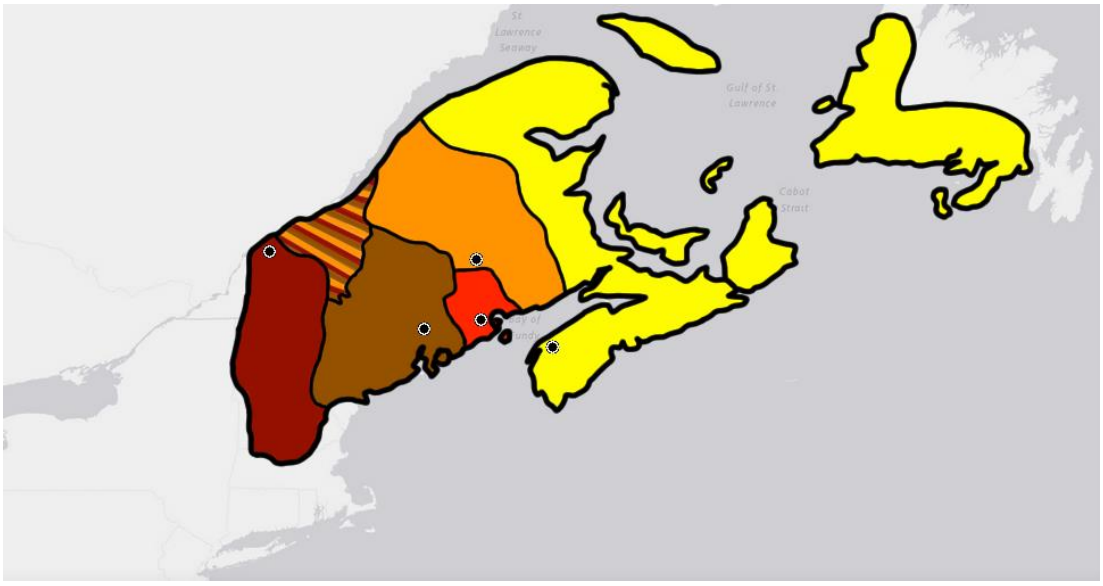

Fig. 2. Map of First Nations of the now disbanded Wabanaki Confederacy, C. 1600. Mi'kmaw territory is highlighted in yellow. (Wolastoq, 2020)

The most impacted Indigenous group on the island of Newfoundland is Miawpukek First Nation, located in the Coast of Bays region. The Miawpukek First Nation resides on land near the Conne River[6] which is one of the five largest rivers on the island of Newfoundland. Until recently, all the larger rivers of the island, including the Conne, were known for their prolific runs of wild Atlantic salmon which attracted groups of recreational anglers. Conne river no longer has healthy salmon runs.

The Miawpukek Mi'kmaw first settled in the Conne River estuary in approximately 1822, although the reserve was not formally recognized until 1987

[6] Conne River is well known on the island of Newfoundland for its history of great salmon runs, the others being the Gander, Humber, Codroy, and Exploits (See Fig. 1 Above).

(Miawpukek, 2014). As of 2020, the total population of registered Indigenous people living within the Miawpukek First Nation reserve was approximately 834 (Cape Breton University, 2020). Since contact with Europeans, Mi'kmaw guides have established strong reputations for their high level of wilderness skills in outfitting operations[7]. Perhaps a testament to the knowledge of Mi'kmaw guides, was the decision of prominent explorer William Cormack, during colonial exploration on the island of Newfoundland, to name a mountain in his Mi'kmaw guide's name, Sylvester Joe (Cormack, 1822/1928). This naming took place despite numerous recorded attempts by Cormack and other explorers to undermine Mi'kmaw guides, including Sylvester Joe (Cormack, 1822/1928, Mallais, 1907/2005). Unknowingly to Cormack, Sylvester Joe would go on to lead the European expedition away from the Beothuk that Cormack had sought to contact (Joe and O'Neill, 2021).

Over the last few decades, the Conne's run of wild salmon decreased dramatically whereby the Department of Fisheries and Oceans (DFO) announced in 2015 that Conne River angling for salmon was prohibited. At the time of writing this thesis, angling for salmon there remains prohibited. Caught in the middle of the drastic decline of salmon on the Conne River, is the Miawpukek First Nation who consider the Atlantic salmon to be an integral part of their culture and diet.

[7] Europeans relied heavily on Mi'Kmaw guides during colonial expeditions into the new lands. William Cormack, John Mallais and other European explorers relied heavily on Indigenous knowledge in navigating and exploring the island of Newfoundland during the 19th and 20th centuries (Joe and O'Neill, 2021).

I will argue that, although the commercial salmonid aquaculture industry and salmonid conservation groups appear divided at present, these social groups share a common but unacknowledged colonial historical lineage on the island of Newfoundland. The respective members of the salmonid aquaculture industry, the salmonid conservation groups and the Miawpukek First Nation all have different fundamental beliefs as to how salmon should be understood and valued. While the aquaculture industry and the salmonid conservation groups (who represent recreational anglers) both share common histories and conceptualize salmon primarily in resource capitalistic terms, Indigenous people have a different historical relationship with Atlantic salmon and have valued the fish differently; that is, in non-capitalist terms. Mi'kmaw people know that "the Mi'kma'ki (land of the Mi'kmaw) is held in communal ownership, and that the land and sea are not commodities but are "gifts from the creator" (Denny, Denny, Christmas and Paul, 2016, p.3). According to the Mi'kmaw people, all animals have spirits, are understood as equals, and must be treated with respect (Denny, Denny, Christmas, and Paul, 2016, p.4). Therefore, animals, including fish, are understood by many Indigenous peoples as living beings, rather than inert resources to be exploited. Perhaps as a result of this worldview, the Miawpukek First Nation has sought to maintain an economically self-sufficient community, guided by traditional values (Schreiber and Brattland, 2012, p. 59). Culture and traditional heritage are emphasized over monetary considerations, so much so that Indigenous food fisheries have been voluntarily abandoned in favor of protecting the future of wild salmon (Schrieber and Brattland, 2012, p. 60). Ross

Hinks, the Miawpukek First Nation Director of Natural Resources, has questioned the social and economic benefits of aquaculture as this jeopardizes what he says some call “just a few salmon.” Hinks as cited in Schreiber and Brattland (2012, p.62) remarks, hopefully, that “a united voice for the once almighty *Plamu*” will be formed.[8]

Focus on the division and public battles between Newfoundland’s commercial salmonid aquaculture industry and provincial salmonid conservation groups has largely excluded the perspectives of Miawpukek First Nation anglers who have seen both the decline of *Plamu* and continuous erosion of their sovereignty by both Newfoundland and Labrador provincial and Canadian federal governments. As I was told by anglers during my research with Miawpukek First Nation, the extinction of *Plamu* is more akin to the loss of a family member than the statistical decline of a fish stock. *Plamu* is of central importance to the Mi’kmaw throughout Mi’kma’ki.

While Miawpukek First Nation recognizes the importance of the decline of *Plamu*, the band has had some involvement in the aquaculture industry. There are no cage sites within the Conne River estuary, however, Netukulimk Fisheries Ltd (NFL), a commercial fishing enterprise established by the band in 1999 does operate a commercial fishing venture that provides services to the local aquaculture industry[9]. Many Conne river inhabitants are also employed by the

[8] P*lamu* is the Mi’kmaw word for salmon (Denny et al., 2016, p. 3).
[9] Miawpukek through industry partnerships provides services, such as; net cleaning services, suppling wild caught cleaner-fish, support vessel services, and crewing (O’Neill and McDonald, 2019, Collier, 2020, Hunt, 2017).

industry at operations in St. Alban's and Harbour Breton (Hunt, 2017). Sea cages, processing plants, and a salmon hatchery provide employment for some Conne River band members (Dean-Simmons, 2021B). As employment opportunities in the Bay d'Espoir region are limited, it is not surprising that the Band has taken advantages of those few jobs available in the aquaculture industry.

The Mi'kmaw First Nation were guaranteed their constitutional rights to fish for subsistence through the R. V. Sparrow case ruling of 1990 (Supreme Court of Canada, 1990), and to a moderate livelihood through the R.V. Marshall case ruling of 1999 (Supreme Court of Canada, 1999). Despite this, the Mi'kmaw of the Miawpukek First Nation have voluntary ceased their food fishery on Conne River. This decision was made in response to alarming declines of wild salmon returns on the Conne River (Randell, 2018)[10]. The use of nets, weirs, and traps has been abandoned in favor of rod-based angling as it is seen as a lower impact form of angling[11]. The salmon are targeted when they enter the river through rod-based angling and there is no catch and release angling permitted (Ross Hinks, Miawpukek Natural Resources Director, Personal communication, Winter 2015, Conne River). Through an agreement with the provincial government, eligible Band members are granted in-river angling rights to fish for salmon on the Conne

[10] Indeed, at the time of the finalization of this thesis (2021), with record low returns for the 4th consecutive year, the Conne river salmon are nearing extinction (CBC News, 2021).
[11] The Mi'kmaw of Miawpukek now hook and catch salmon with fly rods via the federal recreational salmon fishery. Fly rods are used in substitution of traditional angling methods that use nets, traps, and weirs.

River (Schreiber and Brattland, 2012, p. 60.). I should emphasize however, that this rod-based fishery has voluntarily not taken place for years in the hope that salmon returns of the Conne River will recover (see Randell, 2018). In a country whereby many First Nations are fighting for their rights to a share of nearby fisheries (Parenteau, 2002, p.434), the forfeiture of commercial salmon fishing is unusual As of 2021, angling is not taking place on Conne River and the river's wild salmon stock is nearing extinction.

Chapter two outlines my methods and research questions. Chapter three explores angling, fish culture and its colonial roots in Newfoundland and Labrador. Chapter four discusses the development of the aquaculture industry in the province. Chapter five discusses the catching and releasing of salmonids by Newfoundland anglers. Chapter six explores how the apparent conflict between the aquaculture industry and conservation organizations obscures shared historical roots and proposed solutions to wild salmon decline. In my conclusion, I emphasize the main arguments in the thesis, explore several weaknesses of my study and propose how they could be remedied with future research.

Chapter Two. Methodological Considerations: Fishing for perspectives

For this thesis, three methodological approaches were used: key-informant interviews with salmon anglers, participant observation of salmon angling and guiding, and contextualizing historical research of primary and secondary documents related to angling and aquaculture in Newfoundland and Labrador. Key informants were identified with the assistance of Chief and Council members of the Miawpukek First Nation and the Salmonid Association of Eastern Newfoundland (SAEN). In total, 13 Mi'kmaw elders from Conne River, and 7 non-Indigenous anglers from across the island agreed to participate in the study and were subsequently interviewed on their experiences catching escaped salmonids. The experiences of both Indigenous and non-Indigenous anglers are both important. Participant observation took place among Indigenous and non-Indigenous anglers during 2015 on several Newfoundland salmon rivers. Textual sources consisted of mostly of secondary materials focused on angling and aquaculture histories within the province of Newfoundland and Labrador. Don Hustins' books in particular (Hustins 2007,2010) were central in forming my historical understanding of angling and aquaculture in the province. Hustins books are foundational works on the history of angling on the island of Newfoundland. Academic journals, government reports and news articles were also reviewed.

The Research Process

As part of my participant observation, I had the pleasure of angling for trout and salmon throughout the province. These interpersonal experiences provided me with a first-hand account of how anglers experienced and understood salmon angling in Newfoundland. Even before embarking upon my research, I was an avid salmon angler, having spent a great deal of time on the rivers of Newfoundland and Labrador chasing wild salmon and acting as a fishing guide. In between the sessions of waist-high rapid water and jumping salmon, there would occasionally be intense riverside discussions with recreational anglers about fish abundance, weather, angling techniques, and even politics. I always enjoyed talking to salmon anglers and I realized that our discussions were increasingly turning to aquaculture and catching escapes. After hearing captivating stories about anglers catching escaped farmed salmon around Newfoundland, I was intrigued. Anglers spoke of aggressive fish, and alien fish — fish that were perceived as not belonging. Stories of introduced rainbow trout being captured on scheduled salmon rivers were frequent, along with stories of rivers filling with unhealthy looking salmon following fish-farm escape events. The anglers described their experiences in significant detail and expressed deep concern for wild Atlantic salmon. There was a strange surrealism surrounding their stories as the recreational anglers voiced concern for the well-being of wild salmon while also demonstrating a callousness towards the invading farmed fish whenever they encountered them. I heard stories of rainbow trout being caught in the pursuit of brown trout, and of farmed salmon being caught in rivers on the

Burin peninsula. Through the conversations I had and the stories I heard, I came to know that something was happening on the island involving wild salmon and the aquaculture industry. At the time, I just was not sure what exactly this all really meant. In order to make sense of my personal experience with my fellow anglers, I hypothesized that the people and communities who lived most adjacent to active aquaculture operations would have the most experience with escapes.

During a field course while attending the last semester of my undergraduate degree, I approached a course instructor who would become my future supervisor, Dr. Dean Bavington. I spoke about the stories that I had heard on the rivers of the province, and I mentioned my interest in graduate school. At the time the issue of salmonid escapees in the aquaculture industry was still largely outside of the public eye. It had not yet been picked up by news outlets and angling channels as it has today. Dr. Bavington agreed to take me on as a student, and I began my master's studies later that semester.

In the Fall of 2013, I attended a regional workshop on aquaculture in the Town of Harbour Breton located on the south coast of Newfoundland. During this regional workshop, organized by Memorial University's *Harris Centre for Regional Development*, I became aware of citizens concerned about aquaculture by listening to participants at the workshop. Labour rights, commercial fishing rights and recreational angling concerns dominated the discussions at the workshop. Two of the workshop participants from the nearby Miawpukek First Nation raised concerns about how the salmonid aquaculture development in the region was impacting their band and reserve. I had heard about the decline of wild salmon on

the Conne River but I had not heard about the Miawpukek First Nation's experiences with and opinions on the salmon-run decline until the Harris Centre's workshop. I introduced myself to the two band members, and I was advised by both members to contact the Miawpukek Band Council regarding my research interests.

Around the same time, I found an unrelated posting from the resource manager of Miawpukek First Nation asking for researchers to investigate aquaculture in the region.[12] I emailed the band's natural resources division in October 2013 and contacted Ross Hinks, the Director of Natural Resources Division of the Miawpukek First Nation. With assistance from the Harris Centre, a mutually beneficial collaborative relationship was established between MUN and the Miawpukek First Nation. The initial request for research, outlined in the posting, sought to recruit biologists to conduct genetic research on the salmon of Conne river, however my expertise was in angling and my advisor's expertise was in aquaculture. I reached out to Mr. Hinks and we arranged to meet during March of 2014. A meeting took place at the Harris Center, and although Dr. Bavington and I were unable to provide Mr. Hinks with scientific research, we could conduct research that would document the sociological dimensions of the salmon escapee phenomenon, including personal experiences, of catching escaped farmed salmonids in the Conne River. Mr. Hinks said there was a need

[12] The request was found on Yaffle, a communications tool developed by Memorial University of Newfoundland (MUN) and the Harris Centre to link university researchers with community leaders who have identified a research need.

to document such knowledge, and that it could be useful to Miawpukek. A collaborative relationship with Miawpukek was developed and plans to interview anglers with personal observations and concerns around escaped farmed salmonids.

To recruit non-Indigenous anglers, I contacted SAEN for assistance. SAEN distributed a recruitment bulletin to its member base, and seven respondents were recruited and were subsequently interviewed.

Ethical Considerations and Establishing Trust

Following the research[13] process which involved both Memorial University and the Miawpukek First Nation, key informant interviews were conducted with the goal of documenting knowledge of anglers and their experiences. The historical perspectives of Miawpukek First Nation with both aquaculture and angling were central to understanding the relationship between wild and farmed salmon escapees and the severe and relatively sudden decline of salmon on the Conne. Miawpukek First Nation personnel assisted by providing a list of potential band members who would be interested in speaking about their experiences with farmed-salmonid escapees. Attempts were made to contact, via telephone, all band members on the list and eventually contact with 13 band Elders was established and they agreed to participate and were subsequently interviewed. The formal structured interviews and semi-structured conversations took place in comfortable private locations chosen by key informants. Trust was

[13] See Appendix B, C.

solidified by establishing a mutually beneficial cooperation between myself, on behalf of Memorial University, and the Miawpukek First Nation. Trust also deepened, in general, by showing respect; for example, by better educating myself on Mi'kmaw people's rights and attempting to be sensitive to cultural differences. Decolonialization and reconciliation may only be achieved through recognizing past mistakes and wrongdoings towards Indigenous peoples (Smith, 1991). Because almost all imperial and colonial research benefited European colonial institutions, modern research with Indigenous people must be of direct benefit to those participating or it reproduces colonial relations (Smith, 1999, 128).

It must be emphasized that without documenting the perspectives of both Indigenous and non-Indigenous anglers, it would be difficult to appreciate how Newfoundland's anglers have experienced the simultaneous boom of the aquaculture industry and the decline of the wild Atlantic salmon. As such, I made it a priority to capture the thoughts, experiences, and perspectives of the anglers on catching or observing aquaculture escapees. This was achieved through formal and structured interviews and casual conversations with anglers to try to understand their experiences with wild salmon, and how their historical and contemporary angling experiences have been impacted by aquaculture salmonid escapees in Newfoundland.

Consultations, collective meetings, open debates and shared decision-making are extremely important aspects of research with Indigenous people (Smith, 1999, p.129). My primary goal was conducting research *with* Indigenous

People rather than conducting research *on* Indigenous people. As such, I made extra effort throughout the collaborative relationship to ensure that members of the Miawpukek First Nation maintained full direction and guidance over my research project. As part of my ethics approval, I was advised to remind all participants that they could opt out of my research project at any time — and was grateful that none of them did. I reflected on the history of research which I understood was inseparably linked to European imperialism and colonialism (Smith, 1991, p.1) and attended Band Council meetings to receive approval and to report my findings to the council. This process has helped me understand the importance of Mi'kmaq directed research on fisheries, angling and aquaculture issues as Miawpukek has historically been excluded from this research.

The Literature and Conceptual Framework

To try to best understand the experiences of salmon anglers, a baseline level of knowledge regarding the aquaculture industry, conservation and salmon angling in Newfoundland had to be established. The literature review, which begins with chapter three, served to fulfil this objective. I used public sources such as news reports, social media, magazines and the CBC radio program called The Fisheries Broadcast. Academic sources consisted of journal articles, historical publications, academic journals, manuscripts, and government reports. Through my literature review and examination of the public discourse between the aquaculture industry and salmonid conservation group representatives, *controversy* emerged as a primary theme.

Venturi (2010, p. 258) suggests utilizing the 'cartography of controversies', a branch of Actor Network Theory (ANT) (Law and Hassard, 1999) for describing social debates involving technoscientific issues. This method was originally developed by Bruno Latour (1999, 2004), and has been described as a way to "live, know, and to practice in the complexities of tension" (Venturi, 2010, p. 258). Venturi wrote that Latour suggested that students should just observe, but "just" constitutes three commandments of observation according to the cartography of controversies; "(1) you shall not restrain your observation to any single theory or methodology; (2) you shall observe from as many viewpoints as possible; and (3) you shall listen to actor's voices more than to your own presumptions" (Venturi, 2010, p.260). In the context of my research, an effort was made to ensure that all three of Latour's three commandments of observation were upheld during research. I did not restrict my observation to any single theory or methodology, I observed from as many viewpoints as possible, and strived to listen to different actor voices as much as to my own experiences and ideas. Fulfilling Latour's three commandments of observation allowed me to produce a well-rounded piece of research and helped to gain a variety of perspectives from anglers on aquaculture escapees.

My conceptual framework was developed to identify some of the possible experiences encountered by anglers on the Conne and other salmon rivers on the island of Newfoundland. Such 'experiential factors' contributed to the overall experience of the angler. If the factors in question change, so does the experience. I must stress however, that experiences are completely subjective.

Experiences will vary from one individual to another. I was more interested in identifying changes in perceived experiences. That is, how experiences changed for salmon anglers over the years since farmed salmon showed up on the scene. I sought to identify how are escaped farmed salmonids affecting the experiences of salmon anglers since salmonid aquaculture expanded into the region. It is generally accepted that salmonid escapees are now present and, increasingly, common in the region. As a graduate student, how these escapees are affecting the salmon angling experience of anglers was of great interest to me.

The following diagram[14] is intended to help the reader to conceptualize possible experiential factors that I believed indicated a change in the experiences of salmon anglers on the Conne River. Marianne Lien and John Law's (2011) paper '*Emergent Aliens'* provided a key starting point for the development of this conceptual framework.

[14] See Fig.3.

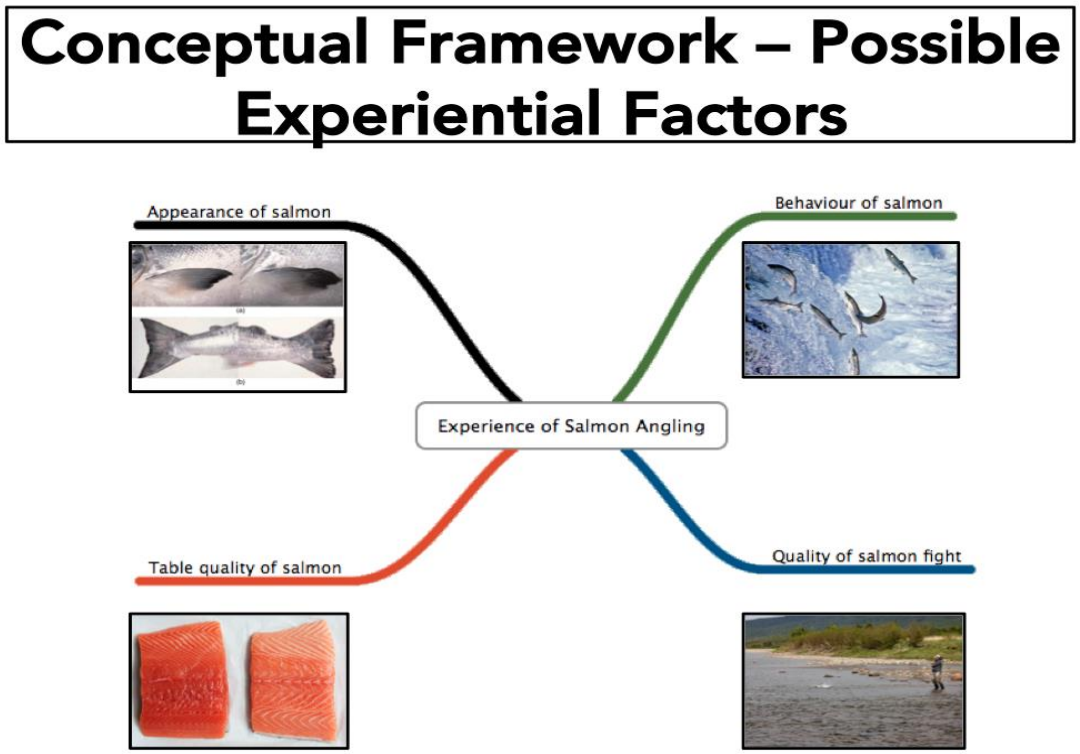

Fig. 3. Conceptual Framework.

Based on my experience as a salmon angler, I thought and listed out some of the possible experiential factors that could indicate a change in the overall angling experience for salmon anglers. These included but were not limited to: the appearance of the salmon, the behavior of the salmon, the table quality of the salmon and the quality of the salmon fight. The various experiential factors listed may have differed when a farmed escaped salmonid was caught instead of a wild salmon, but nonetheless this conceptual framework provided me with a starting point. Based on this diagram I developed a list of questions to follow in the formal and structured interviews and casual conversations that I

conducted[15]. Differences or changes in these experiential factors would hopefully highlight, at least to some degree, what the salmon anglers had experienced, and in either a positive or negative way.

A list of 30 questions was created and guided all my interactions with salmon anglers. I attempted to determine what salmon anglers experience when they head out onto the river to fish. Their historical experiences were of great interest to me. By interviewing these salmon anglers, I planned to build a picture of what the experience of salmon angling was like on the Conne and other rivers before aquaculture, and how it has changed in an environment where aquaculture salmon escapees have been identified. Are wild salmon viewed as superior to domestic salmon by the angler? Is the quality of the fight poorer with a domesticated salmon? Do they taste the same? Are they both aesthetically pleasing? These were some of the questions that were incorporated into the questionnaire that I used to guide my key informant interviews[16]. Ethnographic interviews share many features with friendly conversation and using research questions, or ethnographic elements, carefully, can prevent interviews from feeling like interrogations (Spradley, 1979, p.58). As such, I conducted my interviews in a casual fashion.

Following the completion of the study, primary data was returned to Chief Mi'sel Joe, the Chief of the Miawpukek First Nation. A public presentation and a

[15] See Appendix A.
[16] See Appendix A.

13-page report[17] was presented to the band council and attending band members during the Fall of 2015. The data and observations presented to the band council was prepared with the intention of aiding Miawpukek in documenting evidence for historical usage of land and documenting the cultural impacts of the decline of Conne River salmon.

In addition to qualitative interviews, participant observation was a key component of this research project. During the Summers of 2013 and 2014, I spent time angling across the island of Newfoundland and observed local anglers and their interactions with salmon, enforcement officials, and each other. This was done with the intention of gaining a broader understanding of salmon angling and experiences with catching escapees on the island. Angling trips were made to the Northern Peninsula, Codroy Valley, Central Newfoundland, and Bay d'Espoir. During the course of my fieldwork, I observed events that would add to my overall understanding of the politics of salmon angling and industrial aquaculture in Newfoundland. My field work excursions provided me with an opportunity to further immerse myself in salmon angling in Newfoundland and experience how escapees were transforming salmon angling.

Synthetic Bait, Fish and Rivers

During the Fall of 2014, I had the opportunity to travel to Bay d'Espoir and angle for escaped Atlantic salmon and rainbow trout, as many anglers did in the region during the past. I was unfamiliar with the area and with catching farmed

[17] See Appendix E.

rainbow trout and had no idea where to target the fish or how to catch them. Despite my initial stubbornness and misguided hunches, local anglers shared the hot spots where the locals of Bay D 'Espoir frequented for angling. These areas included the government wharf in St. Alban's, the causeway in St. Veronica's, and other general areas that were adjacent to active fish pens. I proceeded towards the causeway and spent the next three days fishing during the morning, afternoon, and evening for escaped rainbow trout. The causeway is basically an outflow from a large power generator on the Southcoast. Although the facility itself is not visible from the road, a wide spill off from the large hydroelectric operation owned by Newfoundland and Labrador's provincial energy corporation (NALCOR) pushes an impressive volume of water into the nearby ocean. A drive along the Southcoast will bring the adventurer over this causeway, via bridge, as they drive westwards. Upon escaping, the farmed fish often head to the causeway as it is the strongest and most plentiful source of flowing freshwater into the Bay d'Espoir region. The causeway is undeniably awe-inspiring; with a large, multi-beamed bridge sits atop a torrent of freshwater dumping into St. Veronica's Bay.

I was told that the best bait to use were "pieces of rubber glow worms from Canadian Tire that were cut up into small pieces to look like fish meal pellets". As luck would have it, my tackle box that I had used extensively during my time working as a laborer in Fort McMurray had a healthy supply of such bait; previously reserved exclusively for pike and walleye. I was specifically told not to use real bait. The escaped rainbow trout supposedly preferred the artificial lures

that looked, smelled, and tasted like fish-meal pellets. Artificial bait is seen at the most productive lure to use at the causeway — an interesting place to fish. The warm fresh water exiting from NALCOR's Bay d'Espoir hydroelectric generating facility flows steadily into the cool bay. An aura of warm mist and fog fills the air nearby, where the outflow contacts the brackish estuary like environment on its way to the ocean. Given the attractive aesthetics and contrast between the large-scale industrial development and seemingly pristine wilderness of the ocean environment, it was a very strange place to fish.

Unfortunately, the fishing during my time there was slow. Despite my persistent efforts to catch fish from the causeway, I saw – and caught – nothing. I was told that my poor luck was a factor of there being no storms in the past three months; it had been a calm Fall. The local anglers in the area explained that had there been more storm activity that there would have been plenty of escaped salmon and rainbow trout in the area. I was told to return after a storm passed through, or when the weather conditions deteriorated, as this was the best time to catch farm escapees at the causeway. It was some time afterward that it finally dawned on me: these fishers had expert knowledge on the relation between storms and escaped farmed fish. This was not the kind of knowledge I would find in a government or industry report but was a product of their lived experience with intensive aquaculture over time.

The experience of fishing at the causeway felt very artificial to me. Fishing on a synthetic river, using synthetic bait, in search of somewhat of a synthetic fish, a fish which has been manipulated and selectively bred, which did not

belong.[18] This 'trinity of synthetics' combined to form a strange wilderness-like experience for me; the unassuming academic angler. At this point I was deeply engaged within the synchronism of wild and native fish. I could somehow feel or perhaps understand, at least to some degree, how it felt to be an angler that derived a benefit from the otherwise harmful actions of aquaculture operations be it intentional stocking or unintentional, negligent escapes. These munificent feelings associated with pursuing an escaped farmed salmonid that triggered the research process are in stark contrast to my more recent feelings of animosity towards the aquaculture industry. This juxtaposition led me to wonder how did things get to where we are today? I began to look towards historical literature on the salmon and trout angling activities of Newfoundland and during my review of the literature, I became exposed to the historical timeline of settler enthusiasm for 'improving' natural ecosystems, from the earliest experiments in fish hatcheries to the advent of extensive, large scale salmonid aquaculture operations. Synthetic fish run deep through Newfoundland's history.

[18] Synthetic in that these fish are not naturally occuring; they are present as a direct consequence of the activities of humans.

Chapter Three. Angling and Fish Culture – Entangled Colonial Projects

In this chapter I will describe the shared historical connections between the industrial salmonid aquaculture industry and salmonid conservation groups in Newfoundland and Labrador. I will also demonstrate how this shared lineage helps explain the present conflict between industry and conservation groups. Both groups can trace their lineage to angling enhancement stocking activities which were pioneered in European settlements during the colonial period. The basic technology and principles utilized by both industry and conservation groups were developed during the 1800s and remain in use today. In fact, as late as the 1990s salmonid conservation groups and local communities were in support and working with the industrial salmonid aquaculture industry and this was a result of the direct shared lineage of colonial British improvement projects conducted by the two settler groups.

I will now provide an overview of government and industry initiatives in aquaculture and some of the opposition to these actions that have developed since 2015. The Colonial British elite's early involvement in creating the sport of angling will be discussed, along with the imperial and colonial history of angling in the Dominion of Newfoundland. The penchant of the British colonial elites to alter fish environments, a theme introduced in the above section, is further explored by discussing early experiments in fish hatcheries and angling enhancement, namely the practice of stocking. These discussions provide an important

historical background for understanding current aquaculture practices in Newfoundland, the subject of chapter four.

Government and Industry Initiatives in Aquaculture and their Opposition since 2015

In the Fall of 2015, the ruling Progressive Conservative government of Newfoundland and Labrador revealed plans to help a private company build the largest salmonid aquaculture hatchery facility in the history of the province (CBC News, 2015a). The new facility would be the largest of its kind in Canada and would further contribute to the province's reputation as a major player in the aquaculture industry. Soon thereafter, a lengthy Memorandum of Understanding (MOU) between the province and the Norwegian aquaculture company Greig Seafood was promptly announced to the public (Atlantic Salmon Federation, 2015). The MOU described how a combined government and private investment of nearly $251 million would aim to double provincial salmon production. The government would contribute $45 million to aid in the construction of a new $75 million "state-of-the-art" facility which would include a hatchery in Marystown and 11 sea-cage sites in Placentia Bay. Roughly 560 person years of employment through production, harvesting and processing would result (Department of Fisheries and Aquaculture [DFA], 2015). Jobs would be created in a region of high unemployment and youth outmigration. This would have likely led to economic spinoff in the region, such as grocery stores, barbers, gas-stops, and building supply stores. Other industries may also have benefited from such

investments. The hastened announcement just weeks before the 2015 provincial election was likely made in confidence that the reception would be overwhelmingly positive; and indeed, there was a degree of support for the project (Southern Gazette, 2016a).

Unexpectedly, the government's announcement of the deal with Greig Seafood was followed by intense opposition in the days and weeks thereafter (National Observer, 2016). Using local media, anglers, environmentalists, and commercial fishermen all expressed negative concerns surrounding the project. Several NGOs, including the Atlantic Salmon Federation (The Navigator, 2016), were particularly concerned with plans to import exotic salmon eggs from Europe, the lack of a formal public consultation process, and the approval of the MOU without all the components of the project being registered for the environmental assessment process (Atlantic Salmon Federation, 2015). The Fish, Food and Allied Workers Union (FFAW) wrote to Minister Dan Crummell, then minister of Environment and Conservation, raising serious concerns about the approval process for the project (FFAW, 2015). Following a short period of intense public debate the provincial government announced on November 20th, 2015, that the project would be put on hold pending the completion of an environmental assessment (CBC News, 2015c). The government-Greig Seafood partnership quickly responded to the criticism. Later however on July 22nd, 2016 following a brief period for public consultation on the project, the project was approved (CBC News, 2016a; Department of Environment and Conservation [DEC], 2017). The fact that the project was released from the environmental assessment process

without having undergone a full environmental impact statement created the most controversy, with critics claiming the project required a lengthy environmental assessment (Southern Gazette, 2016b). Dwight Ball's Liberal government, the victors of the 2015 election, suggested that a decision to support the massive aquaculture project would not be rushed into since any approval would require the investment of taxpayer money (CBC News, 2016b). The project was seemingly rushed through however with approval granted on July 22nd, 2016, through a government news release headed: 'Ensuring Responsible and Sustainable Resource Management' (Department of Environment and Conservation, Fisheries and Aquaculture [DEEFA], 2016). This was not surprising, given that Dwight Ball's Liberal government, like the previous Progressive Conservative government viewed, aquaculture as a "fundamental pillar of the economy' and a 'sustainable engine of wealth generation" (Liberal Party of Newfoundland, 2015, 16). Despite the hastened approval, opposition would continue to grow and challenge the project's future.

Widespread opposition to the project eventually led to a new coalition of concerned groups and individuals, formed to oppose the salmonid hatchery operation proposed by Grieg Seafood (Telegram News, 2017; CBC News, 2017b). The Newfoundland and Labrador Coalition for Aquaculture Reform (NL-CAR) formed from a broad coalition of fishers, First Nations, municipal, conservation and environmental groups, academics, and individuals. NL-CAR was concerned with the direction aquaculture was taking in the province of Newfoundland and issued a five-point conditional list of demands (NL-CAR,

2017). The aquaculture industry would:

- “not degrade the ecosystem in which it is located, or ecosystems on which it is dependent;”
- “be in harmony with economic, social and cultural activities that use the same natural resources;”
- “allow access to information and participation in decision-making in fair, equitable, and meaningful ways;”
- “would not hide some of their costs of production by externalizing them to the environment, the public, other sectors, or individuals;”
- “would not diminish the ability of future generations to use the same natural resources.”

NL-CAR appeared to be well organized and situated to provide substantial opposition to the Placentia Bay Grieg aquaculture project and possibly other projects in the future. (At the time of publication, the actions of NL-CAR are ongoing and its future impact remains to be seen.) It is certain however that the formation of the group stemmed from public criticism, concern, and disapproval of the both the Marystown and Placentia Bay aquaculture projects. Groups such as the Salmonid Association of Eastern Newfoundland (SAEN), the Atlantic Salmon Federation (ASF), the Salmon Preservation Association of Western Newfoundland and Newfoundland (SPAWN), Ecojustice, Sea Shepherd, and the Newfoundland and Labrador Coalition for Aquaculture Reform (NL-CAR)) have collectively resisted the expansion of the salmonid aquaculture industry in the

province. The Atlantic Salmon Federation has even initiated a court challenge to dispute the approval of the Grieg Aquaculture plan, and at the time of the completion of this thesis, the case has worked through the provincial court system (CBC News, 2017a) and the facilities are now constructed (Farrell, 2019), despite the efforts of opposition conservation and environmental organizations. Most recently, Grieg NL has received approval to construct additional ocean salmonid farming sites in Placentia Bay (Dean-Simmons, 2020). Despite further developments, the aquaculture industry and salmonid conservation groups remain at odds with one another.

As shown in the *Gardner Pinfold Report*[19], conservation groups, representing recreational anglers and outfitting operations, tend to value Atlantic salmon primarily in economic terms and, as a result, are staunch supporters of catch and release, while simultaneously being strongly opposed to open-pen aquaculture. Indeed, increasing levels of aquaculture development may threaten the future sustainability of salmon angling (Arlinghaus et al., 2012). In 2010, the south coast Newfoundland population of Atlantic salmon, which corresponds to the Department of Fisheries and Oceans Designatable Unit 4 (DU4), was classified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as threatened (Adams and Cote, 2010). Aquaculture was directly named in the major COSEWIC report as a potential contributor to the decline of

[19] The Gardner Pinfold Report was a study prepared by a consultant group for the Atlantic Salmon Federation that focused solely on the economic valuation of Wild Atlantic Salmon. See Pinfold (2011).

Atlantic salmon. The COSEWIC report placed importance on understanding how aquaculture could be negatively affecting wild salmon and the associated resource users. As a result of the documented risk of aquaculture to wild salmon, conservation groups placed continued pressure on the provincial government to police the aquaculture industry more aggressively. This, they argue, would be achieved through the court system and through enforcement of environmental regulations and precautionary policies, most notably Environmental Impact Assessments (EIA).

New aquaculture developments, wild fish declines, sea lice outbreaks and salmonid escapees continue to be contentious between proponents and critics of fish farming. The present lines of conflict between the commercial aquaculture industry and recreational sport anglers, conservation groups and commercial fishermen are well known. The aquaculture industry (usually government backed) and salmonid conservation groups (and their allies) are often in disagreement with each other. However, the present relationship of diametrical opposition between the aquaculture industry and salmonid conservation groups has not always been the case. It is important to note that both salmonid conservation groups and the salmonid aquaculture industry share common historical lineages. Both continue to share an understanding of fish as stocks (Telesca, 2017) and both share common economic valuations of fish. Many of the techniques and methods used, such as fish culturing, within the present salmonid aquaculture industry were initially developed and remain in use by salmonid conservation groups. Though salmonid conservation groups display some reticence towards

stocking today, historically stocking and habitat enhancement projects aiming to increase fish production guiding thought and practice.

Fish for Kings and Fish for Paupers: The British Colonial Origins of the Sport of Angling

Angling has been conducted throughout many cultures for thousands of years. In the history of angling in Britain, not all fish were viewed equally. Izaak Walton, an early British writer and bait angler, first specified what was considered acceptable quarry and what was considered undesirable fish for aristocratic gentlemen anglers. In his epic treatise, *The Compleat Angler,* Walton (1653/2004, p. 101, 340) argued that the supreme method to take fish was with a single hook and line, rather than a net or weir. Walton meticulously described fish behavior, habitat, and angling techniques. He categorized fish as being either trash or game fish—game fish were associated with civilized anglers, trash with the uncivilized. Trash fish were associated with savage and barbaric people associated more with nature than humanity or civilization. The chub was described as the “worst fish that swims” (Walton, 1653/2004, p. 53) while carp were referred to as the “Queen of Rivers” (Walton, 1653/2004, p. 153); perhaps because Walton himself was an avid bait angler and fished for carp regularly. Walton seemed to admire the carp for both the utilitarian value of the fish and the sporting challenges it offered (Walton, 1653/2004, p. 159). Walton described Atlantic salmon to be the “King” of fish, even more valuable than the highly prized trout (Walton, 1653/2004, p. 128). This hierarchal classification of fish species,

between coarse and game fish, mirrored social orders of crass and civilized anglers, fishing for food and fishing for sport. The rigid British class system extended itself onto angling dichotomies. These hierarchies of fish and fishermen have spread throughout the centuries and manifested in certain fish and fishing people being devalued and, in some cases, exterminated while others were praised, prized, domesticated and improved throughout the British empire including in Newfoundland and Labrador (Halverson, 2010, Walton, 1653/2004). In the case of Newfoundland, the high status (Ibid) attached to the exotic brown trout and rainbow trout, or steelhead, (deliberately planted all over the British Empire as part of imperial ecology) and the less than praiseworthy vernacular "mud trout" (brook trout) for the native trout species reflects the hierarchy of anglers and the species they prefer to catch and release for sport as opposed to eaten as subsistence catch. This hierarchy did lead to conflict between subsistence and sport fishers throughout the British Empire[20].

Class conflict surrounding wild resources was not uncommon throughout European colonial history. British historian E.P. Thompson (1975) described the violent conflicts that arose in the 1700s between peasant subsistence hunters and fishers and upper-class sport-minded landowners in his book *Whigs and Hunters*. The creation of the Black Act, a law of Britain's 1723 parliament which

[20] Imperial ecology refers to growth and implementation of ecological based practices in the British colonial period. Anker (2001) offers an in-depth analysis of imperial ecology, whereby the growth of the field of ecology set the percussive narrative required for managing white-settler colonial interactions with Indigenous peoples and managing natural resources. The idea of imperial ecology served to distinguish "civilized" white settlers from "uncivilized" colonial frontiers.

authorized capital punishment for fisheries and game offences, solidified the divisions between the Blacks[21] (subsistence resource poachers) and the Whigs (upper-class landowners) (Thompson, 1975). In another example, in 1896, in the province of Ontario, federal fisheries caved to angler lobbyists and instituted laws which restricted market and subsistence fishing by both Indigenous people and settlers (Knight, 2016, p.60). By the 1900s, sportsmen had separated angling from subsistence, transforming angling into a noble pursuit that focused on intellectual and social distinction rather than the pursuit of food (Knight, 2016, p. 61). Angling continued to be pursued for both subsistence and social status throughout 19th and 20th centuries in Canada and Newfoundland and Labrador and continue up to the present.

Angling was, and remains, an affair that is practiced by all classes of society. However, throughout the colonial period, upper-class men distinguished themselves by becoming fly anglers (Halverson, 2010, p. 61). Their chosen method of angling involved a long-split cane rod, horsehair line, and fancily dressed feathered hooks. Fly fishing was understood to be the ultimate gentlemen's sport as it presented the greatest individual challenge, requiring the most skill and persistence to be successful (Knight, 2016, p. 62). Angling for salmon and trout served as a way for distinguished 19th - century men to exhibit their high social status and presumed intellectual superiority through the skill and

[21]Poor, low-class subsistence poachers (so-called) were referred to as *blacks* because of the coal and dirt used to darken their faces when they would raid the King's forests around London. (Thompson, 1975). These men were *not* Black in racialized terms.

self-reliance required when angling (Knight, 2016, p. 62). Not surprisingly, these elites formed angling clubs that engaged in what they called “acclimatization”. Acclimatization involved the purposeful modification of the landscape through the importation of non-native plant and animal species that were seen as improvements on native species by settler colonists (Halverson, 2010, p. 28; Knight, Snyder et al., 2016). Acclimatization was undoubtedly an extension of the “Columbian exchange”, the exchanging of diseases, foods, ideas, crops, populations and peoples between Europe and the New World following Christopher Columbus’ landing in present day Bahamas in October of 1492 (Nunn and Qian, 2010, p. 163). The first of such clubs was established in France (Halverson, 2010, p. 29; Del Vecchio, 2012). Many more such clubs spread throughout the New World through colonial extensions of European empires. Such clubs focused on spreading fish that were desired by the upper-middle settler classes and elites who lived within the new colonial territories.

The introduction of foreign species and displacement of native species by angling clubs would later limit access to native species and force Indigenous people and settlers to let go of relationships with them (Todd and Davis, 2017, p. 774). These introduced species served to expand colonial reach, rule and resources into the vast expanses of the newly acquired territory. Settler colonialism requires the erasure of through genocide and processes of assimilation where Indigenous ways of living are criminalized and replaced with settler ways of living, legal orders and relationships between fish and people (Belcourt, 2015, p.9). Such stocking activities also aimed to make Indigenous

land and life feel ‘’more like home’’ for settlers through practices such as the introduction of familiar species (Snyder et al., 2016, p. 21). Indeed, the scale and scope of “acclimatization” was significant (see Fig. 4), with many trout species being purposefully spread outside their native ranges to locations, including South Africa (Nustad, 2018), around the British Empire. Scientific and technological advances of aquaculture allowed for this colonization through acclimatization (Del Vecchio, 2013). The transformation of rivers through the transplant of foreign fish species has led to a transformation of subjectivities, whereby both fish and humans’ relationships with nature change (Brown, 2013). Wild environments are reconfigured, and heavily shaped through global colonial and capitalist histories (Nustad, 2018).

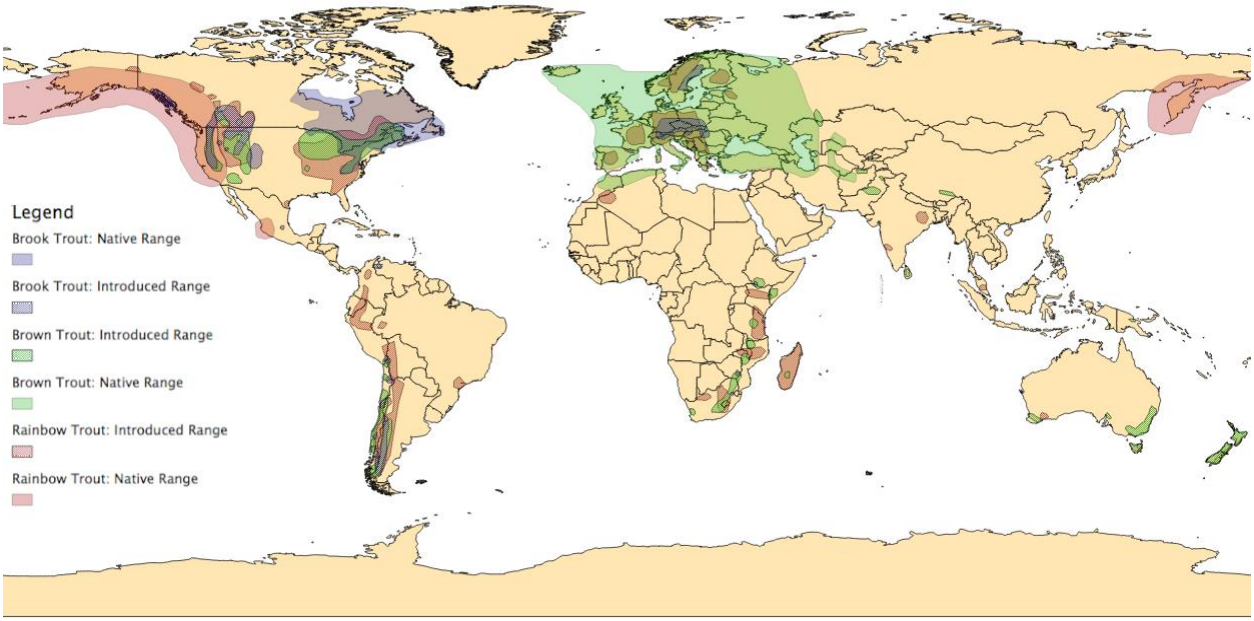

Fig. 4. Range of introduced and native trout species; (Del Vecchio, 2013.)

Originally, stocking and planting new fish for the future was understood as a means of improving upon nature, of civilizing lands and lives. In their work on the Anthropocene, an era of time dominated by capitalism and colonialism, Zoe Todd and Heather Davis have suggested that the Anthropocene began with the colonization of the Americas (Todd and Davis, 2017, p. 764, 765). Although some may dispute that suggestion, most would likely agree that the Anthropocene is not a new event, but one that can be categorized by continued practices of dispossession and genocide, along with a dramatic transformation of the environment over the last 500 years (Todd and Davis, 2017, pp. 761, 771). Acclimatization through stocking was a major activity of the British Empire. Through stocking, colonial territories were made to feel more like home for settlers, while displacing and destroying those same places for Indigenous people. Without the technological advances of aquaculture and the colonial practices of acclimatization around their Imperial territories, trout would not have been spread as far as they evidently have been everywhere where the British have colonized. The native ranges of trout compared to their current distributions bear a troubling resemblance to the historical claimed territory of the British Empire. Similar to agriculture, fish exploitation has undergone intensification (Selgrath et al. 2018). However, in the 21st century, stocking; be it intentional, through the use of hatcheries, or unintentional, through aquaculture escape events, has fallen out of favor among fishery scientists, managers and anglers alike (Montgomery, 2003, pp. 165-169).

Since 2000, the practices of salmonid aquaculture and fish hatcheries shifted from being perceived as a win-win relationship between industry and conservationists to something despised by anglers, managers, environmentalists and conservation scientists alike. To understand the significance of this shift where former friends become supposed enemies and how it specifically took place in the province of Newfoundland and Labrador, I will unravel the intertwined histories of stocking and stock enhancement, salmonid aquaculture, and conservation-oriented angling[22]. Both the aquaculture industry and conservation groups are rooted in fisheries biology (Hubbard, 2014), and there are important connections among them that suggest a complicated political and moral terrain. This complicated terrain fuels ongoing controversy. Former friends and allies are now enemies; fish enhancement has become redefined as genetic pollution and a form of homogenization. I am interested in how this has happened and a quick history of aquaculture technologies in England provides some useful context to begin moving toward an answer.

A Brief History of Aquaculture in England

The practice of aquaculture originates in Asia and has been around for thousands of years (Food and Agriculture Organization of the United Nations [FAO], 1998), with the Chinese domesticating Carp around 3500 B.C. (Fagan, 2017, p.8). In Asia, aquaculture was, and continues to be, a sustainable source of

[22] Conservation oriented angling may be understood as direct heir of Izaak Walton's *The Compleat Angler* (1653/2004).

food for many, with fish produced through cultured-farming operations accounting for over one quarter of all fish consumed by people (Naylor, 2000, 1017; Matthews and Young, 2010, p. 4). The art of multi-trophic aquaculture was perfected in Asia long before Western operations had begun to experiment with the concept. When Western Europeans adopted aquaculture the reasons for doing so were not related to caloric-intake requirements but to the avoidance of red meat consumption for religious purposes in monastic Christian communities (Harland, 2019). Carp were domesticated and imported from Asia to Europe from the 12th to 14th centuries and this act began a long tradition of fish manipulation by Europeans (Hartland, 2019).

For the elites and aristocrats of England in the early 19th century, fish hatcheries served to restore bodies of water that had been over-fished and exhausted due to poaching or over-harvest (Montgomery, 2003, p. 109). Pollution was likely also a source for such fish decline. Although aquaculture was initially used to supply fish for Lent during medieval times (Bonow, Olsen and Svanberg, 2016, p.30), aquaculture was later used as an enhancement tool, a mechanism by which to improve fish stocks that were privately owned in closed, private fishponds (Bonow, Olsen and Svanberg, 2016, p.191). For example, the Duke of Bedford owned private ponds near Woburn Abbey, and introduced exotic fish species such as catfish from central Europe, Eels from the Danube River and Pike from Germany. Fish improvement was undertaken by landowners and targeted a limited number of species deemed valuable by the landlord class (Bonow, Olsen and Svanberg, 2016, p.19). This improvement was mostly

intended for sport, not for use as a source of food. Angling was for recreational anglers (mainly white property-owning men from industrializing cities who wanted an escape to the wild to regain manliness softened by managerial industrial work by the 19th century (Walton,1653/2004). Aquaculture and angling enhancement methods, through the commonality of hatcheries, share common roots and end goals. Fish stocking in the form of angling enhancement understands fish as both commodities and stocks; bringing together fish farmers and recreational anglers in a shared history of capitalism and European empire. It is well known that the United Kingdom was engaged in salmonid production and juvenile fish rearing since the late 19th century to enhance wild stocks and to introduce foreign species to new areas (Hambrey and Evans, 2016, p.116). A healthy population of fish, ready for exploitation through recreational sport angling was a valuable commodity. And aquaculture and angling enhancement have been a joint project from the beginning. It is only very recently that the anglers and aquaculture have clashed and not seen their goal as increasing the number of valued fish while eliminated those deemed “trash.”

Contemporary aquaculture and salmon angling on the island of Newfoundland is the result of a century of interaction between colonization, capitalism and the forces of conservation. Throughout the last one-hundred years, the push and pull of capitalist development and conservation led to a situation where angling conservation groups are sometimes adamantly opposed to industrial salmonid aquaculture, despite conservation groups playing an

essential role in the creation and development of the industry and shared interests in the use of hatcheries for stocking.

In their book, *Environment and Empire*, (2007, p. 2), historians William Beinart and Lotte Hughes put forward the concept of the “commodity frontier”. According to Beinart and Hughes (2007, p. 1), British settler and colonial states sought to both regulate and commodify natural resources within their occupied territory. The term commodity frontier may be used for meanings that are environmental, spatial, and socio-economic. Commodity frontiers arose during the Columbian Exchange period. European commercial activities expanded resulting in commercial activity, productive enterprises, and settlement in overseas territories. Beinart and Hughes (2007, p.167) suggest that in certain cases, new species were introduced to foreign colonies to provide the necessary ingredients to enclose and commodify the land. In the case of Newfoundland, such introductions included, but were not limited to Brown trout, grouse, snowshoe hare, and moose.

While the commodification and regulation of the land was the primary goal of the British Empire, Beinart and Hughes (2007, p. 3) suggest that conservation rose out of a need to both preserve and control assets and that doing so could guarantee long-term profitable efficient use. Conservationist policies were imposed by colonial states on colonized peoples and went hand in hand with colonial economic development. Beinart and Hughes also state that conservationist innovation and intervention often took place in response to local crises of subsistence and commercial overexploitation. The embracing of science

and technology was a key contributing factor in the advancement and development of conservation and commodity frontiers. In the context of angling in Newfoundland, conservation also arose out of concerns of depleted fish stocks. Settler colonists began to conclude, and act upon, the realization that wild salmon and trout had been exploited to the point where artificial stocking and propagation methods were necessary to restore angling opportunities. Over time the impact of conservation in Newfoundland would lead to increased regulations, limited access to wild fish, and would eventually contribute to the development of the salmonid farming industry on the island while wild salmon continue to decline in number. Ironically, the act of conservation which seeks to protect and secure wild resources, has been a catalyst in the development of an industry which threatens to destroy them.

The Imperial and Colonial History of Angling in the Dominion of Newfoundland

Angling in Newfoundland and Labrador is a common past-time and is enjoyed by a high number of residents in the province. While nationally, approximately one in ten citizens participate in recreational angling; in Newfoundland approximately one third of the adult population are active anglers (Hoffman, 2008, p. 7). Primarily, anglers in Newfoundland fish for Brook trout (known in the vernacular as ‘mud trout’), brown trout, Atlantic salmon, and occasionally, freshwater eels (American eel). Europeans and their settler descendants have been fishing and consuming fish on and around the island of Newfoundland since the arrival of the first Norse settlers on the island over 1000

years ago (United Nations Educational, Scientific and Cultural Organization, 2021). Additionally, Indigenous inhabitants have used traditional methods to fish on the island for hundreds, if not thousands, of years prior to the arrival of Europeans (Renouf, 1991). Recreational angling in Newfoundland with rod and reel began with exploratory excursions by British ship captains searching for sport during their downtime while on postings in the then British colony of Newfoundland (Hustins, 2010, p.19). The first complete account of fly fishing on the island was written by Campbell Hardy in *Sporting Adventures in the New World* (1855). However, the first European to cast a fly rod in Newfoundland may have been Joseph Banks, a naturalist who travelled to the island from England during the early settlement period (Hustins, 2010, p. 19). Banks reported on other early rod angling accounts in Labrador which can be found in the journal of Captain George Cartwright (1792). Cartrwright, and other explorers such as John G. Millais were often guided by Indigenous guides, including the Mik'maw (Mallais, 1907/2005, p. 230). Military officers also pioneered angling on salmon rivers of Quebec, New Brunswick and Nova Scotia, notedly always with the help and assistance of Indigenous guides (Hustins, 2010, p. 39). Settlers of the early settlement period, being mainly cod fishermen and farmers, had no interest in fly fishing as they simply did not have the equipment or time to partake in the sport (Hustins, 2010, p. 40). Salmon were caught primarily and efficiently with nets as fishing was a time-consuming yet necessary subsistence activity. Following the opening of the Newfoundland Railway in 1882 (Hustins, 2010, 43), tourists began to travel to the province of Newfoundland to fish for wild Atlantic salmon.

Newfoundland was touted as “The Norway of the new world” for its beautiful scenery and many sporting opportunities (Parsons, 1910).

Conflicts arose early between sport rod anglers and subsistence anglers on rivers in Newfoundland. British naval officers, charged with patrolling and enforcing the rule of the Crown on commercial fisheries, often recorded reports of illegal fishing activities. The captain of HMS Buzzard, charged with recording statistics on fishery catches (as well, on judicial decisions and levels of destitution), stated that “The salmon fishery in St. George’s Bay has been the best known for many years; up North has not been so good” (Bourke, 1898). The poor angling was blamed on subsistence angling conducted by local settlers. Subsistence fishing was demonized even though many settlers had inadequate access to steady sources of food and suffered from malnutrition-associated diseases, many of which were documented by medical officers on the same vessels charged with enforcing the rules and regulations of the fishery (Bourke, 1898). In the late 1800s, the barring of rivers for subsistence and commercial salmon fishing was under scrutiny from a variety of sources and is mentioned multiple times in the Journals of the Newfoundland House of Assembly (J.N.H.A., 1856-1891). Commercial harvests began in Newfoundland close to salmon river mouths in the early 1700s, however conservation measures initiated in the late 1700s and early 1800s shifted the commercial salmon fishery to saltwater and by the 1880s the commercial river fishery had ended (Daniels and Mather, 2017B, p.5). Despite some early conflicts between colonial elites and settlers over fish stocks, the quality of angling on the island continued to draw anglers from outside

the country. In nearby Canada, the Federal Government of Canada assumed control of fisheries management in 1867, with attempts to regulate Atlantic salmon fisheries continuing (Parenteau, 2004, p. 438). Sporting organizations would later influence the conservation movement that pushed salmon management in the direction of sport fisheries rather than commercial or subsistence activity. Sport angling would be the future of salmon fishing.

In Newfoundland, one of the first angling establishments that catered to foreign tourists in search of Atlantic salmon was the Afton Farm House initially run by John and Judith Tompkins (Hustins, 2010, p. 50). The Afton Farm House, established in 1887, focused on the angling opportunities available on the Grand and Little Codroy watersheds located in the Codroy Valley on the southwest coast of Newfoundland. The relatively mild climate, proximity to the mainland, and abundance of excellent angling opportunities meant the Tompkins' outfitting establishment experienced great success until 1956 when a fire destroyed the main camp. Following the destruction of the camp, the decision was made not to rebuild. Local salmon stocks had been over-fished by the commercial fishery and by poaching (Tompkins, 2004, pp. 20, 24). Prior to the destruction of the camp, in 1935, prominent American angler and pilot Lee Wulff stayed at the Afton Farm House (Hustins, 2010, p. 152). It was here, at the Afton Farm House, where Lee Wulff first released salmon on the island and introduced the idea of catch-and-release angling to the Dominion of Newfoundland (Hustins, 2010). The Tompkins establishment was significant in that it was one of the island's first outfitting operations. Angling on the island would continue to take place but was largely the

activity of tourists from the United States and British colonial elites throughout the late 19th, and early 20th centuries. When fish were sought for the purpose of food, in the main, nets were used. Indeed, conflicts did occur between subsistence fishermen and sport rod anglers on the island. The Game and Inland Fisheries Board, focused on regulations and recommendations for the Department of Game and Inland Fisheries, recorded almost verbatim minutes from 1913 to 1934. In multiple meetings, violations of game laws were discussed, and solutions were suggested such as: “That’s where a warden is being appointed for Robinson’s River . . .[to] prevent annoyance by boys in the river and attempt to report and other matters pertaining to violations of the game laws.” (Game and Inland Fisheries Board Minutes, 1913, pp. 12, 124). These quotes demonstrate that poaching, or fishing illegally, was understood to be a problem and suggest that conservationists sought to monopolize wild fish resources and prevent “violations” by subsistence fishermen: “boys in the river” and “poachers”, as they were labeled. As years passed, the focus of tourism would remain on Atlantic salmon fishing, and Lee Wulff, who had the ear of government, would carry on the torch of conservation.

Lee Wulff would go on to promote catch-and-release angling and angling tourism in Newfoundland and make key impacts on provincial government policy that are still felt today. Wulff called for the privatization and limited access of certain ‘prized’ salmon rivers in the name of conservation and for the promotion of tourism. In Lee Wulff’s own words “Game fish are too valuable to be caught once” (Lyman, 2004). For Wulff, catch and release meant that fish could be

caught and released multiple times. Each cycle of capture and release would bring in economic revenue to the locality in which the fish was caught. Capitalist profit, in the name of conservation, could be realized by ensuring a stable fish stock. Through the influence of conservationists like Lee Wulff, nearby Eastern Canada would become a hotspot for exclusive Atlantic salmon sport angling (Parenteau, 2004). Ultimately, the Newfoundland government rejected calls for privatization of water, and although most of Lee Wulff's suggestions for salmon conservation were accepted, almost all of Newfoundland's angling waters remain open for public access for catch and release.

A Brief History of Fish Hatcheries in Newfoundland and Labrador

Extensive hatchery and egg import operations saw a multitude of exotic fish species brought too Newfoundland in order to 'improve' and 'enhance' local sport fisheries. Whitefish (*Coregonus clupeaformis*), pink salmon (*Oncorhynchus gorbuscha*), brown trout (*Salmo trutta*), and rainbow trout (*Oncorhynchus mykiss*) were all enthusiastically introduced into Newfoundland's waters (Hustins, 2007). Initial stocking activities were conducted with the use of boats until the opening of the Newfoundland Railway, in 1884, when trains served as a more efficient means of spreading the progeny of a variety of gamefish species throughout the island (Knight, 2014, p. 187; Hustins, 2007, p. 32; Hustins, 2010, pp. 43-49). Early fish hatchery operations and stocking programs were forms of imperialism, changing natural landscapes and exporting a white-settler mentality that aimed to colonize, conquer and tame wild, unknown landscapes, fish species and

Indigenous people (see Halverson, 2010; Knight, 2016). European settlers asserted their dominance over wild ecosystems through the introduction of preferred European gamefish, species such as brown and rainbow trout. In fact, at the peak of the colonial period, cultures who practiced agriculture and animal husbandry were considered civilized while those who did not were believed to be "savages" (Cassidy and Mullin, 2007, p. 8).

The first documented hatchery on the island of Newfoundland was located on Long Pond, in the heart of present-day St. John's (Hustins, 2007, p. 50). The Long pond watershed was leased to the Newfoundland Game Fish Protection Society, during the 1800s, for fish culture and primarily served as a facility where brown trout could be artificially propagated and then spread throughout the Avalon peninsula. Initially, hatchery operations were highly successful within the Long Pond watershed but the hatchery and stocking project was later abandoned. Vandalism by disgruntled locals, who were denied access to the watershed, and the failure of a rainbow trout stocking project led to the closing of the hatchery. Later, another hatchery was established at Murray's pond, located in the nearby community of Portugal Cove where the Newfoundland Game Fish society switched their focus to rainbow trout (Hustins, 2007, pp. 52, 53, 55).

Various experimental transplants of several trout and salmonid species would occur over the next hundred years. On occasion, the stocking of Atlantic salmon was suggested in response to a perceived decline in wild stocks and even on the suggestion that local fish were inferior to those native to the Gaspé region of Quebec (Hustins, 2010, p. 12; Fish Culture in Newfoundland, 1874;

Journals of the Newfoundland House of Assembly [JHNA], 1875). Ultimately, however, the stocking of Atlantic salmon never occurred in the province. Brown trout would later be stocked throughout the Eastern portion of the island both before and after the construction of the railway. Two strains of brown trout were imported, one from Loch Leven, Scotland, and another from an unknown location in Germany (Hustins, 2010 p. 91, 96). Rainbow trout stocking operations would continue until the 1970s (Hustins, 2010 p. 153-156). Historically, fisheries enhancement and acclimatization was used to improve the various locations which were colonized and had become extensions of the British Empire. Improving elite sporting opportunities and civilizing wild rivers and human beings in the colonies was of great importance to the British Empire, and this was also the case within the then Dominion of Newfoundland. Except for the activities of the aquaculture industry and the private body of water at the Murray's Pond Country Club in Portugal Cove, at present, all stocking operations that take place on the island of Newfoundland are classified as enhancement operations; they are oriented to restore or enhance the environment, and native fish populations, through projects, outreach and assisting government organizations with technical knowledge (SAEN, 2020).

Angling Enhancement: A continuation of colonial practices

While the Newfoundland salmonid aquaculture industry has grown rapidly over the last thirty years through the use of Federal and Provincial subsidies, until recently there has been little organized opposition. Salmonid conservation groups

actively supported the initial development of the aquaculture industry, and the aquaculture industry utilized hatchery and stocking techniques that were developed by conservation groups. While the aquaculture industry used propagation methods for creating profit, conservation groups simultaneously used the same techniques to restore and enhance wild fisheries within Newfoundland. Both the government backed aquaculture industry and salmonid conservation groups concurrently partake in fish propagation activities but for different reasons. The aquaculture industry remains committed to increasing shareholder profit, while salmonid conservation groups remain committed to increasing catch and release angling opportunities. However, both industries value Atlantic salmon in terms of their economic potential rather than their intrinsic value as living beings. This is in direct opposition to Mi'kmaw cosmologies of *plamu* with fish understood as kin or relatives (Schreiber and Brattland, 2012). Similar indigenous understandings of wilderness and fish exist elsewhere in Canada, such as within the Northwest Pacific, where rivers are viewed as living beings susceptible to destruction by European tools such as axes (Colombi and Brooks, 2012). As colonial settler activity has intensified, wild fish stocks have decreased, while hatchery activity has increased.

Even though in many states and provinces hatchery-based fisheries and restocking programs are increasingly frowned upon by biologists[23] (Montgomery,

[23] Negative attitudes towards fish stocking are based upon the idea of "genetic purity". Genetic purity has been an important factor in the development of conservation biology (Ben-Ari and Lavi, 2012). Wild fish are understood as having unique genetic sequences which must be protected

2003, pp. 165-169), in Newfoundland and Labrador stocking programs continue under the banner of salmon enhancement. Such enhancement programs often seek to replenish previously exploited or destroyed trout or salmon fisheries on the island portion of the province. Although historical enhancement projects relied primarily upon the introduction of exotic species to restore or improve angling opportunities, modern day stocking operations generally utilize native species and, where possible, native brood stock to the stocking region. Stewardship groups, such as the Salmonid Association of Eastern Newfoundland (SAEN), or the Salmon Preservation Association of Western Newfoundland (SPAWN), raise funds through social events, obtaining publicly available government grants and collecting membership fees with the goal of spending accumulated funds on enhancement programs. The Department of Fisheries and Oceans (DFO) oversees such enhancement programs and makes sure they follow established scientific guidelines and are implemented according to relevant regulations.

Over the last three decades, SAEN initiated or was involved in many enhancement projects that sought to increase numbers of wild salmonids (SAEN, 2013). In 1984, SAEN initiated an aggressive enhancement project on Rocky River, located in St. Mary's Bay on the Avalon Peninsula of Newfoundland. The Rocky River Enhancement Project saw the plantation of salmon eggs, fry, and adults between the periods of 1984 to 1996 (Bourgeois, Murray, and Mercer, 2000, p. 3). According to the Department of Fisheries and Oceans (DFO, 2013, p.

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from "contamination". As knowledge of the importance of genes has increased (Redford et al., 2019), so has the desire to manipulate some species, and protect others.

13), this project also saw the construction of a concrete fish way to allow passage of anadromous Atlantic salmon and to enable returns to be counted, creating an additional 2300 hectares of Atlantic salmon habitat. Rocky River was not a historical salmon river as no anadromous Atlantic salmon were present within the river (DFO, 2013, p. 4). An impassible eight-meter-high waterfall at the location where the Rocky River met saltwater was blamed for the absence of wild anadromous Atlantic salmon (SAEN, 2013). Historically, the Rocky River did not have any wild sea-going salmon traveling downstream from the falls. These salmon would be caught due to their inability to traverse the falls. C.H. Palmer, commissioned by the Dominion of Newfoundland government to write a guide on the salmon rivers of Newfoundland in the early 20th century noted that "good fishing could be had for sea-trout and salmon below the falls" (Palmer, 1928/2005, p. 242). At present, Rocky River remains Canada's newest salmon river and now has a self-sustaining population of wild Atlantic salmon (SAEN, 2013). Although some challenges remain, for example, the marine survival of Rocky River smolts remains low (DFO, 2013, p. 9), the project was widely accepted to be a success by conservationists and anglers. This project exemplifies enhancement stocking and expansion of sport fish habitat. This ties into the colonial improvement approach associated with acclimatization. Rocky River was not SAEN's only Atlantic salmon enhancement project. Other SAEN projects include the Rennie's River restoration project and a variety of sponsored scientific studies conducted through academia (SAEN, 2020).

SAEN is not the only conservation group that has undertaken Atlantic salmon enhancement projects in Newfoundland. SPAWN also spent considerable funds, time and effort on several high-profile enhancement projects. Such projects sought to increase the number of returning adult Atlantic salmon to rivers with dwindling, or crippled, populations and to educate the public on the importance of Atlantic salmon conservation through catch and release angling. One relatively recent project that was commenced by SPAWN was the Corner Brook Stream Restoration Project. The project saw the installation of a fishway at a renovated pulp and paper dam along with the stocking of young Atlantic salmon fry (Crocker, 2013). The project was deemed largely a success with increasing numbers of salmon returning annually and remains an important tool for educating young people about the importance of conservation.

Exploits River Enhancements

Perhaps the most successful example of salmon enhancement on the island of Newfoundland took place on the Exploits River. Human focused industrial manipulation of the river began in 1890 (Taylor and Bauld, 1972, p. 4) and expanded in 1909 with the construction of a major pulp and paper mill, initiating the first of many major industrial developments on the Exploits River. In tandem with the development of industrial projects on the river, developing the Exploits as a prime Atlantic salmon tourism destination became a priority. It was well known that Atlantic salmon existed on the Exploits and were used by the Beothuk (O'Reily, 1959, p. 9). Spearing and netting fisheries for salmon took

place elsewhere in Canada (Parenteau, 2004, p. 441), and it is likely the Beothuk conducted similar activities on the Exploits. However, salmon populations were understood to be below the maximum potential of the river system prior to human modification, as spawning habitat made up only five percent of the potential (Taylor and Bauld, 1972, p. 2). As historically, the Exploits Atlantic salmon were being obstructed from using so much of the watershed, returns remained low.

In 1983, a group of members of the Grand Falls Chamber of Commerce met with the intention of improving the Exploits River, turning it into a world-class salmon fishing destination (Environment Resource Management Association [ERMA], 2016). The result of this meeting would be the creation of the Environmental Resource Management Association (ERMA). ERMA functioned by working in partnership with DFO to enhance Atlantic salmon habitat and numbers in the Exploits River. ERMA planned to continue and expand on work which began in the 1970s (Davis and Farwell, 1975, p. 2), that sought to improve on the existing run of wild Atlantic salmon on the Exploits River through aggressive habitat enhancement and stocking. Over the next few decades, a variety of physical enhancements, stocking, and fish passage construction programs were initiated. A Salmonid Interpretation Centre was also constructed and contained a trap with a viewing window to educate tourists and students of the importance of Atlantic salmon conservation. As of 2021, The Exploits River still boasts a return of fish that varies annually but sometimes number well above 20,000 individual salmon. ERMA achieved the goal of improving the Exploits River for tourism and angling exploitation in line with the colonial acclimatization projects of the past.

Rennie's River Enhancements

Rennie's River is a small fast-flowing watershed that drains Long Pond, located within the boundaries of the City of St. John's, Newfoundland. Rennie's River historically was populated with wild brook trout and Atlantic salmon, and there are historical and anecdotal accounts of residents engaging in successful salmon angling (Hustins, 2010). Unfortunately, due to increasing industrialization and eventually urban development, the wild Atlantic salmon on Rennie's River was thought to have been lost sometime during the mid-20th century. Pollution during the industrial revolution and population growth, which led to destroyed river habitat, were seen as the main causes (Smith, 2012). The introduction of the non-native European brown trout to many watersheds on the Avalon Peninsula, including Rennie's River (Hustins, 2007, p. 30), was also suggested as a possible factor in the decline of wild Atlantic salmon on Rennie's River (Hustins, 2007, pp.102-103). Had the continuous quest to improve local angling through acclimatization contributed to the elimination a native species? This dilemma is recent and hints at the shifting value attached to stocking non-native angler-fish species. A new fishery opportunity was created. However, with the loss of Atlantic salmon on Rennie's River, brown trout flourished—to the extent that at one time Rennie's River boasted the highest density of brown trout in the world (Suncor Energy Fluvarium, 2019). The introduced brown trout made for new angling opportunities. Anglers could pursue brown trout in the upper boulder-strewn sections of the river, or target sea-run browns at the mouth of the river at

Quidi Vidi. These opportunities, it is now understood, came at a cost however: the loss of the wild Atlantic salmon run on Rennie's River.

The Salmonid Association of Eastern Newfoundland (SAEN), with the support of several private corporations, government bodies and non-governmental organizations, initiated an aggressive habitat and stocking program during 2013 to reintroduce Atlantic salmon back into Rennie's River (CBC News, 2012). The project was named the Rennie's River Enhancement Project with initial stocking occurring during the Fall of 2012. Eggs were provided with the assistance of the Environmental Resource Management Association (ERMA) and brood stock came from the Exploits River (Smith, 2012). As I was working on the project we made an interesting discovery, one that led some members of the organization to question the value of continuing the project. Following the installation of a DFO-funded smolt-counting fence (see Fig. 5), a large 55 cm kelt, an adult Atlantic salmon that had spawned the previous Fall, and several three- and four-year class Atlantic salmon smolt were found in the counter. In other words, many of the Atlantic salmon that were counted in the smolt counter in these age classes indicated they were naturally conceived in the wild. This meant that there were wild Atlantic salmon already present in the system before the stocking program. Rennie's River, contrary to the scientific and public knowledge, had, against all odds, been found to harbour a small population of wild Atlantic salmon.

Fig. 5. Rennie's River smolt fence (SAEN, 2020)

The discovery of wild Atlantic salmon on Rennie's River placed SAEN in a somewhat difficult position. Although SAEN's enhancement efforts were well-intentioned - seeking to restore wild salmon populations… the revelation that the river already had a population of wild Atlantic salmon placed the restocking component of the project into question. Introducing brood stock from another river system or hatchery may provide an additional source of competition for native fish (Wild Trout Trust, 2012). Controversies like this one lie at the heart of the

hatchery debate. Indeed, earlier fish- management paradigms that took the position that a "'trout is a trout" and more fish is better than less were eventually overturned during the mid-1990s. Wild trout became revered and treasured and stocking became increasingly frowned upon as knowledge of the impact of introduced fish on wild fish grew (Snyder et al., 2016, pp.12-15). Presently, be it an introduced non-native fish competing with a native fish, an artificially propagated Atlantic salmon competing with an endangered wild Atlantic salmon, or a hatchery steelhead trout being released into a river in the Pacific Northwest, stocking of fish into wild ecosystems is complicated, often controversial, and challenges normative settler colonial understandings of nature, technology and culture.

Angling Enhancement: a double-edged sword

Many argue that stocking activities are beneficial and serve to restore nature. In cases where wild salmon or trout have been nearly extirpated, introducing artificially raised fish has generally been interpreted as positive by biologists and conservationists. However, such glorification of stocking, of quantity over quality, neglects the fact that each river contains a unique stock of wild fish. Advances in genetic research have shown that even the tiniest of streams may be home to genetically distinct fish populations. Due to genetic drift, Newfoundland has many populations of genetically distinct Atlantic salmon found nowhere else in the world (Adams and Cote, 2010). Indeed, each freshwater system contains fish with genetic histories unique to that particular system with

some being more unique and genetically isolated than others. Present scientific arguments suggest that stocking may in fact cause more damage to wild populations. It would, perhaps, be preferential to refrain from contaminating and possibly compromising wild fish gene pools through activities such as stocking. Although native fish could potentially be captured and used as brood stock for fish egg propagation and planting; this is often expensive and logistically unfeasible. There is also the added concern that introduced fish may provide a source of competition for existing wild fish, thereby further reducing the reproductive capacity of wild fish. One of the most shocking examples of the failure of stocking and the widespread damage to salmon rivers, through damming and subsequent fish stocking for example, is in the Pacific Northwest of North America.[24]

Over the last three decades many more rivers have also been enhanced on the island of Newfoundland. Such enhancement programs must go through long, often complicated review and approval processes. Stocking is now heavily critiqued among the scientific community and has become increasingly contentious. Many argue that stocking a wild ecosystem with domestically raised fish genetically bottle necks the gene pool or reduces the fish's ability to survive in the wild. Yet, the practice continues. It is often crucial to tourism, as Michael

[24] The Columbia River, running through two countries, two states and one province, has had eleven dams installed between 1938 and 1972 on its main stem and many more on the dozens of tributaries that feed it (Scott, 2009). Fish runs that once saw nearly sixteen million adult salmon returning to spawn per year now only produce less than a million adult salmon annually. Of those million returning fish, four-fifths are produced in hatcheries (Lindholt, 2011, p. 138). Indeed, settler colonial activities have been a disaster for wild salmon on the Columbia River plateau.

Del Vecchio (2010) noted in his study of sports angling in Ontario; without stocking anglers will not come. Although managerial regimes now view native fish as superior to non-native fish, there is still a desire to continuously improve and refine wild fisheries. Fish stocks have been continuously quantified and understood as something to be built upon and improved, perhaps even maximized. If a lake contains 3,000 fish it may be enhanced to increase the amount of fish present to 4,000, or perhaps 5,000 fish. Modern enhancement programs embody the *legacy of conservation* directly linked to colonial commodity frontiers (see Fig. 6).

Fig. 6. Environmental Resource Management Association (ERMA) logo at the Salmonid Interpretation Centre, Grand Falls Windsor, NL Canada. 2016.

Throughout the ages, viewing nature and culture in oppositional and dualistic terms (Strauss, 1953, p.11), people have sought to improve upon the "natural" human condition and, in many circumstances, attempted to improve upon human and more than human natures. As part of the so-called Columbian Exchange, activities of conservation groups in the colonial period whereby animals and plants (as well as technology, ideas and diseases) were transferred from Europe to the Americas, elucidates well European men's obsessive desire to improve, control and dominate nature (Nathan and Qian, 2010). Whether it be

the colonial powers and their acclimatization projects or the modern-day conservation groups such as SAEN and ERMA, humans have maintained a progressive, modernistic view of expanding fish habitat and employing methods such as stocking and habitat enhancement to improve nature. This was especially true in cases where natural environments were being industrialized, such as in the damming of the Exploits River in Newfoundland, or the manipulation and artificial fish runs of the Columbia River in the United States. The commodification, destruction, and disruption of wild ecosystems become legitimated and acceptable to the public when ample attempts to compensate for the loss of fish habitat and stocks are undertaken at the behest of EIAs, even when wild systems and fish populations are seriously and adversely impacted. In the case of the Columbia River Plateau in the Northwestern United States, biologists warned in the 1940s that the damming of rivers would cause irreparable damage to wild fish stocks. Damming continued causing irreversible damage to salmon and other wild fish stocks. The public was assuaged when damage to fish migration and habitat was “mitigated” in the form of fishways, hatchery installations and fish-relocation (White, 1995, pp. 96-8; Lindholt, 2011, p. 135). Human efforts to manage wild fish stocks in industrial environments changed from preventing damage to simply mitigating it. When Vale Inco converted Sandy Pond, a large lake near Long Harbour, Newfoundland, into a tailings pond for a hydrometallurgical (hydromet) nickel processing plant, a fish habitat compensation program was proposed by the chief proponent and accepted by the Canadian government (Canadian Legal Information Institute,

2013). Although many argued, mainly through an aggressive lobbying group of academics and environmentalists, that Sandy Pond and the fish stocks that resided there, were genetically unique and ultimately irreplaceable (Canadian Legal Information Institute, 2013), the pond was destroyed and today serves as a tailings pond for Vale Inco's operations. Sandy Pond, like the Columbia River, was sacrificed in the name of progress and modernization. The DFO accepted Vale Inco's habitat-compensation plan that "created" and "improved" upon the habitat and fish populations lost.

The so-called "improvement" of other watersheds through habitat restoration and stocking activities often legitimates or is seen as some form of compensation for the destruction of natural, wild ecosystems. Hatcheries are always attempting to compensate for lost and destroyed fish habitat and populations. Although hatcheries traditionally acted as agents of fish enhancement and restoration, today they are, as in the case of Newfoundland, centers of industrial aquaculture production. Human culturing of fish continues, although today it is primarily done in the name of economic gain and profit, rather than for habitat conservation or to produce local food sources. In the imagined world of corporate fish farms, nature and culture are divisible, separate, and distinct. In practice, however, the boundaries between nature and culture are blurred, complex and intertwined. Few wild Atlantic salmonids are now eaten, nearly all fish consumed are farmed (Lien, 2011). Human-created structures such as fiberglass hatchery tanks and nylon growing cage nets are compromised through destructive natural events such as storms, increasing temperatures due

to climate change, or floods. Predators outside sea cages may compromise nets and allow domesticated fish to escape into the wild. Aquaculture operators in Newfoundland know this better than most and have had millions of dead and escaped fish on their hands. Since commercial farming of salmonids began in Newfoundland during the 1980s, leading up to 2014, nearly a million domesticated salmon and trout had escaped from their sea cages into the wild (Atlantic Salmon Federation, 2014). The number of escaped salmon is possibly far higher at present. That these escapees have had negative impacts on wild populations of Atlantic salmon is no longer a hypothesis, but rather scientifically demonstrated (CBC News, 2013a; CBC News, 2018b, Dean-Simmons, 2021A). To contemporary Atlantic salmon anglers, the sheer number of aquaculture escapees is deeply troubling, leading to public criticism of the aquaculture industry in the province.

Conflict between the aquaculture industry and angling groups

The conflict between angling conservation groups and the aquaculture industry is a relatively new phenomenon in the history of angling. In fact, if one were to travel back to the 1980s, they would find angling groups and the incipient aquaculture industry working side by side. Throughout the 1980s, salmonid aquaculture in the form of aquaculture and fish culturing was a shared project between the aquaculture industry and conservation groups (Kincaid and Stanley, 1989; Montgomery, 2003, pp. 152,165). The motivations were to provide a steady flow of income in the face of diminishing returns due to lost wild stocks (Sinclair

and Ommer, 2006, p. 147). Colonial conservation groups and angling clubs pioneered these stocking technologies (Naylor, Eagle and Smith, 2003, p. 20) which were eventually utilized by the industry to kick-start industrial-scale fish farming operations.

The collaborative relation between industry and conservation during the 1980s and 1990s would see the Atlantic Salmon Federation (ASF) and its partner organizations develop advanced scientific genetic and breeding programs for the industrial-scale culturing of Atlantic salmon (Reid and Benfey, 2012). Some of the first smolt supplied to salmon farmers were provided to salmon farmers by the ASF as the growth of the commercial industry was threatened by the availability of smolts (Reid and Benfey, 2012, p. 19). Historically, industrial salmon farming was initially supported, and even financed, by conservation groups such as the ASF (Reid and Benfey, 2012, p. 19) and the commercial activity was pioneered in collaboration with conservation groups in Canada in the late 1970s and early 1980s (Farquharson, 2018). The very wild spaces, like rivers and oceans, that were once protected and enhanced in the name of colonial acclimatization and conservation enhancements are also being utilized for industrial salmonid production on a massive scale. The expansion and continuation of salmonid conservation and salmonid aquaculture has led to the continuation of commodity frontiers and a situation where farmed Atlantic salmon make up over 99% of all salmon in existence. This is illustrated by the fact that all Atlantic salmon that reach the market are now farmed, not wild.

Up to the late 2020s, an ongoing controversy between the salmonid aquaculture industry and salmonid angling conservation groups has been fought. Arguments about diminishing salmon returns near large-scale salmon farming operations and concerns about the impact of increasing numbers of salmonid escapees, are primary points of contention between industry and those opposed to it (Atlantic Salmon Federation, 2014; Tourism Consulting Associates, 2000 p. 6). I witnessed such conflicts while attending regional workshops on aquaculture in the Bay d'Espoir region. Atlantic salmon farming is a contentious subject in the region and has led to conflicts between the industry and local fishers. Despite aquaculture being identified as a potential risk to wild fish populations in the report of the Committee on the Status of Endangered Wildlife in Canada (Adams and Cote, 2010), industry continues to expand. And with this expansion comes unavoidable growing pains and mishaps. As mentioned earlier, the Atlantic Salmon Federation (2014) claimed that nearly a million salmonids have escaped from the ocean pens since industrial aquaculture commenced in Newfoundland. In response to this and similar claims, Greig, a Norwegian-owned salmon farming giant, in the last couple decades, turned to developing so-called "escape-proof cages" in response to concerns regarding detrimental impacts on wild fish put forward by both government scientists and angling conservation groups (Thorstad et al., 2008*;* CBC News, 2016, Rigby et al., 2017). Such escapes are not limited to Newfoundland however, as farming operations elsewhere and the associated escapees have now established reproductive populations in the Pacific Ocean as well as in their native range in the North Atlantic (Lien, 2005). In

other areas of Atlantic Canada, the aquaculture industry has criticized angling conservation groups for their salmon enhancement stocking projects, suggesting that the conservation industry is no less guilty of influencing wild fish populations (Power, Melvin and Mather, 2021, p.8). The conflict between industry and those opposed to their activities will likely continue to play out within the public sphere in Newfoundland and Labrador and elsewhere.

The Atlantic Salmon Federation (ASF), a powerful NGO composed of mainly well-off salmon anglers, has engaged in public-relations campaigns to raise public awareness of the threats posed by ocean-pen aquaculture. The ASF's anti-aquaculture stance was evident in their highway billboard ad campaigns (Atlantic Salmon Federation, 2012a), a dedicated website for cleaning up salmon farming (Atlantic Salmon Federation, 2012b), and their full-length feature documentary called *Salmon Wars,* (on the threat of the salmon aquaculture industry in Nova Scotia) (Cameron, 2012). In addition, the ASF frequently publicized conflicts with salmon aquaculture industry officials in the form of media releases and media appearances. While the ASF has battled the industry, television personalities and celebrities such as David Suzuki (2014) and Pamela Anderson (see Braden, 2016) have also called for a shift from open-ocean pen aquaculture operations towards closed-containment facilities. Although such calls are well-intended they are essentially advocating for a techno-fix to the problem, dodging the ongoing violent colonial history that introduced fish acclimatization to Newfoundland and Labrador, and like catch and

release valuing the fish as a commodity first and living being a distant second or third to fish as food.

According to Johnston (2018, p. 620) the term technological fix, or "techno-fix" was coined by technologist Alvin Weinberg in 1965 as being a "vaunted engineering innovation as a generic tool for circumventing problems commonly conceived as social, political, or cultural." Johnston further suggests that "the reliance upon technological solutions to address human problems is arguably a human trait, but it has become a more ubiquitous aspect associated with modernity over the past century". In Western society the preferred approach is to engineer or create technological solutions to problems rather than to step back and examine why problems arise in the first place. For many problems, all the scientific research and technological innovation in the world often leads too little, if any, improvement (Sarewitz and Nelson, 2008, p. 871). Modern approaches to problem framing and solutions have focused on fixing our way out of problems through increasingly complex technological solutions, even when the solutions produce further unanticipated problems demanding expanded technological solutions (Johnston, 2018, p. 639). With regards to aquaculture, closed containment, while possibly more ecologically friendly, is the next logical step in the technological ladder of fish farming and husbandry.

Although fish culturing, stocking and habitat enhancement were initially developed for conservation purposes, such interventions, in certain circumstances, can often manifest new or additional problems (Cassidy and Mullin, 2007, p. 95; White, 1995, p. 47). Negative views held by conservation

groups on the expansion of the salmonid aquaculture industry contrast with conservation group enthusiasm for wild-fish population enhancement through stocking and habitat management—despite the possibility that fish enhancement may also be understood as a detrimental activity. While some advocates and organizations like the Atlantic Salmon Federation (ASF), Environmental Resource Association (ERMA), or Salmonid Association of Eastern Newfoundland (SAEN) may argue that the benefits of enhancement programs outweigh the associated costs and risks, it remains unclear what the benefits, costs and risks actually are. The argument that low wild-salmon stocks should be provided protection has gained support in relation to the argument that precariously low wild salmon stocks should be helped through stocking programs or enhancement. The debate on whether to stock, or not to stock, remains highly controversial and contested; conflict prevails.

Both salmon farming and conservation enhancement stem from a troubled history of artificial fish propagation within the European colonial context, initially carried out for the purpose of enhancing recreational angling opportunities for settler colonists. The fish propagation technology developed during the same period remains in use by both groups at present day, and although their goals are drastically different, they have both enabled the creation and exploitation of commodity frontiers originally established by European empires namely by the British in Newfoundland. The resulting industrial aquaculture Atlantic salmon industry is reliant upon but also devaluing wild Atlantic salmon that live outside of the cages on the shorelines (Power, Melvin, and Mather, 2021).

Commodity frontiers have led to a legacy of land theft and extractives tied to imperial colonial institutions and societies that exclude Indigenous ways of knowing and being with fish. Both the aquaculture industry and conservation groups continue to assert European cultural dominance and utilize civilizing language when it comes to arguments in favour of aquaculture. Through this belief, fish are understood as capital and represented as numbers . Such discourses uphold the fundamental dualistic notions of nature and culture, and of humans and wildlife (Todd, 2014, p. 218). These modernist belief systems exclude Indigenous ways and other non-modern understandings of fish. The dominant wildlife management framework in Canada, the North American Wildlife Model of Conservation, as Elcher and Baumiester point out, has been criticized for excluding Indigenous people and fails to incorporate Indigenous knowledge into resource management policy. This is perhaps because Indigenous people (specifically the Mi'kmaw) view wildlife and nature differently from settler governments and other resource users that utilize the North American Wildlife Model of Conservation. For the Mi'kmaw, animals are spirited beings on an equal level of existence with humans, while for governments and other resource users, those same animals may be understood as resources or commodities to be exploited. While the North American model of Wildlife Conservation has made efforts in the past to include Indigenous people in the management process (Mahoney and Geist, 2019, p. 34), Indigenous people have, in the past, been excluded from governance or reparations through land being given back (Mahoney and Geist, 2019, p. 33). Because the North American Wildlife Model of

Conservation was a European settler construction that was enabled by the Columbian exchange, Indigenous knowledge of wildlife was not and cannot be incorporated into the model (Mahoney and Geist, 2019, p. 5). This has led to an increase in fishing conflicts between Indigenous people and settler states (Ibid). Historical expulsions of Indigenous people from territorial lands, the projection of game-use regulations upon Indigenous people in violation of treaty obligations by Canada (TRC, 2016), and a general lack of trust in Indigenous people's capacity to self-regulate their use of wild resources, all contributed to increased tensions and violent conflict (Mahoney and Geist, 2019, p. 34). For many Indigenous people, the North American Wildlife Model of Conservation is understood as a colonial entity. Although today Indigenous people may be consulted in various capacities, these are often empty gestures and usually have little long-term impacts nor do they address sovereignty and the return of the land. Historic wrongdoings continue to haunt present relations between fish, settlers and Indigenous peoples (Hanrahan, 2003, Mahoney, 2019, Todd and Davis, 2017). These realities are present in Newfoundland, Canada's last frontier for Atlantic Salmon farming (Knott and Mather, 2021).

Chapter Four. The Development of the Aquaculture Industry in the Province of Newfoundland and Labrador

In chapter three, I established the idea that salmonid conservation was well-entrenched within imperialism and colonial relations. Considering this legacy, in this chapter, I will outline the growth and development of the aquaculture industry within the province of Newfoundland and Labrador and examine how a similar logic has facilitated the growth of the industry within the province, despite opposition from conservation groups. The important thing to keep in mind around ongoing calls for expansion is that it never seems to occur to industry proponents, government, and advocates for the industry that there are human consequences involved with such expansion: both to Indigenous people and to European settlers. Next, in chapter five, I'll consider the issue of escapees from aquaculture operations and how the aquaculture industry has, somewhat awkwardly, attempted to address this ongoing problem.

The Growth of Aquaculture in Canada

The growth of the aquaculture industry in Canada and around the world was mainly driven by developments in technology and increases in market access. Global markets where it was once impossible to deliver fresh product without spoiling, are now accessed rapidly with the help of airplanes and improved supply-chain networks. Some species, such as codfish, are not farmed commercially due to lack of demand, issues with supply chains, or feasibility surrounding the expensive nature of cod farming (Burke Consulting, 2000, pp. 2-

3, Bavington, 2010, pp. 95-96). Additionally, aquaculture producers are less motivated to farm cod when they can simply substitute the white fish fillet of cod with less expensively farmed or caught wild species such as tilapia or pollack (Bavington, 2010). Technological advancements are expected to help overcome such barriers to farming a range of fish species. In anticipation of this possibility, governments and rural development grant boards have spent millions annually in research and development in the aquaculture sector. The limited growth of cod aquaculture may also be attributed to its pseudo-appraised value as an inferior fish in comparison to the higher valued Atlantic salmon, where production is already advanced. Despite previous failures in research and production, cod aquaculture research continues but the development focus for provincial, federal, and municipal governments remains focused on salmon (De Guzman, 2019).

As the aquaculture industry grew over the last thirty years, controversy and conflict also grew in parallel. In 2015, the Newfoundland provincial government announced a major aquaculture expansion, a project that would see the construction of a $75-million-dollar salmon hatchery in Marystown/Placentia Bay (DEC, 2016; CBC News, 2015b). Roughly 2000 hectares of ocean space would be handed over to Norwegian-owned Grieg Seafood for open-ocean salmon farming (DEC, 2016a). The project, the largest of its kind in Canada, would lead to the operation of 11 sea cages growing out 29,937,096 kg of Atlantic Salmon annually (CBC News, 2015a). The provincial government of Newfoundland and Labrador received much criticism and opposition to which it responded. During an interview with CBC News, former premier Paul Davis was

quoted as saying: “Our goal is to work towards an agreement with Greig, but we want to make sure that we protect our environment, and that we take all the necessary steps to ensure that we’re doing it properly” (CBC News, 2015c).

Former premier Davis’s remarks suggested that the province was fully invested with industry and that the project would go ahead, however potential environmental impacts would still be considered. Many felt that the environmental assessment of the Greig project was completed, not out of genuine concern and respect for the environment, but simply to satisfy legal requirements and ensure that the project continued within the required legal framework. Environmental assessments are conducted with the purpose of assessing the potential risk of a project for environmental and wildlife damage. However, by pushing forward and then dragging the environmental assessment process on for years, public anger could be managed rather than confronted directly. Greig’s environmental-assessment process served to silence critics and quell conservation-minded opposition to the project, illustrating the central conflict of interest involved with government’s acting as both proponents/investors and regulators of aquaculture.

Given that the Newfoundland and Labrador Department of Fisheries and Aquaculture (DFA) serves dual mandates as both an industry promoter and regulator, the outcome of such environmental assessments may be compromised and lead to further debate and criticism by conservation and angler groups. Although the Marystown aquaculture project would later be approved following federal and provincial assessments (CBC News, 2016e), conservation and environmental groups fought back legally winning a court ruling against a

controversial seperate expansion of the aquaculture industry in Stephenville and on the south coast of the island (CBC News, 2020). Public debate on the legal, social, economic, environmental, and moral merits of the salmonid aquaculture industry played out in the province. Key opposition groups emerged and solidified their positions against the aquaculture industry in Newfoundland and Labrador. Nevertheless, the Canadian and Newfoundland and Labrador governments continue to be key players supporting the expansion of the Canadian aquaculture industry with an emphasis on farming Atlantic salmon.

Salmonid Aquaculture: ranching salmon

Atlantic salmon may be raised in hatcheries and produced, through the strictly controlled process of industrial aquaculture, from *egg to plate* (Bavington, 2010, p. 94).[25] Farmed salmon are valued as a commodity and are ranched in ocean pens until they reach market size and are slaughtered for sale and consumption (Power, Melvin and Mather, 2021, p.6). Atlantic salmon farming on an industrial scale was first practiced in Norway during the 1970s to produce a high-quality product for high-end consumers during the commercial salmon-fishing off-season. Norwegian farmed salmon were initially fed diets of ground up pelagic fish which limited the growth of the industry, but this was rapidly replaced by fishmeal and oil (Torrissen, 2011, pp. 258-259). Fishmeal mainly consisted of Peruvian anchovies (anchovies make up roughly 90% of all meal and oil) (Barlow, 2003, p. 2486). According to Naylor et al. (2000, p. 1022) the use of

[25] Egg-to-plate refers to the complete control of the farming of fish literally from egg to plate.

anchovies and krill may be a limiting factor in global aquaculture growth. The production of feed relies upon the stability of wild fish stocks, which fluctuate wildly. Naylor et al. (2000) further suggests that fishmeal could be replaced by plant-based soy, corn or other agriculture-based substitutions. They caution however that giving carnivorous fish a plant-based diet may have serious limitations. As a result of easily obtainable fishmeal and access to global markets, salmon farming expanded exponentially along Canada's Eastern and Western coastlines, including of course, around the coasts of the island of Newfoundland. As of 2011, Canada was the fourth largest salmon producer behind Chile, the United Kingdom, and Norway (DFO, 2011). The Canadian salmonid farming industry has grown at an exponential rate. During the year 2009, $635,000,000 worth of Atlantic salmon was produced in Canada of which 97%, approximately 73,000 metric tonnes, was exported to the United States. It is estimated that the Canadian aquaculture industry employs approximately 15,000 Canadians, generating $2.1 billion in annual revenue (DFO, 2011). The industry has grown by over 400% in Canada over the past twenty years or so, and as of the year 2018, the Canadian salmonid aquaculture industry was valued at a total of $1,114,163,000 (DFO, 2019). Between the year 2000 and 2018, the aquaculture industry on the island of Newfoundland expanded exponentially by 561% (Government of Newfoundland and Labrador, 2020). The industry provides varied seasonal and full-time employment to approximately 31,560 people (DFO, 2020). The provincial economy of Newfoundland and Labrador was decimated by mass layoffs in the early 1990s, after the federally imposed cod moratorium (Heritage

Newfoundland and Labrador, 2020). Overnight, roughly 30,000 Newfoundlanders lost their livelihoods and centuries-old lifestyles.

Initially, salmonid conservation groups in Canada were in favor of industrial salmon aquaculture as they believed the commercial salmon fishery was placing too much pressure on wild salmon stocks (Daniels and Mather, 2017, p. 16). The development of industrial aquaculture was understood to be shifting commercial fishing pressure away from wild stocks that had began declining in the 1980s and to which a commercial fishing moratorium was announced in 1993 one year after cod. As such, conservation groups such as the Atlantic Salmon Federation initially funded and supported salmonid research projects in the 1980s and helped foster the growth of the industry and the adoption of the large-scale technologies pioneered in Norway (Farquharson, 2018). Government and private industry saw the potential for salmonid aquaculture and pursued the expansion and development of the industry. The global commodity production of farmed salmon exponentially increased between the late 1980s and 2010s, while, conversely, wild Atlantic and Pacific salmon stocks, often present in areas adjacent to salmon farms, drastically decreased (Young and Matthews, 2010, pp. 8,11). Problems such as salmonid escapees, disease, and sea-lice infestations would plague the industry, leading biologists, and conservationists to push the argument that these problems posed a threat to wild salmon. Despite these arguments the growth of the industry continued.

Aquaculture industry growth in Atlantic Canada has been most prominent in the province of Newfoundland and Labrador. The South Coast of

Newfoundland was developed, with the promise of added local employment and a large portion of year-round ice-free coastline being preferred by the aquaculture industry. A lack of aquaculture industry regulation and availability of financial incentives also contributed to Newfoundland's status as an aquaculture frontier (Knott and Mather, 2021). Additionally, During the late 1980s both of Newfoundland's major commercial fish species, Atlantic cod and Atlantic salmon were both in serious decline which, contributed to a situation whereby aquaculture was seen by conservation groups to alleviate pressure on dwindling wild stocks. Aquaculture in Newfoundland, like aquaculture elsewhere, promised to take advantage of the full productivity of marine environments while alleviating pressure on already declining wild fish stocks (Young and Matthews, 2010, p. 5).

The Growth of Aquaculture in Newfoundland

Newfoundland's commercial aquaculture industry began during the late 20th century; the first mussel and salmon farms were constructed during the late 1970s, the first steelhead farms during the late 1980s, and the first cod farms during the early 2000s (Bavington, 2010). Aquaculture turned out to be a highly productive capitalist venture for Newfoundland, as evident when considering that the production of aquaculture in Newfoundland and Labrador doubled between 1998 and 2004 from $11 million to $22 million (Atlantic Canada Opportunities Agency [ACOA], (2012, p. 1). As of 2016, salmon farming sites in Newfoundland covered an area of over 25 km^2 and production was roughly 23 million kilos comprising a total value of approximately $263 million. Moreover, there was a

rise in salmonid production of 29% between 2015 and 2016 (Newfoundland Aquaculture Industry Association [NAIA], 2020). While Newfoundland blue mussel production has risen and as of 2019 was valued at roughly $13.6 million (NAIA, 2020) it has failed to achieve the same levels of growth as the salmon-farming sector which has been heavily supported by government grants, low interest loans, and foreign capital investment.

As of 2022, high levels of investment continue and following the announcement of Liberal Prime Minister Justin Trudeau's post-Covid-19 Canadian Seafood Stabilization Fund, over $62.5 million became immediately available for Canadian seafood producers and processors—of which $38.1 million was reserved specifically for the Atlantic Provinces (Government of Canada, 2020). We can see that Atlantic salmon became, and remains, the dominant aquaculture product of the province of Newfoundland and Labrador, followed by blue mussels in a very distant second. This is strange, when one considers that blue mussels lack the same level of environmental controversy as Atlantic salmon. This is more evidence of the Atlantic salmon's status as a highly sought-after table species. Although aquaculture, if viewed through economic measures of success such as GDP, has been for the most part a success in Newfoundland and Labrador, there have been growing pains, such as 2019's major salmon die-off on the south coast, known as the 'pink sludge' event from the graphic display of liquified dead salmon being pumped from net pens (CBC News, 2019a). Such massive die offs due to disease and temperature spikes do not result in the collapse of the salmon farming industry as federal and provincial

feed-load guarantees and other insurance allows for costs to be socialized while profits are privatized.

The multi-million-dollar Placentia Bay Atlantic Salmon project is an example of industry moving forward spurred on by generous public financing, loans and direct government investment with the promise of jobs for rural areas. The provincial government originally agreed to provide up to $45 million in support for the Marystown project (CBC News, 2016a). The Placentia Bay Atlantic Salmon project is nearing completion, but the facility remains under construction as of the writing of this paper. However, continuing economic troubles in Newfoundland and Labrador and the uncertainties created by the COVID-19 pandemic challenged project completion (VOCM News, 2020). The financial successes of such projects hinge on public investment and government insurance and other financial supports, such as: feed-loan guarantees, insurance when fish die or escape, provincial veterinary services and vaccines and public-private partnerships (PPP).[26] Very often at a diminished return on investment, government support is crucial for allowing industry to expand, often justifying millions in tax subsidies in the hope of a few dozen or a hundred jobs in return. In Newfoundland in 2017, for example, aquaculture production value reached over $276 million, a 70% increase from 2015 but between 2011 and 2016 the number

[26] A public-private partnership is "a long-term contract between a government agency and a consortium of private sector firms whereby the consortium provides a range of project services and at least some private capital" (Boardman, Siemiatycki and Vining, 2016, p. 2).

of people employed by the industry only grew by roughly 12%[27] (MQO Research, 2018, p.1, 8). Despite the industry seeing massive revenue growth with minimal job growth, many of which are seasonal or part-time, government remains committed to aquaculture in Newfoundland and Labrador.

A number of non-governmental organizations, development initiatives and business associations aim to influence the operation, growth and expansion of the aquaculture industry in Newfoundland and Labrador. While the Aquaculture Association of Canada, the Canadian Aquaculture Industry Alliance and a handful of other groups aim to exert influence related to aquaculture in Newfoundland from the outside, I think that the most influential private group within Newfoundland would undoubtedly be the Newfoundland Aquaculture Industry Association (NAIA). NAIA serves to "promote opportunities for aquaculture in Newfoundland and Labrador" (NAIA, 2020). It maintains aggressive marketing campaigns, defends association positions in the public sphere and partakes in lobbyist activities which aim to guide public and government opinions towards positive perceptions of the aquaculture industry. This is all done with the growth of the industry in mind. Although certain interest groups and associations have influence on the future development of the industry, the provincial government was, and remains, the main facilitator for aquaculture growth and promotion in the province.

[27] Employment in the aquaculture industry increased from 1940 in 2011 to 2175 in 2016 (MQO Research, 2018, p. 8).

A set of three policy initiatives that aimed to encourage investment in the aquaculture sector in Newfoundland and Labrador throughout the 2000s was put forth by the Department of Fisheries and Aquaculture (DFA) with the goal of maximizing industry quality, productivity and sustainability. The three main policy initiatives were developed in 1999 in response to the province's consulted Aquaculture Strategic Plan recommendations (Burke Consulting, 2000, p. 1). The various policy initiatives aimed to encourage new investment in aquaculture, minimize risk for potential investors and advance the existing aquaculture industry in the context of the collapsed commercial Northern cod and Atlantic salmon fisheries. The Aquaculture Working Capital Loan Guarantee program, the Aquaculture Capital Equity program and the now defunct Aquaculture Strategic Development Program all served as hubs for potential aquaculture investments that, given enough government support, could then be launched (Burke Consulting, 2000). These programs directly contributed to the growth of the industry in Newfoundland.

Newfoundland Provincial Aquaculture strategies

While salmon pen growth has been slowed through regulation elsewhere, Newfoundland's facilitative policies and financial assistance towards aquaculture have led to rapid growth of the industry (Knott and Mather, 2021, p.803). The first and arguably the most important policy in place to plan, facilitate, and direct growth and expansion of the aquaculture industry in Newfoundland and Labrador was, and remains, the Newfoundland and Labrador Aquaculture Strategic Plan

(DFA, 2020). The Newfoundland Aquaculture Industry Association, in partnership with the Atlantic Canada Opportunities Agency and Service Canada, the Department of Fisheries and Oceans Canada, the now-defunct provincial Department of Innovation, Trade and Rural Development, and currently named Department of Innovation, Business and Rural Development collectively assembled and formulated the Newfoundland and Labrador Aquaculture Strategic Plan (NLASP) during the summer of 1999 (DFA, 2013a). The purpose of the document was to provide a strategic plan through examination of existing data, industry interviews, detailed Strengths, Weaknesses, Opportunities and Threats analysis (SWOT) (DFA, 2020) and specific suitability and viability evaluations of thirteen species of shellfish and cold-water finfish. The document provided a guideline that outlined the risks and benefits associated with potential aquaculture species, along with a comprehensive list of recommendations with the intended goal of addressing industry concerns discovered during the review (Burke Consulting, 2000). Cost-reduction strategies, improvements to regulatory measures, market development, debt management and investment attraction were all important areas addressed in the NLASP. The plan was updated twice, in 2002 and in 2005, to address changing industry needs (DFA, 2013a). Lack of financing and investment issues were named as the primary concerns for the NLASP during the plan's development (DFA, 2013a). From the beginning, industrial aquaculture in Newfoundland and Labrador has always required considerable ongoing levels of public investment through Federal and Provincial government support.

The Aquaculture Working Capital Loan Guarantee program was designed in 2004 to meet the needs for improved financing for new aquaculture operations (Department of Fisheries and Aquaculture [DFA], 2013). According to the DFA, this initiative was and continues to be available to companies that were able to prove their business ability in areas such as technical skills and marketing. Providing the business plan of the applicant meets the requirements specified within the plan, the applicant becomes eligible for a maximum net loss compensation of 80% for losses incurred due to issues such as escapes, disease, feed purchases or labor costs (DFA, 2012a). Following the implementation of the Aquaculture Working Capital Loan Guarantee Program, productivity was doubled in the salmon aquaculture industry (DFA, 2012a). Thus, risk-related responsibilities from disease, escapes and feed costs were effectively transferred onto the shoulders of the provincial and federal governments while profits remained in private corporate hands. Atlantic salmon farming carries high risks due to high feed costs[28], and the uncertainty of the production of a healthy marketable stock of fish. The Aquaculture Working Capital Loan Guarantee Program (AWCLGP) helped the aquaculture industry in the Coast of Bays region, due to geographic-industry suitability advantages, achieve high growth rates (Newfoundland and Labrador Regional Economic Development Association [NLREDA], 2013). The AWCLGP provided the support and insurance needed for the salmonid aquaculture industry to grow and expand, despite facing many

[28] Approximately 1.15Kg of feed is required to grow 1Kg of Atlantic salmon (Skretting, a Nutreco Company, 2020).

challenges. However, it was not the only program which facilitated the explosive growth of the aquaculture industry within Newfoundland and Labrador.

The Aquaculture Capital Equity Program (ACEP) was the second aquaculture industry support program established by the provincial government (DFA, 2013a). According to the program brochure (DFA 2012b), the objective of the program was to provide additional funding for new aquaculture projects for the purposes of securing employment, establishing processing, constructing hatcheries, and increasing output, primarily within rural Newfoundland. The ACEP was launched in the early 2010s with the stated goal of revitalizing rural communities on the island. The provincial government would match private sector investments provided the applicant met program requirements. For shellfish operations, a minimum investment of $100,000 was required, and for finfish operations a minimum investment of $250,000 was required (DFA, 2012b). Industry operators were eager to take advantage of programs which enabled the continued growth of their business. For example, as of 2012, capital-equity investments in aquaculture made by the provincial government to Gray Aqua Group Limited ranged from $1 million to $5 million (Newfoundland and Labrador Government, 2012). Between 2006 and 2011, the program generated $35 million in repayable investments (Government of Newfoundland and Labrador, 2011). The ACEP provided a substantial means for the expanding industry to quickly generate investment in the industry's growth.

The third and final program, implemented during the early 2000s, that was instrumental in the expansion of the Newfoundland aquaculture industry was the

Aquaculture Strategic Development program (ASDP) (DFA, 2013a). The ASDP aimed to promote growth through a variety of means, including diversification of industry, increased funding, increasing competitiveness, increasing capacity, and improving quality and enhancing sustainability (DFA, 2011c). The ASDP ensured that feed loan guarantees were readily available to the industry. As feed costs comprise up to 80% of the financing costs of aquaculture, the provincial government's feed loan guarantees were welcomed from the industry. Without such government loan guarantees, salmonid aquaculture industry producers would not be able to afford to procure feed from feed producers, such as Shurgain or Cargill who do not deliver feed on credit without a loan guarantee. Feed loan guarantees ensure industry profitability and transfer financial risks onto the public (Bavington, 2010, p. 97). Feed loan guarantees do this by lowering the overall debt incurred by the aquaculture producer when purchasing feed for the fish to be cultured. Proposals for the ASDP initiative were only accepted after the applicant met the detailed requirements of the program and facilitated the production of Atlantic salmon, blue mussels, or steelhead trout (DFA, 2011c). Cod fish farming development projects were also funded through the development program. Funding for the ASDP program initiative was comparably lower than the first two program initiatives as outlined earlier, as funding did not normally exceed $100,000 per project (DFA, 2011c). The program was later terminated in 2014, placing increasing importance on the remaining two programs.

The Newfoundland Aquaculture industry (NAIA), Newfoundland Grower's Association (NGA), Human Resources Development Canada (HRDC), Department of Development and Rural Renewal (DRRR), National Research Council (NRC), and the Canadian Centre for Fisheries Innovation were all mentioned in the Burke Consulting report (2000) as commercial and research elements that also provide direct funding and support for the aquaculture industry. Activities as of 2019 ranged from collaborative applied research and development initiatives to industry trade shows and sustainability initiatives. According to Burke Consulting (2000, section 3.3) the rise of the aquaculture industry was attributed to several main factors: "a long coastline with many protected areas suitable for salmon farming, limited human settlements, low cost for labour, feed and water, and government policies that provided the foundation for aggressive development in the industry".

Despite significant investment and policy building for the development of the aquaculture industry in Newfoundland, it has generated limited jobs and had profound impacts on the surrounding ecosystems. The decline of Conne River salmon, continuous ISA outbreaks and common mass escape events of farmed salmon have all constituted major threats to the environmental sustainability of the industry yet funding continues and the industry continues to grow. Although provincial salmon production is worth over $200 million CAD in Newfoundland, this has only materialized in 414 direct jobs, many of which are seasonal or part-time (Knott and Mather, 2021, p.807). While aquaculture capital has increased following the implementation of these policies, jobs within the industry have

remained limited. The governmental policies have served to support and foster the growth of the salmonid finfish aquaculture industry in Newfoundland but the related impact on the local population has been unsatisfactory.

Having discussed the governmental policies which have supported the development and growth of the aquaculture industry in Newfoundland despite resistance from conservation and other groups, the next chapter addresses farmed fish escapees and how the industry responds to these problems through *techno-fixes.*

Chapter Five. Lost Inventory and Catching the Released

The effects of farmed salmonid escapees on the environment and changing attitudes toward escapees are the focus of this chapter. Escape events are increasingly occurring around the coast of Newfoundland and, uncannily, parallel the growth of the aquaculture industry itself. Moreover, escape events occur over longer time intervals and in increasingly larger numbers (CBC, 2013b). Despite industry efforts to recapture escaped fish (CBC News, 2018a), following such escape events local anglers often catch escaped farmed salmonids on adjacent, or even distant, river systems. As I found out while conducting my interviews with anglers, such escapees have been showing up on the Conne River system, located in the Bay d'Espoir region, for over two decades (Dempson, Furey, and Bloom, 1999). In addition, an abundance of both recent scientific studies and anecdotal reports (CBC, 2016c) provided strong evidence to support the hypothesis that escaped farmed salmonids are heading into local river systems. The Newfoundland aquaculture industry regulates such escape events through the Newfoundland and Labrador Code of Containment (The code) (Schoot and Mather, 2021). The code represents a complex set of regulations and requirements for industry, most of which fall short for actual containment and allow continuous, "seepage", escapes of farmed salmon and trout to occur (Schoot and Mather, 2021). These escapees interact and have affects on both human and non-human agents nearby.

Since the beginning of aquaculture in Newfoundland, the impact of escapees has been neglected, mirroring the development of aquaculture elsewhere. However, recent studies indicate that interbreeding between escapees and wild fish was (and is still) occurring in Newfoundland rivers and possibly to the detriment of wild fish (Karlsson et al, 2016). Usually, such escapees are distinguishable from wild fish, but not always. Without access to DNA analysis, or more specific fish identification techniques (Bell-Tilcock et al. 2020), it can sometimes be hard for anglers to distinguish between wild and farmed fish. Experienced anglers however, with years of catching and eating wild salmon and trout, claim that they can tell the difference. This was evident in my discussions with Miawpukek First Nation elders and settler recreational salmon anglers before and during my research. The sometimes-difficult nature of identifying escaped domesticated salmon may add to the problem of identifying the full extent of salmonid escape events.

A Note on Rainbow Trout

Almost all respondents in the study had caught non-native rainbow trout in Newfoundland. Rainbow trout are a non-native species to the island, though they were originally stocked in a very limited area in the 1960s (Hustins, 2007). The so-called rainbow trout caught by the anglers I interviewed were likely farmed salmonid escapees, or at minimum their naturalized descendants. Following the revelation that all anglers had caught escaped rainbow trout I shifted the focus of the project from experiences of catching escaped farmed Atlantic salmon to

experiences regarding escaped farmed salmonids, a term that includes both trout and salmon. I did this because in many angler estimations, salmon, and trout at their various stages of development and origins, are often hard to distinguish between one another without scale or genetic testing. Some anglers described how to differentiate an escaped farmed salmon from a wild one, while others said it wasn't possible to do so.

Rainbow trout, *Oncorhynchus mykiss*, are a species of salmonid that are native to the Pacific rim from Kamchatka to Mexico (Halverson, 2010, p. 45). They may express life cycles that contain freshwater or saltwater (anadromous) forms but in all cases, they must return too freshwater to spawn. Rainbow trout that migrate to sea are commonly referred to as steelhead (Behnke, 2002, p. 75). The mechanisms that cause some rainbow trout to migrate to sea are complex and not completely understood (Ibid, 71). Regardless, rainbow trout are unarguably the most popular trout in the world, and they are highly valued for both their table and sporting qualities (Ibid, 67). Because of their high status, rainbow trout were artificially propagated (Halverson, 2010, p. 33) and stocked around the world, especially in the vast British Empire throughout the 19th and 20th centuries. The aquaculture industry over time found that rainbow trout were a suitable commercial fish and industrial farming of rainbow trout began in the 1980s (Monterey Bay Aquarium, 2018). Farming of Rainbow trout in Newfoundland began in the 1980s and continues to the present, accounting for most of the aquaculture exports in tonnage for the province. The farming of rainbow trout/steelhead epitomizes the colonial legacy of acclimatization. Due

the commonality of large-scale industrial aquaculture within the province, escape incidents are not uncommon, and rainbow trout escape in such events.

When encountering escaped farmed rainbow trout on wild salmon rivers, some anglers understand the introduced rainbow trout as a wonderful food source. Given that the rainbow trout angling season on the Southcoast of Newfoundland is open year-round, for all residents of Newfoundland (DFO, 2017), this is not surprising. Rainbow trout could in some instances be filling a niche regarding food security that was previously absent. Since Atlantic salmon are seasonally present for only three or four months of the year, rainbow trout provide some anglers with a new opportunity to catch food when Atlantic salmon are either out of legal season or simply not physically present. Fish also remain an important component of Miawpukek First Nation culture. Recreational salmon angling was also economically important to the Mi'kmaw people of Conne River (Pinfold, 2011, p. 61) as many residents were employed as guides and outfitters.

When anglers were asked about eating escaped rainbow trout, some anglers preferred to catch the farmed fish while others would rather eat the wild fish. Some anglers from Miawpukek First Nation in Conne River were not overly enthusiastic about eating escaped rainbow trout. This importantly underlined the integral nature of fish in food security in the area. Salmon, or rainbow trout, was a food source for the whole family, not just the person catching the fish. Consistently, respondents described catching fish and sharing it with family members and community elders who are unable to go fishing themselves. The fish were caught and kept for food, not for sport. So much so that Miawpukek

First Nation anglers even commented on the quality of the wild salmon compared to farmed fish and farmed fish were sometimes described as being too oily to eat. Many anglers prefer to catch and eat wild salmon rather than escaped farmed fish.

Perhaps somewhat surprisingly, some anglers enjoyed the taste of farmed rainbow trout. A minority of Mi'kmaw anglers from Conne River expressed such opinions. The meat of rainbow trout was valued for its uniqueness. Both positive and negative assessments of the taste of farmed rainbow trout were related to the farmed fish tasting oilier than wild salmonids. Wild Atlantic salmon were drier, and most often more highly sought after than farmed rainbow trout. Some anglers even described the taste of rainbow trout improving after being in the wild for a prolonged period, as the fish would use up their fat reserves and the taste of their meat would improve. Similar taste preferences for escaped farmed salmonids have been described in the West coast of Canada (Schreiber, 2002).

Rainbow trout, in some circumstances, are understood to be a new food source. The taste of farmed rainbow trout was a commonly mentioned topic among anglers who consumed them, with many respondents suggesting that rainbow trout that had escaped from a fish farm tasted differently from wild salmonids. The taste of escaped rainbow trout was one of two topics that dominated discussions with anglers on the south coast of Newfoundland fishing in rivers adjacent to fish farms.

Rainbow Trout Interactions with Wild Ecosystems and Salmonids

The other, perhaps somewhat more concerning topic that was continuously brought up during my discussions with Miawpukek First Nation anglers was the impact that escaped farmed rainbow trout were having on wild ecosystems. Repeatedly, Elder anglers described the invasive rainbow trout as being aggressive, abundant predators that were negatively impacting wild salmon. What I found most surprising was that these rainbow trout were described in detail, including the contents of their stomachs. Anglers spoke of the fish as eating strange things. The rainbow trout were compared to other non-native invasive species. Just as the coyote is blamed by many Newfoundlanders for the decline of moose and caribou populations, the rainbow trout is being blamed for the decline of Atlantic salmon on Conne and Little rivers and their general decline in the Bay d'Espoir region over the last twenty years. Anglers described catching rainbow trout with metal and garbage in their stomachs. The rainbow trout were described as invaders and were blamed for eating wild salmon eggs and occupying spawning habitat.

Rainbow trout are present in Conne and Little rivers and the impact of their presence on anglers was overwhelmingly described as being negative. Although rainbow trout are recognized and understood to constitute a new angling opportunity by some, they are also concurrently recognized, by others, to be a real threat to the endangered wild salmon populations. Once escaped farmed rainbow trout are recognized and understood to be threats to existing wild salmon populations, the urgent importance of removing and destroying the "invader"

takes precedence and becomes a priority. Some anglers suggested that the rainbow trout must be destroyed, or at minimum removed from the water. Some of the anglers I spoke with remembered times in the past when they thought catching a few escaped rainbow trout was a good thing but their minds have changed. The salmonid aquaculture industry has expanded in Bay d'Espoir concurrently with the dramatic decline of wild Atlantic salmon on the Conne and Little river systems. This has led to a reconceptualization and re-valuing of escaped rainbow trout for some anglers who now see them as a threat.

Escaped Farmed Fish: A Threat or Lost Opportunity?

As Dwight Blackwood, a popular outdoor host of the 1990s television show *Newfoundland Sportsman*, is seen reeling in and landing an escaped farmed sea-run rainbow trout, otherwise known as steelhead trout, he exclaimed; "Boy. What a pretty fish!" (Vatcher and Langille, 1996a, 12:15) and then concluded with "Oh man, this makes my day." (Vatcher and Langille, 1996a, 12:40). Dwight Blackwood continued fishing and exclaimed to his co-host Paul Amminson:

> *I'm telling ya Paul, I love this. I must have the honey hole!" "Isn't that a beaut what? Isn't that a beaut. I'm soon up to my limit. I'd say one more like this and I might have to give it up, or start releasing . . .* (Vatcher and Langille, 1996a, 13:30).

Later In the same episode Dwight gently released an escaped rainbow trout and said:

> *Let's put this guy back now for somebody else to catch. It sort of breaks my heart to do it, but that's the only way you can conserve these species.* (Vatcher and Langille, 1996a, 24:20).

Television host Dwight Blackwood's testifies to how escaped rainbow trout in Newfoundland were first understood with gratitude and appreciation, not contempt. In the 1990s a rainbow trout was more free lunch than exotic invader, a resource to be conserved rather than a risk to be mitigated or pollutant to be removed. Anglers would travel from far and wide to catch the escaped farmed fish to eat; locals also stood to gain from the unintended introduction of exotic rainbow trout into the waters of Bay d'Espoir on the south coast of Newfoundland. These rainbow trout, having escaped from their ocean growing pens, provided new sporting and economic opportunities that were not previously available in the geographically isolated and economically depressed Bay d'Espoir region. Anglers were not alone in their desire to capitalize on the fish farm escapees; local municipalities also envisioned a bright and lucrative sport fishing future build on them. In the same Newfoundland Sportsman episode, Brian Strickland, a coordinator for the Bay d'Espoir Development Association spoke positively of rainbow trout escapees in this 1996 episode:

> *One of the biggest impacts, I guess, from our point of view, as a development association, with the rainbow trout and the aquaculture that we have is the jobs that's being created through aquaculture but then there's an unforeseen spin-off that, we ah, no one anticipated with the number of fish that are getting loose from the cages and what have you; and this is turning into a recreational fishery so really its adding a lot to our tourism industry and it's a good drawing card for the area.* (Vatcher and Langille, 1996a, 16:00).

Strickland continued:

> *And the area right now, at this point, as we speak, are really finding the effects of this recreational fishery. We do believe that this is just the tip of the iceberg and if we advertise it properly and enough people become aware of it then it's got nowhere to go but up and we're fairly excited about*

> *it. A matter of fact we've even made a festival, a folk festival, around the rainbow fishery and we call it the Rainbow Folk Festival. We had it last year, and we're definitely going to have it again this year and we hope it's going to be an annual event. It's something we can build on.* (Vatcher and Langille, 1996b, 2:20)

The Bay d'Espoir Development Association was intent on capitalizing on the newly established aquaculture industry in Bay d'Espoir. Aquaculture was seen to revitalize a region still suffering from the collapse of North Atlantic cod and the ensuing 1992 cod fishing moratorium, and the closure of the commercial Atlantic salmon fishery in 1993. The development association understood aquaculture escapees as an opportunity for a "spin-off" industry tied to exploiting escapees from the aquaculture operations themselves. Escape events were common occurrences that were not seen as a problem or something to prevent. Clyde Collier, former local manager with SCB Fisheries Limited, an aquaculture company, admitted this:

> *While the fish that are out there swimming around will probably be around for two to three more years there will be continual trickle losses from the farm [emphasis added] so as long as we have fish farming in this area you're going to see a really good sports fishery for steelhead.* (Vatcher and Langille, 1996b, 24:30)

Clyde Collier's statements at the time demonstrate that there was no concern for the escaped fish within the region. We can also see that the aquaculture industry which was operating in the Bay d'Espoir region was aware of the escape events and informed the public that such events would continue to occur well into the future. The fish would escape from the pens, move inshore with the tides, and head into the local rivers. Once the fish were in the rivers, resident anglers would travel from all over the island of Newfoundland to fish for

these, often large, escaped fish which were now called rainbow trout (no longer steelhead) once they escaped the pens. During the Newfoundland Sportsman episode, it is mentioned how the rainbows take different lures, often things that local “mud-trout” will not take. These fish presented a new challenge for anglers, and rewarded them with thick, delicious orange fillets when cleaned. The origin of the fish[29] was of little concern to the anglers and municipalities who were taking advantage of the “continuous trickle losses” to build a recreational angling tourism industry.

Dwight Blackwood was not alone in his enjoyment of angling for escaped farmed rainbow trout in Bay d’Espoir. The earlier mentioned Causeway, a wide, powerful, deep outflow from the Bay d’Espoir hydroelectric generation station, constructed in 1964 (Heritage Newfoundland and Labrador, 2006), is shown in one episode of the Newfoundland sportsman (Vatcher and Langille, 1996b, 22:50). Dozens, if not hundreds, of anglers lined the shores along both sides of the Causeway, casting many varieties of both artificial lures and live bait in an attempt to connect with and catch an escaped steelhead/rainbow trout from nearby fish farming operations. Writing this in 2022 it is hard to imagine the previous excitement about escapees that spawned an annual rainbow trout folk festival. Anglers no longer flock to the Bay d’Espoir to catch the “continuous trickle” of escaped steelhead trout like they did in the 1990s.

[29] Although stocking of rainbow trout took place in other parts of the island of Newfoundland (Hustins, 2007), It is difficult to find any records of stocking of rainbow trout in the Bay d’Espoir region. This is perhaps because the Newfoundland railway did not run through the region and it would have been logistically difficult to do so.

I recently travelled to the same location where the Newfoundland Sportsman episode was filmed. There I spoke with some locals including a few anglers. It was evident that this form of stocking (via unintentional fish-farm escapees) has become unpopular and unwanted. Escaped fish, once prized, are now understood as form of *pollution*, in the sense that the prominent cultural theorist Mary Douglas meant it: as matter out of place (Douglas, 1966, p. 126). Throughout the passage of time, foreign, non-native, escaped farmed rainbow trout have been transformed from being welcomed quarry to becoming despised invaders for those same anglers. This is even though the escaped fish created new angling opportunities and generated both food and economic activity in a region that had been devastated by the cod moratorium (Heritage Newfoundland and Labrador, 2020b).

Relatively positive attitudes towards escaped farmed fish would continue for roughly twenty years after the 1992 cod moratorium. Between 1990 and 2013, over 750,000 salmonids escaped from fish farms on the south coast of Newfoundland (DFA, 2012; Atlantic Salmon Federation, 2014). However, as more and more farmed Atlantic salmon and steelhead were farmed on the South Coast and the "trickle" of escapees became a flow making their way into adjacent rivers, native populations of returning wild Atlantic salmon massively declined. Miawpukek First Nation's Conne River is the largest river in DFO's Designatable Unit 4 (DU4). The Conne has experienced severe declines in annual wild Atlantic salmon returns (Adams and Cote, 2010; Randell, 2018). From 1990 to 2013, returning wild salmon dropped from many thousands to a few hundred fish while

conversely and inversely, local aquaculture exports increased (see Fig. 7). This decline has seen the river fall from producing over 10,000 wild salmon returning in the 1980s to present numbers well below 2000 returning salmon a season. This decline has continued to date. While I am aware of the basic statistical concept that correlation does not mean causation — there are undoubtedly many factors which led to the decline of Conne River Atlantic salmon — there is, nevertheless, the experience of anglers to consider and the graphs in Figure 7. These graphs do support ideas and perceptions that escaped farmed salmonids are detrimental to wild Atlantic salmon. As farmed salmon production and escapes escalate, it seems as if wild salmon numbers in the associated regions decline.

How salmon are understood, how they are known differently by anglers and scientists, and how they are counted (both numerically and in the sense of ethical value) are important things to consider when trying to understand the crisis of the Conne River Atlantic salmon. Industrial salmon farmers and their government promoters and regulators understand salmonids as aggregates that are measured in tons for the purpose of economic exchange. In contrast, the Miawpukek First Nation anglers who shared their experiences with me, spoke of the Atlantic salmon in their rivers as more akin to a relative than a resource, echoing similar experiences elsewhere (Elcher and Baumeister, 2018). Exploring this relationship in more detail is beyond the scope of my research but are important questions that are being taken up by Mi'kmaq people throughout Mi'kma'ki.

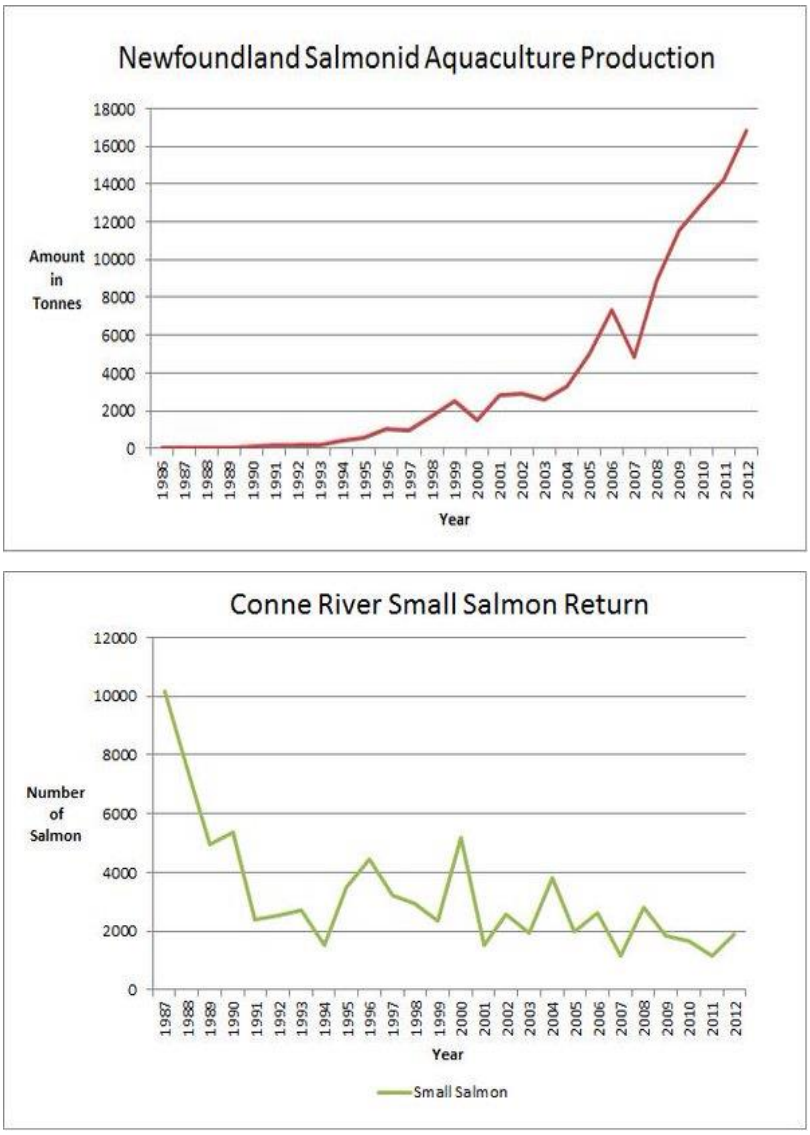

Fig. 7. Conne River small salmon returns 1987-2012 and Newfoundland salmonid aquaculture production (1986-2012) (Data plotted through available data from DFO, and DFA).

Farmed-Salmon Escapees: the case of Norway

The issue of farmed salmonid escapees is not limited to Newfoundland and Labrador. Since Atlantic salmon and Steelhead aquaculture first was developed and took off in Norway, Salmonid escapees have been showing up in

their rivers for a number of years (Jensen and Korban, 2020). Industrial fish farming began in Norway (Seafood from Norway, 2021), and similarly, mass salmonid escape events have been causing both trouble and controversy there since the industry was established. The problem of escapees is not specific to Norway, and can be found in Ireland, Scotland, Chile, British Columbia, Nova Scotia, New Brunswick, and other jurisdictions where Atlantic salmon are farmed (Thorstad et al., 2008). Local anglers are so concerned in parts of Norway, that there are even guidebooks and pamphlets that have been distributed which aid anglers to identify farmed salmonid escapees when they encounter them (TOFA, 2014; see Fig. 8.). Over time, farmed salmon have been selectively bred to grow faster and produce higher yields for fish farmers. Hannink (2017) believed that this changed the genetics and physical characteristics of the salmon, which led to higher occurrences of growth deformities and birth defects. At present, it has been estimated that up to 95% of all farmed salmon are deaf due to otolith deformation from the rapid growth that has been bred into their genome (Hannink, 2017). How these changes are experienced by the salmon or how they affect angling has not been studied.

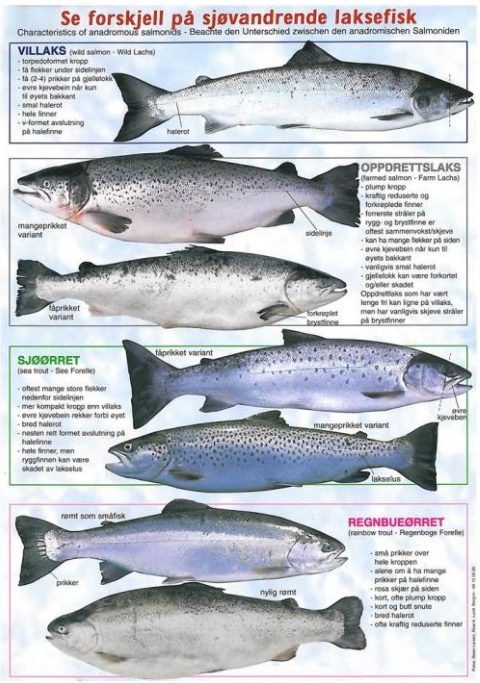

Fig. 8. Norwegian angling guide displaying the differences between villaks (wild salmon), oppdrettslaks (farmed salmon), sjoorret (sea trout), and regnbueorret (rainbow trout) (Trondheim Omland Fiskeadministrasjon, 2014).

The Problem of Escapees is as Old as the Industry Itself

The problems posed by salmonid escapees are as old as the aquaculture industry itself. As evidenced by the issues in Norway, salmonid escapees present a problem that has plagued the aquaculture industry since its earliest beginnings. It is not unusual for sea-cage salmonid farming operations to contain upwards of 70,000 salmonids (Eriksson et al., 2016, p. 396). The animals are separated from the wild by a nylon netting system, held in place using a system of weighted and floating PVC skeletons; such an arrangement is commonly referred to as open-net pen systems. Such systems could consist of a net-pen with eight modular units, each unit having a dimension of 24m x 24m, with a sidewall and a depth of approximately 15m - 21m (Eriksson et al., 2016, p. 395). The sea cages are

placed in bays, fjords and inlets in locations according to a variety of criteria. Exposure to the open ocean, sea temperature, the strength and direction of ocean currents, and sea ice presence were all factors considered during sea-cage location feasibility studies (Corbin, Holmyard and Lindell, 2017). Industry officials claim that the sea cages are secure, reliable structures that have been continuously improved (Rust et al., 2014), and that the risk of escapes is presently low given the sheer amount of technology and development invested in the structures. The ocean is a harsh, unforgiving environment whereby storms, tidal swells, and strong ocean currents are common. Sea cages are not immune to the brutal forces of the ocean and are often damaged or destroyed during inclement weather or tidal phenomena. When the sea cages are damaged, farmed salmonids escape, in some cases by the thousands (Naylor, Eagle and Smith, 2003, p. 31.). A couple of holes in a sea cage three to five feet long may result in the escape of many thousands of farmed fish, against the wishes and without the knowledge of the farming companies (CBC News, 2018a).

In addition to the problem of rough seas for keeping salmon within sea cages, there are other inherent problems with aquaculture that are mitigated in a variety of ways. There is an abundance of nutrients in the areas adjacent to salmonid aquaculture sea-cage operations (Besson et al., 2016). These nutrients can cause algal blooms that may choke out sea life in the surrounding area. The abundance of farmed salmonids, fishmeal pellets, and “morts”, dead salmon that have sunk to the bottom of the pens, creates a food scent that ocean currents bring to a variety of predators. The very ocean currents that supply an abundance

of nutrients and clean water to wild salmon also carries the scent of the aquaculture operation to wild tuna, sharks, whales, bald eagles, and other larger predators (Uglem et al., 2014, p. 94). Predators are attracted to the sea cages, and often damage the pens in their search for food. I have seen for myself how large bluefin tuna blow through the sea cages like torpedoes in their effort to eat the farmed salmonids. Sharks, of various species, and seals use their strong jaws and rows of hundreds of teeth to chew holes through the nylon netting holding the farmed salmonids. In some cases, the predators become trapped in the sea cages and must be euthanized; but more importantly for this thesis is the damage created by the predators that allows the domesticated salmonids an opportunity to escape which they eagerly do. The attraction of wild fish to industrial salmon farming sites also increases the chances of disease transmission to and from wild, farmed and escaped fish (Uglem et al., 2014, p. 91, Rigby et al., 2017).

The impact of salmonid escapees on wild ecosystems remains an issue of contention between the aquaculture industry and conservation groups. Although recent scientific research suggests that interbreeding, disease transfer and habitat competition may all pose considerable threats towards the survival of wild salmon by farmed salmonid escapees (CBC News, 2018b), industry representatives maintain that such research is site specific and may not be applicable to all regions or stages of technological development. However, as wild salmon stocks have decreased alongside the growth of industrial-scale aquaculture wherever they have been established, conservation groups and anglers have unambiguously pointed the blame towards the aquaculture industry.

This is especially so in the area adjacent to the Miawpukek First Nation's Conne and Little rivers. Salmonids continue to escape and the consequences of this are only now being investigated and understood by government agencies such as the DFO. I spoke with several Miawpukek First Nation anglers who had personally experienced catching escaped salmonids in Conne River and in the surrounding area. One angler explained:

> *We got eight out of there. You could tell that they were farmed 'cause they got the cage rub on them. The fins is rubbed and outta the ones we caught there was one wild one, because he was kinda slinked out and really dark. So we let that one go back in the river again and just kept the ones that, and these were October or November and they were really silver and that.*

Another angler observed:

> *It's getting worse every year. More every year. That's those cages they got out there they got rainbow fish in those cages…sometimes they breaks loose in thousands and thousands and they goes in all those salmon rivers and they eats the salmon eggs and destroys the salmon eggs and then that's it.*

Interviews have identified that anglers on the Conne and Little rivers encounter farmed salmonid escapees first-hand (see also CBC News, 2013c). The creation of new salmon-cage technology allowed the aquaculture industry to benefit from a narrative of progress, whereby all new steps in development imputed improvement toward some sort of perfect aquaculture era of zero escapees. Indeed in 2018, Grieg Aquaculture introduced its "escape-free" cage system that Grieg employees proudly displayed with virtual reality demonstrations at aquaculture conventions and media events (CBC News, 2018c). According to Grieg demonstrators:

a) *The threat posed by predators is neutralized by "predator nets". A*

second outer-layer net is constructed and placed so that it provides a first line of defence in the event of a predator breach. Predators cannot reach the salmon or breach the innermost net due to the predator nets.

b) *The harm posed by birds of prey and seals is eliminated by avian nets installed above the salmon pens.*

c) *The threat of ocean swells and tides (from storms) is eliminated by improved mooring systems, stronger net and frame materials, and in some cases, by using new, experimental net systems.*

Martin Soreide, a technical director for Aqualine, producer of sea cages for Norweigan aquaculture giant Grieg, was recorded as saying "It's 100% escape-proof, if the customer is using it the right way" (CBC News, 2016d). Unfortunately for the industry, despite efforts to exert control over nature, sea cages still fail. Domesticated salmonids still escape into the wild and fish are still preyed upon by predators. Several of my informants told me that they witnessed large predators such as tuna, whales, and seals attacking farmed salmonids and breaking holes in their containment pens. If one reads the promotional material from the salmon aquaculture industry one would be led to believe that the issue of sea-cage effectiveness has been essentially solved. This implies that criticism of escapees and their "continual trickle" from net pens is no longer a problem as technological innovation can and does solve all problems given enough time and money.

To maintain the problem-free narrative of the industrial aquaculture industry, the industry has started to shift blame for escaped farmed salmon from inadequate fish-farming technology to human error by employees requiring more education and training. Rather than confronting this erroneous narrative, government regulators, such as the Department of Fisheries and Oceans,

became complicit with this blame-shifting endeavour by subsidizing training for aquaculture workers and, indirectly, the industry itself (Bavington, 2010, p. 97). The introduction of government professionalization, through training and certification, of aquaculture workers follows the previous professionalization of cod fisherman; both fishermen and aquaculture workers take training on how to fish and culture fish responsibly. Errors or failures in fisheries management or aquaculture can be blamed on the workers, not the system or process itself. This fact is evident when one examines the concept of "trickle" or "leakage" in the industry. Such small daily escapes of farmed fish under 100 fish need not be reported according to government regulatory standards as they are categorized as being too insignificant for reporting (Living Oceans, 2021b). The very notion of 'leakage' however, exposes the failure of techno-fixes to contain domesticated salmonids in an uncontrolled, chaotic ocean environment and normalizes fish escapes. Leakage does not discern how many fish escape per day and is based on an arbitrary threshold of 100 fish to trigger reporting, making enforcement extremely difficult.

Given that, farmed salmonids escape from pens[30], often in large numbers, focus must be shifted to the escapees themselves and their ongoing impact in the ecosystem. Farmed salmonid escapes threaten wild salmon populations in a variety of ways such as: genetic contamination, competing for

[30] The chronic escaping of salmon from their pens is referred to by the aquaculture industry as "*Leakage*" (Naylor et al., 2005). Leakage serves to redefine escape events, so they seem less severe in nature. The term *leakage* also removes the salmon's agency, and further reduces it to a quantifiable fish stock.

food sources and breeding habitat, and through spreading disease and sea lice originating from the sea cages (Naylor, Eagle and Smith, 2003, pp. 27, 30-1). Much evidence exists showing that farmed salmonid escapees attempt, sometimes successfully, to breed in wild environments, with wild fish, and in other cases compete with wild fish for food and habitat. Farmed salmonid escapees pose a clear and omnipresent threat to wild salmonid populations when they come near sea-cage operations. Wild populations are also at risk many hundreds of kilometers away from farming sites due to the tendency of escaped salmonids to roam and colonize new river systems. Scientific literature available in the mid-2010s began to suggest that there was indeed a real threat posed by farmed salmonid escapees and sea cage diseases, but industry has on occasion suggested otherwise on the public record (CBC News, 2013). Fish stocking and enhancement activities have been used as tools to remediate anthropogenic damage to wild fish populations, but at a cost (Lichatowich, 2013).

Just as the release of hatchery-reared fish into wild environments, through the process of acclimatization, was severely misguided (Snyder, 2016, p.12), contemporary aquaculture operations that allow farmed fish to escape into wild environments, pose similar existential threats to wild species. The laissez-faire attitude of the aquaculture industry towards escaped salmonids epitomizes the colonial legacy of fisheries science that was seen throughout the British Empire when exotic European fish species were planted in intentionally colonized waterways and raised in hatcheries for settler colonists from Europe. Such colonial legacies are re-enacted through the activities of the present-day

aquaculture industry. The colonial replacement of native, wild fish with stocked hatchery-bred fish was indeed a part of the Columbian Exchange (Nunn and Qian, 2010) and one could make the argument that this continues today through the replacement of wild fish by escaped domesticated fish species from corporate farms. Genetic studies have shown that in many rivers in Eastern Canada, farmed salmon, and farmed salmon that have interbred (hybridized) with wild salmon, now far outnumber reproducing wild Atlantic salmon on those rivers (Karlsson et al., 2016). A clear distinction between native fishes and wild fishes arose in the 1900s (Snyder et al., 2016, p. 13) and still informs fisheries and resource management today yet is not matching the observed and experienced hybridity and complexity in ocean and freshwater ecosystems.

No Nets Could Hold Back the *Pink Sludge*

Industrial aquaculture proponents often fail to recognize developments in fish biology, especially the risks associated with the escape of domestic fish into wild ecologies. Only recently has the biological study of fisheries withdrawn support for running hatcheries and stocking to prop up wild fish populations (Lichatowich and Bakke, 2012). Today, the aquaculture industry continues to struggle with containment and the survival of domesticated fish within the open sea-cages (CBC News, 2020b). Such struggles were epitomized in 2019 during the highly public ‘Pink Sludge’ event that involved the death of roughly 1.8 million salmon at a Newfoundland farm and where the nearby ocean and shoreline was coated in a thick, stinky, pink coagulation of rotting dead salmon (Mercer, 2019).

The mass die-off event drew the attention of local fisheries unions, environmental groups and, unsurprisingly, the media. Mercer stated that a “15- meter-thick floor of rotten fish sludge” was on the sea floor in some areas and that there were loud calls for the industry to reform its practices. According to Mercer, the highly public die-off event was blamed on abnormal water temperatures, but marine biologists suggested that “unnatural high densities of crowded salmon” was likely the real cause of the mass die-off. Again, the industry ignored the science but, in this case, the result was loss of significant revenue and public trust. Given that profits drive industry practice, there are no assurances that such calamities will not happen again. The trend of industry ignoring scientific-based regulation and angler experiences that oppose their financial interests continues apace.

Although escapees are most certainly entering Newfoundland rivers, they are not viewed as favourably as they were in the 1980s. Since the first introductions of non-native salmonid species to the colony and country of Newfoundland and the associated British imperial ideology of acclimatization, native rivers and species have become revered and valued by many contemporary biologists and anglers. Fisheries managers and angling organizations at present have argued that introducing *any* artificially reared fish into the wild should be severely restricted and that most of the restoration work should focus on habitat rather than stocking (Daniels and Mather, 2017, p. 17). Unsurprisingly, recent scientific studies have found that stocked fish are maladapted for living in the wild and cause a decrease in the resilience of wild populations especially when interbreeding takes place (Loew, 2019). While past

approaches to angling have focused on increasing hatchery-based stocking, contemporary approaches focus on protecting and expanding habitat. Native fish stocks and wild rivers are key to ensuring wild fish survival according to current conservationist and ecological thinking.

While fish farming was initially seen to alleviate pressure on wild fish populations, support of fish farming would eventually decline among conservation organizations as newly emerging science in the 1990s painted a negative picture of the impact of industrial aquaculture on wild salmon. Industrial aquaculture was no longer understood as the saviour to restore and conserve wild salmon populations taking pressure off them. Salmon farming introduced a new range of issues which challenged the collaborative relationship between conservation groups and industrial aquaculture corporations and their scientists. This divide continues to the present day and while salmonid conservation groups and the industrial aquaculture industry still share a common colonial lineage through applied science and conservation, they have become public enemies over open net cage aquaculture. The next chapter will explore how anglers and aquaculturists became friends and allies again through the support of a new technology applied to farming salmonids, land-based closed-containment recirculating aquaculture systems or RAS for short.

Chapter Six. Techno-fixes: Engineering Problems and Solutions

The previous chapter focused on the problem of salmonid escapees. In this chapter I will focus more on the various ways the aquaculture industry has responded to lost inventory, leakage and large-scale salmonid mortalities and escape events by deploying public relations tactics and proposing technological fixes to address criticism.

Aquaculture Saved by Public Relations

The aquaculture industry has responded to damage caused to the ocean and sea life through public relations tactics and the purposeful cultivation of ignorance (Rigby et al. 2017). Such ignorance of real environmental and ecological threats posed to wild salmon by aquaculture operations has and continues to be actively constructed. The aquaculture industry in Newfoundland has essentially handled criticism by using strategies like those used by so called "harm industries" such as tobacco, mining, and oil and gas industries; all in attempts to dispel or quell public criticism of industrial aquaculture operations in the province while allowing for ongoing expansion (Rigby, 2014, p. 3, Rigby et al., 2017). The Newfoundland Aquaculture Industry Association (NAIA) handles public relations on behalf of the aquaculture industry (Rigby et al., 2017). Benson and Kirsch (2010), in their crisis framework, argue that corporations handle criticism through public relations tactics in three successive stages:

1. Denial
2. Acknowledgement and Token Accommodation; and

3. Crisis Management.

Problems are first *denied* but then eventually acknowledged and given some *tokenized accommodation* and, finally, "poorly mitigated" through *crisis management* techniques that do not actually solve any problem at hand but displace them. Crisis management could be understood as what the aquaculture industry is always doing; that it is not a stage *per se* but more of a general necessary condition. Once problems reach the point of being undeniable and become significant burdens to maintaining profitability, corporations act to prevent future crises through political or public policy capture.[31] Rigby et al. (2017) wrote in their article *Industrial aquaculture and the politics of resignation* that the Newfoundland aquaculture industry has been plagued with a variety of public image problems that are met by industry with specific and intentional public relations strategies. They note that denial of public crises often entails the "manufacturing of uncertainty" through the creation and development of science that support specific points of view. In their book, *The Aquaculture Controversy in Canada: Activism, Policy and Contested Science* (2010), Nathan Young and Ralph Matthews described the growth of the Canadian aquaculture industry and the associated controversies. Young and Matthews (2010, p. 14) suggested that aquaculture policy *qua* social development must consider larger social, political, economic and cultural developments that are taking place on both the Eastern and Western seaboards and in Canada. These include recognition of Mi'kmaq

[31] Policy capture refers to how government agencies and organizations can become dominated by powerful lobby groups and industry advocates.

Treaty rights, addressing the recommendations in Canada's Truth and Reconciliation report, and Reparations guided by the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) (United Nations, 2007).

Unlike forestry, mining and other industries, aquaculture sprung up during the era of neoliberalism, when aquaculture corporations in Canada were facing stiff international competition, weak market positions, and anti-aquaculture activism (Young and Matthews, 2010, p. 45). The Canadian commercial aquaculture industry has, over time, become an important flash point for activism concerning globalization, environmentalism, and indigenous rights (Young and Matthews, 2010 p. 9). The issue of aquaculture has become an embodiment of a struggle of coastal inhabitants and environmentalists and in doing so has created a public relations nightmare for both the fish farming industry and government regulators. Young and Matthews (2010) argued that science is utilized by both sides of the aquaculture controversy to bolster their competing arguments and claims, asserting the authority of Western science and the privileged knowledge it entails. By limiting official knowledge to those published within scientific studies and journals, both industry and conservation opponents alienate and marginalize Mi'kmaq sovereignty and rights to the land and sea as well as their knowledge and experience with wild, farmed and feral salmon. The authority of science is used to exclude and delegitimize some while centering and legitimizing others just as the authority of British anglers was used to determine what fish species to extirpate and which to introduce to Newfoundland as part of settler colonial dispossession and ongoing economic development. This fetishizing of science

compels competing actors to adopt the language of science, economic development and conservation in order to be regarded as legitimate and thereby be effective in implementing their interests. If marginalized positions, such as those of Miawpukek First Nation anglers who shared their experiences catching escapees with me, do not use the language of science, economic development and conservation, then they are unjustifiably and unjustly dismissed; they are neither heard nor given legitimacy in national and provincial aquaculture debates.

Following the release of the controversial final report of the Cohen Inquiry into salmon farming in British Columbia (Cohen, 2012), concerns and recommendations raised by the inquiry were met with stalling tactics by the Canadian aquaculture industry (EcoJustice, 2015); and in some cases, were simply ignored. Public criticism, even when supported by the court system and backed up with peer reviewed scientific research, is dismissed and neutralized by the industry. The lack of government action in the face of real environmental issues and problems may be anticipated because of the conflicting dual mandates of government agencies to both promote economic growth *and* protect the environment at the same time (EcoJustice, 2015; DFO, 2020).

The open net pen salmon farming industry remains on a path of expansion in Newfoundland and Labrador with a focus on managing public perception through communications and public relations campaigns rather than engaging directly with criticism. As such, conservation groups and the aquaculture industry remain largely at odds with one another. For conservation groups, Atlantic salmon must continue to be protected to maximize their economic potential as

catch and release trophies, while for the industry, Atlantic salmon continue to be understood primarily as commodities produced profitably under techno-scientific control. The result is an aquaculture industry that externalizes all costs while enclosing profits for a small few (Rigby et al, 2017, pp. 21-22).

Recirculating Aquaculture Systems (RAS) or How Angling and Aquaculture Got Back Together

The aquaculture industry in Newfoundland and Labrador has dealt with criticism in a variety of ways (EcoJustice, 2015, p. 41). The most dominant stage[32] of criticism response by "harm industries" according to Benson and Kirsch (2010), following the outright denial stage, is acknowledgement and token accommodation. Acknowledgement and token accommodation is by far the most dominant form of crisis management found within the salmonid aquaculture industry producing salmonid commodities in Newfoundland and Labrador. The industry, while simultaneously denying that there are problems (VOCM News, 2016) has occasionally admitted that fish farming may be having negative impacts on wild environments (DFA, 2014). Industry acknowledgement of salmon farming problems is evidence of outright failure of denial narratives to quash criticism and proves that the industry is aware of the negative impacts of their operations. Industry proposes that problems have simple solutions within the status quo, and that through complex relationships with government bodies and public institutions, technological solutions or techno-fixes may be employed to solve problems created by open-net pen salmon farming. These techno-fixes,

[32] For overview of three stages, refer to page 94 of thesis, paragraph 1; 3 stages of denial.

serve to meet, redirect, and silence, criticism. Recirculating Aquaculture Systems (RAS) are the latest technological solution offered up by both salmon conservation organizations and the aquaculture industry to further advance “win-win” so called sustainable solutions. Perhaps, the creation of uncertainty and flux in farmed salmon prices (through the unreliable nature of RAS) could present a myriad of opportunities for financial profit making through purchasing stocks of aquaculture sector corporations and gambling on futures contracts (Martin et al., 2021). Interestingly, angling conservation groups have also adopted techno-fixes such as RAS and further technological innovation as solutions to problems with fish farming.

Angling lobby groups have endorsed the continued growth and operation of the salmonid aquaculture but only if production shifts towards operating in facilities with Recirculating Aquaculture Systems (RAS) (Martin et al., 2021). RAS provides a means for angling conservation organizations and the aquaculture industry to come back together through land-based aquaculture (Martin et al., 2021). For conservation groups, the issue is not with the scheme of salmon farming but merely the geographic location in which it takes place. The main matter of contention is with open-pen aquaculture and the associated problems with it that were described, earlier, in the last chapter with escapees. Conservation groups have no problem with industry valuing salmon purely as commodities so long as their operations do not impact the activities of conservation groups focused on maintaining wild salmon stocks to be caught and released again and again.

Farming Atlantic salmon in land-based, secure facilities, and other common forms of RAS, are offered as complete solutions but merely serve to bring the development and regulating functions of government, and the anglers and aqua-culturalists, back together by excluding Indigenous land and sea rights and sovereignties and ongoing histories of colonial capitalism from the "win-win"conversation. Just as cattle ranching in protected areas of North America was encouraged by large conservation NGOs while feedlot production was discouraged by those same organizations, intensive research and development of salmon farming RAS is encouraged while industrial salmon farming in the ocean is becoming highly discouraged in Atlantic Canada as well as in British Columbia (Association for the preservation of the Eastern Shore, 2012; Burke, 2019).

RAS also remains a type of potential mediating factor in the token accommodation stage described by Benson and Kirsch (2010). Closed-containment experimental facilities, such as those in Nova Scotia, Indiana, and multiple other geographic locations, are now understood as the answer to the sustainable expansion of aquaculture and the ability to feed the world and meet the global food crises[33].

The funding of RAS by both conservation groups and private investors

[33] The prominent Canadian seafood billionaire businessman, John Risley, called in 2021 for a moratorium on ocean-based salmon farming. Risley stated; "The government's science community is increasingly concerned about the environmental costs of salmon aquaculture, as it is currently carried out on the south coast of Newfoundland (and for that matter the southwest coast of Nova Scotia and the south coast of New Brunswick." The column that Risley wrote for Atlantic Business magazine was so controversial, that it was later pulled from their website (Dean-Simmons, 2021A).

signifies that both industry and conservation see RAS as a potential solution. Closed-containment farming is not without problems however and will introduce a whole new set of problems in need of technical solutions. Primarily, operating costs are much higher as closed systems are inherently more complex. Closed-containment systems also require reliable sources of clean water (DFO, 2014). Additionally, energy requirements are greater and waste output, in the form of fish excrement and mortalities, can be an issue (DFO, 2014; Sharkey, 2012). A feasibility study conducted by the Department of Fisheries and Oceans (DFO) concluded that full-recirculation closed-system salmon aquaculture showed a marginal return of 4% while a conventional net-pen system operating over the same period posted a return of 52% on invested capital (DFO, 2014). When one considers that the initial investment for the closed-containment system is CAD 22.6 million in comparison to the net-pen investment of CAD five million, this is significant difference in the return on investment. While closed containment may be impractical because it is less profitable, it remains the case that the present practices of the industry are becoming increasingly recognized as being unacceptable and unsustainable and are losing public support.

In 2013, the DFA conducted a major public consultation regarding aquaculture in Newfoundland (DFA, 2013). An online consultation was undertaken following a prolonged period of sustained aquaculture industry growth in Newfoundland and Labrador. The report, entitled "*A Summary of What we Heard: 2013 Aquaculture Operations"* outlined participant responses on issues such as communications, finances, governance, research, and growth of the

industry. One interesting section of the report stated:

> *Growth has created welcomed socio-economic opportunities for many rural communities in the province. Continued growth, however, requires a renewed strategic vision to ensure aquaculture development is sustainable* (DFA, 2013, p. 1).

While the assessment of mussel farming aquaculture was generally positive, the same could not be said for public assessments of salmonid aquaculture. Incredibly, 80% of consulted respondents believed that the salmonid aquaculture industry in Newfoundland had a poor (32%) or very poor (48%) reputation (See Fig. 9). These results were consistent with the results of a later Aquaculture in Canada report (2019), where although most of the population supports aquaculture, an overwhelming majority of respondents believe that aquaculture has a large impact on wild ecosystems (Ekos Research Associates, 2019, p. 19).

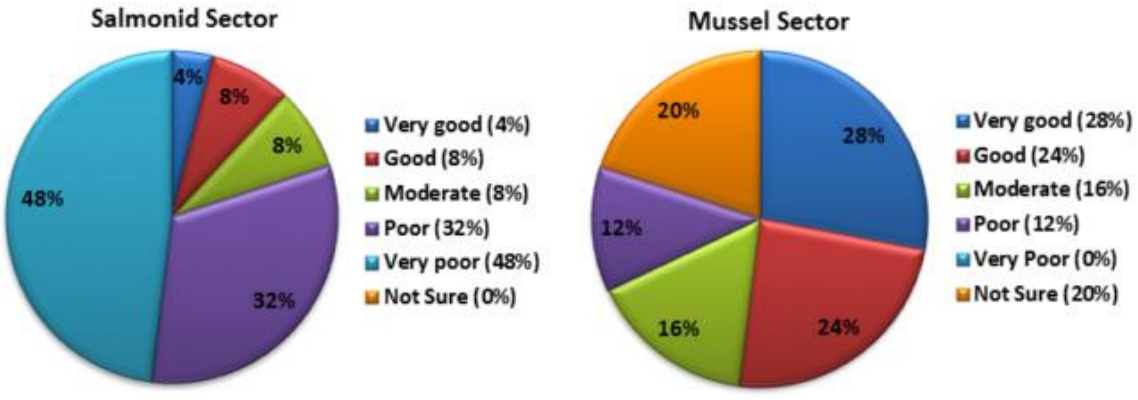

Fig. 9. Online participant responses regarding the reputation of the salmonid and mussel aquaculture industries in Newfoundland and Labrador (from DFA, 2013b, p. 7).

Many members of the public have negative views of the salmonid aquaculture industry in Newfoundland. The Department of Fisheries and

Aquaculture (2013b) report suggested that the poor perception of the salmonid industry was due to a variety of issues including but not limited to perceptions that:

1. Sea-cage aquaculture had a general impact on wild salmon populations
2. There were disease-outbreak risks within sea cage operations
3. Farmed salmonid escapees caused decreases to the wild salmon population
4. Supporting private aquaculture entrepreneurs especially following disease outbreaks was wrong.

The DFA report also contained calls for government to be open to the possibility of switching to land-based closed-containment salmonid aquaculture. Closed containment aquaculture, particularly Recirculating Aquaculture Systems (RAS), aim to quarantine salmon aquaculture operations from wild environments. The DFA would later respond to the various concerns outlined within their report summary by publishing "*A guiding framework for the future of the industry in Newfoundland*" (DFA, 2014) which would become the revised sustainable aquaculture strategy. Unsurprisingly, new regions were to be investigated for growth and industry expansion in addition to the forming of an aquaculture development plan to communicate the "facts" of aquaculture and deal with negative public perception of the industry and engage in debate (DFA, 2014, pp. 12, 16). There was little to no mention of financing or policies that supported the expansion of Recirculation Aquaculture Systems (RAS). This was not a surprise given the federal government's position as stated in 2014: closed-containment

technology could possibly be economically feasible at some point but would quickly become uneconomical due to several variables (DFO, 2014). As such, the technology has yet to reach the mass adoption phase in Canada.

Industry, supported by the government of Newfoundland and Labrador, has responded to criticism from salmonid conservation groups in ways that ensure the continued growth of the sea-based salmonid aquaculture industry in Newfoundland while undergoing relatively little change in operating procedures. Dissent and criticism from conservation groups and the public are met with promises that industry will uphold high standards and maintain strict regulatory measures even if they have not done this in the past. In actuality, the practice remains essentially the same: new industry self-management measures and practices serve to dispel public dissent and criticism rather than to mitigate or cure problems with the industry (Rigby, et al., 2017). The status quo is to change public perception rather than to modify or alter the production practice itself. Recirculation Aquaculture Systems (RAS) is what some conservation (Atlantic Salmon Federation, 2016) and environmental activist groups (Coastal Alliance for Aquaculture Reform, 2017; the David Suzuki Foundation, 2014) have called the solution to sea-cage controversies currently plaguing the aquaculture industry (Apostle, 2012, 4). However, the industry claims that RAS cannot be profitable in Newfoundland and is seen as a threat to current fish farming capital investment in infrastructure based on open net pens. Seafood billionaire John Risley's statement that there is no future in net cage aquaculture, made in May 2021, suggests that the industry is aware of this (Dean-Simmons, 2021A, Martin et al.,

2021).

The Triploid Salmon as Techno-Fix

A triploid salmon is a fish which has undergone a process to create fish with three sets of chromosomes, rather than the naturally occurring two-chromosome fish. There are a variety of reasons for creating triploid fish, including faster growth rates, higher commercial suitability and (assumed) sterility. The process of triploidization involves taking fertilized diploid fish eggs, subjecting the eggs to heat and pressure quickly after the fertilization of the eggs (California Department of Fish and Wildlife, 2017). The combined heat and pressure prevent the eggs from rejecting the third set of chromosomes, as it occurs normally in nature during the reproduction phase of trout and salmon. The resulting females do not develop eggs; the males develop testes, but the testes are supposedly non-viable. The growth rate of triploid salmonids is contested: in certain environments fish growth surpasses those of diploid salmon but in others the diploid salmon grow faster than the triploid fish. Studies have also shown that after three years, the growth rates of triploid trout surpass those of diploid trout due to a reserve of energy that is not expended during breeding (California Department of Fish and Wildlife, 2017).

Regardless of which fish grows faster, the more contentious and pertinent point here is the erroneous claim of aquaculture scientists that triploid salmon are sterile and therefore pose no threat to wild salmonids if they escape. This is false. Some males in fact remain sexually viable. During the process to create triploid

fish, there is an error margin whereby certain eggs reject the third set of chromosomes and remain sexually viable. This margin of error may range from 90% of fish being sterile in the worst of cases to 99.9% of fish being sterile in the best of cases. The triploidization of salmon, therefore, does not make 100% of the fish processed sterile. In fact, DFO has suggested that using all female commercial triploid fish reduces the likelihood of direct genetic effects on wild populations of fish; but would not completely eliminate the risk (DFO, 2016, p. 2). No matter how careful the fish culturing process is undertaken, there is always a chance of producing fertile fish which can breed. These fertile fish could escape and breed with wild fish and therefore pose a risk to wild populations.

Triploidity serves as another industry techno-fix to address legitimate concerns held by biologists and anglers alike that farmed and wild salmon are interbreeding. Industry representatives are quick to cite that the usage of triploid fish ensures that the impact of farmed salmonid escapees on wild salmon is non-existent. Indeed, the claim that all fish used in salmon farming operations are female is often used in response to public concern following large-scale escape events. The triploid process is certainly a positive remedial and/or preventative measure to mitigate some of the threats posed by escape events. There will always be an inherent level of risk with regards to this method of salmon sterilization. It is by no means a perfect solution, especially when 0.1% can be a large number when dealing with hundreds or thousands or even millions of fish. In addition, it is not just the genetic changes that concern anglers and conservationists, but also the behavioural changes exhibited by escapees that

can pose a threat to wild salmon.

Closed-containment salmon farming was seen as a way to continue the, arguably unsustainable, practice of salmon farming while insulating wild populations from the impact of the activity. By calling for closed-containment salmon farming, salmonid conservation groups lobby industry as a partner rather than engage them in conflict coming together around techno-fixes that can support conservation of wild fish and the growth and development of the aquaculture industry. The embracing of closed-containment technologies would perhaps ensure that wild salmon populations remain unaffected by industrial aquaculture operations, and this would therefore ensure that the wild salmonids remain available for future exploitation through recreational use. Both groups seek to monopolize salmonids for their monetary value. While the aquaculture industry develops technologies to exploit the wild environment and generate economic activity, conservation groups develop and advocate for technology which would protect the wild environment and secure resources, such as wild salmon, to ensure future economic activity through recreational angling employing catch and release. It is with the technology of land-based RAS where the common colonial lineage between anglers and aquaculturalists is most pronounced and allows these two seemingly opposed positions to find common ground.

Techno-Fixes: Engineering solutions

The use of Science, Technology, Engineering and Medical (STEM) -

derived technologies to manipulate nature into commodities is extensive (Masci, 2016). Memorial University of Newfoundland, a comprehensive research and teaching university located in St. John's Newfoundland, has invested heavily in technologies to increase region-specific aquaculture yields and efficiency. The Marine Institute (MI), a branch of Memorial University dedicated to studies and research relating fisheries and maritime studies, has a contingent of academic researchers who focus on ways to improve practices in aquaculture. The Centre for Aquaculture and Seafood Development unit within the School of Fisheries at the Fisheries and Marine Institute of Memorial University, possesses the largest pilot plant facilities of its kind in Atlantic Canada with a combined area of roughly 1400 square metres (Marine Institute of Newfoundland [MI], 2017). This facility houses a state-of-the-art food processing plant, a marine bioprocessing facility and an experimental aquaculture facility. Since the 1980s, many collaborative research projects have been conducted at both the Marine Institute and in other departments of Memorial University. One of the most notorious, world-renowned, aquaculture-research projects originated in Memorial's Biology and Biochemistry departments through a project that began in the late 1980s. Dr. Garth Fletcher (Biology) and Dr. Choy Hew (Biochemistry), would make a discovery that was commercialized by MUN's Genesis Center and that would introduce the first genetically modified organism, AquaAdvantage® salmon, to the market (Foss, 2015). AquaAdvantage Salmon® was, and remains, at the forefront of controversy.

Fletcher and Hew's ongoing research into the genetic manipulation of wild

Atlantic salmon was, and still is, venturing into new territory in food and aquaculture industries. They discovered a way to selectively transfer genes from one species of fish into another. Following their successful experiments, the scientists sought private investors to fund a biotechnology start-up company. And with the help of Elliot Entis, an American businessman, AquaBounty was formed (Foss, 2015). AquaBounty would provide the researchers with the economic and political prowess needed to advance the newly conceived transgenic salmon. However, this salmon was like no other. According to Foss, through years of experimentation, Drs. Fletcher and Hew, successfully transferred the genes of the ocean pout (a species of eel) and a chinook salmon (a salmon native to the Pacific ocean) into the Atlantic salmon genome.

Fig. 10. The Aquabounty AquAdvantage Salmon (Aquabounty, 2010)

Chinook salmon, the largest of the seven salmon species found in the Pacific Ocean (Behm, 2005), was selected for its ability to grow extremely quickly, while the ocean pout was selected for its ability to withstand cold ocean

temperatures. The resulting, patented, transgenic organism, the AquAdvantage salmon, could grow twice as fast as a wild Atlantic salmon while kept in captivity (see Fig. 10). In an industry obsessed with feed-conversion ratios as the cost of feed accounts for between 50 and 70% of production costs (Rana, Siriwardena and Hasan, 2009, 12), this was, and remains, as stated by AquaBounty, a potentially revolutionary and highly profitable biotechnology. Despite concerns and criticism regarding the approval of such novel biotechnology (CBC News, 2015d), the AquAdvantage salmon was approved by the US Food and Drug Administration (FDA) in 2015 following nearly 20 years of approval seeking by AquaBounty (CBC News, 2015d).

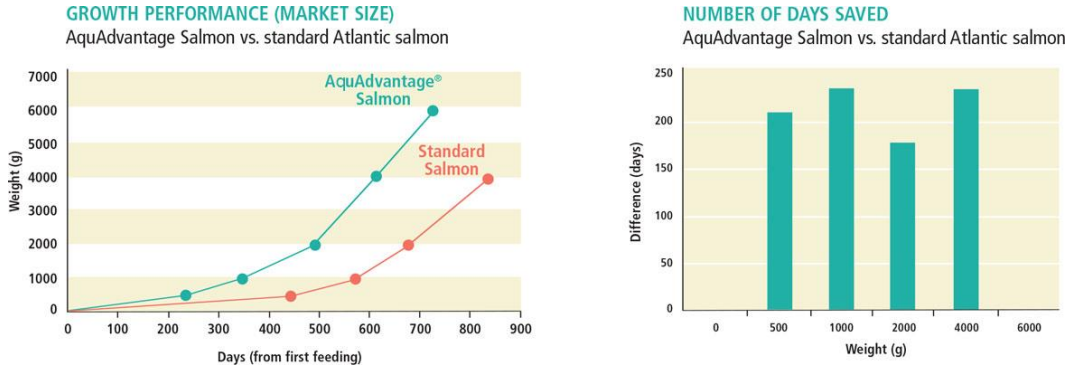

Fig. 11. Market performance of Aquabounty Salmon ® (Aquabounty, 2020)

There were strong concerns regarding the AquaBounty AquAdvantage salmon that dealt with both consumer safety, labeling and potential environmental impacts of the GM salmon. AquAdvantage salmon were, and remain, the first transgenic animal approved for human consumption by the FDA, where the labeling of the transgenic fish was not a requirement for the consumer market as the FDA concluded that there was equivalence between wild and modified forms

of salmon (CBC News, 2015d; Associated Press, 2019). However, importing the genetically modified AquAdvantage salmon in United States waters was made illegal by the FDA. To circumnavigate this problem of legality, AquaBounty had planned to engineer the salmon and produce the eggs in a hatchery in Prince Edward Island, Canada, and then to transfer the hatched smolt to a closed-containment grow out operation on a land-based facility in Panama where they were to be raised to adults (CBC News, 2015d). Plans to produce the eggs in Prince Edward Island were approved in 2019 (CBC News, 2019b). Many critics argued that the potential risks of an escape of AquAdvantage salmon outweighed the benefits of the reduced feed-conversion ratio and faster growth rate. After the Cohen report was released, it was clear that farmed fish were escaping in British Columbian waters and doing irreparable damage to wild ecosystems that were millions of years in the making (See Cohen, 2012; Langer, 2003). Competition between wild fish and transgenic fish for habitat and food has also been a concern (Volpe, Taylor, Rimmer, and Glickman, 2000), Moreau, Conway, and Flemming, 2011). Additionally, the development of transgenic salmon took place without any national or international regulatory plan for managing, and possibly mitigating, the special risks posed by AquAdvantage salmon. Because there was no existing regulatory framework for transgenic animals, the FDA treated AquAdvantage salmon as a drug, under their New Animal Drug Application (NADA) (Clausen and Longo, 2012, p.16). More recently, in the year 2019, AquaBounty would close its facility in Panama, in response to the lifting of regulations which previously limited the importation of genetically modified

salmon into the United States. AquaBounty salmon are now grown at a land-based facility in Indiana and have been sold unlabeled in the US and Canada (Seafood Source, 2019). As such, the validity and legitimacy of the approval of AquAdvantage salmon for both human consumption and commercial production has been continuously questioned by critics and environmental interest groups, such as the Canadian Biotechnology Action network and Living Oceans (CBAN, 2019, Living Oceans, 2021a).

MI's branch of Aquaculture and Seafood Development is actively developing and pioneer new aquaculture technologies. The main purpose of such technologies is obvious, to increase efficiency and ultimately profit for the associated investors, whomever they may be. There are efforts to commodify and exploit other fish species in the name of capitalist expansion (Power, Melvin and Mather, 2021). Memorial University provides a huge public subsidy for the industry. Through a complex system of government granting, business incubation and industry-academia collaborations, the Centre for Aquaculture and Seafood Development served as a key proponent for the advancement of technology and grow out sites for the Newfoundland aquaculture industry. During the 2010s, the centre's activities focused on fisheries and aquaculture waste, an important concern given that in 2010, for example, Newfoundland's fisheries and aquaculture industry created 100,000 metric tones of waste (Marine Institute of Newfoundland, 2017). Interestingly, the centre's website suggests that there is an enormous economic potential in the waste; and it suggested that the waste could potentially provide a massive source of income. While this may be true, such a

claim misses the point: there seems to be little emphasis or concern with what the waste is doing to marine ecosystems in the first place. The only concerns stated online were focused on monetizing the waste, rather than addressing what the marine waste's impact meant. Such a diversion tactic is found commonly in neoliberal environmentalism and regulatory regimes, whereby government subsidies are favored over penalties (Czarnezki and Fiedler, 2016, p. 15) and where additional public-private partnerships are encouraged and developed. Market-based mechanisms allow corporations to self-regulate disposal of waste (Czarnezki and Fiedler, 2016). In the neoliberal corporate-dominated public sphere, responsibility for the waste and damage caused by consumer products is often passed on to the public not the producer (Middlemiss, 2010). Regardless of the potentially devastating consequences, Liberal and Progressive Conservative provincial governments in Newfoundland and Labrador have consistently acted in support of techno-fixes and the implementation of experimental, risky technologies such as AquAdvantage salmon. The risks associated with AquAdvantage salmon[34], or any transgenic organism, have received a great amount of criticism and the risks are unknown and without full study, pose a major threat to not just salmon, but perhaps to human health as well. Inattention to the inherent risks of transgenic organisms, the silencing and marginalization of criticism while simultaneously furthering industry interests, serves only to

[34] The FDA has declared that aquaculture salmon is indistinguishable from wild salmon and as a result does not have to be labeled as aquaculture originated (Food and Drug Administration, 2012).

increase the profits of the aquaculture industry (see Rigby et al. 2017).

Public Concern is Not Mollified

Industry responses are, paradoxically, not 100% effective in quelling concerns and criticism. Anglers who frequent Newfoundland salmon rivers often come into direct contact with escaped salmonids originating from commercial aquaculture operations. The Miawpukek First Nation and SAEN have major concerns surrounding the impact of farmed escapees on wild salmon populations. Such concerns are legitimate and well founded and are, as suggested earlier in the thesis, supported by scientific evidence. My research aimed to understand these concerns, not to validate or disregard them. Regardless of whether the concerns are scientifically valid and factual or that evidence for such claims is based on experimental or experiential knowledge, they remain legitimate concerns to Newfoundland anglers, environmental groups, and most importantly to the Miawpukek First Nation.

Industry and conservation techno-fix-based approaches such as improved fish containment, genetically modified salmon and fish culturing practices such as triploidity are flawed in at least three distinct ways. First, techno-fix approaches hinge on valuing salmon as commodities, not as food or beings with an intrinsic value to exist. Science and technology have no ontological understanding of the salmon as living beings or kin. Second, techno-fixes never work all the time. There are advantages and disadvantages to each approach, but no single approach can solve all problems that arise from the practice of industrial salmon

farming. Lastly, techno-fixes, in essence, continue the colonial tradition and repeat historical patterns of land theft (land and sea grabbing) and other forms of ongoing appropriation or accumulation by dispossession of Indigenous land and life (Liboiron 2021). The techno-fixers, be it industry or conservation organizations, view salmon as commodities and this is incommensurable with the sovereign Mi'kmaw ontologies of wild salmon as beings, kin and food.

Chapter Seven. Toward a conclusion

Anders Halverson in his 2010 book *An Entirely Synthetic Fish* wrote that "the introduction of non-native species has been at least partially responsible for the extinction of 27 species of North American fishes alone. And hatchery rainbows are perhaps the guiltiest fish of them all" (Halverson 2010, p. 146,147). Acclimatization (Halverson, 2010, p. 28), the process through which colonial powers introduced species, is associated with the respective colonial power's home countries and saw transplanted species placed into the colonized wild with the understanding that this was an improvement over nature. The farmed salmonid escapees of industrial aquaculture operations on the south coast of Newfoundland are a contemporary example the previously mentioned historical process of settler colonialism. Escaped salmonids on the island of Newfoundland are actively colonizing river systems, symbolically acting as a neo-colonial entity, simultaneously destroying wild salmon and threatening the future existence of the "wilful salmon" (Daniels and Mather, 2017). It is also a concrete example of the ongoing colonial legacies altering and threatening salmon on the Conne and Little Conne rivers that are part of the Miawpukek First Nation reserve.

The idea of voracious escaped farmed rainbow trout transforming the rivers along the south coast of the island of Newfoundland is troubling to many now however, escapes were seen by settlers as an economic opportunity in the early days of aquaculture in Newfoundland. Jen Daniels, a former graduate student at Memorial University of Newfoundland, theorized in her MA thesis that

wild Atlantic salmon on the Gander River in Newfoundland are being understood in three ontologically distinct forms, “the commercial salmon, the catch-and-release salmon and the willful salmon” (Daniels, 2014, p. 96). These categories may help us understand the fluctuating opinions held on escaped fish. The commercial salmon is that which is created through commercial fishing with nets and no longer exists due to the cessation of the commercial Atlantic salmon fishery in 1993, while the catch-and-release salmon is enacted through the process of angling, for sport, with rod and line and the subsequent release of the fish. The wilful salmon, is the salmon that is caught, killed, and eaten (Ibid, p.136). The wilful salmon’s “will” is acknowledged, by Indigenous anglers, throughout the process (Ibid. p. 154) – The salmon fights the process of being caught on rod/line and with vigorous energy, it tries to escape with all its strength, submitting only after its will to escape has been broken. A single salmon is caught with rod and reel and is killed for the purpose of food.

Escaped farmed salmonids, such as rainbow trout in Newfoundland, are in some cases eaten, but also often interpreted as alien, invading entities. As farmed salmonids in Newfoundland are non-native to the environment to which they escape, they may be afforded self-determination, or a will of some sort. However, they may not be totally understood by the Miawpukek First Nation to be “wilful salmon” (Daniels, 2014) as they are not readily consumed by all anglers who caught them. Often, they were described to me by anglers I spoke with in Miawpukek First Nation as invaders and threats to existing wild salmon and the way of life associated with them. While industry officials may present a narrative

whereby they are the keepers of domesticated salmon under threat from wild diseases, wild predators, and wild environmental fluctuations, it could be argued that wild salmon are under threat from domesticated escaped farmed salmonids. The shepard-wolf binary presented by industry only serves to further discredit concerns regarding the impact of industrial salmon farming on wild ecosystems; specifically, the assault of escaped farmed salmonids on wild, or wilful, salmon.

While most settler anglers consumed escaped farmed salmonids when the aquaculture industry began in Newfoundland, and escaped rainbow trout were initially considered a boon to the Bay d'Espoir area for settler-based angling tourism, many settler anglers and their respective organizations now voice great concern of the potential impacts that escaped salmonids, particularly rainbow trout, are having on wild salmon. For Some Miawpukek First Nation band members who shared their experiences and perspectives with me, wild Atlantic salmon (*Plamu* in Mi'kmaq) play an important role in fulfilling food security and sovereignty. Indeed, wild salmon are an integral part of Mi'kmaw culture, history and futures (Schreiber and Brattland, 2012, p.59). Historically, as Europeans conquered and colonized newly found lands, they violently attempted to replace existing Indigenous people, flora and fauna with what were considered to be "improved" people, flora and fauna (Halverson, 2010, p. 30). The intended imperial objective was to "improve" fishing and fish stocks in the interests of the new colonial settler population. A colonial era promoter of acclimatization once stated, "Let the best fish, like the best man win" (Halverson, 2010, p. 30).

Acclimatization, perhaps best understood as a process of more-than-human eugenics, served to replace native fish populations with fish stocks of European origin. The same eugenic mentality seems to be widespread within the aquaculture industry in Newfoundland today, with industry officials promoting views of the industry as competitive and industry leaders in certification and egg-to-plate production. When one considers the amount of state financial support and light touch regulation of the aquaculture industry in Newfoundland and Labrador and the ongoing marginalization of Indigenous Rights and Sovereignty, we can see that the "best fish, like the best man" is determined by the settler colonial state. Salmon and steelhead are understood and managed as commodities, being produced through extensive industrial systems and such operations are based on the myth that industrial processes can fully replace wild ecosystems and improve upon them (Lichatowich and Bakke, 2012, p.1). The best fish, from the industry's perspective, is the most profitable fish in the global seafood market.

At present, both the aquaculture industry and conservation organizations value Atlantic salmon primarily as commodities. Wild Atlantic salmon are an "economic generator" and should be protected to ensure the future survival of the species and subsequently ensure future economic growth in Newfoundland and Labrador. Less importantly, recreational anglers value wild Atlantic salmon as food. Daniels and Mather (2017, pp. 2-3) argued that prioritization of these valuations of fish should be reversed with fishing for food taking precedence over profits.

The intrinsic value of fish as living beings is non-existent in contemporary fisheries management models that are founded on understanding fish as stock (Telesca 2014). These dominant regulatory approaches implemented by the DFO and DFA are incommensurable with the Mi'kmaw people's historical understanding of *Atlantic salmon (plamu)* as beings with which appropriate kin-like relations allowing for 'moderate livelihoods' can be established. Escapees are seen as escaped inventory, a financial loss for industry. For the Miawpukek anglers who shared their stories of catching escaped salmonids with me, these fish may be conceptualized as food or as a threat to existing food sources. These perspectives may be shaped by the subsistence needs and lived experiences of the indigenous anglers. Some of these perspectives align with settler perspectives while others digress completely.

There are no obvious clear answers or solutions. New disagreements between non-Indigenous and Indigenous anglers and the aquaculture industry, backed by government, suggest that conflicts will continue. The Placentia Bay Grieg aquaculture project and the reaction to the near extirpation of wild Conne River salmon in 2021 suggest that the friendly working relationship between aquaculture and conservation groups in Newfoundland is over. Yet both anglers and aquaculturalists share a common colonial lineage that brings them back together over technological fixes and RAS is now being presented by the fish farming industry and wild salmon conservationists as the key to future profitable salmon farming operations and as the key to saving wild salmon. However, while conservation and development have always gone together in settler colonial

states like Canada, First Nations, Treaty rights and the UNDRIP continue to be violated.

Newfoundland's salmonid conservation groups and commercial salmonid aquaculture industry share common lineages and are offshoots from the same tree of scientific management and settler-colonial capitalism. The aquaculture industry values salmon purely as a commodity, while salmonid conservation groups representing anglers see salmon as economic generators that must be protected and secured for future generations and long-term revenue generation by practicing catch-and-release. The historical traditions and principles of both groups have become apparent through the growth of stocking and aquafarming practices within the island of Newfoundland that have led to the decline of wild Atlantic salmon populations on several rivers and waterways, such as the Conne and Little River that are adjacent to intensive fish farming in the Bay d'Espoir region. Different historical colonial movements such as the Columbian exchange, commodity frontiers, and acclimatization live on through the activities of salmonid enhancement groups and the aquaculture industry. This project revealed that the commonality in the beliefs — how salmon and trout are understood — of two seemingly apparent divided actors, is what separates them from the Miawpukek First Nation, a group that has been profoundly impacted group by salmon declines and the underlying colonial-capitalist dynamics that have led to them.

Historically, outdoor guiding, including guided-angling trips for Atlantic salmon, provided a source of income for some members of the Miawpukek First Nation. However, at present, the low numbers of returning wild salmon are not

strong enough to support Atlantic salmon tourism in the form of guided angling. Currently, the Conne River, like many other south-coast Newfoundland rivers, is producing far less Atlantic salmon than ever before in recorded history. Other salmon returns on other rivers throughout the province are fluctuating unpredictably. The salmon decline has become an issue of much concern and public debate. At the time of the writing of this thesis, Conne River has remained closed to all salmon angling, Indigenous and non-Indigenous, due to a lack of adequate salmon returns.

As wild Atlantic salmon are supplanted by escaped rainbow trout from fish farms, Indigenous sovereignty is being continually challenged. Solutions to the crisis put forward by both the aquaculture industry and salmonid conservation groups, such as closed containment and other technologies, are attempts to depoliticize a highly moral and political issue, which challenges our understanding of how to relate well to wild salmon in Newfoundland and Labrador at this moment in history.

If the aim is to bring wild salmon back to Newfoundland rivers one must centre the perspectives and knowledge of those who have known those fish longer than any others, the Mi'kmaq of Miawpukek First Nation. Rethinking the way colonial settler states understand salmon and reframing economic and wildlife policies to become more compatible with Indigenous sovereignty will be needed if Truth, Reconciliation and Reparations are to be achieved (Truth and Reconciliation Commission, 2015).

I wish to finish my thesis with an angling story from when I worked as a fishing guide for American and Canadian elite anglers in Labrador during the summer of 2018. This story illuminates the ongoing colonial relations between anglers and fish farmers on Indigenous lands and waterways.

It is 2018, and I am guiding clients on one of the most famous salmon rivers in North America. The setting is the secluded Flowers river in Northern Labrador, with mature taiga forest surrounding the riverbanks and blankets of snow carpeting the foothills of the Torngat mountain range. The weather shifts between howling blasts of wind down the mountain valley in which the river sits, to peaceful, calm and serene evenings only interrupted by the persistent and almost desperate buzzing of mosquitos and blackflies. This is Labrador, and I have made it as a fly-fishing guide. Both Labrador's beauty and cruelty are on full display. Black bears, biting insects, and the weather are a frequent nuisance. However, think about how fortunate I am to be on such a secluded river and how privileged I am to be making money doing something I truly love – guiding.

Guides work hard, and we spend all waking hours of the day on the water placing our clients on large wild Atlantic salmon. My clients often land many fish in a day. We fish from daylight to dark, and large fresh salmon on the fly are common. Trophy photographs are taken, and cigars and fine alcohol are consumed by the clients. Sometimes the fish are played to exhaustion. As this is a catch and release lodge, all salmon are put back into the river to ensure their future survivability and to preserve the fish stocks on the river. During times of extreme weather – be it wind, rain or sun, the guides are still sent out with clients

even when there is little to no chance of catching fish. Such long, hard days of guiding are rewarded with meals in the warm, wood stove heated lodge.

Meals are provided by the lodge cooks, and every Thursday evening, closed-containment salmon is served with mashed potatoes and corn. Closed containment farmed salmon is flown from Nova Scotia, northward to the camps to be served to the angling clientele and the guides - although some of the guides refuse it as they disagree on the practice of farming salmon on both moral and environmental grounds. I can't help but think how ironic it is that Atlantic salmon are being released in the river but flown in from thousands of kilometers away to be consumed in the lodge. The angler elites were adamant about catching and releasing wild salmon, and yet eager to consume domesticated, RAS produced salmon.

Through this experience as a salmon guide in Labrador, I saw how *plamu* is being exploited for sport, as a fish to be caught and released, and as a seafood commodity, being raised in an RAS system and shipped to a remote Labrador fishing camp for performative consumption. The shipping of processed farmed salmon that was grown in another province, well away from Labrador, insulates the wild population of salmon from the industry. Something about this whole process made me feel inherently uncomfortable. This thesis has been an attempt to better understand those uncomfortable feelings on that Labrador River, and the complexities that underpin them.

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APPENDIX

Appendix A: Interview Questions:

1. When do you first remember fishing salmon rivers?

2. Which river do you fish the most?

3. Have you caught any steelhead on that river or any others?

4. Have you caught any farmed salmon on that river or any others?

5. What kinds of changes have taken place on the river over the years?

6. Have these changes been positive or negative?

7. What do you know about the history of the river you first fished on?

8. How has the river changed since aquaculture entered the region (if it has)?

9. Are you concerned with any changes taking place on the river you first fished on?

10. Do you think that changes on the river impact the future of the salmon angling in the area?

1a. Do the river's salmon look the same as they did years ago?

2b. Can you tell a farmed fish from a wild fish?

3c. What types of physical differences exist between wild salmon and farmed salmon?

4d. Are the salmon on the river healthy looking?

5e. Have you seen any different looking fish in or around the river?

1f. Can fish still be caught on the river?

2g. Do salmon frequent the same areas of the river as years ago?

3h. Do salmon on the river act strangely in any way shape or form?

4i. What time of year did the salmon on the river return years ago?

5j. What time of year do the salmon on the river return now?

1k. Do fish on the river taste the same as they did years ago?

2l. Have you eaten any steelhead or farmed salmon from the river?

3m. Has the colour or appearance of Salmon on the river changed over the years?

4n. Would you prefer to eat a wild salmon or farmed salmon?

5o. Have you caught any fish that have eaten pellets from the fish farms?

1p. Do salmon on the take the same flies as before?

2q. Do salmon on the jump when hooked?

3r. How long does it take to get in a wild salmon on the river? How about a farmed fish?

4s. Do farmed salmon put up a better fight?

5t. Have you noticed any changes in the way that salmon fight on the river?

Appendix B: MUN ICEHR Ethics Approval:

Interdisciplinary Committee on
Ethics in Human Research (ICEHR)

ICEHR Approval #:	20150243-AR
Researcher Portal File #:	20150243
Project Title:	*Too big to ignore: global partnerships for small-scale fisheries research*
Associated Funding:	20120790
Supervisor:	Dr. Dean Bavington
Clearance expiry date:	**August 31, 2021**

Dear Mr. Christopher Baird:

Thank you for your response to our request for an annual update advising that your project will continue without any changes that would affect ethical relations with human participants.

On behalf of the Chair of ICEHR, I wish to advise that the ethics clearance for this project has been extended to **August 31, 2021**. The *Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans* (TCPS2) requires that you submit another annual update to ICEHR on your project prior to this date.

We wish you well with the continuation of your research.

Sincerely,

DEBBY GULLIVER
Interdisciplinary Committee on Ethics in Human Research (ICEHR)
Memorial University of Newfoundland
St. John's, NL | A1C 5S7
Bruneau Centre for Research and Innovation | Room IIC 2010C
T: (709) 864-2561 |
www.mun.ca/research/ethics/humans/icehr | https://rpresources.mun.ca/

Appendix C: Miawpukek Research Approval:

January 12, 2015

Research Authorization Form

Miawpukek First Nation

Project Title: "Examining Newfoundland Experiences With Escaped Farmed Salmonids"

Primary Researcher: Christopher Baird

Supervisors: Dr. Dean Bavington, Memorial university; Dr. Reade Davis, Memorial University

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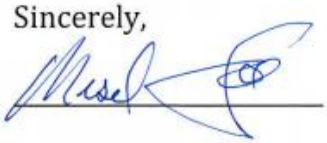
To whom it may concern,

On behalf of the Miawpukek First Nation, I authorize researcher and graduate student Christopher Baird, to conduct research in Conne River during the Winter/Spring of 2015. A list of possible key informants has been provided to Christopher to assist in his research project. Christopher will also be given access to related band historical archives to assist in his research.

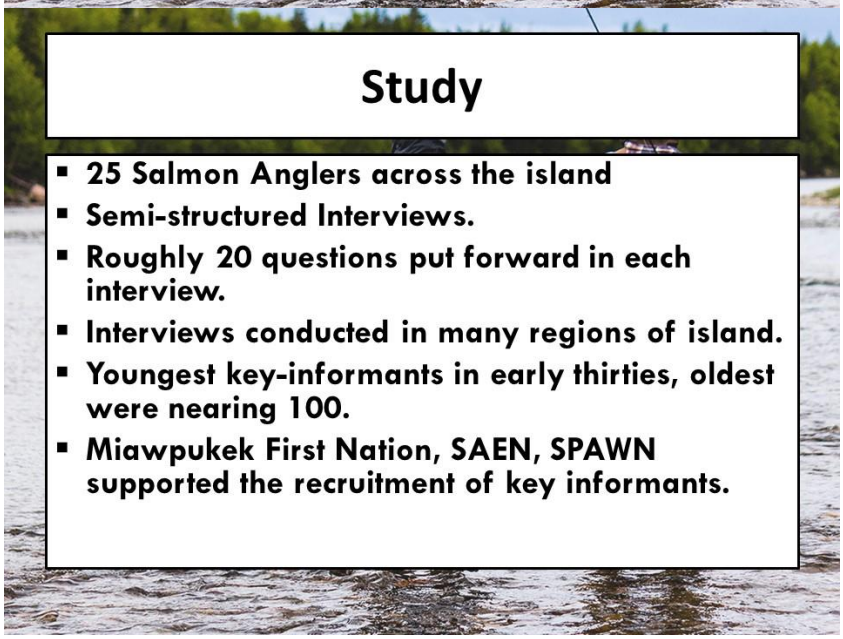
It is understood that consent forms will be modified and participant withdraw dates be extended appropriately to accommodate the research start date. Christopher will also be producing a piece of work for the band council to provide documentation of the aboriginal salmon fishing culture and history of Conne River.

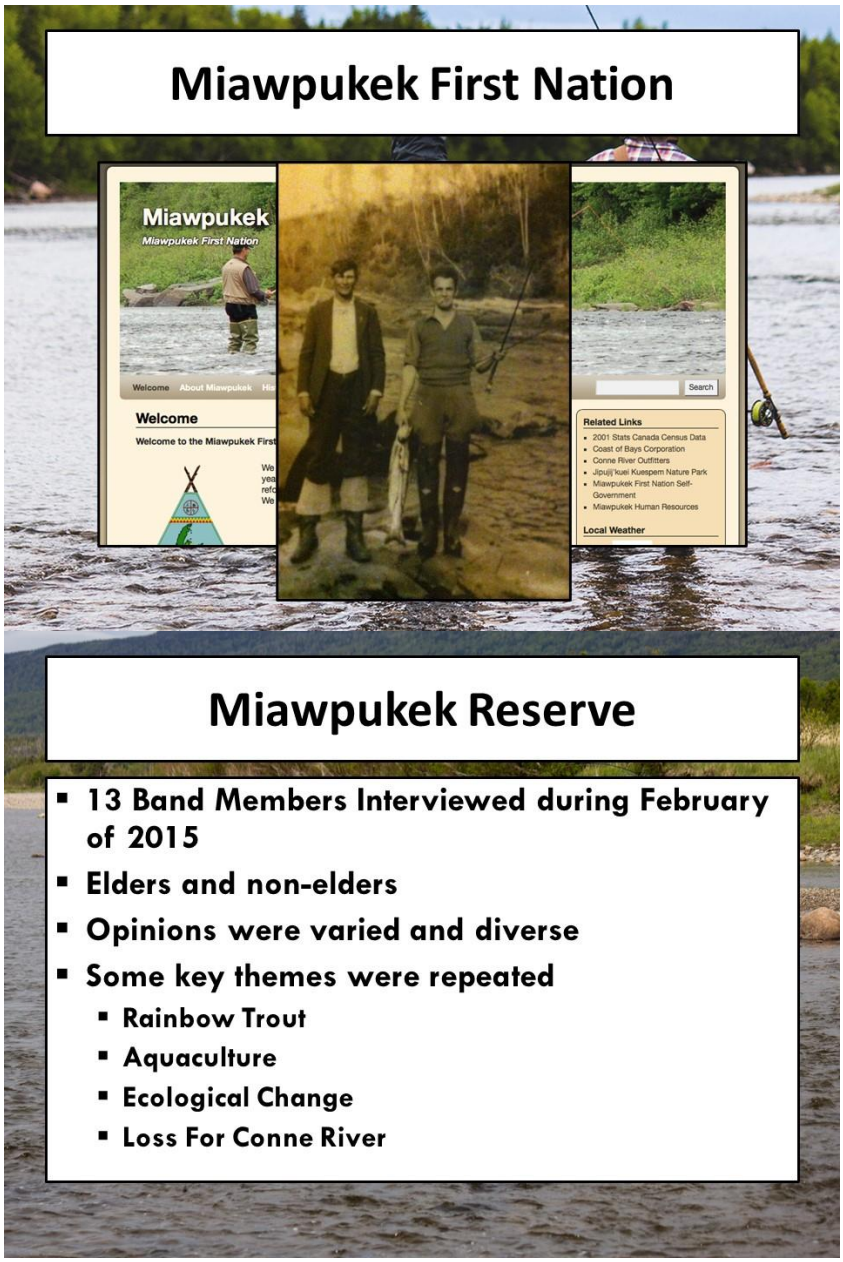
Sincerely,

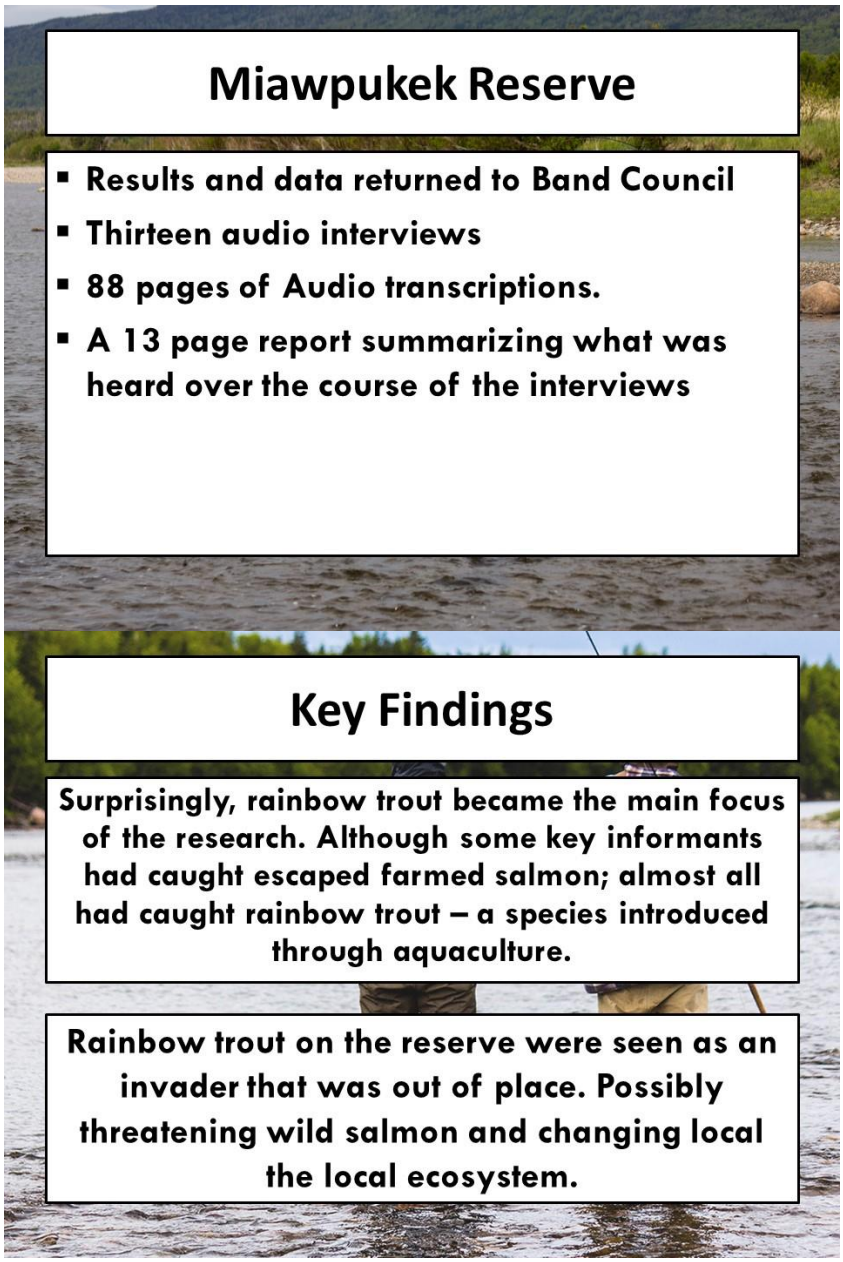


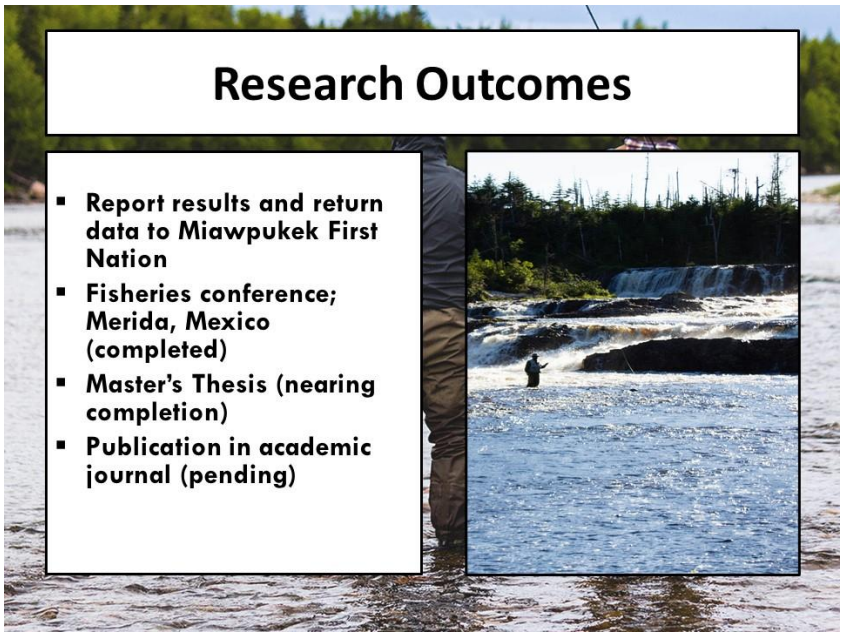
Chief Misel Joe

Appendix D: Miawpukek Research Presentation Powerpoint:




Miawpukek First Nation
Miawpukek
Miawpukek First Nation
Welcome
About Miawpukek
Welcome
Welcome to the Miawpukek First
Search
Related Links
2001 Stats Canada Census Data
Coast of Bays Corporation
Conne River Outfitters
Jipujij'kuei Kuespem Nature Park
Miawpukek First Nation Self-Government
Miawpukek Human Resources
Local Weather
Miawpukek Reserve
13 Band Members Interviewed during February of 2015
Elders and non-elders
Opinions were varied and diverse
Some key themes were repeated
Rainbow Trout
Aquaculture
Ecological Change
Loss For Conne River


Miawpukek Reserve
Results and data returned to Band Council
Thirteen audio interviews
88 pages of Audio transcriptions.
A 13 page report summarizing what was heard over the course of the interviews
Key Findings
Surprisingly, rainbow trout became the main focus of the research. Although some key informants had caught escaped farmed salmon; almost all had caught rainbow trout – a species introduced through aquaculture.
Rainbow trout on the reserve were seen as an invader that was out of place. Possibly threatening wild salmon and changing local the local ecosystem.


Research Outcomes
Report results and return data to Miawpukek First Nation
Fisheries conference; Merida, Mexico (completed)
Master's Thesis (nearing completion)
Publication in academic journal (pending)


THANK YOU!
TAQAMKUKWA MIKMAG
MIKMAWI NATIONIMÖW

Appendix E: Miawpukek Research Report:

Growing up on Conne Brook – A Report on Qualitative Interviews of 13 Aboriginal Members of the Miawpukek First Nation

Miawpukek First Nation

Christopher Baird

October 29, 2015

Your participation

I would like to thank the band members of the Miawpukek First Nation for allowing me to conduct my research within the reserve and graciously inviting me into your homes; sharing with me your experiences on the Conne, and Little Rivers. The experience is something that without the support and cooperation of the Miawpukek first nation would not have been possible and for this I will be forever grateful. It was something that I shall not soon forget.

The information gathered during the course of my 13 interviews with both experienced salmon anglers and those connected to salmon on the Miawpukek reserve will help in the direction and development of Miawpukek First Nation's fisheries policies in the future. According to the 2015 special report on Wild Atlantic Salmon in Eastern Canada (prepared by Minister's Advisory Committee on Atlantic Salmon): Atlantic salmon are important for both food and social and cultural aspects of aboriginal communities. What I heard during my interviews on the Miawpukek reserve was no different; Atlantic salmon have been historically important in Conne river, and will remain an integral part of the local culture and society of the Miawpukek First Nation.

Study

13 band members of Miawpukek reserve were interviewed during February 2015. The key informants were contacted through a suggested list of potential band members provided by the band council. All members on the list were contacted and out of those suggested 13 band members wished to take part in the study. The 13 band members that participated came from a variety of backgrounds and included both elders and non-elders. Semi-structured interviews were conducted in private locations with the intention of learning how escaped farmed salmon are impacting the experiences of anglers of the Miawpukek first nation. A similar study was conducted on non-aboriginal members outside the reserve across the island of Newfoundland.

What I heard

- **Ecological Change Observations**
  - Many residents of Miawpukek described perceived changes that have occurred or are presently occurring in the ecosystems in or surrounding Conne River.
  - The appearance of exotic animal species including but not limited to; Orcas, Tuna, multiple species of sharks, swordfish and rainbow trout were frequently mentioned and understood as significant concerns.

- Salmon are smaller, and return in much lower numbers than in previous years.
- Rainbow trout are present in and around the Conne and Little River watersheds.
- Codfish and capelin are no longer encountered well within the Conne bay and those who wish to catch them must travel further out into the bay in comparison to earlier years.
- The disappearance of terrestrial mammals, such as caribou, was mentioned as a concern.
- There is a general concern among the band members interviewed that the river is in danger of "dying" and that the possible causes of the changes must be investigated.

- **Aquaculture**
  - Band members expressed somewhat ambiguous opinions towards the aquaculture industry in the area. There is concern regarding the impact of the industry on the local ecology but also an understanding that the industry is an important employer for many in the area.
  - Some blame for the decline of wild Atlantic salmon was placed on the aquaculture industry but in many cases was speculation.
  - While some aquaculture companies in the area were spoken of in positive terms, other companies seemed to have poorer reputations based on their behavior in the region

over the years and this response was heard during many interviews.

- While some band members were confident they caught escaped farmed salmon, others were unsure. Some band members said they could confidently distinguish farmed salmon from wild salmon while other band members suggested that telling the two apart was not an easy process.
- It was generally accepted that the rainbow trout being caught in the area originated from aquaculture operations in or near Conne Bay.
- Key informants describe catching codfish that were full of aquaculture feed pellets. The smell from these fish was overwhelming (described as sewer, or manure) and these fish were discolored and not deemed to be edible.
- There were concerns that escaped farmed salmon may breed with wild salmon and reduce the wild salmon's ability to survive.

- **Rainbow Trout**
  - The appearance of non-indigenous, invasive, rainbow trout on Conne River and Little River was a significant concern for a high number of key informants.
  - Rainbow trout are seen as an alien invader, something that does not belong in Conne River or in the surrounding waters.

- Reports of large numbers of escaped rainbow trout suddenly showing up in Conne River and smaller watersheds was a common observation in interviews.
- There was concern that Rainbow trout are possibly eating the eggs or young smolt of native Atlantic salmon.
- Concerns regarding the aggressive feeding nature of rainbow trout were supported by stories of rainbow trout being unselective with regards to angling lures.
- Multiple stories of rainbow trout being caught with strange items, such as sausage cans, in their mouths and stomachs provide additional evidence to the idea that the rainbow trout are perhaps impacting native fish through their aggressive feeding habitats.

- **DFO Conne River Salmon Counter**
  - A significant number of respondents placed considerable blame, for the decline of wild Atlantic salmon, on the initial installation of the DFO Conne River salmon counter.
  - It was suggested that following the first installation of the river counter that the migration of wild Atlantic salmon was considerably restricted. Band members described witnessing salmon experiencing significant difficulty attempting to traverse the lower counter (sub-tidal zone) following the initial installation. Salmon would jump towards the counter and strike the metal tubing holding the counter in place.

- It was suggested that following the moving of the counter further up the river that this problem was mediated, somewhat, however some band members are still weary of the counter and the associated activities.
- Some key informants theorized that, because of the inability to pass the counter, many salmon originally destined for Conne River instead travelled to nearby watersheds; rather than their natal waters.
- Theories of salmon traveling to nearby rivers to navigate around the counter may be supported by stories of overabundant salmon in nearby rivers.
- One incident where salmon that were tagged with rubber bands by DFO and later perished due to infection was brought up by many band members.

- **Bay d'Espoir Hydroelectric Power Station**
  - The Bay d'Espoir Hydroelectric Power station (constructed in 1964) was frequently brought up in interviews and some key informants were concerned with the environmental impact that the installation and continued operation of the dam may be having.
  - The main concern; with the Bay d'Espoir hydroelectric Power Station was the resulting change of ocean salinity, following construction, in the bays adjacent to the dam.

- The disappearance of Eel Grass, Goose Grass, and Codfish within Conne Bay was blamed on the Bay d'Espoir hydroelectric Power Station.
- Key Informants suggested that Conne Bay has become a region of considerable hypo-salinity following the installation of the dam. They said that this could be reducing the health and productivity of Conne Bay.
- Some respondents told stories of salmon failing to return to their natal rivers and instead travelling up the outflow of the operation, locally known as the "Causeway". This was suggested to be because the Causeway is now the largest volume of water flowing into the region.

- **Pressure on Conne River**
  - Elder band members brought up the issue increased angling pressure on Conne River.
  - It was suggested that angling pressure has increased heavily, to date, since the mid 20th century.
  - The opening of the Bay d'Espoir highway was regarded as a main factor leading to overcrowding on Conne River.
  - Some elders suggested that where once dozens of anglers fished now hundreds of anglers fish and this may pose issues for access to fish and therefore access to food.
  - Salmon are harder to catch because fishing is now more competitive due to the increased angler numbers.

- **Atlantic Salmon**
  - Wild salmon in Conne river have been an extremely important source of subsistence, recreation, cultural enrichment, economic importance and family tradition.
  - The sudden disappearance of wild Atlantic salmon in Conne Brook has nearly all key informants concerned
  - Key informants described how Conne River historically had three or four different runs of returning Atlantic salmon (May-June, July, August) and how the different timed runs were different sexes or sizes of fish. Early runs were described as being large, mid-season runs were mostly averaged sized females and later runs were primarily jacks (males).
  - Conne River no longer receives multiple runs of salmon and the majority of the salmon return in Mid-June/Early July according to those interviewed.
  - Increasing scarcity of Atlantic salmon was a primary concern for all key informants interviewed. Nobody thought that the changes associated with salmon abundance were positive.
  - Nearly all key informants interviewed described how the Atlantic salmon on Conne river have become smaller over the years. Where once fish ranging from 7-10lbs were plentiful; it was said that it is now common to catch Atlantic salmon between 2 and 3lbs.

- One pronounced event, approximately 2 years ago, where small salmon were very frequent was mentioned in almost all interviews. There was great concern regarding this event.
- A frequent concern of Conne river Miawpukek salmon anglers was that the river could be closed down altogether due to the lower and lower salmon returns.

- **Food Security**
  - Atlantic salmon remains an important source of food for the members of the Miawpukek first nation. The act of catching the salmon was highly regarded, as was the act of eating the fish.
  - The decrease in the number of fish that anglers may retain was a primary concern for most band members. While two tags can be filled on Conne River, anglers who wish to retain more salmon must travel to the Northwest Gander and this was described as a great inconvenience and trouble.
  - The often short angling season for the salmon was described as a major inconvenience to anglers as they are not always able to get out to the river to fish during the period when it is designated as open.
  - Catch and Release angling was viewed by some band members as being a threat to the ability of other band members to catch and retain fish. While some key informants believed catch and release, in the upper

stretches of the river, was not a problem; many viewed it as a clear threat to both the fish and anglers looking to catch food. There was also significant criticism for barbless hooks.

- Barbless hooks were seen as ways in which wild salmon were hurt and later died. Some band members suggested that barbed hooks would help land salmon faster and ensure less waste.
- Rainbow trout are consumed by some band members while others will not eat rainbow trout at all; as they dislike the taste of the rainbow trout's flesh.
- Sea trout are caught around Little River and Conne Bay and are a source of food for Miawpukek anglers. There was no reported decline in sea trout abundance.
- The Elder/Disabled license designation program was universally viewed as a positive program and all anglers hoped that the program would continue into the future.

- **Land Use**
  - Key informants described fishing the watersheds in and around Conne bay from young ages to present. Hunting and fishing has been, and remains, a key part of growing up on the Miawpukek reserve.
  - Band members described fishing, trapping, and hunting in and around Conne Bay including but not limited to the following areas;
    - Conne river, from bay to Conne pond

- Northwest Gander river
- Little river
- Southeast brook
- Southeast Head
- Northbay River
- Twillick Pond
- Gander river

- **Guiding Industry**
  - Band members described an active outfitting industry in and around Conne River that attracted tourists from all over the world to fish for wild Atlantic salmon on Conne River.
  - Band members were employed as skilled guides to take tourists out to catch salmon.
  - Many of the band members that guided tourists did so on a personal basis and did so without the use of a guide manager or formal outfitting company.
  - With the decline of salmon on Conne River the guiding industry slowly declined.

Conclusion

Atlantic salmon on Conne River serve as an important source of food, recreation, and economic generator for the members of the Miawpukek First Nation. Both angling and non-angling band members placed high

value on wild Atlantic salmon and were concerned about aquaculture escape events taking place in the region. The decline of salmon returns described by the members of the reserve is perplexing and mysterious; with many possible causes for the decline. Band members showed great concern regarding the decline of salmon on Conne River and suggested that the causes of decline be further investigated. Of great surprise was the influence and ever increasing presence of rainbow trout. While many band members could not say if they had caught an escaped farmed salmon; they could say with confidence if they had caught a rainbow trout. Many residents are particularly alarmed with the presence of rainbow trout and are worried that they may be affecting the wild salmon population. It was generally accepted that the loss of salmon on Conne River would be a great loss to the community and the younger generations of band members.

Appendix F: SAEN Recruitment Email

Dear Member of SAEN or SPAWN,

My name is Christopher Baird. I am a Masters Student, studying geography, from the Memorial University of Newfoundland. With the help of SAEN (Salmonid Association of Eastern Newfoundland) and SPAWN (Salmon Preservation Association of Western Newfoundland), I am conducting a research inquiry into the experiences of Newfoundland salmon anglers catching escaped farmed salmonids. My project is part of a global research effort on small-scale fisheries entitled Too Big to Ignore, to which I hope to contribute to an understanding of the impact of aquaculture on recreational salmon angling. Recreational salmon angling is a small-scale fisheries activity that is currently facing challenge and change in Canada and abroad.

I am actively searching for anglers whom are willing to take part in an interview in which you will be asked questions about your experiences with salmon angling. The interview will touch on your role and your relationship with nature and culture, and your knowledge about how escaped farmed salmon are affecting the activity of salmon angling. Industrial scale salmon farming is expanding at a rapid pace, despite the fact that the impacts of this activity on salmon angling are unknown. If you, or someone you know, have caught escaped farmed salmonids or non-native salmonids originating from industrial aquaculture operations (farmed Atlantic salmon, farmed rainbow trout/Steelhead, farmed arctic char), I would like to hear from you.

Participation in this study is voluntary and should take approximately one and a half hour(s), depending on how you answer the questions. The interview would be recorded with your permission, and you are free to refuse to answer any questions or withdraw your participation at anytime. Before the interview takes place, I will explain the study and its objectives in more detail, and provide you with a consent form that will tell you about possible benefits and risks to participating. The interview will not take place until your questions have been answered and you feel comfortable with proceeding.

Please contact me, Christopher Baird, at Christopher.baird@mun.ca or 709-631-9599 if you have

useful knowledge and/or are interested in taking part in this study.

Sincerely,
Christopher Baird,
MA Candidate, MUN