Media perspectives of salmon aquaculture over time in New Brunswick, Nova Scotia and Newfoundland

by

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Abstract

Kraly, P. (2019). Media perspectives of salmon aquaculture over time in New Brunswick, Nova Scotia and Newfoundland [graduate project]. Halifax, NS: Dalhousie University.

In Canada, Atlantic salmon (*Salmo salar*) aquaculture has been growing rapidly and is consistently being promoted for its potential to support economic growth and employment opportunities. However, salmon aquaculture is a controversial topic in Canada, making acquiring and maintaining social license an enduring challenge. The factors that drive acceptance by neighbouring communities and wider society, however, are poorly understood and are likely highly place-specific, due to different environmental, economic, and social contexts. Through a media analysis and literature review, the aim of this research was to understand the relations between how aquaculture is portrayed and the evolving environmental, socio-economic, and political dimensions of the industry. Newspaper articles in New Brunswick, Newfoundland and Nova Scotia were compared to identify any potential similarities or differences among the factors that drive social acceptance in areas that have different histories of aquaculture development. Results suggest that acceptance may be due to the age of the industry as areas with a longer history of aquaculture activity face fewer obstacles to development and encounter less negative media. Additionally, beliefs about how environmental risks are managed may result in a lack of trust in industry and government. Finally, the way neighbouring communities view the industry's potential contribution to local benefits and risks may be more of an influencing factor than the perceived or actual environmental impacts of a farm. This study concluded by providing recommendations on potential ways to increase social acceptance of the industry, such as including the communities more in the decision-making process and increasing transparency of the industry.

Keywords: *aquaculture, social acceptance, social licence, media analysis, Atlantic Canada, history, case studies*

List of abbreviations

ASF – Atlantic Salmon Federation

BC – British Columbia

CBC – Canadian Broadcasting Corporation

CFIA – Canadian Food Inspection Agency

DFO – Department of Fisheries and Oceans Canada

EAA – Ecosystem Approach to Aquaculture

EIS – Environmental Impact Statement

FAO – Food and Agriculture Organization of the United Nations

FPMB – Friends of Port Mouton Bay

GM(O) – Genetically Modified (Organisms)

ISA – Infectious Salmon Anemia

MPA – Marine Protected Area

NB- New Brunswick

NGOs – Non-Governmental Organizations

NIMBY – Not in my backyard

NL – Newfoundland and Labrador

NS – Nova Scotia

PESTE – Political Environmental Social Technological Economic

PRISMA - Preferred Reporting Items for Systematic Reviews and Meta-Analyses

SLO – Social license to operate

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Chapter 1: Introduction

Aquaculture is defined as "the farming of aquatic organisms in both coastal and inland areas involving interventions in the rearing process to enhance production" (Food and Agriculture Organization of the United Nations (FAO), 2019). Due to an increasing human population and declining wild fish stocks, aquaculture is continuously being promoted as necessary to meet future global seafood demand (Troell et al., 2009). Today, the aquaculture industry is considered the world's fastest growing food producing sector and was responsible for 47% of total global fisheries production (capture fisheries plus aquaculture production) in 2016, compared to 26% in 2000 (FAO, 2018).

In Canada, aquaculture has been growing rapidly and is consistently being promoted for its potential to support economic growth and employment opportunities (Fisheries and Oceans Canada, 2012). For example, the Canadian industry had a production value of $1.39 billion in 2017, compared to just $761 million ten years prior (Fisheries and Oceans Canada, 2018). Much of this growth has been supported through high demands for Atlantic salmon (*Salmo salar*), which accounted for 76% of Canada's aquaculture production value in 2017. In 2007, Atlantic salmon was responsible for 80% of Canada's aquaculture production value. As part of having the largest coastline in the world, Canada is well situated to help supply the growing demand for seafood. As such, the Standing Committee on Fisheries and Oceans has the desire to see the Canadian aquaculture industry double in production within the next decade (Canada. Senate, 2016).

While finfish aquaculture can offer important contributions to local economies (Nguyen & Williams, 2013), due to the rapid expansion of the industry, it is often a highly controversial topic in many countries as it raises concerns about human health, environmental degradation, as well as economic and socio-cultural issues (Liu et al., 2016; Osmundsen & Olsen, 2017). However, the spatial scale at which these social conflicts are analyzed is important as the social acceptance, or lack thereof for aquaculture, can be highly localized depending on the context of the area (Mather & Fanning, 2019; Whitmarsh & Palmieri, 2009). Although the impacts of such an industry, be they positive or negative, will be felt locally, such social conflicts can often include stakeholders who are based far from the site of resource extraction (Gehman et al., 2017). Young and Liston (2010) suggest that in Canada, the aquaculture sector has made contingent progress for addressing opposition at the local level, but Canada has failed at

addressing concerns and opposition at national and international scales. Perceptions, however, can change over time (Kluger et al., 2019). While there is limited information on this regarding aquaculture, Rosser (2005) investigated whether campus faculty members' perceptions of their work life and satisfaction changed over time from 1993 to 1999 and found that most of the dimensions analyzed changed positively over time. Additionally, perceptions of climate change have been known to differ not only over time, but also between and within different nations (Capstick et al., 2014).

The idea that aquaculture enjoys support locally but encounters opposition from distant communities can also be found in how the media portrays aquaculture conflicts and developments (Mather & Fanning, 2019). While media effects theory is complex, and an ever-growing field of research, research has shown that mass media can heavily impact public awareness of certain topics and issues, their perceptions towards the issue, and in some cases, can even influence individual behaviours (Macnamara, 2005). In the case of aquaculture, the media may not have the ability to tell people *what to think*, but rather may be quite successful in telling people *what to think about* (Olsen & Osmundsen, 2017). In some places in Atlantic Canada, the media is a very well-trusted source of information among the various actors in the aquaculture network, including both government and industry (Maxwell, 2018). It is also possible that media coverage follows public opinion, telling readers what they already believe, so as to expand and maintain their audience (Gentzkow & Shapiro, 2010; George & Waldfogel, 2006). By doing so, media can still vary in terms of the tone with which they cover certain topics and issues, but public opinion is the main driver of media coverage, rather than the reverse (Hopkins et al., 2017). As such, it is possible media may not only influence public opinion, but may be driven by societal beliefs, as well.

Media analyses have found that newspapers from developing countries often portrayed aquaculture more positively than developed countries and that public attitudes are more positive when aquaculture is associated with the creation of new jobs (Froehlich et al., 2017; Whitmarsh & Palmieri, 2009). However, there is sufficient evidence to warn that researchers should be cautious in assuming the support for aquaculture is local, and that opposition is only from distant communities (Mather & Fanning, 2019). Research from Norway suggests that globalized aquaculture companies focus their social responsibility efforts at the global scale but tend to neglect the importance of having strong ties and relations with the community at the local level

(Carson & Ronningen, 2016). In many countries around the world including Canada, there has been strong public opposition against further development of the aquaculture industry (Bacher, 2015). Due to this opposition and poor acceptance by the public, development of the aquaculture industry has been limited far below its capacity potential (Knapp & Rubino, 2016).

1.1 Management problem

Within the last couple of decades in Atlantic Canada, the salmon aquaculture industry has encountered longstanding opposition and experienced periods of stagnated growth (Young & Matthews, 2010). Young and Matthews have described aquaculture as "one of the most divisive and intense struggles over industrial development ever to have taken place in Canada" (2010, p. 3). If aquaculture is to develop to reach its full potential, there is a need to fully understand what factors are enabling or inhibiting its growth and social acceptance. Decision-makers and scientists increasingly recognize that perceptions of aquaculture can influence the development of the industry and its acceptance in certain areas (Froehlich et al., 2017; Knapp & Rubino, 2016; Verbeke et al., 2007). This recognition of the need to incorporate social context in aquaculture management has resulted in holistic management frameworks such as the Ecosystem Approach to Aquaculture (EAA) (Soto et al., 2008). The desired outcomes of the EAA include an aquaculture sector that is environmentally, economically, and socially sustainable, as well as to have a change in the public's perception of, and attitude towards aquaculture. The drivers of acceptance, however, are poorly understood and are likely highly place-specific, mainly due to different environmental, economic, and social contexts (Whitmarsh & Palmieri, 2009).

1.2 Research objectives

Ultimately, a better understanding of how different factors can influence acceptance can help guide decision-makers and promote a sustainable and socially accepted aquaculture industry in Atlantic Canada. Thus, this research sought to answer the question: how have local factors influenced the historical media portrayal of salmon aquaculture across Atlantic Canada? To answer this question, this study investigated how the industry has been portrayed by the media in parallel to an analysis on how the industry has developed over time in three major salmon-producing provinces in Atlantic Canada: New Brunswick (NB), Newfoundland (NL), and Nova Scotia (NS). Three different provinces were chosen to compare areas that have different histories

of salmon aquaculture development, which could help identify any potential similarities or differences among the factors that drive social acceptance. The findings from this research could help identify critical factors that drive social acceptability of the aquaculture industry in Atlantic Canada.

1.3 Overview of Methodology

A media analysis was conducted in order to understand how the media in Atlantic Canada has portrayed salmon aquaculture. In relation to media coverage of crisis events such as oil spills, readers evaluate a crisis, its cause(s), and the organization(s) responsible for the crisis based on how the media covers the event (An & Gower, 2009). As a result, it is important to understand how the media portrays the crisis, the cause of the event, and the actor(s) responsible because these portrayals influence the public's perception and impressions of the organization(s) (Coombs, 2006). Therefore, media portrayals can provide a general indication of how aquaculture is perceived in Atlantic Canada. By selecting what to include and exclude, the media frame a story around a particular issue, thereby limiting or defining a story's meaning, shaping people's perception of that story and surrounding events (Hallahan, 1999; Iyengar & Kinder, 1987; Pan & Kosicki, 1993). For example, Olsen and Osmundsen (2017) argued that when the media gives aquaculture risks more coverage than benefits, it could create or perpetuate a negative risk perception of the aquaculture industry. There is also evidence that media preferentially chooses to focus on risks and events that are rare and dramatic and places more weight on these events as opposed to positive ones (Nelkin, 1995). An example of how the media influences the public's perceptions is after a study claimed farmed salmon contained more health-threatening dioxins, polychlorinated biphyenls (PCBs) and chlorinated pesticides than wild salmon, the mass media quickly picked up on it and a surge of media articles resulted from it (Huang et al., 2006; Luoma & Löfstedt, 2007; Olsen & Osmundsen, 2017). However, experts later reached different conclusions, due to differences in choices of data, yet these results were not as publicized by the media as those from the study claiming negative health impacts (Leiss & Nicol, 2007).

Furthermore, a literature review was used to supplement the news articles to build a timeline of how the industry has developed, and when important events occurred. Using this historical approach is important as it can help managers and stakeholders learn from the past, and

to help determine what factors and events may, or may not have led to social acceptance of the salmon aquaculture industry. Taking this historical perspective means understanding the social, cultural, and emotional settings that helped shape actions in the past (Canadian Heritage, 2019).

This study used a PESTE (Political, Environmental, Social, Technological, Economic) analysis as the analytical framework to organize and identify common macro-environmental attributes within the media analysis and timeline. A PESTE analysis is a commonly used strategic planning tool, which is used to evaluate the political, environmental, social, technological, and economic impacts on a project (Rastogi & Trivedi, 2016). Therefore, this study compared how the PESTE attributes have been expressed across the timeline of historical events within each province's development of the salmon aquaculture industry to identify drivers that can influence development and perceptions.

Chapter 2: Background

2.1 Aquaculture

Aquaculture is a globally diverse activity, farming 598 different species of finfish, crustaceans, shellfish, and aquatic plants, as well as a few reptiles and amphibians globally in 2016. However, the majority of production is dominated by a select number of high production species at the national, regional, and global level (FAO, 2018). Finfish dominates total production volume, and although the majority of finfish production occurs inland, marine and coastal aquaculture production accounted for 35.8% of total finfish production in 2016 (FAO, 2018). Mollusks dominate the marine aquaculture sector, being responsible for 58.8% of total production in 2016, with finfish making up 22.9%. Atlantic salmon was the highest produced marine finfish, accounting for 4% of all finfish production in 2016. In Canada, 75% of survey participants said their seafood of choice is salmon, while it is the second most consumed seafood product in the USA (Canadian Aquaculture Industry Alliance, 2011; World Atlas, 2017). Meanwhile, it is the third most consumed fish in Europe, behind tuna and cod (European Commission, 2017). Atlantic salmon is a high value species and is Canada's top aquaculture export (Fisheries and Oceans Canada, 2017). The major markets for farmed Atlantic salmon are Japan, Europe, and North America (FAO, 2010). The majority of farmed Atlantic salmon is produced by five countries, which were together responsible for 94.8% of Atlantic salmon production in 2010 (Asche et al., 2013; Figure 1).

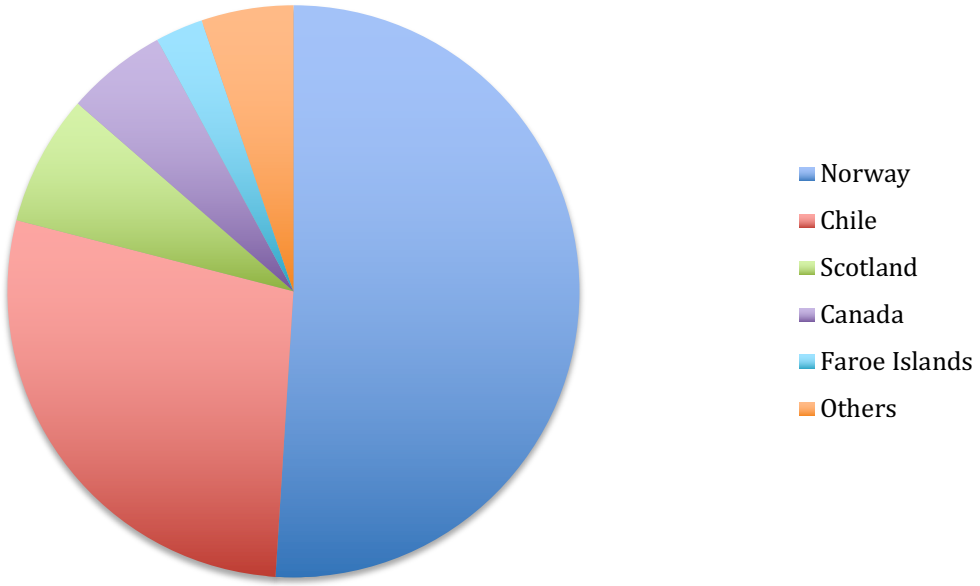

Figure 1. Top five Atlantic salmon producing countries in 2010, responsible for 94.8% of total production (Asche et al., 2013).

2.1.1 Aquaculture in Atlantic Canada

All provinces in Atlantic Canada are engaged in the aquaculture industry (Figure 2). It is a diverse industry that includes the cultivation of many species, although the main species are bivalves (oysters and mussels) and Atlantic salmon. Atlantic salmon production accounts for approximately 82% of all aquaculture production value in Atlantic Canada (Fisheries and Oceans Canada, 2018). However, British Columbia (BC) is the most productive Atlantic salmon-producing province, responsible for 69% of production value in Canada. Of the three salmon-producing provinces in Atlantic Canada, New Brunswick has the largest salmon farming industry, and is consistently the largest in terms of production tonnage, value, and number of farms (Table 1). The aquaculture industry within the three Atlantic study provinces provided 1,160 jobs in 2017, while providing 3,460 jobs across the country (Fisheries and Oceans Canada, 2019). However, Canadian Atlantic salmon production is quite modest on a global scale, representing one-tenth of Norwegian production, by volume (Young et al, 2019).

In Atlantic Canada, Atlantic salmon aquaculture has only begun in the last 40 years. Since then, the industry has grown substantially in all three provinces in terms of production value, number of farm sites, as well as companies operating in the province (Table 1 & Figure 2).

In many places such as Nova Scotia, the industry has developed slower than other parts of Canada, and certain areas of the coastline remain available for new farm sites (Nova Scotia, n.d.). Due to several natural advantages such as a large coastline, an abundance of cold and clean water, favorable climates, and a rich fishery tradition, the aquaculture industry holds great future potential in Atlantic Canada. Additionally, there is the advantage of having already established trade relationships with some of the largest global markets, as well as a commitment to sustainable and responsible practices to ensure longevity of the industry (Atlantic Canada Opportunities Agency, 2013; Chopin, 2015).

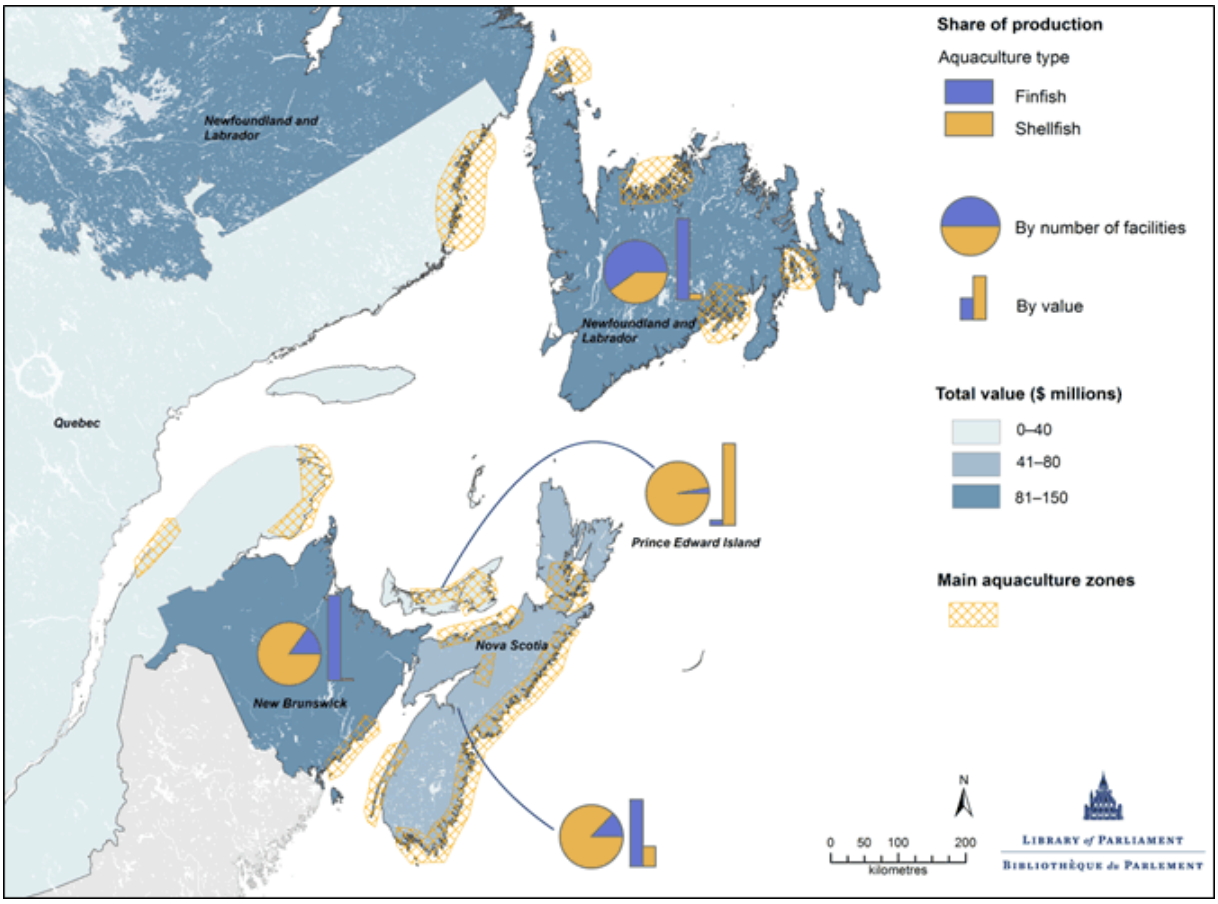

Figure 2. Map showing the location, type, and value of aquaculture sites across the Atlantic Canadian provinces (Nguyen & Williams, 2013).

Table 1. Breakdown of the salmon aquaculture industry by province, based on production statistics from 2017 (Canadian Aquaculture Industry Alliance, 2018; Fisheries and Oceans Canada, 2018; Newfoundland Aquaculture Industry Association, 2019; New Brunswick, 2019; Nova Scotia, 2019a).

Province	Industry beginnings	Production (tonnes)	Value ($000)	Number of sites	Companies operating in the province
New Brunswick	1978	23,867	227,843	More than 90	-Cooke Aquaculture Inc. -Marine Harvest Atlantic Canada
Newfoundland (in 2016, and includes trout)	Mid-1980s	25,411	263,000	88	-Cooke Aquaculture Inc. -Marine Harvest Atlantic Canada
Nova Scotia	1984	11,078	99,644	38 (finfish sites; map does not specify salmon or trout)	-Cooke Aquaculture Inc.

2.2 Social acceptability of aquaculture

2.2.1 Perceptions and social acceptance

Social acceptance of the aquaculture industry, and thus how the industry is perceived, are necessary components to understand, in order for the aquaculture industry to expand to reach its potential (Froehlich et al., 2017; Knapp & Rubino, 2016; Verbeke et al., 2007). Previous studies that have looked at perceptions and portrayal of aquaculture have found that the public is most often concerned with any potential risks for human health if farmed products are consumed, as well as the environmental impacts of the industry, with little focus on benefits such as what the industry means for local economies (Amberg & Hall, 2008, 2010; Höijer et al., 2006; Schlag, 2011). An analysis of German media, however, showed positive coverage of aquaculture was the most prevalent tone, and when negative tones were used, they were often counteracted with ways in which such an issue could be dealt with, leaving the readers with an overall positive to neutral impression of the industry (Feucht & Zander, 2017). Despite recent technological advancements and better environmental monitoring and management, the aquaculture industry still faces strong animosity from the local communities regarding new projects for fear of the environmental harm the farms may cause (Kluger et al., 2019).

Young and Matthews discuss how competing scientific narratives exist about aquaculture, thus creating "science wars" between the general public and industry (2010, p. 100). These "science wars" have led to disagreements regarding environmental issues such as the possible spread of disease and/or parasites from the farmed salmon to the wild populations, interbreeding between escapes and the wild population, as well as human health concerns centered around the consumption of farmed products. As a result of this conflicting information and differing views between the public and industry, the governance of aquaculture has been deemed a "wicked problem" that is difficult, or impossible to solve (Osmundsen et al., 2017).

Although social acceptance is often a widely used term, it is one that does not have a clear definition. When discussing the social acceptance of renewable energy sources such as wind energy, Wüstenhagen et al. (2007) break social acceptance into three dimensions: socio-political acceptance, community acceptance, and market acceptance. They define socio-political acceptance as social acceptance at the most general level, which may also include acceptance by key stakeholders and policy actors. Community acceptance refers to more specific acceptance, such as the type of project, as well as the location of the project. Finally, Wüstenhagen et al. (2007) define market acceptance as the willingness of the market to accept product innovation. As a result of this, acceptance of the aquaculture industry by communities and stakeholders may depend on the local context of the area.

2.2.2 Social License to Operate

As communities become more aware and informed of local operations, there is greater demand and expectation for sustainability, with communities pushing for more transparent industries and more involvement in decision-making processes (Kelly et al., 2017; Moffat et al., 2015). This combination of increasing pressures on industry performance, and the associated social acceptance of the operation has been described as the social license to operate (SLO) (Moffat et al., 2015). Although it is not a well-defined term (Kelly et al., 2017), according to Thomson and Boutilier (2011), a social license to operate is the community's, and stakeholders' perceptions, and opinions of a project. As new information arises about a project, these perceptions and beliefs of the community toward the project may change, and therefore SLO has to be earned and maintained as the project continues to move forward (Thomson & Boutilier, 2011). Although the concept of SLO began in the mining industry in the 1990s, it has recently

emerged as in issue in policy debates and academic research in other resource intensive sectors such as aquaculture (Mather & Fanning, 2019). While SLO is not a pre-requisite for legal activity, it is often helpful in a regulatory environment to demonstrate social acceptance for an activity (Cooney, 2017). Additionally, having social acceptance can help improve the likelihood of obtaining legal licenses, such as obtaining new fish farm licenses (Cullen-Knox et al., 2017; Haward et al., 2013; Kelly et al., 2017). Leith et al. (2014) argue that rather than viewing SLO as something that can be granted or retracted, it might be best to consider a social license as "an emergent, distributed, and reciprocal phenomena" that links scientists with stakeholders, industry and government managers, as well as policy decision-makers for more effective management and decision making.

As a result, how the public perceives the industry can influence the acceptance, investigation and implementation of new aquaculture operations (Knapp & Rubino, 2016; Verbeke et al., 2007). As aquaculture attempts to expand into areas where there is a significant number of people, tensions between industry and communities may become more prominent, thus increasing the need for SLO (Baines & Edwards, 2018; McGinnis & Collins, 2013).

2.2.3 Factors influencing acceptance

Community and public perceptions of aquaculture are quite variable and are likely influenced by a combination of factors. Several studies have been done to understand the perceptions of aquaculture, and what factors may lead to any potential opposition of the industry (Bacher et al., 2014; Freeman et al., 2012; Mazur & Curtis, 2008; Whitmarsh & Palmieri, 2009). From these studies, many factors have been identified as affecting perceptions of the industry including awareness and knowledge levels of how the industry operates, credibility of information sources, and perhaps most notably, perceived environmental risks. One analysis of perceptions of aquaculture on the Swedish west coast found that individuals who had a cultivation site near their home or went out to sea by boat had a more positive view of the industry than individuals who did not (Thomas et al., 2018). However, Shafer et al. (2010) found that people living close to the location of proposed fish farms in New Zealand recognized the positive economic benefits of the farms but were less positive in their evaluation of the farms, as these farms encroached on the marine space the community members frequently use. Thomas et al. (2018) also found there to be a difference in perceptions and acceptance of the industry based

on age and gender, where older generations had more positive perceptions of the industry than younger generations, and men viewed aquaculture more positively than women. This is further exemplified by a survey of community members and stakeholders of the aquaculture industry in southern Australia where it was found that female respondents were more concerned about the industry's impacts, and less trusting of the industry, while respondents who had been to an aquaculture farm or had a social link to aquaculture were more trusting and supportive (Mazur et al., 2004). Additionally, aquaculture tends to be viewed positively when it is associated with the creation of new jobs and revitalization of the economy (Froehlich et al., 2017).

Furthermore, different demographics between and within areas may lead to a difference in perceptions and opinions as these communities may have different histories and experiences with the industry. For example, Flaherty et al. (2018) found that respondents on Canada's Pacific and Atlantic coasts viewed and evaluated aquaculture quite differently. Regional settings and conditions of the local environment also influence how the industry is perceived. Respondents in rural areas of Australia and Scotland showed higher levels of support, and trust in the industry as well as lower environmental concerns compared to those in more urban settings (Mazur & Curtis, 2008; Whitmarsh & Palmieri, 2009).

Through a multi-methods study to gauge people's perception of aquaculture in BC, D'Anna and Murray (2015) found that interviewees outside of the aquaculture industry wanted to support local aquaculture, but a lack of information about the plans for such farms led them to having feelings of distrust towards the industry. However, evidence has suggested that consumers' perceptions of aquaculture may be based more on beliefs, values, and emotions rather than objective knowledge about the industry (Schlag & Ystgaard, 2013; Verbeke et al., 2007). As a result, providing transparent and fact-based knowledge and information may not be enough to change public opinion (Bacher, 2015). Furthermore, D'Anna and Murray (2015), found that at least in relation to shellfish aquaculture, perceptions of the industry are not as simple as jobs versus environment but rather include the quality and sustainability of the job, as well as the community's sense of place, and history within the environment. The ways in which governments regulate, manage, and/or enable the industry also plays a role in the acceptance of the industry as the history of aquaculture management in Tasmania has led to distrust from the community due to concerns regarding transparency of planning processes, poor information

distribution, as well as a lack of social and cultural inclusion in decision-making processes, among others (Leith et al., 2014).

Public perceptions of the industry have the potential to be shaped by how the media portrays the industry and how the science from the industry is relayed to the public (Feucht & Zander, 2017). Research has shown that the public's general opinion of aquaculture is interlinked with their understanding of the industry's environmental impact, and this understanding is often informed by the media (Osmundsen & Olsen, 2017; Schlag, 2010). Governments, industry, scientists and environmental non-governmental organizations have all taken to the media in various forms in an attempt to relay their messages to a wider audience and to sway the readers and listeners one way or another about their views on aquaculture (Flaherty et al., 2018). Consequently, media accounts of scientific information and how it is conveyed to the wider audience play a key role in whether the information is seen as trustworthy and credible (Olsen & Osmundsen, 2017). However, many factors influence the scale of coverage of how the media covers science and environmental controversies such as aquaculture, including current and ongoing events, newsworthiness of a story, economic priorities, as well as the perceptions and trustworthiness of the sources (Bocking, 2010).

2.2.4 Social acceptance in Atlantic Canada

In Atlantic Canada, acceptance of aquaculture has been an enduring challenge, with many critics having adopted a "zero tolerance" stand on the industry, and in some cases, swaying the public and some governments against the industry as well (Mather & Fanning, 2019; Young & Liston, 2010). For example, in Nova Scotia, public scrutiny was partly responsible for the provincial moratorium on new salmon farms licenses in 2013 (CBC News, 2015a). Furthermore, community groups have been protesting a recent expansion project in Liverpool Bay, Nova Scotia (CBC News, 2018a). However, Flaherty et al. (2018) conducted face-to-face interviews and found that 48% of Atlantic Canadian respondents had favorable, or positive impressions of the industry, compared to just 14% in BC. Coletto et al. (2011) found that most people garnering a positive view of the industry felt that it helped to rebuild wild fish stocks, or that it is sustainable and associated with the creation of new jobs. Those who had negative views cited environmental risks, disruption to wild fish stocks, and the use of chemicals as worrisome. Furthermore, Flaherty et al. (2018) also found that 67% of Atlantic coast respondents felt

aquaculture was a valid use of the coastline, and 77% felt that, if done in a sustainable manner, aquaculture should be allowed to increase. This is reiterated by Baines and Edwards (2018) who found that the loudest voices in the community do not necessarily reflect the majority views, which make it difficult for a company to fully understand the nature of the opposition, and may inevitably lead to community misunderstandings of the company's operations.

Chapter 3: Methodology

3.1 Media analysis

The analysis of media's portrayal of Atlantic salmon aquaculture in Atlantic Canada was based on the reading and coding of articles from nine Canadian newspapers from July 26, 1997 until May 1, 2019. The aim was to start in 1970, but due to limited availability, the search began in 1997, depending on the source (Appendix A; Table A1). Three newspapers were chosen from each province; one national paper, one provincial daily newspaper, and one local weekly newspaper, due to the relevance of spatial scale on perception. Newspapers were selected based on a combination of high circulation, the number of relevant results when searching the keywords in the online archive databases Eureka (https://nouveau-eureka-cc.ezproxy.library.dal.ca/Search/Reading) and Nexis Uni (https://advance-lexis-com.ezproxy.library.dal.ca/bisacademicresearchhome?crid=fe540505-3869-4cde-bea6-8e3d31de619a&pdmfid=1516831&pdisurlapi=true), as well as their proximity to areas where salmon aquaculture is prevalent. These two databases were used because of their ease of use, as well as the number of news articles available.

Articles were selected by searching Eureka and Nexis Uni for news articles between January 1, 1970 and May 1, 2019, with the search words *("salmon aquaculture" or "salmon farm*" or "fish aquaculture" or "fish farm*"*). Furthermore, the PRISMA (preferred reporting items for systematic reviews and meta-analyses) method was used for article selection (Figure 3). Articles were selected for analysis based on relevance, and were excluded if the article: 1) made a passing reference to aquaculture or fish farming unrelated to the rest of the article, 2) referenced fish farming other than Atlantic salmon (i.e. trout or striped bass), or 3) referenced salmon farming outside of the three study provinces. Articles were not distinguished between opinion pieces, letters to the editors, editorials or news reports and any article that was found using the databases that met the exclusion criteria were used in this study. Articles that appear

both in print and online (otherwise known as reprints) were only counted once. This resulted in a total of 829 articles deemed relevant for this study (Figure 3).

Upon reading and downloading each relevant article, each article was uniquely coded in Excel by location, date, tone and PESTE attribute, along with an ID number (see full coding scheme in Appendix A; Table A2). Coding also included summary notes of the article, as well as if there was a major media event surrounding the release of the article. Media events were defined as major events when spanning multiple newspapers and/or discussed in several articles; for example, a new farm site approval, regulatory changes, or disease outbreaks. Location was classified by the location discussed within the article, the scale of the article (local, regional, provincial, or national) and the province where the article was published. The local scale was defined as a particular community/city being the focus of the discussion (e.g. Shelburne, Nova Scotia). Regional, for the purposes of this analysis, was defined as a large body of water or area encompassing multiple communities (e.g. Bay of Fundy). Provincial generally discusses the province as a whole (e.g. when new regulations came out for NS), and national is discussion of aquaculture spanning more than two provinces. Dates were used to evaluate the prevalence of certain themes and issues over time and for building a timeline of historical events within each province. To indicate how the media portrays the aquaculture industry, the article was also coded for tone (negative, neutral, or positive) based on how the article portrayed aquaculture, the language used in the article, and whether it discussed the risks (negative tone), or benefits of aquaculture (positive tone), or if both views were presented (neutral tone). To understand which topics are discussed within the media, articles were coded based on the presence of one or more PESTE (political, environmental, social, technological, economic) attributes.

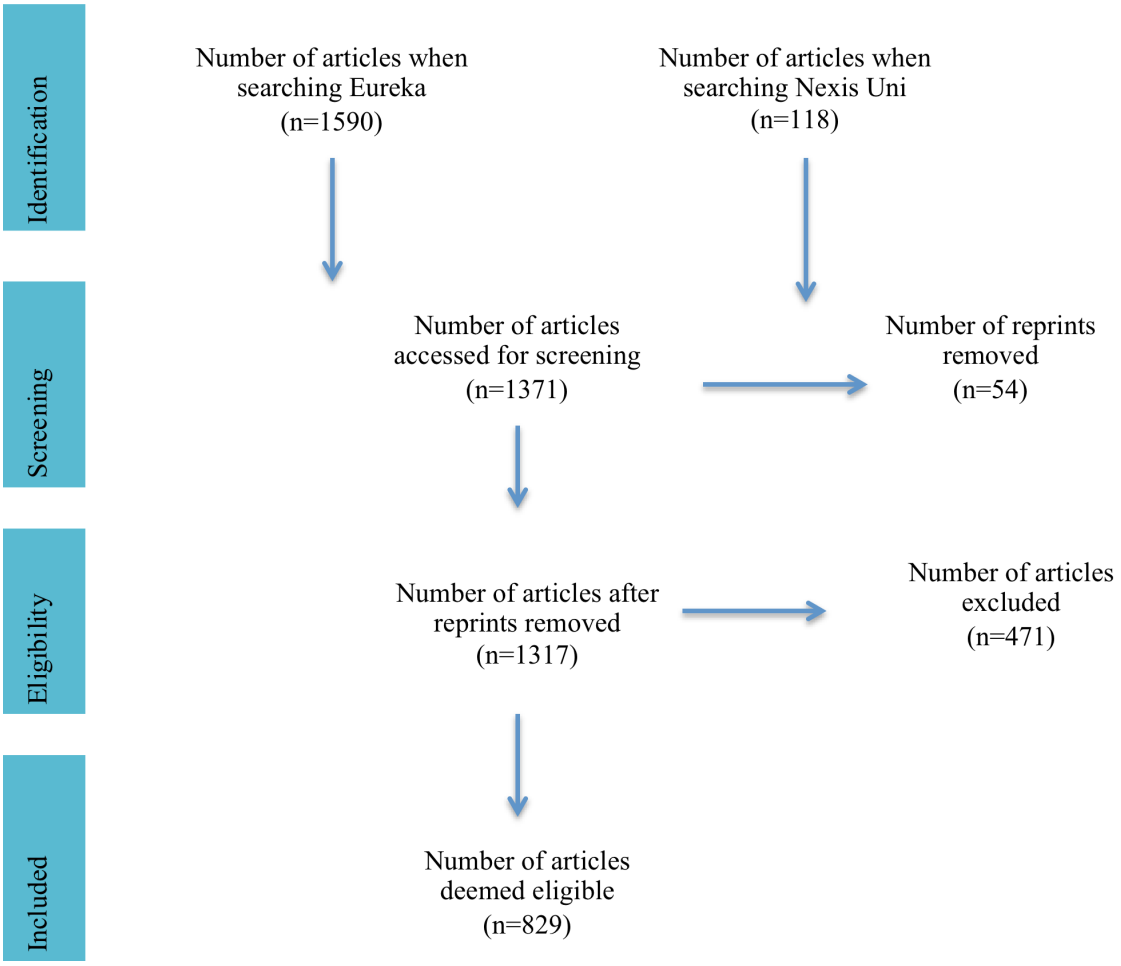

Figure 3. Flow chart of articles available via Eureka and Nexis Uni databases using the search words described above, and the number used in the analysis.

3.2 Timeline and literature review

To better understand how the industry has developed across Atlantic Canada, a detailed historical timeline of events in each province was created. This was done by drawing from relevant literature and information elicited from the media analysis. The literature included primary literature and grey literature such as online resources, including government websites and documents. Major events were identified and coded as discussing one or more of the PESTE attributes.

Chapter 4: Results

4.1 Media analysis

4.1.1 General characteristics

Among all three provinces, media reports about aquaculture were most frequent within Nova Scotia, followed by Newfoundland and New Brunswick (Table 2). The New Brunswick media published the fewest articles overall (137 articles), although online articles were only accessible from 2005 onwards compared to 1997 and 1999 for NL, and NS respectively. In addition to the reprints, 36 articles were duplicate articles, whereby they had the same title, or variations of the same title, and reported on the same story, but were published across multiple newspapers.

Table 2. Total number of articles per province, as well as how many articles from each individual newspaper.

Province	Newspaper	Scale of distribution	Total number of articles	Date of first article found
New Brunswick				
	CBC New Brunswick	National	23	October 13, 2005
	The Telegraph-Journal	Provincial	83	January 12, 2007
	Saint Croix Courier	Local	31	September 6, 2011
		Total	**137**	
Newfoundland				
	CBC Newfoundland	National	39	October 13, 2005
	The Telegram	Provincial	174	July 26, 1997
	Western Star	Local	35	January 25, 2000
		Total	**248**	
Nova Scotia				
	CBC Nova Scotia	National	59	April 17, 2006
	Chronicle Herald	Provincial	277	August 30, 1999
	The Queens County Advance	Local	108	April 18, 2006
		Total	**444**	

Despite the fluctuation between years, there was a general increase in the number of articles that reported on aquaculture over time (Figure 4). Additionally, all provinces showed similar patterns in the peaks of 2012 and 2018. In 2012, there was an increase in the number of articles published in the three provinces, but substantially more articles in NS compared to the

other two provinces. A similar increase is seen in 2018 as well, however, to a far less degree than in 2012, and is predominantly due to an increase in NL news articles.

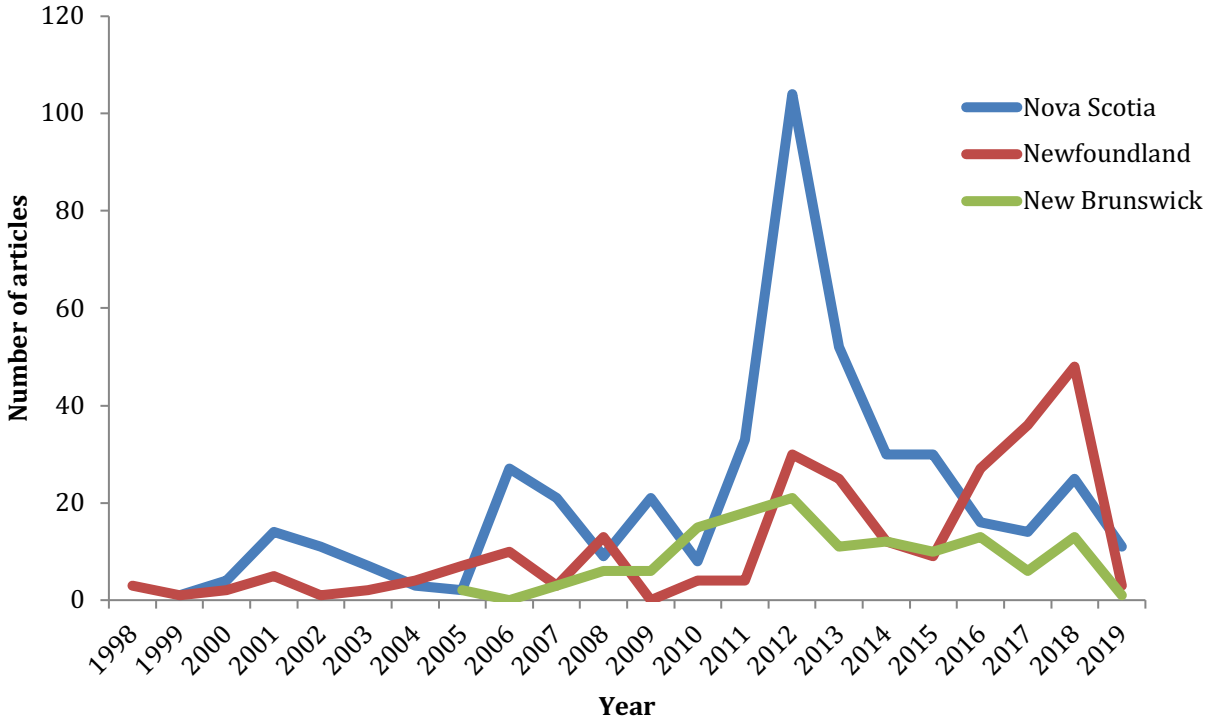

Figure 4. Total number of articles selected for the study over the years for the newspapers in the three study provinces.

News stories about aquaculture across Atlantic Canada were most often (50.4% of all articles) focused around local stories within particular communities (Figure 5). Stories with relevance to particular provinces were also prominent within the media. However, New Brunswick media discussed aquaculture evenly across all scales. Although the local scale dominates in total number of articles, all scales are discussed more by the provincial newspapers, rather than the national or local newspapers (Figure 6).

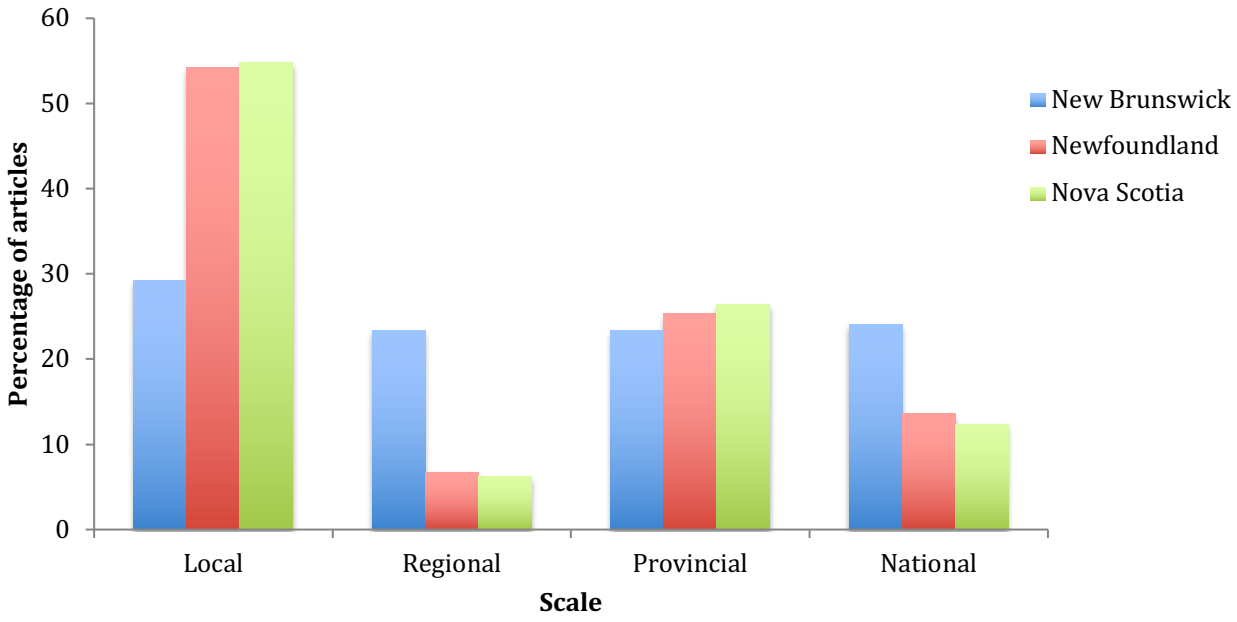

Figure 5. Percentage of articles per province based on the scale of discussion.

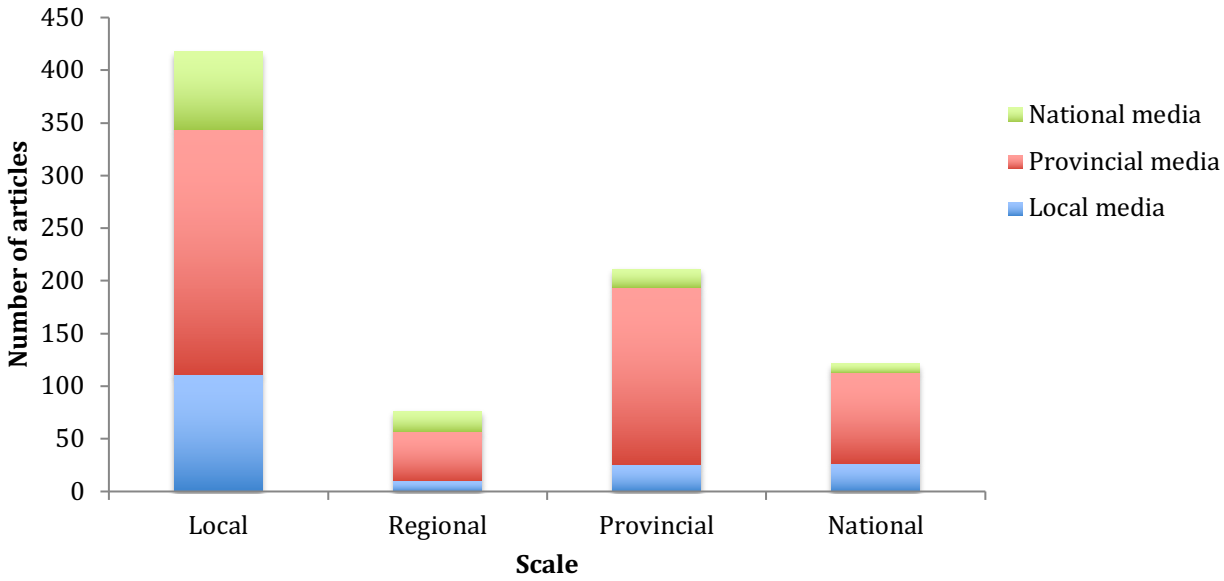

Figure 6. Number of articles discussed at each scale, by each scale of media.

4.1.2 Tone of the articles

Overall, the tone most used by Atlantic Canadian media was negative (46% of articles), followed by neutral tones (33% of articles), and positive tones being the least used (21% of articles). NS and NL media mostly used negative tones when discussing aquaculture, while NB was an even distribution among all three tones and utilized positive tones the most (Figure 7).

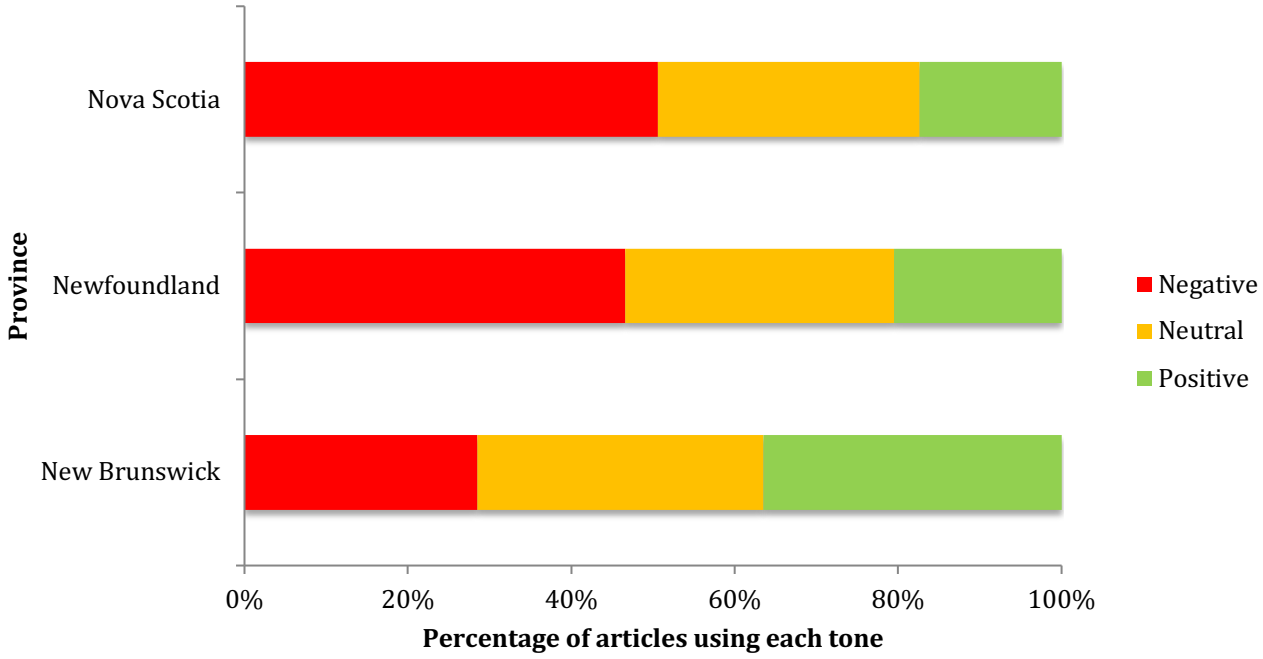

Figure 7. Percentage of articles from each province that use each tone when discussing aquaculture.

Negative tones were consistently the predominant tone of use by Atlantic Canadian media over time, with the exception of a few years where other tones were more often used (Figure 8). In 2012, there was a large spike in the use of all three tones, though a marked increase in neutral and negative tones compared to positive tones, paralleling the increase in total number of articles seen in that year (Figure 4). Similar increases are seen in 2018 as well, though most of the increase is attributed to the use of negative tones. Additionally, negative tones were the predominant tone of use at each scale when discussing aquaculture, except the regional scale, where neutral tones were the prevailing tone (Figure 9).

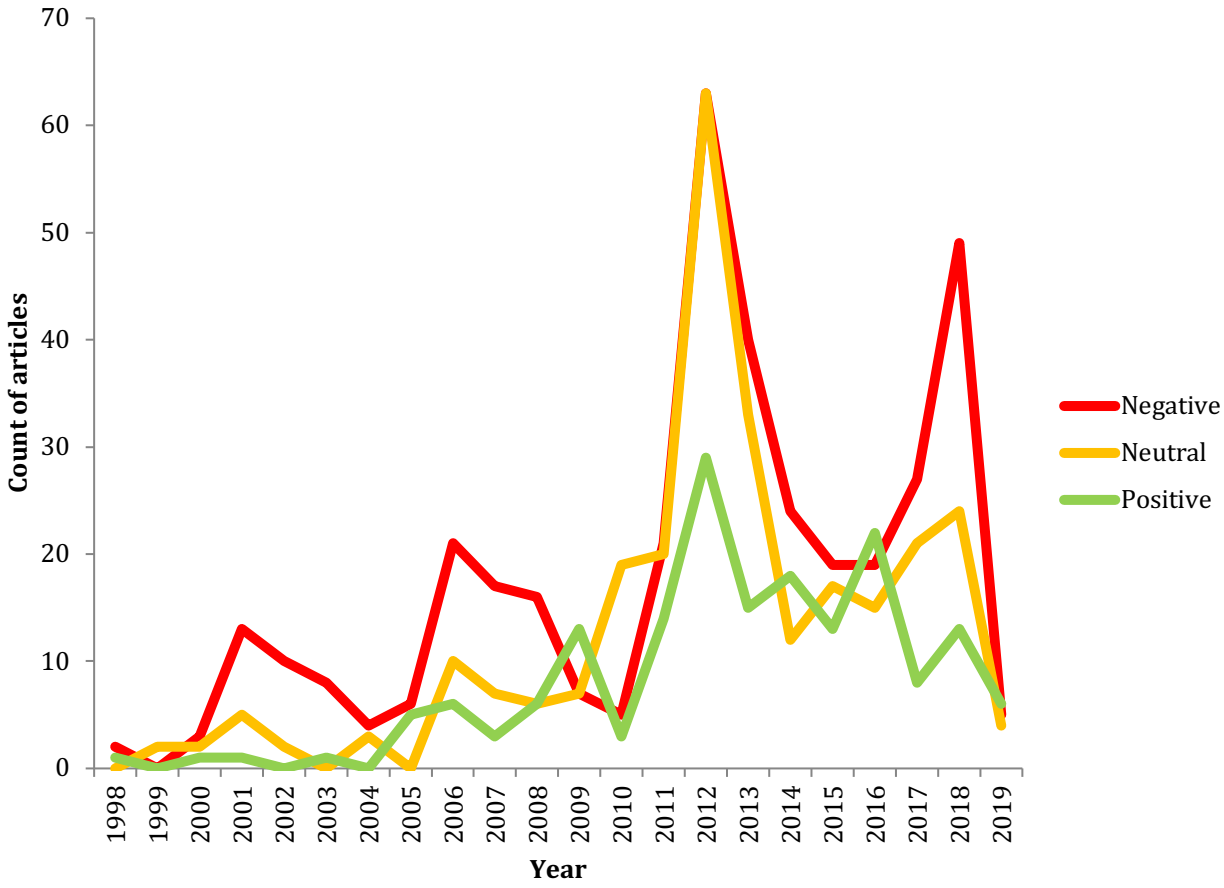

Figure 8. Number of articles that use each tone over the years.

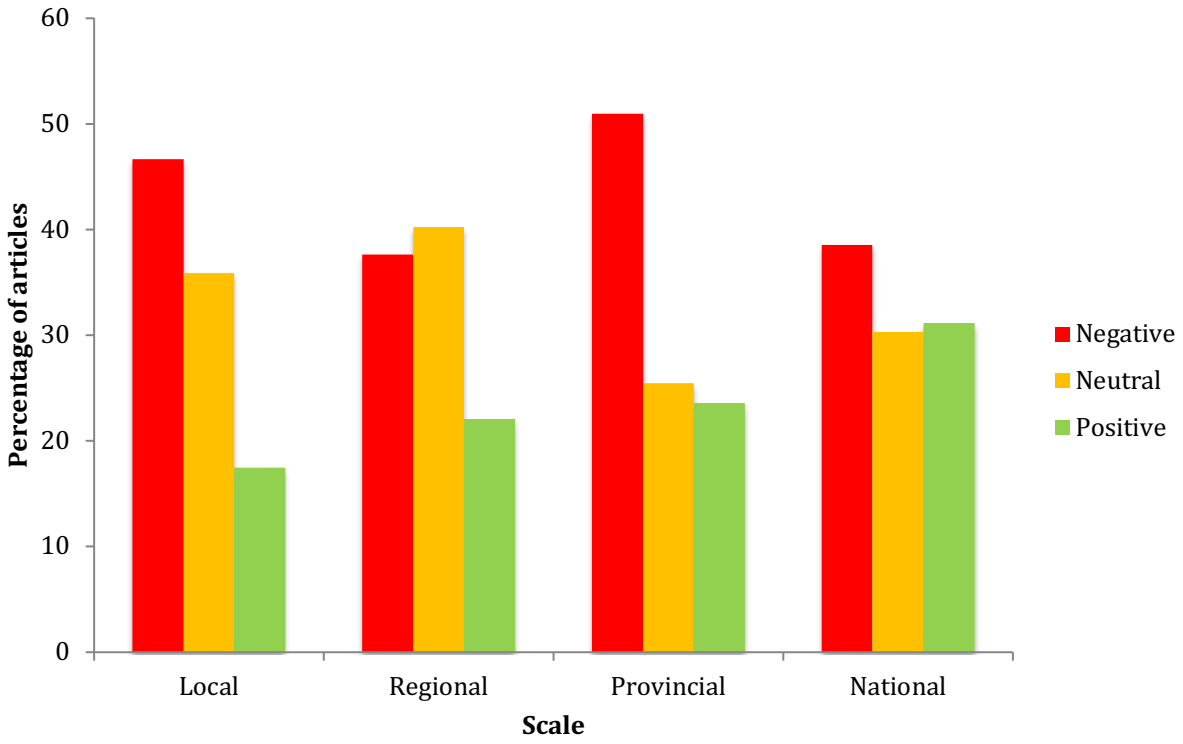

Figure 9. Percentage of articles that utilize each tone when discussing aquaculture by the various scales.

4.1.3 PESTE attributes

Overall, environmental and social aspects of aquaculture were the most frequently discussed attributes within Atlantic Canadian newspapers, appearing within 75% and 69% of articles respectively, with all three provinces showing similar patterns (Figure 10). Meanwhile, technological aspects of aquaculture were the least discussed, representing 11% of all newspaper articles. Particular topics within each PESTE attribute were discussed more so than others such as effects on wild salmon and diseases for environmental, while animal welfare and community opposition encompassed the social aspects (Table 3).

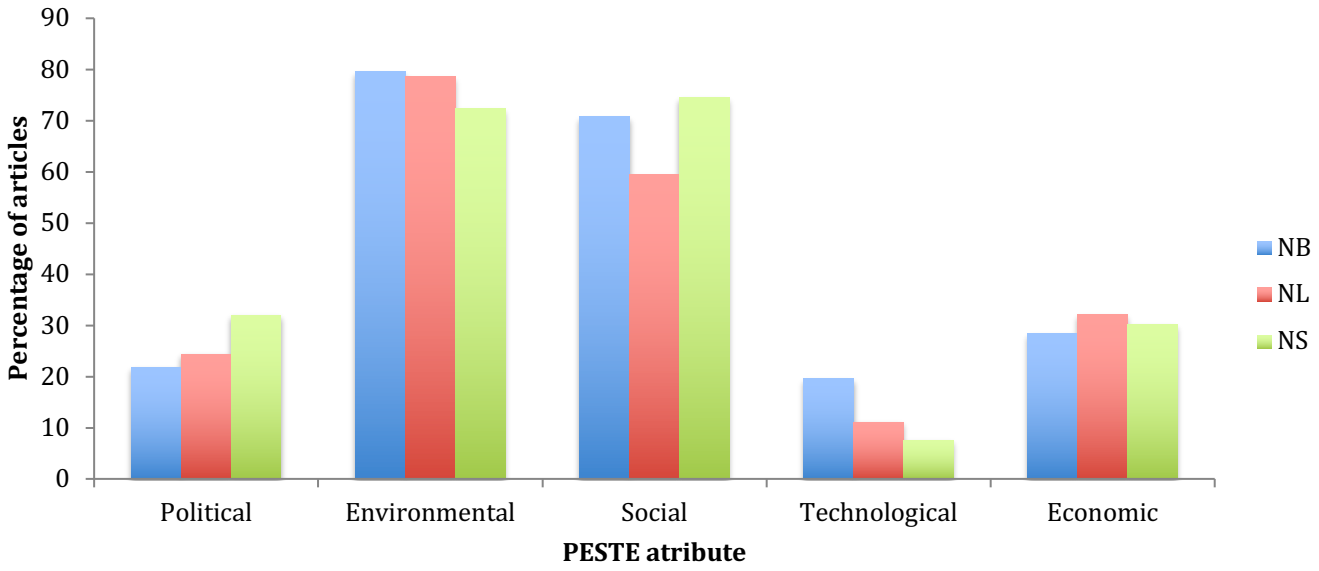

Figure 10. Percentage of articles within each province that were coded as discussing each of the PESTE attributes.

Table 3. The most frequently discussed topics in news articles based on the coding scheme as defined for each PESTE attribute.

PESTE attribute	Frequently discussed topics
Political	- Call for moratorium or actual moratorium put in place - Political parties' views on aquaculture (relevant for elections) - New regulations - Court rulings, particularly relevant for Grieg's proposed Placentia Bay, NL project
Environmental	- Potential harm to wild salmon from either escapees, transfer of disease and parasites etc. - Potential harm to lobsters because of pesticides - Infectious salmon anemia (ISA) outbreak
Social	- Community involvement (either through groups opposing farms, community engagement with industry, protests, etc.) - Animal welfare - Potential human health implications of consuming farmed fish (i.e. ISA infected fish when they went to market)
Technological	- New technology to improve aquaculture monitoring, feeding, husbandry etc. - Scientific studies such as the one by Ford and Myers (2008)
Economic	- Industry growth and expansion - Creation of jobs - Funding from government - Loss of product due to ISA culling and subsequent compensation from government

Across PESTE attributes, the prevailing tone was negative, with the exception of technological aspects (Figure 11). Political, environmental, and social attributes show similar patterns in the tones in which they are discussed. Although it is the least discussed attribute, the technological attribute was the only one to be generally conveyed in a predominantly positive tone. Economic aspects were also portrayed more positively, with just over 30% of aspects portraying a positive or neutral tone.

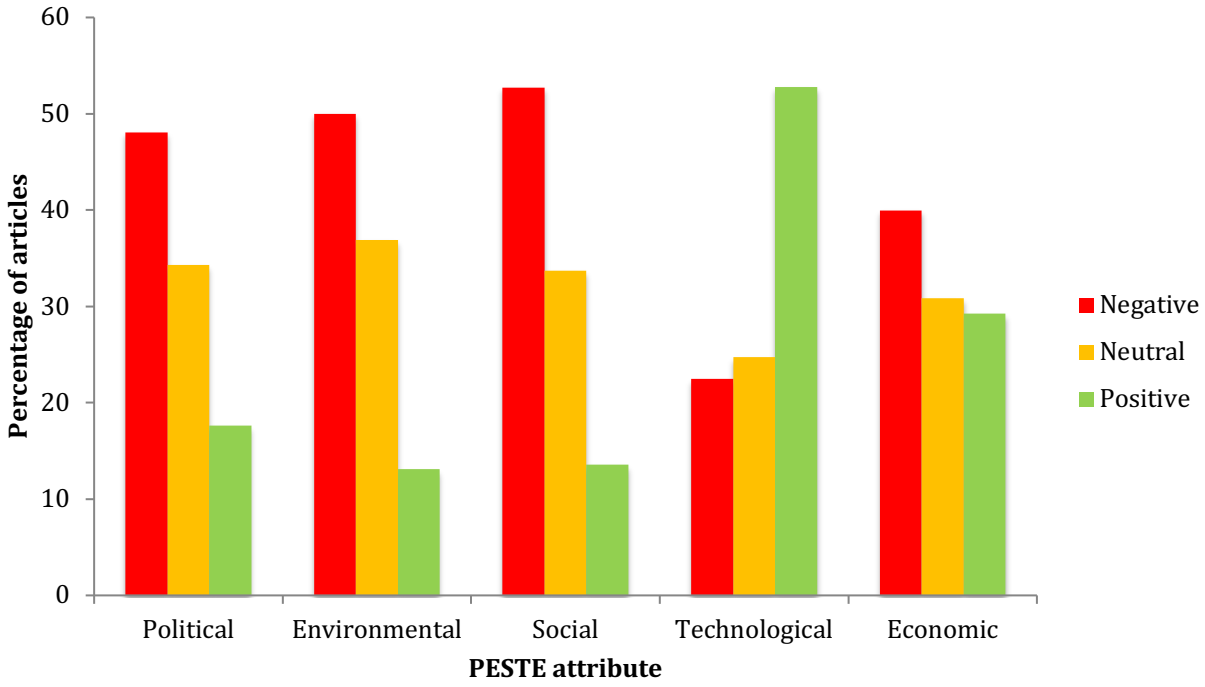

Figure 11. Percentage of the tone used when discussing each of the PESTE attributes among all articles.

When comparing how each of the articles published in each province discuss the PESTE attributes, and the scale they are discussed at, the NB media tended to discuss each PESTE attribute to similar degrees across all four scales (Figure 12). For NL and NS media, all attributes, except political in the NS media, which was discussed to a similar degree on the provincial scale, was largely discussed on the local level (Figure 13 and 14).

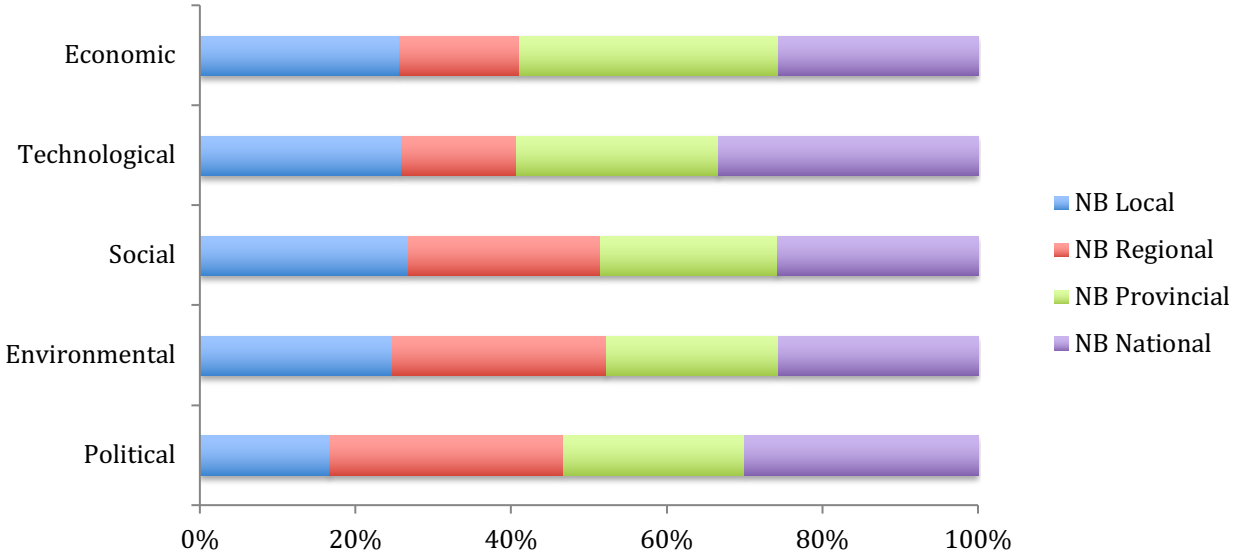

Figure 12. Percentage of the articles within the NB media that discuss each PESTE attribute at the various scales.

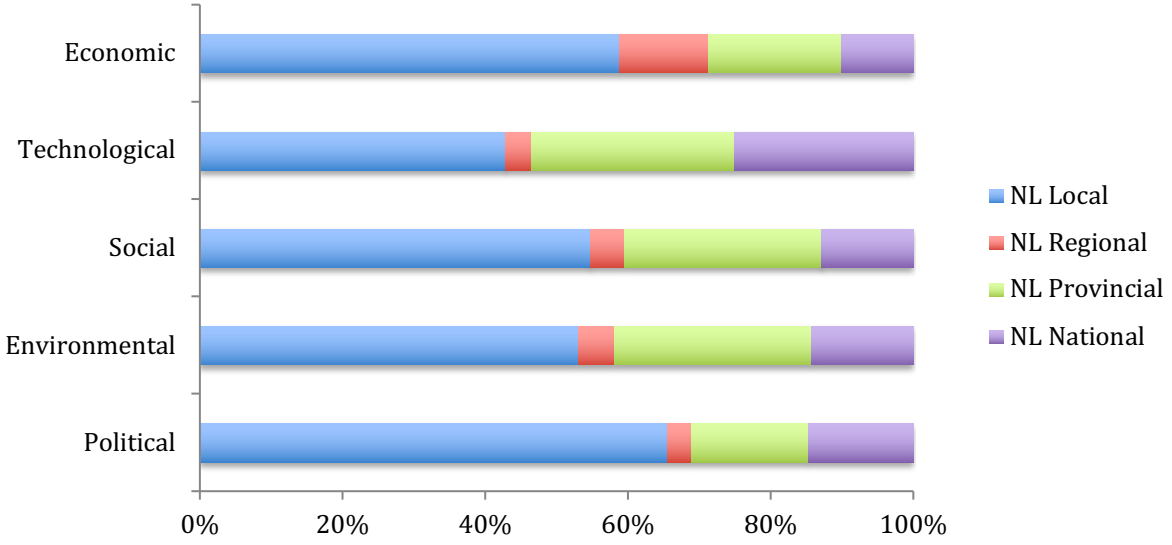

Figure 13. Percentage of the articles within the NL media that discuss each PESTE attribute at the various scales.

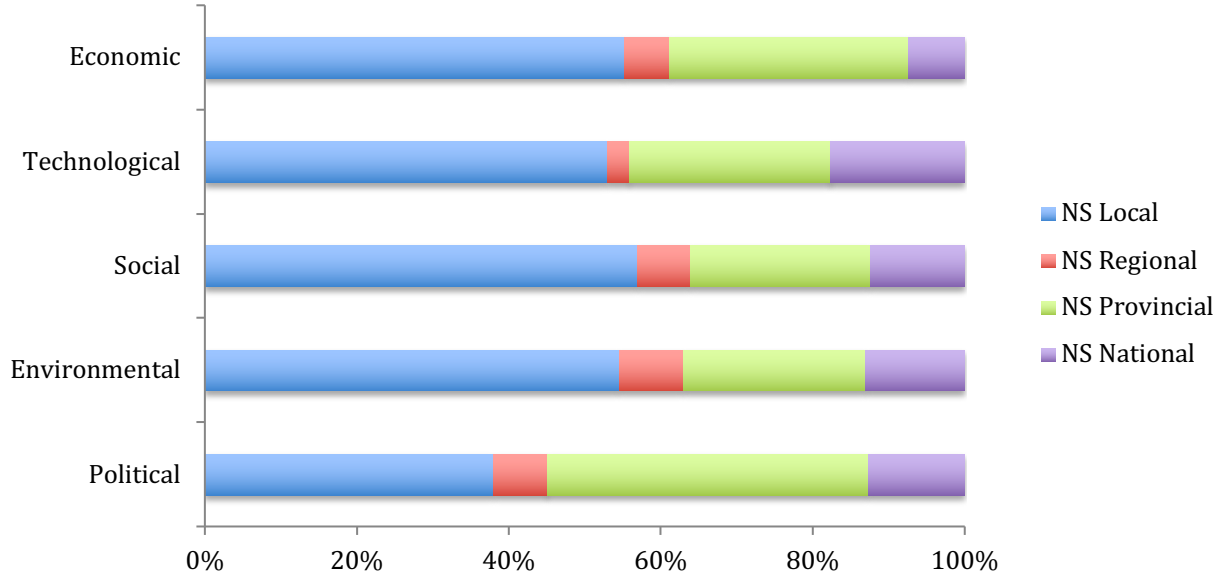

Figure 14. Percentage of the articles within the NS media that discuss each PESTE attribute at the various scales.

4.1.4 Media events

Overall, 71 media events emerged from the media analysis. Although the topics of each media event may have spanned several articles, each media event was only coded by a single news article, the first article encountered that described the event. There were two main periods of increased media activity that are characterized by a large spike in media events in 2012 and 2013, particularly in NS and again in 2017-18 in NL (Figure 15). This spike in media events is consistent with the overall increase in the total number of published articles (Figure 4). Nova Scotia accounted for the most media events (62% of all media events across the three provinces) during the time period analyzed. This suggests that the Nova Scotia industry has had the most changes in the industry over the time period analyzed. Some of these media events (Table 4) include landmark events such as Cooke Aquaculture (Atlantic Canada's largest aquaculture company) being charged in court for the illegal use of pesticides in the Bay of Fundy that resulted in the death of hundreds of lobster, several ISA outbreaks across NS and NL, the NS government giving Cooke Aquaculture $25 million to expand within the province, as well for the first time ever, the Canadian Food Inspection Agency (CFIA) allowing ISA infected salmon to go to market and declared safe for consumption. In 2017-18, these media events can be characterized by developments within the Grieg Placentia Bay aquaculture project and whether

the project was released from its environmental impacts statement (EIS), and the many court cases that ensued, as well as a few ISA outbreaks and escapement events (Table 4).

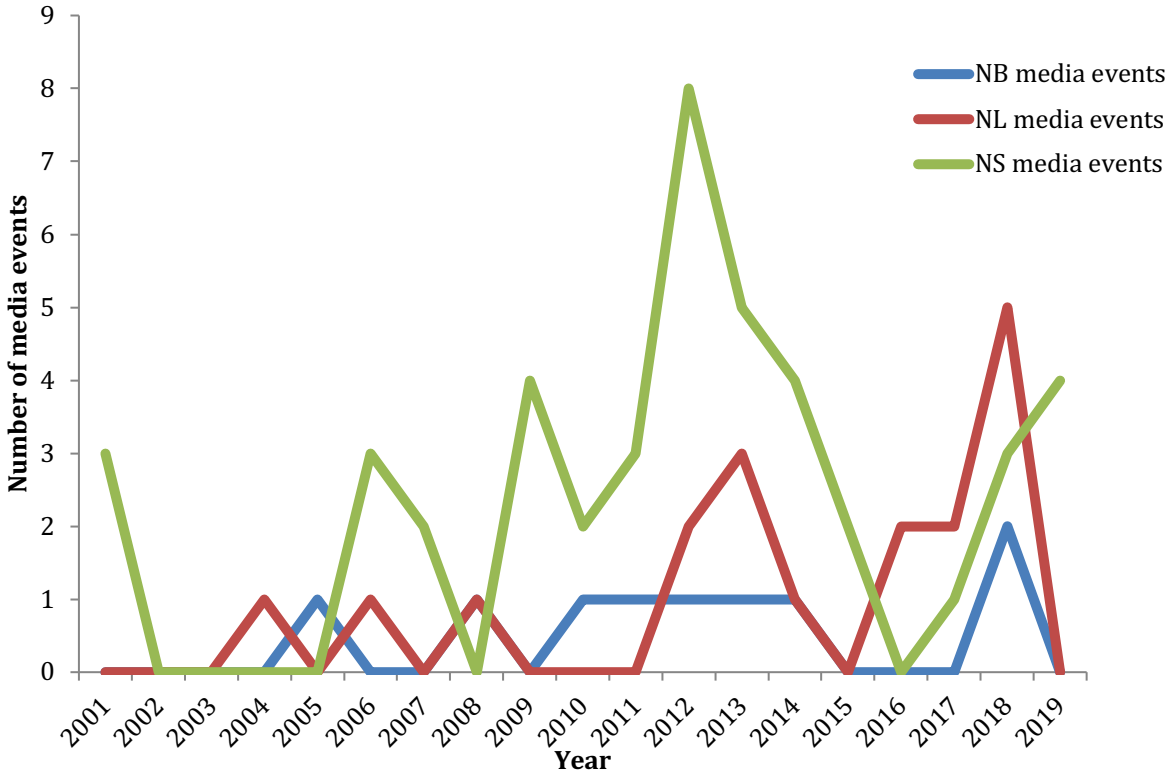

Figure 15. Number of media events by province per year, starting from the first media event in 2001.

Table 4. Some of the most salient media events that were elicited from the newspaper articles.

Media event	Province the event occurred in	Year
Application for the second largest fish farm in NS submitted for Port Mouton, sparking years of community opposition to follow	Nova Scotia	2006
In a continued battle of opposition, Friends of Port Mouton Bay (FPMB) conduct their own study to show the negative effects of the pre-existing farm on the environment	Nova Scotia	2007
Study by Ford and Myers (2008) shows the negative effects fish farms have on the wild salmon and surrounding environment	Nova Scotia	2008
Moratorium implemented on fish farms in Port Mouton	Nova Scotia	2009
Investigation underway to determine why, and how large numbers of lobster died in the Bay of Fundy	New Brunswick	2010
Cooke Aquaculture in court for illegal use of pesticides in the Bay of Fundy	New Brunswick	2011
Several ISA outbreaks across Newfoundland and Nova Scotia	Newfoundland and Nova Scotia	2012
Cooke Aquaculture recieves $25M from provincial government to help expand in the province	Nova Scotia	2012
CFIA allowed ISA infected fish to go to market	All three study provinces	2013
Moratorium on new fish farms across NS	Nova Scotia	2013
Court orders Grieg to undergo an EIS, to which they appealed	Newfoundland	2017
After several appeals back and forth about whether the project needs to undergo an EIS or not, the NL government says Grieg's EIS is sound, and the project is given the green light	Newfoundland	2018

Regarding PESTE attributes, media events across Atlantic Canada predominantly covered environmental (70% of events) and social (65% of events) attributes for the time period analyzed (Figure 16).

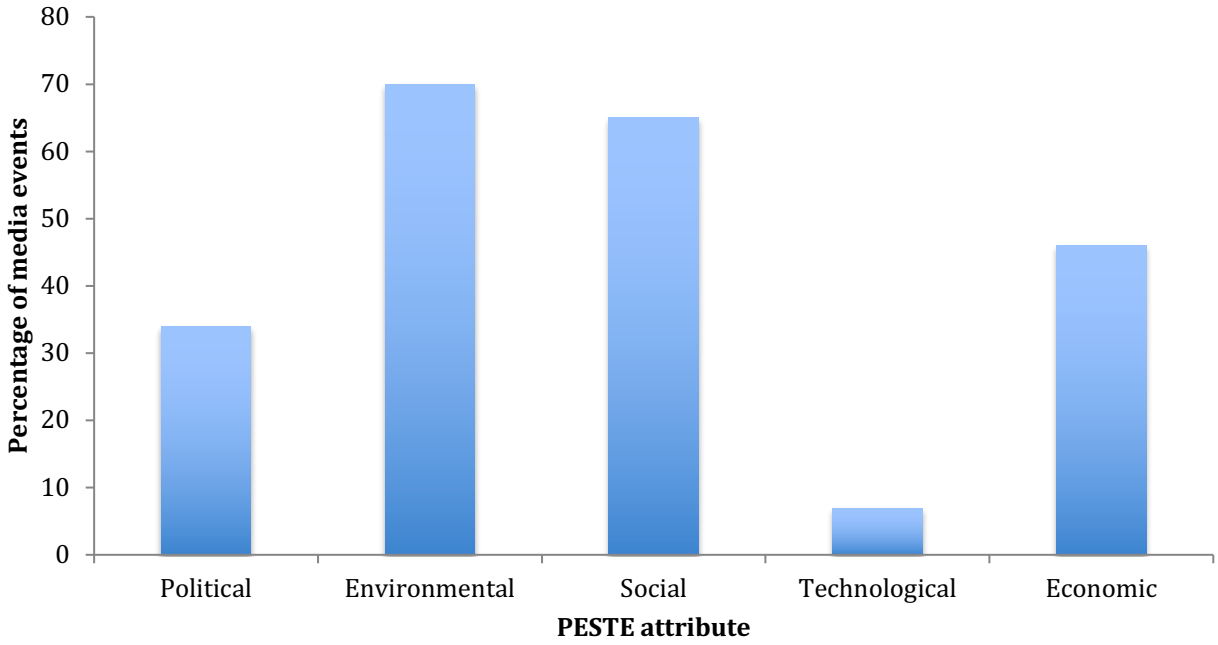

Figure 16. Percentage of all media events coded by each of the PESTE attributes.

4.2 Salmon aquaculture development in Atlantic Canada

The timeline for each province is described below in their respective sections (Figure 17, 18, and 19), as well as a full table detailing all of the media events, and historical literature events in the appendix (Appendix A; Table A3). Each timeline describes important events and changes in the development of the industry, extracted from both the literature and media. The events that are included in the timeline are those that are important to the development of the industry and/or likely to have the largest impact on social acceptance of the industry in their respective provinces. NS has the most events on its timeline, which suggests it has had the most happening within the development of the industry, while NB had the least number of events, suggesting its industry has not encountered as many dilemmas or the need to undergo regulatory changes. This is in line with the fact that NS had the most media events of the three provinces, while NB had the least.

4.2.1 New Brunswick

Salmon farming began in Atlantic Canada in 1978 when Fisheries and Oceans Canada (DFO) initiated a research project in partnership with the New Brunswick Department of Fisheries (now the Department of Agriculture, Aquaculture and Fisheries), and a private company Marine Research Associates to show the feasibility of commercial salmon farming in southwestern New Brunswick (Sutterlin et al., 1981). This project resulted in the first harvest of farmed salmon in Atlantic Canada, amounting to six tonnes in 1979 at Lords Cove, Deer Island (Chang, 1998). The NB salmon farming industry grew rapidly, and by 1997, was farming 18,600 tonnes of salmon from 80 grow-out sites, with some of the grow-out sites permitted to hold upwards of 340,000 individual fish at any one time. Currently, all salmon leases are located within a 60x60 km area along the southwestern coast of New Brunswick, where the rugged coastline provides sheltered locations, and where winter temperatures do not reach the lower lethal limit for salmon (Chang et al., 2014; Cook et al., 1987; Saunders, 1995).

The only salmon that are permitted to grow in NB aquaculture are those that are derived from the Saint John River (Chang et al., 2014). Using this strain, the Salmon Genetics Research Program and subsequent breeding programs have developed strains specific for aquaculture with increased growth and survival rates, higher filet yield, lower rates of early maturation, as well as enhanced disease and parasite resistance (Friars et al., 1997; Quinton et al., 2005).

When the industry first began in NB, there were no policies, legislation or guidelines in place to help give guidance for how the industry should grow, and the farm sites were allocated on a first-come, first-serve basis (Chang et al., 2014). However, due to rapid growth of the industry, a moratorium was put in place on new applications from 1986-1991 to allow time to develop policies, legislation, as well as to develop the capacity to produce smolts on a commercial scale. The New Brunswick Aquaculture Act (S.N.B. 1988, c A-9.2) was assented to in 1988 and became law in 1991. The Act defined the provincial authority and responsibilities for how the aquaculture industry is to develop, and how fish health would be managed (Chang et al., 2014). In 1993, the first guidelines were established for determining the size of a fish farm, the maximum number of fish a farm could support based on the site area, size, and depth (known as the estimated site potential), as well as establishing a maximum stocking density of 18kg/m^3 (New Brunswick Department of Fisheries and Aquaculture, 1993). From this, the industry was able to set allowable production levels, which were usually 50-70% of the estimated site

potentials, and these were used to regulate fish numbers until 2005. Since then, a performance-based standards framework is used, partly based on environmental performance of the farm, which is monitored by the sediment sulfide concentrations under the farms (New Brunswick Department of Environment and Local Government, 2012). Farms that receive poor environmental ratings are required to implement mitigative and remedial actions such as an early harvest of the stock, and/or reducing the stocking density in subsequent years.

The development of the industry did encounter some hardships early on. The first major outbreak of sea lice (*Lepeophtheirus salmonis*) in Southwestern NB was in 1994 (Hogans, 1995). Although chemical treatments and management practices (the establishment of ten sea louse management zones where chemical treatments were coordinated and sites were fallowed and further reducing louse numbers by practicing single-year-class farming) were put in place thereafter to keep louse numbers at a minimum, since 2008, louse numbers have increased once again due to the lice building up resistance to the main chemical treatments being used (Chang et al., 2011). ISA first appeared in Southwestern NB in July 1996 (Byrne et al., 1998). When the disease first appeared, it was initially termed haemorrhagic kidney syndrome because the pathological findings were only apparent at the microscopic level and included things such as acute tubular necrosis (Byrne et al., 1998; Kibenge et al., 2000). Management of ISA thus required the culling of approximately 10 million fish between 1996 and 2006, and ISA management strategies were implemented as a result in 2007 (Chang et al., 2014; Martin, 2007).

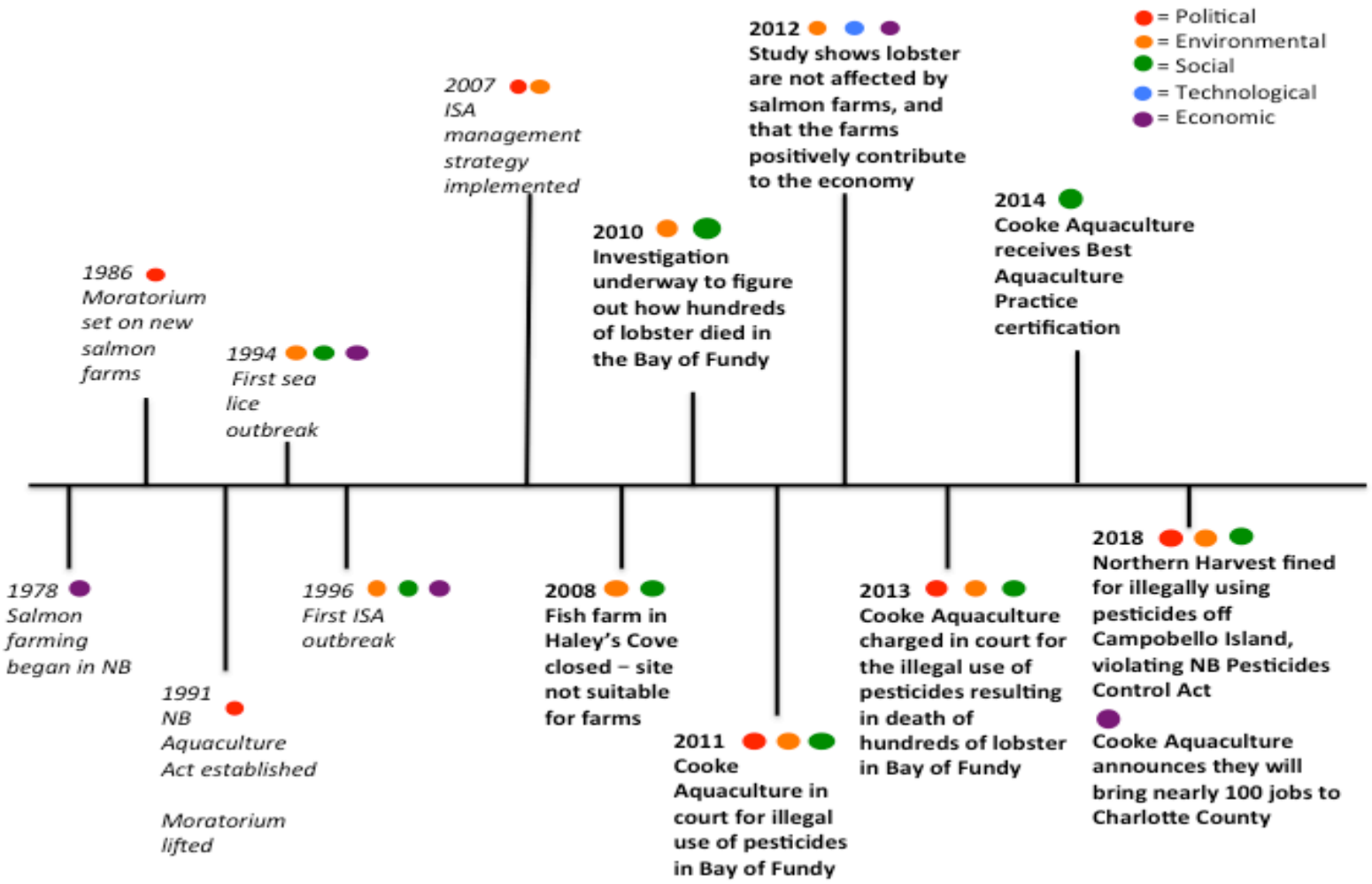

Figure 17. A timeline of the most salient events in the NB aquaculture industry, elicited from both the media analysis and the literature review. Literature events are italicized, while media events are bolded. Each event is coded by PESTE attribute.

4.2.2 Newfoundland

The Newfoundland industry is primarily situated in the Coast of Bays region on the south coast of the province where interest in developing an aquaculture industry began in the mid-1980s (Fisheries and Oceans Canada, 2016). Aquaculture within the province was slow to develop as there was insufficient technical support for the development of seed supplies, gear technology and proper culturing techniques (Pepper & Parsons, 1987). The aquaculture sector has grown in importance in the province since 1992, when the cod moratorium was put into effect (Heritage Newfoundland & Labrador, 2011). It was not until the early 2000s, however, that large-scale commercial production in the region began. Since then, there have been considerable investments from various programs of both the government and Atlantic Canada Opportunities Agency (ACOA) to develop the Newfoundland aquaculture industry sustainably and estimates suggest that within the next few years, production may reach upwards of 40,000 tonnes (Fisheries and Oceans Canada, 2016).

When the industry first began in Newfoundland, the farms were utilizing local wild stocks. However, these stocks were determined to be unsuitable for aquaculture, and subsequently commercial activity began with stocks from the Saint John River in 1991 (Fisheries and Oceans Canada, 2013). There have been previous requests from industry to import Atlantic salmon of Norwegian origin to test whether this strain has the potential for improved performance in Newfoundland conditions compared to those of domestic origin (Fisheries and Oceans Canada, 2013). However, these requests have been denied due to the uncertainty and knowledge gaps in their effect on the wild populations' growth, survival, and overall effects on the habitat.

Recently, the industry has been attempting to expand into Placentia Bay, but has faced several setbacks due to community groups such as the Atlantic Salmon Federation (ASF) appealing ministerial and court decisions to release the project from its EIS (Maxwell, 2018). The initial timeline was to have the land-based hatchery, and nursery complete by 2021 (Grieg Newfoundland Salmon Ltd., 2016), but due to the court cases delaying construction, the project is now projected to be complete by 2025 (CBC News, 2019).

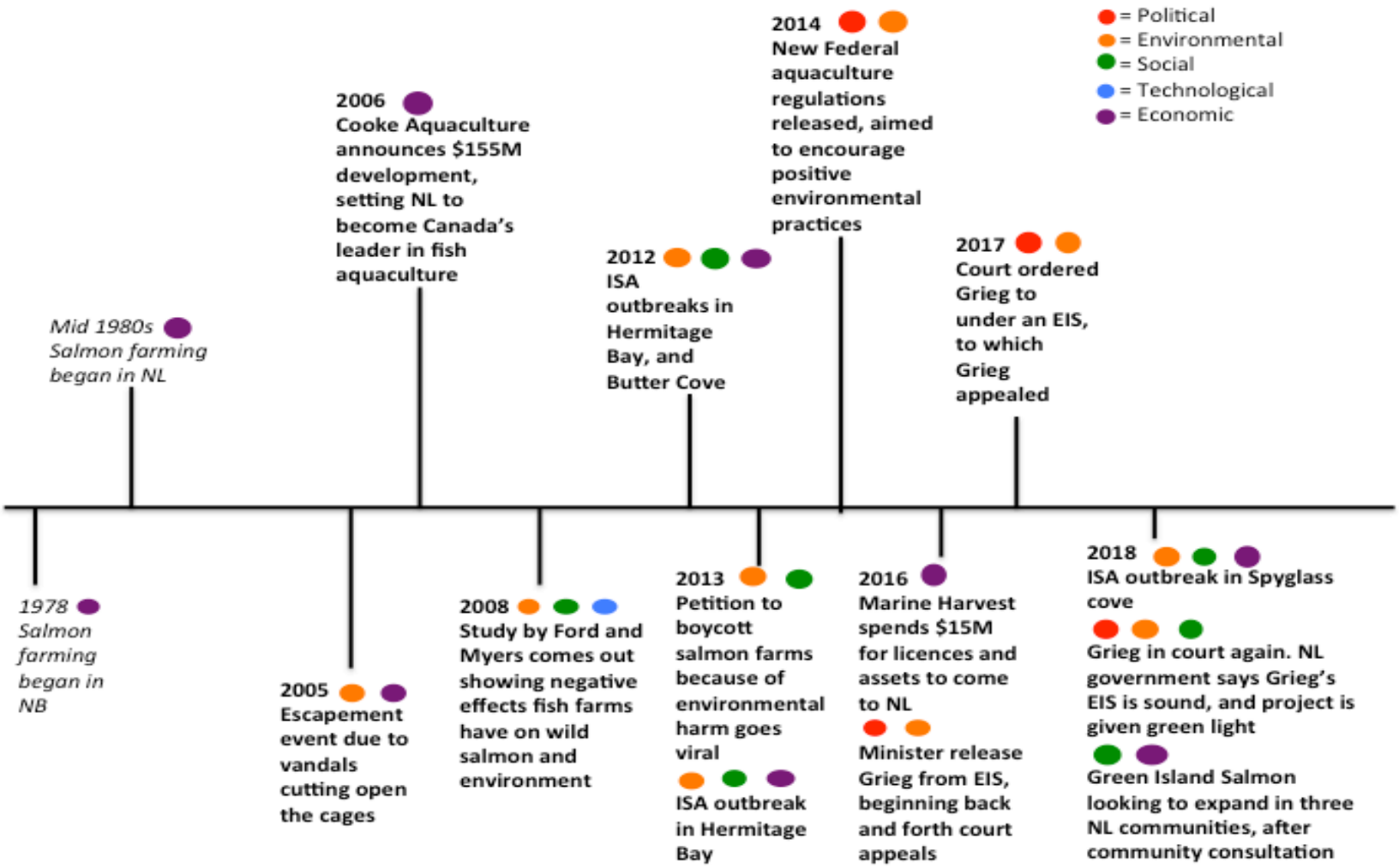

Figure 18. A timeline of the most salient events in the NL aquaculture industry, elicited from both the media analysis and the literature review. Literature events are italicized, while media events are bolded. Each event is coded by PESTE attribute. The beginning of salmon farming in NB in 1978 is used for reference purposes.

4.2.3 Nova Scotia

The Nova Scotia industry was slower to develop than NB and did not have its first harvest of farmed salmon until 1984 when five tonnes were harvested from an undisclosed location (Chang, 1998). By 1998, production reached 1,100 tonnes harvested from 11 marine grow-out sites. The NS aquaculture industry did not have many policies in place and it was not until 2002 that a provincial environmental monitoring program was established (Nova Scotia, 2019b). The monitoring is based on the presence or absence of a sulphur-eating bacterium known as Beggiatoa, and 5% presence indicates an affected site. Currently, the majority of finfish aquaculture sites are located on the southern and southwestern shore of the province.

In 2010, in order to gauge the level of public knowledge and perceptions of the aquaculture industry, the Nova Scotia government hired a consultant to conduct random phone interviews with 673 people. The main conclusions from this survey were that Nova Scotians were generally comfortable with aquaculture, so long as it is not in their backyard (M. Giles, personal communication, May 14, 2019). They are generally okay with eating farmed products, and existence of the farms, they just do not want to see the farms from their houses.

Due to the continued public backlash towards the aquaculture industry, the Nova Scotia provincial government placed a moratorium on new aquaculture farms in 2013 (CBC News, 2015a). Resulting from this, the provincial government hired an independent review panel, led by two environmental lawyers, to carry out a review of the provincial aquaculture regulations, and provide recommendations for improvement (Doelle & Lahey, 2014). Despite the opinion of many calling for a permanent ban on open-net pen fish farms, the recommendations instead recommended a better regulated industry, and one that is of low environmental and social impact, yet high economic value (Doelle & Lahey, 2014). Additionally, in 2014, the Ivany report on rural economic development recommended the aquaculture industry at least double in size to support growth and development in these rural communities (Ivany et al., 2014). This commitment to expansion can be seen through considerable investments from the provincial government (CBC News, 2012a). Using the Doelle-Lahey recommendations, in an attempt to "restore public confidence," the Nova Scotia government released new aquaculture regulations in the fall of 2015 (CBC News, 2015b). While the new regulations were based on recommendations from the Doelle-Lahey Report, not all recommendations were included, leaving some

communities and non-governmental organizations (NGOs) disappointed (Ecology Action Centre, 2015). Consequently, open-net pen fish farming continues to be a controversial topic in Nova Scotia (CBC News, 2016a).

Since the lifting of the moratorium in 2016, Cooke Aquaculture was given an option to lease in the Liverpool Bay area, where they were permitted to conduct feasibility assessments to test the viability of the area for a new farm (The Chronicle Herald, 2018). This location would be the first new farm in the province since the lifting of the moratorium. In March of 2019, Kelly Cove Salmon Ltd., a subsidiary of Cooke Aquaculture, submitted an application requesting approval for the expansion of its current farm in Liverpool Bay from 14 cages to 20, while also expanding and increasing by two new sites of the same size (LighthouseNow, 2019). More community opposition resulted because of this, with the intention of protesting any and all expansion of the industry in Liverpool Bay (CTV News, 2019). A petition has even begun, demanding a moratorium on all future open-net pen farms, but rather to permit aquaculture in closed containment facilities (LighthouseNow, 2019).

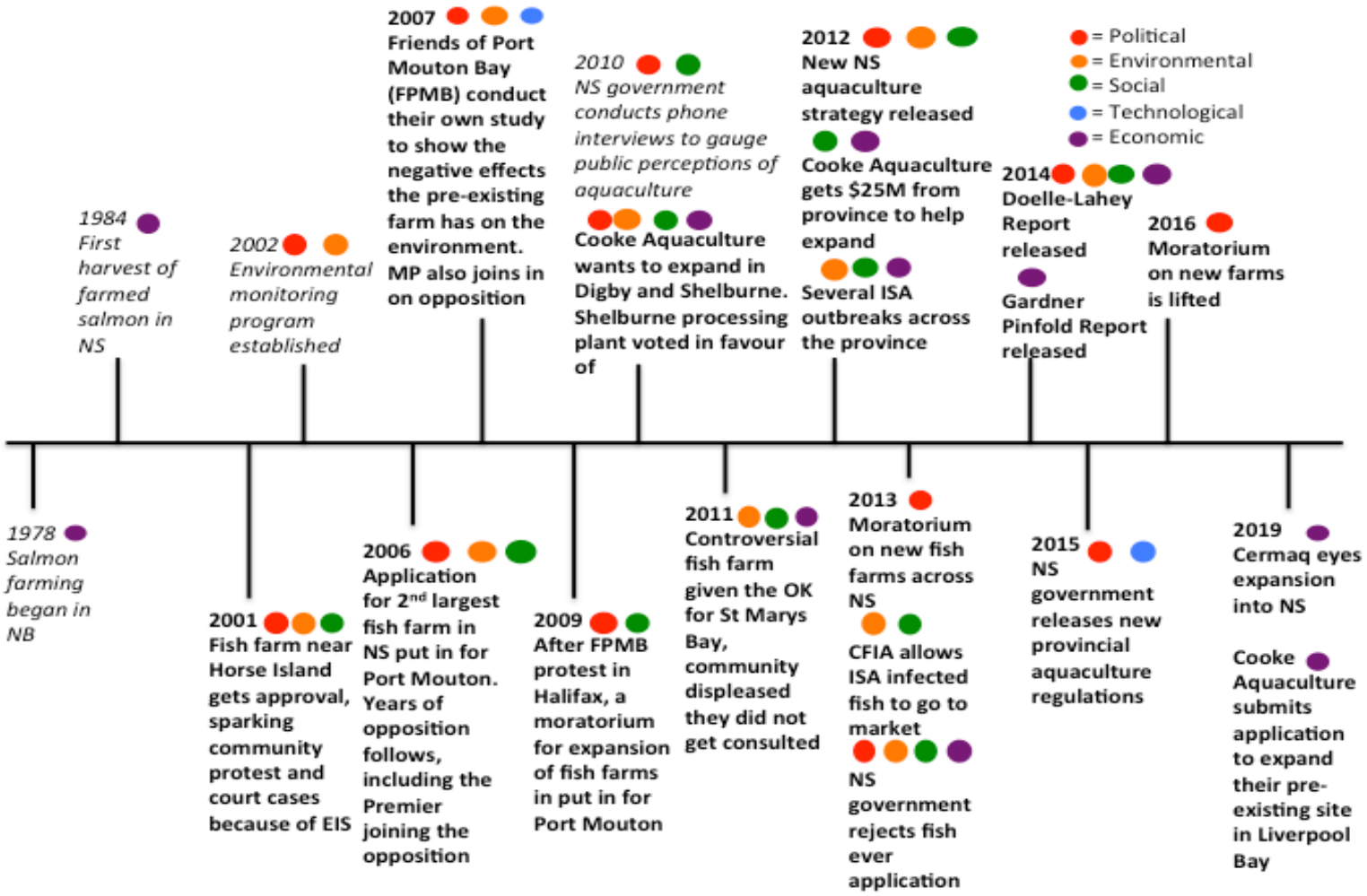

Figure 19. A timeline of the most salient events in the NS aquaculture industry, elicited from both the media analysis and the literature review. Literature events are italicized, while media events are bolded. Each event is coded by PESTE attribute. The beginning of salmon farming in NB in 1978 is used for reference purposes.

Chapter 5: Discussion

This research identified how the media within New Brunswick, Nova Scotia, and Newfoundland portrayed Atlantic salmon aquaculture, the tones used and the political, environmental, social, technological, and economic (PESTE) attributes of the articles, in order to understand what factors could be relevant for social acceptance of the industry. The media analysis was complemented with a literature review that aimed at reconstructing the timeline of events for each province to glean an understanding of how the salmon aquaculture industry has developed and the potential links with the media portrayal. Understanding how these factors may influence acceptance of the industry in relation to how the industry has developed over time may help guide decision-makers in promoting a sustainable and socially accepted aquaculture industry in Atlantic Canada.

5.1 Comparison of provinces

There were many similarities and differences among the provinces in not only how the industry developed, but also in how the media portrayed the industry. Across provinces, the media primarily portrayed aquaculture in a negative tone, focused often around environmental and social risks, and concerns over how they are managed and regulated. This is in line with results from other studies (Amberg & Hall, 2008, 2010; Schlag, 2011), though other studies have begun to find more positive coverage of aquaculture of late (e.g. Feucht & Zander, 2017). Additionally, the media across all three provinces had similar discussions of the PESTE attributes, focusing largely on environmental and social aspects of aquaculture, while discussing technological aspects the least. Similarly, all provinces have endured forms of environmental risks, and social pushback, whether that be for a moratorium to be put in place in NS (CBC News, 2012b), the NS locals not wanting farms in the area (The Chronicle Herald, 2006), NL conservation groups calling for projects to undergo an EIS (The Telegram, 2018a), or locals in NB calling for increased fines for companies using illegal pesticides (CBC News, 2018b).

While media across Atlantic Canada discussed similar attributes of aquaculture, there were differences in the tone of coverage between provinces. In particular, media in NB covered fewer media events, while coverage was generally also more positive in NB (36.5% of all NB articles) compared to NL (20.5%) and NS (17.4%). This may be attributable to the age difference between the industry in each province. The New Brunswick aquaculture industry underwent

many political and environmental changes with a moratorium on development within the first ten years of development, as well as an implementation of ISA management strategies in the early 2000s and is now the largest aquaculture industry of the three provinces (Fisheries and Oceans Canada, 2018). Conversely, Nova Scotia has appeared to have undergone a number of changes over the past ten years, in particular from a regulatory and economic standpoint, with a moratorium being in place for three years, and new regulations implemented in 2015, as well as the continued desire to see the industry grow in production. However, the relationship between age of the industry and media portrayal could not be statistically tested since news articles were only available for New Brunswick since 2005, making it difficult to have equal sample sizes to assess media portrayal. Nevertheless, the age of the industry may have the potential to influence how the industry is portrayed and discussed in the media as the older industries such as in NB are perhaps less newsworthy due to the lack of more recent developments.

Additionally, the surrounding socio-economic contexts within the provinces may have influenced how the industry has developed. Despite the industry in NL and NS starting around the same time, the industry in NL is larger in terms of production tonnage than that of NS (Fisheries and Oceans Canada, 2018; Newfoundland Aquaculture Industry Association, 2019). This may be a result of a greater need for economic activities in NL, especially since the cod collapse of 1992 (Heritage Newfoundland & Labrador, 2011).

5.2 Factors influencing portrayal of aquaculture in Atlantic Canada

To better understand what influences the portrayal and acceptance of aquaculture in Atlantic Canada, this research identified a set of frequently emerging factors across various political, environmental, social, technological and economic dimensions. First, the relevance of articles on environmental effects, and potential impacts on other species and industries, suggests that aquaculture's interaction with the environment likely plays a large role in the acceptance of salmon aquaculture. Across all three study provinces in Atlantic Canada, similar discussions largely focused on the potential impacts on the wild salmon and lobster fishery, and discussions around diseases and parasites were frequently reported on in the media. These environmental risks were often the basis for the opposition of many community groups, despite technological advances in the industry. Previous research has found that Norwegian media discussed both negative and positive aspects of aquaculture, however, the articles discussing environmental

challenges were more extreme (Olsen & Osmundsen, 2017). This study likewise found similar extreme articles around environmental risks in Atlantic Canada.

Social factors that have influenced how aquaculture has been portrayed in Atlantic Canada were predominantly linked to concerns around the lack of community involvement in decision-making. The lack of communication between industry, governmental decision-makers and local community has the potential for creating conditions in which local skepticism and negative attitudes towards developments can turn into actual actions against specific projects (Wolsink, 2007; Wolsink, 2012). Similarly, acceptance has also been related to how the community is treated during the process (Bates & Firestone, 2015; Château et al., 2012; Soma & Haggett, 2015). The occasions where the local community felt as though they were not adequately part of the decision-making process may explain the opposition to new developments in the area (The Chronicle Herald, 2012a, 2012b; The Queens County Advance, 2007, 2008; The Queens County Advance, 2013).

Perceptions of the health and nutritional value of farmed versus wild fish also play a role in how aquaculture is portrayed by the media, particularly around the time the CFIA allowed ISA infected salmon to go to market (The Chronicle Herald, 2013a). Health and safety were issues of concern surrounding the use of genetically modified salmon in aquaculture farms, with some articles even terming them "Frankenfish" (CBC News, 2010, 2016b). In a survey among Belgian consumers, the perception was that wild salmon had a better taste and were healthier and more nutritious than farmed salmon (Verbeke et al., 2007). There is a lack of consensus among researchers, however, in terms of the actual health benefits and risks of farmed salmon compared to their wild counterparts. Some studies have found the level of toxins to be higher in farmed salmon compared to their wild counterparts (Hites et al., 2004), while others have found toxin levels to be higher in wild salmon (Lundebye et al., 2017), and found the level of dioxins to have decreased over time (Nøstbakken et al., 2016). Another study found the levels of omega-3 fatty acids to have decreased in farmed fish over time, yet, the authors caution these farmed fish still provide more omega-3 than other fish and terrestrial livestock (Sprague et al., 2016).

Much of the political discussion within the media was centered on concerns raised around the environmental and social aspects of aquaculture and how the industry is managed. Many of these discussions revolve around community involvement seeking moratoriums to be put in place (CBC News, 2012b), transparency of the industry and release of information to the public (The

Telegram, 2019), and the environmental impacts of the farms (The Telegram, 2018a). Moreover, the majority of news articles that discussed political aspects of aquaculture were generally discussed negatively. Combining that with the fact there were numerous calls from the public for moratoriums on expansion, this may suggest the community feels the governments are not doing enough to properly regulate the industry while also ensuring any potential environmental effects are mitigated. Management and policy approaches of aquaculture often independently address these concerns, but recognition that these issues interact with each other is needed given this silo approach to management will likely not lead to changes in public opinion and trust (Weitzman & Bailey, 2019). This portrayal therefore may suggest there is a lack of trust in the government oversight of the industry from the community.

Acceptance of the industry may also be affected by whether the local community will benefit from the aquaculture development, such as local jobs, or if the community views the project as risky (Krøvel et al., 2019). For example, within different communities in Nova Scotia, the media portrayed different attitudes towards aquaculture expansion. In Port Mouton, the media reported almost unanimous opposition against new fish farms, yet in Shelburne County, there was an equal divide among who is for, and against industry expansion (The Queens County Advance, 2011a), potentially due to the promise of jobs in Shelburne. Across the provinces, there was also a desire for local ownership of the farms to help ensure the economic benefits stay within the community. Within the media, several articles from NS and NL emerged expressing concerns over new developments by foreign investors. The local communities feel they will not see the benefits directly if a company is foreign-owned as opposed to a local company, as sometimes jobs are provided to low paid employees who are brought in from other countries (The Queens County Advance, 2011b). This is also the case in some Norwegian communities where farms are mostly owned by large companies that have few ties to the local communities, and therefore has been presented as a possible explanation for negative attitudes from the community (Lindland et al., 2019). Furthermore, local ownership was the preference of 75% and 64% of survey respondents in Ireland and Norway, respectively (Hynes et al., 2018). Krøvel et al. (2019) discuss how local community's negative attitudes towards aquaculture related more to wanting greater return from the aquaculture activities as opposed to the farm's ecological footprint, as it is believed the community should not have to give away its resources and be exploited in order to satisfy the economic needs of distant foreigners. This has been recognized

by Norwegian authorities, and now a fund has been established to ensure municipalities that have aquaculture receive economic benefits.

The main economic factors reported in the media related to the industry's provision of local economic benefits and therefore, have been presented as both a positive driver and also an area of public concern. Announcements for increased expansion of the industry such as in NS emphasize positive economic aspects of the industry such as jobs and economic input into the community. This has been the case in some communities (Fisheries and Oceans Canada, 2014); however, the public sometimes questioned the industry's ability to make good on their promises of jobs (The Western Star, 2016). Similarly, the public was concerned with whether aquaculture companies should receive subsidies and compensation for lost product due to unforeseeable circumstances such as ISA outbreaks (The Chronicle Herald, 2013b; The Queens County Advance, 2014). This is not a commonly shared belief worldwide, as in a survey of Irish and Norwegian respondents, among the many statements the participants were given, "fish farming is too dependent on subsidies" was the statement to get the least degree of agreement with only 26% and 23% of Irish and Norwegians agreeing or strongly agreeing to this statement, respectively (Hynes et al., 2018).

Aquaculture can also be viewed as risky to the local community if there is an actual or perceived conflict of interest in the use of the marine space. Since cultural identities of local communities are often intimately interlinked to their traditional values, and uses of the marine space (Agardy et al., 2003), having aquaculture impede on the marine space local community members use could impart negative views of the industry. This behaviour is in part exemplified by Krøvel et al. (2019) where it was found that in a local Norwegian community where aquaculture dominates, negative attitudes towards the industry were more a result of conflicts of interest in the marine space as opposed to the perceived environmental impacts.

Coinciding with the marked increase in news articles in 2012, across Atlantic Canada there has been an increase in the discussion of the technological attributes of aquaculture within the Atlantic Canadian media. These discussions of the increase in scientific and technological advances have generally been portrayed in a positive manner; however, there have been concerns from the community around not only about how the research is conducted, but also how it is funded. For example, whether salmon farms actually have an effect on lobster fisheries has been a topic of research in Atlantic Canada, yet studies have produced conflicting results (Grant et al.,

2016, 2019; Loucks et al., 2014). However, research on this topic has been controversial as some local community members have negatively viewed researchers who are funded by industry, and consequently those studies have been seen as biased (The Chronicle Herald, 2014). Previous studies have found that perceptions of aquaculture may be based more on beliefs and values about the industry rather than objective knowledge (Schlag & Ystgaard, 2013; Verbeke et al., 2007). Therefore, if people who are strongly opposed to aquaculture believe the industry is producing biased information to be able to continue farming in the area, it may be difficult to change their perceptions, regardless of the information that has been put forth, and the technological advancements that have been made (Bacher, 2015).

5.3 Implications for understanding social acceptance

It has been recognized that perceptions of aquaculture can influence the development of the industry and its acceptance in certain areas (Froehlich et al., 2017; Knapp & Rubino, 2016; Verbeke et al., 2007). Furthermore, the drivers of acceptance are poorly understood and are likely based on the environmental, economic, and social contexts of the local area (Whitmarsh & Palmieri, 2009). Since the late 1990s in Atlantic Canada, this media analysis suggests that much of the debate surrounding aquaculture occurred at the local community level. Accordingly, the issues that could affect social acceptance within the aquaculture industry in Atlantic Canada could be driven by the lack of community acceptance. This is particularly evident in Nova Scotia through local community groups protesting farm expansions (Friends of Port Mouton Bay, 2012), and some have even started crowdfunding campaigns to raise money for expert advice, and mapping and printing costs, in preparation for their participation in further protesting local expansions (Gofundme, 2019).

Furthermore, lack of community acceptance is often argued to be the arena where the "not in my backyard" (NIMBY) debate unfolds, where people generally accept the industry, so long as it is not in their backyard and affecting their community (Wolsink, 2006). The NIMBY attitude was present in some Nova Scotian news articles. For example, one community member in NS expressed "I had finally come to terms with seeing three salmon cages; now there are eight... How do they have the right to devalue my property, spoil my view and cause me so much stress when I can look out any window of my house and see eight ugly salmon cages 24 hours a day, 7 days a week? Not to mention the boats and barges" (The Chronicle Herald, 2013c).

NIMBY could be sustained by different drivers, including potential detrimental environmental effects for future generations (Halstead et al., 1993). Additionally, NIMBY opposition is project-dependent, being weaker for less risky projects that bring economic benefits to the local community (Rasmussen, 1992). Delving deeper into what drives NIMBY mentality with respect to aquaculture and how the community views any potential benefits or risks from the industry may help in addressing community concerns and opposition, thus increasing the likelihood of social acceptance.

Previous studies have suggested that media's portrayal of aquaculture can influence how individuals view the industry (Feucht & Zander, 2017). Across Atlantic Canada, the media frequently portrayed the aquaculture industry in a negative tone, often perpetuating the same topics. For example, 60% of all articles analyzed from the three provinces between 2006 and 2009 were related to discussions around the protest of new farm developments in Port Mouton, NS. In this way, the media may act to reinforce issues. Yet, these portrayals may not necessarily reflect the general public opinion of aquaculture, as Flaherty et al. (2018) found that 48% of Atlantic Canadian survey respondents had positive, or favorable impressions of the industry. However, the media has portrayed the industry in Atlantic Canada in a way that would suggest that everyone is against the industry, it is not accepted and that the companies are always having to deal with disease outbreaks or escapement events. This is not the case, however, since as discussed above, some communities like Shelburne, NS are more accepting of the industry because it brings along the promise of new jobs (The Queens County Advance, 2011a).

The media also appears to be an arena where strong voices and opinions are often expressed. In one article in *The Telegram* (2018b), the author of the article essentially compares pesticides used on salmon farms to Nazi nerve gases by saying, "In an attempt to control the massive sea lice infestations that collect around such open-net pens, thousands of tons of highly toxic nerve agents could be dumped into Placentia Bay. These nerve agents are designed to kill by attacking the nervous system. Some of these nerve gases were developed by the Nazis as chemical warfare to destroy human nervous systems". The author goes on to claim that if Newfoundlanders allow the Grieg project to go ahead, that it shows how little they care about, or do not care at all, about "our own children, our poor, obese, under-nourished, brain-damaged and poorly educated next generation". Another article in *The Telegram* (2018c) likewise expresses strong views, describing the industry as "one even wants to use pressure bombed mutated fish"

or “We can’t blame the Vikings – it’s in their blood to conquer new territories”. Furthermore, the media was often used as an arena for people to spread (mis)information about industry practices (e.g. The Chronicle Herald, 2013d), or claim that any research shedding positive light on aquaculture was seen as biased because it came from industry, or those that support industry (e.g. The Chronicle Herald, 2014). In some cases, this may be due to some articles being opinion pieces, although the distinction between types of articles was not made in this study. Understanding the way society uses and trusts different sources of information, such as the information presented by the media, could play an important role in understanding social acceptance of the salmon aquaculture industry.

5.4 Management recommendations

In order for the aquaculture industry to grow sustainably and responsibly, there is a need to recognize how public perceptions, and therefore social acceptance of the industry can influence development (Froehlich et al., 2017; Knapp & Rubino, 2016; Verbeke et al., 2007). Based on the findings from this study, a set of recommendations are provided for policy development in order to help incorporate and respond to social acceptability of the Atlantic salmon aquaculture industry in Atlantic Canada.

1. **Involving the local community more in the decision-making process is critical.** In order for the community to accept the industry, they should be able to feel as though they are included as part of the decision-making process and that their concerns are heard and seen as legitimate. Otherwise, if the industry imposes itself on the community and is not willing to work cooperatively with the locals, the industry may never be accepted. Effective policy delivery requires effective communication and interactions between policy makers and the public, with the public playing an important role in not only informing policy makers, but also supporting the policies (Potts et al., 2011).
2. **There is no “one size fits all” type of management.** Due to the fact there are geographic differences at both the provincial and local scales, as well as the fact that acceptance of the industry may depend on past experiences, as well as history of the area and trust of the companies, there is likely not a “one size fits all” type of management approach. As such, when entering a new location, the same process of

communicating with the community making sure they are on board and on the same page and carrying out environmental assessments to ensure the area is suitable for aquaculture should be carried out each and every time. Having flexibility in the way industry approaches a new location is key. Just because one approach was successful in one area, does not mean it will translate into success in another location.

3. **Provide local communities with education programs about the industry.** In the media, there was often considerable argument about who is right about certain issues within aquaculture, and the trustworthiness, or biasness of the information being cited. Providing the local communities with education programs about the industry, its practices, goals and objectives may therefore help in improving social acceptance. Often times, negative attitudes towards aquaculture are a result of poor, and often times lacking knowledge about the industry and how it operates (Kelly et al., 2017). Caution should be taken as to how this education program is done, however, and who would be responsible for it, as many local communities felt anything that came from industry was biased (e.g. The Chronicle Herald, 2015). Previous research has shown those that are well informed about aquaculture issues, and its operations, are less likely to be influenced by dramatic media articles, such as those described above from *The Telegram* (Hynes et al., 2018).
4. **Continue to increase transparency of the industry**. Transparency has been identified as an issue (Doelle & Lahey, 2014). Increasing transparency and effective communication could improve accountability, which could help to clarify the environmental effects of the industry, another major issue identified within the media analysis. As pointed out by Terpenning (2018), increased communication and information sharing may open up opportunities for increased criticism, but it also allows stakeholders to see how their concerns are impacting decisions (Besley, 2010; Mazur & Curtis, 2008).

5.5 Conclusions

The provinces within Atlantic Canada have developed through different experiences and socio-economic contexts. As a result, acceptance of the salmon aquaculture industry may be different across provinces, and even across communities within the same province. Part of these

differences may be due to differing experiences with industry, and trust of the industry. As a result, areas with a longer history of aquaculture such as New Brunswick in this case study, may encounter less negative reporting on by the media, and face fewer obstacles to development.

Moreover, issues around environmental risks and how they are managed have been major factors influencing how the industry is portrayed by the media across Atlantic Canada. Concerns over the risks and benefits a project brings to local communities is also a factor that may influence development, and these risks and benefits may be more influential in driving acceptance than the perceived or actual environmental impacts of the farms. As a result, having the industry and government gain the trust of the local communities has been an issue of concern, posing consistent challenges.

While the media can be an important source of information to understand acceptance, it also plays a role in perpetuating and sensationalizing certain topics of discussion, while also being an outlet for strong voices. Therefore, this may suggest that understanding social acceptance may also be influenced by how individuals respond to the media. By recognizing how individuals respond to the media, and how the media may play a role in information mobilization, results from this study could lead to a better understanding of the Atlantic salmon aquaculture controversy in Atlantic Canada. The findings from this media analysis are particularly relevant, as they can be used to inform regulators and industry about how the opinions, values, and concerns of the surrounding communities are affected by governmental policies and decision-making. Future studies could expand on this work by disentangling any potential differences between how opinion pieces discuss aquaculture compared to journalistic articles, and how that may influence development and acceptance of the industry.

This study concluded by providing a set of recommendations to respond to social acceptance factors within the Atlantic salmon aquaculture industry in Atlantic Canada. Firstly, involving the local community more in the decision-making process than the community appears to be, as reported on by the media, is critical. Without their support, and granting of social licence, the industry may continuously face an uphill battle no matter how environmentally friendly the industry claims to be, or how many jobs the industry may provide. The effort to increase transparency should continue to be made, not only on the part of industry, but also on the part of the governmental departments that regulate the industry. This ensures everyone, including the community, is up to date and on the same page as to what is happening, or will

happen in the local area. Providing local communities with education programs about the industry, how it operates, and its goals and objectives may be helpful in increasing acceptance. There is, however, no one size fits all type of management strategy and each site should be treated separate from the rest. Provincial and federal regulators in Atlantic Canada should strive for a framework similar to that of the EAA. The guiding principles of the EAA from the FAO provides a holistic framework that can accommodate all environmental, economic, and social concerns and help provide solutions to move forward towards a more sustainable Atlantic salmon aquaculture industry.

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Appendix A

Table A1. Newspapers used for the media analysis, the province they are from, the date of the first article accessed, their scale of distribution, as well as the number of hits in the database, plus how many were relevant for the study.

Province	Newspapers and date of first article found	Scale of Distribution	Location	Number of hits in Eureka/Nexis Uni[1]	Number of relevant articles
New Brunswick	Canadian Broadcasting Corporation (CBC) New Brunswick – October 13, 2005	National	Saint John	48	23
New Brunswick	The Telegraph-Journal – January 12, 2007	Provincial	Saint John	118	83
New Brunswick	The Saint Croix Courier – September 6, 2011[1]	Local	St. Stephen	46	31
Nova Scotia	CBC Nova Scotia – April 17, 2006	National	Halifax	99	59
Nova Scotia	The Chronicle Herald – August 30, 1999	Provincial	Halifax	506	277
Nova Scotia	The Queens County Advance – April 18, 2006[2]	Local	Liverpool Bay	149	108
Newfoundland	CBC Newfoundland and Labrador – October 13, 2005	National	St John's	57	39
Newfoundland	The Telegram – July 26, 1997	Provincial	St John's	319	174
Newfoundland	The Western Star – January 25, 2000	Local	Corner Brook	166	35

Table A2. Description of the coding scheme used to code news articles.

	Categories	Level	Description

[1] The Saint Croix Courier has a weekend edition called Courier Weekend, which was also included as part of the analysis.

[2] The Queens County Advance seized publication on June 26, 2018 before joining the South Shore Breaker. Articles for the South Shore Breaker from June 27, 2018 to May 1, 2019 were therefore also included in the analysis.

Article Tones			
	Negative	Article	Focuses mostly on the risks of aquaculture (i.e. environmental degradation, harm to humans if consumed, uses words like "bad," "harmful," or describes aquaculture as "feedlots"), or voices the negative communal opinions
	Neutral	Article	Discusses both the positives and negatives of aquaculture (or has both positive and negative views in the same article), or does not sway the reader to change their perceptions of the industry
	Positive	Article	Discusses the advantages/benefits of aquaculture (i.e. the creation of jobs, or the growth of the industry through new leases, uses positive language such as "opportunities," "benefits," "improve"), discusses new regulations
	Categories	**List of topics/issues**	**Description**
PESTE Attributes			
	Political	-Regulatory reports/new regulations/strategies -Court rulings for or against new farms/environmental assessments -Council voting - Party views on the subject (mainly relevant to any elections or to the Port Mouton protest) -Public call for a moratorium, or one actually put in place	Refers to things along the lines of the regulatory aspects of aquaculture, including environmental law or a court ruling of a decision (also action of being in court)
	Economic	-Creation of jobs -Industry growth (new farms, new sites and leases) -Awards won for companies - Loss of product due to storms or other unforeseen circumstances -Funding from government or other external contributors	Refers to the economic aspects of the industry such as growth and development of the industry through farm expansions (creation of new farms), creation of jobs

	Social	-Community engagement (open houses, town halls, protests, petitions, conservation groups etc.) -First Nations rights -Human health issues (i.e. is ISA infected salmon safe to eat) -Animal welfare (health of the salmon, or other animals) - Access to food	Topics affecting specific interest groups or public well being, like human health, animal welfare, community wellbeing (including First Nations rights), etc.
	Technological	-Technological advancements (i.e. Thermolicer to mitigate sea lice) - Research and scientific developments - Education	Referring to any technological advancements (or lack thereof) in the industry (i.e. ways of making the industry more sustainable), while also discussing research and scientific developments
	Environmental	-GM organisms -Risks to wild salmon, escapes -Water temperature/storms affecting the health of the farmed salmon -Any mention of sea lice, ISA, or other parasites/disease -Any mention of farms and MPAs together -Potential positive environmental impacts as well, such as land-based facilities, or restocking -EIS	Referring to environmentally relevant issues related to aquaculture (i.e. environmental risks, environmental protection, GM organisms, etc.)
	Category	**Level**	**Description**
Scale			
	Local	Article	A particular community/city being the focus of discussion (i.e. Shelburne)
	Regional	Article	A larger water body or area encompassing multiple communities (i.e. Bay of Fundy)
	Provincial	Article	Generally discussing the province as a whole (i.e. when new regulations came out for Nova

			Scotia)
	National	Article	Discussion of aquaculture spanning more than two provinces
		Level	**Description**
Media Event			
		Article	Major event that was reported on by the media (i.e. moratorium on new farm licenses in NS, outbreak of ISA etc.)
		Level	**Description**
Reprints			
		Article	If there were two of the same articles from the same newspaper, such as one from online and one in print, only one of them were included. Articles that were identical, or similar but in different newspapers, were all counted towards the final analysis
		Level	**Description**
Province of Newspaper			
		Article	The province where the newspaper is published

Table A3. A detailed timeline of all of the events elicited from the media analysis and literature review for all three provinces.

Event	**Province the event was coded from**	**Year**	**PESTE attribute(s)**	**Information source**
Salmon farming began in NB	New Brunswick	1978	Economic	DFO document
First harvest of farmed salmon in NS	Nova Scotia	1984	Economic	DFO document
Salmon farming began in NL	Newfoundland	Mid-1980s	Economic	DFO website
Moratorium on new applications in NB until 1991	New Brunswick	1986	Political	Literature
The NB Aquaculture Act becomes law	New Brunswick	1991	Political	Literature
First sea lice outbreak in NB	New Brunswick	1994	Environmental, Social, Economic	Literature

First ISA outbreak in NB	New Brunswick	1996	Environmental, Social, Economic	Literature
Fish farm near Horse Island, NS recieves approval sparking community protest and court cases because of the project's EIS	Nova Scotia	2001	Political, Environmental, Social	Media analysis
Environmental monitoring program established in NS	Nova Scotia	2002	Political, Environmental	Provincial government
Company in St Alban's, NL on the verge of bankruptcy	Newfoundland	2004	Economic	Media analysis
Escapement event in NL due to vandals cutting open the cages	Newfoundland	2005	Environmental, Economic	Media analysis
Cooke Aquaculture named winner of Canada's Best Managed Companies Platinum Club (and every year thereafter)	New Brunswick	2005	Economic	Website
Application for second largest fish farm in NS put in for Port Mouton. Years of community opposition follows, including the Premier joining the opposition	Nova Scotia	2006	Political, Environmental, Social	Media analysis
Cooke Aquaculture announces $155M development, setting NL to become Canada's leader in fish aquaculture	Newfoundland	2006	Economic	Media analysis
Friends of Port Mouton Bay (FPMB) community group conduct their	Nova Scotia	2007	Political, Environmental, Technological	Media analysis

own scientific study that show the negative effects of the pre-existing farm on the environment. MP now joins the opposition				
NB ISA management strategy implemented	New Brunswick	2007	Political, Environmental	Literature
Haley's Cove, NB not actually suitable for aquaculture - fish removed from farm site and no longer used	New Brunswick	2008	Environmental, Social	Media analysis
Study by Ford and Myers (2008) comes out that shows the negative effects fish farms have on the wild salmon population and environment	Newfoundland (but applicable to all)	2008	Environmental, Social, Technological	Media analysis
Cooke Aquaculture takes over the Port Mouton application from Aqua Fish Farms	Nova Scotia	2009	Environmental, Social	Media analysis
After FPMB protest in Halifax, a moratorium on expansion of fish farms is put in for Port Mouton	Nova Scotia	2009	Political, Social	Media analysis
FPMB win award for their efforts to stop fish farm expansion	Nova Scotia	2009	Social	Media analysis
NS government conducts phone interviews to gauge public perceptions of aquaculture	Nova Scotia	2010	Political, Social	Literature
Cooke wants to	Nova Scotia	2010	Political,	Media analysis

expand in Digby and Shelburne. The Shelburne processing plant is voted in favour of by city council			Environmental, Social, Economic	
Investigation underway to determine why, and how large amounts of lobster died in the Bay of Fundy	New Brunswick	2010	Environmental, Social	Media analysis
Cooke Aquaculture is in court for illegal use of pesticides in the Bay of Fundy	New Brunswick	2011	Political, Environmental, Social	Media analysis
Although Minister Belliveau tried to say an appeal was not filed on time, a court judge has allowed a Shelburne couple to appeal a fish farm decision that is larger and closer to their property than initially announced	Nova Scotia	2011	Political, Environmental, Social	Media analysis
New controversial farm given the OK for St Marys Bay; community displeased since they were not consulted on the process, and fear it may harm lobster and other fisheries	Nova Scotia	2011	Environmental, Social, Economic	Media analysis
Shelburne couple's court appeal is dismissed because the expansion was not deemed unreasonable	Nova Scotia	2012	Political, Environmental, Social	Media analysis
New NS aquaculture strategy released to	Nova Scotia	2012	Political, Environmental,	Media analysis

help industry expand – community members felt they should have been consulted first and worry about the potential environmental impacts of more farms			Social	
Cooke Aquaculture recieves $25M from NS provincial government to help with their expansion plans for the province	Nova Scotia	2012	Social, Economic	Media analysis
Study shows lobsters are not affected by the salmon farms, and that salmon farms positively contribute to economy	New Brunswick	2012	Environmental, Technological, Economic	Media analysis
Snow Island Salmon withdraws an application for a new fish farm along the Eastern Shore due to proximity to a river that might have implications for wild salmon – Atlantic Salmon Federation (ASF) happy	Nova Scotia	2012	Environmental, Social	Media analysis
ISA outbreak in Hermitage Bay, NL	Newfoundland	2012	Environmental, Social, Economic	Media analysis
ISA outbreak in Butter Cove, NL	Newfoundland	2012	Environmental, Social, Economic	Media analysis
ISA outbreak on Coffin Island, NS	Nova Scotia	2012	Environmental, Social, Economic	Media analysis
Multiple ISA outbreaks in	Nova Scotia	2012	Environmental, Social,	Media analysis

Shelburne			Economic	
Moratorium on new fish farms across NS	Nova Scotia	2013	Political	Media analysis
CFIA allows ISA infected salmon to go to market	Nova Scotia	2013	Environmental, Social	Media analysis
Doelle-Lahey panel announced; panel in charge of reviewing of aquaculture regulations in NS	Nova Scotia	2013	Political	Media analysis
First harvest of farmed salmon from the controversial St Marys Bay farm	Nova Scotia	2013	Environmental, Social, Economic	Media analysis
Salmon escape from a farm in Hermitage Bay	Newfoundland	2013	Environmental, Social, Economic	Media analysis
Federal Standing Committee says land-based tanks are not economically viable, nor more environmentally friendly than open-net pens	New Brunswick	2013	Political, Environmental, Social, Economic	Media analysis
NS government rejects first fish farm application because of the moderate risk to wild salmon in Shoal Bay	Nova Scotia	2013	Political, Environmental, Social, Economic	Media analysis
A petition to boycott salmon farms in NL because they spread disease and pollution goes viral, industry says it's a spread of misinformation	Newfoundland	2013	Environmental, Social	Media analysis
Cooke charged in court for illegally using pesticides which resulted in the death of hundreds of lobster in Bay of	New Brunswick	2013	Political, Environmental, Social	Media analysis

Fundy				
ISA outbreak in Hermitage Bay, NL	Newfoundland	2013	Environmental, Social, Economic	Media analysis
ISA outbreak in Shelburne	Nova Scotia	2013	Political, Environmental, Social	Media analysis
Doelle-Lahey Report released	Nova Scotia	2014	Political, Environmental, S, Economic	Media analysis, Literature
Cooke Aquaculture receives Best Aquaculture Practice certification	New Brunswick	2014	Environmental	Media analysis
Gardner-Pinfold Report released that states land based tanks are doable, but only on large scales since they are expensive to operate and salmon prices are too low to compensate	Nova Scotia	2014	Economic	Media analysis
New federal aquaculture regulations released, aimed at encouraging positive environmental practices	Newfoundland (but applicable to all)	2014	Political, Environmental	Media analysis
Due to a power failure, Sustainable Blue lost their entire stock of farmed salmon – this would have been the company's first harvest of land raised farmed Atlantic salmon	Nova Scotia	2014	Social, Economic	Media analysis
NS provincial government releases new aquaculture regulations	Nova Scotia	2015	Political, Technological	Media analysis
A superchill event in	Nova Scotia	2015	Environmental,	Media analysis

Shelburne, where water temperatures reached the lower lethal limit and killed salmon on the farms			Economic	
Marine Harvest spends $15M for farming licences and other assets to come to NL	Newfoundland	2016	Economic	Media analysis
Minister released the Grieg Placentia Bay project from having to undergo an EIS, beginning a back and forth of being in court for appeals to the decision	Newfoundland	2016	Political, Environmental	Media analysis
NS government lifts the moratorium on new farm licences	Nova Scotia	2016	Political	Website
Court ordered the Grieg project to undergo an EIS, which Grieg later appealed	Newfoundland	2017	Political, Environmental	Media analysis
Storm in Shelburne cause the net pens to falter, and salmon escape	Nova Scotia	2017	Environmental, Social, Economic	Media analysis
Grieg once again in court over whether the Placentia Bay project should undergo an EIS	Newfoundland	2018	Political, Environmental, Social	Media analysis
ISA outbreak at two hatcheries in close vicinity, at an undisclosed NS location	Nova Scotia	2018	Environmental, Social, Economic	Media analysis
ISA outbreak in Spyglass Cove, NL	Newfoundland	2018	Environmental, Social, Economic	Media analysis
Cooke Aquaculture announces it will	New Brunswick	2018	Economic	Media analysis

bring nearly 100 new jobs to Charlotte County				
NL government says Grieg's EIS is sound, and project is given the green light	Newfoundland	2018	Environmental	Media analysis
Ottawa announces setting of new aquaculture legislation	Nova Scotia (but applicable to all)	2018	Political, Technological, Economic	Media analysis
Northern Harvest is fined for illegally using pesticides off Campobello Island, violating the NB Pesticides Control Act	New Brunswick	2018	Political, Environmental, Social	Media analysis
Green Island Salmon conducting community consultation, looking to expand into Burgeo, Ramea, and La Poile, NL	Newfoundland	2018	Social, Economic	Media analysis
Salmon escape from farm site in Hermitage Bay	Newfoundland	2018	Environmental, Social, Economic	Media analysis
Washington State bans open-net pen fish farming - community groups in Atlantic Canada call for similar action	Nova Scotia	2018	Environmental, Social	Media analysis
Cermaq eyes expansion into NS; in Guysborough County, Richmond Valley, and St Mary's regions	Nova Scotia	2019	Economic	Media analysis
Cooke Aquaculture submits application to expand in Liverpool Bay, increasing how	Nova Scotia	2019	Economic	Media analysis

many cages and sites it has in the area				
Study says lobsters near Grand Manan, NB are not affected by salmon farms	Nova Scotia	2019	Environmental	Media analysis
A superchill event in Liverpool Bay, caused salmon to die due to cold temperatures	Nova Scotia	2019	Environmental, Economic	Media analysis