

# *Public Perceptions of Off-Shore Salmon Farming in Nova Scotia*

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## ***Abstract***

The rapid growth of intensive aquaculture production in Nova Scotia has caused public concern about environmental impact, human health and economic development. This study used a public survey tool to identify these concerns and analyze public perceptions about the industry across a variety of stakeholder groups. The findings highlight a common economy vs. environment battle in which most respondents recognized the potential for job growth and economic development through aquaculture, but believed they came at the cost of environmental damage. When comparing the results of this study to historic public survey data about aquaculture, there is a clear trend highlighting the increasing prevalence of awareness of environmental impacts among consumers. The findings also note perception and knowledge gaps within the province that may be negatively impacting public perceptions. With global demand for seafood increasing and wild fisheries declining, the annual supply needed from aquaculture will reach 62% by 2030. This presents tremendous challenges to the industry and its governance actors to expand the aquaculture industry in the face of prevailing negative perceptions. Improving these perceptions will be instrumental if the world is to meet this increasing demand for seafood and continue to support coastal economies.

## ***1.0 Introduction***

### ***1.1 Why aquaculture?***

Aquaculture is the world's fastest growing food-producing sector; the industry accounts for almost 50% of the world's fish supply and is considered to have the greatest potential to meet the growing demand for seafood (Food and Agriculture Organization, 2006). The world's growing population coupled with the overexploitation of fisheries have caused a worldwide expansion of the aquaculture industry. Aquaculture avoids the resource depletion and scarcity that traditional fisheries face by producing substitute products (Katranidis et al, 2003). For this reason, it has been stressed as a potential source of food by the World Commission on Environment and Development, which has urged its further expansion in all countries (WCED, 200)

In recent years, Atlantic salmon has overtaken other species and is now the number one harvested aquaculture species today. Four nations together produce approximately 80-90% of the world's supply of Atlantic salmon: Norway, Chile, the UK, and Canada. (Food and Agriculture Organization, 2006). However, production in Canada and other industrialized nations has stagnated, partly due to the prevalence of negative perceptions of the industry (Flaherty, 2017).

### ***1.2 Aquaculture in Canada and Nova Scotia***

Canada is currently the fourth-largest producer of farmed Atlantic salmon in the world (Fisheries and Oceans Canada). Atlantic salmon aquaculture is Canada's third largest seafood export by value and represents an average of 70% of total Canadian aquaculture volume (Fisheries and Oceans Canada). Aquaculture plays a significant role in supporting many coastal and rural communities in Canada. As a result of declines in resource based

industries including traditional fisheries, these communities have been struggling to maintain economic stability (Food and Agriculture Organization, 2006). A recent report commissioned in 2017 by the Canadian Senate supports the doubling of Canada’s aquaculture production in the next decade, as it represents an opportunity for employment and economic growth in coastal and rural communities (The Standing Senate Committee on Fisheries and Oceans, 2016).

In the Maritimes, salmon farming began in the Bay of Fundy with just one small commercial site in 1978 and has since grown to over 90 sites that contribute approximately 40% of all Canadian salmon production. Atlantic salmon is the highest revenue generating form of aquaculture in Nova Scotia. In 2017 the province produced over 11 million kilograms of salmon with a total value of \$99,643,655, which accounted for over 85% of aquaculture value. (Fisheries and Oceans Canada) Aquaculture in Nova Scotia is an established and growing industry that is becoming an increasingly important economic contributor to rural regions in the province.

NOVA SCOTIA FISHERIES AND AQUACULTURE				
Aquaculture Production and Sales				
2017				
SPECIES	PRODUCTION (KGS.)	VALUE \$	% OF TOTAL VALUE	
Atlantic Salmon (Marine/Hatchery/Grow Out)	11,078,491	\$ 99,643,655	0.858704945	85.87%

Table 1 - 2017 Provincial Aquaculture Production and Sales ([Province of Nova Scotia, 2017](#))

**1.3 Why study public perceptions of aquaculture?**

In a study that examined 68 countries, Canada had the highest proportion of negative sentiment towards aquaculture, as well as the most polarized split between positive and



negative opinions. In this study, the greatest concerns expressed by respondents pertained to salmon farming (Bacher, 2015). The aquaculture industry has encountered much more stringent public scrutiny than other industry and is especially sensitive to public opinions; the public's impressions of the social, economic, and environmental dimensions of aquaculture can exert a substantial influence on the industry's ability to retain and/or expand its access to production sites (Flaherty, 2017).

There are a few reasons why people have such strong opinions about aquaculture, especially in Canada. The technology is still relatively new to the Western world, so most people don't have any personal experience with it or fully understand it. Additionally, the world has become much more conscious of environmental issues over time and now more than ever, are conscious of their own consumer habits, as well as impacts of industry on the environment. Finally, recent food crisis such as salmonella in eggs and mercury in wild-caught tuna have raised serious food safety concerns in general, making people that much more critical of new food products (Bacher, 2015).

In Nova Scotia specifically, though the industry is relatively small, its development has not been without controversy. In 2013, 51 organizations representing a diverse range of interests including wild salmon conservationists, commercial fisheries, and environmental organizations expressed concern over the existing management practices which resulted in the province imposing a moratorium on new finfish sites in order to review the industry and update legislation (Flaherty, 2017). Since then, the province's aquaculture regulations have been updated and the moratorium was lifted in 2016 to allow for further expansion of the industry in Nova Scotia, as both the provincial and federal governments have recognized the potential of aquaculture to be an economic driver in rural and coastal communities and plan to support the growth of the industry. (Flaherty, 2017) While this sounds like it may suggest

a bright future for aquaculture, the path ahead is anything but smooth. Social acceptance will have a major impact on how and where the aquaculture industry develops in Canada. Stakeholder concerns have (and have had) the potential to steer the industry on a different path, and to speed up or slow down its expansion. Understanding the various perceptions of aquaculture is an important part of management and planning in order to move forward in making Canada a leader in the industry (Bacher, 2015).

### ***1.4 Research Objectives***

The overall objective of this research is to assess how public perceptions of Atlantic salmon farming differ across a variety of stakeholder groups and how those perceptions align with current management practices in Nova Scotia. In order to achieve this objective, the research uses surveys to examine public sentiment in coastal communities along the south shore of Nova Scotia, where aquaculture is being interspersed with traditional fishing and other coastal economies. Additionally, the research uses surveys to identify the primary concerns of citizens related to aquaculture in the province and assess the public's expectations of the state in addressing these concerns. Ultimately, these findings will be used to reflect on how these perceptions may affect the future of the industry.

## ***2.0 Literature Review***

While there is plenty of existing literature on the aquaculture industry itself, to date there has been very limited community-level research into the public perceptions of aquaculture. This paper focuses general supporting literature about the industry and on the results from four other public perception studies about aquaculture. The first study was conducted in 2005 by the Department of Fisheries and Oceans across Canada, the second was conducted in 2010 by a private consulting agency in Nova Scotia, the third was conducted in 2015 globally by

the Food and Agriculture Organization of the United Nations, and the most recent survey was conducted in 2017 across Canada by independent researchers.

This existing literature tells us that public perceptions of aquaculture can generally be broken down into three different themes: socio-economic perspectives, human health perspectives, and environmental perspectives. These seem to be the most common reoccurring themes in previous public survey data as well as studies done on general consumer preferences of seafood.

## ***2.1 Socio-economic perceptions***

Almost all of the literature regarding the socio-economic impacts of the aquaculture industry is positive; people generally tend to recognize aquaculture as a contributor to economic development and job growth, especially in coastal communities. A 2017 study conducted in Nova Scotia found that 55% of respondents identified employment and local economic benefit as factors contributing to a favorable impression of the industry (Flaherty, 2017). In a 2010 study, 94% of respondents agreed that aquaculture created development in coastal communities and 69% said that the industry did not interfere with the livelihoods of traditional fishermen (Protocol, 2010). This shows that not only do people believe the aquaculture has the potential to enrich the economies of local communities, but that it can do so without sacrificing existing employment in what could be seen as a competing industry in these communities. Another interesting result from the 2010 study was that regardless of respondent's overall view of local aquaculture operations, they stated that they were not against aquaculture in general and cited its job creation as a positive attribute (Protocol, 2010). Despite any negative externalities that people perceive the industry to have, economic impact was valued as the highest factor at stake by most people. Most people seemed willing

to accept environmental and health tradeoffs in exchange for job creation and economic opportunity.

## ***2.2 Human health perceptions***

Since the epidemic of mad cow disease at the end of the 20<sup>th</sup> century, consumers have increased their awareness towards information concerning the methods used in food production (Fernandez-Polanco, 2012). Now more than ever, consumers are critical of new food technologies and food processing practices, but opinions on the human health impacts of aquaculture are still mixed. The 2005 DFO study reported a frequent analogy linking food safety issues such as mad cow disease (“mad fish disease” or “crazy salmon”) and genetically modified food “Frankenfish”) with risks related to aquaculture, highlighting why aquaculture is personally relevant to consumers (DFO, 2005). However, in the 2010 study conducted in Nova Scotia, 80% of respondents agreed that aquaculture provided a high quality food product that was safe to eat. It should be noted that several diet advocates, activists, and ENGO’s have campaigned against farmed salmon on the basis that it is not safe to eat (Morton, 2017). However, there is not enough evidence to determine if this has had an effect on public perceptions.

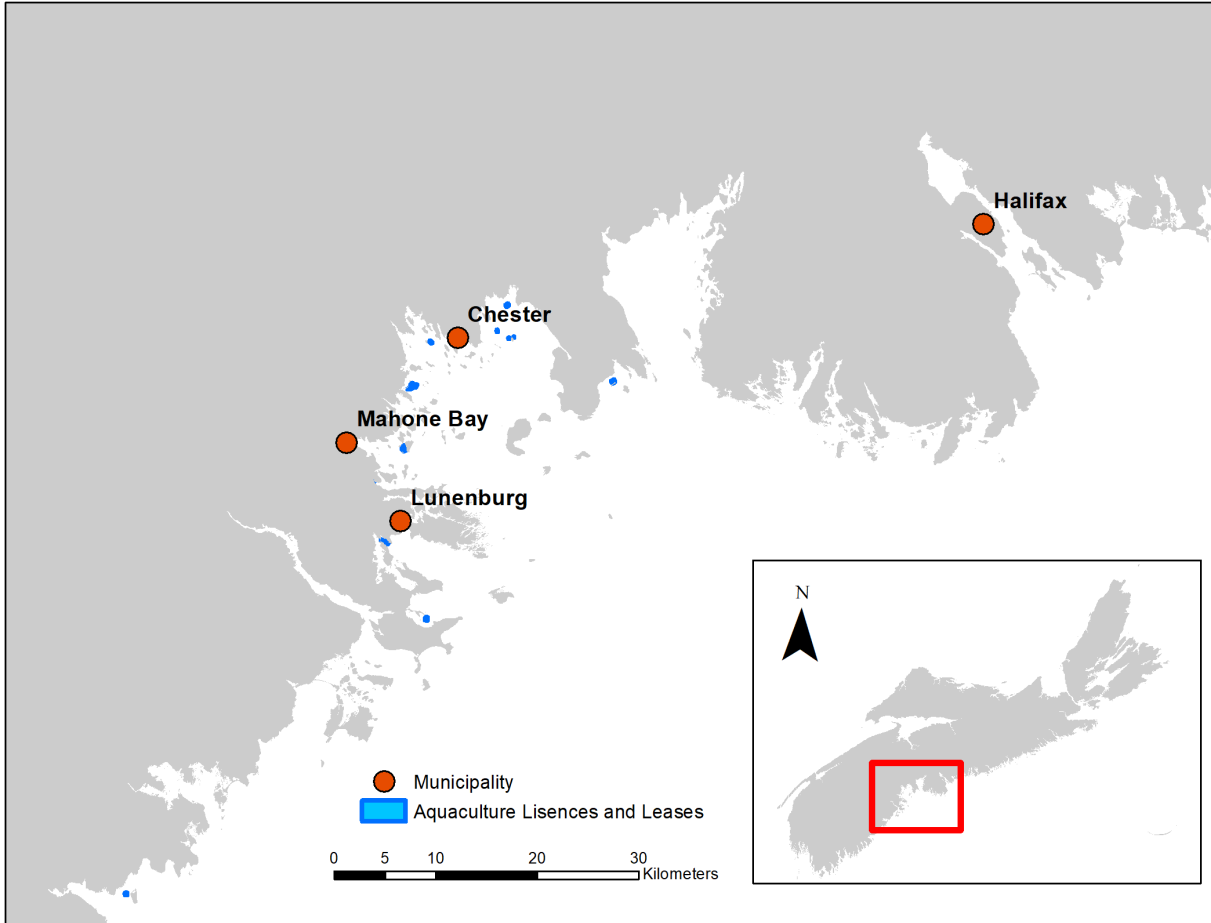
## ***2.2 Environmental perceptions***

Negative environmental impacts are by far the most cited concern in literature regarding aquaculture production and the continued growth of the industry and this perception only appear to be becoming more prevalent over time. In the 2010 study, 37% of respondents thought that aquaculture had a negative impact on the environment, but 79% of respondents believed that aquaculture was necessary in order to take the pressure off of wild fish stocks (Protocol, 2010). Here, respondents clearly believe that the industry has negative environmental externalities, but also recognize that it can support conservation of existing

ecosystems. In the 2017 study conducted in Nova Scotia, the most commonly cited concerns all related to the environmental externalities of the industry: chemicals/antibiotics (17%), waste accumulation (15%), disruption to wild stocks (11%), and sea lice (5%). (Flaherty, 2017). However, despite the overwhelming concern about negative environmental externalities, 84% of participants in this study strongly agreed that aquaculture was necessary to meet the growing global demand for seafood (Flaherty, 2017). In both studies, even those respondents who were most concerned about the industry's negative environmental impact were able to cite tradeoffs that benefited as a result. It appears as though most people are willing to accept environmental externalities in favor of something they value more like food security or economic stability.

### ***3.0 Approach and Research Methods***

#### ***3.1 Study Location***



**Figure 1 - Map of research locations**

The objective in selecting these study locations along Nova Scotia’s south shore, was to focus the research in coastal communities within proximity to aquaculture sites in order to target the highest concentration of stakeholders directly implemented in the aquaculture industry. This research took place in three primary regions across Nova Scotia: Lunenburg, Mahone Bay, and Chester. These towns are home to only 2263, 1036, and 2348 residents, respectively.

The town of Lunenburg first emerged as a fishing leader in the 19<sup>th</sup> century when it began building and manning fishing schooners to exploit the Grand Banks of Newfoundland and the

fishing banks off of Nova Scotia. Today, tourism is the town's most important industry, however is supported heavily by the seafood industry; many visitors come to Lunenburg to indulge in Nova Scotia's seafood products (Tourism Nova Scotia) Mahone Bay is home to numerous fishing communities including Big Tancook, Little Tancook, and Blandford. Economic activity began in the town with shipbuilding and farming, but today the principle economic driver is also tourism that is heavily reliant on "ma-and-pa" style seafood restaurants (Tourism Nova Scotia). Chester is one of the wealthier communities in the province as a result of being a popular tourist and resort destination. It's main economic driver is the tourism industry, supported by fine seafood dining (Tourism Nova Scotia).

Each of these towns has historical roots within the traditional fishing industries and their economies today are still indirectly supported by fishing through seafood. With such a high dependence on seafood products, these small towns are some of the most important stakeholders in the aquaculture conversation.

### ***3.2 Public Survey***

This research was conducted using a randomly distributed public survey tool that consisted of three components: (1) identifying questions to separate respondents into stakeholder groups, (2) Likert scale questions to distinguish general public sentiment, and (3) open ended questions to identify primary citizen concerns and their expectations of government in addressing these concerns. The survey was conducted at the end of August 2018. A total of 25 respondents are included in the study; 12 from Lunenburg, 8 from Chester, 3 from Mahone Bay, and 2 from Halifax.

Respondents were selected randomly throughout outdoor, high-traffic areas within the selected study locations. Those who agreed to participate in the survey were first asked to identify themselves within three different stakeholder groups. The first being whether or not

they identified as a regular seafood eater; for the purpose of this study a “regular” seafood eater was considered someone who consumed seafood products more than once a month. The second identifying question separated respondents based on their residential status as either a tourist or resident of the province of Nova Scotia. The final question identified participants as industry affiliates or non-industry affiliates, based on whether or not they had ever been employed by the fishing or aquaculture industry. These questions helped to identify and separate my respondents in order to conduct a thorough comparison of the perceptions three different stakeholder groups: seafood eaters and non-seafood eaters, residents and tourists, industry affiliates and non-industry affiliates. Per Quagraine, Hart and Brown, experience and knowledge about aquaculture, along with frequency of seafood consumption are two factors that affect perceptions of farmed seafood, which is why identifying seafood eaters and industry affiliates was of particular interest to this research (Quagraine, Hart & Brown, 2008).

The second component of the survey consisted of five Likert scale questions. Respondents were read out loud five short statements about Atlantic salmon farming in Nova Scotia and asked to rank their agreement with the statements on a scale of 1 to 5, with 1 being strongly disagree and 5 being strong agree. Two of the scales are related to the economic impact of the aquaculture industry and its contribution to the coastal communities in the province. Other two refer to the environmental consequences local ecosystems and wild marine life. This distinction accounts for potential differences in the importance of attitudes and highlights what literature has identified as two of the most polarizing debates about aquaculture: environment or economy. Finally, a fifth scale records respondent’s general thoughts on the overall impacts of the industry. These questions helped to provide the research with a general overview of the public sentiment towards Atlantic salmon farming in the province.



The final component of the survey consisted of two open-ended questions inquiring about the primary concerns of citizens in regards to aquaculture and their expectations of the role of the government in addressing these concerns. It was intended to use the open-ended questions as follow-ups to Likert scale questions, to gain insight into why respondents answered the way that they did. These questions allowed for identification of which issues the public perceived as most important in relation to Nova Scotia's aquaculture industry in order to identify factors that contribute to stakeholder concerns and what issues stakeholders value the most. The second question allowed the research to scope public perceptions through a governance lens by assessing how the public's expectation of the role of the state within the aquaculture industry aligned with existing management practices.

### ***3.3 Analysis***

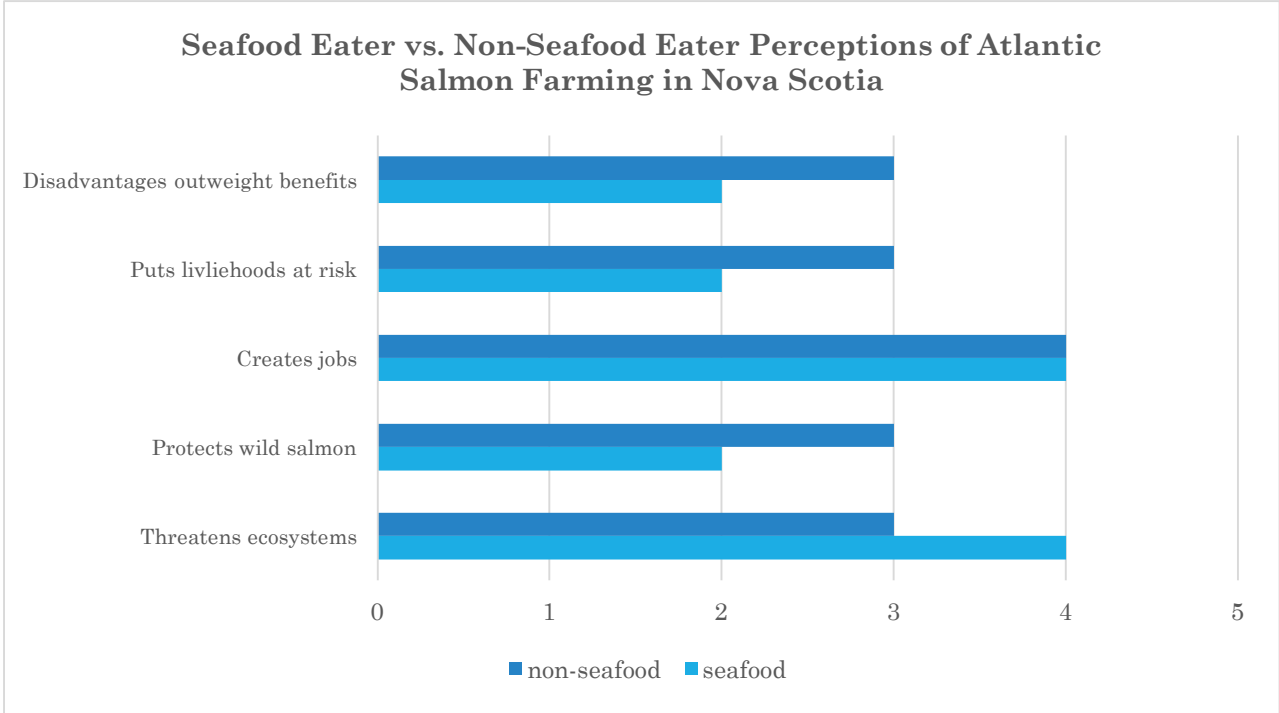
Participant responses to the public survey were analyzed using Excel and NVivo. Excel was first used to analyze the Likert scale questions; since each level of agreement already corresponded to a number on a scale, responses were input into Excel as a numerical response. The mode, or most frequently occurring response, was the number used to represent the data set. NVivo was used to analyze the responses to the survey's two open-ended questions. The word queries tool was used to pull out prevalent and reoccurring themes within responses in order to establish a common narrative for each question.

## ***4.0 Research Findings***

### ***4.1 No distinct difference across stakeholder groups***

When comparing the responses of 18 participants who identified as regular seafood eaters and 7 participants who identified as non-seafood eaters, the findings produced results shown in Figure 3. No large discrepancies were observed between the two stakeholder groups;

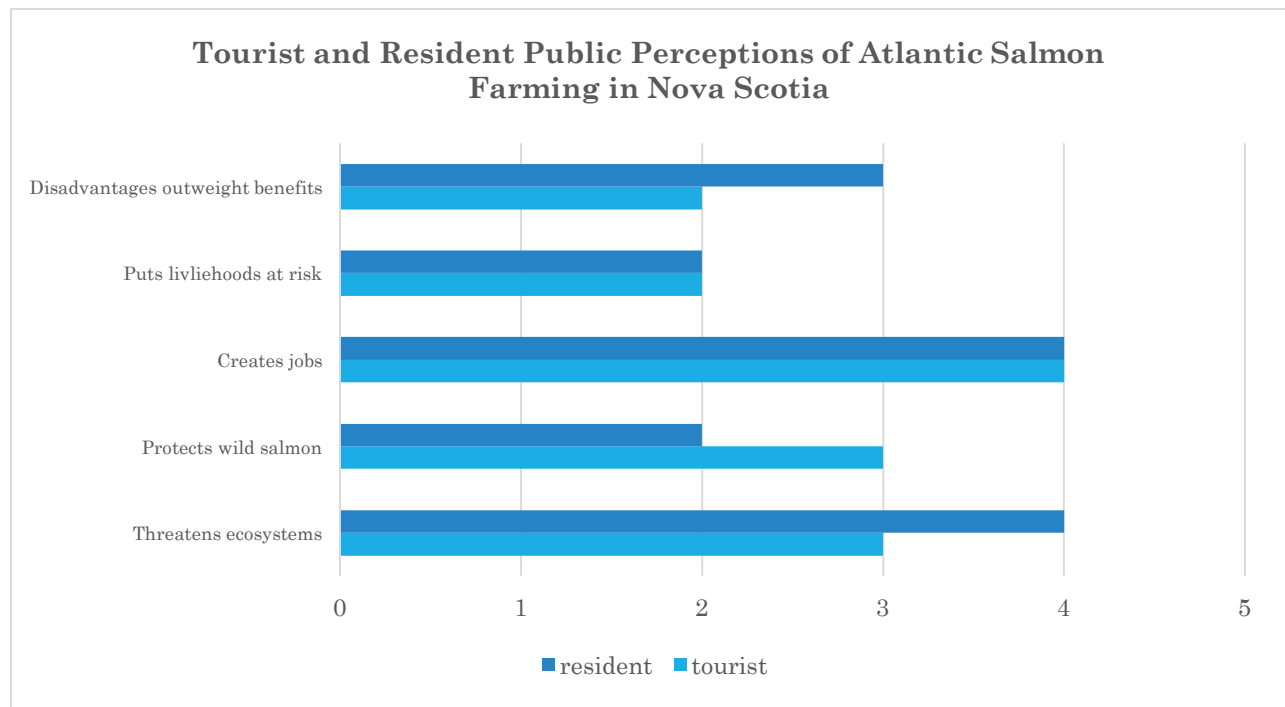
seafood eaters and non-seafood eaters tended to have the same level agreement towards all of the statements, with non-seafood eaters responding “neutral or don’t know”, represented by the number 3 on the Likert scale, slightly more often than seafood eaters. This finding is expected as regular seafood eaters would have more personal experience with seafood products than non-seafood eaters, and most likely have a more comprehensive understanding of the seafood industry.



**Figure 2 - Comparison of Seafood Eater and Non-Seafood Eater Likert Scale Survey Responses**

When comparing the responses of 17 participants who identified as residents of the province and 8 participants who identified as tourists, the findings produced results shown in Figure 4. No large discrepancies were observed between the two stakeholder groups; residents and tourists tended to have the same level agreement towards all of the statements,

with residents being slightly more agreeable that Atlantic salmon farming threatens natural ecosystems.



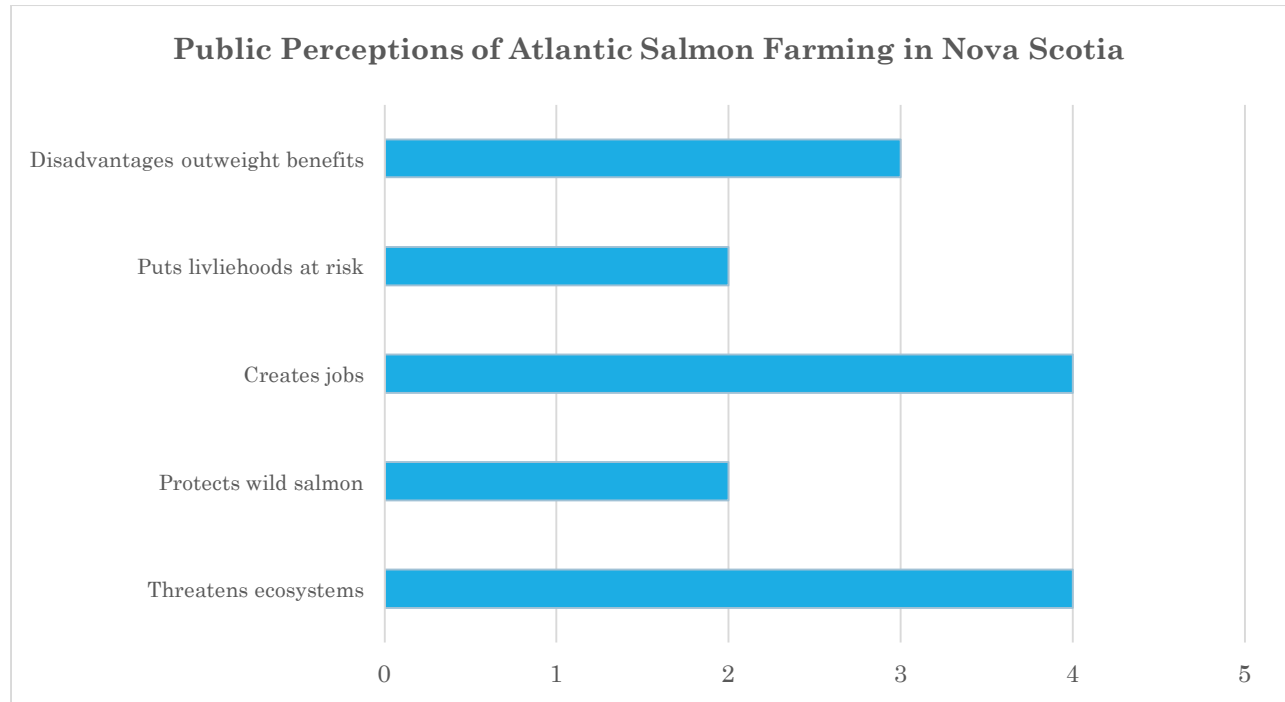
**Figure 3 - Comparison of Tourist and Resident Responses to Likert Scale Survey Questions**

As mentioned in the methods section of this paper, these stakeholder groups were selected based on pre-existing literature that led the research to believe there would be comparable differences between these groups, however no considerable differences were observed in this research. (Quagraine, Hart and Brown, 2008)

Unfortunately, there was not a statistically representative data sample collected from participants affiliated with the fishing or aquaculture industry, so the final stakeholder group responses could not be accurately analyzed.

## ***4.2 Clear recognition of environment and economy battle***

Due to the fact that there were no major discrepancies across the major stakeholder groups, the research decided to focus on the entire respondent pool as a whole. When the mode of all participant's responses was graphed, there was a clear trend that was consistent with the four other public surveys mentioned: respondents identified a clear economic and environment battle with the aquaculture industry.



**Figure 4 - All participant responses to Likert Scale survey questions**

Most respondents tended to agree that Atlantic salmon farming creates jobs and threatens natural ecosystems, while disagreeing that it puts the livelihoods of traditional fishermen at risk and protects wild salmon stocks.

### ***4.3 Environmental concerns leading among respondents***

Upon analyzing the responses to the survey's first open-ended question, the findings showed that most participants were most concerned about the impact that the aquaculture industry had on the environment. Respondents then went on to elaborate that their concerns

were as a result of the pollution that aquaculture farms produce and their unknown effects on wild salmon stocks. The next most cited concern was the effects of farmed seafood products on humans. 6 respondents were concerned about the use of antibiotics in salmon farms leading to disease transmission between infected salmon and humans consuming them. One participant ruled the economy their primary concern, citing the impact that a new technology such as aquaculture would have on jobs in the traditional fishing industry. One participant mentioned Indigenous Rights as their primary concern due to the rights violations associated with land use disputes in Canada.

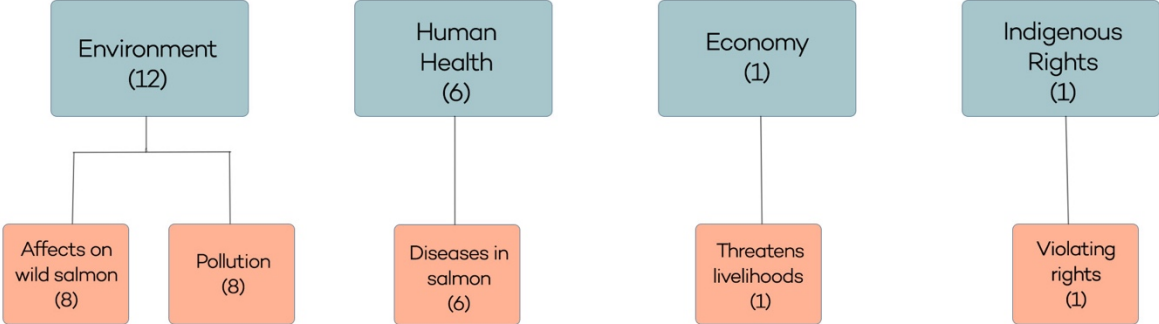


Figure 5 - Primary Concerns of Citizens Survey Responses

**4.4 Stakeholders want state regulation**

Consistent with a 2005 study by the Department of Fisheries and Oceans, the perception is that without enough of the right control and regulation, the aquaculture industry is in the hands of people or corporations driven by the dollar, who do not care about public health or environmental impacts (DFO, 2005). In response to this survey’s second open-ended question regarding the role of the state in aquaculture, most participants cited that they believed the

role of government in the aquaculture industry was to implement more regulations on aquaculture farms in the province.

#### ***4.5 Significant knowledge gaps in public perceptions***

Though this research wasn't specifically testing for knowledge or perception gaps among the general public, there was clear evidence revealed in the public surveys that these gaps exist among the general public in Nova Scotia and may be misleading public perceptions. The first finding was in the call for regulation from government by participants. Many Atlantic salmon farming regulations already exist in the province of Nova Scotia, which participants were not completely aware of, highlighting a potential perception gap between existing management practices and what the public believes is happening. The second perception gap was identified by three respondents who identified as seafood eaters and claimed that they only purchased "wild Atlantic salmon" due to health concerns associated with farmed Atlantic salmon. However, fishing for wild Atlantic salmon is illegal in Canada and 100% of Nova Scotia's Atlantic salmon comes from aquaculture (Fisheries and Oceans Canada). This revealed a perception gap among the public as consumers may not even be aware that they're already consuming the farmed seafood products that they feel so negatively about. Minimizing these perception gaps and ensuring that citizens have access to and understand information related to aquaculture is crucial in order for the industry to move forward.

### ***5.0 Discussion***

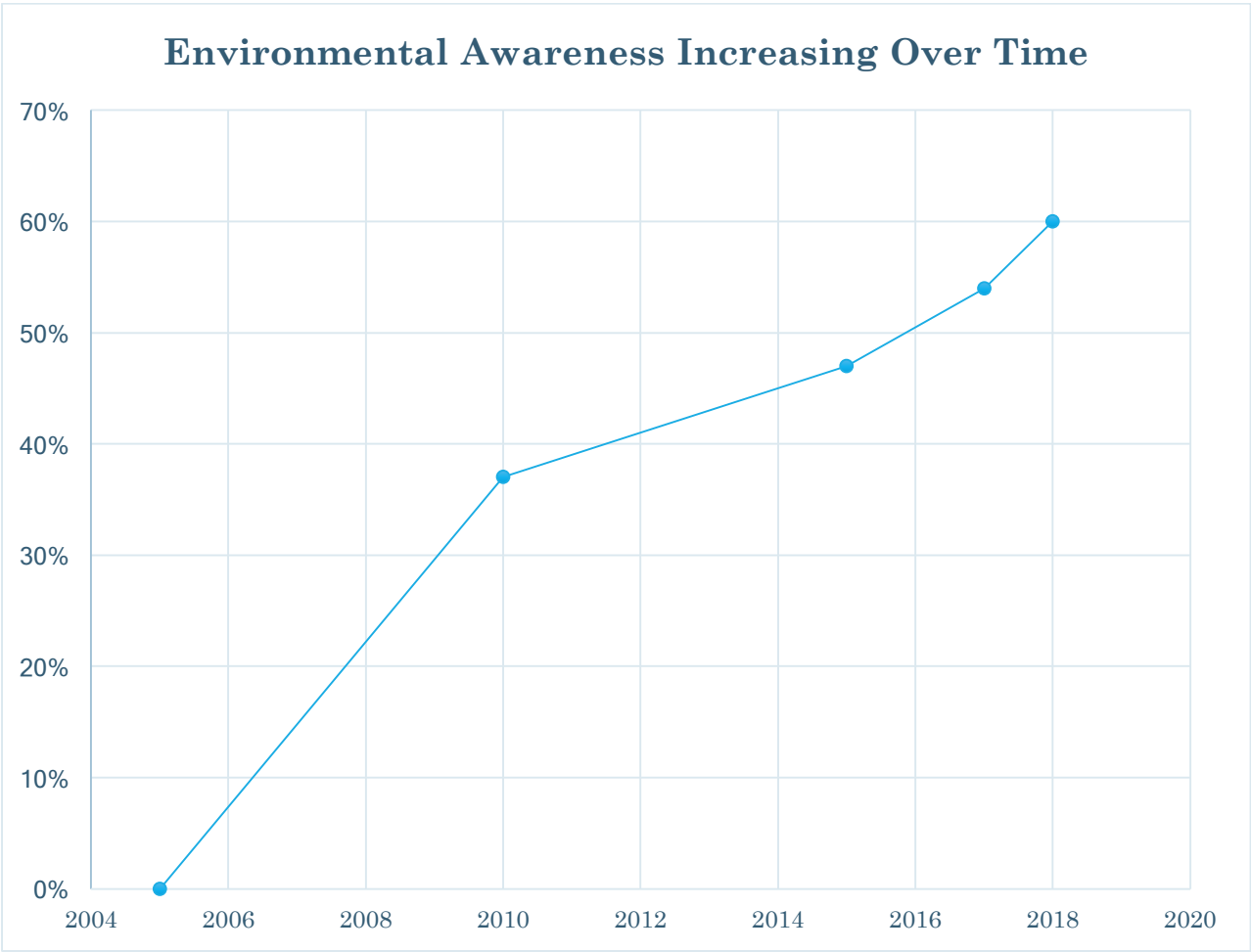
#### ***5.1 Connections to literature***

Results provide evidence regarding public perceptions about aquaculture that can be classified by two main thought processes, aquaculture is beneficial for economic development and job growth, but is harmful for the natural environment. There is a clear economic and

environment trade off continuously being recognized by respondents in not only this survey, but this is a finding consistent with four other studies done on the public perceptions of aquaculture. Respondents in this survey overwhelmingly agreed with Likert scale statements that were positive about aquacultures impact on economic development and negative about the industry's impact on the environment, highlighting a perceived economic and environment battle. In the 2017 FAO study, 54% of respondents believed that the industry was unsustainable, but 55% of respondents identified employment and local economic benefit as important favorable factors about the industry. Even in earlier reports where the environment was not as much of a concern, such as the 2010 study done where 37% of participants believed that the aquaculture industry had negative impacts on the environment, this perceived battle was still prevalent with an overwhelming 94% of respondents agreeing that aquaculture creates development and jobs in coastal communities. However, this economic and environment battle appears to be closing in as public perceptions are changing in favor of the environment.

Sustainability has become an increasingly recognized and valued concept since the Rio Earth Summit in 1992. As the term has become more widely acknowledged, the perceived threat from aquaculture practices represent a major constraint to the acceptability of the industry and its products (Young et al, 1999). The findings of this study produced a result that support this trend that the general public is becoming more conscious of environmental issues over time. In the earliest public survey referenced in this paper, conducted in 2005 by DFO, there was no mention of environmental concerns from respondents. The next study conducted in 2010 throughout Nova Scotia produced results that identified 37% of participants as believing that the aquaculture industry had negative impacts on the environment. The 2015 study conducted by the FAO found that 47% of people had negative perceptions of the environmental impacts of farmed seafood. In the most recent study

conducted in 2017, the environment was the most cited concern among participants who had negative perceptions of the industry, with 54% of people believing that the industry is unsustainable. In this study, 60% of participants reported that their primary concern related to aquaculture was the industry’s impact on the environment.



**Figure 6 - Comparison of public surveys to show environmental awareness trend over time**

With the preconceived notion of an economic and economy battle in the mind of the general public about the aquaculture industry and increasing awareness about environmental issues, the aquaculture industry faces a potential obstacle in justifying the tradeoffs of the industry as it continues to grow, unless it can prove that these economic and environment tradeoffs do not actually exist.



The 2005 DFO study found that for the Canadian public, environmental safety and food safety are highly interrelated; Canadians perceive a wide range of risks, including disease, damage to the coastal ecosystem, escaped fish and the food fed to fish (DFO, 2005). Based on NVivo word queries, the results of this study also support that consumer beliefs about safety and environmental benefits of aquaculture are consistent. Contradictory opinions such as “aquaculture is eco-friendly but unsafe to eat” were not found in my study. Both concepts are balanced in consumer’s mind; a consumer from my study would identify aquaculture as a safe source of food and a potential mechanism for environmental protection. Of the six participants of this study who identified “human health” as their primary concern, five of them also mentioned environmental impacts in their responses. Thus, the concepts of food safety and ocean sustainability, with regard to aquaculture, are linked based on consumer perceptions (Young et al, 1999). It can then be assumed that improving public perceptions about the environmental impacts of aquaculture will also improve the public’s perceptions of its impacts on human health and lead to higher rates of consumption, allowing the industry to grow.

## ***5.2 Implications of findings***

The findings of this study have tremendous practical implications, specifically for influencing management practices, governance structures, and communication within the industry.

Private aquaculture farms and marketing professionals within the industry may benefit from the results of this study which identified consumer’s primary issues with the industry; these data can increase knowledge of the different factors that influence consumer perceptions. Understanding why consumers perceive aquaculture the way that they do provide useful information to design effective promotional and communication materials,

target the appropriate audiences, and develop effective messaging that resonates with the majority of consumers. These responses can act as targets for future communication and promotional programs focused on strengthening the positive perceptions of farmed seafood among consumers.

Government may leverage the results of this study to identify where management practices and aquaculture regulations can be improved, taking into account the responses participants gave for their expectations of the state. The findings of this study can be used to encourage more transparency about management practices and improved communication about regulations between government and the general public.

### ***5.3 Study limitations and avenues for further research***

While this research provided valuable insight about public perceptions of Atlantic salmon farming in Nova Scotia, it was limited in scope and depth and only provides a partial overview of the research topic. The study was conducted in within a short four-day time frame which did not allow for the collection of data from a large sample size. Future research may be conducted over a period of several weeks or months in order to achieve a more statistically representative sample size, and in particular, speaking to more respondents with affiliation to the industry in order to compare and analyze that stakeholder group. The public survey tool would also benefit from improvement in future research. The middle of the Likert scale response, represented by the number 3, was labelled as “Neutral/Don’t Know”; future research may separate “neutral” and “don’t know” into different responses in order to identify knowledge gaps and separate participants with no opinion, but an understanding of the industry, from those who are not familiar with aquaculture. Doing so may provide context to help explain why participants have answered a certain way to more accurately pinpoint opportunities for improvement. Furthermore, future research could also include media

discourses to investigate the sources and information upon which public is basing their opinion. Doing so would provide another opportunity to analyze knowledge gaps and identify where aquaculture communications can be improved to ensure participants are basing their perceptions off of factual information.

## ***6.0 Conclusion and Recommendations***

Results suggest common themes surrounding public perceptions of aquaculture and identified several opportunities for increasing consumer exposure to market information as a means to growing the aquaculture industry. The main goal of the industry and its involved stakeholders moving forward needs to be ensuring that the information that the public is basing their opinions is factual, well-informed, and readily available.

### *Recommendation: Provincial-Wide Public Awareness Campaign*

Preferences toward farmed seafood products such as Atlantic salmon should be expected to increase when they are associated with characteristics representing values for food consumers. Literature has identified three main factors that improve perceptions and willingness to pay for seafood products among consumers: food safety, health benefits, and fisheries sustainability (Fernandez-Polanco, 2012). In order for a public awareness campaign to be successful in gaining consumer trust and increasing the strength of positive opinions about the aquaculture industry, the campaign needs to address aquaculture's safety concerns, the health benefits of farmed Atlantic salmon, and how the industry is contributing to fisheries sustainability.

Information regarding the safety of farmed seafood products may increase product's perceived value and concerned consumers may even be willing to pay premium prices for

safety assurances, especially in recent periods of food crisis. This presents an opportunity for profit maximization and growth within the aquaculture industry. With many participants of this survey citing environmental and human health concerns, this is a clear area to focus future marketing campaigns on. The general public already appears to understand the economic benefits of the industry, so a public awareness campaign should be aimed at educating the public on the environmental and health benefits of farmed Atlantic salmon. With leading credible sources such as government, public awareness campaigns focused on farmed species will improve perceptions and increase frequency of consumption in the same way they have evidenced in other seafood species (Myrland & Kinnucan, 2001).

*Recommendation: Endorsement of Aquaculture Stewardship Council in Nova Scotia*

Research has proven the positive effects of the use of ecolabels or private third party certification schemes in seafood demand and consumer willingness to pay. These labels, including established organizations such as the Marine Stewardship Council (MSC) and newer organizations such as the Aquaculture Stewardship Council (ASC), are more useful than quality claims in obtaining positive consumer feedback (Myrland & Kinnucan, 2001). Based on this research and the findings of this study, should the Nova Scotia government work with the Aquaculture Stewardship Council to certify its farmed seafood products, it may help to drastically improve the public perceptions of aquaculture products in the province. Continuing with the theme of transparency and improved communication however, the ASC would need to make its certification standards publically available and easily accessible so that consumers can verify the sustainability of their seafood products on their own. Endorsing the ASC in Nova Scotia could have tremendous impacts on increasing the consumption of farmed seafood products and growing the aquaculture industry in the province.

*Recommendation: Transparent Regulations and Improved Public Inquiry Process*

The results of this study showed that most respondents wanted more regulations for Atlantic salmon farming operations in the province. While many regulations do already exist, they either being perceived as insufficient or the public is unaware of their existence. With this finding in mind, the research suggests that the provincial government take steps towards improving the transparency of existing regulations and work with residents to improve them moving forward through public inquiry processes. The provincial government is identified as the stakeholder responsible for the improvement of regulations because studies have shown that most people have very positive responses to the idea of standards, but not national ones (Fernandez-Polanco, 2012). Thus, it's recommended that DFO work towards creating a flexible, national framework for aquaculture in which all aspects of it could be tempered with by the provincial and local input. Additionally, local governments working to improve the public inquiry process for the creation of new aquaculture sites is of high importance. Residents in Nova Scotia have previously expressed their dissatisfaction with the secretive nature of public inquiries into new aquaculture developments; making these opportunities more available to citizens moving forward will be crucial to the growth and development of the industry in the province. Insufficient participation and consultation of relevant stakeholder groups could lead to mismanagement of resources, social conflict, and decreased support for the aquaculture industry (Bacher, 2015).

In conclusion, this study has proved that there is a perceived economic and environment battle existing among public perceptions of the aquaculture industry. At the same time there is growing public awareness about environmental issues and the public tends to see environmental health and human health as synonymous as it relates to seafood. In order to improve public perceptions and grow in Nova Scotia, the aquaculture industry needs to justify

the economic and environment tradeoffs by proving that the economic benefits outweigh the environmental impacts. This paper has given recommendations on how to do this through mechanisms like improving regulations and their transparency through public awareness campaigns and the introduction of third party certification systems. The province of Nova Scotia has a tremendous potential for aquaculture, representing an opportunity to grow food to feed the world while at the same time developing jobs and economic opportunities for coastal communities. However, the growth of the aquaculture industry in the province is going to require the support of the general public. Once the public is able to believe that the aquaculture industry is stimulating economic development without negative environmental externalities or threats to human health, consumption of farmed seafood products across the province will increase, helping to grow the industry, support coastal communities and feeding a growing global population.

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# ***Appendix 1: Public Perceptions of Atlantic Salmon Farming Survey Tool***

Resident?

Industry Affiliation?

Do you eat seafood more than once a month?

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*Rank your agreement with the following statements:*

**Atlantic salmon farming threatens natural ecosystems.**

STRONGLY AGREE – AGREE - DON'T KNOW – DISAGREE - STRONGLY DISAGREE

**Atlantic salmon farming protects wild salmon populations by eliminating the need to fish for wild fish.**

STRONGLY AGREE – AGREE - DON'T KNOW – DISAGREE - STRONGLY DISAGREE

**Atlantic salmon farming creates jobs for the community.**

STRONGLY AGREE – AGREE - DON'T KNOW – DISAGREE - STRONGLY DISAGREE

**Atlantic salmon farming puts livelihoods at risk.**

STRONGLY AGREE – AGREE - DON'T KNOW – DISAGREE - STRONGLY DISAGREE

**The disadvantages of Atlantic salmon farming outweigh its benefits.**

STRONGLY AGREE – AGREE - DON'T KNOW – DISAGREE - STRONGLY DISAGREE

**Which issue is most important to you in regards to Atlantic salmon farming?**

**What is your level of trust in the government's capacity to handle that issue?**

**What do you think their role should be in handling that issue?**

## *Appendix 2: Comprehensive Recommendations for Nova Scotia Aquaculture*

	<b>Address public concerns</b>	<b>Increase transparency</b>	<b>Improve communication (make information readily available)</b>
Aquaculture farms	<ul style="list-style-type: none"> <li>• Work with other companies and government to address public concerns and meet set regulations for environment and human health</li> </ul>	<ul style="list-style-type: none"> <li>• Report on social sustainability</li> <li>• Disclose relevant information on social, environmental, and economic impacts</li> </ul>	<ul style="list-style-type: none"> <li>• Use media more effectively to inform and respond to criticism</li> <li>• Strengthen the sectors presence in policy and consumer lobbies</li> </ul>
Department of Fisheries and Oceans (DFO)	<ul style="list-style-type: none"> <li>• Work with provincial government to establish a good aquaculture framework</li> <li>• Streamline policies and communicate them better among actors</li> </ul>	<ul style="list-style-type: none"> <li>• Work with federal and provincial governments and independent certification systems in order to strictly enforce correct seafood labelling rules</li> </ul>	<ul style="list-style-type: none"> <li>• Distribute the tasks of regulation, education, information, and promotion among public and private bodies</li> <li>• Work with federal and provincial governments and independent certification systems to regulate the use of private certifications to reduce confusion among consumers</li> </ul>
Provincial governments	<ul style="list-style-type: none"> <li>• Continue to annually update the Provincial Aquaculture Strategy and incorporate public concerns</li> </ul>	<ul style="list-style-type: none"> <li>• Publish information on aquaculture planning and development</li> <li>• Launch public inquiry's before approval of new sites to ensure decision-making is transparent and participatory</li> </ul>	<ul style="list-style-type: none"> <li>• Launch public awareness campaign province-wide to increase awareness and reduce perception gap related to aquaculture industry</li> </ul>
Retailers	<ul style="list-style-type: none"> <li>• Work with governments, aquaculture farms, and independent</li> </ul>	<ul style="list-style-type: none"> <li>• Demand greater transparency from producers</li> </ul>	<ul style="list-style-type: none"> <li>• Increase knowledge and awareness among sales personnel to better answer questions</li> </ul>

	certification systems to reduce the number of certification systems		from consumers related to farmed seafood products
Food and Agriculture Organization (FAO)	<ul style="list-style-type: none"> <li>• Communicate best aquaculture practices</li> </ul>	<ul style="list-style-type: none"> <li>• Develop global guidelines on transparent reporting in aquaculture</li> <li>• * provide more-easily accessible and understandable information on aquaculture for the wider public</li> </ul>	<ul style="list-style-type: none"> <li>• Raise awareness of the importance of aquaculture to food security, employment, and economic development</li> </ul>