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A MIXED METHODS APPROACH TO SOCIAL LICENSE TO OPERATE FOR AQUACULTURE:
UNDERSTANDING HOW BROAD PUBLIC PERCEPTIONS AND LOCAL COMPANY ACTIONS
INFLUENCE COMMUNITY ACCEPTANCE

BY

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DISSERTATION

Submitted to the University of New Hampshire
In Partial Fulfillment of
The Requirements for the Degree of

Doctor of Philosophy
In
Sociology

May, 2023

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DEDICATION

To you mom. I am forever grateful for your unwavering support, endless patience (with me and my well-behaved children) and unconditional love. I truly could not have done this without you.

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ABSTRACT

A MIXED METHODS APPROACH TO SOCIAL LICENSE TO OPERATE FOR AQUACULTURE:
UNDERSTANDING HOW BROAD PUBLIC PERCEPTIONS AND LOCAL COMPANY ACTIONS
INFLUENCE COMMUNITY ACCEPTANCE

By

Emily Whitmore

University of New Hampshire, May 2023

With aquaculture development becoming increasingly important in meeting global food needs, understanding social dynamics of development is essential. Social license to operate (SLO), a concept that describes community acceptance and approval of incoming industry, offers a lens into these dynamics and possible strategies for successful development. Using a mixed-methods approach, this project aimed to investigate how broad public perceptions and local company actions influence social license to operate in aquaculture. First, a systematic literature review of SLO studies identified perceptions that would likely condition a community's willingness to issue social license, independent of company actions. These predictors included environmental values, economic values, use-conflict, knowledge of aquaculture, experience with aquaculture, confidence in government, and perceptions of the safety of farmed seafood. Second, data from a nationally representative survey validated six of the seven themes as significant predictors of acceptability of aquaculture here in the US. Third, interviews with 30 Maine shellfish and seaweed farmers identified specific strategies used by farmers to earn trust from stakeholders, offering insights into state-specific barriers to social license for aquaculture.

As stand-alone pieces, these three chapters add to a growing body of work on social license in aquaculture. The first chapter enhances SLO measurement, providing a community-focused framework that could be refined to help to identify communities that would benefit from and be receptive of aquaculture activity. The second chapter validates these predictors, but also expands research related to public perceptions of aquaculture more broadly. This chapter demonstrates that key predictors found in studies from across the globe are also relevant here in the US. The third chapter, though structured as an applied guidebook for SLO, contributes to several research gaps including understanding of the social networks that exist around aquaculture development, the community benefits offered by aquaculture, the ways that aquaculture companies incorporate SLO activity into their business strategies, and the relationship between third party certifications and SLO in aquaculture.

Together, this body of work offers insights into the relationship between public perceptions, community dynamics, and social license. While farmers relay specific strategies used to gain local trust, they acknowledge that community context and pre-existing perceptions affect success. Considering public knowledge of aquaculture is low, perceptions are often formed through local experiences. For farmers, social license as a heuristic encourages creating positive experiences for community members. Collectively, these experiences could bolster support for the industry more broadly, acting as a catalyst for future growth. Further, putting community at the forefront leads to a more socially sustainable industry, where industry members are aware and attentive of social concerns. Though there is still much work to be done, this project highlights the utility and necessity of social license to operate as a way of thinking within aquaculture as well as natural resource industries more broadly.

INTRODUCTION

With a growing population and rapidly changing climate, experts argue that aquaculture is becoming critically important in meeting global food needs (FAO 2018). This need has spurred efforts for expansion, specifically in the US where demand for seafood is high, yet only around 15% of this demand is met with nationally grown products. These initiatives have brought sustainability to the forefront, with concerns ranging from environmental impacts, to food safety, to conflicts with other marine industries. These concerns vary depending on the type of aquaculture operation—with some production methods requiring higher inputs and posing greater risk for environmental impacts, and others being environmentally benign or even beneficial. However, if done responsibly, aquaculture production can meet all 17 Sustainability Goals defined by the United Nations (NOAA 2020).

While the three pillars of sustainability are well-known, research addressing social sustainability within aquaculture is limited, yet essential for responsible development. One line of work that has been recently gaining traction within the aquaculture industry that incorporates social sustainability is the concept of social license to operate (SLO)—a term describing informal, ongoing approval or acceptance of a project granted by the community (Kelly et al. 2017; Billing 2018; Baines and Edwards 2018; Mather and Fanning 2019; Sinner et al. 2020; Whitmore, Cutler and Thunberg 2022; Whitmore, Safford and Hamilton 2022). SLO, while often used in an industry setting as a tool for mitigating ‘social risk’ (Gunningham et al. 2004), also functions as a community empowerment tool. By withdrawing or withholding social license, communities can have more of a say in what happens to their shared resources, which provides environmental security (Lacey et al. 2012; Lacey and Lamont 2014).

The social license work required for this form of community acceptance contributes to social sustainability in myriad ways. For companies to gain social license, they must communicate and consult with a broad network of stakeholders, listen and make reasonable accommodations in response to community concerns, and offer meaningful community benefits. Ultimately, companies must prove to their communities that they are responsible, respectful, and skilled operators. This trust is built through consistent engagement, responsible operating practices, and value alignment with their host communities. Further, this work is ongoing, as social license is dynamic and can be withdrawn at any point. Aquaculture farmers must continuously work to gain and maintain support from their communities. Thus, this social license work creates a more socially sustainable industry because it fosters the industry-community collaboration necessary for farmers and communities to benefit from each other in meaningful ways and co-exist harmoniously over time.

Social license also draws attention to issues of community fit, which is an important consideration for social sustainability. In some cases, companies can do everything right, yet their operation may not align with the community's vision of sustainable development. Often, this is influenced by the type of aquaculture operation and resulting impacts. The size of the operation, as well as other factors like local ownership, plays a role in whether communities will accept aquaculture operations in their waters despite a company's community outreach. Value alignment is key for the trust generation necessary for the development of social license (Voyer and van Leeuwen 2019). Identifying communities that would embrace aquaculture is key for socially sustainable growth.

This set of work adds to a new, but growing body of research that investigates social license to operate within the aquaculture industry. The first chapter seeks to identify community

characteristics that would increase or decrease community suitability for aquaculture independent of company actions. While there are ongoing efforts to develop measurement techniques so that companies are able to assess their level of social license within their community, this project offers a starting point for the development of an assessment tool that can identify communities that are well-suited for aquaculture development. With support from two co-authors from the National Oceanic and Atmospheric Administration (NOAA), I developed this initial framework through a review of SLO literature and a systematic review of surveys on social acceptability. My role in this project involved conducting the literature review, analyzing results of the survey review, developing the framework, and writing the document. This chapter was published as a NOAA Technical Memorandum in 2022 (Whitmore, Cutler and Thunberg 2022).

Because the studies included in the social acceptability review were conducted in various places across the globe, there was a need to validate that these indicators would also influence acceptability in the US. The second chapter uses secondary data collected in 2017 to confirm that the indicators identified in the review predict social acceptability of aquaculture here in the US. My co-authors, Thomas Safford, Lawrence Hamilton and I published this chapter in *Ocean and Coastal Management* in 2022 (Whitmore, Safford and Hamilton 2022). My role in this project included conducting the literature review, preparing and analyzing the dataset, and writing the document.

Informed by this set of predictors, the third chapter diverges to examine how aquaculture farmers have incorporated SLO practices into their businesses and what practices have helped them generate the trust needed to gain social license to operate. Through 30 in-depth interviews with Maine shellfish and seaweed farmers, the third chapter is an applied, co-constructed guide

to social license to operate that offers rich insight into how farmers are *doing* social license work. While some core social license practices found in other industries were also central to farmers work, there were many ways that farmers worked to gain trust that were very specific to aquaculture and are key to understanding how social license functions within the industry. This chapter will be released during the summer of 2023 through the Maine Aquaculture Innovation Center (MAIC). Co-authors on this chapter include Anne Langston Noll, Christopher Davis and Sydney Avena of MAIC. My role in this project involved designing the study, conducting interviews, analysis of data and writing the document.

Together, these three chapters offer insight into each side of the primary parties involved in a SLO relationship—the community and company—and can provide guidance on creating a more socially sustainable industry. By better understanding what primes a community to issue social license, we can (1), better understand community concerns surrounding aquaculture, (2) better understand why aquaculture is working in some places and how companies can adapt or pivot for improved value-alignment, and (3) better understand what communities value about aquaculture development. By learning about how aquaculture farmers are navigating social license and gaining community trust, we can (1), better understand how farmers are making adjustments and responding to community concerns, (2) better understand how farmers and communities are collaborating, and (3) better understand how farmers are contributing to their local communities.

CHAPTER 1: SOCIAL LICENSE TO OPERATE IN THE AQUACULTURE INDUSTRY: A COMMUNITY FOCUSED FRAMEWORK

Emily H. Whitmore, Matthew J. Cutler, and Eric M. Thunberg

1. INTRODUCTION

As climate change and overharvesting threaten natural fish stocks and the world's population approaches 9 billion, marine aquaculture is becoming critically important in world food production (FAO 2018). Capture fishery production has remained stagnant since the 1980's even while demand for seafood rises. Thus, aquaculture has been the primary driver of growth in the supply of fish for human consumption (FAO 2018). Currently, over 50% of all seafood consumed is farmed, and that percentage is predicted to increase (NOAA 2020). The United States is the second largest market for fish and fish products, but only produces about \$1 billion worth of aquaculture products annually, ranking 16th globally in production (FAO 2018, Woods Hole 2007; NOAA 2018). However, with its long coastline, large Marine Exclusive Economic Zone, and skilled labor force, the US has vast potential for expansion (FAO 2013). With clear opportunities for growth, the Department of Commerce has called for the development of an aquaculture industry worth \$5 billion by 2025.

To foster this growth, research institutions have been putting considerable effort into developing ways to improve and increase production, streamline regulatory processes and identify potential sites (e.g. the National Aquamapper). However, one major barrier to growth that has been neglected involves public perception—a problem situated squarely within the

social sciences (Leith et al. 2014; Cullen-Knox et al. 2017; Krause et al. 2020). Local resistance to aquaculture has been well documented and can present insurmountable barriers to development (Young and Matthew 2010; Bacher 2015; Anderson 2013; Hargreaves 2017; Alexander et al. 2018; Flaherty et al. 2018). A community may be situated on a section of coastline ideal for aquaculture production biologically, but without community approval and support, companies may never progress beyond the planning stage.

Social license to operate (SLO), a concept used in resource extraction industries, has recently emerged within the aquaculture literature to address the importance of the social relationship between industry and community (Mather and Fanning 2019). Although scholars have presented varying definitions, broadly, SLO has been described as the informal, ongoing approval or acceptance of a project granted by communities (Joyce and Thomson 2000; Thomson and Boutilier 2011; Lacey et al. 2012). Communities can be powerful actors in the development of shared resources. They have the ability to create delays in operation, pressure governing bodies into tightening regulations, and even influence consumer purchasing preferences—all of which produce real economic costs to companies (Lacey et al. 2012; Prno and Slocombe 2012; Franks et al. 2014; Moffat et al. 2014; Moffat et al. 2016). By securing and maintaining community approval, companies are less likely to encounter resistance (Moffat et al. 2016). Thus, securing SLO is essential to the development of the aquaculture industry.

However, the meaning of SLO varies by industry and remains vaguely defined (Hall et al. 2014, Dowd & James 2014; Moffat et al. 2016). Scholars have only scratched the surface of SLO as it applies to aquaculture and researchers point out the need for a conceptual model specific to aquaculture so that SLO can be quantitatively measured (Mathers and Fanning 2019). While efforts to create such a model have begun (Sinner et al. 2020), gaps remain. A key element

missing to both widely accepted models of SLO in mining, and preliminary models of SLO within aquaculture, is community context. This paper seeks to address this gap.

Consistent and clearly defined measures can help researchers, industry, communities and regulatory agencies better understand the conditions that encourage or hinder the development of SLO, which is key to fostering growth within the wider industry. As pointed out by Mather and Fanning (2019), while the research on social license within aquaculture is limited, there is a vast literature on the social acceptability of aquaculture. Researchers have studied public perception on varying scales in places across the globe. This research, in addition to the literature addressing SLO across several industries, will inform the construction of a quantitative model that assesses the likelihood of the development of SLO. However, rather than focusing solely on company actions and impacts, as is the case with existing models, this paper identifies potential indicators related to community context that influence the likelihood of SLO issuance. While further research is needed for empirical validation, this model offers a starting point for the development of a consistent measurement that includes a community context perspective, thus advancing our understanding of what constitutes SLO as it applies to the aquaculture sector.

2. METHODS AND APPROACH

2.1 Literature Selection Process

This paper and the resulting framework is based on a compilation of three comprehensive literature reviews. The first review (Review 1) included key works on social license to operate as applied to several resource industries. Beginning with highly cited, canonical texts on SLO within the mining industry—where the concept has been most thoroughly investigated, we then broadened the scope to include the literature applying SLO to forestry, agriculture, and the

marine sector (see Kelly et al. 2017). This breadth allowed for a more comprehensive understanding of SLO and illuminated key conceptual consistencies across industries.

The second review (Review 2) focused on SLO as it applies to aquaculture. In a manner similar to that of Kelly et al.'s (2017) review of SLO in the marine sector, we performed a systematic search of the literature using three online search engines: Academic Search Complete, Web of Science, and ProQuest (see Figure 1). We performed two separate queries within each database, one using the search terms 'social license' and 'aquaculture,' and a second using the alternative spelling 'licence.'

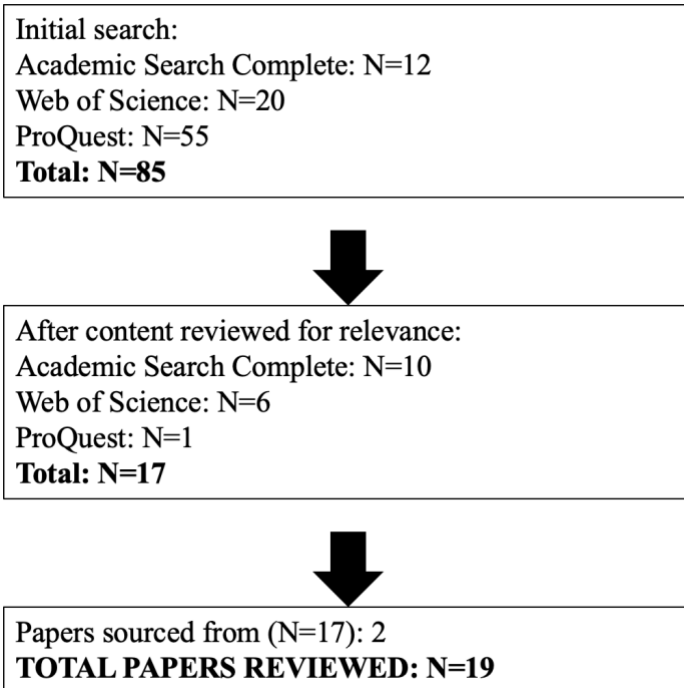


Figure 1. Visualization of the SLO within aquaculture review process.

Following the initial search, we then reviewed the list of results for relevance using article abstracts. In cases where relevance remained unclear after reviewing the abstract, we reviewed the full text. The final list included articles where social license was a central analytical

theme or frame as applied to the aquaculture industry. Discarded articles included texts where authors would reference a company or industry’s ‘social license’ without expansion or analysis. The use of SLO in this regard affirms a major critique of the concept—mainly that it is frequently deployed but lacks analytical substance (Owen and Kemp 2013). See Figure 1 for a visual representation of the review process. Table 1 provides a summary of papers included in the final review.

Table 1. Summary of papers (N=19) reviewed focusing on SLO within aquaculture

Author	Year
Baines and Edwards	2018
Billing	2018
Billing et al.	2021
Buck et al.	2008
Kelly and Fleming	2017
Leith et al.	2014
Kelly et al.	2017
Krause et al.	2020
Mather and Fanning	2019
McGhee et al.	2019
Murphy-Gregory	2018
Newton et al.	2020
Runge et al.	2021
Sinner et al.	2020
Stephen and Wade	2019
Tollefson and Scott	2006
Vince and Haward	2017
Vince and Haward	2019
Voyer and van Leeuwen	2019

The third review (Review 3) in this report investigated the extant literature on public perception and social acceptability of aquaculture. Utilizing the same, systematic process used to

compile articles for the SLO in aquaculture review, we performed two separate queries within the three online databases. The first query included the search terms ‘public perception’ and ‘aquaculture.’ In the second query, we used ‘social acceptability’ and ‘aquaculture’ resulting in a combined list of 190 articles. After reviewing the article abstracts for relevance and removing duplicates, we were left with 24 items. Twenty additional articles were sourced from the references, resulting in a final list of 44 items for review. Figure 2 provides a visualization of this process.

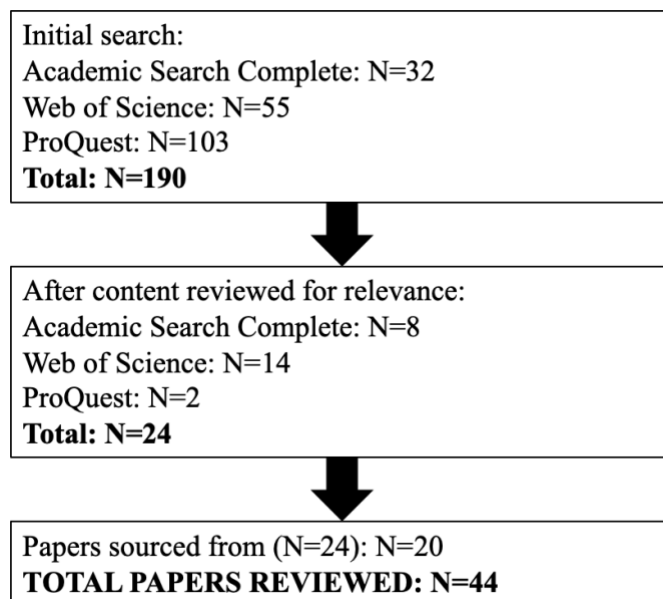


Figure 2. Visualization of the social acceptability of aquaculture review process.

While all 44 documents were reviewed in their entirety, for the purposes of this review, we focused on articles that included empirical public perception surveys (n=25) as identified in Table 2. By focusing on survey results, we were better able to systematically search for patterns that would illuminate community characteristics that are consistently associated with support of

or opposition to the aquaculture industry. The themes identified are explored in detail in Section 4.

Table 2. Summary of papers (N=44) reviewed

Author	Year	Survey?
Alexander et al.	2016	1
Alexander et al.	2018	1
Amberg and Hall	2008	
Bacher et al.	2014	
Bailey and Eggereide	2020	
Barrington et al.	2010	
Beckensteiner et al.	2020	
Bouchard et al.	2021	1
Chu et al.	2010	1
Claret et al.	2014	1
Dalton and Jin	2017	1
Fernandez-Polanco and Luna	2012	1
Feucht and Zander	2016	
Flaherty et al.	2018	1
Freeman et al.	2012	1
Froelich et al.	2017	
Hynes et al.	2018	1
Johnson et al.	2019	
Joyce and Satterfield	2010	
Katranidis et al.	2003	
Kluger et al.	2019	
Krovel et al.	2019	1
Krause et al.	2020	
Mazur and Curtis	2006	1
Mazur and Curtis	2008	1
Murray and D'Anna	2015	1
Murray et al.	2017	1
Outeiro et al.	2018	1
Reig et al.	2019	
Rickard et al.	2020	1
Ridler et al.	2007	
Robertson et al.	2002	1
Safford and Hamilton	2012	1
Schlag and Ystgaard	2013	
Shafer et al.	2010	1
Sinner et al.	2020	1

Thomas et al.	2018	1
Tiller et al.	2019	
Weitzman and Bailey	2019	
Whitmarsh and Palmieri	2009	1
Whitmarsh and Palmieri	2011	1
Whitmarsh and Wattage	2006	1
Young and Liston	2010	
Young and Matthews	2010	
Total		25

2.2 Analytical Approach

Using the texts compiled as a result of Review 1, we were able to first establish a basic foundation of SLO conceptually and distinguish key components of SLO that appear to be universal across industries. Additionally, we were able to review any existing quantitative models pertaining to SLO in mining in order to assess their applicability to the aquaculture industry and determine whether they could inform a community-suitability framework. Review 2 was narrower in focus and provided valuable insight into how SLO has been applied to the aquaculture industry to date. However, considering this pocket of research remains in its infancy, significant gaps remain. While researchers have highlighted the importance of company actions in securing social license, they have yet to define concrete measures that can predict whether a community is more or less likely to issue social license, independent of company actions.

Review 3 was conducted in an attempt to fill this gap. Though we reviewed both qualitative and quantitative studies, by focusing on survey research, we were able to identify several commonly addressed themes and systematically compare results. We created a table containing survey scale, methods, and results. Results were then grouped by theme. This process allowed us to identify patterns within each theme, which are described in detail in Section 4.

Collating results from the three reviews, we created a list of indicators that are key to community willingness to issue SLO. A visualization of the review process is shown in Figure 3.

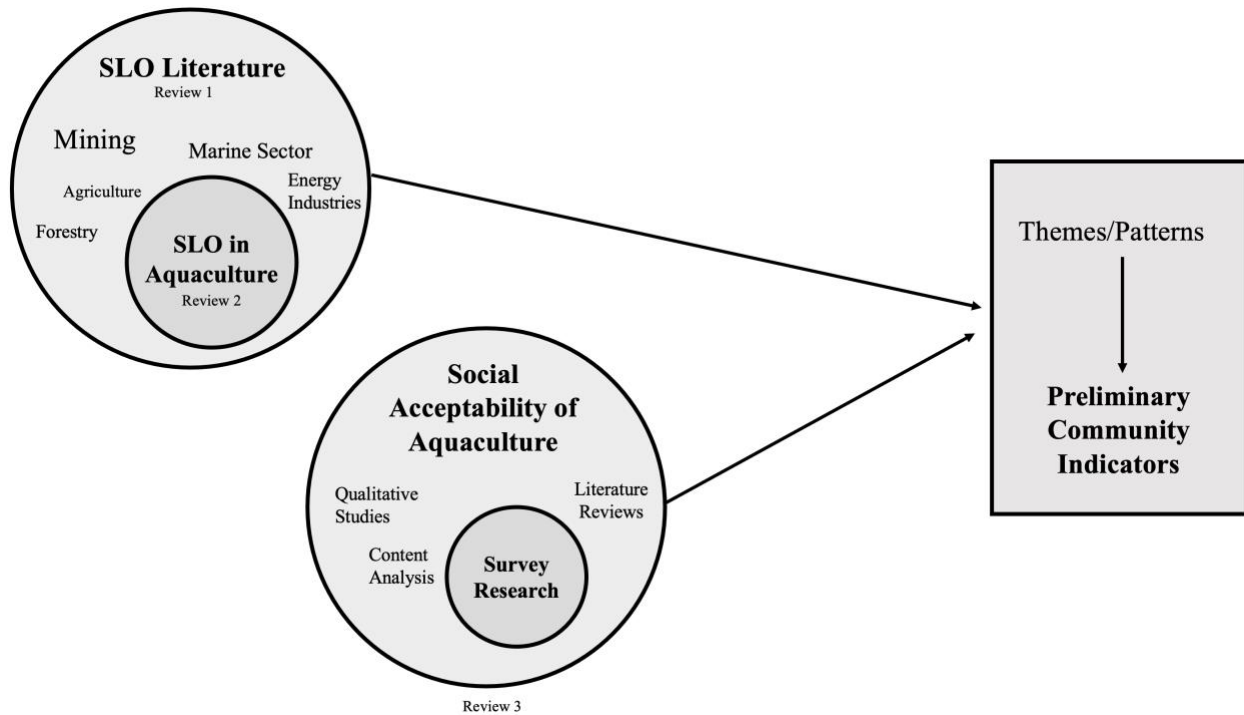


Figure 3. Overview of the review process. Themes from each review were collated to inform a set of preliminary indicators that intend to predict community suitability for aquaculture.

3. SOCIAL LICENSE TO OPERATE: AN OVERVIEW

The term social license to operate emerged in the mining industry in the 1990s in an effort to highlight the importance of community-industry relationships in mitigating risk (Gunningham et al. 2004; Thomson and Boutilier 2011; Lacey, Parsons and Moffat 2012; Dowd and James 2014; Moffat et al. 2016; Baines and Edwards 2018). Although scholars have presented varying definitions, broadly, SLO has been described as the informal, ongoing approval or acceptance of a project granted by communities (Joyce and Thomson 2000;

Thomson and Boutilier 2011; Lacey et al. 2012). Within the mining sector, regulatory compliance alone had become increasingly insufficient as companies began seeking social approval from host communities to reduce the risk of costly social conflicts that frequently occur with resource development projects (Gunningham et al. 2004; Parsons and Moffat 2012; Prno and Slocombe 2012; Prno 2013; Moffat and Zhang 2014; Cullen-Knox et al. 2017). Researchers have documented wide-ranging negative effects resulting from unmet community expectations and demands. Through a variety of mechanisms, communities have the ability to create delays in operation, pressure governing bodies into tightening regulations, and even influence consumer purchasing preferences—all of which produce real economic costs to corporations (Gunningham et al. 2004; Lacey et al. 2012; Thomson and Boutilier 2011; Prno and Slocombe 2012; Franks et al. 2014; Moffat et al. 2015; Moffat et al. 2016). By securing and maintaining community approval, companies are able to proceed with operations with fewer encumbrances (Moffat et al. 2016).

However, companies are not the only party benefiting from the establishment of SLO—when granted, often both companies and communities gain (Hall et al. 2014; Dowd and James 2014; Moffat et al. 2016). Companies are required to go above and beyond regulatory requirements in order to build the trust necessary for the establishment of SLO (Lacey, Parsons & Moffat 2012; Hall et al. 2014; Moffat & Zhang 2014; Falck & Spangenberg 2014). Thus, companies are incentivized to involve the local community in planning and operations, actively address concerns, communicate openly, and be culturally sensitive in their decision-making (Thomson & Boutilier 2011; Prno and Slocombe 2012). While this is especially important in the planning and permitting stages, companies must work to maintain SLO over time, as it can be

easily withdrawn if trust is violated (Thomson & Boutilier 2011; Lacey, Parsons & Moffat 2012; Prno 2013; Vince & Haward 2017; Hall et al. 2014).

This constant negotiation and maintenance work can result in tangible benefits for the community. Some are simply transactional—companies will offer financial compensation to host communities in the form of rent, local taxes, royalties or donations. Some are economically based like when companies ensure that a percentage of jobs go to local community members (Prno 2013). Other benefits are less tangible. For example, in many cases corporations will modify operations to lessen environmental impacts when a community expresses disapproval. Thus, the establishment of SLO can provide a degree of certainty about the future health of the environment for residents (Baines and Edwards 2018). Communities are able to hold companies accountable for their environmental impacts by requiring operational modifications. Communities can also benefit from SLO through their ability to withhold it altogether. In cases where the development of an industry has the potential to seriously disrupt a community or a community's public resources, members have been able to prevent development entirely (Lacey et al. 2012; Moffat et al. 2015; Moffat et al. 2016). Thus, SLO is empowering as it provides a mechanism for communities to play an active role in determining what happens to shared resources (Lacey et al. 2012; Lacey and Lamont 2014).

3.1 Who issues SLO?

The question of who issues a SLO is complex and has raised multiple critiques. Thomson and Boutilier (2011) assert that the 'community' issues the SLO but specify that they use community as a generic term that describes the networks of stakeholders that have a shared interest in the company. These stakeholders are those who affect and are affected by the company (Thomson and Boutilier 2011). The 'community' as issuer is most commonly used in

the literature, although some have argued that the term is unclear. Owen and Kemp (2013) argue that use of the term ‘community’ homogenizes a diverse group of stakeholders. They explain that while SLO is typically understood as an ‘inclusive’ concept, often certain stakeholder group’s perceptions are privileged which can potentially exclude disempowered or marginalized groups. Billing (2018) echoes this, arguing that key stakeholders with financial resources are the ‘community’ driving SLO outcomes as they have the resources necessary to gather oppositional support through local campaigning. Researchers document that stakeholders hold this perception as well. In a study examining the role of SLO in marine governance, stakeholders believed that the loudest and most resourced group controls SLO (Cullen-Knox et al. 2017).

Researchers note that SLO operates on multiple scales, complicating ‘community’ as it is typically conceptualized (Hall et al. 2014; Dowd and James 2014; Moffat et al. 2016; Mather and Fanning 2019). While the local host community typically does have the most influence (Lacey et al. 2012), stakeholders across the globe can have a significant impact on operations as well (Moffat et al. 2016). NGO’s, a frequent source of well-resourced and organized resistance to mining operations, are rarely locally based and often have a hand in the issuance of SLO (Cullen-Knox et al. 2017). As a way to conceptualize the varying scales of SLO, Voyer and van Leeuwen (2019) identify two main categories of stakeholders: communities of place—commonly the host community, and communities of practice—or stakeholders that are geographically dispersed but have an interest in the project. This conceptualization clarifies that community, as it pertains to SLO, should be understood broadly, rather than as a homogenous, local group.

3.2 What does SLO require?

Gunningham et al. (2004) argue that on a basic level, most stakeholders expect that corporate behavior should not negatively impact human health, the environment, or enjoyment of

property. Thus, resource development industries are often subject to public resistance because of their potential impacts. Not only can their operations create use conflict by operating in shared public spaces, but their practices can be damaging to the environment and subsequently, human health. To remedy public opposition, these sectors have to be particularly mindful of their SLO, requiring them to go beyond regulatory requirements to meet the demands of the public (Gunningham et al. 2004). While specific demands vary, scholars agree that developing SLO requires ongoing relational work to build trust—a central component of SLO (Gunningham et al. 2004; Thomson and Boutilier 2011; Prno 2013; Moffat and Zhang 2014; Ford and Williams 2016; Moffat et al. 2016; Baines and Edwards 2018). It is this relational aspect, according to Lacey et al. (2012), that is the key differentiating feature separating SLO from other concepts like corporate social responsibility, sustainable development, and free, prior and informed consent.

From an industry perspective, researchers argue that companies must first identify key stakeholders and initiate engagement (Prno 2013). Thomson and Boutilier (2011) point out that companies must engage all parts of the stakeholder network, as failure to connect with certain segments could result in perceptions of illegitimacy. Particularly in the planning stages, stakeholders need to be informed of operational plans and potential impacts to avoid perceptions of secrecy. Transparency and openness are essential to gaining legitimacy and building the trust required for SLO (Thomson and Boutilier 2011; Leith et al. 2014; Rooney et al. 2014). Beyond initiating contact and informing stakeholders of development plans, companies also need to provide ample opportunities for stakeholder feedback (Thomson and Boutilier 2011; Hall 2014; Voyer and van Leeuwen 2019), as studies have shown that active participation can build trust and promote compromise (De Cremer et al. 2005; Gouldson et al. 2007; Diez et al. 2015). This

participation, according to Zhang et al. (2015) is what generates perceptions of ‘procedural fairness,’ or whether people believe that they have a voice in the process. Though important early on, this active dialogue must exist throughout the duration of the project (Gunningham et al. 2004; Baines and Edwards 2018).

Beyond providing opportunities for stakeholder feedback, companies must also actively respond to that feedback. According to Moffat and Zhang (2014), contact must be perceived as ‘positive’ and ‘pleasant’ by stakeholders. They find that contact quality, rather than quantity, aids in trust building. A 2020 study by Sinner et al. echoed this—with contact quality as the strongest predictor of SLO. It is clear that stakeholders need to feel respected and understood (Boutilier and Thompson 2011). Further, companies need to provide “demonstratable evidence of efforts to address stakeholders’ concerns” (Voyer and van Leeuwen 2019:105). It is the accumulation of this evidence over time that builds credibility and relational trust, both of which are essential for the development of SLO (Thomson and Boutilier 2011; Moffat and Zhang 2014; Voyer and van Leeuwen 2019). This ‘evidence’ can come in many forms. Thomson and Boutilier (2011) argue that a primary form of ‘evidence’ is making and keeping promises. Hall (2014) points out that companies can build evidence by effectively managing concerns—specifically concerns she terms ‘game-changers.’ While some concerns are unavoidable problems and simply require transparency, ‘game-changers’ are issues that have the potential to enhance or diminish SLO depending on how the concern is managed. While each case is unique, if a company facilitates robust, two-way consultation when dealing with ‘game-changers,’ this process can contribute towards developing an effective SLO. In essence, it is the cycle of listening to stakeholders, responding to concerns with potential resolutions, coming to agreement, and following through

with action that builds the reputation of credibility that is necessary for SLO (Thomson and Boutilier 2011; Voyer and van Leeuwen 2019).

Along with engagement, stakeholders also need to experience tangible benefits that help to offset the risks associated with operation (Mason et al. 2010; Hall 2014; Zhang and Moffat 2015; Zhang et al. 2015; Moffat et al. 2016). Often, stakeholders are willing to accept negative social impacts because they are outweighed by positive socio-economic impacts. Vince and Haward (2017), among others conceptualize this form of agreement as ‘contingent consent,’ where stakeholders can rescind their consent at any point if the company fails to follow through with benefits (Levi 1997; Owen and Kemp 2013). These tangible benefits include increases in general wealth, infrastructure, and employment; however, expectations vary with the presumed impact of the operation (Zhang and Moffat 2015). Ultimately, stakeholders are more likely to approve of an operation if they believe that the distribution of outcomes is fair (distributional fairness) and that they had a voice in the process (procedural fairness) (Zhang et al. 2015). These perceptions generate trust which Moffat and Zhang (2014), among others, argue leads to SLO (Thomson and Boutilier 2011; Zhang et al. 2015; Moffat et al. 2016).

3.3 Withheld or Withdrawn SLO

Scholars have also noted that while it takes time to generate the foundation of trust necessary for SLO, SLO is dynamic and can quickly be withdrawn (Thomson & Boutilier 2011, Lacey et al. 2012; Lacey, Parsons & Moffat 2012; Prno 2013; Hall et al. 2014; Vince & Haward 2017). Further, SLO may be withheld from the start, which can lead to the cessation of a project altogether (Prno 2013). Withholding or withdrawal of SLO can occur for a multitude of reasons. In a study of SLO as it applies to four different energy industries in Australia, Hall et al. (2014) found that the most common reasons for withdrawn or withheld SLO were mishandled

engagement approaches, not following through with commitments, and failing to identify where stakeholder input could be most influential in the life of a project (Hall et al. 2014). Similarly, Thomson and Boutilier (2011) cite that providing incomplete or false information, failing to respect and listen to stakeholders, failing to facilitate continued engagement with all stakeholders and failing to deliver on promises made can lead to withheld or withdrawn SLO.

Considering much of the SLO literature is from a management perspective, researchers have typically focused on the company's actions or non-actions. However, several scholars have asserted that context specific place-effects of the host community can prevent the establishment of SLO before a project even reaches the formal planning stages. For example, there is growing evidence that collectively held community values are important in determining whether an incoming industry might be successful. Researchers argue that value alignment between the host community and company is key to developing SLO (Prno 2013; Leith et al. 2014; Ford and Williams 2016; Cullen-Knox et al. 2017; Billing 2018). Two studies in particular describe this in terms of public perceptions of 'acceptable use' or whether they value the coast for 'lifestyle/landscape vs. livelihoods' (Billing 2018; Leith et al. 2014). In essence, they argue that how community members and stakeholders value the area of interest (for example, recreational use, peace and quiet, industrial activity, etc.) plays a key role in their acceptance of incoming aquaculture development. Different communities may place higher value on different activities depending on community characteristics. Prno (2013) also lends support to this in his study of SLO in the mining industry. He contends that while sustainability is an important factor in all cases, communities often have differing conceptions of sustainability. What is most important to SLO is whether the development of a particular industry matches the community's vision of sustainable development. In short, when values are not aligned, communities are more likely to

withhold SLO (Voyer and van Leeuwen 2019). Further, there is evidence that trust in government increases the likelihood of SLO issuance (Zhang et al. 2015; Moffat et al. 2016; Runge et al. 2021). Communities with more confidence in regulating agencies will be more trusting of incoming industries. Again, this emphasizes the importance of community context in SLO.

3.4 Measuring SLO

As an intangible agreement, SLO has proven difficult to measure. Lacey et al. (2012) point out that it is often easier to define when an operation does not have SLO than when it does. It is clear that companies lack SLO when they face public protests, incur delays in operation due to public complaints, or in extreme cases—have to move their operation to an entirely new site because of the host community’s resistance. However, in most cases, SLO is less observable. Turning to the mining literature where the concept of SLO has been more thoroughly investigated, researchers use several methods to measure SLO. Some simply ask if participants “approve” or “accept” a company’s practices (Prno 2013; Moffat and Zhang 2014). For example, in a highly cited 2014 study, Moffat and Zhang measure SLO with two items asking participants whether they approve/accept of the company of interest (1=*not at all*, 5=*very much so*). In a subsequent study, they use four items in the measure: tolerate, accept, approve, or embrace (Zhang and Moffat 2015).

However, other scholars have developed more complex measures. In a 2017 paper by Boutilier, one of the authors of the most widely cited works on SLO within the mining industry (Thomson and Boutilier 2011), he suggests a 12-item measure (see Table 3). He argues that the declarative statements included address key theoretical elements of SLO as outlined in previous works: legitimacy, credibility, and trust (Thomson and Boutilier 2011; Moffat and Zhang 2014).

Between 2012 and 2015, this set was used in 23 different studies in 11 countries for a total of 2,152 interviews. Using this data, Boutilier (2017) performed factor analysis and found that the measures were internally consistent. Thus, the set is reliable. In a subsequent analysis, he addressed validity by analyzing stakeholder comments and seeing if their sentiments correlated with the survey results. The qualitative measures were significantly correlated with the quantitative measure of approval ($p < .02$), suggesting that the measure is also valid. However, he points out that further research is needed to confirm validity (Boutilier 2017).

Table 3. Set of 12 statements that measure SLO (Boutilier 2017)

[Company] shares information on matters that affect us.
[Company] contributes to regional well-being.
[Company] takes account of our interests.
[Company] respects our way of doing things.
We're satisfied with our relation with [Company].
We have similar vision for future as [Company].
[Company] treats everyone fairly.
We can gain from a relationship with [Company].
[Company] listen to us.
The presence of [Company] is a benefit.
[Company] gives more help to those who it affects more.
[Company] shares decision-making on matters that affect us.

While both Boutilier's (2017) metric and Moffat and Zhang's (2014) four-item measure have been utilized in several studies, two questions remain. First, to what extent are the two metrics measuring the same thing? Can the level of SLO be captured by simply asking if a participant 'approves' of an activity, or does Boutilier's measure capture more nuanced aspects of SLO that are key to measurement? Future studies that utilize the 4-item metric should include a second independent measure in order to confirm whether the scores correlate, and the measure is valid. Further, a comparative study using both measures should be conducted to see if the

measures are both getting at the same thing. If results are the same regardless of the measurement used, this could inform future studies and enable consistency in research.

Second, are these metrics universal? Considering they are both rooted in research on SLO within the mining industry, can these metrics be used as effectively in other industries? While studies have shown that understanding and application of SLO varies by industry (Dowd and James 2014), the underlying components of SLO are relatively consistent. Scholars have examined SLO as it applies to forestry (Moffat et al. 2016), various energy sectors (Hall et al. 2014), Marine Protected Areas (Voyer et al. 2015a, Voyer et al. 2015b), aquaculture (Baines and Edwards 2018; Sinner et al. 2020) and more. In all cases, SLO is definitionally similar. As researchers continue to investigate SLO, the effectiveness of these measures will come to light.

3.4.1. SLO Conceptualized

Whatever the measure used to assess SLO, most scholars agree that SLO exists on a continuum (Thomson and Boutilier 2011; Prno 2013; Parsons and Moffat 2014; Moffat and Zhang 2014). A binary understanding of SLO as either ‘issued’ or ‘withheld’ fails to capture the varying levels of SLO. This is especially problematic when SLO is considered ‘issued’ simply when a company faces little to no opposition. As Owen and Kemp (2013) argue, ‘minimal community resistance’ is a poor measure of SLO because it conflates the tangible evidence available—no resistance—with support. Absence of opposition, interpreted as latent support, is an inaccurate gauge of SLO. A binary understanding of SLO masks the complexities and varying levels of support and company/community benefits.

Thomson and Boutilier (2011) provide a detailed conceptualization of SLO as a continuum in their foundational study of SLO. They present a cumulative pyramid model that progresses from withholding/withdrawal, to acceptance, approval, and finally co-ownership.

They saw this step-wise progression as a result of a company first gaining legitimacy, then credibility, then finally garnering full trust from the community (Thomson and Boutilier 2011). While a company may be able to proceed with little resistance after reaching ‘acceptance,’ Thomson and Boutilier (2011) argue that the highest level (full-trust and co-ownership) is most beneficial to all parties. Once co-ownership status is reached, communities incorporate the operation into their collective identity and can become advocates and defenders of the industry (Thomson and Boutilier 2011). Though this cumulative model has failed to be empirically validated, subsequent research has maintained that SLO exists on a continuum and scholars have continued to draw on this conceptualization.

Recognizing that Thomson and Boutilier’s (2011) conceptualization has not been validated—even by the authors themselves, Moffat and Zhang (2014) offer another model that situates community trust at its center. Specifically, Moffat and Zhang (2014) find that trust is the mediating variable between three exogenous variables—contact quality, impacts on social infrastructure, and procedural fairness—and social license. The path model included in their 2014 paper is included below as Figure 4 (Moffat and Zhang). Results revealed that contact quantity was not a significant factor in the development of SLO, and that impacts on social infrastructure had only an indirect effect on acceptance and approval through trust.

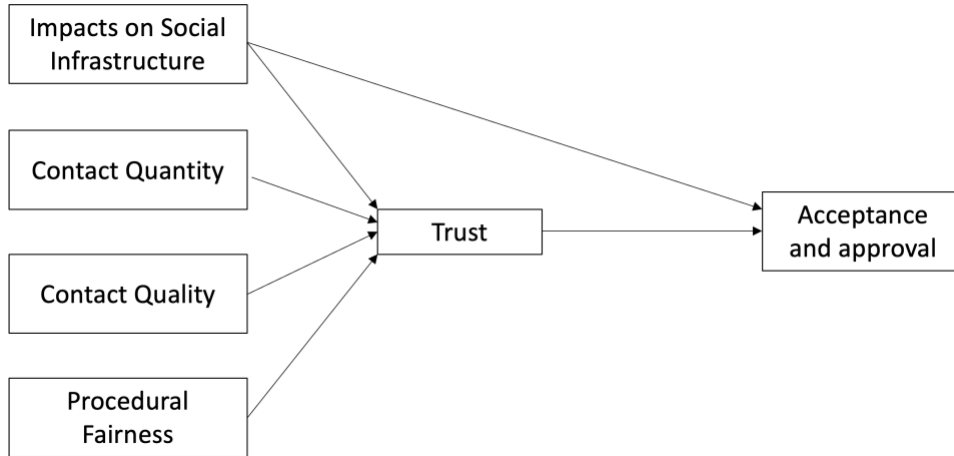


Figure 4. Path model for SLO within the mining industry developed by Moffat and Zhang (2014).

Drawing from this model, Sinner et al. (2020) sought to develop a model for SLO within the aquaculture industry that outlined the factors likely to influence the granting of social license. To do this, they identified the aquaculture industry’s potential economic, social, cultural, and environmental impacts and performed a survey to assess which impacts were significant predictors of SLO. Following Moffat and Zhang (2014), they also included questions about contact quality and the equitable distribution of benefits (economic fairness). Findings revealed that three variables—cultural impacts, contact quality and economic fairness, were significant predictors of SLO in the overall sample, however, contact quality was the one variable that was highly significant across all demographic subsamples (Sinner et al. 2020). These findings further validate Moffat and Zhang’s (2014) model and reiterate the importance of company actions in securing social license. The quality of contact between a company and community is key to the development of SLO.

3.5 Contribution

Answering Mather and Fanning's (2019) call for research contributing to a model or measure for SLO within aquaculture, this paper builds upon existing models that focus on company actions to create a model that considers community context. Sinner et al. (2020) offers an important contribution by verifying that company actions like quality of contact and distribution of economic benefits (economic fairness) are relevant beyond the bounds of the mining industry. Nonetheless, neither Sinner et al. (2020) or Moffat and Zhang (2014) address community context which has been cited as key to SLO (Thomson and Boutilier 2011; Prno 2013). As Prno (2013) argues, a community's needs, expectations, values and previous experience with mining all affect the likelihood of the development of SLO. It is reasonable to assume that this is also true with aquaculture development. This paper addresses this gap by incorporating important contributions from the Social Acceptability (SA) of aquaculture literature. Research from this area identifies key topics of importance from a public perspective. These themes serve as the foundation for a model that predicts a community's willingness to trust incoming aquaculture operations (detailed in Section 5). Section 4 offers results from a systematic review of the survey research on the social acceptability of aquaculture. We then discuss the results from this review within a SLO perspective in Section 5. The merging of these two bodies of literature informs the resulting framework.

4. SOCIAL ACCEPTABILITY OF AQUACULTURE

4.1 Introduction

The social acceptability of aquaculture research offers key insights into a public perspective of issues of importance surrounding aquaculture development. In seeking to develop a model based on community characteristics, this body of work is particularly relevant because it addresses public concerns and impacts of aquaculture broadly, rather than focusing on specific relational elements. Instead of looking at what companies can do to improve their likelihood of gaining approval, this research provides clues as to what preestablished community characteristics make it more or less likely for incoming aquaculture operations to acquire SLO. Questions addressed by this body of literature are wide ranging. For example, what values are associated with approval or opposition to aquaculture development? Do higher levels of knowledge or awareness of aquaculture contribute to increased support? Do perceptions of regulatory effectiveness influence public approval? While both qualitative and quantitative studies investigating social acceptability of aquaculture were assessed and used in analysis, Section 4.2 outlines the results of a systematic review of survey research addressing public perceptions of aquaculture. By focusing on survey research, we were able to identify clear themes and patterns after collating survey results into a detailed table. An abbreviated version of this table is shown below as Table 4.

4.2 Results

After initial review, we identified seven major themes addressed in the surveys: environment, economy, use conflict, knowledge, experience, government and regulation, and health and safety. Table 4 identifies which themes were addressed in each of the 25 articles

examined. The following sections outline the findings within each theme and identify any patterns. These patterns will inform the conceptual model presented in Section 5.

Table 4. Summary of social acceptability of aquaculture survey results (N=26), including type of aquaculture investigated, the geographic scope, and themes discussed

Study	Aquaculture Type	Geographic Scope	Environment	Economy	Knowledge	Use Conflict	Experience	Govt. & Regulation	Health & Safety
Alexander et al. 2016	IMT	Multinational: Ireland, Israel, Italy, Norway, UK	■		■				
Alexander et al. 2018	IMT	Multinational: Ireland, Israel, Italy, Norway, UK	■		■				
Bouchard et al. 2021	Finfish, Shellfish, Sea Vegetables	Regional: Atlantic States, USA			■				
Chu et al. 2010	All	Cross-national: Norway, USA	■	■				■	■
Claret et al. 2014	Finfish	Regional: Spain			■				■
Dalton and Jin 2017	Shellfish	Regional: 3 coastal regions, RI, USA	■			■			■
Fernandez-Polanco and Luna 2012	All	National: Spain	■						■
Flaherty et al. 2018	Mariculture	Regional: coastal Vancouver Island & CA Maritime	■		■			■	
Freeman et al. 2012	Mariculture	Multinational: Israel, Germany	■		■				■
Hynes et al. 2018	All	Cross-national: Norway, Ireland	■		■			■	
Krovel et al. 2019	Finfish	National & local, Norway	■						
Mazur and Curtis 2006	Finfish, shellfish	Regional: Australia	■		■			■	
Mazur and Curtis 2008	Finfish, shellfish	Regional: Australia	■		■			■	
Murray and D'Anna 2015	Shellfish	Local: Baynes Sound (Vancouver & Denman Isl)	■		■				
Murray et al. 2017	All	National: USA	■		■			■	■
Outeiro et al. 2018	Finfish	National: Chile (tourists)	■						
Rickard et al. 2020	All	National: USA	■		■		■	■	
Robertson et al. 2002	Offshore	Local: Hampden Beach, USA			■				
Safford and Hamilton 2012	All	Regional: Hancock & Washington County, ME, USA	■	■					
Shafer et al. 2010	All	Local: Banks Peninsula and Christianchurch, New Zealand			■		■		
Sinner et al. 2020	All	National: New Zealand	■	■	■		■		
Thomas et al. 2018	Seaweed, mussel, finfish	Regional: Sweden, west coast	■		■				
Whitmarsh and Palmieri 2009	Salmon	Regional: Scotland	■						
Whitmarsh and Palmieri 2011	Salmon	Regional: Scotland	■			■	■		
Whitmarsh and Wattage 2006	Salmon	Regional: Scotland	■	■					■

4.2.1. Environment

Environmental concerns were included in all but four of the 25 surveys reviewed. Both concerns and benefits were addressed. Concerns typically included were aquaculture's effects on the marine floor and seascape, pollution, the interaction of escaped non-native species with wild stocks, sea lice, and disease. Benefits included decreased pressure on wild stocks due to overfishing and improved water quality (in the case of shellfish aquaculture). Overall, survey results indicate that respondents are greatly concerned with the environmental impacts of aquaculture (Whitmarsh and Wattage 2006; Mazur and Curtis 2008; Murray and D'Anna 2015; Alexander et al. 2016; Murray et al. 2017). In fact, in three studies that allowed participants to rank a series of concerns based on perceived importance, researchers found that participants consistently ranked environmental impacts as the most important aquaculture issue (Whitmarsh and Wattage 2006; Mazur and Curtis 2008; Freeman et al; 2012).

Further, surveys reveal that social acceptability of aquaculture is strongly linked to its perceived environmental impacts (Hynes et al. 2018; Krovel et al. 2019). In a comparative study of Norwegian and American perceptions of aquaculture, Chu et al. (2010) found that those who believed that aquaculture was harmful to the environment were significantly less likely to support development. In a 2009 study investigating perceptions of salmon aquaculture in coastal regions of Scotland, Whitmarsh and Palmieri found that respondents who ranked minimizing environmental damage as most important in a series of aquaculture related concerns were least likely to favor aquaculture expansion. In a subsequent study, the same authors (2011) found that environmental beliefs surrounding aquaculture impacts also translate to purchasing behavior. Respondents who attached a higher priority to minimizing environmental impacts of salmon aquaculture were less likely to purchase farmed salmon. Murray and D'Anna (2015) linked

support for aquaculture to environmental values more broadly by including a widely used attitudinal measure known as the New Ecological Paradigm (NEP). The NEP assesses the degree to which participants see humans as being part of nature rather than separate from nature (Murray and D'Anna 2015). In their study measuring perceptions of shellfish aquaculture in Baynes Sound, Canada, they found a significant negative relationship between NEP score and support for the aquaculture industry—those with more pro-environmental views were less likely to support shellfish aquaculture (Murray and D'Anna 2015). Other specific predictors of opposition to aquaculture development include the belief that aquaculture spoils the beauty of the coastal environment (Dalton and Jin 2017), and the belief that aquaculture displaces wild fisheries (Chu et al. 2010).

While studies show significant concern for aquaculture's environmental impacts, several studies also show that participants recognize that aquaculture does have environmental benefits—mainly, the relief of pressure on wild fish populations (Freeman et al. 2012; Alexander et al. 2016; Murray et al. 2017; Flaherty et al. 2018). Further, one study investigating public perception of Integrated Multi-trophic Aquaculture, a type of synergistic cultivation where multiple species are grown together to reduce waste, found that the majority of respondents believed that IMTA would improve waste management and the sustainability of aquaculture overall, in addition to helping to replenish wild stocks (Alexander et al. 2018). Shellfish and plant aquaculture were also recognized as having fewer negative impacts on water quality (Thomas et al. 2018) and as more sustainable than finfish aquaculture (Flaherty et al. 2018).

While overall it appears that people who are concerned about aquaculture's environmental impacts are less likely to support development, three studies show that this relationship may be more complicated. A 2020 US study found a positive relationship between

environmental values and support for aquaculture, complicating the narrative that positions environmentalists as aquaculture opponents (Rickard et al. 2020). Further, a 2018 study of Vancouver Island and Canada's Maritime Provinces found that the same environmental concerns were cited by aquaculture supporters and aquaculture opposition alike, raising questions about whether environmental concerns are always at odds with development (Flaherty et al.). Concerns cited included harm to wild fish stocks, use of chemicals and antibiotics in farming, waste accumulation on the sea floor and detrimental effects on sea life. Safford and Hamilton (2012) found a similar pattern among highly educated respondents. While highly educated respondents were more critical of aquaculture's impacts than less educated respondents, they were simultaneously more supportive of development. The authors argue that these views are not necessarily contradictory, as highly educated respondents who are not fundamentally opposed to aquaculture may also have serious questions about best practices. Freeman et al. (2012) identified a similar trend. While environmental concerns were ranked high in importance in both German and Israeli samples in their cross-national study, these concerns were only linked to lower levels of support in the Israeli sample.

Lastly, it is clear that perceptions of environmental impacts and the way these perceptions affect support for aquaculture vary greatly by place. For example, Hynes et al. (2018) found that only 20% of their Norwegian sample felt that aquaculture posed a threat to the marine environment, compared to 40% of their Irish sample. Another cross-national study conducted in 2016 showed that environmental concern and level of support varied by region (Alexander et al. 2016). In Sweden, similar amounts of respondents agreed and disagreed that they are concerned about the environmental impacts of the aquaculture industry, though they were significantly more concerned about fish aquaculture than shellfish or seaweed aquaculture (Thomas et al.

2018). In the US, participants were very concerned about environmental impacts, with 80.9% of respondents agreeing that aquaculture has the same problems as land-based agriculture like the use of processed feeds and antibiotics being a source of pollution.

In sum, while the relationship between environmental views and approval for aquaculture is complex, concern over the environmental impacts of aquaculture generally translates into increased skepticism and lower approval. Level of concern, however, appears to vary by place. It is likely that local experience (or lack thereof) with aquaculture operations influences how people perceive potential impacts.

4.2.2. Economy

The economic benefits of aquaculture are widely considered a positive outcome of development (Murray and D'Anna 2015). Benefits addressed include economic growth, generation of tax revenue, and the most widely cited benefit—job creation. Research shows that participants agree that aquaculture is an important economic activity (Flaherty et al. 2018), and that those who believe that aquaculture is good for the economy are more likely to be supportive of future development (Dalton and Jin 2017; Krovel et al. 2019). Regarding job creation, Murray et al. (2017) found that nearly 90% of participants in their study of US attitudes towards aquaculture believed that the aquaculture industry provides local employment. Similar findings were cited in a 2018 comparative study of Norwegian and Irish perceptions of aquaculture, with 85% and 95% of respondents agreeing that aquaculture generates local jobs (Hynes et al.). Coastal Canadians also appear to agree, with 85% believing that aquaculture creates good jobs in coastal communities (Flaherty et al. 2018). However, within this same study, only 36% of Pacific coast respondents and 55% of Atlantic coast respondents said that these employment benefits lead to favorable impressions of the industry, indicating that economic benefits, while important,

may not be enough to offset other factors that may have stronger influence on public perceptions of aquaculture (Flaherty et al. 2018). Though questions remain about the relative importance of economic impacts, it is clear that the economic effects are considered a positive impact of aquaculture development and that this perspective is linked to support for the industry (Murray and D'Anna 2015; Dalton and Jin 2017; Krovel et al. 2019).

4.2.3. Environment vs. Economy

While it is clear that both environmental and economic values condition people's perceptions of aquaculture, several studies have attempted to sort out the relative importance of these ostensibly conflicting values. In a 2009 study, Whitmarsh and Palmieri attempted to develop a hierarchy of concerns by determining specific weights attached to a variety of socio-economic and environmental concerns. Using the Analytic Hierarchy Process, a statistical technique used to determine preferences and choices at the community level, they found that those who favored the expansion of salmon aquaculture attached the highest priority to maximizing economic benefits and the lowest priority to minimizing environmental damage. Further, the authors found evidence that the social and economic profiles of the area influenced the priority participants attached to socio-economic benefits and environmental impacts. They argued that people in poorer areas prioritized economic effects of aquaculture while those in more affluent areas prioritized minimizing environmental impacts (Whitmarsh and Palmieri 2009). Similarly, a 2018 study of ecotourists in Southern Chile found that wealthier tourists were more willing to pay to avoid further environmental impacts due to aquaculture development compared to less affluent tourists (Outeiro et al. 2018).

Freeman et al. (2012) also found support for the connection between the need for employment and support for industry development within their Israeli sample of their

comparative study. Israeli respondents who were more concerned with job security were more supportive of aquaculture development. While this pattern was not apparent in their German sample, the authors argued that this was due to minimal awareness of aquaculture in general. The Israeli sample had significantly more exposure. Safford and Hamilton (2012) also found economically rooted predictors. In a comparative study between two coastal Maine counties, respondents who were from Hancock county, the more prosperous and economically diversified of the two, were more likely to be concerned with aquaculture's environmental impacts while Washington county respondents were more likely to think that aquaculture development was important. Further, Washington county respondents favored jobs over preserving local character more frequently than Hancock county respondents (Safford and Hamilton 2012). Clearly, economic place effects are important determinants of both environmental concern and aquaculture perceptions.

4.2.4. Knowledge

Public knowledge of aquaculture was assessed in 15 out of the 25 surveys reviewed. In general, surveys found low levels of knowledge of aquaculture within their geographic areas of study (Robertson et al. 2002; Mazur and Curtis 2006; Mazur and Curtis 2008; Freeman et al. 2012; Alexander et al. 2016; Murray et al. 2017). Mazur and Curtis (2006) found that 72% of survey participants considered themselves 'not well informed' about aquaculture. In a 2018 study, Thomas et al. found that only 1/9 of participants self-selected 'high awareness' when asked about their knowledge of aquaculture, while 1/3 of participants selected 'low awareness.' This trend was even more pronounced when asking participants about specific aquaculture practices like offshore or Integrated Multi-trophic Aquaculture (IMT) (Robertson et al. 2002; Alexander et al. 2016).

However, two surveys did find higher levels of knowledge among participants. The first was a regional study in Spain that investigated consumption preferences of farmed versus wild fish (Claret et al. 2014). They measured both subjective (self-assessed) and objective knowledge with two sets of questions and found that 85% had moderate to high levels of subjective knowledge and 70% had moderate to high levels of objective knowledge (Claret et al. 2014). The second study was conducted in coastal communities on Vancouver Island and Canada's Maritime Provinces, where 66% of participants considered themselves very or somewhat familiar with the aquaculture industry (Flaherty et al. 2018). The authors assessed objective knowledge as well by asking participants about what species were farmed in their area. Responses revealed that Canadians had an "impressive awareness" of what species were and were not being farmed locally (Flaherty et al. 2018:17). However, awareness levels differed by region and by species. They attributed this regional variation to differences in media coverage (Flaherty et al. 2018).

In several cases, researchers investigated the link between knowledge level and support for aquaculture. Overall, results suggest that higher levels of knowledge and awareness are associated with support. For example, Thomas et al. (2018) found that while low and medium awareness groups had more neutral responses to questions assessing support, the high awareness group had more positive opinions of aquaculture and was more likely to support blue growth initiatives. Robertson et al. (2002) similarly found that participants who were more familiar with offshore practices held significantly more positive attitudes of aquaculture. In a more recent study, Bouchard et al. (2021) also found that participants who were more aware of aquaculture operations had more positive attitudes about aquaculture. However, other studies offer more mixed results. Rickard et al. (2020) found a positive relationship between subjective knowledge

and support, but a negative relationship between objectively measured knowledge and support. Murray and D'Anna (2015) found no support for the link between knowledge and positive attitudes. While more research is needed for consensus, evidence does suggest that knowledge level could be an effective predictor of positive attitudes, with higher levels of knowledge and awareness leading to increased support (Robertson et al. 2002; Thomas et al. 2018; Bouchard 2021).

4.2.5. Use Conflict

Considering aquaculture is an activity that primarily occupies space in common pool resources, opposition can arise due to competing uses. For example, aquaculture development along the coast of Maine has faced damaging opposition from the lobster industry, wild-catch fishermen, recreational ocean users and summer shorefront property owners vying for continued use of prospective aquaculture areas (Conkling 2000). While use conflict is addressed in 36% of the survey articles assessed, findings vary by place. In the US, Murray et al. (2017) found that nearly 70% of respondents agreed that aquaculture can interfere with recreation. In comparison, Hynes et al. (2018) found that only 2.5% of Norwegians and 11% of Irish respondents believed that aquaculture hindered their use of the coast. Connecting perceptions of use-conflict to support for aquaculture, Dalton et al. (2017) found that Rhode Islanders who believed that aquaculture interferes with other uses were less supportive of future development. Krovel et al. (2019) investigated perceived use-conflicts in both national and local samples in Norway. Their results echoed Dalton et al. (2017), showing that within both samples, those who agreed that fish farms create conflict with other activities had more negative views of the industry. Shafer et al. (2010) similarly found that water-users in two New Zealand towns disliked the idea of more aquaculture farms more than land-users. However, Thomas et al. (2018) presented conflicting results, finding

that those who ‘go out to sea by boat’ were actually more supportive of development. Further, Sinner et al. (2020) found that impacts on recreational fishing or other marine recreation did not significantly predict support at all in their New Zealand sample.

Though more research is needed to gauge how the public’s understanding of use conflict shapes their likelihood of supporting aquaculture development, the inclusion of use conflict in community assessment is important. The wider public may have varying views on the effects of use conflict, but it has been documented that stakeholders directly engaged in shared-resource activities can present serious challenges for aquaculture development (Conkling 2000).

Alexander et al. (2018) suggests that there is a ‘stakeholder hierarchy’ that determines which voices influence aquaculture decision making. They point out that those voices at the top of the hierarchy are often other resource-use applicants. Thus, use conflict is an important place-based indicator to consider when thinking about community suitability for aquaculture.

4.2.6. Experience

Participant’s experience with aquaculture appears to influence public perceptions of aquaculture, yet the findings vary. Experience includes questions about proximity to farms or the ocean, engagement with farms, consumption of farmed seafood and social connections to the industry. The relationship between proximity to aquaculture operations and support for the industry was addressed in four of the surveys reviewed with mixed results. Thomas et al. (2018) found that participants with farms near their home were more likely to support aquaculture. Yet Hynes et al. (2018) and Shafer et al. (2010) found the opposite—those with farms in their locality were more sensitive to marine development. Murray and D’Anna (2015) found no significant relationship between proximity to aquaculture and support. Proximity to the sea was also addressed with equally mixed findings. Norwegian and Irish participants with a sea view

were more likely to see aquaculture as a threat to the environment (Hynes et al. 2018), while Rhode Islanders with coastal views were marginally more supportive (Dalton and Jin 2017). No relationship existed between support and sea views in Thomas et al.'s (2018) survey of Swedes.

Similarly, there is no consensus regarding the relationship between participant's engagement with farms and support for aquaculture. While Murray and D'Anna (2015) found no significant association, Mazur and Curtis (2008) found that those who had visited aquaculture sites were more likely to be concerned about aquaculture's environmental impact, though the causal direction of this relationship is unclear. Mazur and Curtis (2008) also investigated whether social ties to the industry led to increased levels of support, finding that participants who had social connections to people working in aquaculture were more likely to support the industry. Lastly, consumption of aquaculture products has been linked with public sentiment. Participants who consumed farmed seafood more frequently or who were aware that they had consumed aquaculture products in the past also held more positive attitudes towards aquaculture (Murray and D'Anna 2015; Rickard et al. 2020). While more research is needed to draw conclusions surrounding the connection of proximity and engagement, what is clear is that these discrepancies highlight significant regional variation. It is likely that participant's responses are colored by place effects, including previous experience with aquaculture and place-based values.

4.2.7. Government and Regulation

Another topic often addressed in aquaculture survey research is public perception of government regulating agencies. The surveys reviewed investigated public opinions on the importance of participation, regulatory strictness, and credibility of government agencies. Regarding participation, Mazur and Curtis (2008) found that the vast majority of participants in both surveyed regions in Australia believed that the benefits of public participation outweighed

any costs incurred by the government to facilitate input. Participants highly valued the principle of ‘having a say’ in planning. Though they stopped short of analyzing whether increased participation was linked to support, Dalton and Jin (2017) did investigate this link, finding that those who had attended planning meetings were in fact more supportive of future aquaculture development.

One 2010 study investigated whether perceptions of regulatory strictness influenced public support for aquaculture development among aquaculture ‘experts’ in Norway and the US (Chu et al. 2010). To do this, they clustered respondents based on whether they thought that governing bodies were lenient, balanced or strict in regard to aquaculture. They found that US respondents in the ‘strict-cluster’ and the ‘balanced-cluster’ were more supportive of aquaculture than respondents in the ‘lenient-cluster.’ In fact, the predicted probability for opposition to aquaculture within the ‘strict-cluster’ was 0.00 (Chu et al. 2010). The authors point out that the groups represented in the ‘lenient-cluster’ were primarily fishermen, environmental NGOs, and some researchers. Thus, the causal direction of this relationship is uncertain. Opposition to the industry may fuel perceptions of regulatory strictness, rather than perceptions of strictness fueling opposition. More research is needed to determine if these same patterns arise among the wider public.

Several avenues were used to evaluate trust in government and regulating agencies. Mazur and Curtis (2008) asked directly about the public’s level of trust in national, state, and local government regulating procedures in terms of aquaculture. Though they found varied amounts of trust within each level of government, between one quarter and one half of participants cited low levels of trust across the board. In an earlier paper, Mazur and Curtis (2006) found that participants who felt ‘heard’ awarded higher levels of trust to regulating

agencies, reemphasizing the importance of participation. Further, they found evidence that confidence in government acts as a moderator for aquaculture support. Participants who believed that the current regulatory system would ensure the best environmental outcomes had higher levels of trust in the aquaculture industry. Trust in government as a source of aquaculture information was another avenue investigated, though with mixed findings. While Murray et al. (2017) found that in the US, most respondents felt that government officials were a biased, untrustworthy, unfair, and inaccurate source of aquaculture information, Rickard et al. (2020) found no links between these perceptions and aquaculture support using the same dataset. Flaherty et al. (2018) found that in Canada, 60% of Pacific respondents and 69% of Atlantic respondents rated Canada's Department of Fisheries and Oceans (DFO) as a very or somewhat reliable aquaculture information source, though they did not investigate links with support.

In sum, it is clear that participation in the planning process is valued (Mazur and Curtis 2006; Mazur and Curtis 2008; Dalton and Jin 2017). Participation increases trust in regulating agencies and increases the likelihood of industry approval (Mazur and Curtis 2006; Dalton and Jin 2017). Further, there is evidence that confidence in governing bodies and perceived regulatory strictness may be important indicators of support for aquaculture development.

4.2.8. Health and Safety

The final theme addressed in 28% of the surveys reviewed is health and safety. Surveys showed that the public has mixed perceptions on the safety of farmed seafood (Murray et al. 2017; Flaherty et al. 2018). In Canada, 50% of participants overall felt that aquaculture provides high quality, safe seafood, yet Pacific coast residents felt that wild salmon is safer and healthier than farmed salmon (Flaherty et al. 2018). Within the US, the vast majority (85.3%) believe that aquaculture yields a healthy product. Yet respondents were split on whether they believed that

farmed or wild-caught seafood was safer (Murray et al. 2017). In Spain, Claret et al. (2014) found no significant differences in perceptions of safety between wild and farmed fish.

In addition to measuring perceptions, two studies investigated whether these perceptions are predictive of support (Chu et al. 2010; Dalton and Jin 2017). Chu et al. (2010) found that participants who believed that farmed fish are more likely to contain pollutants are less likely to approve of aquaculture (Chu et al. 2010). Similarly, Dalton and Jin (2017) found that participants who believed that farmed salmon is unhealthy were less likely to support development.

4.3 Summary

Survey research within the SA of aquaculture literature reveals the importance of context—particularly how values, beliefs and experience can color individual opinions of the aquaculture industry. Considering aquaculture companies are entering and operating primarily in common pool resources within established communities, it is reasonable to assume that both collective experience and collectively held values can create an environment that is more or less conducive to development. Patterns within the themes identified above will serve to inform a series of indicators that are predictive of community suitability for aquaculture development. These patterns are discussed within a SLO perspective below.

5. DISCUSSION

5.1 Trust

Trust is one area where the social license literature and the social acceptability literature largely overlap. Within the social license research, trust is featured centrally and its role in developing SLO has been empirically validated (Thomson and Boutilier 2011; Moffat and Zhang 2014). Moffat and Zhang (2014), among others, show that trust acts as a mediator between

several quantitative indicators and acceptance (Zhang et al. 2015; Moffat et al. 2016). They argue that two types of trust, as highlighted by Poppo and Schepker (2010), are key to building relationships between the industry and the community. The first is integrity-based trust, which in this case, is the community's perception that the industry is adhering to a certain set of agreed upon principles. The second, competence-based trust, is whether the community believes that the industry has the knowledge and skills needed to appropriately manage their concerns (Poppo and Schepker 2010; Moffat and Zhang 2014). Company behaviors that increase trust include being transparent and open with the community from early in the planning stages, being well informed when faced with questions, having quality communication with stakeholders and following through with promises (Thomson and Boutilier 2011; Hall 2014; Moffat and Zhang 2014; Voyer and van Leeuwen 2019). Actions that generate trust increase the likelihood of earning social license.

While the SLO literature tends to focus on strategies companies can use to build trust, the social acceptability of aquaculture literature highlights the importance of considering place-based experiences and local values by demonstrating their effect on trust, and subsequently, public approval. Just as certain company actions can generate trust, community context can enhance or hinder trust formation. This consideration is an important contribution to what is currently known about SLO. A community's willingness to trust, determined by key community-based indicators outlined in the SA research, moderates the ability of incoming companies to build trust through their behavior, and thus affects their ability to cultivate SLO. The following section discusses how the SA and SLO literature together inform this contribution.

5.1.2 Experience

Social acceptability research concerning aquaculture demonstrates how local experiences can alter trust in the industry and affect public approval (Freeman et al. 2012; Schlag and Ystgaard 2013; Froehlich et al. 2017). While the relationship between approval and individual experiences like proximity to an aquaculture facility or engagement with fish farms is mixed, several studies look at collective community experiences in relation to approval and find interesting results (Freeman et al. 2012; Schlag and Ystgaard 2013; Froehlich et al. 2017). For example, in a comparative study of Germany and Israel, Freeman et al. (2012) found that areas with a history of negative experiences with aquaculture companies were less likely to support new companies. In 2008, a high-profile court case led to the removal of all aquaculture farms from the Gulf of Eilat in Israel. Resulting media coverage focused on damage to coral reefs and marine pollution. Survey results showed that Israeli participants who were concerned about the environment were significantly less likely to support aquaculture development. This same pattern was not found in the German sample. They deduced that these inconsistencies were due to their differing historical experience with the aquaculture industry. In Israel, trust in the industry as a whole had already been damaged, and thus, participants were less likely to support future development (Freeman et al. 2012).

Examples such as this highlight the importance of examining community-level data. Collective experiences are difficult for survey data to capture when looking at individual level predictors. In fact, the inconclusiveness surrounding experience-related survey results speaks to this. An individual's proximity to an aquaculture operation may yield positive or negative attitudes towards the industry depending on their local experience (Hamilton and Safford 2015). An illustrative example of this comes from comparative survey research conducted by Hamilton

and Safford (2015). They found that coastal Alaskan residents were significantly more concerned with aquaculture's environmental impacts compared to residents of other coastal areas. Alaska has a well-established salmon aquaculture industry and residents have dealt with negative environmental impacts. Their concerns are reflective of their local environment. Thus, it is clear that trust, and subsequently industry approval, are affected by local experience.

The social license literature also emphasizes the importance of local experiences. Specific examples include a prominent paper by Prno (2013) that detailed the case of a proposed mine in Peru where social license was withheld and the project was unable to proceed. The authors found that residents had had several negative experiences with mining development in their area which led to an erosion of local trust that made residents doubt that the incoming mine could be run responsibly. The negative legacy left by other mining operations contributed to anti-mining sentiment and greatly reduced the odds of SLO being established (Prno 2013). This example fits more broadly within the theme of context—which is often cited as important in the SLO literature. Companies are encouraged to operate strategically in response to local contexts (Thomson and Boutilier 2011). Yet it is important analytically to account for context independently. Local experiences, specifically local experiences with aquaculture, are important determinants of a community's willingness to trust, which moderates the effects of a company's actions.

5.1.3. Health and Safety

While the link between public perceptions of the healthfulness and safety of farmed fish is clear—those who think farmed fish are nutritionally inferior to wild-caught fish are less likely to approve of aquaculture (Chu et al. 2010; Dalton and Jin 2017), the SA of aquaculture review reveals one additional key finding: uncertainty. Mixed opinions on the safety and nutritional

value of farmed fish demonstrate that the public has not reached a clear consensus (Claret et al. 2014; Murray et al. 2017; Flaherty et al. 2018). This uncertainty is not related to a lack of education, rather, it is in part due to conflicting reports coming from the scientific community (Kaiser and Stead 2013; Schlag and Ystgaard 2013). For example, a 2004 study by Hites et al. found significantly higher levels of contaminants and insecticides in farmed salmon as compared to wild-caught, suggesting that wild-caught salmon is safer to eat than farmed salmon. Jiang et al. (2017) also found nutritional differences between wild-caught and farmed salmon, with farmed salmon being nutritionally inferior in terms of fatty acid content. However, there are other studies that show insignificant differences or differences in favor of wild salmon (EFSA 2005). Lundebye et al. (2017), for example, found lower levels of contaminants like PCBs, dioxins, and mercury in farmed salmon as opposed to wild-caught salmon. Uncertainty stemming from this dissensus within the scientific community has likely eroded public trust (Schlag and Ystgaard 2013).

Findings such as these are echoed in the social license literature. For example, Beckie et al. point out how conflicting reports surrounding the herbicide glyphosate have increased public alarm, threatening the social license of “unhindered” glyphosate use (2020:2). The use of glyphosate has already been banned in several countries, and companies all over the world are searching for alternatives in an effort to prepare for potential widespread restrictions (Beckie et al. 2020). Additionally, the social license literature demonstrates how public health events resulting from company malpractice can lead to the withdrawal of SLO for an entire industry. For example, Arnot (2018) discusses how a widespread salmonella outbreak in 2008 traced to Peanut Corp America led to a temporary collapse of social license for the peanut product industry. The actions of a single company led to a loss of \$225 million for the nation’s peanut

growers due to plummeting demand. Similar effects are found within public perception of aquaculture research. Interestingly, Schlag and Ystgaard (2013) found that focus group participants from the UK referenced the recent Bovine Spongiform Encephalopathy and foot-and-mouth crises that occurred in their cattle industry when discussing trust in the aquaculture industry. A public health event, even one isolated to a single industry, was able to influence public trust of unrelated food industries (Schlag and Ystgaard 2013). Clearly, a community's willingness to trust aquaculture development does not rest solely on a company's actions or nonactions. Perceptions on the healthfulness and safety of farmed seafood is likely a key determinant of a community's willingness to trust.

5.1.4. Knowledge

The SA of aquaculture research presents two main findings surrounding knowledge. First, the public is generally unfamiliar with aquaculture products and procedures and is often uncertain and skeptical about new aquaculture technologies (Robertson et al. 2002; Kaiser and Stead 2002; Mazur and Curtis 2006; Mazur and Curtis 2008; Freeman et al. 2012; Schlag and Ystgaard 2013; Alexander et al. 2016; Murray et al. 2017). Second, there is some evidence that an individual's level of knowledge of aquaculture may have an effect on their opinion of aquaculture development. Specifically, higher levels of knowledge are linked to increased support (Robertson et al. 2002; Thomas et al. 2018; Bouchard et al. 2021). Similarly, within the SLO literature, scholars highlight how confidence in and availability of scientific information plays a substantial role in the development of SLO. When information is provided by an incoming company, government agency or other interest group just prior to development, it is often perceived as biased or untrustworthy (Cullen-Knox et al. 2017). This is confirmed in the SA of aquaculture literature as well (Murray et al. 2017). Information disseminated by these

groups is often perceived as ‘framed’ to support value-driven objectives (Cullen-Knox et al. 2017). We can hypothesize that areas with higher levels of independent knowledge may be more open to development because they are aware of the potential risks and benefits *a priori* (Owen and Kemp 2013; Falck and Spangenberg 2014; Cullen-Knox et al. 2017; Billing 2018). If the public is confident in their knowledge of aquaculture practices and technologies, they may be more willing to trust incoming development as they can independently assess whether it would benefit their community. Thus, areas with a well-informed public may be more suitable for incoming aquaculture development.

5.1.5. *Government*

In addition to safety concerns, the SA of aquaculture literature highlights that perceptions of government regulating bodies and participation in planning processes are important to public approval of the aquaculture industry. First, the literature highlights that the opportunity for participation in planning is an important determinant of trust in governing bodies and approval of development more generally (Mazur and Curtis 2006; Mazur and Curtis 2008; Dalton and Jin 2017). Second, it suggests that trust in governing bodies may moderate approval of development. Specifically, Mazur and Curtis (2006) found that interviewees who believed that the current regulatory system would ensure the best environmental outcomes had higher levels of trust in the aquaculture industry.

This research dovetails with the SLO literature, where several papers highlight the importance of participatory governance in generating trust in the industry (De Cremer et al. 2005; Gouldson et al. 2007; Diez et al. 2015) as well as the moderating effect of confidence in government (Zhang et al. 2015; Moffat et al. 2016). Confidence in governance increases public acceptance of mining both directly and indirectly through trust in the mining industry. If the

public was confident that the legal and regulatory bodies could ensure that the mining companies would responsibly manage their environmental and social impacts, then they were more likely to support incoming mining operations. This confidence also increased their trust in the mining industry more generally (Zhang et al. 2015). Both bodies of literature support the assumption that confidence or trust in government regulating agencies is an important indicator of a community's willingness to trust.

5.1.6 Values: Environment, Economy and Acceptable Use

The importance of values is made clear in the SA literature. Survey results show that environmental and economic values are key predictors of aquaculture approval and that these views both vary by and are partially determined by place (Whitmarsh and Palmieri 2009; Chu et al. 2010; Freeman et al. 2012; Safford and Hamilton 2012; Murray and D'Anna 2015; Alexander et al. 2016; Dalton and Jin 2017; Flaherty et al. 2018; Hynes et al. 2018; Krovel et al. 2019). Specifically, individuals who were more concerned with the environmental impacts of aquaculture and those who held a 'pro-ecological' world view were less likely to support aquaculture (Whitmarsh and Palmieri 2009; Chu et al. 2010; Murray and D'Anna 2015; Dalton and Jin 2017). Individuals who valued economic development and believed that aquaculture development is good for the economy were most likely to support development (Dalton and Jin 2017; Krovel et al. 2019). When investigated together, Whitmarsh and Palmieri (2009) show that in relation to aquaculture, these values are often oppositional. Those most likely to support aquaculture development were individuals who attached the highest priority to maximizing economic benefits and the lowest priority to minimizing damage (Whitmarsh and Palmieri 2009). It is clear that these values are important determinants of support.

Scholars argue that the role of values has been overwhelmingly neglected in the SLO literature, despite being incredibly important (Ford and Williams 2016). For example, Voyer and van Leeuwen (2019) argue that value alignment is an essential component in the successful establishment of SLO. In their comparative case study examining the role of social acceptability in SLO using Marine Protected Areas (MPAs), they found higher levels of acceptance in the areas that had a history of environmental activism. These communities clearly held strong, collective environmental views that aligned with conservation—a central goal in the creation of MPAs. The most successful MPA projects were those that took place in communities where collectively held environmental values aligned with the goals of the project (Voyer and van Leeuwen 2019).

Scholars have found similar patterns with economic values, particularly when discussing use-conflict. For example, in a 2018 study of SLO within a proposed aquaculture operation, Billing found opposing values when comparing non-locals who vacation in the area with local coastal residents. Non-locals who were resistant to development valued the area for ‘peace and quiet,’ while locals valued their coastal region for ‘industrial activity.’ Particularly with development that has the potential to conflict with a community’s vision of ‘acceptable use’ of local resources (as is the case with aquaculture), value-alignment between a community and industry is central to SLO (Prno 2013; Leith et al. 2014; Ford and Williams 2016; Cullen-Knox et al. 2017; Billing 2018). Further, the *type* of economic development valued by the community has also been shown to propel or hinder aquaculture development. For example, Schlag and Ystgaard (2013) argue that communities with a history of traditional fishing are resistant to incoming aquaculture development because they see aquaculture as an economic threat—even while recognizing and desiring the economic benefits. Participants discussed this conflict in

terms of trust. Particularly in Spain, where aquaculture is often associated with big industry, members of fishing communities felt that aquaculture development would ultimately lead to large conglomerates threatening traditional lifestyles. Participants trusted local, traditional fish production in comparison to the unfamiliar, industrial aquaculture (Schlag and Ystgaard 2013).

Considering the centrality of trust to SLO formation, it is reasonable to hypothesize that value-alignment works to improve the likelihood of SLO at least partially through trust. Communities may be more willing to trust incoming aquaculture development if it aligns with their collectively held values, as Schlag and Ystgaard (2013) have documented. Taking the SLO and SA of aquaculture together, it is clear that environmental and economic values are important determinants. Communities with strong environmental values may be less likely to trust aquaculture development because of potential or uncertain environmental impacts. In contrast, communities who value economic development may be more likely to trust incoming aquaculture development because of benefits such as job creation. However, this development must also align with the type of economic activity valued and desired by community members.

5.2 Indicators

The intention of this review was to develop a list of tangible indicators that predicts whether a local community is well suited for aquaculture development. While SLO is primarily generated through relationships built between stakeholders and company, the literature also highlights the importance of context and how specific place-effects can influence issuance (Thomson and Boutilier 2011; Prno 2013; Leith et al. 2014; Ford and Williams 2016; Cullen-Knox et al. 2017; Billing 2018). However, the only empirically verified quantitative models for SLO thus far focus on company actions and impacts (Moffat and Zhang 2014; Sinner et al. 2020). This paper addresses a key gap in the literature by offering a preliminary quantitative

model focusing on community context and community characteristics. Themes and patterns found within social acceptability of aquaculture surveys, combined with what is known about SLO informed the development of a series of indicators shown in Table X. Though further research is certainly needed, including empirical confirmation of the indicators, this framework serves as a starting point, grounded in two well-established bodies of literature.

Table 5 offers a description of the indicators deemed influential. The first three themes—environment, economy and use conflict, are value-related indicators. Depending on a community’s collectively held values surrounding sustainability and conservation, economic development, and what type of economic development aligns with the community’s values, a community will likely be more or less willing to trust incoming aquaculture development. This willingness to trust moderates the ability for companies to pursue social license through trust generating company actions. The fourth indicator, community knowledge of aquaculture, works to influence a community’s willingness to trust by reducing or increasing uncertainty. It is likely that communities with higher levels of knowledge of aquaculture practices and products will be more likely to trust incoming development because they are not solely relying on information from the company or regulating agency in charge of development. Aware of the risks and benefits *a priori*, they can make informed decisions and are better able to issue SLO (Dowd and James 2014).

The fifth theme, experience, addresses previous experience with aquaculture. These experiences certainly influence a community’s willingness to trust incoming companies. Positive experiences likely lead to higher levels of willingness to trust, while negative experiences lead to lower levels. Government and regulation, the sixth theme refers to a community’s level of confidence and trust in regulating agencies. Both the SA of aquaculture literature and the SLO

literature show that this has a moderating effect on SLO generation. Communities that trust local regulating agencies to have their best interests in mind would have higher levels of willingness to trust. The final indicator is a result of findings within the theme of health and safety. It is likely that communities who perceive aquaculture products to be safe and healthful are also more likely to be willing to trust incoming aquaculture development. Communities that are uncertain, or that think that aquaculture products are inferior to wild-caught seafood would likely have lower levels of willingness to trust. As shown in the preliminary path model (Section 5.3), these seven indicators are all attributes of community context, which determines a community’s willingness to trust incoming aquaculture development.

Table 5. Community indicators that influence SLO issuance

Theme	Potential Indicator	Relationship
Environment	Concern over impact of aquaculture	High (-), Low (+)
Economy	Desire economic development	Low (-), High (+)
	Type of economic activity desired	Not aligned (-), Aligned (+)
Use Conflict	Acceptable use	Leisure (-), Livelihood (+)
	Competing, highly valued industries	Present (+), Absent (-)
Knowledge	Knowledge of aquaculture	Low (-), High (+)
Experience	Previous experience with AQ	Negative (-), Positive (+)
Government & Regulation	Trust in govt. regulating agencies	Low (-), High (+)
Health & Safety	Perceptions of health and safety of AQ products	Unsafe/uncertain (-), Safe (+)

5.3 Preliminary Path Flow Model

Figure 5 is a preliminary path flow model showing how community indicators identified through this literature review work to influence social license to operate within aquaculture. Independent of the community/company relationship, community context, including confidence in regulating agencies, perceptions of health and safety, knowledge of aquaculture, previous experience with aquaculture and environmental and economic values, influence a community's willingness to trust incoming aquaculture development. Considering several of these factors are likely interrelated, they are positioned in a circle surrounding 'community context' so that defined paths can be inserted as the model is tested. Following this model, a community's willingness to trust will influence whether they are likely to issue SLO to incoming aquaculture operations.

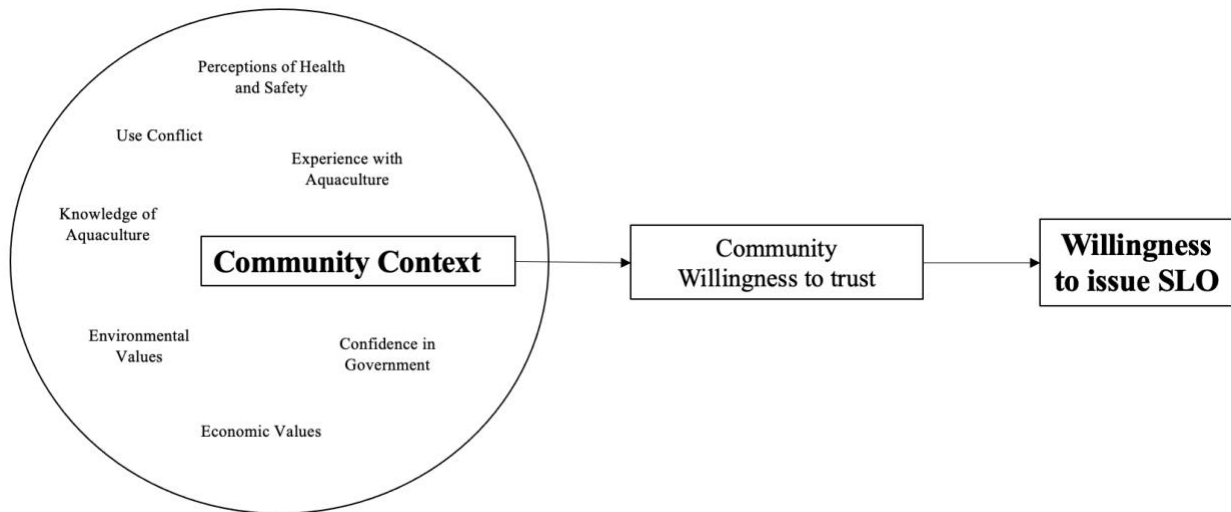


Figure 5. Preliminary path flow model showing how community context influences the likelihood of SLO issuance independent of company actions.

Figure 6 situates this community-focused model within an empirically verified path model of SLO offered by Moffat and Zhang (2014). While Moffat and Zhang’s (2014) model is based on research within the mining industry, Sinner et al. (2020) confirmed that contact quality and perceptions of fairness were significant predictors when applied to aquaculture as well. These indicators address relational aspects of SLO, where perceptions of company actions determine the likelihood of SLO issuance. However, the literature also confirms that SLO is also influenced by community context. Themes identified in this review inform the set of indicators that make-up aspects of community context that influence a community’s ‘willingness to trust’ incoming aquaculture development. The level of ‘willingness to trust,’ determined community context indicators, moderates the ability for companies to garner SLO through company action.

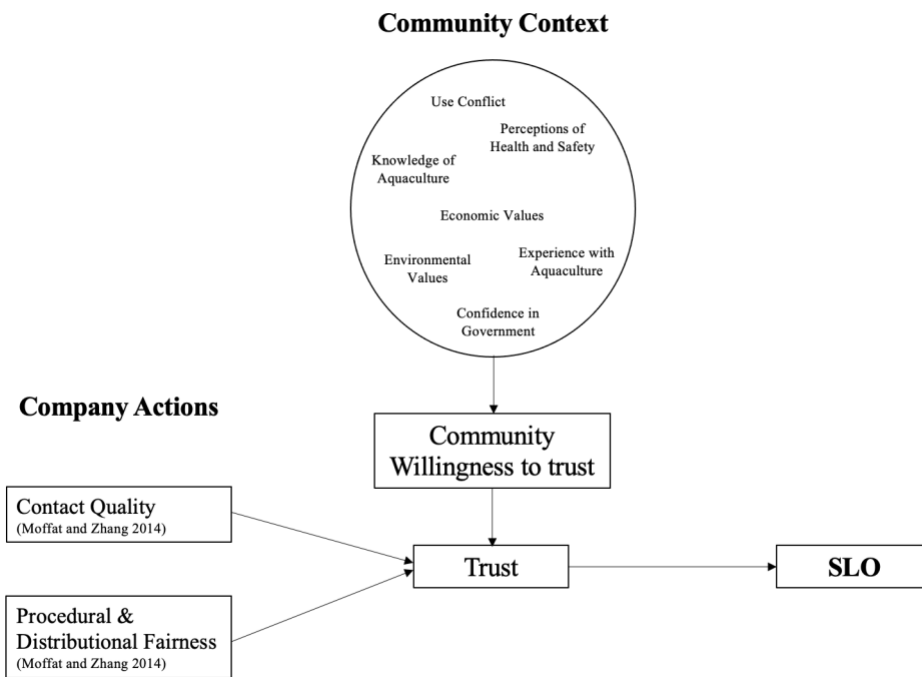


Figure 6. Preliminary path flow model showing the effects of community context and company actions on SLO. Community ‘willingness to trust,’ influenced by the attributes of community context, moderates the ability for a company to generate trust, and subsequently SLO through company actions.

6. CONCLUSION

With aquaculture development seen as increasingly important in maintaining adequate food supply on a global scale, understanding social barriers to development is essential. The social license to operate concept offers a framework for understanding these social barriers and an opportunity to better understand the elements that lead to successful development. What is known so far is that SLO is relational and is gained through the generation of trust between a company and community. Aquaculture companies must be proactive in seeking SLO, as company-controlled impacts and company-community engagement are key predictors of SLO. If companies are able to earn a community's trust through their actions and impacts, they are more likely to receive SLO. However, from the literature it is clear that community characteristics and collectively held values also influence the likelihood of SLO issuance, independent of company actions. The preliminary model presented in this paper addresses this and demonstrates how community indicators can influence a community's willingness to trust incoming operations.

Considering the call for efforts to increase aquaculture development, this research has additional practical applications. Most importantly, this model could inform efforts to identify areas particularly suitable for aquaculture development. While this is being done with biological indicators (for example, National Aquamapper), including social indicators when mapping out areas of interest would provide a more comprehensive and accurate prediction of potentially suitable areas. Aquaculture development could be more or less beneficial to communities depending on certain community characteristics and collective values. By considering these social factors in identifying areas of interest, efforts could be more strategic and effective. While more research is needed for empirical validation, this model is an important starting point for future investigation. The weight of each indicator may vary, yet overall, it is clear that

community context is an essential consideration when modelling SLO. This research fills an important gap in the literature, not only advancing the body of work dedicated to SLO within aquaculture, but to the SLO literature more broadly. Quantitative assessment has been limited to few, key studies focusing on company actions and impacts. Advancement of the academic analysis of SLO as a concept depends on the expansion of our understanding of what constitutes SLO, what indicators influence its development, and how it applies across industries. With continued research, SLO continues to grow into a useful tool for the systematic inclusion of social barriers and catalysts for both industry personnel and researchers. Research looking beyond ‘what a company can do’ to garner SLO is key to broadening our understanding of SLO and expanding its utility.

CHAPTER 2: WHAT DOES THE PUBLIC THINK OF FARMING SEAFOOD? MODELING PREDICTORS OR SOCIAL SUPPORT OF SOCIAL SUPPORT FOR AQUACULTURE DEVELOPMENT IN THE U.S.

Emily H. Whitmore, Thomas G. Safford, Lawrence C. Hamilton

1. INTRODUCTION

As climate change and overharvesting threaten wild fish stocks, marine aquaculture has become critically important for global food security (FAO 2018). Yet while the necessity of aquaculture is clear, negative perceptions of the industry have proved to be a significant barrier to growth (Mazur and Curtis 2008; Whitmarsh and Palmieri 2009; Young and Liston 2010; Young and Matthews 2010; Froehlich et al. 2021). In many cases, opposition groups have successfully slowed or even stopped development, demonstrating the importance of considering social dimensions when designing development strategies (Noakes et al. 2003; Barton and Floysand 2010; Knapp and Rubino 2016). Explanations for this opposition vary, though industry advocates often attribute resistance to either a lack of scientific understanding of the benefits and impacts of aquaculture or simply NIMBYism (not in my backyard) (Shindler et al. 2002; Ertör and Ortega-Cerdà 2015). While there is some evidence supporting these explanations (Murray et al. 2017; Cowperthwaite and Branchina 2018; Rickard et al. 2020), social acceptability research suggests that opposition is far more nuanced and is often colored by external factors (Knapp and Rubino 2016). Researchers from across the globe have identified a wide-range of indicators that likely influence perceptions of aquaculture—from environmental values to perceptions of use-conflict. This paper seeks to extend this body of work in two ways. First, we seek to create a list

of empirically verified indicators shown to influence public perception of aquaculture through a systematic review of survey research exploring social acceptability of aquaculture. Second, as studies have shown that perceptions vary by place, we seek to determine the validity of such indicators in a U.S. context.

To date, only a limited number of surveys have explored public opinion of aquaculture in the United States. While three are regional (Robertson et al. 2002; Dalton and Jin 2017; Bouchard et al. 2021), to our knowledge only two national surveys have been conducted (Chu et al. 2010; Murray et al. 2017; Rickard et al. 2020). The most recent national survey was conducted in 2017 under the Sustainable Ecological Aquaculture Network (SEANet) project at the University of Maine. (Murray et al. 2017; Rickard et al. 2020). Intending to gain insight into consumer and citizen decision making surrounding sustainable aquaculture, the SEANet survey explored a variety of topics relating to public perception of aquaculture. Due to the breadth of topics, this dataset in particular provides an opportunity to explore the indicators identified in the survey review on a national-scale. While localized studies are invaluable, looking at patterns of perceptions nationally is especially useful when creating national-level policies and development initiatives that will be applied to diverse coastal areas. To analyze this data, we apply General Structural Equation Modeling (GSEM), an analytical technique that allows us to investigate the effects of demographic characteristics and social indicators in a multi-step equation. With this technique, not only are we able to validate whether the indicators identified in the review perform in a U.S. context, but we can see whether these factors vary by social group. This analysis allows a more nuanced understanding of the social factors that influence public perceptions of aquaculture.

2. BACKGROUND AND ANALYTICAL MODEL

The extant research assessing public perceptions of aquaculture provides a roadmap for assessing how different factors affect views of the industry and farmed seafood. Using three online search engines, Academic Search Complete, Web of Science, and ProQuest, we conducted a systematic literature review of previous surveys assessing public opinions of aquaculture. We performed two separate queries within each database. The first queried included the search terms ‘public perception’ and ‘aquaculture.’ The second query included ‘social acceptability’ and ‘aquaculture.’ After reviewing the article abstracts for relevance and removing duplicates, the final list for review included 44 items.

While all 44 documents were reviewed in their entirety, for the purposes of this review, we focused on articles that included empirical public perception surveys (n=25). By focusing on survey results, we were better able to systematically search for indicators that have been statistically linked to public approval of or opposition to aquaculture. After review, we collated the data and created a list of evidenced indicators. A summarized table of this review that includes geographic scope and type of aquaculture is included as Table 4. For a full description of methods, see Whitmore, Cutler and Thunberg 2022.

While surveys assessed several types of aquaculture in different countries across the globe, despite this heterogeneity, seven themes emerged as evidenced influencers of public approval: environmental values, economic values, trust in government and regulating agencies, knowledge of aquaculture, perceptions of health and safety, and perceptions of real or potential use-conflict. Informed by this analysis, we formulated eight unique hypotheses.

To test our hypotheses, we utilized a dataset from a 2017 national survey conducted by a team of researchers at the University of Maine under the Sustainable Ecological Aquaculture

Network (SEANet), selecting survey items that most closely operationalized those emergent themes. Our dependent variable, *support*, is a composite measure of seven statements measuring active support for aquaculture (see Table 6)¹. Themes, corresponding variables and hypotheses are outlined below.

Table 6. Variable definitions and corresponding theme with codes and weighted summary statistics (n=1,210).

Endogenous Variables:

Support: Composite score of seven statements measuring active support. Scores were additive (mean 26.0, SD 7.3) “For each statement below, please indicate how likely you are to engage in the following.” Responses, ranging from 1 (strongly disagree) to 6 (strongly agree).

- a. Support policies that fund research on aquaculture.
- b. Support policies that expand aquaculture operations in the U.S.
- c. Support policies that expand aquaculture operations outside of the U.S.
- d. Buy aquaculture products.
- e. Look for aquaculture products when I purchase seafood.
- f. Seek more information on aquaculture.
- g. Learn more about the issues surrounding aquaculture.

Theme: Environmental Values

EnvFragility: Factor score variable that includes the following survey items (mean .02, SD 1.0): “What is your general opinion of the state of the environment? For each statement below, please tell us how you feel”

- a. Almost everything we do in modern life harms the environment.
- b. Nature would be at peace and in harmony if only human beings would leave it alone.
- c. Any change humans cause in nature – no matter how scientific – is likely to make things worse.
- d. Economic growth always harms the environment.

EnvProgress: Factor score variable that includes the following survey items (mean .01, SD 1.0): “What is your general opinion of the state of the environment? For each statement below, please tell us how you feel”

- a. We worry too much about the future of the environment, and not enough about prices and jobs today.
- b. People worry too much about human progress harming the environment.

HelpWild: “Aquaculture is a good way to relieve pressure on wild fish populations and other marine species.” Strongly disagree (coded 1, 3%), disagree (coded 2, 4%), slightly

¹ To assess internal consistency of the composite measure *support*, we conducted a principal component factor analysis. All seven items loaded onto one dimension, explaining 69% of the combined variance. Using the resulting factor score variable (supportF) in place of the additive composite variable did not change analytical outcomes.

disagree (coded 3, 9%), don't know (coded 4, 30%), slightly agree (coded 5, 30%), agree (coded 6, 36%), strongly agree (18%).

Theme: Economic Values

Economy: “The aquaculture industry supports U.S. communities by providing a source of local jobs.” Strongly disagree (coded 1, 2%), disagree (coded 2, 3%), somewhat disagree (coded 3, 7%), don't know (coded 4, 14%), somewhat agree (coded 5, 29%), agree (coded 6, 34%), strongly agree (coded 7, 11%).

Theme: Trust in Government and Regulating Agencies

TrustGovernment “Government officials are a possible source of information about aquaculture. Considering what you know, please click on the number (1–6) between the two phrases that best describes your feelings about information from government officials.” Following Rickard et al. 2020, responses for each statement pair, ranging from 1–6, were averaged to create a credibility index (mean 3.1, SD 1.2).

- a. Cannot be trusted (1)—can be trusted (6)
- b. Is inaccurate (1)—is accurate (6)
- c. Is not fair (1)—is fair (6)
- d. Does not tell the whole story (1)—tells the whole story (6)

Theme: Knowledge of Aquaculture

Knowledge: “Please estimate your current knowledge of marine aquaculture on a 0–100 scale, where 0 means knowing nothing and 100 means knowing everything you can possibly know about the topic. How much do you think you currently know?” (mean 16.5, SD 19.3)

Theme: Perceptions of Health and Safety

Safety “Farm-raised seafood is safer to eat than wild-caught seafood.” Strongly disagree (coded 1, 5%), disagree (coded 2, 9%), slightly disagree (coded 3, 21%), don't know (coded 4, 31%), slightly agree (coded 5, 22%), agree (coded 6, 9%), strongly agree (3%).

Theme: Experience

EatFarmed “Have you consumed aquaculture-raised seafood?” Definitely have not consumed (coded 1, 9%), probably have not consumed (coded 2, 5%), don't know (coded 3, 27%), probably have consumed (coded 4, 31%), definitely have consumed (coded 5, 28%).

Theme: Use Conflict

Recreation: “In coastal areas, aquaculture operations can interfere with recreational activities (e.g., swimming, boating).” Strongly disagree (coded 1, 3%), disagree (coded 2, 7%), slightly disagree (coded 3, 16%), don't know (coded 4, 17%), slightly agree (coded 5, 34%), agree (coded 6, 19%), strongly agree (coded 7, 4%).

Exogenous Variables:

Age (weighted mean 47.5 years, SD 17.4 years, range 18–85 years)

Gender: Male (coded 1, 48.3%) Female (coded 2, 51.7%)

Education: <HS (coded 1, 11.8%), HS (coded 2, 29%), Some college (coded 3, 28.5%), Bachelors or higher (coded 4, 30.8%)

Race: White, non-Hispanic (coded 1, 64.4%), Non-white (coded 2, 35.6%)

Income: 21 groups ranging from <\$,5000 (coded 1) to >\$250,000 (coded 21)

Ideology: “When it comes to social issues, you generally consider yourself to be:” and “When it comes to fiscal issues, you generally consider yourself to be:” (Very liberal (1) to Very

conservative (7). Following Rickard et al. 2020, both items were averaged to create *ideology*, mean 4.4, SD 1.4).

Region: New England (coded 1, 4.5%); Mid-Atlantic (coded 2, 13.5%), East-North Central (coded 3, 15.2%), West-North Central (coded 4, 5.9%), South Atlantic (coded 5, 21.9%), East-South Central (coded 6, 4.9%), West-South Central (coded 7, 10.6%), Mountain (coded 8, 7.6%), Pacific (coded 9, 16%).

2.1 Environmental Values

Previous studies have linked environmental values with opposition to aquaculture development. Specifically, those who are more concerned with environmental impacts tend to be less supportive (Whitmarsh and Palmieri 2009; Chu et al. 2010; Dalton and Jin 2017; Hynes et al. 2018; Krovel et al. 2019). While most surveys inquired about environmental concerns by asking participants about their perception of ‘environmental harm’ caused by aquaculture operations, other surveys included more marine-specific questions about concern over the displacement of wild fish stocks (Chu et al. 2010) or impacts on the beauty of the coastal environment (Dalton et al. 2017). Both types of questions yielded similar results. Public support for aquaculture was also linked with environmental views more generally, with one study finding that participants with higher scores on a New Ecological Paradigm (NEP) measure, which gauges pro-environmental views, were significantly less likely to support shellfish aquaculture (Murray and D’Anna 2015). Lastly, Whitmarsh and Palmieri (2009, 2011) explored the relationship between pro-environment and pro-economy views, which are frequently juxtaposed. In their analysis, they found that those who favored aquaculture expansion were those who minimized environmental impacts and prioritized maximizing economic benefits.

Though these results are reflective of several qualitative studies showing that opposition to aquaculture is often driven by environmental concern (Young and Liston 2010; Young and Matthews 2010; Billing 2018), the relationship between environmental views and public

sentiment of aquaculture is likely more complex. For example, participants in several surveys acknowledged environmental benefits of aquaculture—mainly, the relief of pressure on wild fish populations (Freeman et al. 2012; Alexander et al. 2016; Murray et al. 2017; Flaherty et al. 2018), though these perceptions were not investigated as predictors of public sentiment. Further, a recent study by Rickard et al. (2020) drawing from the SEANet survey shows a positive relationship between perceptions of environmental fragility and support for aquaculture. They also investigated whether participants who favored economic progress despite environmental harm were more supportive and found no relationship.

Considering the importance and complexity of this theme, we included three environment variables. Consistent with previous research (Dietz, Stern and Guagnano 1998; Rickard et al. 2020), we created two variables through a principal component factor analysis of a series of six questions assessing participants' environmental values. Responses loaded onto two factors—one measuring progress verses environment (*progress*), and the second measuring perceptions of environmental fragility (*fragility*). Our hypotheses for both variables are based on findings by Rickard et al. (2020), though they diverge from previous research. This analysis seeks to confirm whether or not the relationship between *fragility* and support holds in our 7-category model. The third variable, *helpwild*, assesses whether perceptions of environmental benefits of aquaculture influence public sentiment. *Helpwild* measures the extent to which participants agreed that aquaculture helps restore wild stocks (*helpwild*). Teasing out which views are tied to support is key to developing policy and information campaigns that addresses public concerns that drive opposition within the US.

H1: Beliefs favoring progress despite environmental harm will have no effect on support for aquaculture development(a); those who believe in the fragility of nature will be more

supportive of aquaculture development(b); those who believe that aquaculture helps restore wild stocks will be more supportive of aquaculture development(c).

2.2 Economic Values

Economic benefits such as tax revenue and job creation are often cited as a major advantage of aquaculture development and survey research confirms that those who recognize economic benefits tend to be more supportive. Specifically, those who agree that aquaculture increases economic growth, boosts tax revenue and creates jobs are more supportive of development (Murray and D'Anna 2015; Dalton and Jin 2017; Krovel et al. 2019). Considering previous research illustrates that job creation is one of the most cited economic benefits of aquaculture development (Whitmarsh and Palmieri 2009; Freeman et al. 2012; Murray and D'Anna 2015; Murray et al. 2017; Alexander et al. 2018; Flaherty et al. 2018; Hynes et al. 2018), we included an item that asked participants the extent to which they agree that aquaculture is a good source of local jobs (*economy*) to assess whether this view is predictive of support for aquaculture development within the United States.

H2: Respondents who believe that aquaculture is a source of local jobs will be more likely to support aquaculture development.

2.3 Trust in Government and Regulating Agencies

Previous survey research has shown that confidence in governing bodies and trust in government officials can increase support of aquaculture operations (Mazur and Curtis 2006; Rickard et al. 2020). The SEANet survey included a set of questions measuring trust in government-provided information. Using a series of four statements, participants were instructed to select a number from 1 (representing low levels of trust) to 6 (high levels of trust) on whether they trusted information from government officials and whether they believed that information

was accurate, fair, or complete. Following Rickard et al. 2020, we averaged these scores to create the variable *trustgovernment* to gauge whether level of trust influences public support for aquaculture. Considering development initiatives are often launched by government agencies, this relationship is especially important to consider.

H3: Respondents who believe that information from government officials can be trusted, is accurate, fair and complete will be more likely to support aquaculture development.

2.4 Knowledge

Studies consistently show that public understanding of aquaculture is limited (Mazur and Curtis 2006; Mazur and Curtis 2008; Freeman et al. 2012; Alexander et al. 2016; Murray et al. 2017). This was also found within the US (Robertson et al. 2002; Murray et al. 2017). While three studies show that participants with higher levels of knowledge are more supportive of aquaculture (Robertson et al. 2002; Thomas et al. 2018; Rickard et al. 2020; Bouchard et al. 2021), a fourth showed no association (Murray and D’Anna 2015). This is a key area of inquiry, considering public perceptions can be shaped by strategic awareness initiatives. To assess whether knowledge level is linked to support within the US, we included the survey measure in our model that asked participants to estimate their level of knowledge of marine aquaculture from 0 (knowing nothing at all) to 100 (knowing everything there is to know).

H4: Respondents who believe they are more knowledgeable about aquaculture will be more supportive of development.

2.5 Perceptions of Farmed Seafood Safety

Perceptions of consumer safety of farmed seafood also appears to play a role in public acceptance of aquaculture. While these perceptions varied by place, two studies connected perceptions with support, finding that participants who believed that farmed seafood was safe or

healthy were more likely to support aquaculture development (Chu et al. 2010; Dalton and Jin 2017). We considered this issue using a survey item that gauged the extent to which participants agreed that farm-raised seafood is safer than wild-caught.

H5: Respondents who believe that farm-raised seafood is safer than wild-caught seafood will be more likely to support aquaculture.

2.6 Experience

Scholars have also suggested that the public's experience with aquaculture, including proximity to farms, engagement with farmers, and consumption of farmed seafoods might influence support for widening the industry. However, the direction of the experience—support relationship appears to depend on the characterization of that experience. For example, surveys conducted in places where the public has witnessed negative impacts from aquaculture operations will have lower support (Murray and D'Anna 2015). This demonstrates the importance of place-specific research (Mazur and Curtis 2008; Murray and D'Anna 2015; Dalton and Jin 2017; Hynes et al. 2018; Thomas et al. 2018). While this relationship likely varies across the US, it is useful to have a national approximation when designing policy that will be broadly applied to wide-ranging areas. Though assessing only one dimension of 'experience,' we selected a SEANET survey item that asked about awareness of consumption, considering consumption is the primary avenue of exposure. Specifically, the question asked whether respondents had consumed aquaculture products. Respondents were provided with a scale from 1(definitely have not consumed) to 5(definitely have consumed). We expect a positive relationship.

H6: Respondents who are more certain that they have consumed aquaculture products will be more likely to support aquaculture.

2.7 Use Conflict

Lastly, concerns over interference with competing uses of marine areas also appears to influence support, though there is no clear consensus among researchers as to the direction of this relationship (Dalton et al. 2017; Thomas et al. 2018; Krovel et al. 2019; Sinner et al. 2020). This is likely to due to variation in the type of ‘competing use’ as well as place-based variability. For example, fishing-dependent communities may be less likely to approve of incoming aquaculture operations if residents suspect that these activities would encroach on fishing areas. Participants from areas with less dependence on coastal resources may be less concerned about incoming industry. Further, surveys varied in what ‘competing use’ they addressed. While some asked about competing coastal activities, others asked more specific questions about conflict with boating or swimming (Shafer et al. 2010; Dalton and Jin 2017; Krovel et al. 2019). The SEANet survey included one question that asked participants the extent to which they agreed that aquaculture interferes with other recreational activities. Though this question does not address the most contentious conflict among resource users—use conflict between competing economic activities, it does allow us to consider how perceived competition with recreational activities may influence support for aquaculture.

H7: Respondents who agree that aquaculture will interfere with recreational activities will be less likely to support aquaculture development.

2.8 Demographic Characteristics

In addition to the seven themes found in the literature, we included a series of demographic variables in our model to investigate whether perceptions of aquaculture are patterned by group. Such information could be critical for tailoring policies and management efforts. To date, researchers have found varying links between gender, age, education level,

income level, geography, and measures of support for aquaculture (Mazur and Curtis 2008; Fernandez-Polanco et al. 2012; Safford and Hamilton 2012; Murray and D'Anna 2015; Alexander et al. 2016; Hynes et al. 2018; Outiero et al. 2018; Krovel et al. 2019). Females appear to be more concerned with aquaculture impacts (Mazur and Curtis 2006; Hynes et al. 2018; Thomas et al. 2018), though there are mixed results for the relationship with age. Younger people seem to be more concerned about environmental affects, which could negatively influence support for aquaculture (Mazur and Curtis 2006; Hynes et al. 2018; Outiero et al. 2018). Older individuals were found to be more supportive in two studies (Murray et al. 2017; Krovel et al. 2019) but were also less likely to see economic benefits (Alexander et al. 2016) or think that development was important (Safford and Hamilton 2012). A handful of studies suggest that more highly educated people are more supportive of aquaculture (Fernandez-Polanco et al. 2012; Safford and Hamilton 2012; Murray et al. 2017), though additional studies found no relationship (Outiero et al. 2018; Krovel et al. 2019). Local and regional variation has been found in several studies, with perceptions varying by exposure to and experience with aquaculture (Hamilton and Safford 2015; Dalton and jin 2017; Thomas et al. 2018; Hynes et al. 2018). Lastly, the effects of income, political party and race are less often included in statistical models, leaving this question open for investigation.

H8: Participants who are male, older, and more educated will be more supportive of aquaculture development.

3. Methods

3.1 Analytical Approach

Figure 7 is a conceptual path diagram representing our structural equation model (SEM) design. However, classical SEM analysis assumes that endogenous variables are continuous and

linearly related. Because several of our endogenous variables are ordinal, we utilized the generalized structural equation modeling (GSEM) procedures of Stata v.16 (StataCorp 2019), which permits nonlinear specifications such as (in this case) ordered logit regression, within a structural equation framework for a more flexible approach. SEM and GSEM models permit tests of intervening or mediating effects, involving variables that are causally subsequent to exogenous factors such as age and gender, but more general and prior to the dependent variables of interest—in this case, support for aquaculture. They also provide insight on the indirect effects of exogenous variables, operating through mediating factors. This analytical approach offers a more nuanced understanding of the way our independent variables influence support.

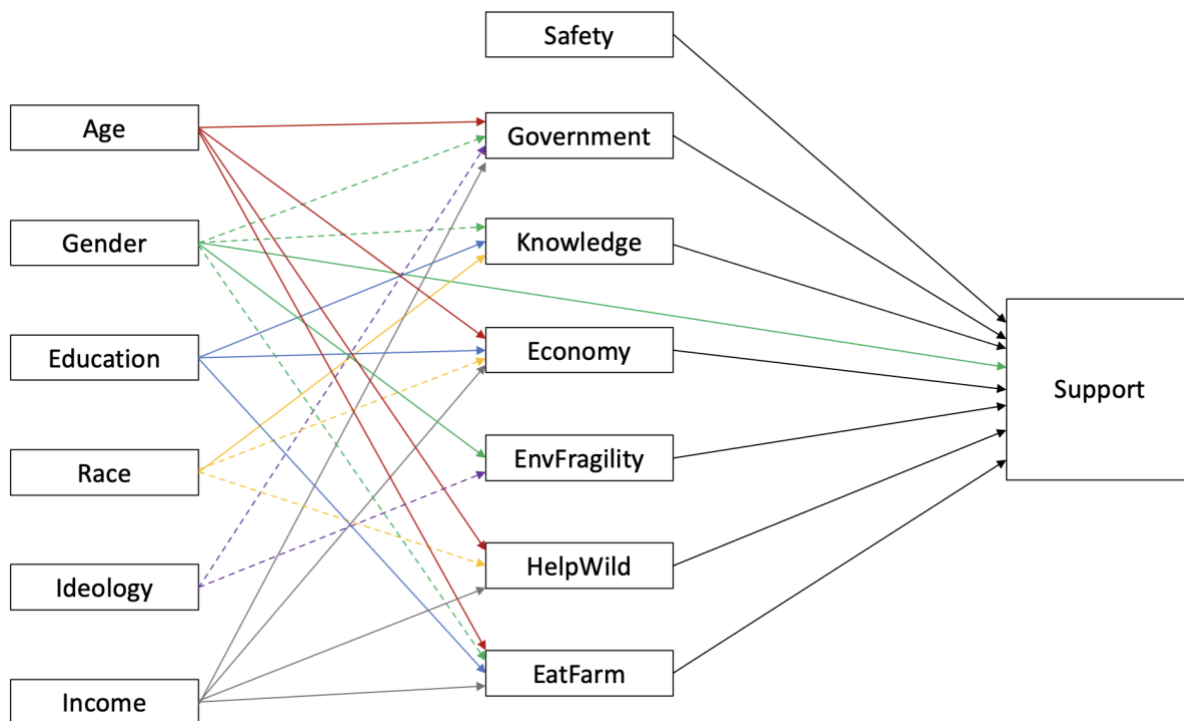


Figure 7. Path diagram showing relationships from demographic factors, through a set of general views on environmental and related topics, to support for aquaculture (*support*). Solid lines represent statistically significant positive relationships, while dotted lines represent statistically significant negative relationships, based on the analysis in Table 7.

3.2 Survey Data and Sample

The SEANet study, conducted in January 2017, was designed by the SEANet Theme 4: *Human Dimensions of Sustainable Aquaculture* research team at the University of Maine. The survey itself was administered by the GfK Group using a sample from KnowledgePanel[®], an online probability-based, representative web panel. The sample was drawn from a target population of English-speaking, non-institutionalized adults age 18 and over living in the United States. Out of 2125 sampled, 1210 participants completed the survey. While the raw distribution of KnowledgePanel[®] closely represents the population of US adults, results were weighted to the demographic benchmarks set by the most recent Current Population Survey using probability proportional to size (PPS) methodology. In a concluding step, final weights were calculated using an iterative proportional fitting procedure.

3.3. Path Model

To begin answering our research question, we position the thematic variables outlined above as intervening variables between individual demographic characteristics (*age, gender, education, race, income and ideology*) and support of aquaculture. Figure 7 visualizes this model as a path diagram, with arrows representing results from the analysis in Table 7. The arrows indicate causal direction for both exogenous and endogenous variables. Only relationships that pass criteria for statistical significance ($p < 0.05$) are shown. Solid lines indicate a significant positive relationship, while dotted lines represent negative. The thematic variable *recreation*, and the demographic variable *region* were omitted as they were not significant predictors in the final model.

4. Results

Figure 8 visualizes the bivariate relationships between intervening variables and *support*, showing the mean score for *support* broken down by participant response to each thematic variable. Adjusted Wald tests showed that all relationships, aside from *EnvProgress*, were statistically significant. Because of this, the graphic for *EnvProgress* was omitted. Figure 8a and 8b show that both *envfragility* and *helpwild* are positively related to *support*. Participants who believe the environment is fragile and those who believed that aquaculture helps to relieve pressure on wild fish populations were more likely to support aquaculture (H1b, H1c). As expected, *economy* is also positively associated with support for aquaculture (H2), with those who agree that aquaculture is a good source of local jobs being more supportive. Also as anticipated, those who trust government officials as a source of information about aquaculture are more likely to be supportive (H3). Higher levels of knowledge (*knowledge*), the belief that farmed seafood is safer than wild seafood (*safety*) and those that are certain that they have consumed aquaculture products (*eatfarmed*) are also predictive of support (H4, H5 and H6). Lastly, bivariate analysis revealed that contrary to H7, participants who believed that aquaculture operations can interfere with recreation (*recreation*) were surprisingly more supportive of aquaculture activity. However, when controls were added in the full GSEM model, *recreation* lost all predictive power showing that this result is likely spurious.

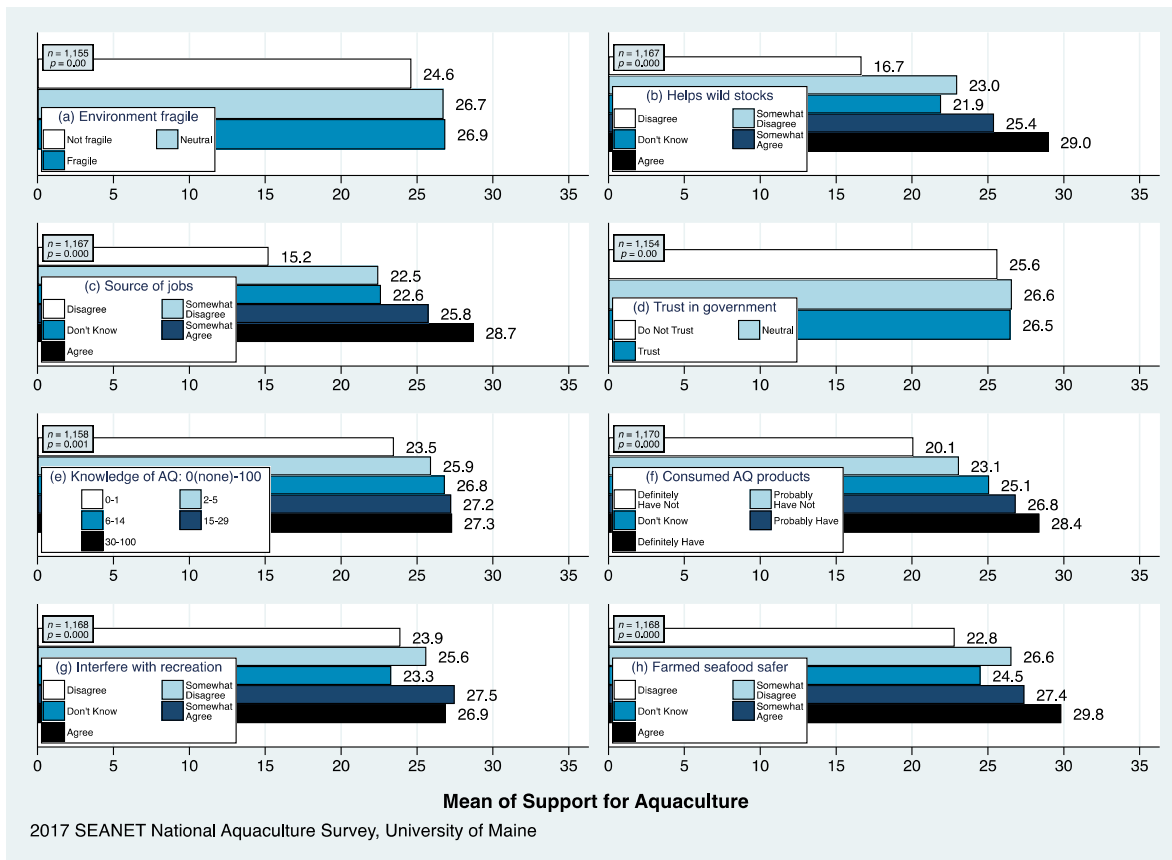


Figure 8. Weighted mean of support for aquaculture broken down by participant views on thematic variables.

While these bivariate visualizations are helpful for understanding the basic direction of these relationships, multivariate analysis allows us to estimate the independent effects of each variable while adjusting for the effects of the other variables included in the model. Using GSEM, we are also able to position demographic characteristics as exogenous variables preceding our set of topical variables in order to gauge both direct and indirect effects on support. These indirect effects are masked in standard logistic regression. Detailed results for the GSEM model are outlined in Table 7.

Table 7. Statistically significant coefficients and standard errors from a generalized structural equation model (GSEM) using probability-weighted ordered logistic regression (n=1,178).

Effect on	From	Coefficient	Standard Error
EnvFragility	<i>Gender (F)</i>	.149*	.060
	<i>Ideology (Con)</i>	-.191***	.025
EnvProgress	<i>Education</i>	-.042*	.017
	<i>Race</i>	-.245**	.071
	<i>Ideology (NW)</i>	.281***	.023
HelpWild	<i>Age</i>	.010***	.003
	<i>Race (NW)</i>	-.389***	.104
	<i>Income</i>	.023*	.011
Economy	<i>Age</i>	.010***	.002
	<i>Education</i>	.056*	.024
	<i>Race (NW)</i>	-.364***	.098
	<i>Income</i>	.035**	.010
TrustGovernment	<i>Age</i>	.007***	.002
	<i>Gender (F)</i>	-.186*	.074
	<i>Income</i>	.020*	.009
	<i>Ideology (Con)</i>	-.115***	.031
Knowledge	<i>Gender (F)</i>	-3.757**	1.237
	<i>Education</i>	.839*	.407
	<i>Race (NW)</i>	4.015**	1.515
EatFarmed	<i>Age</i>	.007**	.002
	<i>Gender (F)</i>	-.268***	.071
	<i>Education</i>	.092***	.019
	<i>Income</i>	.025**	.008
Recreation	<i>Education</i>	.061*	.024
Support	<i>Gender (F)</i>	.834*	.401
	<i>EnvFragility</i>	.775**	.232
	<i>HelpWild</i>	1.328***	.211
	<i>Economy</i>	1.262***	.214
	<i>TrustGovernment</i>	.471*	.215
	<i>Knowledge</i>	.027*	.011
	<i>EatFarmed</i>	1.199***	.205
	<i>Safety</i>	.464**	.163

*p<.05, **p<.01, ***p<.001

Results confirmed H1 through H6. While we did not find a relationship between *recreation* and support, this non-finding is certainly not conclusive. It is likely that the non-association is because *recreation* does not capture the breadth of competing uses. Lastly, contrary to our hypothesis, we did not find a direct relationship between age, education and support (H8). The only demographic characteristic predictive of support was gender. While several previous surveys elsewhere found that women were more concerned with aquaculture development, counter to our hypothesis, U.S. women were significantly more supportive.

In addition to identifying direct predictors of support, GSEM also allows simultaneous evaluation of direct and indirect effects of multiple interrelated variables while assuming causal order. This extends the results of our hypotheses to evaluate which groups hold which perceptions, which in turn influences sentiment. Following the path model shown in Figure 7, Table 7 outlines the significant effects from our set of demographic variables on each endogenous variable, and the effects of each intervening variable on our dependent variable. The table includes both β coefficients and standard error for each equation. Non-significant relationships (p values greater than .05) were excluded from the table for simplification.

As Table 7 describes, *gender* and *ideology* have significant, direct effects on *EnvFragility*. Women and people with more liberal political views are more likely to hold beliefs of environmental fragility. In turn, those who are concerned with environmental fragility are more supportive of aquaculture ($p < .001$). Those with lower levels of education, whites and political conservatives are more likely to prefer progress despite environmental risk (*envprogress*), yet this view is not predictive of support for aquaculture. For the final environment variable, *helpwild*, older, white, high-income participants are more likely to agree that aquaculture is a good way to relieve pressure on wild fish populations. *Age, education, race*

and *income* are predictive of participant's perceptions of aquaculture's ability to produce jobs. Specifically, older people, highly educated people, whites and those with higher income are more likely to believe that aquaculture is a good source of local jobs ($p < .001$). Subsequently, those with positive views on aquaculture's ability to produce jobs are more likely to be supportive. Looking at which demographic characteristics predict *trustgovernment*, we see that older people, men, people with higher income and those who identify as more liberal tend to believe that aquaculture information provided by government officials can be trusted, is accurate and fair, and tells the whole story. In turn, this group is significantly more supportive of aquaculture ($p < .05$).

Knowledge is also directly influenced by certain demographic characteristics. Men, those with higher educations, and non-whites perceive that they know more about aquaculture. Those who believe they are knowledgeable about aquaculture are significantly more supportive ($p < .01$). *Age*, *gender*, *education* and *income* are predictive of whether participants are aware that they have eaten farmed seafood products. Older individuals, men, those with higher education and higher income are significantly more likely to have consumed—or be aware that they have consumed aquaculture products. Subsequently, consumption of farmed seafood is a strong predictor of support ($p < .001$). Lastly, those who are more highly educated are more likely to believe that aquaculture interferes with recreational activities, though this belief is not related to support.

Interestingly, we found that *safety* is unrelated to demographic characteristics in our model, making it an exogenous variable rather than intervening. Participants who believe that aquaculture products are safer than wild-caught seafood are significantly more likely to support aquaculture ($p < .01$), and this does not vary by demographic group.

5. Discussion & Conclusion

Considering the importance of aquaculture for global food security, it is essential to have an understanding of social factors that can influence public perception. This is especially true for an industry that has faced considerable public opposition. Through a systematic review of prior survey research investigating public perceptions of aquaculture, we identified seven themes that influence approval of development and formulated hypotheses as to how these relationships would play out in a U.S. context. We then investigated the validity of these potential indicators with a U.S. sample and found support for most of the hypothesized relationships. Participants who are concerned with ecosystem fragility, believe that aquaculture helps to restore wild fish stocks, believe that aquaculture is a source of good jobs, are more trusting of government officials, are more knowledgeable about aquaculture, eat more farmed seafood and believe that farmed seafood is safer than wild caught are more likely to support aquaculture development. We did not find support for H7, measuring use-conflict. Using GSEM statistical techniques, we were also able to assess how individual demographic characteristics influence support directly and indirectly through mediating perception variables. Analysis revealed that demographic characteristics effect support primarily through indirect pathways. Gender was the only demographic characteristic directly related to support, with females holding more positive sentiment.

These findings have several implications for ocean and coastal development and policymaking., First and foremost, public perception research identifying issues of importance surrounding aquaculture development could guide more socially sustainable growth. For example, our results confirm that people are more supportive of aquaculture when they recognize environmental and economic benefits. Maintaining rigorous regulatory standards for

environmental stewardship and seafood safety, expanding opportunities for low-input, net positive operations, and incentivizing new businesses to hire local, year-round employees are strategies that would likely improve social sustainability.

However, most notably these findings provide guidance for developing strategic knowledge campaigns or raising public awareness about aquaculture. It is well known that public understanding of aquaculture is limited (Robertson et al. 2002; Mazur and Curtis 2006; Freeman et al. 2012; Alexander et al. 2016; Murray et al. 2017). Echoing others, our analysis shows that enhanced knowledge of aquaculture is associated with support (Robertson et al. 2002; Thomas et al. 2018; Rickard et al. 2020). Further, increased experience with aquaculture—in this case, through consumption, is also positively associated with support. Thus, initiatives aiming to raise awareness of farmed seafood could enhance support for coastal aquaculture development. However, considering levels of knowledge and awareness vary by social group, targeted initiatives may be most effective. Women, participants with lower levels of education, and whites rated their knowledge lowest. Similarly, women and less educated participants were less confident that they had consumed aquaculture products. Campaigns aiming to foster awareness in these groups would likely have more impact than initiatives designed for broader audiences.

Additionally, our results show that certain groups are less likely to trust information about aquaculture provided by government officials. Two of these groups—women and those with lower levels of education, overlap with the target groups above. As many individuals have misgivings about information from government, our efforts to inform the public about aquaculture may need to engage non-governmental organizations and key private sector actors such as supermarkets. Our results suggest broadening outreach and targeting key groups could be beneficial.

Relatedly, laws and regulations could play an important role in bolstering approval. In 2005, a law passed that required seafood sold in stores be labeled as wild-caught or farm raised (C.O.O.L. §60.300). Though the law has faced criticism (Mullins 2010), expanding labeling in stores to contain more information about growing methods and making that information highly visible could increase awareness. This strategy could be particularly effective for increasing knowledge among women, considering they continue to be the primary shoppers in most households (Pew Research Center 2019). Further, the source of this information would be coming from food purveyors rather than government officials, potentially increasing receptiveness among women and those with lower levels of education.

Findings from our study also add to our understanding of the way environmental values influence perceptions of aquaculture. While the environment is often centerpiece to local conflicts, our results validate recent findings showing that nationally, pro-environmentalists tend to support aquaculture development and that supporters are not more or less likely to value progress despite environmental harms (Rickard et al. 2020). This complicates a common narrative that links environmental activism to anti-aquaculture sentiment—a link that is likely strengthened by high-profile opposition cases where well-resourced groups and environmental NGOs combat development on an environmental platform. While these cases provide insight into specific environmental concerns, this analysis shows that more broadly, pro-environmentalists are supportive of aquaculture. Further, our results confirm that the recognition of specific environmental benefits of aquaculture is a strong predictor of support and that older individuals, whites and those with higher incomes are more likely to recognize benefits. Campaigns aiming to increase awareness of the environmental benefits of aquaculture—

specifically the reduction of pressure on wild stocks, may be more effective in bolstering support if tailored to younger, non-white, lower income individuals.

Lastly, this study demonstrates the value of quantitative analytical techniques as a policy resource as they provide a rigorous method for identifying broader patterns of perceptions and can give the general public a voice. Integrating such broader perspectives with locally-situated stakeholder engagement may be key to crafting socially sustainable coastal management policy. Additionally, GSEM in particular allows researchers to identify direct and indirect effects following a causal model, thus identifying factors that might otherwise have been overlooked despite their importance. Here, GSEM allowed us to position perception measures as intervening variables between demographic characteristics and support. With this path model, we were able to identify which groups were most likely to hold perceptions that were predictive of support for aquaculture, thus providing insight into how to create more targeted outreach and engagement initiatives.

However, quantitative analysis on this scale also has limitations. While there are clear benefits to looking at broader patterns—especially when crafting policies that will be applied uniformly across states, it is important to note that quantitative analysis on this scale can miss local variation. Considering experience with aquaculture can shape perceptions of support, certain communities may be more or less supportive of aquaculture due to local interaction with aquaculture operations or impacts from neighboring farms. A second major limitation to this analysis is the lack of specificity of aquaculture type. Survey items from this questionnaire asked participants about aquaculture generally, despite there being various cultivation methods for various species. These methods differ significantly in size and environmental impact. Net-pen operations, for example, can be highly intensive and can present several environmental risks like

the escape of non-native species, disease transmission to wild populations and impacts from fish waste. On the other hand, shellfish aquaculture requires limited inputs and has been shown to improve water quality. Other technologies such as land-based recirculating aquaculture systems can raise concerns over effluent or fish welfare. However, despite this real complexity, scholars have found that in addition to limited awareness of aquaculture generally, knowledge of differences between types of aquaculture is also limited (Robertson et al. 2002; Alexander et al. 2016; Thomas et al. 2018). It is likely that this is true in the U.S., thus the public's conception of aquaculture may be homogenous despite these real differences. While more research is needed to investigate the extent to which perceptions vary by aquaculture type, this analysis shows that support is socially patterned nonetheless, demonstrating the utility of a generalized measure of aquaculture support.

Overcoming negative perceptions of the industry is key if aquaculture is to reach its full potential in the U.S. Considering policy and development initiatives are often national in scale, research intending to better understand public opinion of aquaculture nationally is key. Collated from research in other parts of the world, this paper tests the validity of a series of evidenced predictive indicators of approval for aquaculture in a U.S. context, finding support for six of seven variables. Further, this analysis incorporates demographic variables that could inform strategic information campaigns. While more research is certainly needed, this analysis confirms that environmental benefits, economic benefits and the safety of aquaculture are important factors in public sentiment and that those who eat more farmed seafood, who trust regulating agencies and who are more knowledgeable are more supportive. Armed with this information, policy-makers and industry advocates will be better able to develop a socially sustainable industry that garners support by addressing concerns.

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CHAPTER 3: A GUIDE FOR SHELLFISH & SEAWEED FARMERS IN MAINE: WORKING TOWARDS SOCIAL LICENSE TO OPERATE

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1. Introduction

Over the past decade, the aquaculture industry in Maine has experienced rapid growth. In fact, since 2014, the industry has doubled in both value and volume, with oysters alone becoming the fourth most valuable commercial marine species in Maine (Sadusky et al. 2022). With this growth, aquaculture producers are facing new challenges—one being social acceptance. While broad perceptions of aquaculture are overwhelmingly positive (Alvarez et al. 2019), local opposition has created serious barriers to growth for new and seasoned farmers at varying scales. In response to this, farmers have been working hard to gain community support using a wide range of community engagement strategies. These strategies, in conjunction with responsible operating practices and management of environmental impacts, are essential to the growth of individual farms as well as the broader industry.

This guidebook on social license to operate, a term describing this community support, is the result of a collaborative research project with 30 Maine shellfish and seaweed farmers who shared insight into practical ways to earn community support. Farmers contributed to the project at multiple points, from participating in an in-depth interview, to providing feedback on the final document. The photographs used in this guide were also provided by farmers.

The structure of the guide was dictated by themes brought up during farmer interviews and the content features quotes from farmers interspersed with prior research on social license to

operate. The resulting document is an attempt to articulate the ways farmers are thinking about social license, how they are doing social license work, and how social license as a way of thinking can be beneficial to farmers and communities alike.

1.1 What is social license to operate?

The term social license originated in the mining industry as a way of describing the informal, ongoing approval or acceptance of a project granted by communities (Joyce and Thomson 2000; Thomson and Boutilier 2011; Lacey et al. 2012). Mining companies across the globe were experiencing varied community reactions to their projects. In some cases, communities embraced the mining activity, even incorporating it into their identity (i.e. a ‘mining town’). In other cases, community members were organizing in protest, at times effectively shutting down operations. A mining executive started describing this as social license to operate, a continuum that captures community support for a project that is primarily gained through quality engagement and relationship building with stakeholders.

The degree of social license ranges from withheld/withdrawn to full social license, or what researchers have termed ‘psychological identification’ (mining town, fishing town, etc.) (Thomson and Boutilier 2011). Tolerance, or lack of opposition, does not indicate any degree of social license. Social license occurs when communities show active support for a project. Sarah, an oyster farmer, described this succinctly when talking about an ideal lease hearing. She says, “a lot of people think you’re successful if no one shows up, but in my opinion, I think it’s a success when everybody shows up and is in support and aware of what you’re doing.”

Social license is also dynamic, having been described as an “ongoing negotiation” between a community and company (Rooney et al. 2014). Farmers acknowledge this important aspect of SLO. For example, describing support as “little chips,” Kelly said she would “love to

collect all those little chips in the basket and keep them and use them in the future. But I think that sometimes when you propose a change, or something happens, that basket easily gets tipped over.” She recognized that social license is slippery and can be easily withdrawn. While the work often clusters around certain events in the life of a farm, particularly when securing new or expanded leases, social license demands constant maintenance work.

Building and maintaining social license requires gaining trust from community members. While aquaculture-specific strategies will be discussed in section 3, researchers have statistically linked certain company actions and impacts (see Table 8) to SLO. While some actions influence acceptance directly, most influence acceptance through trust generation. For example, quality communication with stakeholders increases trust in the company, which in turn generates social license (Moffat and Zhang 2014; Sinner et al. 2020).

Table 8. Company actions that generate SLO in other industries.

Company Action	Source
Quality Communication	Moffat & Zhang 2014; Sinner et al. 2020
Distributional Fairness/Economic Fairness (whether the community feels that the benefits are fairly distributed)	Zhang et al. 2015; Moffat et al. 2017; Mercer-Mapstone et al. 2018; Sinner et al. 2020
Procedural Fairness (whether the community feels that they had a voice in the process)	Moffat & Zhang 2014; Zhang et al. 2015; Moffat et al. 2017; Mercer-Mapstone et al. 2018
Cultural Impacts	Sinner et al. 2020
Impacts on social infrastructure	Moffat & Zhang 2014
Balance of positive & negative impacts	Moffat et al. 2017; Mercer-Mapstone et al. 2018

Considering social license is intangible and fluid, measuring SLO is challenging. Researchers argue that it is easier to tell when a company does not have social license, than when it does (Lacey et al. 2012). Farmers echoed this, often describing the importance of gaining social license through the consequences of *not* having it. It is obvious when companies are struggling with social license when they are facing widespread community opposition. Yet if a company is able to proceed with their operations without facing pushback, it is difficult to gauge. However, farmers brought up several tangible benefits of social license that suggest that they have been able to secure some level of social license from their communities.

1.2 Why is social license important?

Having a degree of social license from the community provides a variety of benefits to farmers. One important benefit is that high community approval can reduce the risk of social conflicts that often arise in resource industries (Gunningham et al. 2004; Parsons and Moffat 2012; Prno and Slocombe 2012; Prno 2013; Moffat and Zhang 2014; Cullen-Knox et al. 2017). In Maine, community opposition has created significant obstacles for farmers. Legal challenges to lease applications are costly and the resulting delays can be detrimental to growth. Further, some of the more highly publicized conflicts have led to the formation of well-organized anti-aquaculture groups that are trying to limit aquaculture growth in the state through localized moratoriums and statewide regulatory changes.

In this sense, social license is an important tool for farmers who want to take an upstream approach to opposition, understanding social license work as a form of ‘risk management’ (Gunningham 2004). Like Joe describes, you can get a license from DMR if you meet all of the conditions outlined by 12 M.R.S.A. §6072, but “if you don't do the outreach responsibly and correctly, you're gonna have trouble.” Bill made a very similar comment. Being accepted and

supported by your community may not be mandated, but it is in a farmer's best interest to do the outreach and try to build relationships to limit pushback.

The people on the shore, and who might be likely to oppose you, they almost certainly will have more money than you. They can almost certainly out-lawyer you. They can slow you down, they can change up things. They can make your process much more difficult than it needs to be, first of all. So that's like a bare minimum. And then everything else is the good stuff to try to reach for. Ideally, we want to have an industry that is well known, that's understood and is supported by the local and State community, because they are our customers. And they also have a stake in the health of the resources that we depend on. Clean water, clean air, shorefront access, all that kind of stuff.

The “good stuff” that Bill refers to the positives that come out of quality relationships between communities and farmers. Both can benefit from coexisting, with communities experiencing positive environmental effects, access to locally produced food, more local jobs, and a way to preserve and reimagine Maine's working waterfront in the face of a changing climate. Farmers benefit from active community support as well in several concrete ways.

First, farmers brought up numerous examples of local stakeholders helping care for their site or equipment because of positive relationships they had built. For example, Andrea talked about a riparian landowner offering to paddle out and shut off navigation lights that were accidentally left on. Jon talked about his relationship with a landowner who was initially fearful that the farm would grow too large. A simple phone call opened the door for communication and Jon was able to ease fears and in turn gained a supporter who would reach out if he noticed anything “awry.” He said that “another time he called me and said, hey,

it looks like something's wrong with one of your lines. It was after a blowout gale or something like that. And I was like, Oh, thanks Ed.” Jon was able to go out and fix the line, and dropped some oysters off to Ed as a thank you. Through relationships, these stakeholders became stewards of their local farms.

Second, social license can also be protective when farmers’ livelihoods are threatened. For example, several farmers discussed instances when their supporters voluntarily showed up in their defense when they were under fire. Mark discussed a time when a genuine regulatory mistake had left him in a “pickle,” but his supporters—specifically those who were most impacted by his operation—went to bat for him.

They wrote letters to DMR for me. Three landowners that abut me, the three closest people to me, wrote letters. And then I also had just a crew of people who have become friends that buy my oysters or visit my farm, and I let them know about this. And some of them wrote letters, and some of them said I'm on standby. When you need me, I'll be happy to either write a letter or make a phone call.

Others who experienced more contentious lease hearings talked about how the positive support made a difference in both the outcome of their lease decisions and in their wellbeing. Ben discussed the “volumes” of testimony from lease hearings, citing that many of those testimonies were in support of the proposal and that “having their support certainly helped the department make decisions. It definitely helped us and our families and our crew.”

Jackson brought up Ben’s lease hearing as well as an example of the ways social license can benefit farmers. He said that the anti-aquaculture groups that had mobilized “went out to top media saying there’s a problem,” but that Ben and his partners “had done their ground work and people in their community weren’t talking to PBS or CBS or whoever because they knew what

was going on.” In this case, the support that they had from their local community helped prevent negative press. According to Jackson, this was a result of them going “from the community level up.”

Third, though social license work does have a cost—even if just in time and labor—farmers acknowledged that there are monetary gains to be made from building relationships. Like Bill said, these people are also “customers.” Claire discussed this as well, describing how giving away product to neighbors led to some of them becoming regular customers.

We had a few that were just about big enough. We get these ones that double up, oysters that aren't really any good for sales. And we had a bunch of those. And so instead of putting them down for the winter and feeding starfish with them, we decided that we would just go knock on doors, all the doors on the neck, the houses on the neck that overlook the farm. And the people that answered, I sat and chatted with them for a while, I gave them some free oysters. And some of those have become customers.

Lastly, though the concept of social license focuses on relationships between individual farms and their stakeholders, social license work can also facilitate statewide industry growth by creating positive public perceptions. Increased knowledge and awareness of aquaculture—often a result of farmer engagement—has been consistently linked to support for aquaculture development (Bouchard et al. 2021; Robertson et al. 2002; Thomas et al. 2018; Whitmore et al. 2019). Higher engagement with shellfish farms in particular has been linked to higher SLO (Sinner et al. 2020). Farmers are well aware of the importance of working “the ground game,” which Jackson argues is “vital” for the development of the industry.

Further, successful development of a truly sustainable industry requires social considerations. To achieve social license, farmers have to put community considerations and concerns at the forefront and find meaningful ways to engage and provide benefits. Ultimately, it is the community that controls social license, so farmers must genuinely invest in order to secure it (Lacey et al. 2012; Lacey and Lamont 2014). This can create long-term benefits for the host community.

2. Study Methods

To investigate social license in aquaculture we designed a qualitative study consisting of semi-structured interviews with 30 Maine seaweed and shellfish cultivators². Using a list of all commercial Standard, Experimental and Limited Purpose Aquaculture (LPA) leaseholders from the Maine Department of Marine Resources website, we were able to draw a random sample of farmers stratified by lease-type (standard and experimental vs. LPA), region (southern, mid-coast, and downeast), and aquaculture product (shellfish vs. seaweed). In total, there were 184 active and pending standard and experimental leases in Maine. After removing finfish farms and deleting duplicate leaseholders, we were left with 106 standard or experimental leases. We then stratified by region and aquaculture type and randomly selected 3 shellfish farms and 3 seaweed farms per region, resulting in 18 total leaseholders. Quotas for sampling were adjusted when there were no farmers left in a particular category. For example, there were very few seaweed farmers in Downeast, Maine, so some of these slots were filled with Mid-Coast seaweed farmers.

We opted to select more standard leaseholders than LPA leaseholders because of the more extensive public process involved with securing a standard lease. In Maine, standard leases

² This study was approved by the University of New Hampshire Institutional Review Board, IRB # 8414.

require scoping sessions and public hearings. Standard leases can cover a maximum of 100 acres and are secured for up to 20 years. LPAs, on the other hand, are less than 400 square feet and are renewed yearly, requiring little public input aside from getting approval from the town harbormaster, though landowners may submit comments. Our original list of all active LPAs consisted of 696 leases. After removing all non-commercial operations and deleting duplicate applicant names, 234 active commercial LPAs remained. We randomly selected two shellfish farms and two seaweed farms per region resulting in 12 LPA leaseholders. Participating farmers, their product, lease type and region are listed in Table 9.

Table 9. Participating Farmers

Farmer	Product	Lease Type	Region
Andrea	Oyster	LPA	Southern
Steve	Oyster	LPA	Southern
Sarah	Oyster	Standard	Southern
Tonia	Oyster	Standard	Southern
Kelly	Oyster	Standard	Southern
Mark	Oyster	Standard	Southern
Clark	Mussel	Standard	Southern
Carl	Oyster	LPA	Mid-Coast
Jon	Oyster	LPA	Mid-Coast
Bill	Oyster	Experimental	Mid-Coast
Hank	Oyster	Standard	Mid-Coast
Ben	Oyster	Standard	Mid-Coast
Glen	Oyster	Standard	Mid-Coast
Claire	Oyster*	LPA	Downeast
Judd	Oyster	Standard	Downeast

Adrienne	Oyster	Standard	Downeast
Kate	Mussel	Standard	Downeast
Phil	Scallop	LPA	Downeast
Julie & Ada	Seaweed	LPA	Southern
James	Seaweed	Standard	Southern
Anna	Seaweed	Standard	Southern
Lisa	Seaweed	LPA	Mid-Coast
Sharon	Seaweed	LPA	Mid-Coast
Michael	Seaweed	LPA	Mid-Coast
Paul F	Seaweed	Experimental	Mid-Coast
Joe	Seaweed	Experimental	Mid-Coast
Alice	Seaweed	Standard	Mid-Coast
Evan	Seaweed**	Standard	Mid-Coast
Jackson	Finfish***	Standard	Downeast
Sam	Seaweed	LPA	Downeast

*Was selected as part of the seaweed sample, also is licensed for seaweed but not currently growing.

**Also grows oysters.

***Was selected as part of the seaweed sample for past IMTA methods, kept in sample due to the value of perspective from a larger aquaculture operation.

Farmers were contacted via email to participate in a thirty-minute interview focusing on their planning and permitting process, stakeholder outreach, community engagement, and specific ways they have worked to gain the community’s trust. Farmers were provided with a consent form explaining the risks of participating (IRB #8414, see Appendix A) which they read prior to the interview. Most opted to consent verbally at the start of the interview, rather than signing and returning the form. Farmers were given pseudonyms but were aware that they may be identified by those familiar with the industry; anonymity was not guaranteed. We conducted most interviews using recorded Zoom video calls, though some were recorded phone calls or in-

person interviews. We then transcribed all interviews and then thematically coded using Nvivo qualitative data management software.

3. Social License for Maine Shellfish & Seaweed Farmers

Though many of the SLO generating practices from previous research are applicable across industries, farmers that participated in the making of this guide show how SLO work can be highly sector-specific. Farmers are operating within a unique network of stakeholders, responding to a unique set of public concerns, and engaging in a unique and novel activity with its own set of impacts and benefits. At the same time, they emphasize a key part of social license that is ubiquitous—that social license work is context-specific and place-based. Being in Maine, farmers are contending with stakeholder groups that have competing values and have created strategies for connecting with each group in different but meaningful ways. They are also navigating how to work their way in alongside other heritage industries that have been central to Maine’s economy for hundreds of years and offer insight into ways to do so respectfully. The following sections are an effort to organize and present how shellfish and seaweed farmers are ‘doing’ social license here in Maine.

3.1 Learning and Integrating

All Maine farmers discussed the importance of knowing the landscape—both physically and socially—and being able to seamlessly integrate into that landscape as a new user. This process of learning and integrating was evident during the planning stages, particularly in site selection, and in farmers’ overall approach with their host community after permitting.

3.1.1 Site Selection

Farmers recognized that site selection has as much to do with growing conditions as it does the social fabric and culture of the host community. Connecting with other users,

landowners, town officials and interested community members is an essential part of gaining insight into the community and in working towards early acceptance. Farmers suggested casting a wide net when determining your stakeholder network since neglecting groups, whether intentional or not, can be detrimental to gaining a community's trust (Thomson and Boutilier 2011). Michael talked about how they expanded their stakeholder network to include "every land-owner we could get our hands on" and "every lobsterman we thought might be in that particular area." Their team went beyond what was legally required by the permitting process to make sure that they connected with everyone who could potentially be impacted, or have an impact on the project. For Michael and his team, this was made easier because their corporate business structure included shareholders who were local residents and fishermen. Michael was also a local resident. Michael and his shareholders were already integrated into the communities and were connected to different stakeholder groups, which helped them gain credibility and trust.

In many cases, farmers were farming in their own communities where they were already well-rooted. They had accumulated social capital—a term that describes a person's social network (Putnam 2000). These networks provide certain resources that can be transformed into other forms of capital, like financial capital. In this case, farmers who had large social networks (social capital), primarily through living in their host community, were able to use those networks to gain support and grow their businesses. Adrienne talked about this in the context of her own farm, having grown up in the same town she is now farming in. Her husband and business partner also grew up there and was a lobster fisherman, which she said "helps." During site selection, she said "we just used our connections to find out if that specific spot would be problematic for any reason, and most people had no real reason to think that it was." Once her

site was finalized and they started the application process, she talked about how her people in her social network acted as advocates for her business and helped to spread the word.

Our family [knew], the fishing community knew, this attorney [knew], developers knew, other sea farmers knew. And so we had a handful of really meaningful conversations. And we were kind of known already in a small town. And so when a public notice goes out about that, there were a certain number of dialogue things that didn't actually have to happen, you know? My dad owns a bike shop, so they knew, and then my uncle is on the town council. So if we go in and we're talking about it at the bike shop, I feel like there were probably 20 conversations that were held about it that didn't actually directly involve me.

In this case, the resource gained from having these social connections was access to all of their connections' social networks. This in turn, increased community support for the project. So instead of having to go build these individual relationships, she was able to rely on her network to advocate on her behalf, and this was due to her history in the area and her work maintaining those relationships.

In cases where farmers were not from their host community, they used two primary strategies that required building these networks from scratch. First, was natural integration, where farmers would work their way into the industry slowly and in doing so, would build relationships and gain credibility. Paul talked about how his reputation earned through his “long histor[y] being around the seafood business and fisheries management” was key when starting his own operation. Over the course of his career, he spent time in the shrimp and groundfish fisheries, he worked for one of the largest lobster dealers, and even spent years as a fish cutter doing piece work. According to Paul, “you can't just expect to move to a new place and then take

a piece of the bottom right off the bat. To me, that's asking a lot.” While this type of slow integration isn’t feasible for everyone, Paul was speaking to a key part of social license, which is the importance of knowing your community and being respectful of community members.

A second strategy used by farmers who were coming in from other communities or who were new to the working waterfront was finding gatekeepers who were well connected to the waterfront. Tonia suggested that aspiring farmers “start talking to the farmers in the area first and see what they think” before starting the application process. Julie and Ada talked about how connecting with their local harbormaster gave them access to the local lobstering community. They were able to have a better idea of how their project would be received after he “ran it past” them and reported back. Overall, farmers reported that other aquaculturists, harbormasters and fishermen were most useful in gaining insight into information key to site selection, including relevant stakeholders and competing uses of the potential lease area. “You need to know the people there,” Joe said simply. He advised that while being an outsider “doesn't preclude somebody from out of town to getting involved if it's something they want to pursue. But they'd have to just take some extra steps in the beginning to get to know the community.”

3.1.2 Alignment in Approach

A second way that farmers demonstrated the process of learning and integrating was through value alignment in their business approach. Farmers showed that they were aware of local values and consciously tried to reflect those values in their operations. Sarah talked about how local ocean users respected the way she grew her business “really organically...start[ing] with nothing” because “that’s the way traditionally people worked their way up lobstering or in other fisheries here in Maine.” She said “you start with a little boat, when you finally make some money you buy a bigger boat. I don’t have any flashy things....so the way that I operated my

business and how I live my life, they identified with.” Jackson also talked about value alignment in his company’s growth, saying “we’ve been very slow, methodical, cautious about how we do things, which is kind of like the coast of Maine. That’s the way people are.” He said that by going “from the community level up” and “focusing on things that are important to that individual community” their company has been able to integrate into Maine’s working waterfront.

Farmers also reflected local values in how they structured their businesses. In many Maine coastal communities, fishing is central to community identity. Farmers in these fishing communities recognized this and saw aquaculture as a way of diversifying the working waterfront and giving watermen options. This alignment also benefited them in terms of social support (Leith et al. 2014). For example, Hank’s non-traditional cooperative business structure provided locals with the start-up capital and growing space to start their own oyster farm. This model was “a direct response to [his town’s] comprehensive planning exercise”—one that prioritized bolstering the working waterfront to help “water men and women who want to stay in a marine economy” which was quickly disappearing. This project only offered spots to local residents, and Hank said that “after communicating that, we didn’t have very much difficulty at all.” Their alignment with the values of the local community—maintaining their heritage as a working waterfront—was essential to their local support.

In another community with a long maritime history, Alice and her husband started their seaweed farm as “a way to help our fishing community because we had lost shrimping.” They decided early on that they would only hire fishermen. They also worked closely with lobstermen to time their season and kept their farm open for fishing even when they had “the ability to say we don’t want fishing in it at all.” She aligned herself with lobstermen, knowing that watermen

on the island are just “trying to make a living to support [their] families,” so working together was a priority for her. Because of this effort, the fishermen were key in securing their lease. When they faced pushback at their public hearing from some seasonal landowners who claimed that their farm was going to displace fishermen, the fishermen “all stood up and said ‘not going to hinder us. We think this is great.’”

These strategies demonstrate how farmers are actively trying to align themselves with local values in an effort to co-exist with other users and gain community support. SLO research across industries confirms the importance of this, arguing that value-alignment is key to trust-generation, which in turn generates social license (Leith et al. 2014; Ford & Williams 2014). In addition to learning, farmers also demonstrated an education component in their social license work that they said is important to their own social license as well as future growth of the broader industry.

3.2 Engagement through Education

A significant barrier to aquaculture development and local SLO for aquaculture companies is lack of public knowledge and awareness of aquaculture practices (Robertson et al. 2002; Mazur and Curtis 2006; Mazur and Curtis 2008; Freeman et al. 2012; Alexander et al. 2016; Murray et al. 2017; Thomas et al. 2018; Bouchard et al. 2021; Whitmore et al. 2022). Lack of knowledge and uncertainty can feed into fears about development. Many farmers recognized this. Jon said “when people think about aquaculture, they get scared because they don’t know.” Adrienne compared awareness of aquaculture to fishing, saying “Mainers know fishing, they get that, like it’s kind of in our blood. We can picture it and we romanticize about it, it’s what our grandfathers did, and sea farming is kind of something scary. It’s just different. We don’t know what it looks like.”

Considering the prevalence of concerns over visual impacts, many farmers brought up strategies they used to reduce uncertainty. During initial planning, farmers brought up the importance of connecting with stakeholders and explaining. Evan talked about how discussing the “actual” visual impacts with stakeholders makes a big difference.

Once you talk to somebody and explain to them what you're doing, and the benefits and the actual visual impacts, or maybe you can come up with ways that there could be a compromise, then all of a sudden, you realize that they shift 180 degrees, and they're excited to support it, because now they know about it.

Michael talked about how one of their riparian landowners “was concerned that it was right in front of her property. So she was a riparian landowner, but that she was fine with it once she understood what it was going to look like. I think that was the big concern.” Other farmers found using visuals to help landowners get a better sense of what their farm would look like was helpful during the application process. If these farmers hadn’t done the initial outreach, these stakeholders could have formed hardened opinions that were fear-based and opposed their operation.

Lack of knowledge can also create problems when the limited information community members do possess is negative. This was the case when Sam applied for a lease site in Lubec. Though he ended up deciding to site only in Eastport for unrelated reasons, he initially faced pushback because they weren’t familiar with seaweed aquaculture. The only experience they had with kelp was when a research organization had placed data-collecting buoys in municipal water for potential biofuel kelp sites without involving the town—even though they didn’t need municipal permission. According to Sam, because the application was for kelp, it “triggered

everybody” and they were “like oh, hell no, no, absolutely no kelp here.” In response to this, Sam explained what he was doing and was able to change minds.

I was like, listen, it's just two small lines. I understand these people came and dropped this mooring here for a data collecting buoy without your permission, but I'm coming here to talk to you about it. This is what I'm doing. It's small. This is my boat, I fish around people in your community too, I'm not trying to be some large corporate investment firm coming in to take up your bottom. And then it was a good conversation after that. It's just understanding any apprehension people might have to aquaculture and listening to them fully before you get defensive. Like I'm trying to have a small seafarm. Just listen to what they have to say first and see how you can console them the best you can. My first-hand experience.

Another consequence of this lack of knowledge is the risk that these knowledge gaps could be filled with information from anti-aquaculture interest groups, who according to Claire, are “trying to introduce a moratorium on aquaculture on a town by town basis.” Ben voiced this concern as well, saying that communities that are unfamiliar with aquaculture are “very susceptible to the gaslighting that's going on, because they really don't know. All they know is what they're being told by the anti-aquaculture people.” This emphasizes the importance of being “the one to tell people your side of the story before they hear somebody else's side,” in Evan's words. Claire said that the difference between towns where moratoriums have been successful, and where they have not, is “because there's been an awful lot of time and effort put in by local farmers, liaising with their communities to raise awareness of why the industry is important.

So farmers were clear on the solution: work to actively educate the public. In the planning and permitting, this involved extensive outreach explaining the details of their

operation. Once they were operating, they continued to educate community members via tours, interviews with the media and researchers, and involvement in schools and research institutions. Several farmers pointed out that this was an unexpected, but significant, part of their job as a farmer. SLO research also supports this strategy. Uninformed or uninterested community members do not contribute to social license—social license is about active community support (Thomson & Boutilier 2011; Sinner et al. 2020). Educating, then, is a way of creating more informed members of the community so they have the power to grant social license if they are in support.

3.3 Trust Generating Practices

Earning social license is a result of ongoing efforts to build trust with your stakeholders (Thomson and Boutilier 2011; Lacey et al. 2012; Moffat and Zhang 2014). Researchers who study public trust in companies have identified two different types of trust: integrity-based trust, and competence-based trust. Integrity-based trust is rooted in moral or ethical alignment—whether the company adheres to a set of principles that the public finds acceptable. Competence-based trust is whether the public believes that the company possesses the knowledge and skills that are necessary to run their operation (Butler and Cantrell 1984; Mayer et al. 1995; Kim et al. 2004, 2006; Poppo and Schepker 2014). When asking Maine farmers about their trust-generating practices, they described actions that contributed to both forms of trust, demonstrating that they are aware that the public needs to trust their character as well as their ability to farm. Farmers also brought up the importance of providing tangible community benefits and how those benefits can help contribute to integrity-based trust generation and boost social license.

The following section dives into three categories of trust-generating actions that farmers identified as key to gaining social license. The first category is communication-related actions

which includes voluntary communication, consulting and making accommodations, and honesty and transparency. The second category is operational practices, which includes reducing impacts, keeping a tidy farm, abiding by regulations, and being visible. The third category is community benefits, which includes helping others, filling community needs, employer/employee related actions and using your product to interface with the public. Table 10 describes these trust-generating actions, which form of trust they increase, and the percent of farmers who discussed each action in their interview.

Table 10. Farmer Identified Trust Generating Actions

Trust Generating Action	Avenue	% of Farmers
<i>Communication</i>		
Voluntary communication (not legally mandated)	integrity	100%
Consulting & making accommodations	integrity	35%
Honesty & transparency	integrity	31%
<i>Operational Practices</i>		
Keeping a tidy farm	competence integrity	38%
Reducing impacts	competence integrity	35%
Being visible	competence integrity	31%
Abiding by regulations	competence integrity	14%
<i>Community Benefits</i>		
Product as interface	community benefit integrity	66%

Filling community needs	community benefit integrity	35%
Helping others	community benefit integrity	28%
Employer/employee related	community benefit integrity	21%

3.3.1 Communication

The consensus among researchers is that quality communication plays an integral role in a company’s ability to earn social license. This was confirmed in aquaculture as well in a recent study where they found that positive interaction with aquaculture companies was the strongest predictor of higher social license ratings (Sinner et al. 2020). Maine farmers confirmed the importance of this action and offered deeper insight into what can make communication most meaningful, beyond just being positive.

Voluntary Communication

First, was the importance of voluntary communication, or communication with stakeholders that is not mandated by regulations. While all farmers discussed using this strategy, 41% of farmers specifically said that this action generated trust. Farmers shared examples of voluntary communication during their initial outreach and beyond.

During the leasing process, Michael talked about casting a wide net when identifying potential stakeholders.

Well, I think it's not just following the requirements of the license, which is riparian landowners. It's thinking of your constituencies and anybody that might be impacted by it. Like the story of the wind turbines in Nantucket, which they weren't on anybody's property, but everybody complained about them because

they could see them. So people are going to at least notice your farm, and notice that you're there working during certain times of the year. So I think our strategy was to talk to everybody we could get our hands on. And to make it very public and to do personal contact with the right people, fishermen and landowners.

Like Michael, other farmers agreed that meeting the regulatory requirements for public involvement outlined in the leasing process is the absolute minimum. Nearly all farmers discussed the importance of being proactive with outreach and many specifically said to start outreach prior to submitting any application paperwork. Tonia advised that it's never too soon to start, "but definitely before you submit your final lease application...you don't want that to be the first time the public's hearing about it."

Farmers also talked about the importance of being willing to talk with folks beyond the initial outreach period. Taking the "five minutes," as Evan said, to talk to folks makes a big difference because it's an opportunity to make a good impression. He pointed out that "it's really easy to start forming opinions about somebody that you never see, but when you see somebody and you get to know that person... you're gonna get to know the kind of person they are." This speaks to the way that taking opportunities to interact with others helps to build integrity-based trust. Claire shared similar advice when talking about other users.

Over the past few years we just made sure to try and be nice to them, you know, stop and talk to them, give them a history. We had one just on Saturday, a group came by, were kind of hanging out near the farm and they obviously were interested in what we were doing. So we just drove over and chatted to them. First, I think they were a little worried that we were going to shout at them to get

out of here, but we weren't. It's like, hey, just saw you hanging out. And, yeah, they were interested and asked some questions.

It is this voluntary communication over time that gives stakeholders the opportunity to get to know farmers and develop trust in their character. Sarah talked about her primary engagement strategy. “Well personally,” she said, “I walk right up to people and start talking to them, like when I see them at the dock, or when I see them on the water.” She also attended town meetings to meet local community members. She said that “people needed time to get to know me, and still do. I’ve been operating seven years but that’s nothing in comparison to the length of relationships on the waterfront.”

Consulting & Making Accommodations

Consulting with stakeholders about plans, rather than simply informing, was another important form of communication that helped to generate integrity-based trust. Bill brought up an example of how running expansion plans by their neighbors prior to filing showed that they were “willing to talk and being open” and “just that simple communication has been helpful.” Even further, farmers brought up the importance of making accommodations based on stakeholder concerns. Making real changes in response to feedback provides stakeholders with tangible evidence that farmers are listening to concerns and want to be good neighbors. This evidence helps to build the integrity-based trust necessary for SLO (Thomson and Boutilier 2011; Moffat and Zhang 2014; Voyer and van Leeuwen 2019;). Joe described how he changed his set up in response to some objections from other lobstermen in the area.

What I was originally going to use, which a lot of guys use is big concrete blocks. 1000, 1800 pound blocks. I switched over to using all pyramid anchors and mushroom anchors. And they're all 200 or 250 pound anchors. I've got 40, well I

just bought more, roughly 50 anchors I use. And so I go scalloping in the wintertime. So my boats rigged so I can get these up and down relatively easily. So it really works out well. It's a significant investment in all the anchors and the lines. But it just allows me to be in there during my lease time. And then during the offseason, because there's some lobstering going on there. Not much. It's just, I empty it right out. It takes me two days to construct the farm and two days to get everything up, so it works. It keeps everybody happy.

Though they required some upfront costs, to Joe, these accommodations were worthwhile. As a lobsterman himself, he respected their concerns and made real changes so that other users felt more confident about any potential impacts.

Honesty & Transparency

Lastly, 31% of farmers brought up the importance of being honest and transparent in generating integrity-based trust, which echoes the research on social license (Thomson and Boutilier 2011; Hall 2014; Moffat and Zhang 2014; Voyer and van Leeuwen 2019). Farmers described several instances where honesty and transparency is key, one of which is when conveying plans to stakeholders. Steve talked about how being upfront about potential growth is important.

I think it's all about communication and transparency. You know, I think it's important to talk about your goals of your farm and what you're long-term looking to achieve. It's one thing to say, 'Oh, hey, I'm just opening up a single LPA' when you're planning on putting in five acres in two years. I think that's important.

Social license is dynamic and can be easily lost through violations in trust. Though it may be tempting to downplay impacts and overemphasize benefits to allay fears, research has suggested that transparency and openness can lead to better social license outcomes (Hall et al. 2014). One farmer described his experience with this during their expansion. In an outreach letter describing the change to neighbors, he said that they didn't include the final acreage, hoping that they would "be able to have that conversation face to face with people" at an upcoming farm event, the invitation for which was included in the letter. While this wasn't an attempt to keep folks in the dark, local opposition used this omission against them, claiming that they were being secretive—an attack on their character. Luckily, the farmers had a long-standing reputation to buffer this attack and had done their due diligence on the lease application, so they were eventually awarded their lease after a lengthy legal process. While there is no definitive way of knowing whether including the acreage would have changed the nature of their opposition, he said that "hindsight being 2020, I think I would have put the size in there."

Farmers also cautioned about overstating the benefits in an attempt to win folks over. Jackson said "try to not be promising the world out of the gate....don't promise that you're going to employ 10,000 people, all this sort of stuff." Others also encouraged farmers to be open about not having all the answers. Bill said he has found it beneficial to "communicate some of your own uncertainty as you as an operator grow and learn." Steve talked about how being open with "what's happening at the farm, good and bad" in his newsletter has helped with his connection with his customers.

I tell people all of my trials and tribulations, like this last year, I brought my oysters up from their winter's nap in March, and they looked fantastic. And I let some just loose on my farm all winter. And everything was great. And then I left,

and I didn't come back probably for three or four weeks till the end of April. And when I came back, like April blew all month, not like storm blew, but just like consistently blew. And when I came back to the tide bank, the sand had shifted and had covered my entire oyster bed in about eight inches of sand. And you know, when you can only really address your farm at low tide, that gave me like an hour to try to excavate with a shovel. So I lost 1000s of oysters. So you know, it's heartbreaking stuff like that. And so I just share that stuff.

While the amount of communication for each farmer varies depending on certain factors like sale method or where they access their farms, all farmers have the ability to build integrity-based trust by following through with promises.

Michael said simply, “we do what we say we’re going to do...we don’t flinch on any commitment we have.” Bill echoed this, saying “be good on your word.” Kate talked about how following through with promises repeatedly is what generates social license, and this has real benefits for farmers when those stakeholders are willing to go to bat for you.

*So we made this arrangement, and we stick to it. And then the next time, we stick to it. And then the next time, you do what you said you’re going to do. And then at the public hearing, they'll stand up and say, **“these guys do what they say they’re going to do.”***

This example demonstrates how gaining integrity-based trust through consistency in follow-through can generate social license.

3.3.2 Operational Practices

Farmers discussed a variety of operational practices that helped generate both integrity and competence-based trust. Many of these practices were motivated by farmer’s efforts to make

a good impression and avoid being noticed for the wrong reasons. Compared to active outreach, these practices could easily go unnoticed in their role in trust generation, but according to farmers, they were key in establishing legitimacy and credibility within the working waterfront.

Keeping a Tidy Farm

Interestingly, the most frequently discussed trust-generating operational practice was keeping a tidy farm. Farmers were acutely aware of the importance of avoiding negative attention at this point in the industry's development.

We keep the farm clean. We tend our equipment. I guess another answer is we've never lost a piece of gear, because we way over build everything. We only use knots, we don't use long line clips, like we've never lost a cage, we've never lost a line. So I think obviously for the lobstermen to see this thing not become a snarl and also just be floating around the bay screwing everyone's lines up, I don't think that they notice, but I think they would definitely notice if we didn't do it right.

Jon talked about how he has consciously worked to incorporate this practice into their business. This practice helped to create positive impressions even when they were not around to talk with people about their operation.

*I would say leaving our workfloat shipshape. So, and this comes from my sailing career, I guess. At the end of the day, we tie our boats up, the bow and stern. before we're spraying in *inaudible*, the kids, they would leave the float and go back to the dock with and leave a mess. But no, this is the way we do it. So like we hose off all the shell and slime and everything. And the tumbler, all the wood parts are painted white. We take a sponge and hose all the mud off and it looks*

like a brand new tumbler. The culling table has mud all over it, we hose it off and sponge it down, sponge off the legs and everything. We pack all the bags in tight underneath there. We pack them in on the ends so that they don't blow away. All the orange crates get stacked and pushed aside. Everything's tight, shipshape, nothing's flapping and dragging around. If somebody comes by when we're gone, it looks like a well-kept workfloat. There isn't junk everywhere. There's no trash. Everything's well-kept.

Adrienne agrees that a “good clean farm...goes a long way.” Others say they try to avoid the farm being “too disheveled” (Paul), “an eyesore” (Tonia) or a “mess” (Phil). This emphasis on keeping the farm organized and tidy reflects efforts to gain competence and integrity-based trust from stakeholders—that farmers know what they are doing and are careful that they aren't creating unnecessary hazards with gear “floating away outside of the cove” (Sam) or “having too much in the way that's going to cause an accident” (Claire).

Reducing Impacts

Another trust-generating action farmers discussed had to do with reducing or minimizing impacts (35%). Reducing impacts has been shown to influence successful aquaculture development in other places (Katranidis *et al.* 2003) . Similar to keeping a tidy farm, reducing impacts appeared to be motivated by wanting to avoid negative attention, yet this practice was broader and helped to generate both competence and integrity-based trust. Like keeping a tidy farm, these practices help farmers gain their stakeholder's confidence that they know what they are doing, but many of these practices also demonstrate elements of integrity—that farmers are considerate and respectful of others. Lisa described how they are hyper aware of their volume in their cove.

We always try to keep our voices down because it's an open cove, and people do live on the cove. So we always try to respect them. Keep the volume down. And then if we do use anything that is loud, we usually try to take it off the ocean and do it at home. So when we clean the cages, we bring all the cages in and we take them to our house and that's when we clean them. And so we just try to keep the noise down. We try to do no wake, that's another thing.

Reducing noise impacts was one of the most frequently cited ways of reducing impacts (50%).

Farmers also discussed reducing visual impacts through gear choice as a way of minimizing their impacts on other stakeholders (60%). Glen discussed both when describing his operation.

I use a plastic sorter and I probably always will. It's slower but it's quiet, you can't hear it 200 yards away. So that was just one of several things I did to try to accommodate the people that live around me. And perhaps, I don't know if you noticed, I don't use the cages to grow in. If you look out there I just use those bags, and if you look across the river, Bill Clark's lease is over there, and he likewise uses bags, and I'm sitting here and I can't see his bags.

Kate talked about minimization in the design of a new system for collecting spat. She said that they “took a long time to try and find the least environmentally and socially impactful system.”

Steve talked about reducing his impacts by eliminating plastics.

All of these practices helped cultivate both competence and integrity-based trust. These efforts gave stakeholders confidence in their ability to farm without excessive impacts, and it demonstrates that farmers care about how their operations impact others, which speaks to their character.

Visibility

A third practice brought up by farmers was simply being visible as members of the working waterfront. According to Evan, being out on the water or at their local dock putting in the work “giv[es] them the opportunity to see what you’re doing and how hard it is.” Jon echoed this, saying “if anybody has a problem with this...it’s not going to be the public. Because we are out there, and they see us.” Andrea touched on this as well. Being seen working hard every day on her farm has helped her gain the support of riparian landowners. She said “they see me working from that mooring field. They could see me in the morning dragging my bags down and my generator, all the things...and they see me when I’m coming in at sunset dragging coolers or bins of oysters up the dock.” For shellfish farmers operating during the summer months, this has proved an easy task, especially in more populated areas or when farmers access their farm using a shared dock. The hard work is a given.

For seaweed farmers, farm visibility can be more challenging due to seasonality and minimal gear. Like Joe described, “there’s nothing on the shore, storage stuff, like any kind of oyster farm would have, it’s just buoys in the water and polyballs on the corners,” so it’s less noticeable. Regarding seasonality, Sharon said “in the wintertime, we have such a small community and usually no one’s even around,” yet she still brought up visibility when talking about gaining her community’s trust. She said that during their harvest, “people are interested, you know, if we bring it to the dock and we’re loading it onto the boat or something, people are interested.” Michael talked about using the local fisherman’s co-op facility when they land their crop. He said that “being there at the co-op exposes us to, I think there’s 40 members, 40 fishermen at the co-op. So they know we’re there, they know they’re helping us with their facilities, using their facilities.” That visibility “helps.” Julie and Ada increased their visibility by

renting greenhouse space at a local community farm to dry their product. The farm gave formal tours, and apparently “the kelp drying aspect was by far the most, people were the most interested in it.” According to Julie, this gave people the opportunity to “see what we were doing.”

While visibility helps farmers on a social license level, it also helps build positive perceptions more broadly by increasing familiarity and normalizing aquaculture as part of the new working waterfront. Paul said that it’s important to “have it out where people can see it, and maybe the kids see it and go home and explain it to their parents or something.” He said “you don’t want to be doing this stuff with a bushel basket over it.”

Abiding by Regulations

Lastly, a handful of farmers brought up abiding by all regulations as a way they earn trust from their stakeholders. Sarah said that “those regulations are there for a reason” so to “put the reflective tape on. Make sure people know that it says seafarm and your name, and where it is.” Bill and Tonia both discussed the importance of keeping your site well marked. Tonia specified that this was to alert other users who are often in their lease site of potential hazards, although she specified that “it’s not like ‘don’t come here,’ it’s ‘come here, but know there’s a farm,’” and this “helps to keep that trust.” Kelly also said that being “rule followers in most every regard” helps to maintain the community’s trust in her company.

This practice also helps to build both forms of trust. Following the rules demonstrates that farmers are knowledgeable about the requirements of their lease, that they are aware of other uses and how disregarding rules like proper marking could be hazardous, and it also demonstrates aspects of their character, like Kelly’s comment about being “rule followers.”

3.3.3 Community Benefits

Researchers agree that in addition to quality engagement, stakeholders also need to experience tangible benefits that help to offset the risks associated with operation (Mason et al. 2010; Hall 2014; Zhang and Moffat 2015; Zhang et al. 2015; Moffat et al. 2016). In aquaculture specifically, community benefits that are often cited include contributions to the local economy including job creation and tax revenue. Farmers did cite their role as employers as an important community benefit, but brought up a variety of other benefits that they provide to community members that help boost support for their operation.

Product as Interface

Compared to other resource industries where SLO is being used like mining or green energy, aquaculture has one key SLO advantage—the output is food, which is a tangible and accessible product that is desirable to a variety of stakeholders. Simply by selling locally, farmers are providing access to a high-value food during a time when locally-grown is especially meaningful. Some farmers chose to sell direct to restaurants or locals because they “wanted to be hyperlocal,” like Steve. Yet even those who sold mostly wholesale found opportunities for face-to-face exchanges over their product. Kelly talked about participating in the Maine Oyster Festival and how despite their preparedness for questions about the farm, “all they want[ed] to do [was] eat the oysters. They just wanted to know that these oysters came from Maine. And they were awesome.”

Additionally, farmers often gave discounted or free product to neighbors to “maintain relations” as Glen described. This kind of offering helps to generate social license in three ways. First, it is a direct benefit to locals who are often most impacted by the operation. Wealthy riparian landowners may not value aquaculture as a job generator, but they may see value in

having access to local oysters delivered to their dock. Second, the gesture helps to build integrity-based trust by demonstrating that farmers are even willing to lose a little bit of money in an effort to provide benefits to neighbors. Third, this aids in relationship building. Claire talked about how they gave some oysters that had “doubled up” to neighbors. She said she “would just go knock on doors, all the doors on the neck that overlook the farm. And the people that answered, I sat and chatted with them for a while and I gave them some free oysters.” Not only did this effort provide the opportunity to build relationships with those living on the neck, but she also reported that “some of those have become customers,” which has benefitted her business as well.

Interestingly, these practices were just as common with seaweed farmers as they were with shellfish farmers. Kelp farmers found opportunities to share their product with locals. Michael sold their dried kelp at a local “truck farm,” saying it was “very popular.” Alice said that they give extra product away to neighbors and have even sold to a local restaurant who features it in their specials. Sam talked about giving away samples of his dried kelp to locals. He recognized that if he “ever wants to expand one day into like, big big, I will need the community. They can have an opinion on whether they think I can expand or not. And so it is important that they like what I’m doing.”

Fulfilling Community Needs

Farmers also talked about how fulfilling community needs was an important practice for generating trust, from serving on committees and boards, to coaching local sports teams. Kate said that she has “spent time and time and time serving on I don’t know how many committees at state level and municipal level.” Several farmers brought up their involvement with local schools. Adrienne said she has “never turned down a school group,” and Michael talked about

how during their first year, they participated in “kelp night” and that “it really helped introduce us into the community and the whole idea of kelp in the community.” Ben and Jon both talked about coaching local youth sports. Ben said that being “active in our community” helped because “people knew our character.”

All of these examples were acts of service. Though farmers do benefit, as these practices help them become better integrated into the community, gain trust from stakeholders, and increase public awareness of their operation, the primary beneficiary is the community. Empty committee seats need to be filled, youth programs need coaches, and schools need support. These benefits are tangible, and in many ways are more meaningful and affect more community members than job creation.

Helping Others

Looking out for others on the water was a third community benefit that many farmers discussed. Judd talked about how he was able to notice when people were in trouble because he’s out on the water all day.

Because I’m not moving I’m just sitting here, I notice when boats have lost power, when somebody’s run aground, when a lobsterman loses a trap or like totes off the back of his boat. I’m not moving I’m just sitting in one place all day so I notice a lot more stuff, and so on many occasions I’ve given somebody a tow, pulled somebody up the rock, run a lobsterman down and give him back his totes that I saw fly off the back of his boat. I think that definitely has given us a fair amount of cachet at least with the water going people here. And you know, word spreads, people are like ‘hey I heard you helped out what’s his name last week.’

He acknowledged that this helped to boost his credibility with other users. Credibility is the foundation of integrity-based trust (Thomson & Boutilier 2011). Other farmers told similar stories, from returning sand toys and beach balls to contacting the owners of a flipped sailboat to pulling a child out of the ice. For Kelly's farm, though they had a contentious lease hearing, "a lot of people spoke publicly on the record" about how they "really are guardians of the creek in a lot of ways." Though she cautioned that social license "changes on a dime," she said that it's important "to have the respect of the people." Being willing to help others is clearly an avenue to gain this respect.

Employee/Employer Related

Lastly, farmers did discuss employment related aspects of their businesses that helped to generate community trust. James said that "creating a culture in the company of trust and a sense of community within the company has a big impact I think in terms of how you're perceived outside." Kate was proud of how her farm treats their employees, saying that "people go away from us saying they're the best people to work for. I'm getting recommendations on Facebook from people who used to work for us saying 'I fully recommend them. They're wonderful people to work for.'" Their reputation as a good employer helps create positive impressions of their business.

Some farmers also brought up how employing locals helped to further integrate their business into the local community. Alice talked about being selective of potential employees—limiting their hires to local fishermen who were in need of supplemental income. She pointed out that this practice also "really helps us in the public sector" but "that's not why we did it." Michael talked about this as well when selecting shareholders. They "hand picked" local lobstermen who were "leaders in the fishing community. So they all have good reputations of

being good citizens...and following rules and doing what you need to do to be good lobstermen. So that helps our credibility as well.”

While the importance of providing local employment opportunities has been shown to increase acceptance of aquaculture operations more broadly in several studies (Murray and D’Anna 2015; Dalton and Jin 2017; Krovel et al. 2019; Whitmarsh & Palmieri 2009; Hynes *et al.*, 2018; Katranidis *et al.*, 2003), farmers have shown how this works on a local level—through integration and reputation.

3.4 Facing Opposition

While social license work can help prevent opposition, even farms who are well established members of the community and have done the work necessary to gain the community’s trust have faced stakeholder pushback at certain points in their growth. Kelly experienced this first-hand when they applied for a larger lease. She pointed out that when “you want to make a change, then people will reevaluate that social license.” Farmers agreed on the best way to manage these challenges—to take the high road, be respectful, listen and respond, and when you find yourself facing folks who are not willing to have a respectful dialogue, disengage. Like Alice said bluntly, “there just comes a point where it’s like, I can’t accommodate you people anymore. It’s not working.” Though she reached this point with a handful of landowners, this didn’t influence the quality of her interaction with them. She said that this past summer, her husband spent “probably four days helping [one of the opposing landowners] fix his waterline” to his island home. She said that “we could shake hands and walk away fine afterwards, and disagree about this one thing.” This speaks to the value of integrity-based trust. The landowners were opposed to the operation itself rather than attacking the character of the farmers. This indicates that the SLO relationship is functioning well (Boutilier 2017). Other

farmers also discussed similar strategies. Kate talked about how she refused to engage in “mudslinging,” and instead opted to “rely on the equity I have had historically for the last 17 years in the community.” By continuing to focus on building support, rather than fighting with the opposition, farmers maintained respect and integrity in the face of challenges.

Lastly, it is important to note that research suggests that in some cases, there are certain communities that will be less willing to issue social license due to conflicting community values (Whitmore et al. 2022). While values change—and the social license work that farmers are doing plays a role in that change—farmers pointed out that in some places, aquaculture operations just might not be a good fit. Sarah talked about how she was looking into a second potential lease site on a private salt pond. In an effort to gauge potential support, she sent “a letter and photographs” to all of the riparian landowners, nearly two years in advance of when she planned to submit an application. She said that she heard back from every landowner, “and everyone was opposed to it except one person.” Due to the response, she said that she might look elsewhere.

Other told similar stories. Sam talked about another farmer who was trying to start a mussel project in an area that “wasn’t going to bother anybody.” He said “there were just too many people that were just like, aquaculture? No. Nope. Not here.” In Sharon’s community where lobstering dominates the working waterfront, she said that “I would love to do shellfish, but because it has to be in the water year-round, I would never take up fishing bottom with mussel rafts or anything like that.” Her seaweed operation was a better fit for their area, since it did not conflict with their primary industry. Stories like these suggest that in the process of learning about the host community, farmers should also consider how their operation would be received based on community fit and how they could tailor their operation in a way that would better align with community values.

4. Conclusion

With the growth in shellfish and seaweed aquaculture in Maine, social license is becoming increasingly important as the industry faces place-specific social challenges that require careful navigation and creative approaches. Farmers already operating in Maine are trying to carve out a place in a working waterfront dominated by heritage industries that are “in our blood.” They are also dealing with a rapidly changing coastline that is bringing a new, competing set of values surrounding acceptable use of the coast. Further, aquaculture as a practice, though not new, is relatively new in Maine, which presents additional challenges like public uncertainty and fear around impacts.

With these challenges, farmers in Maine are working hard to gain the community support necessary to grow their own businesses and the broader industry. They are doing this through social license work—regular practices that function as a way of gaining integrity and competence-based trust—both of which are necessary for social license. While these practices are wide-ranging, they cluster around the process of learning and integrating into the community, community education, communication, daily operational practices, and in offering community benefits. Certain strategies are more or less effective or valuable depending on local context.

While this research offers unique insight into how Maine farmers are doing social license, there are certain limitations that should be noted. First, this study focuses solely on farmer perspectives. Practices that farmers deem effective may be perceived differently by community members. Future research should include stakeholder perspectives as a way of validating farmer trust-generating practices. Second, this guide is specific to the Maine industry which is dominated by small to medium-sized aquaculture operations in rural areas. Most farmers are embedded in their communities, making organic social license work easier. Future research

should investigate areas outside of Maine to include look for urban/rural differences in social license work. Further, the population in Maine is racially homogenous and the sample of farmers reflected this—all participants were white. Future work should include a more diverse sample of farmers. Lastly, this project focused on shellfish and seaweed farming, both of which are touted as environmentally benign forms of aquaculture. Future research should apply a social license framework to more intensive aquaculture operations to see the interplay of environmental and social impacts.

Despite these limitations, there is great utility to this work for Maine shellfish and seaweed farmers and the industry in Maine more broadly. While social license work is essential for farmers' individual success, this work fuels broader industry growth. Every positive interaction is an opportunity to create the experiences necessary for moving the needle on public perceptions, and Maine farmers are hyper aware of this connection. By working the “ground game,” farmers are able to gain the support of their local communities, spread awareness about the benefits of aquaculture, and help to humanize what can be a “faceless” industry. Most importantly, Maine communities also benefit from this social license work because it puts community well-being at the center of conversations surrounding development, which is essential for growth of a socially sustainable industry that can provide food, livelihoods, and fill local community needs.

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DISCUSSION & CONCLUSION: LINKING CHAPTERS 1-3

Contribution to SLO Research

Though three distinct chapters, together, this body of work offers a wholistic view of how social license to operate works within aquaculture. At its core, SLO underscores the importance of the relationship between a company and its stakeholders. Prior research has highlighted the ways that companies seek to gain social license through macro processes like communication, yet little research exists looking at micro processes that aquaculture farmers utilize to gain support and trust from stakeholders. Further, while researchers argue that local context is an important consideration in working to gain social license, research looking at community dynamics that might influence social license is scant. This research considers both parties in the SLO relationship, showing how aquaculture farmers work to gain trust, and how communities may be more or less willing to trust incoming companies independent of company actions. Chapter 3 also introduces the use of integrity and competence-based trust, showing that companies seek to build both forms in their work to gain social license. Figure 9 offers a visualization of this relationship.

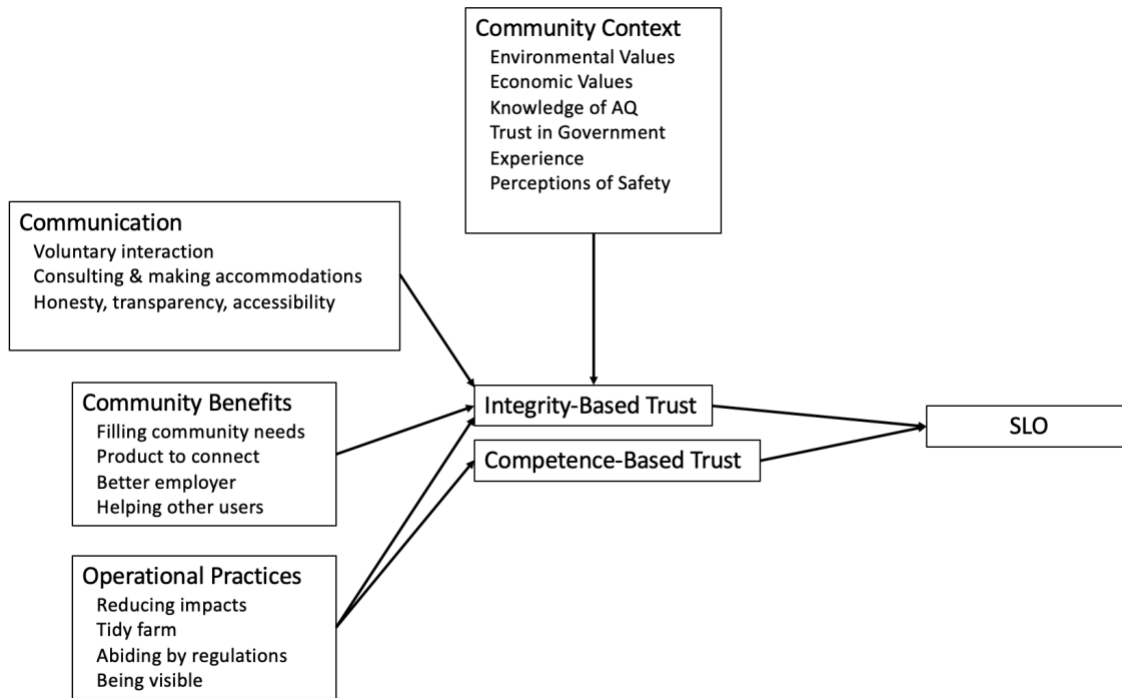


Figure 9. Visualizing the community and company effects on SLO through two forms of trust.

This version builds on an empirically verified path model of SLO from Moffat and Zhang’s 2014 work measuring SLO in the mining industry. While certain elements of SLO are clearly ubiquitous across industries—mainly, the importance of communication and the need for tangible community benefits—the way in which companies fulfil these SLO needs is industry-specific. For aquaculture operations, communication often includes educational components. Farmers argue that education is an essential part of earning acceptance on a local and industry level. The community benefits provided by Maine aquaculture operation also look very different when compared to prior research in other industries. There are several reasons for this. First, unlike industries such as mining or green energy, aquaculture operations provide a very accessible food product that is linked inherently to place. By selling locally or providing discounted or free product, farmers are able to build relationships through the product itself.

Second, most Maine aquaculture operations are small-scale, with the owner/operators living in or near their host community. This allows them to engage with their communities in organic and informal ways that can be less costly to farmers and may be perceived as more meaningful by some community members. However, more research is needed to assess how community members are perceiving local community benefits provided by aquaculture companies.

Further, though aquaculture is not a new practice, in many places aquaculture activity is limited or nonexistent. Additionally, in Maine, farmers are trying to situate themselves in a well-established working waterfront that has been historically dominated by heritage industries. Thus, farmers must first work to gain legitimacy—the most basic level of social license (Thomson and Boutilier 2011)—in ways that other industries may not. This shows up in their trust-generating operational practices or in the way that they incorporate education into their outreach.

Lastly, this model also incorporates industry-specific public concerns that might condition a community's willingness to issue social license, some of which are apparent in the ways that farmers seek to gain approval. For example, farmers were clearly aware of the importance of community perceptions of environmental impacts. Farmers discussed going to great lengths to educate community members on the environmental benefits of their operations and also discussed the various ways they worked to reduced their environmental impact. They were also aware of community perceptions of use-conflict and how coastal communities value their heritage industries. Farmers worked hard to reduce tension or conflict with other users by consulting with stakeholders and making real accommodations to better co-exist. Finally, farmers were aware of how public perceptions about aquaculture are often conditioned through experiences with aquaculture and thus prioritized making positive impressions, even when short on time.

The experience connection between social license work and broader public perceptions on its own is another important contribution of this body of work. There are transformative effects of SLO work, and farmers are very attuned to this. When farmers are doing social license work, they are creating the experiences necessary to generate positive public perceptions of aquaculture more broadly, which could then influence a stakeholder's willingness to issue social license to other operations, leading to industry growth. They also recognize the role of social capital in this process—acknowledging that making a positive impression on one individual could lead to them advocating for their operation (or the broader industry) within their social network as a result. Thus, by making an impression on one stakeholder, they could also be accessing and influencing members of that stakeholder's social network. The more relationships built, the more opportunities for that social dispersion. In sum, while social license work transpires at the community-company level, it can have broader industry effects when those experiences shift public perceptions.

SLO as a Sustainability Tool

This research also highlights the way SLO functions as a tool for social sustainability. Simply, the process of earning social license requires that aquaculture companies put communities at the forefront. In building support, companies must communicate and consult with a wide range of stakeholders, make accommodations when necessary to better co-exist in a shared resource, and offer tangible, meaningful community benefits. They must engage in this work throughout the life of the project, as social license can be withdrawn at any point if trust is broken. All farmers involved in the third chapter of this study were aware of the importance of gaining community support and worked hard to generate trust in ways that were meaningful and appropriate for their particular community. They did this, in part, to reduce potential community

opposition—and this is exactly how social license works to empower communities. While the majority of farmers interviewed experienced little to no community opposition, they continued to do the social license work nonetheless. In sum, social license functions as a tool for social sustainability because it encourages farmers to think about their operations as part of a broader community and prioritizes gaining community support. The result is an industry that is aware of public concerns, communicates robustly with stakeholders, prioritizes being transparent and trustworthy, and works to integrate seamlessly into the working waterfront.

APPENDIX A

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02-Nov-2020

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IRB #: 8414

Study: Social License to Operate within Aquaculture

Approval Date: 02-Nov-2020

The Institutional Review Board for the Protection of Human Subjects in Research (IRB) has reviewed and approved the protocol for your study as Exempt as described in Title 45, Code of Federal Regulations (CFR), Part 46, Subsection 104(d). Approval is granted to conduct your study as described in your protocol.

Researchers who conduct studies involving human subjects have responsibilities as outlined in the attached document, *Responsibilities of Directors of Research Studies Involving Human Subjects*. (This document is also available at <http://unh.edu/research/irb-application-resources>.) Please read this document carefully before commencing your work involving human subjects.

Note: IRB approval is separate from UNH Purchasing approval of any proposed methods of paying study participants. Before making any payments to study participants, researchers should consult with their BSC or UNH Purchasing to ensure they are complying with institutional requirements. If such institutional requirements are not consistent with the confidentiality or anonymity assurances in the IRB-approved protocol and consent documents, the researcher may need to request a modification from the IRB.

Upon completion of your study, please complete the enclosed Exempt Study Final Report form and return it to this office along with a report of your findings.

If you have questions or concerns about your study or this approval, please feel free to contact Melissa McGee at 603-862-2005 or melissa.mcgee@unh.edu. Please refer to the IRB # above in all correspondence related to this study. The IRB wishes you success with your research.

For the IRB,



Julie F. Simpson
Director

cc: File
Safford, Thomas

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