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Mapping the Politics of the Future Growth in Maine's Aquaculture Sector

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EXECUTIVE SUMMARY

Aquaculture sits at the nexus of many coastal issues in Maine, such as the privatization of coastal marine space, real estate development and gentrification of coastal communities, the decline of working waterfront communities, commercial fishing regulations, and other tangential issues such as offshore wind development. Maine's aquaculture sector is expanding because of economic opportunity and the need for social, economic, and ecological diversification of food sources along the coast. Despite this desire for growth, conflicts and a lack of community engagement have built varying misconceptions and levels of trust in communities and among stakeholders actively engaged in aquaculture's development. Regulations about lease sizes, consolidation of leases by corporations or large investors, out-of-state interest, and ecological carrying capacity have been at the forefront of contention within communities. Given the differing sizes of aquaculture companies, the variation of species farmed, and the differences in demographics across communities in Maine, aquaculturists have struggled to build social trust and credibility, which has seen varying results.

For our project, we aimed to account for all stakeholders directly linked to the growing aquaculture industry, assessing their power and positions on the issues they face. In using legislature hearing transcripts on regulatory bills as proxy data and relevant literature on aquaculture to support our data findings, we were able to craft the two deliverables of our project; an actor-network map highlighting stakeholder positions, relations, and power dynamics followed by a set of recommendations and processes for stakeholder engagement. The map will be a resource for assessing and identifying where tensions need to be dissolved and where coalitions between stakeholders can be made. The recommendations aim to build on the theory of social license to operate, where aquaculturists, community members, researchers, and policymakers work together to form mutually agreed upon industry standards and regulations to shape future growth.

The recommendations included methods of community outreach and empowerment that aim to maximize the number of community members reached, increase their access to information, and involve them in decision-making processes regarding research and policy-making. These methods would include, but not be limited to, public forums, cooperative research, advisory groups, public listening sessions, and decentralized decision making. They can be viewed in more detail under the recommendations sections. These methods of community engagement will necessitate various additional components to complete, such as funding and staffing the community and municipal organizations within each of the communities helping expansions of aquaculture farming. We hope these serve as tools and resources to solve and ensure the healthy growth of aquaculture farming in Maine.

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INTRODUCTION

BACKGROUND

Maine– a leader in maritime commerce in the United States– has long been dependent on its marine resources for its economy. Its coastal communities have historically prided themselves on their wild fishery stock and annual marine harvests. While Maine's commercial harvest of marine resources has exceeded historical figures in recent years (amounting to $637,174,944 in 2018), its wild-caught fisheries face serious threats from the rapid warming of Maine's Gulf, increasing real estate development, increased regulation, and other social and political forces (State of Maine Department of Marine Resources 2021). Amid an ever-changing socio-political sphere, aquaculture has been identified as a sector that can alleviate economic and social turmoil that wild-caught fisheries may face in the coming decades due to climate change and warming waters.

In its simplest and most broad definition, aquaculture is the controlled "breeding, rearing, and harvesting of fish, shellfish, algae, and other organisms in all types of water environments" (oceanservice.noaa.gov 2021). Conceptually, it is analogous to the domestication and raising of farm animals– in that human systems exert control over food production– as opposed to hunting or fishing, where individuals of each species have agency. Both in Maine and across the world, aquaculture has been identified as a strategy to provide nutritious food to growing communities while also decreasing anthropogenic impacts on ocean species (Mente and Smaal 2016). Many coastal areas in Maine are dependent on the ocean for both income and nutrition, both of which can be provided by any aquaculture operation. Additionally, this also takes the pressure off the wild stock of certain species– helping to prevent overfishing and maintaining diversity within stock populations. Atlantic salmon, for example– a species that was grossly overfished historically– is one of the most common species used in aquaculture in Maine (Parrish et al. 1998; Dalton and Waning 2004). Aquaculture additionally eliminates the capture of non-target species– known as by-catch– which has valuable conservation benefits for marine species.

While the benefits of aquaculture are many, there are potential drawbacks that– if not addressed– can impact communities, economies, and ecological systems along the coast. Aquaculture may adversely impact current wild fishery operations, which could marginalize coastal communities that are culturally and economically dependent on open water fishing (Hanes 2018). In fear of the potential mismanagement of the industry and possible threats to their coastal livelihoods, many stakeholders, such as commercial fishermen and coastal residents have been quick to oppose the rising prevalence of the aquaculture industry. Concern surrounds the industry's lack of regulation– many fear that aquaculture leases could impede their access to open oceans. Aquaculture leases are being approved at an overwhelming rate– over 95% of marine applicants are approved by the state each year (Canney 2021). Large aquaculture leases can take up to 100 acres of open ocean –with industry consolidation even larger– making those areas inaccessible to many commercial fishing stakeholders. This lacking regulation on lease sizes poses a particular threat to Maine's lobster industry– which is a vital part of Maine's economy, worth approximately $1.6 billion (Canney 2021). Maine's lobster industry is quickly losing viable harvesting ocean, and if this pattern continues, it will no longer be possible for both professions to exist in the same waters.

Since aquaculture privatizes marine areas, there is a continued debate about the relationship between aquaculture and commercial fishing, recreational boating, and coastal landowners (Cabral and Aliño 2011). Coastal communities in Maine differ in average income, size, political opinions, and various other demographics, providing difficulties for generalized strategies to avoid conflict. Finfish require substantial external input to the system in the form of fish food, ironically, often made from wild-caught fish (Slow Food 2021). This can degrade the water quality of bays and coastal regions while shellfish aquaculture requires no input and does not affect the water quality of coastal ecosystem health.

The development of the aquaculture industry requires communication and collective decision-making between stakeholders in its early stages to solidify the long-term success of aquaculture businesses. Co-management practices– the practice of local governments sharing power and decision-making with resource users– are used in the lobster industry where both parties work to ensure social and political stability among stakeholders throughout the state and also avoid mismanagement. As Maine's newest marine industry, aquaculture hopes to improve Maine's economy– however, questions about its long-term sustainability and community involvement are still debated. The sea urchin industry of Maine, which peaked in the mid-1990s, is an example of a marine boom-bust industry that was poorly managed spatially and ecologically. Regulations failed to mitigate the regional effects of large-scale urchin harvesting on the ecosystems, communities, and economies of Maine– subsequently leading to the decline of stock and the eventual collapse of the industry (Johnson et al. 2013). On the other hand, the lobster industry has been co-managed by fishermen and government legislators since the late 20th century– and it continues to be considered a sustainable fishery despite warming ocean temperatures (Acheson et al. 2000). The co-management law used in the lobstering industry has been effective in regulating Maine's seven lobstering zones at an appropriate scale, whereas the two zones used to govern the urchin industry proved ineffective in managing and mitigating the impacts of harvesting. These successes and failures emphasize the need for proper management strategies and stakeholder engagement in these initial development of aquaculture industry standards.

Investors, grant funding, and government incentives, resulting from declining wild fish stocks and economic potential of aquaculture have spurred the rapid growth of the industry in Maine. The Maine Department of Marine resources division has doubled its staff, but lease approval is still lengthy, taking up to three years to approve a standard lease. Huge increases in limited purpose leases (LPAs) have raised concerns about the future growth of aquaculture as those leaseholders apply for larger spaces. Recent policy changes are addressing issues of transferability of leases, deciding whether or not children should be able to inherit leases from their parents or whether leases must be earned completely on merit. With family transferability, generational knowledge can help ensure the future success of a farm providing economic securing for the community. With merit-based entry, only farmers who go through due process to acquire a lease can use a plot of the marine territory.

Concerns surrounding the spatial and ecological footprint of the aquaculture industry continue as out-of-state investors are seemingly unaware of how the rapid growth could harm ocean water quality and aggravate communities of Maine. Many coastal residents fear that aquaculture's spatial footprint will not only impact the livability of their communities but that it will also impact the tourist appeal of their locale– potentially diminishing the tourism industry, a $6.2 billion industry in Maine (Goldfine 2008). Additional concerns regarding the health of the Gulf of Maine– a rapidly warming body of water– raise questions surrounding the sustainability

of salmon pen aquaculture. These types of fish farms are known to pump food waste, excrement, and often pesticides directly into the ocean. This not only pollutes the ocean but also produces suspicions surrounding how healthy it is to consume farmed fish stocks.

Overall, the public skepticism, mistrust, and misconceptions of the aquaculture industry have caused tensions and power struggles between the numerous stakeholders involved. Our research of literature and data collection from testimonies at bill hearings concerning aquaculture shaped our understanding of stakeholder positions, power dynamics, tensions, and concerns within communities. From these results, we have illustrated coalitions between stakeholders that may be possible, as well as recommendations for stakeholder engagement processes that will help dissolve tensions and build trust between stakeholders. We hope this will be a useful guide to researchers, policymakers, aquaculturists, and organizations aimed at facilitating the growth of a stable, productive aquaculture industry.

OUR PROJECT

RESEARCH AIMS AND OBJECTIVES

Aim: This study aims to identify the interests and relationships among stakeholders that are connected to aquaculture in order to recommend frameworks that can enable cooperation between marine resource and community stakeholders.

Objective 1: Account for all possible stakeholders and their agendas. Identify difficulties, vulnerabilities, and barriers of stakeholders within the social, political, and economic spheres to address any differing perceptions of aquaculture and how this industry may result in differing accessibilities to resources.

Objective 2: Once stakeholder positions have been established, assess and map the various power dynamics and hierarchies present between stakeholders to identify any areas of possible coalitions or tensions.

Objective 3: Outline stakeholder engagement and communication strategies within the context of the existing coastal conflicts and tensions in the Gulf of Maine.

DELIVERABLES

Deliverable 1: Create and conduct a power-structure analysis, in the form of an actor-network map, that identifies stakeholders, and their associated power and interests.

Deliverable 2: Develop recommendations for a stakeholder engagement process designed to cultivate a mutually-agreed upon future for aquaculture in Maine.

METHODOLOGY

We proposed the following methodologies to achieve the above aim and objectives. While these methodologies were subject to change, they have provided the fundamental basis and framework for our aquaculture analysis. To ensure efficiency for all meetings– with professors, project partners, and project stakeholders– we designated two notetakers and two discussion facilitators. All documents containing notes, sources, and relevant information were accessible to all group members through the share function on Google Drive. The following section elaborates on each of the steps involved in our research, analytical, and compiling phases of our project.

1. **Identify Stakeholders:** Through communication with our community partners, we first established a quantifiable list of stakeholders directly involved in shaping the aquaculture industry in Maine. This list includes aquaculture farmers, policymakers, community members, and a wide variety of organizations representing, promoting, and funding the many facets of aquaculture. This was a necessary first step in building the actor-network map later in our project.

2. **Data Collection of Stakeholder Positions:** To create a power structure analysis of stakeholders involved in Maine aquaculture, we had to identify the political positions of stakeholders regarding the growth of the industry. Our group collected this information through several different avenues. We utilized testimonies and recordings from local town hall meetings regarding new proposed aquaculture ordinances to establish positions and perspectives of various stakeholders. We also made use of relevant news articles related to the industry, as this was a way to hear directly from Mainers that could not attend more organized meetings. We have relied on their expert opinions regarding the growth of aquaculture in Maine to help supplement our information.

3. **Literature Review:** We used peer-reviewed and other sources to frame and illustrate the tensions and power dynamics of the growing aquaculture industry in Maine. With these sources, we outlined contextual information that has emerged over recent years to examine regulation changes, economic dependencies, and pressures on the industry that will likely affect future decisions and dynamics between actors. Additionally, we used these sources to further develop our understanding of community engagement strategies.

4. **Actor-network map:** With the help of online network mapping technologies like *Kumu*, we created visuals that effectively represent and identify the many stakeholders, their positions on aquaculture, and their relationships with one another. Additionally, this map (or maps) compiles information from previous subsections (subsections 1, 2, and 3) to identify any power dynamics and their sources of power (whether it be funding-related or other). In identifying sources of power behind different stakeholders, we can further recognize any intentions or underlying agendas.

   The main goal in creating an actor-network map such as this was to generate a coherent visual representation that portrays the interconnectedness of stakeholders and their underlying influences. This map will identify the reasonings behind any conflicts and coalitions that could form between stakeholders.

5. **Outreach:** As a group, we contacted industry professionals, members of Bates academia, and various other stakeholders in and around the aquaculture industry. Due to our shortened time frame for this project, efficient outreach was a vital part of gathering information and progressing our project. Due to past scrutiny between our community partners and contacted stakeholders, we had to be deliberate in choosing stakeholders to contact. The following people are who we intend to consult with:
    a. Cait Cleaver, Director of Bates-Morse Mountain Conservation Area and Shortridge Coastal Center at Bates College, Cait was one of our main contacts for this project who helped facilitate connecting with stakeholders as well as assist with resources for research.
    b. Marissa McMahan, Fisheries Division Director at Manomet, Marissa was our other main contact for this project who also helped facilitate connecting with stakeholders and assist with resources for research.
    c. Dana Morse, Researcher at the University of Maine focusing predominantly on fishing gear research for bycatch reduction as well as various other fishery related research. Dana was a valuable resource as he provided information on concepts and issues within the aquaculture industry.
    d. Anne Hayden, Senior Fisheries Program Manager at Manomet, Anne has been a good resource for stakeholder engagement.

6. **Creation of Recommendations for Stakeholder Engagement:** In addition to the actor-network map, our group created a set of recommendations that aim to increase stakeholder involvement and engagement in both the aquaculture operations themselves, as well as in the political processes surrounding the industry. Our recommendations are informed by the data collected from public forums, public access articles, existing scientific literature, as well as expert opinions from the qualified individuals listed above. These recommendations aim to decrease tensions between stakeholders who may have conflicting values, as well as identify areas where stakeholder groups or communities could work in tandem for mutual benefit.

None of our methods required us to consult the Institutional Review Board (IRB). Our above-outlined methods do not include any research on human subjects, nor do they require recordings, videos, or any use of image documentation. While we met with professionals outside of Bates College's faculty, we did not record any conversations, and therefore, did not require the IRB's approval.

RESULTS AND DISCUSSION

Data Synthesis:

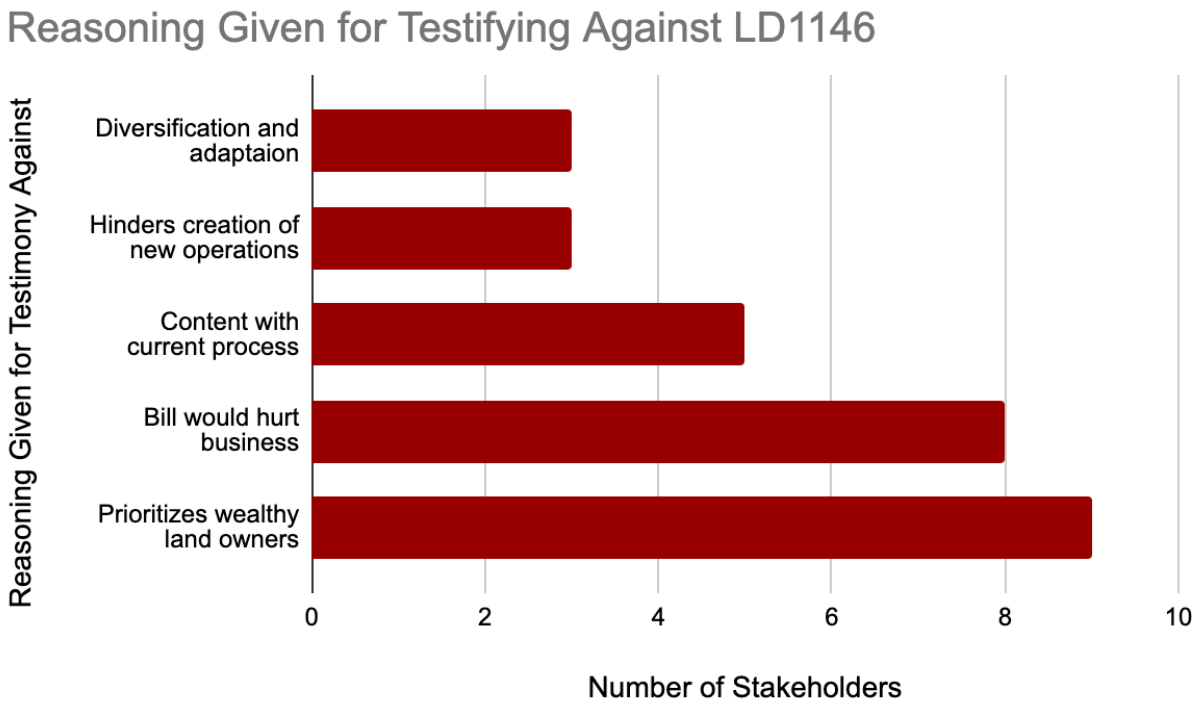
Throughout the process of data collection and synthesis, we have used submitted testimonies as proxy data for stakeholder positions and perspectives on the current and future status of the aquaculture in Maine, as well as their reasoning for holding said position. To ensure personal privacy, and at the suggestion of our community partners, we exclusively collected and

analyzed data from stakeholder groups, as opposed to individuals who testified. Due to the short timeframe in which our project operated, our group focused on submitted testimonials regarding the two most recently proposed aquaculture ordinances. Of those two, we primarily concentrated LD1146– "An Act To Protect Maine's Ocean Waters and Support Regulatory Oversight and the Long-term Health of the Aquaculture Industry", which was put before a committee public hearing on April 20th, and had in excess of 170 submitted testimonies. If passed, this bill would have entailed lease reversion to the state upon expiration, limits to the amount and size of leases per operator, and the implementation of a system for requesting visual impact assessments of proposed or currently functional operations. Analysis of the 28 stakeholder organization's testimonies found that almost 80% (22/28) of groups testified against LD1146. The data has made it abundantly clear that a fundamental divide exists between stakeholders involved in aquaculture, and those involved in commercial fishing or environmental sustainability. Overwhelmingly, groups involved in aquaculture testified against the bill, while almost all those not currently in the industry testified for. These results were echoed in our analysis of LD1211- "Resolve To Create the Study Group To Research Balancing Development and Conservation in Maine's Coastal Waters and Submerged Lands", which went in front of committee on May 4th and 6th. LD1211 aimed to create a study group to "address current system deficiencies in the regulation of the State's coastal waters and submerged land." Stakeholders in the industry almost unanimously testified against the bill, while the handful of environmental/community organizations testified for.

Analysis of stakeholder testimonies has made clear the divide between stakeholders involved in aquaculture and those associated with conflicting groups or industries. In order to better understand the root cause of this schism, we also reviewed and compiled stakeholder reasonings for their testimony. While not comprehensive, as some stakeholders did not provide justification for their testimony, our analysis of reasonings allowed us to identify some of the key issues that fuel this heated debate.

Those who supported LD1146 were mostly environmental non-profits or advocacy groups such as the Sierra Club of Maine, Friends of Blue Hill Bay, and Protect Maine's Fishing Heritage, who have concerns about privatizing or exploiting Maine's marine resources. Our data analysis revealed several common themes among these stakeholder's testimonies. One frequently discussed concern is the lack of regulation in aquaculture, specifically surrounding lease sizes and approval rates. Another point of contention mentioned in the testimonies is the unknown and potentially negative ecological effects that could accompany aquaculture, particularly regarding salmon farming. Stakeholders who testified against also argued that there is increasing concern about the privatization of common marine spaces, which many of the above nonprofits feel should be an open access resource. Lastly, many members of the working waterfront feel as if there is a lack of representation in the policy making process, which has resulted in little attention being paid to the concerns and needs of those in the commercial fish and lobster industry. In contrast, there is a large conglomerate of stakeholders who are against LD1146, including large oyster farms such as Mook Sea Farm and Mere Point Oyster Company as well as Aquaculture nonprofits such as Maine Aquaculture Association and Coastal Enterprises INC. There are many common themes that arose among testimonies against LD1146 such as the idea that an increase in regulation of aquaculture leases would drastically harm business and the Maine aquaculture industry. Second, there is a desire to have there be lease transferability so that aquaculture farmers can either pass down their farms to their kids or sell their leases off, as there is a lot of concern about aquaculture not being able to be a generational business due to lease

regulations. Next, many of these stakeholders feel as if there is a need for the economic diversification that the growth of the aquaculture industry in Maine provides. Lastly, stakeholders are concerned that lease restriction will give too much power to wealthy landowners by prioritizing them. Below you will find a graph that further examines reasons that stakeholders are against LD1146.



Analysis of data also revealed that many of the positions stakeholders held on LD1146 were echoed in testimonies regarding LD1211. Those who supported the bill, such as Friends of Penobscot Bay, cited the need for increased regulation and monitoring to ensure environmental sustainability. Groups who testified against the bill complained that LD1211 was a reworded version of LD1146, and was a disingenuous way to push the bill through committee on a second attempt. These stakeholders were also quite upset by the fact that the proposed Study Group that would be created by LD1211 had no members involved in the aquaculture industry. This lack of representation in the policy making process was brought up by groups both for and against increased regulation of the industry.

Literature Review:

In the initial literature, we found several major themes that illustrate the differences and difficulties within the aquaculture industry overall and in Maine. Aquaculture is difficult to wrangle in overarching terms because of its ecological, economic, social, and regional differences in marine farming sites. Due to the vast range of farmed species, farming practices and farming locations across Maine must approach aquaculture expansion with regionally specific approaches that account for local stakeholders and community members alike. Since aquaculture requires the privatization of marine areas, there is heavy debate about the relationship between aquaculture, commercial fishing, recreational boaters, and coastal landowners. With tensions increasing, the bulk of our research targeted concepts and strategies that could help mitigate opposition between these waterfront stakeholders. The following review helped guide us in the development of our recommendations.

One of the vital concepts we came across in our research was an entity's Social Licence to Operate (SLO). Social licenses to operate come into play when community stakeholders develop differing, sometimes negative perceptions of aquaculture. These perceptions– if negative– can diminish an industry's productivity through social roadblocks associated with lacking acceptability and participation in the industry. Here social license will provide the basis for our community engagement recommendations because it requires and reinforces the willing participation of all stakeholders and community members. For this reason, Social License to Operate is an applicable concept when looking to mitigate lacking community support.

In essence, Social License is an entity's acceptance across a contextual social space (a.k.a. social acceptability). This social acceptability and legitimacy depend on, in part, the community-based evaluation of the individual operation or industry. Depending on the implicit assignment of acceptability and legitimacy, an aquaculture operation and or industry can fall under several stages. The following phases are helpful to consider when visualizing and assessing the aquaculture industry's ability to establish its social acceptance through stakeholder engagement (Raufflet et. al 2013).

- *Stage One*: Is the widespread disapproval of aquaculture operations. Stage one is the lowest stage of social license where the entity and or industry possesses borderline legitimacy and is generally viewed as an entity outside of the community. Indicators for this low-level social license include– but are not limited to– operational shutdowns, sabotages, boycotts, blockades, violence, and legal challenges.

- *Stage Two*: Is the acceptance and tolerance of aquaculture operations. Here, the local community may accept the terms of operations, but the presence of scrutiny and lingering issues and threats are still prevalent. Because of this, the community does not actively participate within the industry and or support it. As previously mentioned, indicators for this stage include the persistence of lingering issues and threats, as well as the presence of NGOs (non-governmental organizations) and watchful monitoring and scrutiny.

- *Stage Three*: Is the approval and support stage of an operation or industry. Here the aquaculture operation is generally viewed as a good neighbor, and local community members take pride in collaborative achievements with the operation.

While an aquaculture operation's social license stage can depend on its location, the aquaculture industry is generally somewhere between stages one and two across Maine. Some communities seem to accept its presence, while others face heavy scrutiny and challenges around its local governance. For this reason, the industry ought to strive for stage 3, as it embodies the community engagement and participation that we will later see is required to successfully implement an industry such as aquaculture.

Components of Social License to Operate

For social acceptance, it's crucial to consider the components of social license as they are fundamental in understanding what is necessary in all community and stakeholder engagement strategies. A company's social license to operate and social acceptance consists of three components. These include social legitimacy, social credibility, and social trust. The following section details our findings on these concepts (Raufflet et. al 2013).

Social Legitimacy:

Social legitimacy comes from an operation's respect for the established norms and values of a given community. Accordingly, aquaculture operations in Maine can attain this by respecting the social rules and expectations surrounding the local waterfront communities. The implicit social norms of communities will differ across contexts and scales– the deployment of local assessments and the use of local experts can be valuable tools in identifying and understanding these contextual norms. In practice, this comes from community engagement and information sharing with the community. A company's willingness and ability to adapt will largely depend on its ability to engage with the community and establish connections within it.

Social Credibility:

Social credibility builds on being consistently transparent and reputable by providing accurate and concise information to stakeholders and community members. This information must not only be comprehensive but also disclose the fullest extent of information that is unbiased and undivided. This concept brings up various questions around credible information and the use of *good science* (refer to the community outreach section on page 16 for further detail on the concept of good science)**.**

Additionally, social credibility is further established by respecting any commitments and responsibilities for the community. This type of credibility is most effectively attained through written agreements where responsibilities and roles of both the community and the operation are defined and negotiated. Similar to social legitimacy, social credibility is established through community engagement and information sharing.

Social Trust:

Social trust is a company's willingness to be vulnerable to the actions of external factors and stakeholders. Social license to operate can only be effective through high-quality relationships that take both time and effort and come from shared experiences beyond monetary transactions. Social trust offers a viable model for operations to establish such high-quality relationships. Building social trust can take many forms, but for all intents and purposes, we will explore *cooperative research* as a model for this later

in this paper (refer to the community outreach section on page 16 for further detail on the concept of cooperative research).

Conditions of Social License to Operate

From the three previously mentioned components, social legitimacy, social credibility, and social trust, we can dive further and establish the implicit conditions required for widespread social acceptance and social license.

Throughout each of the components, three underlying actions remained consistent– these include the early establishment of community engagement, shared risk-taking, and the redistribution of benefits. The following section will detail these conditions and how they feed into each of the previously mentioned components (Raufflet et. al 2013).

Early establishment of community engagement:

The early establishment of community engagement ensures that the community feels in control over the decision-making and implementation processes of projects, therefore, can more easily benefit from the company's presence. Such engagement further ensures mutually beneficial relationships because it provides the opportunity for two-way open dialogue. The early establishment of community engagement promotes social legitimacy through the identification and respectful acknowledgment of social norms. It upholds social credibility through the information sharing needed to engage said community members. Lastly, it encourages social trust as it fosters meaningful relationships that extend beyond monetary transactions.

Shared risk:

Company and community stakeholder partnerships help ensure that all parties are working in one direction and not against each other. Through shared risk, both the community's and the company's aspirations run parallel with one another as they work together toward a common goal. This action can tie the company and community together, which subsequently fosters social trust and credibility as it produces feelings of shared responsibility and promotes collaboration.

Redistribution of benefits:

The redistribution of benefits helps increase and reinforce various socio-economic capacities within the local community. These benefits can come in many forms; some include– engaging with NGOs and other experts, providing local access to educational resources, and local supply and economic diversification. This action directly ties back to social credibility and trust because it promotes disseminating information among other resources subsequently, promoting high-quality relationships.

Depending on the effectiveness and manifestations of these practices, the informal community-based evaluation of operations can create the difficulties and controversies that are relevant in Maine's aquaculture industry today.

Future Considerations

Our ultimate goal in producing stakeholder engagement recommendations was to promote the widespread approval and social acceptance of aquaculture. To help guide us in our stakeholder engagement recommendations, we used a table from the Journal of Environmental Management. This table outlines several stakeholder engagement goals that build off and run in harmony with the conditions and components sections of social license (Mease et al. 2018). The following brief outline will give you an idea of our direction, however for more detail, refer to **Appendix 1**.

a. *Inform stakeholders*: provide and communicate information to the greatest number of people or the most impacted people.
b. *Solicit feedback*: seek input from stakeholders for alternatives or decisions and incorporate their knowledge with known scientific knowledge.
c. *Promote dialogue*: create opportunities for two-way dialogue with managers to ensure interests and concerns are accurately represented.
d. *Delegate or entrust control*: decision-making power
e. *Build trust*: to enhance mutual understanding, increase resiliency after agency missteps, or bolster decision legitimacy.
f. *Engage underrepresented populations*: ensures equitable decision-making and that outcomes are not skewed against their interests.
g. *Ensure compliance*: with management decisions by increasing knowledge of or buy-in to those decisions.
h. *Conduct research*: Collect data to better understand the socio-ecological context of decision making.
i. *Engage efficiently*: because the decision-making process is short.
j. *Educate stakeholders*: about the decision-making process to empower them to involve themselves and peers, and boost capacity to sustain engagement.

These goals encompass the very components and conditions of social license that we advocate using in a community engagement process. They not only promote the early establishment of community engagement, shared risk, and redistribution of benefits, but through these modes, they also bolster social legitimacy, credibility, and trust. With the embodiment of all of the proper components and conditions of social license to operate, these goals can be beneficial to use in some way, shape, or form.

While these goals are a good starting point for increasing equity, trust, credibility, and legitimacy, they should be continually built on and reassessed as the community engagement processes continue to evolve. With these goals in mind, we will discuss our second deliverable– recommendations to help identify components for a successful stakeholder engagement process.

RECOMMENDATIONS

There are many misconceptions and unknowns surrounding aquaculture in the public eye (Rickard et al. 2018). To ensure the success of the aquaculture industry, mechanisms that renew trust and good faith in aquaculturists are needed within communities facing lease proposals and development. The distribution of, access to, and engagement with information and research on different aquaculture species and practices is important for communities. Additionally, decision making prior to research, applications for leases, and policy making should involve community discussion and input. These processes serve to educate and inform stakeholders, solicit feedback and dialogue, and build trust among communities ranging people.

Contextual differences in demographics, such as population, age, growth rate and other factors within communities in Maine will determine the exact strategies necessary, however outreach remains at the forefront when engaging stakeholders. Without knowledge of aquaculture operations and coherent science, communities cannot hope to adequately engage with farmers applying for leases within the region. Communities face differing aquaculture operations based on species, lease size, and company size which will require varying approaches and strategies to engage, inform, and empower specific communities in taking action and improving their relationship with businesses. Despite community and aquaculture operation variations across the coast, we found that the following strategies would help build new relationships, stabilize power dynamics, and equalize decision making processes to inform future policies and healthy industry growth. To further support the evolution of engagement processes, we also included tactics that aim to measure the progression and effectiveness of social acceptability and community engagement.

***Community Outreach*:**

To properly engage community members unaware or unsure of aquaculture operations, outreach action that targets a wide variety of members within a targeted region. Distribution of general information can be propagated through pamphlets, flyers, and newspapers at community events and local businesses such as farmers markets, gear shops, trade shows, and others. Each distribution location and form of communication hopes to target a different audience, for example, pamphlets and flyers at gear shops would target commercial fisherman and recreational marine users alike. Farmers markets would hope to target members of the community interested in the promotion of local food. In addition to the physical dissemination of information, social media and electronic press will target technologically savvy community members. Communication with the community leaders and key communicators is important in the initial stages of outreach. Long-time community members who have proven experience and skill and in gathering local input could support the connection between stakeholders.

Once an audience of interested community members, relevant stakeholders, and aquaculture farmers are gathered or reached, a space for public discussion, information distribution and sharing of concerns can occur. **A public forum**, moderated by researchers and community members, where authentic information concerning proposals and growth within each community would be beneficial. With both the aquaculturist and the interested community members present, an open discussion, prior to lease hearings, would build mutual respect and cultivate trusting relationships. An online forum could also be available for public comment, discussion and record if deemed appropriate for a given community.

Throughout our research process, we have found the fundamental need for **good science** within policy and governance. Good science constructively works to help people better understand the functions in their surrounding systems. In educational and or deliberative settings, this can function to settle conflicts by settling misinformation and false perceptions that any party may have (VanderZwaag & Chao 2006).

Through tactics like **cooperative research**– where researchers and stakeholders work side-by-side– the practice of good science can be supported and mandated. Such tactics serve as a viable model to produce and distribute good science and information within communities. By working together with stakeholders, scientists and researchers are better able to direct their research questions to answer the questions and concerns of the community. With scientists' presence and involvement in community outreach, these can help connect and moderate discussion between stakeholders, such as aquaculturists, commercial fishermen, and interested residents. Their commitment to solving community concerns involves them as neutral yet critical actors in formulating the building blocks for the future of aquaculture in communities across Maine. Overall, this tactic could be helpful to explore further because it could provide insights on social mechanisms that can renew trust and good faith in the aquaculture industry (Kaplan & McCay).

***Community Empowerment*:**

In designing a community and stakeholder engagement process, we ran into questions about incentivizing stakeholders and community members to participate in authentic forms of deliberation and engagement regularly. Through our research, we have found that participation is best incentivized through community and stakeholder empowerment. Community and stakeholder empowerment– if done effectively– can reinforce the industry's social license, as well as various stakeholder engagement goals, some of which include trust, compliance with outcomes, and it opens up the arena for dialogue and feedback on alternatives or decisions. Community and stakeholder empowerment can take many forms; an obvious example of this is public hearings in regulatory deliberation. In theory, this empowers stakeholders to take indirect action on a concern in the form of a testimony. However, with aquaculture's diverse group of stakeholders with varying interests, agendas, and abilities, this strategy– alone– is not nearly as effective as it needs to be. Therefore, more equitable and efficient tactics are necessary to encompass a wide range of concerns.

Through our conversations with experts and our research, we have identified several complementary and actionable engagement strategies that can employ community and stakeholder empowerments. The following subsections detail our findings.

Listening Sessions:

Public listening sessions are in-person meetings between managers and stakeholders. Managers host these forums to provide a venue for stakeholders to voice their interests and concerns. While these managers are the host, they are primarily present in a listening capacity. This being said, they are not there to inform. Rather they are there to record and consider the various topics of interest (Mease et al. 2018).

This particular tactic has multiple functions; it empowers community members by soliciting their feedback, it serves as a mode to engage with underrepresented community members, it helps build trust through open dialogue, and it helps ensure stakeholder compliance to decisions and outcomes– if said feedback is properly accounted for.

Advisory Groups:

Stakeholder advisory groups are multi-interest bodies of identified stakeholders. These groups are gathered in a predetermined location for a set length of time to provide substantive input and advice to a managerial or decision-making body. Such groups can identify specific issues, prompt management alternatives, and establish working relationships between resource managers/ policy-makers and advisory group members. Such group gatherings can happen under many different circumstances; however, it is most effective to have regular meetings to establish relationships and to ensure constant communication throughout all phases of a decision-making process.

Advisory groups are a critical tool for empowering key communicators and stakeholders. This strategy utilizes face-to-face deliberative settings to establish relationships and build trust while also providing a space for stakeholders to problem-solve. Additionally, such interactions can serve to manage expectations and further promote compliance with decisions (Mease et al. 2018).

Decentralized Decision-making:

Decentralized decision-making– or entrusting stakeholders with decision-making power– directly empowers stakeholders and incentivizes them to engage with the broader participatory process. This strategy can delegate decision-making power to multiple stakeholders while resource management maintains legal authority over the final say. Decentralized decision-making can take the form of community deliberation, discussion, and consensus-building of small stakes decisions. Such processes can help develop healthy relationships between stakeholders and aquaculturists in Maine, develop mutually agreed-upon actions, and help make these stakeholders feel in control (VanderZwaag & Chao 2006).

Decentralized decision-making is an effective strategy insofar that community outreach has also been effective. With effective community outreach and dissemination of information, stakeholders can make informed decisions in collaboration with other, maybe opposing agendas. For this reason, we recommend this strategy be coupled with public forums, listening sessions, and cooperative research as they complement each other in their functions. Public assemblies disseminate information while listening sessions and cooperative research allow for open scrutiny and the communication of a wider range of concerns. Additionally, cooperative research can also function to follow up on concerns and allow for greater scrutiny in the research phases of policy-making.

Overall, the implementation of decentralized decision-making serves to empower the community, with the additional side effects of building trusting relationships and enhancing decision-making legitimacy.

Surveying:

In the pursuit of creating measurable outcomes for social license to operate, we propose using surveys. With surveys, resource managers, companies, and small operations can measure the effectiveness of their community outreach. In measuring social acceptability and social license, a baseline survey must be conducted to provide a standard to which the next surveys can be compared. The surveys following this baseline can be sent out multiple times a year via email lists and polling to gauge the consensus of

what people think about aquaculture and how it has changed. Surveys are best kept brief, so it may take some time to come up with the most effective questions. While surveying is a critical tactic in community empowerment, it is equally important to recognize that it is a mode for community outreach as well. For this reason, it can fall under either category. However, for repetition reasons, we decided to include it here. Attached in the appendices section **Appendix 2** and **Appendix 3** are surveys that could help map the progress of community engagement and social license.

CONCLUSION

In the State of Maine, the emergent aquaculture industry is a point of great contention. Over the course of this study, this deep schism surrounding the future of the industry has become increasingly clear. Aquaculture sits at the nexus of both environmental and economic concerns, meaning it is a multidimensional issue, and involves many different stakeholders, with varying degrees of agency and power. Some view it as an economic boon, a useful strategy to produce quality seafood and diversify income without overexploiting wild stocks. Some see the fledgling industry as an attempt from out-of-state powers to privatize Maine's coastal waters, which would harm their livelihood. Other groups support the need to conserve wild stock populations, but want more in depth study on the ecological impacts of aquaculture operations before operations commence. Therefore, any decisions made regarding the industry will almost certainly be in conflict with at least one stakeholder' interests. Over the course of this study, we collected data in the form of submitted testimonies on stakeholder perspectives on the growing industry, which allowed us to identify hot-spots of tension between groups, as well as areas where cooperation or collaboration could occur. Primary points of concern regarding the industry are privatization of public space, ecological impacts, need for economic diversification, and conflict between working and seasonal residents. Because of these conflicting desires, along with the variability in economic and political power associated with them, this issue is incredibly complex and lacks a simple solution. Stakeholders on both sides of the aisle feel as though their voice is not being heard, nor their wants and needs reflected in current policy.

Due to the complex nature of aquaculture in Maine we've recommended several strategies to ensure the healthy growth of the aquaculture industry in Maine. Our recommendations follow two main themes; community outreach and community empowerment. We believe that the implementation of community outreach will increase involvement as well as allow for the education and distribution of information to Maine residents on the current climate of the Aquaculture industry in the State of Maine as well as in their specific communities. There are many ways to distribute information and educate Maine residents for instance like using pamphlets, flyers, newspapers, public forums or cooperative research which involves stakeholders working to distribute good science and direct research in ways that will be helpful to Maine communities. Additionally, we believe that community empowerment will incentivize community and stakeholder participation as well as create a space for dialogue and feedback on aquaculture policy. Community and stakeholder empowerment can take up many forms such as listening sessions for stakeholders to share beliefs in a non-decision making setting, or advisory groups composed of local community members and stakeholders who provide information and education to municipalities regarding both the aquaculture industry broadly, as well as more

specific mediation between stakeholders. Another example of community empowerment is decentralizing decision which will entrust stakeholders with decision-making power therefore directly empowering stakeholders and incentivizing them to engage with the process of aquaculture policy. Lastly, implementing a survey will inform us on community perceptions of the aquaculture industry as a whole as well as on certain operations and companies. Overall this will help to gauge the progress of community outreach and social license.

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APPENDICES

Appendix 1: Community Engagement Goals

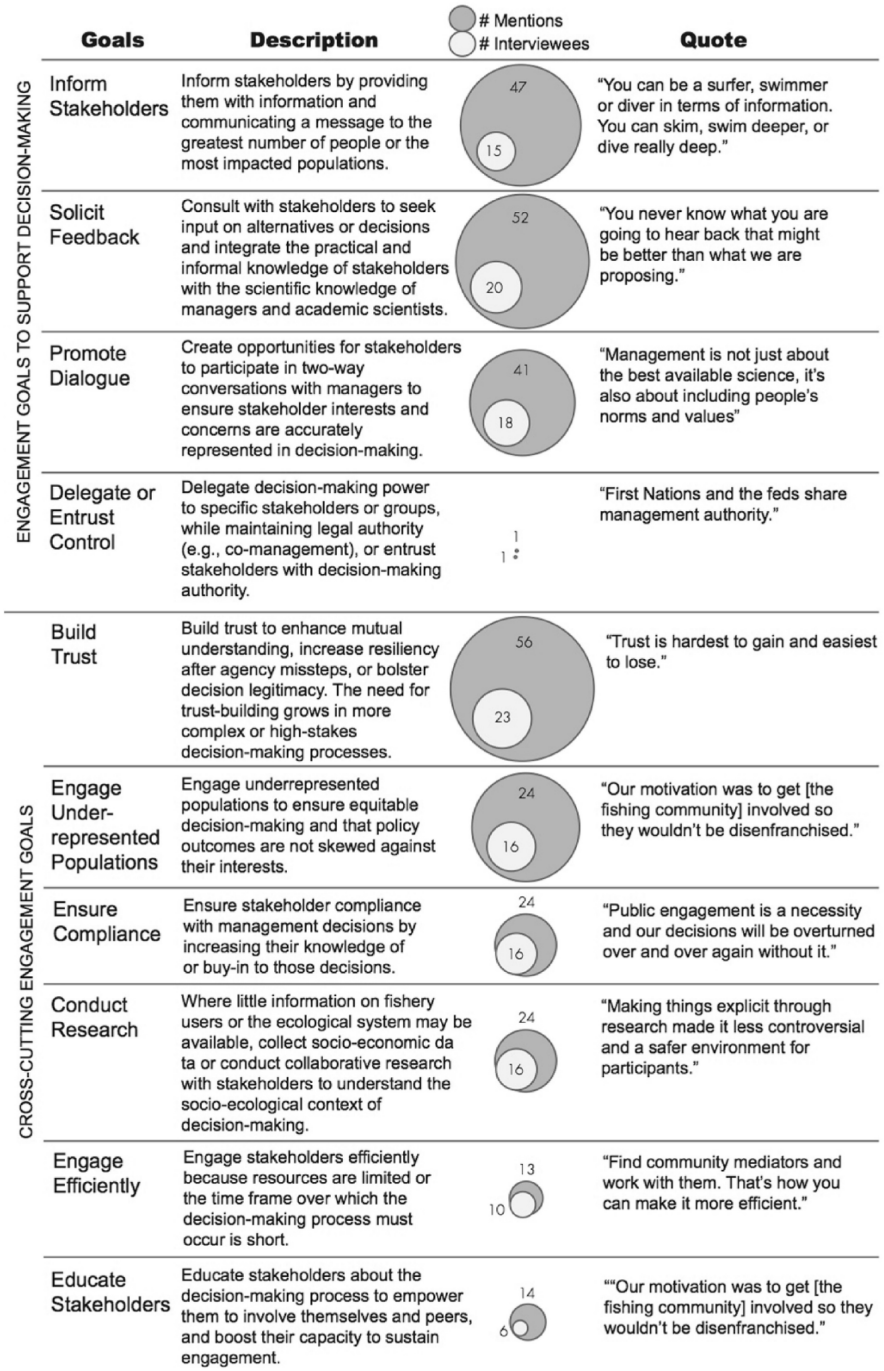

Table source:

Mease, L. A., Erickson, A., & Hicks, C. (2018). Engagement takes a (fishing) village to manage a resource: Principles and practice of effective stakeholder engagement. *Journal of Environmental Management* 212, 248-257. https://doi.org/10.1016/j.jenvman.2018.02.015.

Appendix 2: Survey for Quantifying Social Acceptability

Maine Aquaculture Social Acceptability Survey

1. What is your name? (Your name will not be used without your permission– this is only for our personal reference)

2. Do you have any affiliation with the aquaculture industry? If yes, how?

3. Have you had any prior experiences or interactions with ____(industry, operation, policy, etc.)? If yes, what types of experiences?

4. How have these experiences shaped your opinion of ___(industry, operation, policy, etc.)?

5. Have you had any recent experiences or interactions with ____(industry, operation, policy, etc.)? If yes, what types of experiences?

Appendix 3: Survey for Quantifying Stakeholder/Community Engagement

Maine Aquaculture Stakeholder and Community Engagement Survey

1. Has information been easily accessible pertaining to ____(specific policy, decision-making process, community/stakeholder engagement opportunity)?

2. Has this information been easier to access than in years past?

3. How and/or where has this information reached you? (e.g. email lists, pamphlets, flyers, etc.)(at gear shops, trade shows, farmers markets, etc.)

4. Are there more effective modes of disseminating this information? If yes, where and how?

5. How well informed do you feel in this subject? (1 being not informed at all and 10 being really well informed)

Appendix 4: Link to Actor-Network Map of Stakeholders in Maine's Aquaculture Industry

https://embed.kumu.io/99e679fb81fd940eca7528ab318f9b06