

Is Aquaculture a Path to Community Resilience in Maine?

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ABSTRACT

Coastal towns across Maine face a number of challenges maintaining resilience. The growth of marine aquaculture has been presented as a potential sustainable food system and economy for some coastal communities; however, the question of fit is a source of debate within Maine. Decision makers may seek further understanding of whether supporting growth of the marine aquaculture sector is consistent with community resilience across the coastal regions. To provide this information, we analyze data from a survey of coastal Maine citizens to explore whether marine aquaculture supports resiliency goals along the coastline of Maine.

climate. However, different regions of the state identify different specific concerns, each searching for new answers to resolve core community problems. One of the best ways to promote economic viability in coastal communities is to improve our understanding of how residents perceive the strengths and weaknesses of their communities and how marine aquaculture (mariculture) may contribute to the long-term resiliency of these coastal towns. The current study provides unique insight into these areas.

INTRODUCTION

Maine has long been recognized for providing high-quality seafood (Murray et al. 2017), and the industry supplies the economic backbone of rural, coastal communities. Maine's coastal communities, however, face serious economic uncertainty. Seafood producers must confront unprecedented challenges, including a decline in traditional wild-capture species populations (Ames 2004), changes in seafood consumption patterns (Shamshak et al. 2019), constraints for lobster harvesters related to right whale regulations (Myers and Moore 2020), and most recently, loss in sales due to the COVID-19 pandemic (Whittle 2020). Similar to other US coastal states, Maine continues to consider whether a growing, sustainable marine aquaculture sector could play a key role in supporting the resiliency of rural, coastal communities.

Our research seeks to answer the question, How do coastal residents in Maine view aquaculture, and can investment in this sector improve resilience in communities across the coast? To answer this, we employed a survey of coastal Maine residents in 2018 assessing their knowledge and perceptions of the aquaculture sector in the state and opinions regarding their own community's strengths and weaknesses.¹ Overall, respondents have positive perceptions on core community aspects across Maine's coastal areas, such as the amenities, recreational opportunities, and economic

AQUACULTURE IN MAINE

Rural, coastal communities have historically relied on harvesting of marine species to provide economic activity for their communities. Maine's blue economy faces a daunting future, in which a decline in wild-capture fisheries and increased regulations challenge the backbone of Maine's coastal communities. In response, many fishers, among other coastal residents, have turned to sustainable aquaculture.

Sustainability can be defined as the ability to meet the needs of current generations without compromising the ability for future generations to meet their own needs (United Nations 1987). Applied to marine aquaculture, sustainable aquaculture provides aquatic resources and commercial products to current generations without compromising the ability for future generations to use these resources. This sustainability applies to the pollution, land (or water) use, material inputs, and ecosystem effects that marine aquaculture may have. As aquaculture expands, this concept of sustainable aquaculture must consider incorporating different environmental, economic, and social dimensions, as well as their respective parameters (Frankin and Hershner 2003).

As defined broadly in our survey, "marine aquaculture involves growing species in ocean water including fish,

oysters, sea vegetables and other seafood.” This definition can take many different forms, including mudflat cultivation grounds for shellfish, net pen or land-based tanks for finfish, and even longlines along coastal waters for seaweed. Marine aquaculture has emerged as a potential way to support sustainable food systems. Maine people may have different experiences with the aquaculture industry as size, product grown, and ownership differ. In nine coastal counties, 133 aquaculture farms are licensed by the Department of Marine Resources, with an average size of 10.03 acres. Cumberland has the highest number of farms at 40, while York and Waldo are tied with the fewest at three each. The largest farm is Moosabec Mussels, Inc., with 89.7 acres on the Jordan River in Hancock County. Although Hancock County has the largest farm, Washington County has the largest average size (20.12 acres across 28 farms).²

Growth in the aquaculture sector has been rapid in Maine, as the total economic impact of aquaculture has nearly tripled in the state since 2007, with 45 percent of the aquaculture operations in 2017 beginning operations within the last five years. A 2017 study found Maine’s aquaculture sector had a direct economic impact of \$73.4 million and a statewide annual economic contribution of \$137.6 million (Cole et al. 2017). Moreover, most jobs created in the sector are full-time and year-round positions, which suggests a growing, sustainable aquaculture sector could play a key role in supporting the resiliency of rural, economically challenged coastal communities.

The aquaculture industry provides many key benefits to improve the usage of our coastal resources in Maine. First, increased employment has been a consistent advantage in implementing aquaculture sites, providing increased employment and funding for communities involved (Johnson 2020). Livelihood diversification is another possible benefit from the growth of aquaculture, as introduction of a new sector provides new opportunities for coastal residents. Further aquaculture, particularly seaweed and shellfish production, may provide essential ecosystem services such as positive water quality effects including reducing nutrient and sediment loading, enhancing oxygen, and serving as ecosystem restoration tools (Brayden et al. 2018). While marine aquaculture has been depicted as a sustainable solution, citizens, and seafood consumers may hold perceptions that marine aquaculture has negative environmental or economic impacts. A recent study found that concerns regarding aquaculture as unnatural, the ethics of production,

and the inability to trace the product were impediments to aquaculture acceptance (Rickard et al. 2020). Citizens may use their current understanding of challenges facing terrestrial agriculture when they consider marine aquaculture, including concerns about animal treatment, pollution, product safety, chemical and hormone use, and environmental harm (Rickard 2018).

In our Maine study area, where ecotourism dominates the economy as a source of income for thousands (Maine OT 2023), aesthetic concerns are a serious factor in the economic sustainability of an industry. However, severity of concern is inconsistent across geographical locations. Where commercial waterfronts are already the norm or where marine aquaculture has been economically encouraged, the concern over aesthetics may not be as high as it is in areas that rely on ecotourism (Evans et al. 2017). So although marine aquaculture may conflict with existing uses such as ecotourism, there may be fewer conflicts in areas currently engaged in working waterfront activities. Therefore, we consider whether Maine coastal towns perceive marine aquaculture as an economic or environmental investment or a threat to community resilience.

COASTAL RESILIENCE

Rural communities across coastal Maine may explore sustainable marine aquaculture to enhance community resilience. Communities are built with specific natural, social, and economic environments that influence one another in complex and diverse ways (Norris et al. 2008). Within these communities, changes often occur at inconvenient or uncertain times, making it critical for the community to respond quickly and efficiently to adapt. Such challenges highlight the importance of community resiliency: the ability to marshal resources, by community members, to thrive in a changing and unpredictable environment (Magis 2010). Whether marine aquaculture is considered a fit for Maine’s coastal communities in their quest for community resilience likely differs greatly along our expansive coast.

The literature surrounding the concept of community resilience suggests many attributes that make a rural community more adaptable to change (Jurjonas and Seekamp 2018; Norris et al. 2008). Three key concepts emerge. Livelihood diversification, or the availability of different jobs in a community, must be taken into consideration since individuals from different backgrounds must have access to employment to

TABLE 1: **Maine Region Employment Information**

Region*	Population	Unemployment rate	Median household income	Make living from agriculture, forestry, fishing, hunting
Southern	258,914	2.4%	\$70,907	0.5%
Midcoast	75,665	2.8%	\$56,609	1.3%
Acadia	126,355	3.5%	\$52,499	1.3%
Downeast	31,379	4.5%	\$41,347	4.1%
Maine	1,344,212	2.9%	\$57,918	1.2%

*Regions represent weighted averages of county level data from 2019 to best match 2018 survey data.

Source: <https://www.maine.gov/labor/cwri/county-economic-profiles/countyProfiles.html>; <https://www.maine.gov/labor/cwri/qcew.html>; Gumber and Sullivan (2022)

maintain their livelihoods and stay in the community. Wealth within a community is an important capacity builder for adapting in times of distress. Without access to finances, communities often cannot afford resources that are key to building infrastructure and carefully planning for future disasters. Community cohesion, or the measure of closeness and communication between community members, supports residents during distress. An improved understanding of how areas of Maine may align with current representations of resilient communities can further support the connection between marine aquaculture and community resilience.

Maine's coastal communities differ greatly in resource availability and resource abundance, affecting a community's ability to remain resilient during times of change. To consider alternative paths for Maine coastal communities, we document some of the wealth and livelihood diversification in Maine coastal regions. We create snapshot of Maine's regions in these metrics of resiliency, which shows a state with significant discrepancies across regions in population size and economic opportunities (Table 1).

As of 2019 data, Maine had a statewide population of 1,344,212, with a median household income of \$57,918 and an unemployment rate of 2.9 percent. Maine's southern region (Cumberland and York Counties) has high population levels, below-average unemployment rates, and a median household income well above the state average. Only a small percentage of people in this region make money from agriculture, fishing, forestry, or hunting. In contrast, Maine's midcoast region (Kennebec, Knox, Lincoln, Sagadahoc, and Waldo Counties) has far smaller population sizes ranging

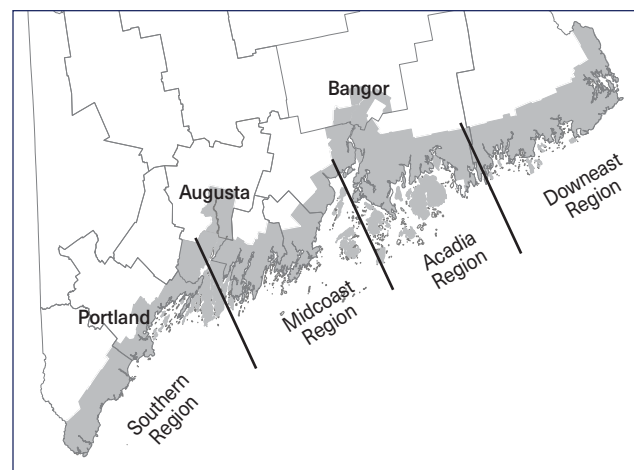
from 122,302 in Kennebec to 34,634 in Lincoln, but median household incomes and unemployment rates consistent with the state average. Interestingly, midcoast Knox and Lincoln Counties have more than double the typical proportion of people working in agriculture, fishing, forestry, or hunting sectors (3.8 percent and 2.1 percent, respectively).³

Maine's Acadia and Downeast regions offer a different picture. The Acadia region (Hancock and parts of Penobscot County) reports a higher unemployment rate and lower median household income compared to state averages. Still, it maintains a similar percentage of workers in agriculture, fishing, forestry, or hunting sectors. The Downeast region (Washington County) reports more than three times the state average proportion of people working in agriculture, fishing, forestry, or hunting, but also reports higher unemployment levels and a lower median household income than the state averages.

DATA COLLECTION

This study analyzes data from a 2018 survey of coastal Maine residents. Surveys were mailed to residential addresses in the Maine Coastal Zone throughout the four regions of interest: southern, midcoast, Acadia, and Downeast (see Figure 1, N=6,000);⁴ 832 surveys were completed.

The survey contained four sections consistent with modified Dillman methods (Dillman et. al. 2014). Section 1 collected information about Maine coastal residents' opinions and awareness about marine aquaculture and current development in their community. Section 2 collected

FIGURE 1: **Maine Coastline with Four Regions of Interest**

information on their preferred mix (i.e., species, location, and size of farms) of aquaculture development. This section also included an embedded information experiment, reporting the economic impact of the Maine aquaculture sector to half of the respondents (randomly assigned), (data are not analyzed here). Section 3 contained a hypothetical choice experiment on willingness to donate to expand/restrict new aquaculture development in Maine. Section 4 solicited respondents’ demographic information and had questions targeting perceived community resiliency. The current analysis focuses on data from sections 2 and 4. While the survey specifies different types of aquaculture, the metrics we used generalize marine aquaculture to the industry as a whole. We understand that aquaculture is more diverse, with different methods, species, locations, and resulting environmental and community impacts. However, our analysis focused on marine aquaculture at the industry level to further understand general industry perceptions, elicit honest opinions, and avoid confusion or indifference from respondents.

Respondent demographic information is presented in Table 2. Our sample participants are older, more male, wealthier, and have a higher education than average in Maine’s coastal region.⁵ We recognize that our sample limits our ability to generalize findings to Maine’s coastal population. The sample affects the study’s generalizability, as preferences and perceptions may change according to any of those attributes. The relatively small sample size also limits our statistical power. Future research should work to recruit a younger sample size, as well as increase outreach among our small sample areas, particularly in the Downeast region.

RESULTS

As citizens and as seafood consumers, Maine residents are being asked to make choices about how our coastal spaces are being used, often with an eye toward enhancing

community resilience. These choices may rely on perceptions or knowledge of a use—such as exposure to and knowledge of the process allowing aquaculture operations. To analyze sustainable aquaculture interest in Maine more closely, we must first understand current residents’ knowledge of the sector.

Knowledge of Aquaculture Governance in Maine

To gauge current knowledge of aquaculture governance in Maine, survey participants were asked “Who permits Maine’s aquaculture farm sites?” Responses show general uncertainty, as 60 percent responded “don’t know,” 29 percent indicated the state permitted sites, 8 percent said local governments, and 3 percent responded federal government. The Maine Department of Marine Resources approves and monitors all current aquaculture leases in the state, so these findings suggest an opportunity to enhance citizen awareness of this process.

To further assess knowledge of the aquaculture sector, participants were asked whether they were familiar with the selection and permitting process for aquaculture sites in Maine. We found a statistically significant difference in the familiarity of respondents by region.⁶ Overall, 89 percent of individuals were unaware of the selection and permitting process, with the highest percentage in the southern region (91 percent) and lowest in the Downeast region (78 percent). Of the 12 percent of respondents who were familiar with the selection and permitting process, 48 percent were satisfied with it, 41 percent were not satisfied, and 11 percent didn’t know. This lack of familiarity with aquaculture selection and permitting should be considered when examining the community resilience of these areas, as any solution aimed at boosting resilience must be understood and accepted by the public.

Finally, to assess current residents’ understanding of aquaculture governance, participants responded to a Likert-scale question about their perceptions of aquaculture farm

TABLE 2: Comparison of Maine Coastal Population to Survey Participants

Demographics	Gender (% female)	Median age	Median household income (\$)	Education (% bachelor’s+)	Unemployment rate (%)
2017 Maine coastal population	51.2	44.1	57,123	31.3	5.0
Marine aquaculture survey respondents	36.3	63.0	87,500	66.1	2.6

Note: The coastal population is composed of residents from counties Cumberland, Hancock, Kennebec, Knox, Lincoln, Penobscot, Sagadahoc, Washington, Waldo, and York.
Source: Calculated using data from the 2017 American Community Survey 5-year estimates (<https://www.census.gov/quickfacts/fact/table/ME/PST045221>).

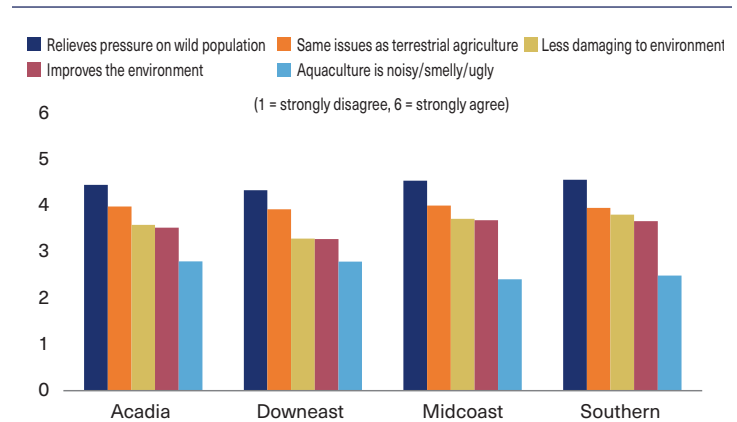
ownership in Maine. Responses to this question can help explain aquaculture's fit with community resilience goals, as local ownership can work to increase both community wealth and community cohesion. Results show statistically significant differences in responses between regions regarding the statement "Maine aquaculture farms are not owned by local people" (1 = strongly disagree, 6 = strongly agree).⁷ The mean response among the sample was 3.30, with a standard deviation of 1.24. Regionally, respondents from midcoast Maine disagreed with this statement the most (mean = 3.08, s.d. = 1.26), followed by respondents from the southern region (mean = 3.20, s.d. = 1.13), Acadia region (mean = 3.66, s.d. = 1.29), and the Downeast region (mean = 4.21, s.d. = 1.40). We believe these differences stem from the type of aquaculture currently occurring in these regions and the respective ownership structures; however, these differences may be another opportunity to provide Maine citizens with information about the aquaculture sector.

Environmental and Economic Perceptions of the Marine Aquaculture Sector

The survey provided a series of Likert-scale questions to gauge citizen perceptions of the marine aquaculture sector in Maine (Figure 2). Results indicated that participants viewed marine aquaculture positively from an environmental and economic perspective. Environmentally, respondents mostly agreed that aquaculture is less damaging to the environment than wild harvest practices, that it improves the marine environment, and that aquaculture is a good way to relieve pressures on wild populations. They tended to disagree that aquaculture is noisy, smelly, or ugly.

Economically, respondents reported positive statements about aquaculture and disagreed with potential negative impacts (Figure 3). With respect to improving community wealth metrics, participants agreed that aquaculture can boost the local economy (91 percent rated 4 or above), has a positive economic impact on the local economy (88 percent rated 4 or above), and provides good jobs to those living on the coast (85 percent rated 4 or above). Additionally, respondents expressed willingness to pay extra for Maine-grown seafood (73 percent rated 4 or above), but agreed that aquaculture can lower the price of seafood (60 percent rated 4 or above). Respondents agreed that Maine residents (72 percent rated 4 or above) and visitors to Maine (61 percent rated 4 or above) support aquaculture development in Maine.

FIGURE 2: **Environmental Perceptions of Aquaculture**

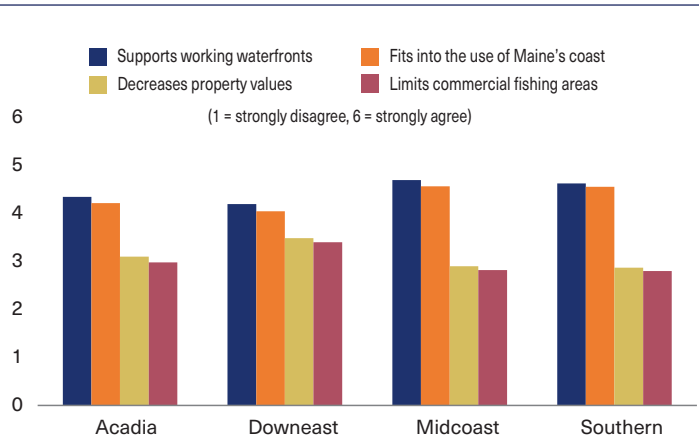


Finally, respondents tended to agree that there are few marine-based jobs for young people in Maine (60 percent rated 4 or above), suggesting potential opportunities in this market sector. Providing industry-based jobs on the coast for young people can further improve livelihood diversification in these communities, boosting overall resilience. Respondents disagreed that there is no more room to add marine aquaculture farms (86 percent rated 3 or below), which shows potential acceptance of further growth in this industry may be accepted by coastal residents.

Perceptions of Marine Aquaculture Expansion or Contraction

Maine citizens must confront an important question concerning marine aquaculture in their communities: restriction or expansion? When asked if marine aquaculture should be allowed in Maine, we found that 98 percent of respondents agreed it should be allowed in at least some areas of coastal Maine (24 percent thought it should be allowed in all areas). We then asked all participants where aquaculture expansion or restriction should occur: none, one, some, or all of the four regions of interest (Acadia, Downeast, midcoast, and southern), thus allowing them to express preferences for within or outside their own region. Citizens from across Maine seem most concerned about expansion in the southern region (46 percent of respondents wanted to restrict in this area), followed by the Acadia and midcoast regions (28 percent and 21 percent, respectively). Concern over expansion in Downeast was largely limited to those from the region (10 percent of the entire sample and 3 percent of respondents from Downeast wanted to restrict expansion). This result may suggest that residents from other

FIGURE 3: Economic Perceptions of Aquaculture



regions of Maine perceive the Downeast region would benefit from aquaculture production, particularly given the current unemployment rate and income metrics of the region. Alternatively, these results may suggest a “not in my backyard” mentality, as the Downeast region has a relatively small population.

After assessing general interest in the growth of marine aquaculture, we asked participants to indicate their agreement with various statements about new aquaculture farms. These answers can provide further insight into community cohesion, as general agreement about accepting a new sector could improve this resilience metric. Ninety-five percent of respondents agreed that the impact of a proposed aquaculture farm on other marine users should be considered, and 97 percent agreed that the environmental impact of a proposed aquaculture farm should be considered. Moreover, 65 percent of participants agreed that there should be limits on how many farms an individual or company can own, and 82 percent agreed that there should be limits on the overall size of an aquaculture farm. In comparison, 54 percent agreed that corporations should not own aquaculture farms. A large majority (88 percent) of respondents agreed that the public should be able to comment on all proposed aquaculture farms, and 84 percent agreed that the aesthetic impact of a proposed aquaculture farm should be considered in the permitting process.

A series of Likert-scale questions, asking individuals about their perceptions of the growing sector, were presented to understand respondents’ interest in marine aquaculture expansion. Most participants were comfortable with marine aquaculture’s current expansion rate. However, more

respondents thought the sector is expanding too slowly rather than too quickly (mean = 2.78, s.d. = 0.724, where 1 = far too slowly and 6 = far too quickly). Responses across regions were marginally statistically different, with the southern region viewing marine aquaculture as expanding too slowly (mean = 2.73, s.d. = 0.70) and the Downeast region seeing expansion at about the right number (mean = 3, s.d. = 1).⁸

Generally, participants were not concerned about the number of marine aquaculture farms near their communities. Instead, more respondents felt there were too few across farms all regions (mean = 2.51, s.d. = 0.76). Further, coastal Mainers have statistically different perceptions of the current number of aquaculture farms across regions.⁹ From a regional perspective, the growth of aquaculture in Maine is generally accepted by coastal residents; however, to maintain public support and incorporate resilience factors through implementation, expansion of this sector must not be rushed.

Perception of Own Community Resilience

A significant aspect of peoples’ perceptions of community resilience is how they rate current community strengths. Amenities enhance a community and retain current residents, while providing an additional pull factor for individuals looking to move to a new area. Across coastal Maine, many amenities (e.g., recreational opportunities or natural beauty) bring in new residents, as well as retain current ones. However, to respond to future challenges within each coastal region, it is also vital to document the perceived weaknesses of communities to assess key issues and potential adaptations.

Preparing for resilience requires the creation of systems that thrive under uncertainty and respond well to different stressors (Jurjonas and Seekamp 2018). We asked residents to rate their current community in five specific areas: (1) amenities/recreation opportunities, (2) housing availability/affordability, (3) transportation, (4) economic climate, and (5) broadband internet/cell quality (Figure 4). These areas were rated using a Likert-scale, from 1 (very bad) to 6 (very good). In general, we found that respondents felt positively about their community amenities. From highest to lowest, across the state, respondents rated the areas in the following order: amenities/recreational opportunities (mean = 4.61; s.d. = 1.20), internet/cell quality (mean = 4.11; s.d. = 1.45), economic climate (mean = 4.05; s.d. = 1.17), transportation

(mean = 3.58; s.d. = 1.48), and housing (mean = 3.17; s.d. = 1.29).

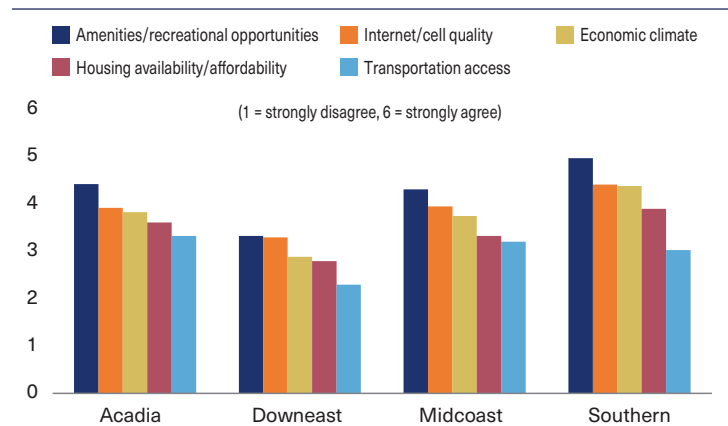
The southern region expressed the least positive view of housing affordability and availability. Sixty-six percent of respondents from this region answered a 3 or lower to housing availability and affordability, which was statistically lower than the other regions.¹⁰ Respondents from the southern region rated the region's other categories positively (transportation, current economic climate, amenities, and broadband/internet availability). In the Downeast region, respondents expressed strong dissatisfaction with several metrics; 76 percent of Downeast respondents chose a 3 or lower when asked about the current economic climate in their community and 20 percent rated the current amenities in this region as very bad (though we remind the reader of the low response rate from this area).

In midcoast Maine, respondents answered positively to many community attributes. Fifty-one percent of midcoast participants rated their amenities and recreational opportunities as a 5 or 6 on the Likert-scale, and 62 percent responded with a 4 or higher to the current state of the economic climate. However, despite high ratings in other key areas, midcoast region participants gave the lowest rating to transportation availability (55 percent rated it as 3 or lower). Finally, the Acadia region rated amenities/recreational opportunities positively (78 percent rated 4 or higher), as well as the availability of broadband internet and good cell quality (67 percent rated 4 or higher). They additionally responded more neutrally to other categories, expressing only a slight concern with the economic climate (67 percent rated 4 or higher), transportation access (55 percent rated 4 or higher), and housing availability (47 percent rated 4 or higher).

Meaningful Characteristics of a Community

To further analyze the current strengths of Maine coastal communities, survey respondents noted characteristics that they value when determining whether or not to move. Interestingly, only 12 percent responded that they plan to move. Respondents were provided with nine reasons to move from their current residence on a Likert-scale and asked to rate each based on their preferences (1 = very unimportant to 6 = very important). Respondents generally valued natural beauty, quality of life, and housing as the three most meaningful amenities when considering a move.

FIGURE 4: **Current Community Perceptions**



Respondents from all regions valued the quality of life (mean = 5.17) and natural beauty (mean = 4.90). However, differences emerge in what characteristics were valued next. Respondents from southern and Downeast regions placed their next highest emphasis on housing, those from the midcoast placed it on education, and respondents from the Acadia region placed it on family.

Financial Stress among Residents

Participants were additionally asked to rate their agreement with a variety of statements to gauge their financial stress, consistent with capturing the resiliency metric of community wealth using a scale of 1 (low financial stress) to 6 (high financial stress), adapted from Wheaton's chronic stress metrics (Turner and Wheaton 1995). Overall, results indicate that respondents have low individual financial hardship or concern (mean = 2.69), but do seem to have strong concerns over the Maine economy in general (mean = 4.66).¹¹

DISCUSSION AND CONCLUSION

Our findings provide evidence that each coastal region of Maine faces unique challenges related to their community resilience. The results show general support for the growth of aquaculture across the state, in part because of the fit with community resiliency goals. Emerging industries connected to Maine's natural-resources-based heritage, such as aquaculture, may provide communities with sustainable ways to increase community wealth and improve livelihood diversification. However, concerned citizens may feel that large-scale aquaculture projects pose a potential risk to the coast's natural beauty. Further, recent state legislation may

limit new leases for future aquaculture sites.¹² Given these views, outlining some policy considerations arising from our survey results is important.

First, respondents demonstrated limited knowledge regarding the state's selection and leasing process of aquaculture sites. Given this knowledge gap, we recommend the state and aquaculture industry partners make an effort to improve general information on the process associated with siting aquaculture facilities and approving aquaculture leases. While large aquaculture leases often require considerable public input, smaller farm leases such as limited purpose licenses and experimental licenses are more easily obtained and require less public outreach (Johnson 2020). Improved educational outreach will allow greater transparency in lease agreements and further support resilience metrics of community cohesion, as further clarity on the aquaculture industry could ease the concern of some community members on further expansion in their region.

Second, it will also be crucial for policymakers to understand and properly address citizen concerns regarding aquaculture (such as pollution and issues of unnaturalness). This finding suggests that such concerns could prevent support from many residents. Our results also show that coastal residents consider the amenities of quality of life and natural beauty when making relocation decisions. Providing clear and concise information and investing in measures to prevent any harm to Maine's natural beauty are imperative to boost citizen support and improve community cohesion.

Third, our results suggest policymakers should ensure any siting process includes opportunities to discuss different geographic locations, including coastal regions that have not yet been used for aquaculture. When assessing new regions, policymakers must also consider current infrastructure and availability of resources, as our results suggest perceptions on these factors vary between regions. Further research into community resilience metrics for these regions may identify issues affecting residents and policy actions necessary to help remove any barriers. Understanding the difference in each region of Maine will allow policymakers and citizens alike to work towards providing a sustainable path forward.

It is important to continue collecting information on citizens' preferences relating to aquaculture within their own regions, as well as in other regions in Maine. Aquaculture may support these key elements of community resilience without risking the meaningful community characteristics highlighted by our respondents. Maine's growing and

changing population brings new challenges as we strive for community resilience; therefore, we must continue expanding citizens' understanding of marine aquaculture and its role in the resiliency vision.

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NOTES

- 1 Maine's coastal zone includes inland communities that border tidal waters; therefore, the survey was sent to nine counties.
- 2 <https://www.maine.gov/dmr/aquaculture/maine-aquaculture-leases-and-lpas/aquaculture-lease-decisions-table>
- 3 <https://www.maine.gov/labor/cwri/county-economic-profiles/countyProfiles.html>
- 4 Coastal cities in Maine are defined by the Maine Coastal Zone Program (<https://www.maine.gov/dmr/programs/maine-coastal-program>). InfoUSA provided a random sample of mailing addresses based on Zip Codes provided by researchers.
- 5 The sample contains fewer than 50 responses from Washington County—a rural, coastal-resource-dependent county in Maine—limiting our ability to generalize responses from this portion of the sample.
- 6 The percentage of participants that were familiar with aquaculture siting were significantly different, ($\chi^2(3, N = 793) = 7.662, p = .054$).
- 7 Aquaculture sites are not owned by local people ($F(5,734) = 5.88, p = 0.0000$).
- 8 Speed of aquaculture growth by region ($F(4,735) = 2.07, p = 0.0832$).
- 9 Amount of aquaculture sites by region ($F(4,695) = 1.97, p = 0.0975$).
- 10 The percentage of perceptions on housing availability/affordability by region is significantly different, ($\chi^2(3, N = 788) = 24.143, p = .063$).
- 11 The percentage of perceptions on housing availability/affordability by region is significantly different, ($\chi^2(3, N = 788) = 24.143, p = .063$).
- 12 Recently passed bill LD 1951 (An Act Regarding Marine Finfish Aquaculture) established a stocking density of 30kg/m³ for all future marine salmon aquaculture leases.

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