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## Including the Human Dimension into Resilience Planning for Maine's Lobster Fishery

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### Cover Page Footnote

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# Including the Human Dimension in Resilience Planning for Maine's Lobster Fishery

by Katherine Maltby and Katherine E. Mills

American lobster. Maine. The two are practically synonymous, a pairing recognized the world over (and if not, a visit will quickly rectify that). One of the most valuable fisheries in the United States and deeply woven into the social and cultural fabric of communities along Maine's coast, the American lobster is an integral part of Maine's past, present, and future. While lobstermen and their families, communities, and businesses are skilled in coping with the challenges being in the lobstering industry presents—both on water and on land—now is a critical time for the fishery. Numerous pressing challenges are afoot, including impending right whale conservation measures, offshore wind development in the Gulf of Maine, and shifting availability of the lobster stock itself.

A central thread to these challenges is climate change. Since the 1980s, the Gulf of Maine has warmed three times faster than the world's oceans.<sup>1</sup> Ocean warming is affecting marine ecosystems along the Northeast US coast, leading to changing plankton abundance and locations (a factor influencing changing right whale distributions as they rely on plankton for food); shifting lobster distributions and population numbers (altering their availability to lobstermen); and increasing urgency for action to reduce warming and its impacts (the impetus behind offshore wind development) (Maine GEO 2023; Meyer-Gutbrod et al. 2021; Wahle et al. 2015). Each of these

challenges presents significant implications for Maine's lobster fishery. Here, we focus on the challenge of the shifting availability of lobster due to this shift's central role in the future trajectory of the fishery and its effects on reliant communities and businesses.

## CHANGING LOBSTER AVAILABILITY

Over time, with warming temperatures, the center of the lobster population has moved further northeast, towards deeper and offshore waters (Mazur et al. 2020). Lobster landings have generally followed suit (Pinsky and Fogarty 2012). Such favorable environmental conditions in addition to lobstermen's long-standing conservation measures have meant that landings for the Gulf of Maine lobster stock have increased substantially over the past couple of decades, breaking historical records and leading to what some call a "lobster boom." These high landings have fostered a high dependency and specialization of Maine's fishing communities on this single species, a trend exacerbated by a broader decline in groundfish and regulatory restrictions that inhibit flexibility to fish other species (Steneck et al. 2011). However, continued warming, the threat of shell disease, and wider marine ecosystem changes present considerable future uncertainty: low juvenile lobster settlement and declines in some recruit indices have been observed, total landings

volumes have declined slightly since 2016 (although are still at near all-time highs), and some model projections indicate declines in lobster numbers into the future (ASMFC 2023; Le Bris et al. 2018; Oppenheim et al. 2019). Such high dependency on one resource increases the vulnerability of individuals and communities to both climate and nonclimate stressors. With Maine's lobstering communities, therefore, on the frontlines of climate change, adaptation and resilience planning is key to ensure that the fishery can continue to provide ecological, economic and sociocultural benefits.

Within these environmental and climate change contexts, research to date has overwhelmingly focused on the biology and ecology of the lobster itself. While necessary, examining changes in lobster is only part of the story: fisheries are complex social-ecological systems that depend on relationships and interactions between the stock and people. To understand these relationships, the social sciences have much to offer. Social sciences can highlight the different ways people interact with their environment and alter their behaviors with changing conditions and examine factors that influence these decisions and behaviors. This sort of research can inform our understanding of the social resilience of individuals and communities to environmental changes and provide important insights for planning for the future.

## LOOKING SOUTH

To help us unpack these questions, we don't have to look far. Southern New England's lobster fishery has experienced declines in its lobster population since the late 1990s, so it provides a valuable case study. Such low population numbers

and poor recruitment led the most recent (2020) Atlantic States Marine Fisheries Commission stock assessment to classify the stock as “significantly depleted,” although notably it is not subject to overfishing (ASMFC 2020). A range of factors contributed to these declines, including warming sea temperatures, shell disease and water quality issues (Goldstein et al. 2022; Pearce and Balcom 2005). In addition to this steady decline, the stock also experienced several short-term mass mortality events, the most significant of which was the 1999 Long Island Sound “die-off” event, which was declared a federal disaster. Causes of this event are contested among stakeholders. Scientific evidence suggests that high temperatures, a tropical storm and high rainfall, and low oxygen were to blame (Howell et al. 2005). Lobstermen and wider industry point to pesticides and poor water quality. Reaching consensus of cause among stakeholders still appears unlikely, and as one lobsterman described, it is likely a “witches’ brew” of issues that affected the stock. What is clear, however, is that the social and economic implications from these short-term events and longer decline are substantial and ongoing. The number of lobstermen in southern New England has fallen dramatically, and impacts are numerous including loss of community ties and friendships, loss of a way of life, psychological distress, and family disruption (Dyer et al. 2002; Seara et al. 2022).

To better understand the consequences of these changes in lobster, we conducted interviews with current and former lobstermen from New Jersey to Maine and analyzed news articles reporting on the lobster declines since the late 1990s. We summarize some of the key findings and contextualize them to Maine.

Lobstermen in southern New England have responded to declining

lobster populations through multiple resilience pathways. Some lobstermen have hung on and are persisting in the fishery; some have adapted to other fisheries; and some have even left the lobster fishery completely. Strategies used include changing fishing behavior or business operations, relying on savings or loans, diversifying fishing portfolios, moving into new fisheries, getting new jobs, or leaving the area. In interviews, lobstermen discussed how the pathways they pursued changed over time, how they moved between pathways as they adjusted to new circumstances and priorities, and how they weighed if or when to let go of the lobster fishery and try something else. Their resilience was not fixed, rather it evolved over time, which highlights that flexibility is key to effectively responding to uncertain conditions.

Multiple factors influenced lobstermen’s abilities to respond, spanning from individual and household factors to community and management factors. Although often circumstantial to individual lobstermen, factors included access to assets such as savings or federal aid; their own financial pressures; and their personal emotions, occupational attachment, and identity associated with fishing. Lobstermen often discussed the inflexibility of management systems to enable switching to alternative fisheries. Interviews revealed the tensions between industry, science, and management due to differences in the perceived causes of the lobster declines and the ways some industry members have been involved in decision-making over time. Through conversations, it also became clear that the lobster declines had important well-being implications (e.g., stress, family disruption) as well as sustainability considerations (e.g., increasing fishing pressure on non-lobster resources).

## INSIGHTS FOR RESILIENCE PLANNING IN MAINE

So, how do these experiences translate to Maine? While there are important differences between the two regions, we can glean some generalizable learnings for future resilience planning (Box 1, discussed in more detail below).

### *Encouraging Diversity in Responses and Preferences*

The different resilience pathways shown by lobstermen in southern New England to changing lobster stocks reveals the importance of accounting for diverse preferences, capacities, and strategies in planning efforts. Similarly to how the inshore Maine lobster stock is managed on a zone basis to reflect local differences in lobster ecology and fishing behavior, adaptation and resilience plans will also need to be locally relevant and contextualized for different communities and individuals. For example, lobstermen in Downeast Maine may find it difficult to diversify their operations because of the region’s rurality and perhaps limited economic opportunities and transportation options. Lobstermen further south, however, may have more diverse economic opportunities, such as tourism and technology, and more access to transportation and other infrastructure that can make it easier to diversify catches and find new markets.

Accounting for multiple resilience pathways means enabling these different approaches and equipping individuals with the support, tools, and information they need to make informed decisions. Previous research indicates that short-term coping strategies were commonly used by Maine lobstermen instead of long-term, more substantial adaptations when they faced economic crises (such as the 2008 recession) and environmental

challenges (such as the 2012 marine heat-wave) (Henry and Johnson 2015). Facilitating actions beyond short-term coping is therefore necessary. For example, those wishing to continue lobstering full time may benefit from greater collaboration across the supply chain to help maintain prices and market access and invest in storage capacity and logistics to increase efficiencies. Raising awareness and creating resilience dialogues with existing initiatives are important steps. For example, Coastal Enterprises, Inc.'s, Maine Seafood Marketing Initiative and the Maine Lobster Marketing Collaborative have the potential to support lobstermen seeking such opportunities.

Different supports or interventions will be required for lobstermen wishing to diversify catches or livelihoods. These individuals may benefit from access to education to learn new skills or regulatory changes that allow them to catch different species. For example, switching to aquaculture, as some lobstermen are doing, may require field visits and on-farm opportunities to learn about establishing an aquaculture business (Cleaver et al. 2018). Enabling lobstermen to access and participate in alternative fisheries should also be a key priority (Johnson et al. 2014; Stoll et al. 2016). Given existing limited-entry and licensing systems, it is important to facilitate access to alternative fisheries as a way to build social resilience and increase diversification options for lobstermen.

#### *Furthering Resilience-oriented Research*

Research on these different resilience pathways for different regions is crucial for future planning. Looking at southern New England, we can see that while there was much research on understanding changes in the lobster stock, there was less attention on the social and economic

### INSIGHTS FROM SOUTHERN NEW ENGLAND'S EXPERIENCES

#### Encouraging Diversity in Responses and Preferences:

Recognizing and supporting a diversity in preferences, capacities, and strategies regarding how people respond to changing lobster availability.

#### Furthering Resilience-oriented Research:

Undertaking collaborative research that centers social and economic science and builds trusting relationships to enable understanding of the needs, barriers, and enablers of resilience strategies at different scales and in different regions and communities.

#### Moving beyond Reliance on Industry Innovations:

Using cross-regional learning and integrative approaches for management and resilience planning to enable more holistic decision-making and action, including connecting multiple stakeholders and sectors not traditionally involved in fisheries management.

impacts of the declines (Seara et al. 2022) or evaluating the conditions needed for certain resilience strategies to succeed. Further, some industry participants question the validity of scientific research conducted to examine drivers of the lobster declines, leading to a lack of trust in methods and conclusions. Maine's lobstering community has a long history of collaborative research, which should continue to be prioritized into the future. Continuing to build trust between science and industry is also critically important at a time when broader topics of right whale conservation and offshore wind lead some stakeholders to question the validity of scientific evidence.

Similarly to southern New England, much of Maine's collaborative lobster research has centered on the lobster itself, often using industry vessels for surveys and biological sampling. Lobstermen and their communities have considerable and varied knowledge, perceptions, and experiences, however, and researchers should focus on collaborative and codeveloped social and economic studies to capture this wealth of information. This

information can inform more locally grounded and contextualized strategies for building resilience in communities. There are some great examples of this. University of Maine researchers are leading a project to codevelop social, sentinel indicators of the lobster fishery that can be used to signal early signs of vulnerability in the fishery.<sup>2</sup> Novel approaches such as these, alongside ecological metrics, provide opportunities to integrate multiple types of knowledge and information into community and management decisions, thereby increasing our understanding of the social dynamics of fisheries.

#### *Moving beyond Reliance on Industry Innovations*

Critically, supporting social resilience must also go beyond relying on individual and industry action and innovation. Indeed, lobstermen are facing a range of challenges and are being stretched to invest sufficient resources and mental energy to proactively respond to future uncertainties in lobster stock availability while balancing other issues. Therefore,

we need to look at scales and approaches beyond the individual.

A readily available opportunity lies in continued investigations of the responses of multiple stakeholders to southern New England lobster declines. We can use these experiences as a source for insights for management decisions and resilience planning for fisheries in Maine. While our research focused on lobstermen's experiences, we propose that it would be beneficial for lobstermen, industry participants, community members, scientists, and managers to come together to reflect on the past 24 years of declines in southern New England and to consider the successes and mistakes and what opportunities or challenges remain. Such conversations may be difficult. Yet, the value of cross-regional sharing cannot be underestimated for informing future resilience planning in Maine: grounding future actions to lived experiences in a similar system is a unique opportunity. Building from this, there are also opportunities for Maine's lobster fishery to undertake scenario-planning exercises to consider future pathways and options the fishery could face and examine ways for getting there. These deliberations and processes work best when they are participatory and involve multiple stakeholders.

At a more transformative level, working towards more integrative, cross-sector approaches for supporting resilience is also needed. Resilience is not just influenced by fishery-specific factors, but also by a broader web of social, economic, and political issues. We need more holistic thinking about how social resilience can be supported and which stakeholders should be involved in decision-making or implementing interventions. Further, while climate change affects lobster availability, other impacts such as sea level rise and an increase in the intensity or timing

or storms will also affect marine resources, fishing communities, and infrastructure. Therefore, it will be crucial to develop ways for management bodies involved in the Maine lobster fishery to connect with other stakeholders and agencies charged with supporting resilience—such as municipal coastal managers tackling sea level rise in coastal communities or nonprofits fostering livelihood diversification—and work towards common objectives and goals.

### LOOKING FORWARD

While the future of the Maine lobster fishery is threatened, lobstermen have demonstrated many examples of innovation, collaboration, and determination. Navigating shifting lobster availability will require concerted efforts and proactive action at a range of scales, from individual to regional, and a diversity of approaches to support resilience. Learning from others, building effective relationships, thinking holistically, and increasing the role of social science in these decisions will be critical for this journey.

### NOTES

- 1 <https://www.gmri.org/stories/warming-22/#:~:text=Since%20the%20early%201980s%2C%20the,per%20decade%3B%20Figure%201>
- 2 <https://social-oceans-lab.github.io/social-indicators-project>

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