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Reflecting on Maine's Changing Productive Coastal Region

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Abstract

This article reflects on Maine's changing coastal region and blue economy. Much of Maine's coastal economy is now considered to be overly dependent on a single commercial fishery, the iconic Maine lobster fishery. Marine aquaculture has grown in the last 10 years, with expansion expected both on land and sea. Marine renewable energy is also an emerging use but remains a frontier. These changes have been exacerbated by demographic changes characterized by youth out- and amenity migration. As community demographics and coastal uses continue to change following the region's postproductive transition, policymakers must be proactive in considering potential conflicts emerging between different uses and value systems held in Maine's coastal communities.

INTRODUCTION

It would be hard to exaggerate the significance of Maine's coastal region to the state's economy and culture. In 2016, Maine's ocean economy employed more than 51,000 people and generated $1.9 billion in wages and $2.9 billion in gross domestic product (NOAA 2019). Tourism and recreation accounted for 62.2 percent of employment in Maine's ocean economy in 2016. Whereas employment increased across the state by 1.3 percent from 2015 to 2016, employment in Maine's ocean economy sector grew by 5.6 percent, with the living marine resources sector experiencing the highest absolute gains in employment (NOAA 2019). Indeed, "people from away" are drawn to the picturesque Maine coastal village and the timeless Gulf of Maine, either for a short visit or permanent resettlement.

But the Gulf of Maine is changing rapidly—its surrounding communities, cultures, economies, and climate, as well as the undersea ecosystems and critters that live within them. Of particular concern are the anticipated impacts from a changing Gulf of Maine, with sea temperatures believed to be increasing at a pace faster than anywhere else on the planet. Impacts from a changing Gulf of Maine are already being observed in Maine's fisheries and coastal communities dependent upon them: changes in the timing and duration of the lobster season, the closure of the northern shrimp fishery, and increasing numbers of invasive predators in the intertidal zone.

In considering Maine's bicentennial, I reflect on some of the recent history of and trends occurring across Maine's ocean economy. The history of Maine's coast has been well documented, and it would be impossible to do it justice in this brief reflection. As such, I focus on the state's productive, natural resource-based ocean economy with the intent to inform an ongoing conversation among policymakers— broadly defined to include municipal leaders, state and regional planners, resource managers, community and other stakeholder interest groups, and staff at nongovernmental organizations. Drawing heavily from my own research, experience, and observations living in and studying Maine's coastal communities, my hope is that such conversations can help cultivate a more resilient future for Maine's coastal region and working waterfronts.

MAINE'S COMMERCIAL FISHERIES

Across the globe, the end of World War II ushered in an era of technological advancement, government subsidies, and renewed interest in marine fisheries. Following the adoption of the 200-mile exclusive economic zone in 1974, the US domestic fishing fleet grew to unsustainable levels. As the saying goes, there were soon "too many boats, chasing too few fish," though the reality of the situation as it unfolded is a bit more complicated. There are important differences across fisheries, regions, and between inshore and offshore sectors, and between state and federal fisheries, but few would disagree that early efforts to manage

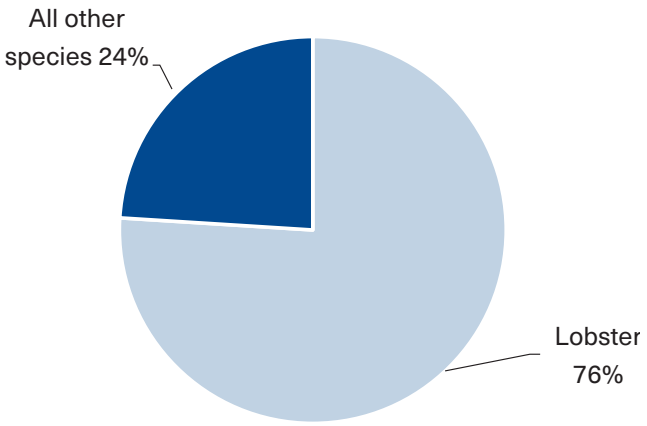
our nation's fisheries, beginning in the 1970s, failed miserably. Fast forward to today, we find many stocks remain depleted, though some are rebuilding and some doing well. Regardless, the resulting social and economic impacts on fishing communities were significant, especially in rural regions along Maine's coast, with consequences that are still felt today.

Long dominated by a diverse set of commercial fisheries, Maine's coastal region is now considered to be overly dependent on a single commercial species, the iconic American lobster. In 2018, 76 percent of all value generated from Maine's commercial fisheries came from sales of American lobster (Figure 1). To be sure, other fisheries are economically and socially important, but none compete economically with the powerhouse that is the Maine lobster fishery—either due to resource depletion, comparatively lower economic value, or severely or entirely restricted access due to management rules limiting entry. Before we discuss the lobster fishery, let's briefly consider some other fisheries in Maine.

Beginning in the late 1800s, Maine was a center of the nation's sardine industry, which canned Atlantic herring and provided an inexpensive and high-protein option for service members in World War II. The industry peaked in the 1950s, with more than 50 canneries employing thousands along Maine's coast. The last Maine sardine factory closed in 2010. Today, Atlantic herring is the most valuable pelagic fishery in the state, and these fish are a critical forage species in the ecosystem, consumed by other larger fish, seabirds, and marine mammals. Federal managers recently reduced the amount of herring that can be taken from the ocean and implemented area closures to protect the resource, raising concerns about potential impacts on the lobster fishery that continues to rely on it as its principal bait source.

The impacts of climate change on fisheries have been visible in the Gulf of Maine. Once a staple fishery along Maine's coast, the Northern shrimp fishery remains closed; in 2018, regulators closed the fishery for three more years, with many predicting a bleak future. This loss is considered one of the earliest impacts of climate change on Maine's coastal communities. Another fishery affected by climate change is Maine's soft-shell clam fishery, which has long been one of the most valuable fisheries in Maine. Soft-shell clam landings have declined significantly over the last 20 years, due in part to pollution and predators, like the invasive green crab, which has benefited from warming waters. As part of the comanagement system, clam harvesters from many municipalities engage in some kind of conservation work—such as reseeding flats and identifying and addressing pollution sources—while the state retains authority necessary to ensure the public's health.

FIGURE 1: **Percentage of 2018 Maine Commercial Landings by Ex-vessel Value from Lobsters and All Other Species**



Source: Maine Department of Marine Resources, "Historical Maine Lobster Landings," https://www.maine.gov/dmr/commercial-fishing/landings/documents/lobster.table.pdf

Once the second most valuable fishery in Maine, the green sea urchin fishery emerged in the early 1990s as a classic boom-and-bust fishery. The fishery remains plagued by the consequences of overharvesting and serial depletion that occurred at its inception. Localized overharvesting and serial depletion that resulted from a mismatch in the scale of management with scale of ecological dynamics of the resource led to ecosystem shifts from urchin-friendly to urchin-unfriendly habitat. Despite a comanagement governance structure that set limits on entry and fishing days, the fishery remains a fraction of it once was in terms of landings and numbers of harvesters.

Perhaps the most visible and socioeconomically important for Maine's fishery-dependent communities was the collapse of the region's groundfish fishery in the mid-1990s. Groundfish includes bottom dwelling finfish species such as cod, haddock, redfish, hakes, and yellowtail and other flounders. Along with vessels and crews, the

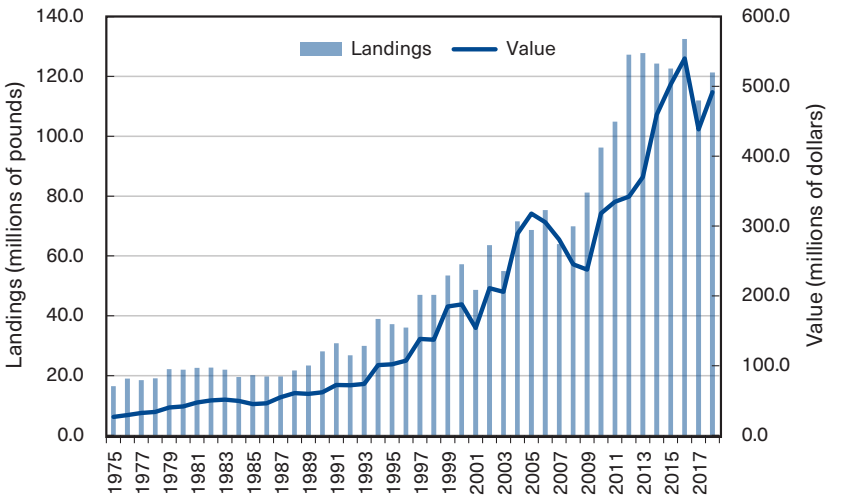
processing and shoreside businesses the sector supported are all but gone, especially in Maine's Downeast region. Exciting efforts are underway to monitor and rebuild the groundfish populations, such as the Eastern Gulf of Maine Sentinel Survey Fishery developed by University of Maine's Dr. Yong Chen and his research team (Henry et al. 2020) in collaboration with the Maine Center for Coastal Fisheries. Without some allocation changes to the federal catch share management system it will be difficult (but not impossible) to revive Maine's traditional small-boat, inshore fishery should the groundfish resource rebuild.

In contrast to these stories, the Maine lobster fishery remains one of the nation's most valuable fisheries. With a strong governance system and conservation rules in place, and combined with favorable environmental conditions, lobster landings and abundance grew rapidly over a period of 30 years (Figure 2). In fact, the management of the Maine lobster fishery is one of the most often-cited examples of effective fisheries governance in the world. University of Maine Professor Emeritus James Acheson (1988) documented the Maine lobster fishery's unique local management practices, including an informal system of limited entry via the local lobster gangs. University of Maine Professor Emeritus James Wilson led efforts that established formal lobster zone councils in 1994, part of a formal comanagement system that embraces many of the fishery's long-standing conservation practices. Under this system, governance is shared between the Maine Department of Marine Resources and seven democratically elected councils that have been given management authority to decide the local number of traps below the state maximum, the number of traps on a line, the time when fishing is allowed, and limited-entry rules. The fishermen in this fishery are known for their conservation ethic, i.e., for sacrificing short-term self-interest for future sustainability. Most notable is the v-notching law, first championed by the lobster industry in the 1930s, that protects egg-bearing females allowing them to reproduce; research has shown that it contributed significantly to the biological success seen in this fishery. Maintaining harvesters' conservation ethic will continue to be important for the future of this and other fisheries in Maine.

The overreliance of Maine's coastal region on the lobster fishery creates social and ecological vulnerabilities for Maine's coastal communities that will continue to demand policy attention. Of particular concern are the anticipated impacts from climate change. The fact that the southern New England lobster fishery collapsed in the 1990s due to ocean warming-induced shellfish disease is more than enough reason for policymakers and the industry to take the threat of climate change seriously. Other threats to the lobster fishery are emerging outside the immediate control of individual fishermen and the industry, including rules to protect the endangered right whale, reductions in the availability of herring used for bait, and global market disruptions as occurring with COVID-19. Given the multiscale complexities of these challenges, innovative policy strategies are going to be needed at the individual, community, state, and national levels of this complex social-ecological system.

Finding a way to allow new entrants into fisheries remains a critical policy issue, not only for the lobster

FIGURE 2: **Maine Lobster Landings, 1975–2018**



Source: Maine Department of Marine Resources, "Historical Maine Lobster Landings," https://www.maine.gov/dmr/commercial-fishing/landings/historical-data.html

fishery, but also for all limited-access fisheries in Maine. Scholars have shown that the absence of some limits to entry in fisheries leads to their overuse and depletion. As seen in other places, an unintended consequence of limited entry has been the aging of the Maine lobster fishery, what is known as the "graying of the fleet" (Johnson and Mazur 2018). For dive fisheries, like the sea urchin fishery, aging of the fleet exacerbates the high risk facing the physical health of harvesters in a fishery that has already experienced a number of tragedies at sea resulting in loss of life. Opening entry into fisheries without some limits is not a good idea for many reasons—the most important being the need to maintain the health and economic value of the resource and the well-being and safety of harvesters. While the state and industry has started conversations to address this problem, a more concerted, all-hands-on-deck effort is needed.

The good news for Maine's fisheries is that the state has long experimented in innovative, adaptive, and collaborative management approaches. The lobster zone management system offers opportunities for lobster fishermen to reinforce the importance of conservation on their livelihoods and to come to agreement when rules need to change. Similarly, comanagement-type arrangements exist in the state's municipal shellfish, sea urchin, alewives, and scallop fisheries. And Maine has never been shy to experiment with new management techniques. For example, Maine's scallop fishery has adopted an innovative rotating closure system that allows for adaptive decision-making, along with a lottery system to allow for new entrants. Maine's somewhat controversial and lucrative elver fishery is managed as an individual quota fishery, where a limited number of individuals are allocated a set amount of eels they can catch each year. There have been both industry-driven and state-initiated conservation closures implemented in effort to rebuild the resource through manipulation and management of sea urchin habitat (Ovitz and Johnson 2019). Collaborative efforts are also underway to rebuild alewife populations, which will hopefully support future groundfish populations. Industry members, policymakers, and researchers will continue to benefit from engaging together to develop effective strategies in response to changing social and ecological conditions.

NEW USES OF THE COASTAL REGION

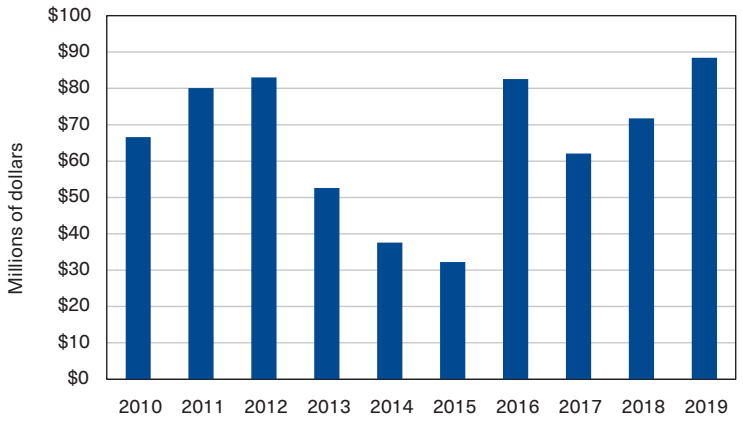
As Maine's communities transition following the decline in, or loss of access to, commercial fisheries and confront an uncertain climate future and overdependence on the lobster fishery, there are increasing calls to diversify Maine's working waterfronts and ocean economy. New opportunities and vulnerabilities arise from these new uses of the marine coastal system, and this section briefly reflects on two growing sectors that are poised to diversify Maine's working waterfront: marine aquaculture and renewable energy.

Aquaculture

Though perhaps not as visible as the state's commercial fisheries sector, marine aquaculture has a long history in Maine beginning in the 1970s (Figure 3). A recent study found that Maine's aquaculture industry currently contributes $137.6 million to the state's economy, including 1,078 full- and part-time jobs and $56.1 million in labor income (Cole et al. 2017). Governor Janet Mill's 10-year strategic economic development plan to grow the state's economy calls out land-based aquaculture as a sector to support and grow with its significant potential to create high-wage jobs and otherwise boost the state's economy (Maine DECD 2019). According to a USDA report (2019), Maine had 65 aquaculture farms at the end of 2018 that generated approximately $72 million sales, up from 35 farms that produced sales of about $57.3 million in 2013. Three land-based fish farm proposals—referred to as recirculating aquaculture systems (RAS)—have been proposed, with high expectations for employment and other economic benefits for Maine's coastal region.

The growth of the aquaculture sector is often portrayed as being in conflict with traditional uses and values of Maine's coast. For example, many are concerned that an increasing aquaculture industry will reduce access for, or otherwise affect, Maine's fisheries and tourism sectors. Conflicts also arise over potential social and environmental impacts. But others suggest that the aquaculture industry can help communities by providing an opportunity for fishermen or others who wish to work on the water but cannot do so due to limited-entry restrictions. Conflicts observed over RAS proposals illustrate a range of support and opposition to aquaculture—from support (seen in Bucksport) to opposition (seen in Belfast).

FIGURE 3: **Maine Aquaculture Harvest 2010–2019**



Source: Maine Department of Marine Resources, "Maine Aquaculture Harvest Data," https://www.maine.gov/dmr/aquaculture/harvestdata/index.html

As with Maine's commercial fishing sector, a key policy issue relates to access and impacts. Currently, aquaculture farmers in Maine must secure a lease or license from the Maine Department of Marine Resources. Standard leases are for up to 40 acres and a maximum of 20 years, with opportunity for renewal. Experimental leases are for up to four acres and a maximum of three years, with no opportunity for renewal except for the purposes of scientific research. Limited purpose aquaculture licenses (LPAs) are for 400 square feet for one year, with opportunity for renewal, with individuals limited to a maximum of four LPAs; these are generally less costly and easier to secure compared to standard leases.

Standard leases require extensive public input, including public hearings in the communities where farms are proposed, whereas LPAs and experimental leases generally require less public engagement. Public hearings can be very contentious with the most opposition from riparian landowners, while in some areas little conflict is seen (Hanes 2018). In some instances, conflicts reflect NIMBY (not in my backyard) opposition, where wealthier residents are able to mobilize legal challenges against farmers with unmatched resources. Such conflicts are likely to increase as the industry expands and communities reach social carrying capacity, or the amount of aquaculture a community is willing to allow.

Renewable Energy

Another seemingly inevitable coastal use expected to transform Maine's coastal landscape is marine renewable energy (MRE). This sector includes offshore wind and tidal power. MRE is one tool to reduce carbon dioxide emissions responsible for global climate change, some impacts from which are already affecting Maine's natural resources. But MRE is especially important when considering Maine's energy needs. Maine is one of the most petroleum-dependent states in the United States; about two-thirds of Maine's households rely on fuel oil for home heating. This makes Maine especially vulnerable to changes in oil supply and price spikes. The state has embraced a goal of reducing petroleum use by 30 percent below the 2007 consumption level by 2030, and 50 percent by 2050 (US EIA 2019). MRE offers a tool to reach those goals, while also providing high-wage jobs that will attract and retain a strong workforce. While the offshore MRE goals have not been met yet, substantive development efforts have been underway for more than a decade.

It is important to consider that there is only one offshore wind farm in the entire United States, the Block Island Wind Farm located off the coast of Rhode Island with 30-megawatt capacity, though several others are in varying stages of development. A second offshore wind farm, the 12-megawatt Coastal Virginia Offshore Wind pilot project, completed construction in June 2020. This stands in contrast to the world's largest offshore wind farm, the Hornsea One Project in the United Kingdom, which will open in 2020 and produce 1.2 gigawatts of renewable energy.[1]

In this context, Maine has an opportunity to be a leader in offshore wind production. In 2009, Maine's legislature set goals to install at least 300 megawatts of offshore wind capacity by 2015 and at least 5,000 megawatts offshore by 2030 (US EIA 2019). For more than a decade, engineers at the University of Maine's Advanced Structures and Composite Center have been advancing technology in hopes of developing this industry. Specifically, they have advanced the patented VolturnUS floating technology to support wind turbines in depths of 150+ feet. In 2013, the

VolturnUS 1:8, a one-eighth-scale, 65-foot-tall prototype became the first grid-connected floating wind turbine in the Americas. The effort will inform the construction of two full-scale floating offshore wind turbines to be located south of Monhegan Island that will use the VolturnUS platform technology.[2] This project will allow researchers to collect data needed to understand the social, economic, and environmental impacts, which can then be used to inform plans for a larger offshore project in the Gulf of Maine. In 2019, Governor Mills lifted a moratorium on commercial wind development that had been previously implemented due concerns about potential impacts on tourism, property values, and the environment. The offshore wind sector is expected to support approximately 2,100 jobs annually (American Jobs Project 2018).

Another promising MRE technology in Maine is in-stream hydrokinetic tidal power that takes advantage of dynamic tidal resources (Johnson and Zydlewski 2012). Although not likely to produce as much energy as wind, tidal resources are more predictable. As such, they offer an important contribution to Maine's energy portfolio. Efforts in Maine have been focused on the tidal resources in eastern Maine, in Cobscook Bay and Western Passage. And in 2012, the Ocean Renewable Power Company (ORPC) became the first company in North America to contribute power to the grid using their TidGen® Power System.[3]

While technological challenges and funding constraints remain significant, MRE development suggests that this sector is likely to face public opposition due to potential threats to tourism, recreation, property values, the environment, and especially the fisheries sector. Not unlike aquaculture, MRE often faces NIMBY-type opposition, where groups support MRE but just not near where they work, live, or play. Lessons from ORPC's stakeholder and community engagement efforts offer insight into how MRE can proceed in ways that minimize such conflicts (Johnson and Zydlewski 2012) and highlights innovative ways to engage the public in conversations and decision-making related to the development of this sector. For example, a marine spatial planning-type effort, like the effort that aided the Block Island offshore wind farm in Rhode Island, should be considered as these projects continue to develop. One lesson learned from efforts in the United States and elsewhere is that conversations around these projects need to occur earlier rather than later.

LOOKING FORWARD

The changes I have described reflect a postproductive transition along Maine's coastal region, one marked by a shift from an economy based on food production (e.g., fishing and farming) to other uses of the marine environment (e.g., recreation, tourism, energy, aquaculture). This transition and the social impacts arising from it on Maine's coastal communities have been significant and have created vulnerabilities for those living in the coastal region.

It is important to note that the postproductive transition across Maine's coastal economy has taken place within the context of changing demographics. After around 1910, much of Maine's rural coast saw declining populations due to the gradual decline in the natural resource-based economy. Coastal Maine, except for the Downeast region, rebounded after 1960 as populations grew again. Cheap land, the interstate highway, the back-to-the-land movement, and its proximity to the northeastern metropolitan regions, all led to an influx of amenity migrants. These new Mainers compensated for continued youth out-migration during this period. While gentrification, including displacement, occurred in some places, these amenity migrants also brought resources to communities (Thompson et al. 2016). However, future gains from these in migrants is expected to decline, raising questions about what these communities will look like in the long term.

As we look to the future at this time of Maine's bicentennial, community demographics and coastal uses are most likely going to continue to change following the state's postproductive transition. The anticipated changes in uses and demographics require traditional fisheries-dependent communities to compete with or adapt to other marine-use activities, interests, and values. In this context, policymakers must be proactive in considering potential conflicts between different uses and value systems in Maine's coastal communities. In some cases, these uses of the coastal region such as aquaculture and marine renewable energy pose potential NIMBY-like conflicts. These conflicts are about how we value Maine's coast, and they reflect the different values held by different groups of citizens about what they want the coast to look like. They call for more opportunities for stakeholders and other members of the public to engage in conversations and

decision-making related to these potentially conflicting activities, interests, and values. Fortunately, Maine has a long history and culture of developing innovative, participatory, and adaptive solutions to engaging stakeholders, science, and policymakers.

NOTES

1 More information about these wind projects is available on the following websites: https://news.dominionenergy.com/2020-06-29-Dominion-Energy-Completes-Construction-of-First-Offshore-Wind-Project-in-U-S-Federal-Waters; https://www.power-technology.com/projects/hornsea-project-one-north-sea/.

2 More information about VolturnUS is available here: https://composites.umaine.edu/research/volturnus/.

3 https://www.orpc.co/

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