East Coast Climate Change Scenario Planning

Exploration Webinar #3: Social and Economic Drivers of Change

March 2, 2022

Introduction

The East Coast Climate Change Scenario Planning initiative is being conducted to explore governance and management issues related to climate change and fishery stock distributions. During a scoping process in 2021, stakeholders provided input on drivers of change that have the potential to shape the future of east coast fishing over the next 20 years. A series of three upcoming webinars will examine these drivers of change in more detail:

1. Oceanographic Drivers of Change (Monday, February 14, 3-4:30pm)
2. Biological Drivers of Change (Wednesday, February 23, 3-4:30pm)
3. Social and Economic Drivers of Change (Wednesday, March 2, 3-4:30pm)

This document provides background material for Webinar 3, outlining the social and economic drivers that are poised to shape east coast fisheries in the next 20 years.

In this document, the driver descriptions have been kept relatively short and simple. The material is not designed to be comprehensive or provide all the answers. Instead, it is meant to get us thinking creatively about what could unfold in the future.

As you review these drivers of change, please keep the following questions in mind:

- Have the main social and economic drivers of change been captured that might affect east coast fisheries over the next 20 years?
- Are there important social and economic drivers that have been missed?
- Do the Key Uncertainties sections contain the most important questions about the drivers?
- Which of the drivers of change do you see as most impactful in shaping the future and your work in fisheries?

Following the webinar discussions, the most important and impactful driving forces will be used to create a scenario framework in a Scenario Creation workshop scheduled to be held in late Spring 2022.

Thanks for your continued interest in this initiative.

Major Social and Economic Drivers of Change

In addition to the combined effect of oceanographic and biological drivers, diverse social and economic factors interact to either constrain or enhance the ability for communities to achieve and sustain profitable and rewarding commercial and recreational fisheries. Some of the most important factors likely to shape East Coast fisheries over the next 20 years are briefly characterized below, by no means an exhaustive list.

Figure 1: Live blue crab in a bushel. Photo: Jason Houston.

Overview of East Coast Fisheries

Coastal tribes along the Atlantic coast harvested shellfish and finfish for sustenance and trade income for millennia. This was followed by several waves of intensive harvest by European and domestic flagged vessels and technological advances during the last 400 years. Since then, advances like steam powered trawling, onboard freezers, fish finders, outboard motors and other innovations sharply increased fishing power and helped drive development of today's fisheries. Current Atlantic coast fisheries have persisted, evolved and expanded through constant adaptation by individual fishermen, communities, and fisheries management agencies. It should be noted that fisheries are reliant on substantial coastwide investment in shoreside infrastructure and diverse supply chain businesses; for example, seafood dealers, processors, gear manufacturers, and thousands of shops selling bait and tackle from Maine to Florida. The economy, culture and quality of life for coastal states and communities and the nation as a whole is tightly linked to future prospects for Atlantic coast fisheries.

In the Northeast (Maine through Connecticut) and Mid-Atlantic regions (New York through Virginia), total landings are dominated by commercial fisheries, while in the South Atlantic region (North Carolina through Florida), the majority of landings are from recreational fishing.

Atlantic coast commercial fisheries have produced landings of about 1.2 billion pounds annually since 2011 (Figure 2), about 40% of total US commercial landings. The seafood industry along the Atlantic coast supported nearly half a million jobs in 2018. Commercial landings and revenue for most continental shelf species have generally been flat or declining since the 1980s. However, total annual landed value has been relatively stable, largely due to high prices for lobster and sea scallops. Recent average landings of select commercially important species by region are shown in Figure 3.

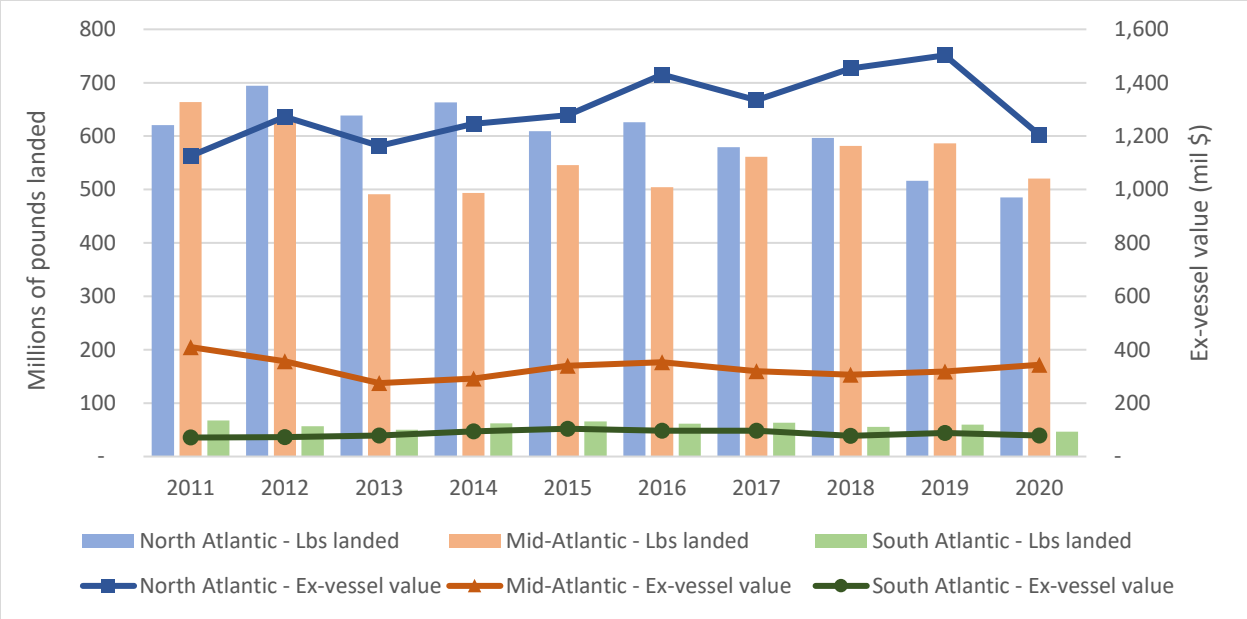

Figure 2: Commercial pounds landed (all species; meat weight for shellfish and whole weight for finfish) and ex-vessel value by region, 2011-2020. North Atlantic = ME-CT, Mid-Atlantic = NY-VA, South Atlantic = NC-East Coast of FL. Source: ACCSP Data Warehouse.

Northeast (Maine-Connecticut)			Mid-Atlantic (New York - Virginia)			South Atlantic (North Carolina - East Coast of Florida)		
	Sea Scallop	311 mil lb		Menhaden	422 mil lb		Blue Crab	30 mil lb
	American Lobster	138 mil lb		Sea Scallop	121 mil lb		Northern White Shrimp	18 mil lb
	Ocean Quahog	103 mil lb		Atlantic Surf Clam	107 mil lb		Marine Shrimp	13 mil lb
	Atlantic Surf Clam	87 mil lb		Eastern Oyster	71 mil lb		Eastern Oyster	8 mil lb
	Atlantic Herring	76 mil lb		Blue Crab	63 mil lb		Northern Brown Shrimp	5 mil lb

Figure 3: Average annual commercial landings for the top 5 harvest species by weight in each Atlantic coast region, 2016-2020. Source: Pers. Comm., ACCSP.

East coast waters also support a variety of important recreational fisheries, with an estimated 5.2 million anglers making 129 million fishing trips in 2018. At well over 100 million fishing trips each year, about 70% of all recreational angler fishing in the US takes place along the Atlantic coast. In recent years (2016-2018), total annual estimated recreational trips have averaged about 16 million per year in the Northeast, 45 million per year in the Mid-Atlantic, and 75 million per year in the Southeast Atlantic. Recent average harvest of the top recreationally harvested species by region are shown in Figure 4.

Recreational fishing effort in New England and the Mid-Atlantic regions has generally declined since its most recent peak in 2010, with total estimated recreational fishing trips dropping by 28% and 19%, respectively. In the Southeast region, recreational fishing effort has been stable, with indication of increased participation in recent years. Recreational anglers in all regions participate in fishing from shore, from private boats, or by paying for trips on for-hire (party/headboat or charter) vessels. Recreational fisheries have considerable economic impact via sales of recreational fishing vessels, bait and tackle and other fishing trip expenses including fuel, ice, and lodging. Total spending on recreational fishing trips and durable goods for east coast fishing is estimated to be nearly $15 billion each year, led by $8.6 billion of expenditures in the Southeast region. In 2018, the recreational fishing industry supported approximately 154,000 jobs along the East coast.

Northeast (Maine-Connecticut)			Mid-Atlantic (New York - Virginia)			South Atlantic (North Carolina - East Coast of Florida)		
	Scup	7 mil lb		Striped Bass	17 mil lb		Bluefish	8 mil lb
	Striped Bass	6 mil lb		Summer flounder	7 mil lb		Dolphin	7 mil lb
	Atlantic Mackerel	5 mil lb		Bluefish	7 mil lb		Red Drum	5 mil lb
	Black Sea Bass	4 mil lb		Scup	7 mil lb		King Mackerel	5 mil lb
	Tautog	4 mil lb		Yellowfin Tuna	7 mil lb		Spotted Sea Trout	5 mil lb

Figure 4: Average annual recreational harvest for the top 5 recreational harvest species by weight in each Atlantic coast region, 2017-2021. Source: NOAA Fisheries Recreational Fisheries Statistics Queries.

Population Growth and Demographics

Human population growth in coastal states is driving development that negatively impacts estuarine and coastal ecosystems as a result of increased impervious surfaces, inadequate wastewater treatment, shoreline armoring in response to sea level rise, and other factors. While past and ongoing coastal development stresses drive coastal habitat damage and loss in all regions, the 2020 census revealed that population growth in southeastern states over the last decade exceeds all other U.S. regions, heightening concerns for the future of fisheries that depend on vulnerable habitats.

A recent assessment of demographic trends in saltwater recreational fishing found that participants were mostly white (79%) and male (64%) and do not mirror the much more diverse demographics of coastal counties. There is an indication of increasing participation in saltwater recreational fisheries by hispanic men and women, and women overall.

Figure 5: East coast waterfronts currently support diverse industries and activities. How will population growth and changing social values impact working waterfronts ? Artwork: Glynn Gorrick.

Fishing communities across the U.S. are experiencing 'the graying of the fleet' as fewer young people choose commercial fishing careers. This is a coastwide issue and recent studies in Maine reveal a long term steady increase in the average age of lobster harvesters. As the average age of fishermen increases, generations of accumulated traditional ecological knowledge can be lost, potentially diminishing the ability for community adaptation to changing ocean conditions and opportunities.

Key Uncertainties: Will more people move to coastal areas in the next 20 years, and will faster population growth across the Southeast region continue? Will sea level rise, coastal inundation etc. mean that coastal living becomes less attractive and less safe as expenses and hazards rise? How will the make-up of fishing communities change in the next 20 years? How might the appeal of commercial or for-hire fishing as a career choice change as climate change continues?

External Cost Factors

Labor, fuel, and other input costs are major drivers of commercial and for-hire recreational profits, and future fluctuations in these costs are expected to continue to drive fishery effort, investment, and fishing behaviors. Rising costs of labor and fuel are exacerbated for vessels that may need to steam longer distances to search for target species as the distribution and abundance of traditional harvest species changes.

Changing conditions may require some fishermen to learn new fishing methods, purchase new gear, or upgrade fishing vessels in order to sustain profitable businesses. Prospects of sea level rise are likely to affect lenders' assessment of real estate values, and impact insurance costs for coastal facilities, which could affect processing facilities, moorings and marinas. Regulatory responses to dynamic ocean conditions with rapidly shifting opportunities can change the number of days available for recreational and commercial fishing. A wide range of regulatory actions in response to climate and other factors could change fishing industry costs for labor, gear and vessels. Depending on how a particular stock is managed, access to permits and/or quota may have associated costs that change over time as management evolves. This may also represent a cost barrier for fishermen without access to capital or affordable financing.

Figure 6: Crew member unloading sea scallops at Atlantic Cape Fisheries, Cape May, NJ. Photo: Jason Houston.

Processors and infrastructure developed to support historic commercial fisheries may no longer be located adjacent to fishing areas. Home port locations and existing port facilities may need to be modified and upgraded to accommodate new mixes of species and product categories. These factors may increase business costs and constrain adaptation. Similarly, recreational anglers may choose to travel further or purchase different fishing gear for better fishing opportunities.

Key Uncertainties: How will costs associated with fishing change over the next 20 years? Will cost increases be steady and predictable, or sudden and unpredictable? What specific cost increases are most damaging to the livelihood of fishing communities? Will such cost increases affect both commercial and recreational fishing?

Working Waterfronts and Infrastructure

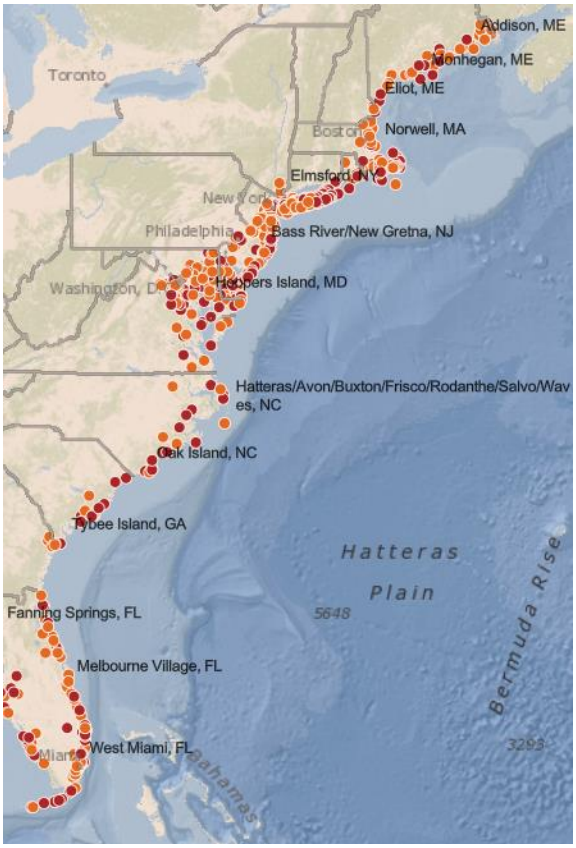

Figure 7: Fishing communities with medium-high or high housing disruption, an indicator of gentrification pressure, in 2018. The housing disruption metric tracks housing market data on home values, rents and mortgages. Red and orange dots indicate communities with the highest housing disruption ranks and potentially higher risk for gentrification of working waterfronts. Source: NOAA Community Social Vulnerability Indicators Toolbox.

Physical damage to ports and marinas caused by extreme weather events will be exacerbated by continued sea level rise. In some ports increased flooding during fair weather high tide events will hinder effective operations and increase costs. One hurricane in 2018 (Florence) caused an estimated $38 million in damages to vessels and businesses, $56.5 million in lost revenues and 3,500 fishing related job losses in one state (North Carolina). However, available federal fishery disaster funds for Hurricane Florence were just $7.7 million. Fishery disaster declarations have been increasingly attributed to extreme environmental events with over 80% of 71 declarations from 1989 to 2020 partially or entirely attributed to events such as marine heatwaves, hurricanes and harmful algal blooms.

These climate and weather related pressures are coupled with persistent trends towards gentrification of working waterfronts in response to cultural and economic drivers as developers seek to maximize profits from waterfront property. Loss of working waterfronts can lead to shifts in cultural identity for coastal communities.

Figure 8: Working waterfront in Portland, ME. Photo: Jay Odell.

Key Uncertainties: How will the locations and physical infrastructure of commercial fishing ports change over the next 20 years? Will we see investment in new infrastructure to support fishing activity? How will population growth and gentrification impact recreational and commercial fishing ports and communities? Will the siting and purpose of shoreside support and infrastructure change as climate change continues?

Consumer Demand and Market Dynamics

Changes in consumer demand and market dynamics for seafood are major drivers of fishery effort, and shifts in societal values can drive consumer demand. U.S. per capita fish consumption has steadily increased since the 1990s, increasing 27% between 1990 and 2019. A 2021 study found that sales of fresh seafood in the U.S. over the last two years increased by over 30%, with increases of about 20% for frozen and shelf-stable product categories. Consumer preferences have changed over time such that today seafood landings and value are dominated by invertebrates including lobster, scallops, clams, shrimp, and squid.

Figure 9: The Maine Avenue Fish Market in Washington, DC, originally opening in 1805, is the oldest continuously operating fish market in the country. Photo: Jason Houston.

Multiple factors can impact market dynamics, including unexpected supply gluts (for example, high lobster landings in 2012) and competition with lower priced international imports, often from countries with fewer regulatory requirements. Periodic harvest restrictions to reduce seafood consumption health risks (e.g. paralytic shellfish poisoning) can impact supply. Consumer perceptions of risk concerning a range of contamination issues (e.g. heavy metals in tuna, *Vibrio* in oysters) can impact consumer confidence and demand, with potentially large effects following poisoning incidents that result in serious injury or death.

Figure 10: Fishadelphia, a pilot community seafood program, was designed to connect low-income consumers in Northern Philadelphia with neighboring New Jersey harvesters. Photo: NOAA Fisheries/Talia Young.

Many fisheries identified vulnerabilities in their supply chains during the COVID-19 pandemic that may be relevant for the future. Adaptive responses included some fishermen developing methods (in person and by mail) for direct sales to consumers when markets were lost due to widespread restaurant closures. This shift was met by seafood consumers who were exploring new ways to

shop more locally, avoid grocery stores, and prepare more seafood at home. Some of the recent changes in consumer purchasing patterns may persist, and some fishermen may choose to take on the significant additional processing and marketing costs required for direct sales. Additional changes within supply chains that move seafood from producers to consumers will evolve in response to diverse external factors, including changes driven by the larger and tightly linked food service industry.

Consumer surveys reveal that environmental sustainability is commonly cited as an important factor in food purchasing decisions, and younger generations appear more likely to believe that individual food choices can have at least a moderate impact on the environment. Generational shifts in values regarding sustainability and animal welfare as well as an apparent increase in rates of vegetarianism, veganism, and pescatarianism may shift market trends and demand levels over the next 20 years.

Figure 11: Charter vessels in the Florida Keys. Photo: ASMFC.

Demand for recreational fishing trips and equipment also fluctuates in response to a number of economic and social factors. While recreational trips on the East coast have seen a generally decreasing trend in recent years, there are indications that the COVID-19 pandemic drove an increase in nature-based recreation including recreational fishing activity. Climate change may impact how people spend leisure time, driven by changes in temperature, precipitation and wind. The influence of climate change linked weather factors on recreational fishing behavior will likely vary by coastal location, and potentially alter recreational harvest patterns.

Key Uncertainties: How will demand, consumer preferences, and supply chains for East Coast seafood change over the next 20 years? Will there be significant changes in local, national and/or international markets? Will consumers become more concerned with overfishing or environmental damage from fishing? Will advances in food technology such as plant-based seafood or tissue culture affect market demand for wild-harvest products? How might markets respond to other future unknown stressors (pandemics, global crises, etc.)?

Technological Change

Advances in technology have often impacted fisheries, in some cases dramatically, for example the shift from sail powered hook and line commercial fishing to steam engine powered bottom trawlers. Many companies are actively developing new types of fishing gear, including increasingly powerful fish finders. Gear technology is also evolving to improve catch rates of target species while avoiding bycatch of non-target species and protected resources.

Technological advances may improve fisheries management outcomes via development of expanded at-sea monitoring and reporting systems that deliver timely and accurate data streams to support nimbler decision making. For example, the Northeast region's Study Fleet includes about 50 fishing vessels whose captains and crews provide high resolution data for uses such as developing thermal niche models and stock assessments. Future information technology advances could enable extension of this approach to a coastwide network with thousands of vessels.

Figure 12: Captain Jimmy Ruhle reviews monitoring and navigation systems on the F/V Darana R while conducting the Northeast Area Monitoring and Assessment Program (NEAMAP) cooperative inshore trawl survey. Photo: Jay Odell.

Effective integration of fishing vessel based ocean sensing networks with next-generation ocean observing system assets (e.g. satellites, buoys, gliders, etc.), and with next-generation stock assessment technology (e.g. sonar, robotic camera systems, e-DNA, etc.) could significantly improve ocean model performance, reduce stock assessment uncertainty, and provide short term forecasts to flag bycatch hotspots and optimal fishing locations.

Southeast region states have for many years operated hatchery programs for red drum and other marine fish to supplement natural population growth and provide additional fishing opportunities. Potential technological advances that significantly improve cost effectiveness of hatchery production and/or enable successful culture of new species may drive increased use of hatchery produced fish and invertebrates to enhance wild harvest stocks.

Advances in food technology may also impact demand for wild-harvest seafood as new product types are emerging, including plant-based imitation seafood which is

already being produced and sold by at least ten different brands. At least two firms have each raised over $100 million to launch commercial scale production of tissue culture seafood. There is high uncertainty regarding future economic viability of producing seafood with bioreactors as estimates of current production costs range as high as $9,000 per pound.

Several firms are currently developing electric powered fishing vessels, including electric outboard motors for recreational fishing. All of these types of technological change could shape the future of Atlantic coast fisheries, in combination with other factors.

Key Uncertainties: To what extent will new monitoring systems be broadly adopted and widely available? How accurate will such technology be? How will investments in any forms of new technology be funded? Will subsidies or regulations be required to encourage/ensure the adoption of new technologies?

Changing Ocean Uses

There are many other ocean uses that overlap with fish habitat and areas of fishery operations along the East Coast, in both nearshore and offshore areas. Development of offshore wind projects and the potential for offshore aquaculture are perhaps the most significant known examples of non-fishing ocean uses expected to affect fisheries on the East Coast.

There are over twenty wind projects currently proposed for the East coast, mostly clustered offshore in New England and the Mid-Atlantic. There is currently a high level of fishing community concern regarding impacts to fisheries, particularly in locations where fishing with mobile gear (trawls and dredges) coincides with wind development areas. Many impact categories are currently being studied pursuant to the Bureau of Ocean Energy Management's permitting process, with ongoing efforts to develop mitigation measures for environmental impacts (e.g. threats to North Atlantic right whales) and impacts to fisheries (e.g. displacement from traditional fishing grounds). Some fishing communities may benefit from addition of new structured habitat in wind development areas (e.g. scour protection at base of turbines), especially those utilizing hook and line gear, generally expected to be recreational anglers.

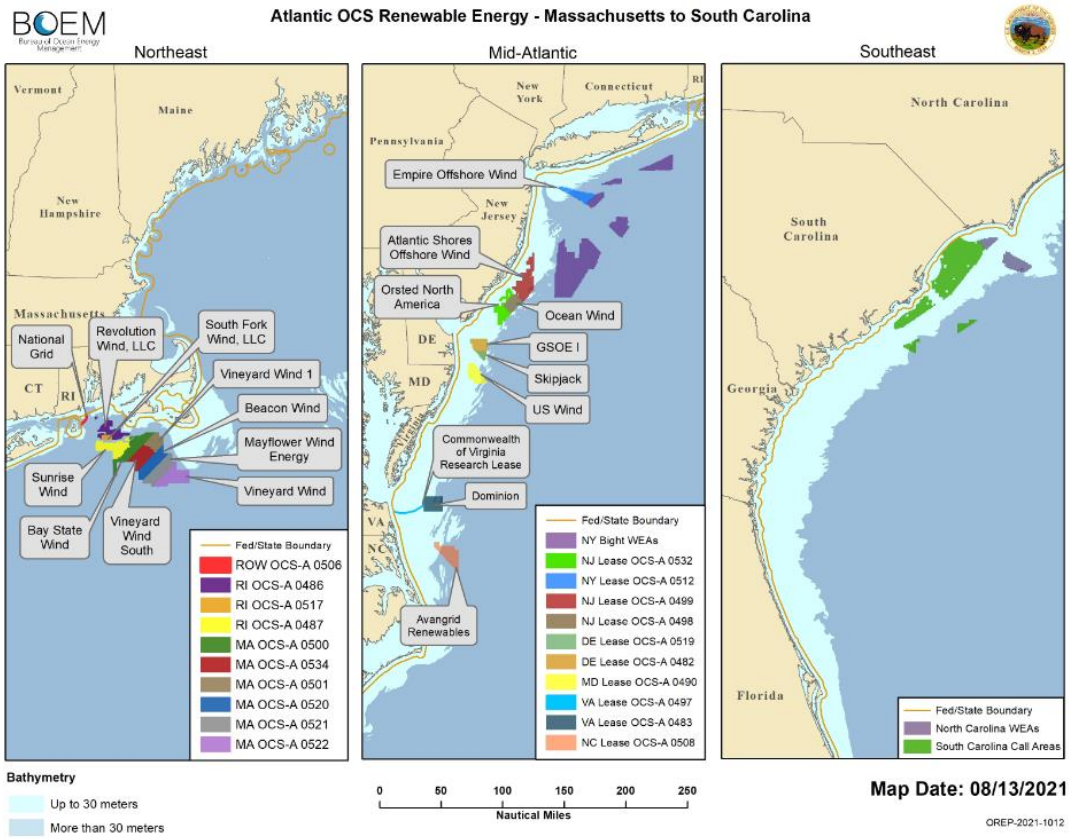

Figure 13: Atlantic outer continental shelf (OCS) Renewable Energy Areas as of 8/13/21. Source: BOEM.

The US Atlantic coast currently supports different aquaculture operations for finfish, shellfish, and marine algae, with commonly farmed species including oysters, clams, mussels, Atlantic salmon and kelp. Aquaculture landings rank third for the East coast in terms of economic revenue, after sea scallops and American lobster. While mariculture on the East coast is currently conducted primarily in inshore or nearshore areas, there is demonstrated interest in developing offshore aquaculture facilities. Changes in the extent of aquaculture or the areas in which it's conducted could impact future seafood market dynamics and may also affect wild caught fishery access in some areas.

Figure 14: Sugar kelp, a marine algae grown and harvested for a variety of uses from food to potential biofuels. Photo: NOAA Fisheries.

Key Uncertainties: What will be the scope of offshore wind development, aquaculture, and other non-fishing ocean uses? How will these projects be sited, and using which technologies? What other industries or interests will use East Coast waters? What effects will competing ocean uses have on fishing effort, coastal infrastructure, marine resources and ecosystems, and research surveys? How will new ocean uses affect stock distribution or stock productivity?

Social Vulnerability and Environmental Justice

NOAA has developed a set of Community Social Vulnerability Indicators (CSVIs), that characterize and evaluate a fishing community's vulnerability and resilience to disturbances. A subset of these indicators addresses environmental justice issues, or the disproportionately high and adverse human health and environmental effects that some actions can have on minority and low-income populations. These include measures of poverty, population composition (the demographic makeup of a community), and personal disruption (capturing unemployment status, educational attainment, poverty, and marital status). Higher rankings in each of these indices indicate a more vulnerable population that may be less resilient to climate change. Many East coast fishing communities rank medium-high to high in these indicators. The CSVIs also provide indices of gentrification pressure, fishing engagement and reliance, economic factors, and climate change risk (to sea level rise and storm surge). Many of the communities along the East coast that have high reliance on commercial or recreational fishing are also associated with high economic and climate change vulnerability.

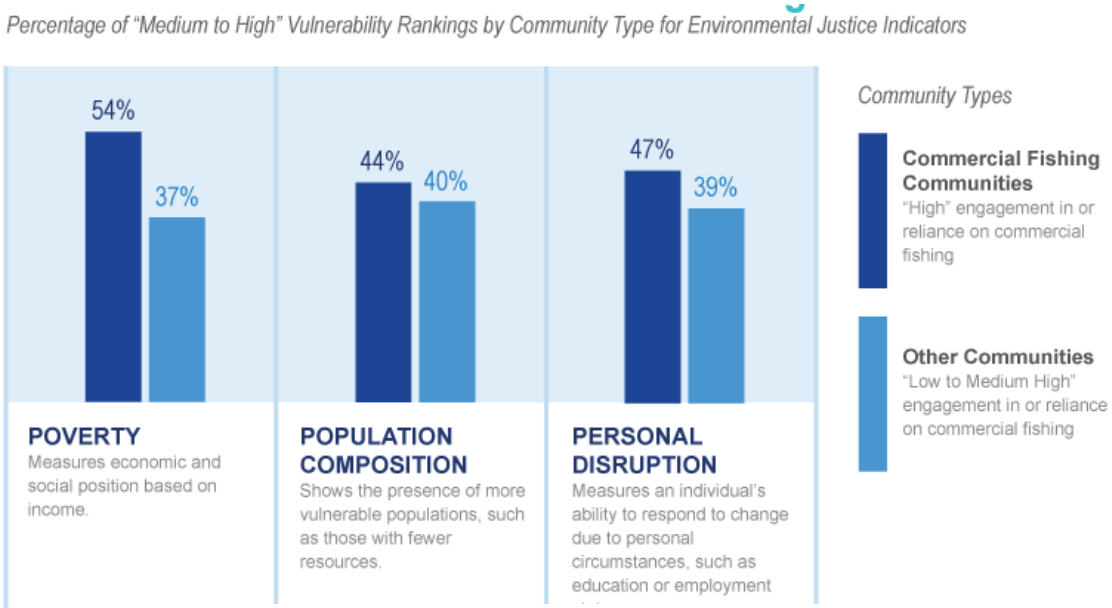

Figure 15: NOAA's indicators of environmental justice for US commercial fishing communities vs. other communities. Communities dependent upon commercial fishing are far more likely to be poor, have a larger percentage of minority and tribal populations, and/or have residents with less 'personal capacity' to respond to change, e.g., higher unemployment rates or lower educational attainment.

Key Uncertainties: How will social and economic vulnerability characteristics of East coast fishing communities change over time? Will communities become more vulnerable or more resilient to change? Will some communities become less reliant on fishing?

References and Further Reading

- Fisheries of the United States, 2019
- Fisheries Economics of the United States, 2018
- 2021 STATE OF THE ECOSYSTEM| Southeast
- 2021 STATE OF THE ECOSYSTEM | Mid-Atlantic
- 2021 STATE OF THE ECOSYSTEM| New England
- NOAA Fisheries Social Indicators for Coastal Communities