

NEW ENGLAND FEEDING NEW ENGLAND

VOLUME 2 SUPPLEMENT

INCREASING REGIONAL SELF-RELIANCE THROUGH SEAFOOD

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NEW ENGLAND FEEDING NEW ENGLAND

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What would it take for *30%* of the food consumed in New England to be regionally produced by *2030*?

What will it really take to grow, raise, produce, harvest, and catch more regional food and move it through a complex supply chain to our homes and other places we eat? What do we need to do in the near term, by 2030, to make tangible progress towards this bold goal? How might the increasing and escalating impacts of climate change impact our ability to feed ourselves? What can we do as a region to make our food system more equitable and fair, resilient and reliable? To answer these questions, the **New England State Food System Planners Partnership**—a collaboration between six state-level food system organizations—and Food Solutions New England—who are mobilizing their networks to strengthen and grow the New England regional food system—convened four teams of researchers.

In Volume 2, a *Food Production Team* created a model of regional self-reliance—an estimate of the region's production of food commodities compared to its consumption of those same commodities—that outlined scenarios for how **the six New England states could meet a goal of supplying 30% of our food from regional sources by 2030.** That research used the average volume of seafood landed from 2010-2019 in New England and did not model potential changes to the contribution of seafood. **This supplement identifies opportunities for increasing regional self-reliance for seafood that may aid future modeling work.**

Researcher

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On the cover, clockwise from top left: The Town Dock in Narragansett, RI (RIFPC); Yankee Fisherman's Cooperative in Seabrook, NH (Ink + Light Creative); American Mussel Harvesters in North Kingstown, RI (RIFPC); Port of Galilee in Narragansett, RI (RIFPC); squid processing at the Port of Galilee (RIFPC); lobster harvesting (Ink + Light Creative)

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1 Introduction

The model developed to determine production milestones in Volume 2 did not account for potential changes to the contribution of seafood to regional self-reliance (RSR) that may occur in the future, either as a result of deliberate intervention to increase this contribution or from external factors. Instead, the model utilized the average volume of seafood landed in New England from 2010-2019 (inclusive of both wild capture and aquaculture-grown products) as a placeholder around which we built out the terrestrial production model.

However, recognizing the importance of seafood to New England's economy and food system, this supplement discusses the scope for intentionally *increasing* RSR through pathways similar to those analyzed for terrestrial production, as well as factors that could potentially *increase or decrease* the contribution of seafood to RSR in the next decade. In the same way that land availability and improvement of crop yields and livestock feed conversion efficiency factor into future RSR from terrestrial food production, future RSR from fisheries and aquaculture may hinge on a number of factors at the nexus of marine ecosystem dynamics, harvest and cultivation patterns, and market integration. The discussion below represents merely a contemplation, rather than a set of recommendations, and its primary purpose is to scope out areas where future modeling work may lend greater detail when projecting the potential contribution of seafood to RSR in New England.

Differences Between Marine-based and Terrestrial Foods

New England's seafood system consists of two sub-systems: a wild capture fisheries system and an aquaculture system. There are several differences between wild capture fisheries, aquaculture systems, and terrestrial food production that are important to consider when speculating on the scope for increasing RSR through seafood.

Wild capture fisheries stand apart from both terrestrial and aquaculture production systems in that production volumes are largely outside the direct control of harvesters and operate within a multi-trophic level food web, such that different harvesting strategies imply biomass production tradeoffs among species (although these are not always taken into account in fisheries management). Harvest activities target a wide range of trophic levels, from primary consumers to top predators. Trophic level in marine systems is a shifting condition determined not only by species but also by size and phase of life (e.g., egg, larvae, juvenile, adult), with most marine species occupying several different trophic niches within their lifetime. As a result of complex trophic interlinkages, steps taken to increase the harvest of one species may have the effect of decreasing the available harvest of others, and vice versa, sometimes causing multi-species ripple effects. Fisheries ecosystem models can elucidate the implications of these tradeoffs in the context of RSR.

Wild capture fisheries represent a common-pool resource in which harvesting activities are performed by privately owned vessels but managed by a constellation of government fisheries management entities with extensive input from scientists and stakeholders. Entities with governance responsibility over seafood landed in New England include local shellfish commissions, state fisheries agencies, interstate coordination bodies like the Atlantic States Marine Fisheries Commission, federal agencies like the National Marine Fisheries Service, and regional federal fisheries management councils like the New England Fishery Management Council and the Mid-Atlantic Fishery Management Council.

These entities manage fisheries by setting species-specific harvest limits, size limits, specifications on allowable fishing gear, open and closed areas, and other controls on harvest and fishing effort. Their actions represent a mediating layer between ecological production and harvested landings that does not exist in terrestrial systems or aquaculture. Moreover, the harvest activities governed by these bodies influence dynamics of ecological production via direct and indirect ecological feedback loops. Consequently, a focus on the role of fisheries management is relevant to identifying opportunities for increasing RSR for wild capture fisheries.

In contrast to wild capture fisheries, aquaculture is not a common pool resource, but it does typically take place in public waters (though this is not always the case, as there is increasing interest in land-based recirculating aquaculture systems, or RAS), and space for aquaculture farms must be leased to private growers by state or federal entities authorized for this purpose. Because aquaculture involves the introduction of cultured products into the environment (the entirety of which are ultimately removed via harvest), there is no government oversight regarding harvest levels, as there is with fisheries. As a result, volumes produced are more directly under the control of producers. However, yields are still constrained by available space and biophysical factors such as nutrients, temperature, plankton density, predation by wild marine fauna, pollution, and disease.

Photo credit: Rhode Island Food Policy Council

Wild capture fisheries represent a common-pool resource in which harvesting activities are performed by privately owned vessels but managed by a constellation of government fisheries management entities with extensive input from scientists and stakeholders.

2 Scope For Increasing RSR From Wild Capture Fisheries

The contribution of wild capture fishery production to New England's RSR can be thought of as a sequential filtering exercise by which a portion of the total biomass produced in waters accessible from New England is rendered into a portion of New Englanders' diet (Figure 1). The process starts with ecological production, a process that is effectively self-regulating and capped in volume by available sunlight and nutrients. The proportion of ecological production that is converted into fishery landings via harvest activities is a function of harvest limits, market demand, and other factors such as regulations, weather, input costs, and crew availability which influence the amount of fishing effort that the fleet applies to the task of harvesting seafood.

Some biomass is caught by fishing vessels but cannot be landed due to regulations (e.g., vessel does not possess permits to land the species in question; vessel has already caught its limit of this species; species in question is under a closed period; the item in question is undersized) or economic considerations (e.g., there is no market demand or local buyer for the species/size in question; limited space on the vessel is reserved for higher-value species/sizes). This biomass is returned to the sea as "discards," a category that includes both live and dead biomass. Live biomass rejoins the ecosystem in its original form, where it can continue to contribute to production of offspring, while dead biomass enters the detrital food chain.

The amount of landed biomass that is available to support RSR is a function of:

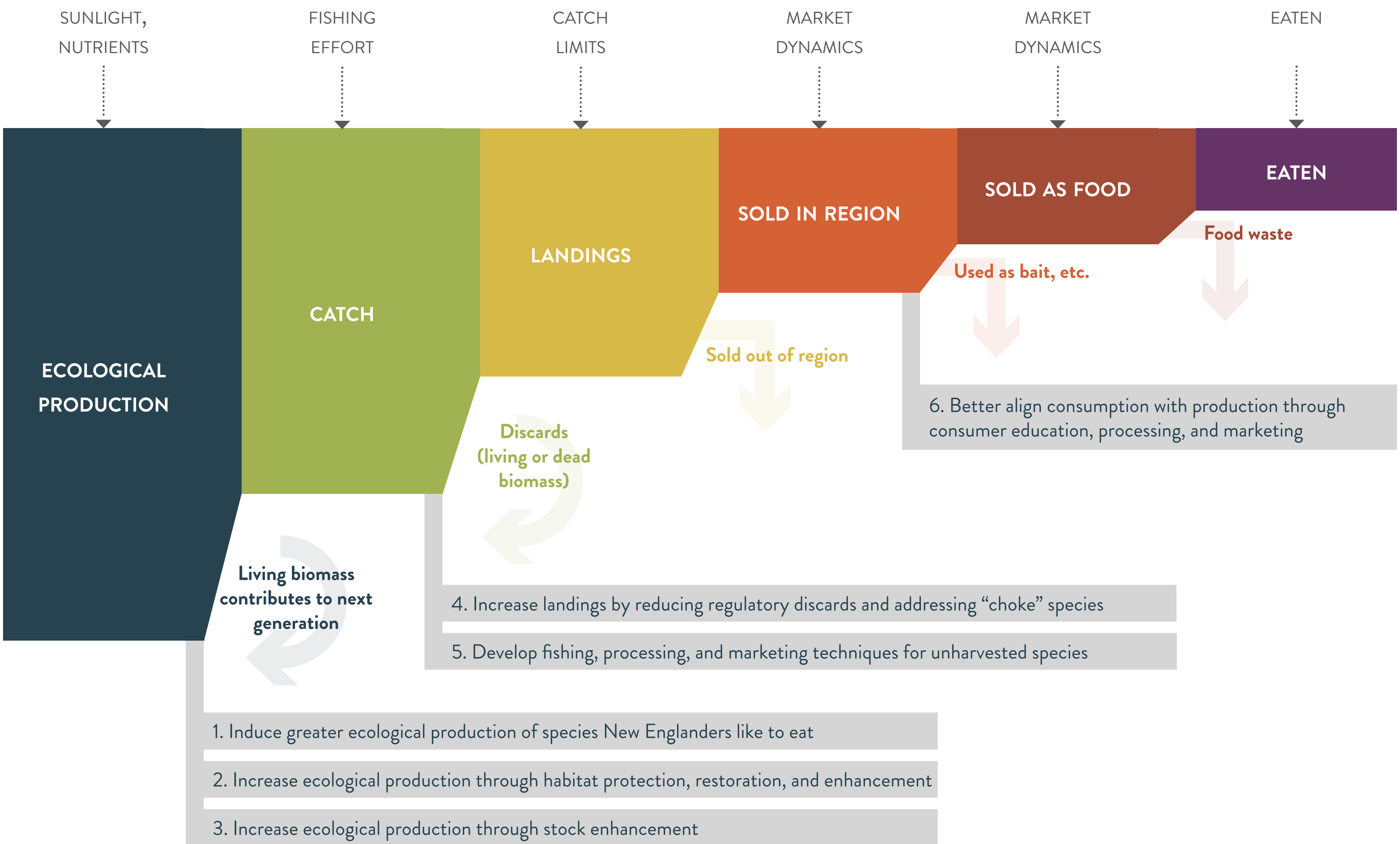
1. What portion of landings are sold to end users in New England or elsewhere;
2. What portion of landings are used for human consumption versus another use (e.g., bait, fertilizer, pet food); and
3. Of that portion of landings that is sold within the region for human consumption, how much is consumed versus enters the waste stream or becomes a secondary non-food product.

Effectively, only that portion of landed seafood that is retained within New England, used for human consumption, and actually eaten (as opposed to being discarded as waste at the processing, retail, or household level) contributes to RSR.

There are multiple leverage points where regional food planners and their partners in fisheries management could potentially intervene in the system to increase RSR for wild seafood. We discuss these below, not as recommendations, but rather the contours of possible scenarios to inform future modeling work and conversation among planners and stakeholders. This list is not exhaustive.

FIGURE 1: Conceptualization of Connection Between Regional Production and Regional Consumption

Factors influencing the volume available at each step are listed along the top of the diagram. Specific interventions that could be taken to increase these volumes are listed in gray at the bottom.



Leverage Points

1. Induce Greater Ecological Production of Species New Englanders Like to Eat

Regional food preference plays a role in determining how much New England-landed seafood is retained in the region and therefore contributes to RSR. In theory, it may be possible for fisheries managers to increase RSR by adopting harvest policies that induce the ecosystem to produce a greater proportion of species that New Englanders like to eat.

Although total ecosystem production is dependent on factors outside human control, the species composition of this system is highly influenced by humans, via fishery harvest activities. For the most part, fishery-induced changes in species composition in New England waters have been largely unintentional. For instance, heavy 20th century removals of groundfish likely contributed to an increase in sea urchins and crustaceans and a decrease in kelp cover in the Gulf of Maine[1] and an increase in dogfish and skate abundance on Georges Bank.[2] However, some experts have postulated that restructuring of marine food webs could be accomplished intentionally, for example by cropping down predator biomass to increase biomass of fast-growing, lower trophic-level fish.[3]

Actions of this sort would represent an application of "ecosystem based" fisheries management (EBFM), a form of fisheries management that is not commonly practiced but offers several key advantages over current "single species" fisheries management (SSFM). For the sake of this discussion, the most important difference between EBFM and SSFM is that SSFM sets harvest rules for species individually, based only on each species' population dynamics (i.e., rates of birth, growth, and death), and does not consider interrelationships among species. In contrast, EBFM is "a systematic approach to fisheries management in a geographically specified area that: contributes to the resilience and sustainability of the ecosystem; recognizes the physical, biological, economic, and social interactions among the affected fishery-related components of the ecosystem, including humans; and seeks to optimize benefits among a diverse set of societal goals."[4]

Deliberate manipulation of the species composition of nearby ecosystems to produce more of the species that New Englanders like to eat would represent a radical departure from current management norms, and one that cannot be presumed to be preferable from an economic standpoint (for the region or its fishermen). Nonetheless, if New England is serious about increasing its RSR, it would be useful to explore such a strategy through linked ecosystem-market modeling.

2. Increase Ecological Production Through Habitat Protection, Restoration, and Enhancement

Habitats are places that are utilized by species because they provide some sort of value to their survival, growth, and/or reproduction. Many coastal species use estuaries for spawning and nursery areas, and anadromous species migrate between the ocean and freshwater through estuaries and rivers. These areas are heavily impacted by historical and present-day drivers of habitat loss and degradation, including industrial activity, urban and suburban development, and agriculture. Offshore habitats, once relatively free from human influence, are now subject to impacts from mobile fishing gear, oil spills, dredge spoils disposal, and increasing interest in renewable energy development.

Protection, restoration, and enhancement of coastal and marine habitat can likely contribute to greater yields of fishery production, although it is rarely possible to quantify just how much additional production could be gained from these activities.[5] For example, Ames and Lichter (2013)[6] suggest that restoration of river connectivity in the Gulf of Maine watershed could enable the reestablishment of thriving river herring runs, thereby enhancing the recovery of cod and other depleted groundfish that were previously abundant in this area.

3. Increase Ecological Production Through Stock Enhancement

Several New England states have programs in place to support restoration of inshore shellfish beds, including the USDA's Environmental Quality Incentives Program (EQIP), the Massachusetts Oyster Project, Save the Bay's bay scallop restoration, and many more. Shellfish restoration is also being explored in the offshore environment; for instance, the Massachusetts-based Coonamessett Farm Foundation has been spearheading the development of strategies to seed sea scallop beds in offshore waters.[7]

Modern-day finfish and crustacean enhancement efforts are rare in New England (with the exception of the stocking of freshwater bodies for game fish), but enhancement of these resources was a major historical focus in New England and continues to be common in other parts of the world (e.g., salmon hatcheries in the Pacific Northwest and Alaska). For instance, the USS Fish Hawk, which was operated by the United States Fisheries Commission (a precursor to the U.S. Fish and Wildlife) from 1880 to 1926, was a floating fish hatchery ship that followed runs of American shad, striped bass, mackerel, and herring up and down the East Coast.[8] Lobster hatcheries operated in Wickford, Rhode Island from 1897 to the late 1940s and in Oak Bluffs, Massachusetts from 1948 to 1984, facilitating lobster copulation and rearing larvae through the first several stages of development before releasing them into local waters.[9] The Wampanoag Tribe of Gay Head has experimented with rearing winter flounder as a response to climate change-induced declines in this species.

4. Increase Landings by Reducing Regulatory Discards and Addressing "Choke" Species.

Catch volumes that have regional market potential, but are discarded due to regulatory prohibitions that prevent their landing (see previous discussion on regulatory discards), can in some cases represent a missed opportunity to support RSR. Discards are a complex issue, because although the practice of discarding fish is harmful to fish populations (at least in the case of species that experience high discard mortality), the regulations requiring fishermen to discard these fish are devised with the conservation of these populations in mind, and by creating greater incentives to target these species, more liberal discard policies may actually lead to a decrease in their contribution to RSR.

In some cases, however, it may be possible to enable fishermen to retain more fish for market through regulatory actions that improve alignment between what a vessel is catching and what that vessel is allowed to land. Anecdotally, fishermen report that discard rates have increased as a result of latitudinally shifting fish stock distributions driven by warming waters:[10] as some species move into new areas or become more abundant towards the northern end of their range, they may be caught in increasing numbers by fishermen who either lack the requisite permits to land them or are capped at history-based harvest levels that do not account for the new abundance of these species in their areas. Thus, adapting fisheries management to climate change could, in theory, increase RSR.

In multispecies fisheries (such as New England groundfish) where vessels are not allowed to discard fish, "choke species" or "weak stocks" can become an issue. These are species for which the allowable harvest is low relative to that of other stocks, forcing the fleet to stop fishing once the limiting stock's quota is reached, even if the fleet has not yet caught its quota for other co-occurring species. In New England, small quotas for Gulf of Maine cod (a stock that has been in a rebuilding plan since 2004 due to low population levels relative to historical biomass) have severely limited the ability of the fleet to fill its quota of other, more abundant species like haddock and flounder.[11] The New England Fishery Management Council is exploring the use of aggregate multispecies catch caps under EBFM as a route to providing more flexibility to vessels and reducing the impact of choke species on overall catch volumes.[12]

5. Develop Fishing, Processing, and Marketing Techniques for Unharvested Species

The history of New England fisheries is a story of sequential development of harvesting, processing, and marketing techniques for one previously unharvested species after another. Species including bluefin tuna, halibut, haddock, and monkfish were once considered "underutilized" until developments in fishing gear, freezing technology, export markets, and consumer interest trends made their integration into the fishery harvest system possible.

Although fewer such opportunities remain today, there are still species in the New England ecosystem that are not currently harvested but could potentially contribute to RSR with proper development of fishing, processing, and marketing techniques. For example, the neon flying squid is an unharvested species of oceanic squid that could potentially be caught using modern LED lights and jigging machines.[13] The slipper limpet is an unharvested estuarine shellfish; efforts abroad have demonstrated that use of a mechanical process to remove the shell from this species prior to distribution could enable cost-effective marketing and the development of a viable fishery.[14] Stock assessments and ecosystem modeling are required to gauge the potential contribution of such species to RSR.

6. Better Align Consumption With Production Through Consumer Education, Processing, and Marketing

As noted previously, there is a degree of mismatch between the species composition of edible marine species found off the New England coast and the species composition of seafood eaten by New Englanders. In part, this is due to regional eating habits and preferences.[15] Many recent studies and initiatives have endeavored to narrow these gaps through consumer education and marketing campaigns targeted at "underutilized," "underloved," or "underrepresented" species and through Community Supported Fishery programs.[16] These campaigns typically target species that are caught in volumes that are low relative to their available biomass; if successful, such species would be caught and landed in greater volumes.

Underrepresentation of New England species in the regional marketplace can also occur in the case of species whose full harvest potential is realized, for instance due to stronger market pull elsewhere (including abroad), a shortage of in-region processing capacity relative to other places, and a regional preference for imported seafood driven by the often inconsistent quality and availability of New England seafood products.[17] Increasing the RSR contribution of these species would represent a diversion of volume from out-of-region sales to be retained within the region, rather than an increase in landings.

Given the continued interest in these initiatives, it is worth considering how they might increase the contribution of seafood to RSR in New England.

3 Scope For Increasing RSR From Aquaculture

Several recent efforts have generated growth projections for specific segments of the New England aquaculture industry. These projections are consistent with recent growth in the sector, particularly in the areas of shellfish and sea vegetables.[18] As an indication of the rapid growth that is taking place in this sector, a recent survey of aquaculture participants in Maine found that 24% of growers had initiated operations within the last two years and that a majority of growers had experienced an increase in sales over the previous five years.[19] Less is known about the volumes produced by the finfish aquaculture industry in New England, since all salmon farms (which represent the vast majority of finfish aquaculture) are owned by a single company.[20] As a result, data on production volumes and market destination are proprietary.

Shellfish production is anticipated to continue increasing in New England in the coming years. For instance, the 2016 *Maine Farmed Shellfish Analysis* estimated a tripling of oyster production and a six-fold increase in mussel production in Maine by 2030, which presumes the conversion of 480 additional acres to oyster farms and 90 additional acres to mussel farms.[21] That study also suggested that Maine could double its total scallop production (based exclusively on wild capture in their 2016 baseline) by introducing scallop aquaculture in its waters. Several authors also contend that Maine can dramatically increase its production of sea vegetables through, for example, lobster businesses integrating sea vegetables into their portfolios as a wintertime crop.[22] Specifically, Piconi et al. (2020) anticipate a 12-15% annual growth rate in Maine sea vegetable production, leading to an additional 1,675,000 wet pounds in annual production by 2030 (compared to 2019 baseline levels).

Some species and forms of production may be more likely to contribute to RSR than others, due to their processing requirements and level of integration into domestic and international trade. Evidence suggests that a sizable majority of New England shellfish growers sell their products through in-region market channels.[23] In contrast, only a quarter to a half of finfish and sea vegetable producers sell their products through in-region market channels.[24] In the case of sea vegetables, finished product formats and distribution networks tend to limit the final destination of products to specialty retail and fine dining establishments; however, it is anticipated that edible seaweed products will eventually expand penetration within traditional grocery and immediate consumption channels.[25]

When considering the potential to increase production of farmed seafood in New England, it is useful to consider the framework of carrying capacity. Byron et al. (2011) applied Inglis et al.'s (2002) four-part definition of carrying capacity to aquaculture, distinguishing between:

1. **Physical carrying capacity:** the total area of marine farms that can be accommodated in the available physical space;
2. **Production capacity:** the stocking density of bivalves at which harvests are maximized);
3. **Ecological carrying capacity:** the stocking or farm density which causes unacceptable ecological impacts; and
4. **Social carrying capacity:** the level of farm development that causes unacceptable social impacts.[26]

As with terrestrial farming, physical carrying capacity for aquaculture is constrained both by competing human uses of the seascape and by natural characteristics that make some sites more productive and/or practical than others (e.g., water flushing, water quality, nutrient availability, protection from rough seas and weather, appropriate depth). From a purely spatial perspective, there is still a large amount of acreage available in New England waters that could support aquaculture uses, perhaps especially along Maine's 3-million-acre coastline, where only 1,500 acres are currently in use for aquaculture.[27] However, some of this acreage may be inappropriate for aquaculture due to pollution, proximity or overlap with competing uses such as fishing, boating, and mooring fields, and aesthetic impacts to coastal viewsheds.[28] Some observers contend that "NIMBYism" is a major limiting factor in the growth of aquaculture in New England[29] and others suggest that offshore areas should be prioritized for future development in order to avoid nearshore user conflicts.[30]

Potential increases in physical carrying capacity could come from several sources. First, more inshore space could be made available for aquaculture leasing by taking steps to improve water quality,[31] for instance through investments in upgraded wastewater treatment facilities and sewer tie-ins. Second, growers could pursue additional opportunities on land through investment in RAS. In fact, RAS for finfish in New England is currently receiving investment from national and international firms.[32] Finally, additional space could be accessed via the leasing of federal waters in the Exclusive Economic Zone (from three to 200 miles from shore) for aquaculture.[33]

Photo credit: Rhode Island Food Policy Council

Evidence suggests that a sizable majority of New England shellfish growers sell their products through in-region market channels.

There have been few studies to date on ecological carrying capacity of aquaculture in New England, suggesting perhaps that experts feel that aquaculture currently operates at rates well below its ecological carrying capacity. Indeed, in one pioneering study, Byron et al. (2011) found no evidence that shellfish in Narragansett Bay will become food-limited with continued growth of the shellfish aquaculture industry there.[34] These authors concluded that cultured oyster biomass in Narragansett Bay could be increased 625 times before reaching ecological carrying capacity, and suggested that if growers continue to use current production techniques and stocking densities, managers could theoretically allow expansion of shellfish farming to cover 26 percent of the surface area of the Bay without exceeding ecological carrying capacity.

4 Climate Change and Offshore Energy Development

Thus far, we have speculated on ways that yields from seafood production could be deliberately increased to support RSR, but we must also note the presence of two relatively new "wild card" factors that could significantly alter the baseline contribution of seafood to regional consumption: climate change change and offshore renewable energy development.

Globally, the ocean has absorbed 30% of the carbon dioxide and 90% of the heat generated as a result of rising greenhouse gas emissions.[35] Physical ocean changes resulting from these trends include: warming water temperatures; changes in salinity; changes in circulation patterns, stratification, and upwelling; decreases in oxygen content; ocean acidification; and sea level rise resulting from melting of the polar ice caps.[36] These changes can affect organisms' growth, reproduction, mortality, biogeographical distribution, community structure, phenology, and trophic interactions, creating both winners and losers.[37]

In the last two decades, New England fisheries have experienced multiple temperature-driven changes. The climate signal can be seen in the northward distributional shifts or expansions of many species historically associated with the Mid-Atlantic coast but now abundant off Southern New England, such as black sea bass, summer flounder, and scup.[38] It is evident in the divergent fates of Gulf of Maine lobster, which has experienced a fivefold increase in population,[39] and Southern New England lobster, which has experienced precipitous declines.[40] It is also evident the prolonged failures of species at the southern end of their ranges, such as Gulf of Maine cod[41] and Southern New England winter flounder,[42] to rebound to desired levels, despite decades of strict management measures aimed at rebuilding these stocks. Trends like these are expected to continue.[43]

An estimated 85% of current seafood production (2020) in New England is derived from species that are moderately (n = 21), highly (n = 19), or very highly vulnerable to climate change (n = 20) based on NOAA Fisheries' assessment of fish species vulnerability (Table 1 and Figure 2). Vulnerability in this case is defined as a change in a species' productivity and/or abundance associated with a changing climate, including both climate change and decadal climate variability.[44]

In contrast, only 8% of seafood production is derived from species with low climate vulnerability (n = 22). The remaining 7% could not be estimated because harvest data is confidential or the climate vulnerability for a species has not been evaluated. In 2020, Massachusetts alone landed nearly $400 millions worth of product that has high or very high climate vulnerability (Figure 2). While figures like those in Table 1 and Figure 2 do not reveal the net impact of climate change on total ecological production or offer much clarity

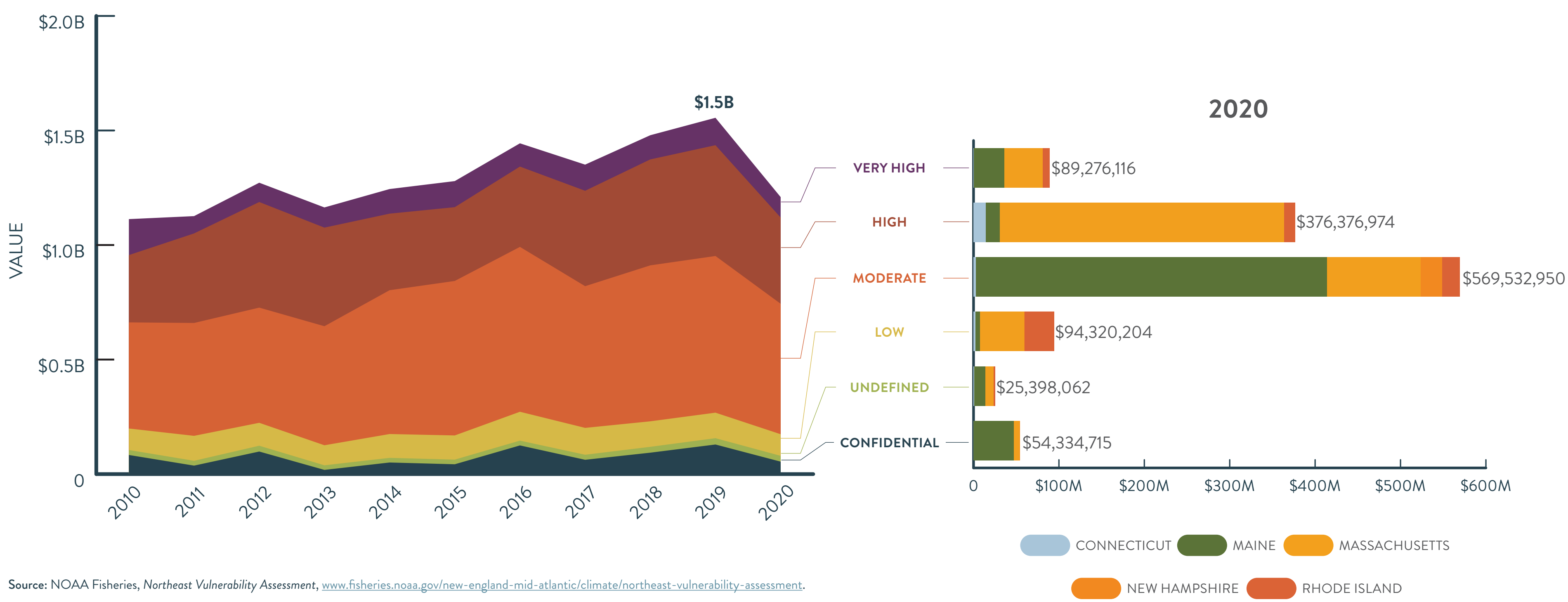
TABLE 1: Climate Vulnerability of New England Catch, 2020

Climate Vulnerability Status	Landings Value	Percent of Total
Low	$94,320,190	8%
Moderate	$569,532,837	47%
High	$376,376,723	31%
Very High	$89,276,037	7%
Undefined	$20,987,944	2%
Confidential	$54,334,714	5%

on how species composition of this production may change, they do hint at the overall significance of the climate issue for wild capture fisheries in New England.

Fisheries management plays an important mediating effect in determining how well the harvest system can adapt to changes in ecological production resulting from climate change,[45] and it will be important to consider these aspects in light of RSR. For example, inertia in the management system can obstruct fishermen's ability to follow fish stocks as they move[46] or capitalize on newly abundant species in their areas.[47] Situations like these can result in foregone yield, defined as ecologically available biomass that remains unharvested, rather than contributing to RSR. Development

FIGURE 2: Climate Vulnerability of New England Catch and Distribution of Catch by New England State



Source: NOAA Fisheries, *Northeast Vulnerability Assessment*, www.fisheries.noaa.gov/new-england-mid-atlantic/climate/northeast-vulnerability-assessment.

of innovative new fisheries management approaches designed to function in non-stationary environments may be key to enabling the wild capture seafood system to continue supplying as much protein as possible to New Englanders in a changing climate.

Expansive development of renewable energy in the offshore environment introduces a second large-scale element of uncertainty into the future contribution of seafood to RSR. New England states have set targets that collectively add up at least 8 gigawatts (GW) of offshore wind energy production by 2030 (this does not include Rhode Island, which is pursuing offshore wind contracts but does not have a specific generation target), and have already awarded or scheduled bids to award contracts to procure over 5 GW of generation from offshore wind developers.[48] Furthermore, the Biden-Harris administration's target of 30 GW of offshore wind nationally by 2030 sets in motion a wave of development that is expected to result in 110 GW by 2050.[49] At the time of this publication, the Bureau of Offshore Energy Management (BOEM) has issued 25 active leases in the Atlantic Ocean from Cape Cod to Cape Hatteras, representing 1.7 million acres of expected development.[50]

For wild capture fisheries, offshore development at this scale raises concerns about impacts to ecological production, fisheries science and management, and the ability of fishing vessels to access traditional fishing grounds. Impacts to ecological production may occur as result of: noise disturbance during construction; electromagnetic fields (EMFs) emitted by cables; introduction of vertical structures and surfaces into pelagic environments, which may act as a substrate for fouling organisms and an attractant for species that feed on them; artificial reef effects; and changes in water circulation, current speeds, and sediment transport, especially with the introduction of many turbines in close proximity.[51] It is not yet clear what cumulative impact of these effects may be at the ecosystem level[52] or on seafood yields.

Independent of its potential ecological impacts, wind farm development may exert a downward pressure on catch for these species, via the mediating factor of fisheries management. This is because wind farm development is expected to thwart the ability of NOAA survey vessels to access portions of their traditional sampling strata, creating a data gap that will introduce additional uncertainty to stock assessments. As a rule, the precautionary approach requires fisheries managers to respond to increased scientific uncertainty by imposing more restrictive catch management.[53] Thus, although NOAA fisheries managers are actively working with BOEM to address this issue, it is possible that the proportion of total available biomass that fishermen are authorized to harvest will decrease as a result of wind farm development.

Finally, offshore energy development may impose significant changes on the ability of fishing vessels to access traditional fishing grounds. The degree to which grounds are lost due to wind farm development may vary, and is likely to depend on fishing gear types practiced in the affected area, turbine technology, spacing of turbines, depth of cable burial, and other factors.[54] Often, safety considerations, increased insurance premiums, and outright restrictions imposed by insurance companies may prevent fishermen from accessing a wind farm area even in the absence of legal prohibitions on fishing there.

Impacts and interactions between offshore renewable energy and aquaculture are a different matter. Since all current aquaculture operations in New England are located inshore of planned energy development, no direct conflict is expected to occur between these uses, with the possible exception of temporary disturbance due to bringing landing cables ashore. In fact, there is some interest in integrating aquaculture into renewable energy developments through "co-location" or "multiuse," a practice that is proposed to yield cost savings and minimize the spatial footprint of development relative to introducing these two uses separate locations.[55]

5 Next Steps

Can the six New England states provide 30% of their food from regional farms and fisheries by 2030? The New England State Food System Planners Partnership, through its *New England Feeding New England* project, set out to explore this question. Inspired by Food Solution New England's *New England Food Vision* of achieving 50% regional consumption by 2060, our objective was to better understand our current food system environment, and exactly what it will take to grow, raise, produce, harvest, catch and move more food through a complex regional supply chain to our homes and other places we eat.

The sixteen NEFNE researchers developed this foundational research so that we can begin to mobilize around a regional food goal, develop strategies, and take action to build a more just, equitable, resilient, and reliable regional food system. A central concept of this approach is the idea of **regional food self-reliance, which is an estimate of how much food we produce compared to how much food we consume.** No single county or state can provide a full menu of food products to meet the needs of its population. For example, within New England, the northern states have *most of the farmland*, while the southern states have *most of the consumers*. Moving toward 30x30 will require, for example, enormous investment in retaining and expanding land in agriculture in the northern states, with most of the people, political power, and potential sources of funding based in southern New England.

A resilient regional food system is both an *investment* in our shared future and an *insurance policy* against future risks.

This dynamic—big population centers in the southern states, and major agricultural production in the northern states—sets the stage for exploring regional food self-reliance.

In Volume 2, a *Food Production Team* created a model of regional self-reliance—an estimate of the region's production of food commodities compared to its consumption of those same commodities—that outlined scenarios for how **the six New England states could meet a goal of supplying 30% of our food from regional sources by 2030.** That research used the average volume of seafood landed from 2010-2019 in New England and did not model potential changes to the contribution of seafood. **This supplement identifies opportunities for increasing regional self-reliance for seafood that may aid future modeling work, including better alignment between regional production and consumption, and inducing greater ecological production through habitat protection and stock enhancement.**

The Questions We Started With

- If we ate in a healthier, more resilient way, could more of our food be supplied by regional production?
- Could the six New England states meet a goal of supplying 30% of the region's food by 2030?
- Do we have the right mix of industries to ramp up food production? What sectors are growing? What sectors are contracting?
- What market channels offer the best opportunities for sourcing regional and local products?
- What might change if we intentionally and regionally plan for our future, making significant investments in strengthening our regional food system and communities?

After a year of intensive exploration by four research teams, we can begin to answer these questions. We have identified key stakeholder groups that we want to engage with over the coming years, because we believe that they have a big role to play in producing and sourcing more regional food and getting into the market channels where most New Englanders access it. We have identified a number of areas where additional investments are most needed to have the greatest impact in order to achieve the 30% regional goal.

The Questions We Now Have

What do we need to do by 2030 to make tangible progress towards this bold vision? What can we do as a region to make our regional food system more equitable and fair, resilient and reliable?

Fisheries and Seafood Questions

- What strategies and/or policies would enable more of the wild-caught fish and seafood from the region to be consumed here?
- What role can habitat protection/restoration and stock enhancement play in increasing RSR for seafood?
- What are the tradeoffs, if any, between aquaculture production and wild capture seafood production?
- What are the most promising strategies to replace imported seafood with seafood landed within the region?
- How can we expect seafood RSR to change as a result of climate change and offshore renewable energy development? What steps can food system planners and seafood eaters take to help the seafood system adapt and build resilience to these changes?
- To what extent is it possible—or preferable—to use ecosystem modeling and harvest management to increase production of species prefered by New Englanders?

What Comes Next for the Region?

The New England State Food System Planners Partnership provides a venue for communication, collaboration, and coordination among food system organizations across the region. A regional approach to food system resilience means that we work collectively to adapt, expand, and fortify New England's food production and distribution systems to ensure the availability of adequate, affordable, and culturally appropriate food for all New Englanders.

It is clear that sustained and collaborative action along with a significant and coordinated investment of resources will be required to meet the 30% by 2030 goal. But we know that the work we intend to do together is by no means the totality of what will be needed and thus we invite you to consider—and then act upon—how your business, your organization, your community and your choice around the food you consume can contribute towards the regional goal we are inspired to work towards. It will take all of us working together, in alignment toward the goal. Each of us—whether we are a farmer, fisher, food entrepreneur, retailer, nonprofit organization, researcher, educator, capital provider, government official, community organizer, or an "eater"—has an important role to play. Each of us has something to contribute, to advance, to accomplish.

System-level change is by its very nature complex, and no one organization, entity or state can change it alone. System-level change requires collaboration, highly networked multi-stakeholder alignment, transparency, continuous communication and strategic action that is properly resourced and built upon trusted relationships.

So let's come together around this goal of 30% by 2030 so that we can build the kind of equitable, resilient, and reliable regional food system that we need to adapt to climate change and ensure that all New Englanders have access to healthy, regionally sourced food from successful food producers and retailers.

We need to do this. We can do this. We invite you to be part of what comes next.

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