Integrating a Fisheries Ecosystem Perspective into the RI Food Strategy

Part I: Food-Producing Habitats

Restoring Rhode Island's coastal habitats for wild food production: why water health, habitat protection, and river passage are critical in increasing food production and income from our fisheries

By Eating with the Ecosystem

Maintaining the availability of abundant Rhode Island seafood starts with taking care of the ecosystems that produce it. The marine organisms that we eat - fish, clams, lobsters, squid, and more - require clean water and healthy habitats to survive, grow, and reproduce. The quality and quantity of our marine habitats in Rhode Island directly affect our fish populations, which can directly affect our fisheries and access to local Rhode Island seafood.

Habitat Protection

Fish habitat is as essential to fisheries as soil health is to vegetable farming. But unlike farmers, who can manage and adjust the characteristics of their own land to produce desired outputs, wild fisheries depend on shared spaces that are utilized by humans for many other purposes as well: waste removal, energy production, building development, and recreation. Many of these other uses can have unintended consequences for marine food production.

For too long, habitat protection and fisheries production have been viewed through separate lenses: governed by separate laws, underpinned by different goals and standards, and implemented in different meeting rooms by different sets of people. A food-focused perspective on wild ecosystems has the promise to bridge this gap.

Fish habitat can include physical factors such as temperature, bottom type, dominant vegetation (ex. kelp forests, seagrass bed, or salt marshes), and water depth but also

includes chemical factors such as oxygen and nutrient levels. In addition to this, habitat requirements at each stage of a fish's life (egg, larvae, juvenile, and adult) may be different even within the same water body. Because of this it is important to protect a wide variety of Rhode Island's marine habitats to maintain diverse and healthy fish populations and support the fisheries that depend on them.

Some of Rhode Island's important fisheries habitats are: the open ocean, salt marshes, seagrass beds, oyster reefs, mud flats, rivers, and hard and soft bottomed benthic habitats.

Coastal and ocean development, watershed integrity, water quality, temperature, pH, nutrient availability, salinity, and many other factors - both natural and manmade – can affect fisheries in big ways, particularly for species that spend at least part of their lives inshore and closer to human impacts.

Narragansett Bay supports many commercial pelagic (water column) fisheries such as mackerel, herring, and butterfish. The health of the pelagic habitat is tied to the health of the coastal waters that lead into the bay and the bottom habitats which are essential for fish and invertebrates to spawn, forage, rest, and hide from predators. The benthic (bottom) habitat consists primarily of soft sediments and provides important nursery habitat for commercially important finfish (such as winter flounder), crustaceans (such as lobster and crabs), and mollusks (such as mussels and clams).

Submerged aquatic vegetation such as eelgrass and kelp beds is an important marine habitat in Rhode Island and an integral part of healthy marine and coastal waters. Seagrasses are the base of many food webs, their roots stabilize bottom sediments, they provide nutrient uptake, and they are very important nursery habitat for finfish and shellfish. Many of our commercially important species, such as bay scallops, quahogs, tautogs, mussels, snails, blue crabs, and lobsters, depend on seagrass and seaweed beds for at least some part of their lifecycle.

However, good water quality is a requirement for these marine plants to survive. Sedimentation, nutrient pollution, boat propellers, dredging, excessive habitat shading (from docks or piers) all can put seagrasses at risk and thus the species that depend on them at risk as well.

Salt marshes are also an extremely ecologically valuable habitat for our Rhode Island coastal resources. Salt marshes protect coastal areas by buffering against storm surges and floods, serve as natural sponges and filter out pollutants from the shore before they reach the coastal waters, and are highly productive ecosystems that provide nursery

and foraging habitat for hundreds of species of fish and crustacean, many of which are commercially important.

There are 3,630 acres of salt marsh located along RI's coastal shorelines. However, it is estimated that 50% of previously existing salt marsh acreage has been lost in RI.[1] Prior to regulations in the 1970s, many marshes were filled, ditched, or drained so that people could build upon them and reduce mosquito populations. The precise cost in terms of food production of these activities is impossible to quantify, but is probably large. Utmost care should be taken to preserve the salt marsh that remains and to restore marsh area where we can.

Rivers and streams are essential for Rhode Island's diadromous species - migratory species of fish that spend part of their lives in freshwater and part of their lives in saltwater. These species include American eel, alewives (buckies), blueback herring, and American shad. The anadromous alewife epitomizes the high costs of habitat degradation in terms of food production. The alewife supported a thriving subsistence food fisheries for centuries, but is now heavily protected in Rhode Island due to low numbers caused by loss of spawning habitat. Fish populations that depend on rivers, like the alewife, have been significantly affected by dams, which block fish passage needed to reach spawning areas, alter the river flows that cue fish eggs to hatch, lead to increased predation on spawning and juvenile fish by causing delays in mobility, and can cause direct fish mortality if fish pass through power-generating turbines. Rhode Island has over 668 dams,[2] many of which no longer serve their original purposes (such as supporting industrial activities). Supporting fish passage and dam removal is an important step in restoring these species – and bringing back the abundant coastal food production that they once supported.

Offshore benthic habitat is critical for Rhode Island's inshore and offshore ocean species, such as squid, bottom fish, skates, and lobsters. As land-based resources come under increasing strain, industries are looking to the marine environment for new opportunities. The last decade has seen a growth in interest in developing the offshore environment for oil, sand, and gravel extraction and renewable energy production. While these activities are societally beneficial, they have tradeoffs, such as competing with

[1] Water Quality 2035: Rhode Island Water Quality Management Plan. October 13, 2016. Online at: www.planning.ri.gov/documents/LU/water/2016/SGP_WQMP_Approved%2010.13.16.pdf

[2] Water Quality 2035

fishermen for workspace and causing potential damage to fish habitat. Rhode Island's Ocean SAMP was a stakeholder- and science-based process that helped identify pathways for offshore development likely to minimize potential impacts on fisheries and fish production.[3] Other offshore planning and development efforts should follow a similarly thorough scientific and stakeholder process, with maintenance of wild seafood production identified as the primary social objective.

Water Quality and Pollution

The Rhode Island Water Quality Management Plan lists water as the "most important natural resource for the future of our state." One of the reasons it is so important is because of our commercial fisheries. The RIWQMP has set the goal to protect and restore RI's water and aquatic habitats. However, despite decades of progress toward improving our water conditions, a significant portion of our water resources still do not meet water quality standards due to pollution and other stressors.

The greatest water pollution concerns identified by the RIWQMP are pathogens and nutrients.

Pathogens include bacteria, viruses, and other organisms that can cause diseases or health problems in humans. In Rhode Island, sources of pathogens include sewage overflows, wastewater treatment systems discharges, pet wastes, agricultural animal wastes, as well as waterfowl and wildlife. Shellfish such as clams and oysters filter feed and can consume these pathogens in the process. The pathogens may not have an impact on the shellfish themselves. However, when pathogen levels are high, consumption of these filter feeders can be dangerous for humans. Elevated levels of pathogens result in shellfish harvest closures which can impact shellfish harvesters and the availability of local shellfish for consumers.

Nutrients like nitrogen and phosphorous are chemical elements that living organisms require to grow. However, when too many nutrients are introduced into the environment through human activities, it can create problems. In Rhode Island, this can occur through sources such as wastewater treatment facilities discharges, runoff, animal manure, fertilizer use, pet wastes, and air pollution sources.

[3] Ocean Special Area Management Plan. October 2010. Online at: http://seagrant.gso.uri.edu/oceansamp

Excess nitrogen in an estuarine environment can fuel algal blooms, which cause problems due to water quality degradation through eutrophication. This occurs when algae die and decomposing bacteria use large amounts of oxygen to break the algae down. These bacteria use oxygen for their respiration, and when the oxygen is depleted, it means less oxygen for marine animals such as fish and shellfish. Eutrophication can create anoxic areas, or dead zones, where the oxygen content is so low it cannot support life.

Additionally, excess nutrient loading is also a leading factor in coastal acidification. As bacteria consume a phytoplankton bloom, their cellular respiration produces carbon dioxide. Just as the carbon dioxide emissions from fossil fuel burning are causing a lowering of pH on a global level, the carbon dioxide produced by these bacteria can cause hotpots of low pH in coastal areas. In some estuarine areas, pH levels are at low levels not expected to occur in the global ocean until the end of the century. Ocean and coastal acidification can impact shell formation, metabolism, and predator avoidance abilities for a variety of marine organisms. Mitigation measures such as buffering these areas with crushed shells and kelp beds are being explored. Rhode Island's recently created Legislative Task Force on Ocean Acidification will enhance our state's knowledge base on ocean and coastal acidification and what we can do to minimize their effects on food production.

Lastly, algal blooms can reduce water clarity, which can harm important fish habitat by impacting seagrass beds that require light to survive. Water pollution can also impact other important habitats such as salt marshes through storm water discharge. Storm water discharge can deposit sediment, nutrients and other pollutants into a wetland.

Other sources of water pollution include:

- Runoff from roads and parking lots that can carry oils, chemicals or road salts.
- Runoff from farms and lawns that can carry fertilizers, which add extra nutrients to the bay and can lead to eutrophication, as well as pesticides that can poison local fish and marine life.
- Sewage that enters waterways through weak septic systems and sewer overflow systems. This can carry pathogens and excess nutrients but also pharmaceutical residues which may contain endocrine disrupters that would alter the reproductive ability of fish.

- Power plants that discharge heated water or thermal effluents, which can kill larval fish, disrupt normal development, or cause species to leave the area. Now boasting two prominent cooling towers and slated for decommission, the Brayton Point Power Plant in Somerset, MA was implicated in the near-total destruction of Narragansett Bay's winter flounder fishery in the 1980s and 1990s.
- Heavy metals from historical industrial businesses that are buried in the bottom sediments and they run the risk of being turned up and re-suspended into the water column during dredging or extreme storms. If re-suspended heavy metals can harm marine life as well as the humans that consume it.

Climate change and ocean acidification

Perhaps the largest and most irreversible habitat impacts on fisheries are those brought about by global greenhouse gas emissions on climate and pH. Climate change and ocean acidification are well-recognized global phenomenon that will continue to occur even if a global accord to stabilize greenhouse gases is reached. Locked-in climate change affects the distribution and abundance of key fisheries resources as well as their prey, and will continue to do so for some time. Locked-in ocean acidification trends are slowly bringing down the pH of ocean water, and are expected to have drastic effects on shell-bearing organisms like quahogs and oysters within a 50-100 year timeframe.

The Resilient Fisheries RI project[4] is a current industry-led endeavor to jump-start a dialogue among Rhode Island's wild-harvest fishing industry about the effects of environmental changes on our state's fisheries. The project is currently working to develop an Adaptation Blueprint that will encapsulate industry consensus on next steps that Rhode Island can take to maximize fisheries resilience in the face of unknowns. Fisheries policy and management have a major role to play in resilience-building and adaptation. An ecosystem-based approach to fisheries management, a push for greater representation for Rhode Island in decisions made about Mid-Atlantic fish stocks, a revisiting of the notion of state-by-state fish harvest allocations, and an overall commitment to fostering flexibility and diversification among industry participants have emerged as key recommendations of the project so far.

[4] Learn more at www.ResilientFisheriesRI.org

Unanswered questions

Ecosystems are highly complex, and changes occur in cumulative fashion. Taking an ecosystem-level approach to understanding impacts and trends is critical. For example, climate change and ocean acidification have the capacity to exacerbate other habitat problems such as oxygen depletion, invasive species, and marine disease. Stressors must be monitored and understood in a comprehensive manner.

Fishermen are astute observers of the marine environment. They spend many days each year on the water, and many possess long time series of observational data. While fishermen's monitoring of the marine environment is not as structured as that performed by scientists, it can have the advantage of being more open-ended - less directed towards answering specific research questions and more oriented to picking up on unexpected changes in the environment.

Many Narragansett Bay fishermen have recently begun to voice observations about the bay's changing environment. Anecdotal observations include a disappearance of barnacles and hydroids from lobster pots and boat hulls, a down-estuary distributional shift of rockweed and kelp, a remarkable increase in water clarity / decrease in plankton abundance, and a decrease in the abundance of many finfish in the bay. Fishermen are raising questions about the drivers associated with these changes, chiefly focused on two aspects of wastewater management: (1) potential byproducts and chemical interactions taking place as a result of the chlorination/dechlorination processes that are used in wastewater treatment to eliminate pathogens, and (2) the rapid rate of reduction in nutrient loading to the bay, brought about by ambitious nitrogen reduction targets and timelines.

A recent study by URI found that nitrogen levels in Narragansett Bay are half of what they were in the 1990s.[5] While this bodes well for eliminating eutrophication, and many in the state are celebrating this reduction as a win for water quality, some commercial fishermen are fretful about what it means for the base of Narragansett Bay's food web. These questions are important ones for food production, and fishermen are justified in wanting answers. Attaining a better grasp on these nuances could be an important element of a comprehensive wild seafood strategy for Rhode Island.

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[5] See Kuffner, A. 2015. "Decade-long study reports drop in nutrient levels, which in turn means clearer water and fewer algae blooms," Providence Journal, August 19, 2015. Online at: http://www.providencejournal.com/article/20150819/news/150819250

Recommendations

- **Strengthen communication between habitat restoration and fisheries management professionals and stakeholders**. Water quality and coastal restoration are typically conceptualized as discreet arenas of practice from fisheries management. Engaging both sets of practitioners in conversations about stewarding habitat for wild marine food production is a first step to bridging this divide.
- **Support greater integration of habitat concerns into fisheries management.** Upland, coastal, and offshore non-fishing activities have various impacts on the health of the marine fish stocks that we depend on for food, income, and recreation. However, the development of scientific and policy tools to understand and manage "non-fishing" impacts has lagged behind other, "fishing-induced" aspects of fisheries management such as harvest controls, bycatch reduction, and impacts of fishing gear on habitat. Concerns about fish-producing habitat need to be better reflected in the laws and policies of fisheries management.
- **Support habitat restoration practices that enhance the public supply of seafood.** Habitat restoration can include salt-marsh restoration, seagrass restoration, shellfish restoration, fish passage, and more. Rhode Island has many organizations dedicated to using these practices to improve the health of our estuaries and watersheds. However, barriers remain, such as a prohibition on shellfish restoration in contaminated waters (ironically, the very locations where restoration would provide the biggest benefits in terms of water quality). Given the importance of habitat restoration in food production and fisheries income, habitat restoration policies should be geared towards improving production of fish for food and income. A prime example is the Rhode Island Shellfishermen's public enhancement seeding project, which seeds quahogs into areas utilized by recreational quahoggers to gather dinner.
- **Stabilize atmospheric greenhouse gas concentrations.** By advocating for stronger limits on greenhouse gas emissions, increasing renewable energy production, pursuing transportation policies that enable more biking and walking, and approaching land use decisions with an eye to carbon storage, Rhode Island can help stabilize the concentrations of carbon dioxide and other greenhouse gases in the atmosphere that are causing climate change and global ocean acidicifation.

- **Create a new narrative around stewarding our watersheds and estuaries as food production zones.** Rhode Island's food strategy should embrace food-supporting habitat restoration as a pillar of sustaining wild marine food production. Food production should be treated as the highest and best use of marine and coastal areas. Public education about the links between water quality, habitat integrity, and seafood production is key.
- **Call for a comprehensive assessment of the status and trends of Rhode Island's fishery habitat assets.** To better understand cumulative impacts interacting on Rhode Island's fish habitat and to inventory and track the state's fishery habitat resources, Rhode Island should carry out a state-level Fishery Habitat Assessment similar to the *Our Living Oceans: Habitat* report published by NOAA in 2015.[6] This report catalogued the importance of habitat to fisheries, sources of habitat impact nationwide and regionally, scientific mechanisms to assess and quantify habitat, and policy mechanisms to address habitat degradation and restoration.

6 NMFS. 2015. *Our living oceans: habitat. Status of the habitat of U.S. living marine resources*. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-F/SPO-75, 327 p. http://spo.nmfs.noaa.gov/olohabitat/Table_of_Contents.pdf