Commercial Fishermen's Observations of Ecological Change in Narragansett Bay

Executive Summary

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Introduction

The estuarine habitats that support living resources and resource-dependent economies in the Narragansett Bay region are in flux due to a variety of natural and anthropogenic factors. Although physical, chemical, and biological information is routinely collected by resource agencies, universities, and wastewater treatment plants to quantify pollutant loadings to the bay, assess the bay's ecological health, and inform management decisions ("existing monitoring programs," collectively), regulators, researchers, and resource users share a desire to create a more complete picture of these ecological changes and their impacts on the bay's biota.

Around the world, social science has shown that commercial fishermen possess valuable ecological knowledge derived from their regular work on the water ("fishermen's environmental knowledge," or FEK). When properly collected and organized, FEK can fill spatial, temporal, species-level, and other gaps in the information collected by existing monitoring programs, and can contribute to better resource management. However, to do so, it must be gathered in ways that meet standards of scientific data collection and are applicable given constraints on time, funding, and fishermen's availability to participate.

With scientific and financial support from the Narragansett Bay Estuary Program, Shining Sea Fisheries Consulting analyzed a set of 37 semi-structured interviews that elicited biotic and abiotic observations about the bay's changing ecology from 26 commercial fishermen. The resulting report, "Commercial Fishermen's Observations of Ecological Change in Narragansett Bay: A Pilot Project," presents the analysis methods used, a synthesis of FEK data collected, and a comparison of FEK data with ecological data derived from existing monitoring programs. The report provides a suite of tools and reflections to help regulators, scientists, and resource users jointly consider the value of FEK as a complement to existing monitoring programs, and to map out next steps for how to properly collect and integrate FEK data with such programs to better inform decision-making in a time of change.

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Methods and Analysis

"Commercial Fishermen's Observations of Ecological Change in Narragansett Bay" organizes and analyzes FEK gathered from experienced commercial fishermen with a range of fishing practices, including quahoggers, lobstermen, trawl fishers, and aquaculturists. In 17 interviews conducted for this purpose in 2019, interviewees were asked to recall any changes they had observed in the bay's biota or abiotic aspects during their careers, describing in as much detail as possible the spatial and temporal aspects of these changes, the duration and directionality of observed abundance trends,[1] and any observed changes in species behavior, characteristics, and relationships with other species. Interviewees utilized a laminated nautical chart to sketch areas where they had observed trends of interest. Interviews were transcribed and photographs of interviewees' sketches were digitized using Esri ArcPro software. These data were complemented with additional qualitative data extracted from 20 semi-structured interviews conducted in 2014 and 2016 for other projects.

The report's first section, "Synthesis of Fishermen's Observations of Change in Narragansett Bay," presents a qualitative and visual summary of trends that fishermen observed with regard to 34 organisms. Interviewees' biotic observations were categorized by species, bay segment,[2] trend type,[1] and temporal description. This categorization yielded a total of 432 unique observational statements regarding trends in abundance, distribution, and other characteristics of the bay's benthic invertebrates, fouling invertebrates, macroalgal and finfish communities, and other species. Interviews also yielded observations on abiotic aspects such as water clarity and odors.

The remainder of the report compares FEK observations synthesized in the first section to datasets derived from existing monitoring programs. A section entitled "Scientific Monitoring in Narragansett Bay: What Kinds of Data Are Being Gathered?" presents a detailed overview of existing monitoring programs (e.g., field surveys, landings data, fixed site monitoring) and the kind of data they collect. The section, "How Can Fishermen's Knowledge and Observations Help Fill Gaps in Scientific Monitoring?" identifies areas where scarcities in existing monitoring could potentially be supplemented through a more robust FEK collection effort. The final section, "Comparing Fishermen's Observations to Scientific Monitoring: Where Do They Align and Differ?" draws rough comparisons between the trends cataloged in the FEK collection effort and existing datasets to pinpoint areas of convergence and divergence between the two. These reflections set the stage for an ongoing conversation among regulators, researchers, and resource users on how expanded FEK collection efforts may complement existing monitoring programs and inform estuarine management.

[1] Descriptions of trends in abundance were divided into eight categories: decrease, increase, constant abundance, variable/cyclical, historical boom, historical collapse, uptick (less than 2 years before interview), and downtick (less than 2 years before interview).

[2] Segments were defined using the Narragansett Bay Estuary Program's "BAYSEGMENTS_NBEP2017" digital map.

Findings and Lessons Learned

Fishermen are observing ecosystem change in Narragansett Bay at a range of temporal and spatial scales and for a broad range of species that extends well beyond those that are economically valuable. Interviews showed that the type of observational data possessed by an individual fisherman tends to vary based on the gear type(s) (s)he uses and where (s)he fishes. Interview data largely clustered in two groups—lobstermen working in the Lower East Passage and shellfishermen working in the upper portions of the bay—with lobstermen more likely to report observations on mobile and fouling invertebrates, shellfishermen more likely to report on sessile benthic invertebrates, and all groups likely to report on finfish, seaweeds/ macroalgae, and abiotic aspects. Although observations were detailed and consistent across individuals with regard to species and spatial aspects, they were often vague and inconsistent with regard to temporal aspects, suggesting that people's recall of when something happened is less reliable than their recall of what happened and where.

Several key patterns emerged from the FEK synthesis. For instance, interview data suggests that quahog populations in many segments of the bay are at an all-time low and that once-reliable recruitment cycles have stalled. A prominent exception to this trend is the Upper Bay, where populations remain high and age structure seems to be intact. Meanwhile, slipper snail populations (called "deckers" by fishermen) have soared, overtaking quahogs in some parts of the bay, according to interviewees. Interview evidence also supports a view that lobster populations are at historic lows; however, in this case, their distribution has shrunk southward towards the Mouth of Narragansett Bay.

Throughout the bay, interview evidence suggests that historically predictable types and distributional patterns in the seaweed/macroalgae community have given way to a more variable community structure characterized by an abundance of nuisance and ephemeral species and a near-absence of habitat-forming species like kelp and rockweed. Interviewees were emphatic in describing a sharp decline in starfish in recent years, and several also described a decline in barnacles and other fouling organisms. In many interviewees' views, these changes have coincided with an increase in water clarity and what several described as a "chlorine smell" in the air above the bay.

Although greater incorporation of FEK into the knowledge base for estuarine management may be useful in many ways, perhaps one of the most obvious and immediate benefits is its potential to help fill gaps in existing scientific monitoring programs, especially outside targeted geographies and taxa. A review of existing monitoring programs highlighted several such opportunities, suggesting that FEK may offer a valuable substitute for science-based monitoring when it comes to: common but unsampled species like slipper snails (deckers); rare/indicator species like bay scallops, urchins, and sea horses; once-common species that have become rare, like rockweed, kelp, and starfish; and taxa that have never been the object of permanent monitoring efforts, such as seaweed/macroalgae and native fouling invertebrates. FEK may also be useful for covering sampling gaps within coves and embayments, which are often undersampled in scientific surveys.

Comparability of fishermen's observations with data from existing monitoring programs is limited due to differences in sampling methodology (temporal and spatial alignment), magnitude/scale of observations (e.g., noting the direction of a trend is easier than measuring the magnitude or impact of the trend), ability to distinguish among similar taxa (especially for seaweeds), and level of abstraction (e.g., human observation tends to "smooth" variability while scientific sampling preserves it). Nonetheless, for species that have been the subject of regular scientific monitoring, few discernible discrepancies were found when this data was compared with fishermen's observations. There are some exceptions: for instance, although fishermen's observations of declining quahog abundance in most segments of the bay align on balance with DEM shellfish landings data, they do not align as well with data from DEM shellfish dredge survey. Direct conversation between scientists and fishermen is needed to further disentangle patterns of convergence and divergence between FEK and existing monitoring datasets.

In conclusion, the effort represented in "Commercial Fishermen's Observations of Ecological Change in Narragansett Bay" fine-tuned a novel framework for organizing a wide range of FEK. Whereas most FEK studies conducted in the Northeast US have focused on single species and have been interested in historic patterns of species distribution, this study has shown the value of FEK for collecting information about an entire ecosystem during a time of rapid change. The project's analytical framework, based on defining observational "units" composed of a species, spatial segment, time period, and trend type, has potential for widespread replicability in future FEK studies in Narragansett Bay and elsewhere. However, to scale up, the FEK collection mechanism used in this project must be refined to be more efficient and precise.

Next steps

As a pilot effort, the principal value of "Commercial Fishermen's Observations of Ecological Change in Narragansett Bay" is as a springboard for future dialogue and planning. The report presents a suite of resources to facilitate these activities, including a text-based and visual summary of 37 interviews conducted in 2014, 2016, and 2019, a systematic framework for organizing FEK-derived ecological information on a species, spatial, temporal, and trend basis, and a comparison of collected FEK with existing monitoring programs both in terms of its coverage and its findings.

Drawing upon these resources, the Narragansett Bay Estuary Program and Shining Sea Fisheries Consulting will work with an advisory panel of experts from the regulatory, scientific, and fishing communities. With guidance from this panel, we will convene a workshop with broader constituencies to discuss the initial findings of this report, develop a draft protocol for capturing and using FEK in the Narragansett Bay region on an ongoing basis moving forward, and explore if and how to integrate and apply FEK datasets to management decisions.