Rhode Island Shellfish Management Plan Research Updates
November 17, 2014

In support of the Rhode Island Shellfish Management Plan (SMP), Rhode Island Sea Grant has dedicated its 2014-2016 research efforts in the areas of shellfish biology and the ecology of the resources that support shellfish and shellfish management.

Researchers have recently finished their first field season collecting data and will be processing this information over the winter months. Below are the latest updates for the seven Sea Grant-funded projects.

Quahog Migration: Understanding Where Quahogs Travel and Settle in Narragansett Bay

Scott Rutherford, Roger Williams University

It is suspected that parts of the Bay act as sanctuaries for adult clam spawning, others as settlement areas for the next generation of clams – both of which are important to the long-term sustainability of the species.

Scott Rutherford from Roger Williams University (RWU), in collaboration with Dale Leavitt (RWU) and Chris Kincaid and Dave Ullman from the URI Graduate School of Oceanography (URI GSO), are using the Regional Ocean Modeling System (ROMS) and Lagrangian TRANSport (LTRANS) models to look at how water flows through Narragansett Bay and how it relates to quahog distribution when originating from a specific place.

Rutherford and his team developed drifters to mimic behavior of floating quahog larvae to get an idea of where they might end up based on the direction of the currents.

Over 30 drifters, both at 1 meter and 3 meters in length, were deployed from Ohio Ledge this past summer to get a sense of how different layers of the water column impact dispersal. All of the drifters were shown to end up somewhere in the East Passage of the Bay, which is contrary to general thinking that Bay circulation flows counter-clockwise.

"The general idea is that the Bay circulates counter-clockwise; water comes in the East Passage and flows out the West Passage. But we're not seeing that happen with drifter tracks. Almost all of them go out the East Passage," said Rutherford, noting that the drifters only indicate surface flow whereas the model is looking at the overall direction of circulation. "So is this a surface versus depth discrepancy? Or is it related to a particular time of year? It's an interesting discrepancy."

- Next Steps -

The team will be looking more closely at the tracks of each individual drifter and incorporate the wind vector to get a clearer picture of surface circulation patterns in the Bay. The team will also as well as incorporating data from 2007 and 2008, as well as 2014, into the ROMs model to get a range of environmental conditions, such as warming water temperatures, which impact larval behavior.

Impacts of Aquaculture in Coastal Ponds: A Look at Subaqueous Soils

Mark Stolt, University of Rhode Island

What impacts do aquaculture operations have on Rhode Island's salt ponds?

This is the question that University of Rhode Island researcher, Mark Stolt, is hoping to answer by evaluating whether oyster aquaculture benefits ecosystem functioning in southern Rhode Island's coastal salt ponds – specifically, Ninigret, Winnapaug, and Potter Pond.

These submerged ponds represent areas with and without aquaculture, and will be compared based on submerged soil types, water quality, and aquatic organisms to decipher environmental impacts of aquaculture.

"We're trying to get a picture of what's happening to these soils as a reflection of the aquaculture that's going on," said Stolt, explaining that the condition of the soils are indicative of the water quality, the tidal fluctuation, and how much energy (food) is coming in.

Stolt will be evaluating several aquaculture sites of different ages from 3 to 17 years to better understand the interaction between bivalve growth and soil condition over time, which will reflect the health of the environment. He will also be evaluating the benthic communities on the same soil type in areas where there is no aquaculture.

"We've identified our sites, and have just started sampling for benthic organisms to characterize the soils under different age [aquaculture farms], and those in areas with no aquaculture," he said.

Stolt and his students will continue to sample, "until it becomes too cold."

Another goal of this project is to get an idea of how things would change if growers increase numbers of animals per area. Stolt will be collecting "bio-feces" from oysters reared at Roger Williams University to test on the four different soil types.

"The ideal is high productivity with no environmental impacts," said Stolt, noting that tradeoffs may include nitrogen influx from waste coming from too many

organisms that can overload the system. "We'll look at the bio-feces and benthic community response."

Whelk Ecology

Kathleen Castro, University of Rhode Island

Little is known about the basic ecology and biology of New England whelk that is needed for proper management.

Kathleen Castro from the University of Rhode Island Fisheries Center, in collaboration with the Rhode Island Whelk Fishermen's Association, will be utilizing knowledge of local whelk fishermen, and conduct targeted research that will better define the biology of the species in Rhode Island waters.

Castro and her team have begun conducting a predator-prey analysis of whelk in quahog using six replicates at the URI GSO aquarium lab. Each replicate has one whelk and 5 quahogs of varying sizes, and are monitored daily for feeding activity. Half of the replicates are testing channeled whelk and the other half are testing knobbed whelk.

Over the course of a week, little results were yielded with lab conditions being suspect. Only one whelk ate one quahog, which is suspected to be the result of external stressors from artificial lighting and lack of sediment in the lab setting.

"Whelks were not feeding in the tanks," said Barbara Somers from the URI Fisheries Center. "We think lighting may be the biggest factor, but not having sediment in the tanks could also be a problem"

To test this, Castro and her team added a field component with collector cages off of the GSO pier. Again, no luck was had in getting whelks to feed despite using various habitats.

"We have not had any success in getting [whelks] to feed," said Somers. "We have tried a few different habitats with no success to date."

"The irony is that [whelks] will eat horseshoe crabs all day…they just won't touch the quahogs, which is supposed to be their main food according to fishermen," said Castro.

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Perceptions of Aquaculture: Support and Opposition in Rhode Island

Tracey Dalton, University of Rhode Island

Aquaculture is growing rapidly within Rhode Island to capitalize on the state's resources and respond to a growing market, but what do people actually think about it, and do they support it?

Tracey Dalton and Robert Thompson from the University of Rhode Island, in collaboration with Di Jin from the Marine Policy Center at the Woods Hole Oceanographic Institution, are looking to identify the key influences on people's perceptions that support or oppose aquaculture in Rhode Island waters. The intent of this project is to minimize conflict where possible and practical, and to suggest changes to current aquaculture practices that could lead towards improved support and management.

"Our plan is to develop a survey of Rhode Island residents, targeting commercial harvesters, aquaculture farmers, waterfront property owners, and then a general sample of coastal residents to understand their level of support," said Dalton.

During the summer Dalton and her team have worked on developing a mail survey that focuses on various types of aquaculture and locations. Two different sites, one in the bay and one in a coastal pond, are being used in photo simulations for the survey to depict farm size and operations.

"Aquaculture can look different in different places, and people have different attachments to different places, which is why we're focusing on two different places," said Dalton. "Answers to the survey questions will help us understand whether certain characteristics of people correlate with opposing aquaculture in all forms or support."

The results of the survey are intended to get a better sense of what level of development is acceptable to people, and why.

The mail survey is undergoing refinements and will go out in late-winter/early-spring of 2015.

The general sample of residents is random, but commercial harvesters and farmers can help by responding and providing the necessary feedback for this research. If you're interested in participating please contact Tracey Dalton or Azure Cygler.

Sea Grant
Rhode Island

Rhode Island Shellfish Management Plan Research Updates
November 17, 2014

Recreational and Commercial Uses of Rhode Island's Coastal Ponds

Robert Thompson, University of Rhode Island

Rhode Island's coastal ponds are highly valued for a range of recreational and commercial activities, but have a limited capacity. How people use the coastal ponds, why, and with what intensity will help resource managers develop plans to minimize conflict and preserve, or enhance, assets users value most.

"I can tell you there are a lot of people there and what they're do, generally, but I can't tell you why they're doing it there, and what they think about it," said Robert Thompson, researcher at the University of Rhode Island.

Thompson is working with Tracey Dalton and James Opaluch of the University of Rhode Island, in collaboration with John Lake and Eric Schneider of the R.I. Department of Environmental Management Division of Fish and Wildlife (DEM), to map recreational and commercial uses in Point Judith Pond, Potter Pond, Ninigret Pond and Quonochontaug Pond.

"We're trying to collect high resolution spatial data of human uses of coastal ponds that can be built into models of ecosystem services," he said, explaining that people respond to fish activity and other biological factors. **"We're trying to include people as part of the ecosystem."**

Multiple surveys, which include observational and in-person interviews, have been developed to compare human activities and biological abundance in ponds. Many activities overlap but are not generally in conflict with each other.

"The misconception is that people view overlapping uses as in conflict," said Dalton, noting that's not always the case. Part of the survey, she said, focuses on what people think about other uses around them, and targets specific areas of use to evaluate areas that are more highly impacted by humans.

"Not everyone is using the same space at the same time," said Thompson.

The team will process information this winter and will continue surveys in the spring and summer of 2015 to increase the database and correct any gaps.

"There are a lot of activities originating from private marinas and beaches that we're not intercepting, and we need to access them and learn what they think," said Thompson.

This project will incorporate findings from Dalton's work on the perceptions of aquaculture to help manage potential conflicts as operations expand, and will also look at the recreational value of different sites based on travel costs.

Sea Grant
Rhode Island

Rhode Island Shellfish Management Plan Research Updates
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Oyster Aquaculture and Water Quality

Robinson Fulweiler, Boston University

One oyster can filter 50 gallons of water a day, ridding the system of an excess of nitrogen and other nutrients that can have negative impacts on the coastal environment. However, the role of aquaculture in water quality is controversial.

Robinson Fulweiler from Boston University, in collaboration with several Rhode Island oyster growers, is examining how nitrogen cycling processes change over time under oyster aquaculture rack and bag farms in southern Rhode Island.

"I'm interested in what oysters do to nitrogen," said Fulweiler. "They indirectly remove nitrogen by filtering carbon out of the water, depositing feces on the bottom, which fuel bacterial processes that remove nitrogen. On the flip side, if oysters aren't being taken care of you can get the opposite process and actually add nitrogen to the system."

Test sites will incorporate optimal nitrogen removal based on farm site characteristics. These farms range in age from 0-3 years, 3-5 years, and greater than five years. The goal is to determine the duration each rack and bag setup should remain in one place to maximize nitrogen removal processes to improve water quality.

The first sampling occurred this past summer at all sites to collect data on summer oxygen demands, nutrient fluxes, and nitrogen fluctuations from core samples, as well as samples from the water column to characterize sites based on dissolved oxygen, salinity, and chlorophyll levels.

Sample data analysis is currently underway and will help inform the next steps, which include getting the data out to people, especially aquaculturists.

"My goal is to make this data available as fast as we can to the shellfish aquaculturists," she said, noting that the shellfishermen have been extremely helpful in collecting information. "They work on the ponds every day and know the systems better than we can."

Fulweiler's research will hopefully help oyster farmers decide when to rotate their rack and bag setup to maximize nitrogen removal, and improve water quality in the coastal ponds and Narragansett Bay.

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Blue Mussel Disease and Effect on Commercial Culture

Roxanna Smolowitz, Roger Williams University

Naturally occurring pathogens have been known to decimate natural mussel beds, and could be a major risk to mussel aquaculture endeavors. The circumstances leading to mussel mortality, however, are not well known.

Roxanna Smolowitz, marine disease expert from Roger Williams University, is exploring the prevalence and life history traits of mussel pathogens common to Narragansett Bay.

Blue mussels of three sizes (15 to 30 mm, 30-45 mm, and >45 mm) were collected from Arnold Point, Hope Island, Roger Williams University Dock, East Passage, and West Passage at five time periods between May and September, 2014. The first three sites evaluated wild harvests to compare to the latter sites with cultured animals.

"One of the interesting findings was the significant increase in the number of animals containing trematodes, and the number of trematodes in each animal over the sampling time period," said Smolowitz, explaining that while statistical evaluations have not yet be done, the trend indicated that males were more often infected than females. "Severe infections appeared to correlate with a sharp decrease in population of mussels in August and September."

The majority of the data is still being processed to evaluate overall physiological condition, reproductive status and commercial meat yield, as well as growth and survival rates. Results are hoped to shed light on the distribution and prevalence of disease in blue mussel farms in Rhode Island and the northeast region, and aid prospective mussel growers to design and implement husbandry practices that will minimize the probability of, or exclude, on-farm disease outbreaks.