Northeast Fisheries Science Center

Science Spotlight

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November 5, 2009
SS09.17

NOAA Lab, N.Y. Town and Oyster Farmer Collaborate to Understand Potential Impact of Floating Nursery on Local Environment

With demand for seafood growing, shellfish farmers often use a floating nursery called a FLUPSY, or Floating Upwelling System, to improve growth of very young shellfish known as seed and increase their chances of surviving until they are harvested. Little has been known about the possible impact of these floating systems on the local environment.

A collaborative project between a commercial oyster farmer, the Town of Riverhead, N.Y., and scientists at the Northeast Fisheries Science Center's Milford Laboratory in Milford, Conn., is measuring the effect of a FLUPSY on water quality and sediment characteristics in Riverhead's East Creek.

"The Town of Riverhead was interested in knowing the potential effect, if any, of the FLUPSY on the water quality in East Creek before issuing any further permits to local oyster growers," said Gary Wikfors, who heads the Milford Lab's Biotechnology Program. "A commercial grower, Karen Rivara, also wanted to know if there was any effect since her livelihood depends on a healthy environment for growing shellfish. We were interested in conducting water quality studies that might help commercial shellfish farmers and the town."

A FLUPSY is a floating dock with small silos or barrels underneath that contain shellfish seed on screens. Surrounding water is pumped up through the silos, enabling the one to ten millimeter long (less than a third of an inch) seed to grow much more quickly and more uniformly than in natural conditions because the young oysters receive a constant supply of food and oxygen from the water.

FLUPSY's have grown popular in coastal areas in the last few decades to culture and protect small shellfish seed through the delicate nursery stage, from the time they leave a hatchery until they are large enough to be placed in shellfish beds in coastal waters to grow to harvest size.

Wikfors' team of biologists, microbiologists, ecologists, chemical oceanographers and lab technicians visited the East Creek site for a pilot study in 2008. They returned four times during the summer and fall of 2009, the last time in early October.

Each time the team brought a mobile laboratory, complete with sophisticated analytical instruments like a variable fluorescence fluorometer and a flow cytometer. The fluorometer measures how much light for photosynthesis or growth a phytoplankton sample is exhibiting, while the flow cytometer measures physical and chemical characteristics of individual cells in the water samples.

When the team arrived on site for a 24-hour experiment in September, Mark Dixon, a biological science technician, set up eight large clear plastic bags suspended from floats on the side of the FLUPSY. Four of the bags were filled with water from the creek before it had been pumped through the FLUPSY, while the other four were filled with water that had come through the FLUPSY. Water samples were then taken from the bags every three hours and split into many smaller samples for various studies.

"By taking water samples before it is pumped up through the silos with the oysters, and after it has passed through the oysters, and isolating it, we can determine what the growth of phytoplankton, the oysters' main source of food, would be in the creek without the oysters being present," Dixon said. "We can then calculate how much the oysters are affecting the plankton."

"We examined the differences between day-night feeding behaviors and algal growth," said Shannon Meseck, a chemical oceanographer. "During the day phytoplankton or algae are growing, and we can see the change with our sampling. Phytoplankton don't grow at night. Because oysters are such efficient filter feeders, it is important that we see what phytoplankton are doing during a 24-hour cycle."

Water sampling and other environmental measurements were conducted around the clock to reflect changes in sunlight and tidal cycles. Some samples were taken every three hours, others every six hours. Samples were analyzed in between for 12 different factors, such as phosphorus, nitrate and ammonia.

Yaqin "Judy" Li, an ecologist, analyzed phytoplankton samples with the lab's new fluorometer to determine growth and health of the organisms. The Riverhead project is one of the first uses of this instrument for monitoring aquaculture facilities.

"This type of fluorometer can tell us about the physiology of the phytoplankton, and also help estimate phytoplankton production," Li said. "Some of the phytoplankton living in East Creek pass through the FLUPSY system and back out into the water. What happens to their growth during that process helps us determine how healthy the environment is with a FLUPSY present."

April Croxton, a fisheries biologist specializing in shellfish, collected adult oysters from a cage on the FLUPSY and extracted blood to test the immune or defense response to the effects of the FLUPSY. The extracts are run through the flow cytometer, transported to the site in the back of a minivan, and analyzed in seconds.

"We bring this instrument into the field because it gives us an accurate reading of the stress level of the shellfish," she said. "If we brought the oysters back to our lab in Milford and then analyzed their blood, we would find a reaction to the stress of their trip, not the possible effect of the environment containing the FLUPSY."

The Milford Laboratory team plans to return to the East Creek site in 2010, earlier in the season when the oyster seeds are growing the fastest, to continue their water quality and environmental tests. Results will be shared with the commercial oyster grower and with the Town of Riverhead, and also be presented at professional conferences and published in peer-reviewed literature.

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Aquaculture in the Northeast Region: http://www.nero.noaa.gov/StateFedOff/aquaculture/