Scientists satisfy our taste for blue mussels and Arctic surfclams

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Blue mussels, Mytilus edulis, live on northern Atlantic shores in the area between high and low tides. "Mussels are one of the most significant filter-feeders in the marine environment," said Brian Beal, a marine ecologist at the University of Maine at Machias. "They are responsible not only for efficiently producing high-quality protein but for cleaning the waters around them through their feeding activities." Because many creatures--especially humans--enjoy eating blue mussels, farmers grow mussels using aquaculture, or aquatic farming. Beal, along with a team of NSF-funded researchers at the University of Maine at Machias and the Downeast Institute, is investigating the growing conditions and practices that will reliably yield healthy and plentiful blue mussels. The researchers also are investigating exactly when to transition the young mussels into ocean pens, and where in the pens they grow best. Find out more in this discovery. Credit: Brian Beal, University of Maine at Machias, Division of Environmental and Biological Sciences

These tiny creatures are Arctic surfclams. They're getting packed up for a trip to the shore. With some help, they're about to take up residence in an intertidal mudflat on the Maine coast, or 'Downeast' as they say around here, referring to ships sailing centuries ago from Boston east to Maine and downwind.

The area's rich maritime history is not lost on Brian Beal, a marine ecologist with the University of Maine at Machias who has lived here all of his life and grew up working on the water.

With support from the National Science Foundation (NSF), Beal and a team based at the university's Marine Science Field Station at the Downeast Institute are putting their aquaculture innovation skills to work. The team's goals are to diversify the U.S. market for shellfish and increase the number of jobs in that market. The researchers are focused on two types of shellfish with the potential to bring more jobs and dollars to the area: blue mussels and Arctic surfclams.

In the case of the latter, Arctic surfclams are not only a valuable species, but, Beal says, no one has ever tackled culturing them before. Arctic surfclams are a deepwater species that range from Rhode Island north to Newfoundland. Low densities have so far prevented the species from becoming a highly valued fishery in the U.S., but in Canada, there's a $50 million fishery off the southeast coast of Halifax, Nova Scotia, and off the Grand Banks, south of Newfoundland.

The other species, blue mussels, aren't new to Maine. They've been a part of the seafood industry here for years. Beal would like to expand the market for blue mussels by making cultivation more of a turnkey operation by providing mussel growers with a choice between collecting wild seed (that depends each year on the vagaries of nature) and a more consistent hatchery-reared seedling.

This is a Partnerships for Innovation: Building Innovation Capacity (PFI: BIC) project, which is focused on examining opportunities to create new marine aquaculture jobs in coastal Maine through shellfish research. The broader impacts of this research are related to increasing U.S. competitiveness in the seafood industry.

The mortality of larval Pacific oysters in Northwest hatcheries has been linked to ocean acidification. Yet, the rate of increase in carbon dioxide (CO_2) in the atmosphere and the decrease of pH (acidity) in near-shore waters have been questioned as being severe enough to cause the die-offs. A December 2014 study of Pacific oyster and Mediterranean mussel larvae found that the earliest larval stages are sensitive to saturation state, rather than CO_2 or pH per se. Increasing CO_2 lowers saturation state, the researchers say, and saturation state is very sensitive to CO_2. The scientists used unique chemical manipulations of seawater to identify the sensitivity of saturation state for larval bivalves such as mussels and oysters. The findings help explain commercial hatchery failures, and why improving water chemistry in those hatcheries has been successful. Shellfish hatcheries are now altering water chemistry to create more favorable saturation state conditions for young bivalves. "Bivalves have been around for a long time and have survived different geologic periods of high carbon dioxide levels in marine environments," says George Waldbusser, an Oregon State University (OSU) marine ecologist and biogeochemist. Larval oysters and mussels are so sensitive to the saturation state (which is lowered by increasing CO_2) that the threshold for danger will be crossed "decades to centuries," says Waldbusser, ahead of when CO_2 increases (and pH decreases) alone would pose a threat to bivalve larvae. Find out more in this news release. Credit: Wikimedia Commons

"This NSF PFI project embodies a quintessential combination of science, engineering, technology, education, outreach and the pursuit of innovation," says Sara Nerlove, program director for the PFI: BIC program. "And because Brian Beal was born and raised in the area, we have a special research situation, one in which he's been able to capitalize on his thorough knowledge of the people and the local economy."

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