Lobster growth rates to decline under increasing ocean acidification conditions

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Lobsters in URI graduate student Erin McLean's study of acidification show significant differences in growth as ocean acidity increases. Credit: Erin McLean

The growth and molting rates of juvenile lobsters are likely to decrease significantly as the oceans become increasingly acidic from climate change, making the animals more vulnerable to predation and leading to fewer adult lobsters being available for harvest.

Those are the results of a four-month laboratory study conducted by University of Rhode Island doctoral student Erin McLean. "I'm not sure yet what the mechanism is that is affecting their growth," she said, "but it takes energy for them to regulate the increased acidity, which is energy they cannot then put toward growth."

She presented her research findings last week at the annual meeting of the National Shellfisheries Association in Monterey, Calif.

Much of the carbon dioxide emitted into the atmosphere, which has led to the changing climate, is absorbed into the oceans, where it dissolves and forms carbonic acid. That acid reduces the pH of the ocean and reduces the available quantity of carbonate that shellfish and crustaceans like lobsters need to build their shells.

McLean, a native of Danvers, Mass. who is studying under URI Associate Professor Brad Seibel, placed 24 juvenile lobsters – each about one-inch long – into one of three tanks with dissolved carbon dioxide concentrations equivalent to present-day levels (400 parts per million), levels expected in 2100 (1,000 ppm), and levels predicted to occur by 2200 (2,000 ppm). She weighed and measured each lobster every day for four months and noted the number of molts each experienced.

Those under present-day conditions grew at expected rates – a 23 percent increase in length and 86 percent increase in weight between each monthly molt. Those in the treatment conditions, however, grew less and less as carbon dioxide concentrations increased, and most only completed three molts. The lobsters in the tank simulating carbon dioxide concentrations in 2100 grew 19 percent in length and 71 percent in weight between molts, while those in the tank simulating 2200 concentrations grew at just 17 percent and 54 percent in length and weight, respectively.

According to McLean, if lobsters take longer to mature, they will remain vulnerable to being eaten by a wide variety of fish and other marine predators for an increased period of time. And as more juvenile lobsters are consumed by predators, fewer will survive to reproductive size and be available for commercial harvest.

While her study focused on juvenile lobsters, she predicts that adult lobsters will also experience slower growth as the ocean continues to acidify, and the period between their annual molt will likely grow longer.

McLean will replicate her study in the coming year to verify her results. She also plans to study the rate of regeneration of lobster claws under ocean acidification conditions, because she observed that an unusually high number of the lobsters in her study lost claws during the molting process.

"It's not a big deal that juveniles lost claws, since they do regenerate, but once they get to adulthood, the lost claws become more of a problem because lobsters without claws are not as valuable to the fishery," she said.

Provided by University of Rhode Island