Effects of climate change on growth and calcification of the green sea urchin, Strongylocentrotus droebachiensis
J. Roger Brothers, 2011

Increased CO₂ causes the world’s water temperatures to rise and the ocean’s pH to decrease, a phenomenon termed ocean acidification. Both of these changes will have impacts on the growth and calcification of the green sea urchin. S. droebachiensis is a marine calcifier. This means the urchin absorbs calcium carbonate (CaCO₃) from the water and uses it to form its skeletal structure.

It has already been shown that higher temperatures cause an increase in urchin food intake and growth for urchins smaller than one cm. Conversely, it has been shown that high CO₂ conditions induce a decrease in urchin food intake. This decrease, coupled with the chemical dissociation of CaCO₃ (the chemical urchins use to form their skeleton) that accompanies increased CO₂ should lower growth and calcification in the green sea urchin.

While both of these factors have been studied individually, they have not been observed in tandem. Therefore, we decided to rear urchins under simulated ocean acidification conditions. To do this we will raise water temperatures and infuse the water with CO₂ to lower the pH. The temperatures and pH values were selected using International Panel on Climate Change (IPCC) predictions for moderate and extreme warming scenarios for 2100 along with contemporary ocean temperature and pH as a control.

This experiment is on going. Growth and calcification data will be taken every two weeks while water quality and characteristics will be measured weekly. To measure growth we will weigh urchins and measure their diameter. Calcification will be measured by ashed skeletal weight the ratio of ashed skeletal weight to wet skeletal weight, skeletal density, calcium content, and skeletal thickness.

These data will be compared to data on corals and mussels, collected by Laura Newcomb. This will provide greater insight into and a bank of knowledge for how ocean acidification and increasing global temperatures will impact marine calcifiers on the Maine coast.

Faculty Mentors: Amy Johnson and Dan Thornhill
Funded by the Howard Hughes Medical Institute Summer Fellowship