Effect of Temperature on Muscle Mechanics and Metabolism in Fish Species of Narragansett Bay

Anabela Maia, Amina Chamanlal, Megan Hatcher & Nicholas Saygeh

Biology, Rhode Island College, Providence, RI

The effects of climate change are particularly strong in estuarine habitats where animals are already exposed to a variety of stressors, including other anthropogenic pressures and changes in salinity.

Summer temperatures in Narragansett Bay have seen a steady increase in the last decades, with even more pronounced temperature increases over winter months. Most fish are not able to regulate their body temperature, and their metabolism is likely to be strongly affected by temperature fluctuations. In general, higher temperatures accelerate biological processes and can lead to faster growth, however they can also induce stress and leave less energy available for maintenance, immune response and reproduction. Temperature optima vary widely between different species and increases in temperature are likely to change the fish composition of Narragansett Bay. We are already seeing changes in population dynamics of black sea bass and scup, which have been increasing in abundance. Species like summer flounder and little skate have been identified as more likely to be negatively impacted, while the effects of warming temperatures in spiny and smooth dogfish populations are complex.

We aim to understand how the metabolic demands of these six species change under different temperatures by measuring basal and standard metabolic rates, that is the oxygen consumed during both rest and normal swimming activity. Swimming for fish is a costly activity and is powered by body undulations and fin musculature. We will also look at muscle contraction through electromyography to determine changes in muscle recruitment that are likely affecting overall metabolism. Preliminary muscle physiology data from summer flounder and spiny dogfish show shifts in muscle properties with increased temperatures.

The next step would be to look at the remainder of the species and to determine oxygen demands of swimming for the six species under different temperatures.