Saving Space: Latitude's not Enough

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According to a recent study in *Ecological Monographs*, predicting the impact of climate change on organisms is much more complicated than simply looking at species northern and southern range limits.

Studying the ecologically important California Sea Mussel (Mytilus californianus), Brian Helmuth (University of South Carolina) and colleagues from the University of California - Santa Barbara, the University of British Columbia – Vancouver, and Oregon State University measured body temperatures of this mussel along most of its range, from Washington to Southern California. "Mosaic patterns of thermal stress in the rocky intertidal zone: Implications for climate change," suggests that conserving areas based on a few similarities including location, may not be enough, as variations in temperature and other variables can turn what would seem like an ideal and "typical" environment into one that's decidedly different from nearby sites.

As global climate changes occur, "the role of organism temperature in driving species distribution patterns has assumed a further sense of urgency," say the authors.

Like terrestrial ectotherms (organisms that can not regulate their body temperature only through outside sources such as the sun), the body temperatures of intertidal invertebrates are driven by multiple factors in their environment. Solar radiation, wind speed, humidity, air and ground temperatures, along with the organisms' own shape, color and mass affect its body temperature.

“In many cases, science has a poor understanding of how physiologically relevant environmental factors vary in space and time. We know little of how ‘climate’ is translated into patterns of body temperature, especially at scales important to organisms,” says Helmuth.

Mussel distribution and physiology is known to be negatively affected by high-temperature stress.

“The thermal environment must be considered from the perspective of the organism’s interaction with the physical environment, as well as the physiological response of that organism to the environment,” according to the study.

Spanning five years and almost 1000 miles (2000 km) the scientists explored how body temperatures change across latitudes, and the role of splashing waves on the mussels. Using sensors placed in several mussel-strong regions throughout the organisms’ territory, the scientists were able to study the temperature changes the mussels experienced on a day to day basis, as well as on a yearly basis. They found that tides as well as wave action impact the temperature ranges the species experience, with varying tolerances depending on where the mussels live.

Helumth and his colleagues found several “hot spots,” - areas warmer than expected - and “cold spots” - sites where daily minimal temperatures ran lower than other sites around the same latitude, creating a picture of complex thermal mosaics rather than simple latitudinal gradients.

Importantly, they found that animal temperatures were as hot at sites well within the species range as they were at sites far to the south, suggesting climate change may cause damage not just at range edges, where scientists usually look for such effects, but also at other “hot spots” well within species ranges.

“Our results stress the importance of examining patterns of environmental variables at levels relevant to the organisms, and in forecasting the impacts of climate changes across the species’ range,” state the researchers.

Source: Ecological Society of America