When you live in the intertidal, even small changes in climate may be shocking!

By Dr. Brian Helmuth

Imagine yourself for a moment, sitting on a beach on a warm summer's day. You sit back, relax, and close your eyes, and begin to drift off to the sound of the lapping waves. Suddenly, and without warning, you are plunged into freezing cold water, where you are bashed repeatedly by forces equivalent to those of a category 5 hurricane. Here you will remain for the next 6 to 8 hours, until you are again exposed to air. This time, however, you are exposed to searing heat, which causes your temperature to rise by more than 20° in a matter of hours. Later that day, you are again immersed in the frigid water, and the cycle repeats itself. This scenario may sound extreme, but is not unlike that experienced by intertidal invertebrates and algae on a daily basis. Intertidal organisms, those creatures that live between the high and low tide lines of the world's coastlines, are marine in origin but must regularly contend with the rigors of terrestrial existence. One of the most dramatic effects of the alternating existence between air and water is the effect on an organism's body temperature.

Unlike humans, marine invertebrates and algae (organisms such as oysters, mussels, anemones, sea stars, and seaweeds) are ectotherms, and have virtually no internal sources of heat. Instead, their temperatures are driven by the characteristics of their ambient environment. While underwater at high tide, the temperature of an intertidal ectotherm closely approximates that of the surrounding water (10-20°C on most temperate coastlines). As the tide recedes and the organism is aerially exposed, its temperature is driven by the interaction of environmental factors such as solar radiation, wind speed, and air and ground temperatures, and is very seldom equivalent to the temperature of the surrounding air. During a sunny summer day body temperatures can easily exceed 35°C, or can fall to below freezing during exposure on clear, cold nights. As a result, body temperatures can fluctuate by 30° or more over a single tidal cycle.

Literally decades of research have demonstrated very strong effects of body temperature on the survival, growth, and reproductive output of intertidal plants and animals. These "abiotic factors" have long been thought to control the vertical zonation...