Climate Change Effects on Intertidal Populations

Issue:

Species living in the intertidal zone, between the high and low tide marks on the shores of the worlds' oceans, can be especially sensitive to climate variability. Animals and plants that live in this habitat are covered with seawater at high tide, and exposed to the air at low tide. As a result, their body temperatures fluctuate greatly over the course of a single day. Understanding the influence of long-term temperature changes on these species will allow us to predict changes in their distributions, and provide information for the management of coastal environments.

This project uses models and observations of air and ocean temperatures to forecast the body temperatures of intertidal species at low tide, when they are most vulnerable. These projected body temperatures are compared to experimentally-derived tolerances of the species, and geographic "hot spots" are identified where climate change could have important effects on intertidal ecosystems.



How susceptible are intertidal ecosystems to temperature changes?

- Are changes in species distributions or mass die-offs part of natural cycles, or are they caused by climate change, pollution or other stressors?
- Are preserves and management areas located in areas vulnerable to increased temperatures, or could they be resistant to such changes?

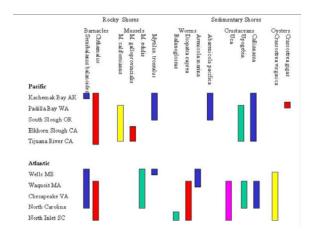
Approach:

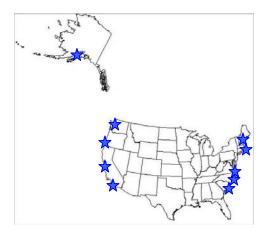
A team of researchers at the University of South Carolina is developing mechanistic links between climate, geography, and population biology of the dominant intertidal species. The target organisms are considered ecosystem "foundation species", meaning that they have large physical impacts on their surrounding ecosystems. For sedimentary shores, the target organisms are animals that can either disrupt sediments (e.g., shrimp and worms) or build tubes and reefs (e.g., worms, oysters). For rocky shores, the targeted organisms are those that occupy and create hard surfaces, such as barnacles and mussels.

The geographic range of the project is from Alaska to Mexico on the Pacific Coast and Maine to South Carolina on the Atlantic Coast, spanning the geographic limits of these ecosystem foundation species. This project has benefited from synergy with a companion proposal funded through the NASA Ecological Forecasting program, which allowed the investigators to add international coasts to the suite of predictions.

Management/Policy Issues:

This project is making important contributions to coastal resource management by developing forecasting tools for coastal managers and planners. National Estuarine Research Reserves (NERRs) on each coast are included as sample sites and represent different biogeographic provinces. On the West Coast, sites include Kachemak Bay AK, Padilla Bay WA, South Slough OR, Elkhorn Slough CA, and Tijuana River CA. On the East Coast, Wells Bay ME, Waquoit Bay MA, Chesapeake Bay VA, North Carolina Bays, and North Inlet SC are included. Foundation species from each of these regions were identified, and comparisons among species can be made across NERRS sites. The project will also provide training for NERRs directors and coastal resource managers in the use of the coastal forecasting tools developed.





Accomplishments:

- The project <u>website</u> now displays daily 7-day forecasts for intertidal temperatures in 7 US and international coastal areas.
- In New Zealand, the product was used to explain mass die-offs of sea urchins, which occurred during a period of anomalously high temperature.
- The project leaders addressed the national NERRS research managers meeting in October 2007, to present the initial results of their work and receive feedback on their model products.
- A new "vegetation type" has been developed for National Weather Service (NWS) models. Currently, NWS uses vegetation types such as grasslands, forests, etc. in calculating surface temperature predictions. This project has included mussel beds as a new "vegetation type" in NWS models.

To learn more about this program and its accomplishments, go to http://www.cop.noaa.gov

http://tbone.geol.sc.edu/forecasting

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