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California coast ecological forecasting: Modeling a harmful algal bloom on the central California coast using GIS and remote sensing

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In recent years, harmful algal blooms (HABs) have been linked to human illness, massive die-offs of fish and shellfish populations, economic losses from decreased ocean-fishing, and ecological damage related to eutrophication and persistent disease of fish species. The most recent HAB event (August-September 2011) off the California coast caused severe economic and ecological impacts to local fisheries and ecosystems, but the exact special extent of the bloom is still unclear. This project focused on the August/September 2011 HAB event using multiple NASA Earth observing resources in an effort to understand the magnitude and scope of this particular bloom. The knowledge gained from this study enables affected state agencies to accurately assess their impacts and predict future HAB events. Remotely-sensed MODIS images were used to measure ocean chlorophyll-α content and map the coverage and path of the HAB. Data from AVHRR and Jason-2 satellites allowed examination of the roles of salinity and sea surface height in HAB formation, and the Regional Ocean Modeling System (ROMS) modeled atmospheric and oceanic factors which could affect bloom movement. A Generalized Additive Model (GAM) later identified the environmental variables most statistically influential in HAB growth. The results from this study will assist the California Department of Public Health and Department of Fish and Game in mitigating and managing the impact of harmful algal blooms.

Biography

Maanya Condamoor is a 4th year at the University of California, Los Angeles, majoring in Environmental Science with minors in Environmental Engineering and Conservation Biology. In the summer of 2012, she participated in the DEVELOP Program at NASA Ames Research Center in Moffett Field, California, and worked on the California Coast Ecological Forecasting project, which used remote sensing and GIS to study red tides off the coast of central California. At UCLA, Maanya is involved in a variety of student organizations, including the Environmental Science Student Network, Engineers Without Borders, and the Education for Sustainable Living Program.

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Does susceptibility for infectious diseases increase in marine invertebrates under the pressure of climate change?

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Rising atmospheric carbon dioxide concentration is causing global warming, which affects oceans by elevating water temperature and reducing pH. A serious consequence of ocean acidification is the reduction of saturated calcium carbonate ($CaCO_3$). So far, effects of climate change on invertebrates have mostly been focused on growth and calcification with a large variety of results. However, adverse physiological effects have been greatly neglected. Recently we have investigated immune and stress responses on the echinoderm Asterias rubens, the crustacean Nephrops norvegicus and the mollusk Mytilus edulis when exposing them to seawater conditions mimicking ocean acidification (OA) at a level predicted to occur at the end of this century. The key players of invertebrate immune defense are the circulating hemocytes/coelomocytes which through phagocytosis or release of antimicrobial compounds are able to kill invading pathogens. In A. rubens and N. norvegicus both the number of hemocytes/coelomocytes and their activation were significantly reduced when the animals were exposed to OA conditions. In M. edulis the major effect of OA was shown as an inhibition of antimicrobial peptide activity and impairment of shell growth. Furthermore, mussels exposed to OA were less efficient in clearing pathogens of the genus Vibrio. Both growth and virulence of these bacteria were shown favored by prolonged periods of elevated temperature. All together our results indicate that climate change as a driving force for infections of marine invertebrates may have serious effects on benthic biota and through our consumption of shellfish, also increase the risk of transmission of pathogens to humans.

Biography

Bodil Hernroth completed her M.D. (PhD) in 2002 at the Medical Faculty of Gothenburg University (GU), Sweden. In 2006 she became Associate Professor at the Inst. of Biology and Environmental Science, GU. She is employed by The Royal Swedish Academy of Sciences as a Senior Researcher and at Kristianstad University, Sweden as Lecturer. Her main research interests are effects of environmental perturbations on host-parasite interactions and she has published more than 30 papers in reputed journals.

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