Biology Department Seminar

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Space-Time Dynamics of Nearshore Upwelling Ecosystems

In coastal ecosystems, nearshore physical processes such as upwelling, circulation, sediment transport, and wave propagation interact with topographic and bathymetric features of the coast at a range of spatial and temporal scales. These processes, in turn, exert a strong influence on the structure of nearshore biological communities. A predictive approach to large-scale coastal ecology requires quantitative description of biophysical coupling over a continuous range of scales from meters to thousands of kilometers and days to decades.

I discuss a variety of approaches to describe, measure, model, and test the strength and scale of biophysical coupling in coastal upwelling systems, focusing on consequences for spatial and temporal variability in the nearshore benthos. New statistical and analytical techniques are developed to describe the multi-scale interaction of coastlines with biological and physical processes, and used to build predictive models of important drivers of ecological dynamics. Common mechanisms of biophysical coupling are found to operate across systems and can be traced to distinct spatial and temporal scales. Ecological patterns are most closely associated to coastline structure where length-scales of coastal features match characteristic scales of important physical processes, imposing structure on turbulent coastal flows. Characteristic patterns can be altered or disrupted by remote forcings transmitted through the atmosphere and ocean. This interplay of coastal geomorphology, large-scale ocean-atmosphere dynamics, and physical forcing has important implications for predictability of upwelling ecosystems in time and space.

I conclude by discussing how similar approaches, coupled with demographic, trophic, genetic, and socioeconomic models, could improve our ability to forecast ecological changes relevant to management and conservation of coastal ecosystems.