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Phytoplankton in a Changing World

Phytoplankton play key roles as the base of the marine food web and as a crucial component in the earth's carbon cycle. These organisms live in the sunlit layers of the surface ocean and are extremely diverse, covering several orders of magnitude in size and a wide variety of biogeochemical functionality. The biogeography of different combinations of species that co-exist ("communities") is set by the light, chemical, thermal, and physical environment. These differences in communities effects both food webs and carbon export. In this talk I will use observations of our oceans, along with a complex physical-biogeochemical-ecosystem computer model to examine the possible changes to phytoplankton productivity and community structure in a changing climate. Warming of surface temperatures will push habitats poleward by many 100's of km. Physical changes such as increased stratification and alterations to the currents will impact the supply of crucial nutrients to the sunlit layers, impacting not only productivity but also favouring smaller phytoplankton are better adapted to low nutrient environments. As the surface waters absorb more CO₂ they will become more acidic. This "ocean acidification" appears to harm some species of phytoplankton, but not others. This alteration in relative fitness will lead to potential large restructuring of plankton communities with ramifications for the rest of the marine food web. We will also use our model to explore our ability to detect these changes over the course of the 21 st century from observations taken in the ocean and from those provided by satellites.