Microbial responses to ocean deoxygenation: New insight from the Saanich Inlet time series experiment

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The oceans are losing oxygen as the combined result of warming climate and increasing nutrient fluxes from land to the sea. Direct impacts of deoxygenation will be felt most acutely by marine organisms that will face challenges related to diminished respiration, habitat compression and loss, immune suppression, impaired reproduction, increased disease and mortality, and reduced growth. Indirect effects extend to life on land and include climate feedbacks and altered biogeochemical cycles. For humans, direct affects come from the vulnerability of the world's fisheries to deoxygenation, which thus poses serious risks to global food security. The specific impacts of ocean deoxygenation, however, will be strongly influenced by marine microorganisms and their responses to declining oxygen. These responses are highly uncertain, and thus so too is our ability to forecast and manage the impacts of ocean deoxygenation. A time series experiment has been running for more than a decade in Saanich Inlet- a persistently stratified fjord on the west coast of Canada – and is providing new insight into microbial metabolism and biogeochemical cycling under low and dynamic oxygen concentrations. Microbiological and geochemical information from the time series experiment has been used to construct reaction-transport-ecology models that quantitatively link rates of biogeochemical reactions to growth of underlying microbial community members. This presentation will focus on new process rate and coupled meta'omic data that inform on dynamics in microbial nitrogen cycling that accompany deep-water renewal events and oxygenation-deoxygenation cycles. Collectively these data reveal complexity in the nitrogen cycle and imply that multiple competing pathways need to be considered in prediction of nitrogen cycle responses to ocean deoxygenation in the ocean more generally.