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2010 Ocean Sciences Meeting

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Spatial and temporal distribution of chytrid fungus infections of diatoms in the Columbia River and estuary

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The chytrid fungal parasite has become well known in the past decade for the worldwide mass decline of amphibian populations. Traditionally, fungi are not included in aquatic food-web models due to their low biomass. However, little is known what effect mass epidemics of chytrid fungus have on nutrient cycling and their impact could be substantial. Here we discuss observations of related species from the phylum Chytridiomycota present as epibiotic parasites on diatom cells in the lower Columbia River, estuary, and plume. Epidemics of chytrid fungi in lake ecosystems have resulted in mass reductions of algal biomass and altered nutrient cycles and food web dynamics. Little is known about the effects of chytrid epidemics on biogeochemical cycles and food webs in river and marine ecosystems. A river to ocean gradient sampling plan was initiated upon observation of chytrid sporangia attached to the diatom Asterionella formosa in early April 2009. From April to September 2009, water samples were collected monthly from the lower Columbia River at Beaver Army Terminal (BAT) and Columbia River Estuary, and plume samples were collected on cruises in May and September of 2009. Samples were fixed in 0.5% glutaraldehyde and stained with chitin-binding CalcoFluor White to confirm the presence of chytrid fungi. The prevalence of infection was quantified in settled samples illuminated by light microscopy. In 2009, the total abundance of diatoms decreased 1000-fold (44,000 to 44 cells/ml) between May and September at BAT. The dominant species in the spring (April-May) was A. formosa consisting of 90% of the diatom population. Aulocoseira spp. were dominant from June-August making up as high as 96% of the population, followed by Fragilaria crotonensis dominance in September (63%). Infection of A. formosa by chytrid fungi was prevalent throughout the spring and summer, with infection rates as high as 50% in July and a maximum mean intensity of infection (parasites per host cell) of 2.0. A succession of diatom species susceptible to infection was observed in late summer. The A. formosa population decreased to less than 2.5% of the total population in July and stayed low throughout the rest of the summer. This corresponded to increased infection rates of Aulocoseira spp. and F. crotonensis in August and September. Chlorophyll was extremely low in early September of 2009 (~1.0 µg/L), confirming the large decrease in phytoplankton cells. However, nitrate levels were high (~18 µM), illustrating a system not limited in nutrients. Using our time series of microscopic observations, we will assess the impact of chytrid infections on diatom population dynamics in the river and estuary, placing our data into biogeochemical context through the use of in situ nutrient and chlorophyll fluorescence sensors. The observations will be used to determine whether transfer of chytrid fungi from the river to ocean ecosystem occurs. Staining, culturing, and molecular techniques will help in the elucidation of the role chytrid fungi have in the Columbia River, estuary and plume.

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