Estuaries as bioreactors: transdisciplinary research on the Columbia River estuary

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Estuaries act as coastal filters for fluvial materials in which microbial, biogeochemical, and ecological processes combine to transform riverborne organic matter prior to export to the coastal ocean. This critical function of estuarine 'bioreactors' is linked to material residence times and is based on heterotrophic activity of estuarine microbial communities. Many river dominated estuaries, like the Columbia River estuary in North America, support highly active estuarine microbial communities on suspended particles that are retained in estuarine turbidity maxima (ETM). ETM particle trapping in this rapidly flushed estuary extends particle residence time from 1-2 days (the average water residence time) to several weeks, which facilitates organic matter transformations by microbes, and permits establishment of discrete and metabolically dominant particle-associated microbial communities. However, we know little about the diversity of this estuarine microbial community, the genomic capabilities that allow them to thrive under estuarine environmental conditions, or the degree to which they respire riverine organic matter. This talk will summarize research on the Columbia River ETM conducted by the Center for Coastal Margin Observation and Prediction (CMOP) which brings together physical models of water and particle transport with predictive models of microbial productivity and detailed studies of microbial metagenomics to describe the ecology of ETM microbial communities and to evaluate the contribution of ETM particle trapping to the estuarine bioreactor.