Nutrient Fluxes from San Francisco Bay Delta Sediments

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Abstract: Rates of N and P fluxes from the sediment were determined in September 2011, along a transect of 12 sites, from the flooded islands in the Bay Delta to Suisun Bay. Comparisons of NH_4^+ fluxes in the light and dark showed that fluxes were generally lower in the light than in the dark, reflecting the uptake of N via photosynthesis, with N derived either from interception of DIN effluxes driven by pore water gradients, or by net uptake from the water column. At Sherman Island, there was a net flux of NO3+NO2 out of the sediment in the light; this suggests enhanced nitrification under illumination. With the exception of Mildred Island, all sites exhibited a net flux of N2 out of the sediment in the dark, indicating denitrification. At Mildred, net fluxes were directed into the sediment in the dark, indicating N2 fixation. In relation to the inorganic N flux rates for these sites, approximately 30% of the N was denitrified. Flux rates of SRP were highly variable from site to site. Flux rates in the dark at the two Honker Bay sites, as well as at Franks Tract, Big Break and Sherman Island were negative, likely reflecting adsorption of water column SRP to iron oxides. Fluxes of SRP were higher under illumination than in the dark. It is suggested that high rates of sediment biological activity may have resulted in localized pH changes which resulted in SRP efflux in excess of biological demand. When SRP fluxes were compared to total DIN fluxes for all sites, most of the data approximated Redfield proportions. However, three Bay sites had significant P retention relative to DIN, while all the Delta sites from the light experiments had excess P release relative to N.

Statement of Relevance: Years of nutrient loading may result in large sediment reservoirs of nutrients, particularly phosphorus, for a considerable time after the rate of loading is reduced. Altered sediment biogeochemical pathways serve to provide a mechanism whereby nutrient dynamics supporting trophodynamics are changed.