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The freshwater tidal wetland Liberty Island, CA was both a source and sink of inorganic and organic material to the San Francisco Estuary

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Abstract It is hypothesized that perennial freshwater tidal wetland habitat exports inorganic and organic material needed to support the estuarine food web and to create favorable habitat for aquatic organisms in San Francisco Estuary. It is also hypothesized that most of the material flux in this river-dominated region is controlled by river flow. The production and export of material by Liberty Island were measured and compared using discrete monthly and continuous (15 min) measurements of a suite of inorganic and organic materials and flow between 2004 and 2005. Seasonal material flux was estimated from monthly discrete data for inorganic nutrients, suspended solids and salts, organic carbon and nitrogen and phytoplankton and zooplankton group carbon and chlorophyll *a* and pheophytin pigment. Estimates of material flux from monthly values were compared with measured daily material flux values for chlorophyll *a* concentration, salt and suspended solids obtained from continuous measurements (15 min) using YSI water quality sondes. Phytoplankton carbon produced within the wetland was estimated by in situ primary productivity. Most inorganic and organic materials were exported from the wetland on an annual basis, but the magnitude and direction varied seasonally. Dissolved inorganic nutrients such as nitrate, soluble phosphorus, total phosphorus and silica as well as total suspended solids were exported in the summer while total and dissolved organic carbon were exported in the winter. Salts like chloride and bromide were exported in the fall. Chlorophyll *a* and pheophytin were exported in the fall and associated with diatom and cyanobacteria carbon. Mesozooplankton carbon was dominated by calanoid copepods and exported most of the year except summer. Continuous sampling revealed high hourly and daily variation in chlorophyll *a*, salt and total suspended solids flux due to high frequency changes in concentration and tidal flow. In fact, tidal flow rather than river discharge was responsible for 90% or more of the material flux of the wetland. These studies indicate that freshwater tidal wetlands can be a source of inorganic and organic material but the export of material is highly variable spatially and temporally, varies most closely with tidal flow and requires high frequency measurements of both tidal flow and material concentration for accurate estimates.

Keywords Freshwater tidal wetland · Material flux · Phytoplankton · Zooplankton · Tide · Estuary

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