THE RELATIVE IMPORTANCE OF PROCESSES CONTROLLING THE DISTRIBUTION OF METHANE IN TOMALES BAY, CALIFORNIA

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ABSTRACT

Annual variability of water column methane concentrations, fluxes across the sediment-water interface, river methane concentrations, and aerobic methane oxidation rates were measured in Tomales Bay, a temperate estuary in northern California. Water column methane concentrations showed spatial and temporal variability (8-100 nM). Benthic fluxes were determined by two methods: direct measurement using benthic chambers and estimates from sediment-core concentration gradients. Chamber fluxes varied from -0.14 to 16 μmol m^{-2} d^{-1}, and were elevated 56-100% over one-dimensional diffusive fluxes calculated from sediment porewater profiles, primarily as the result of macrofaunal activities and the presence of anoxic microenvironments. Net aerobic methane oxidation rates were determined by *in situ* experiments and ranged from -0.95 to 3.38 nM d^{-1}. Methane concentrations in Lagunitas and Walker Creeks varied annually (144-953 nM), and were a significant methane source to the bay during winter. A methane budget indicates export to coastal waters and benthic production dominated during summer, while freshwater input, benthic production, and atmospheric evasion dominated during winter.