

The response of microalgal biomass and community composition to environmental factors in the Sundays Estuary

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Abstract

The Sundays Estuary is permanently open to the sea and experiences regular freshwater inflow in the form of agricultural return flows with large supplies of nutrients. The objectives of this study were to measure microalgal biomass and community composition and relate these to freshwater inflow, water quality and other environmental variables. These data can then be used in setting the ecological water requirements of the estuary. Surveys in August 2006, March 2007, February, June and August 2008 showed that salinity less than 10, expressed in practical salinity units, mostly occurred from 12.5 km from the mouth in the middle reaches of the estuary, which was also where the highest water column chlorophyll *a* ($>20 \mu\text{g}\cdot\text{L}^{-1}$) was found. The study showed that different groups of microalgae formed phytoplankton blooms during individual sampling sessions. These included blooms of green algae (August 2006), flagellates (March 2007), dinoflagellates (June 2008) and diatom species (February and August 2008). The estuary was then sampled over 5 consecutive weeks from March to April 2009 to identify environmental factors that support different microalgal bloom species. Phytoplankton blooms were found during Weeks 1, 4 and 5 from the middle to the upper reaches of the estuary. It was shown that diatoms occurred in blooms during warm, calm conditions whereas wind-mixing and reduced temperature, as a result of a cold front during 17 to 19 March 2009, promoted the dominance of flagellates throughout the estuary although they were present at all times. Dominant diatom species (*Cylindrotheca closterium*, *Cyclotella atomus* and *Cyclostephanus dubius*) indicated brackish, nutrient-rich water. Nanoplankton (2.7 - 20 μm) was dominant during each week sampled and contributed 55 - 79% to the phytoplankton biomass. Maximum benthic chlorophyll *a* was found 12.5 km from the mouth. This study is the first to show successive chlorophyll *a* blooms consisting of different phytoplankton groups in an estuary, an indication of the eutrophic state of the system.

Keywords: Sundays Estuary, phytoplankton, microphytobenthos, chlorophyll *a*, environmental factors