Abstract

Water circulation, water column nutrients and plankton productivity were studied in a tropical bay with high rates of water exchange (60% to 90% per tide) and short residence times (3 to 4 h). The water circulation is predominantly affected by the semi-diurnal tides, which cause strong and reversing currents in the mangrove creeks (0.60 $m \cdot s^{-1}$) and currents of low magnitude in the neighbouring seagrass and coral reef zones (< 0.30 $m \cdot s^{-1}$). Tidal asymmetry, with relatively stronger ebb than flood flows in the mangrove creeks, promotes the net export of nutrients from the river mouth and of organic matter from the mangroves to the seagrass beds. The main sources of the dissolved inorganic nutrients are two rivers (the Kidogoweni and Mkurumuji) which discharge (up to 17.0 $m^3 \cdot s^{-1}$) in the upper and lower regions of the bay. The increased input of nutrients did not cause eutrophic conditions since nutrients were rapidly flushed out of the bay. The mangrove biotope generated small amounts of dissolved nutrients which are likely to be used for primary production within the mangrove zone. The production of nutrients in the mangrove zone was masked by high rates of flushing, such that no appreciable nutrient signal was detected in the dry season when the influence of the rivers diminished. The rates of primary production were low in the mangrove, seagrass, and coral reef biotopes in the dry season. Primary production increased slightly during the rainy season. The level of chlorophyll *a* in the mangrove biotope increased during ebb tides and decreased during flood tides. The highest zooplankton densities, which could not be related directly to primary production in the water-column, occurred at the seagrass station during the wet season.