Terrigenous Nutrient and Organic Matter in a Subtropical River Estuary, Okinawa, Japan: Origin, Distribution and Pattern across the Estuarine Salinity Gradient

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Abstract
Estuaries and their associated rivers are organically rich sites that play an important role in the removal and transformation of organic matter and nutrients derived from terrigenous and anthropogenic sources. This study conducted comprehensive field surveys from March 2010 to January 2011 to study the downstream pattern and distribution of nutrients (NO_2^-, NO_3^-, NH_4^+ and PO_4^{3-}) and dissolved organic carbon (DOC) and particulate organic carbon (POC) and nitrogen (PN) in the surface waters of the Manko estuary, a subtropical estuary in Okinawa, Japan. Fatty acid (FA) analysis and POC–C/N ratios were used to further identify variations in the sources of particulate organic matter along the estuary during summer (July) and winter (January). The results suggest that the estuary contains high concentrations of dissolved inorganic (N and P) and organic (DOC) nutrients, which are largely influenced by terrestrial sources from the Kokuba and Noha rivers, and moderate levels of particulate nitrogen and carbon. In general, suspended particles and dissolved nutrients followed sedimentation and biotic uptake patterns common in other subtropical estuaries. Thus, an important fraction of terrestrial materials was rapidly sinking along the estuary and was replaced with estuarine and marine-derived materials at mid- to high-salinity along the estuary. The FA signatures suggested that bacteria, domestic and agricultural waste-derived organic matter were the dominant sources of suspended organic matter in the Manko estuary. Overall, despite the relatively high terrestrial and anthropogenic influences in the Manko estuary, effective processing of different sources and forms of terrigenous organic matter in the estuarine salinity gradient significantly reduces their signatures prior to export to the coastal ocean.

Keywords
Terrigenous,
Nutrients,
Organic matter,
River–estuary,
Salinity gradient