

Carbon, nitrogen and phosphorus fluxes in four sub-tropical estuaries of northern KwaZulu-Natal: Case studies in the application of a mass balance approach

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Abstract

There are currently no South African nutrient standards for estuarine waters since the concentration of nutrients in the water column will not necessarily be predictive of the response by aquatic biota. In this paper a more suitable approach to assessing nutrients in relation to ecosystem integrity is proposed through compiling a nutrient mass balance for an estuary, which can identify major sources and sinks of nutrients. Recently there has been a move to develop budgets that link several variables using known stoichiometric relationships using limited data availability to infer underlying fluxes. The LOICZ biogeochemical budgeting protocol was applied to data from the Mhlathuze, Mvoti, Nhlabane and Thukela Estuaries in KwaZulu-Natal. Results indicated that these estuaries are all net sources of dissolved inorganic nitrogen and phosphates. The application of the flux-derived parameters used in the LOICZ modelling approach was used to demonstrate how nutrient assessment categories can be assigned to estuaries. As the LOICZ-derived fluxes represent steady-state conditions these were regarded as the reference/benchmark or present ecological state conditions. Alterations in the nutrient assessment category are demonstrated using hypothetical conditions in the Mhlathuze Estuary.

Keywords: KwaZulu-Natal estuaries, LOICZ biogeochemical model, nutrient fluxes, water quality category