

A screening model for assessing water quality in small, dynamic estuaries

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ABSTRACT:

Despite mounting evidence of the harm associated with excessive nutrient loading to estuaries, tools to translate this body of knowledge into sound environmental management and planning practices in data-poor environments are lacking. In this paper, a design science approach is adopted to develop a screening (box) model for the water quality assessment of South African estuaries. The key design principles are first distilled from literature on the nutrient dynamics and hydro-morphological functioning of small, dynamic, bar-blocked estuaries. The proportional volume contribution of land-based flows (river inflows, diffuse inflows from the peri-catchment, point source discharges) is determined, a water quality class is allocated to each of the inflows, and the overall water quality class for the land-based inflows to an estuary is determined. Taking the percentage mouth closure and the perched nature of the estuaries into account, a WQ Similarity rating is allocated. This similarity rating reflects the degree of similarity of the water quality in the estuary to the reference (natural) water quality. The entire water quality assessment uses readily available information such as land-cover data, legal limits for disposal and water quality monitoring data where they exist, making it suitable for a data-poor environment. The screening model is calibrated and validated on a selection of South African estuaries for which official health condition assessments exist. Results are promising, and the screening model is deemed appropriate for assessing the water quality of individual estuaries and for comparing the sensitivity of multiple estuaries to changes in the volume and nutrient loading of land-based inflows. As such, the screening model can be employed at a regional or national scale for strategic assessments of water quality in small, dynamic estuaries.