

# The filtering capacity of selected Eastern Cape estuaries, South Africa

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## Abstract

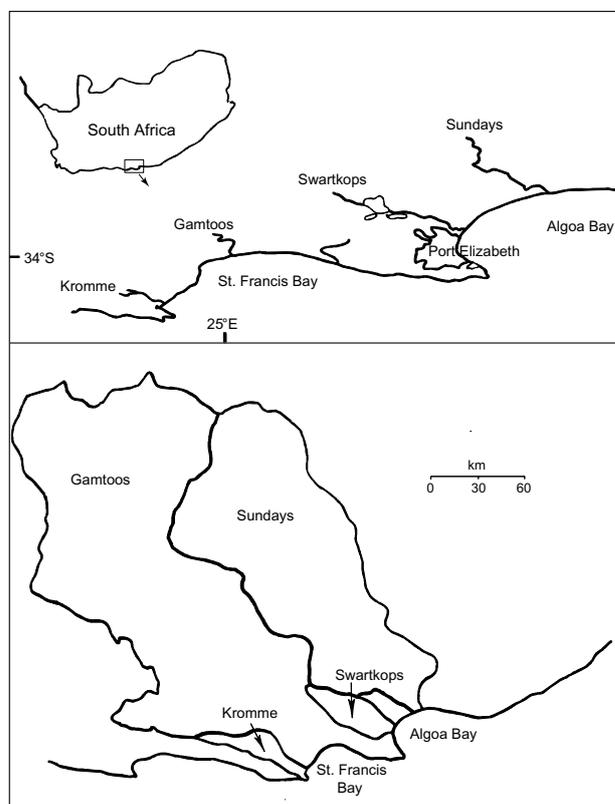
Four Eastern Cape estuaries, the Kromme, Gamtoos, Swartkops and Sundays Estuaries have a permanent connection to the adjacent ocean, but differ in the amount of freshwater inflows as well as in the land-use patterns in their respective catchment areas. The nutrient loading to the four estuaries in terms of phosphate, nitrate, nitrite and ammonia therefore varies. The aim of the study was to show how the nutrient loads received by the estuaries differ, and how they act as filters for nutrients. Discriminant analysis revealed such contrasts: The lower reaches of the four estuaries are similar in their inorganic nutrient concentrations, but concentrations diverge in their upper reaches and in the inflowing river water.

**Keywords:** filtering capacity of estuaries, nutrient loading, phosphate, nitrate, nitrite, ammonia, South Africa

## Introduction

Estuaries are recognised as productive ecosystems, which are of economic, recreational and aesthetic value. Increasingly, the estuarine ecosystem is threatened through anthropogenic influences such as pollution, excessive freshwater abstraction in the catchment and over-fertilisation from nutrients in agricultural and urban runoff. Estuaries, as the end-users of water of the entire catchment, reflect the land-use of the catchment and are important areas to trap nutrients and other chemical compounds before discharge occurs into the adjacent coastal ocean. As popular areas for settlements and recreation, estuaries have been impacted around the world. In South Africa several cities, agriculture, tourism, residential developments, and recreational activities are concentrated along the coast (Morant and Quinn, 1999), but largely focus around or adjacent to estuaries. These impact estuaries in the way of nutrient over-enrichment, siltation, and reduced freshwater inflow due to freshwater abstraction. In this study we investigated the differences between four Eastern Cape estuaries (Kromme, Gamtoos, Swartkops, Sundays) in terms of their inorganic dissolved nutrient status and how well the estuaries act as filters as transition zones between the river and the sea. The hypotheses tested in this study highlight that all four estuaries differ in terms of their inorganic dissolved nutrient status in the riverine reaches just above the tidal head, but that concentrations in their lower reaches are very similar. In this case, the estuaries would act as important filters for nutrients derived from their catchment areas.

The four Eastern Cape estuaries under investigation are situated along the south coast of South Africa (Fig. 1) and belong to the 23% of South African estuaries that have a permanent connection to the sea (Whitfield, 2000). The four estuaries differ in the amount of inorganic dissolved nutrients (phosphate, nitrate, nitrite, ammonia) they receive from runoff, due to different land uses in their catchment areas. The Kromme Estuary (34°08'S,



**Figure 1**

The location of the Kromme, Gamtoos, Swartkops and Sundays Estuaries along the South African coast, including an indication of their catchment size.

24°51'E) is subject to major freshwater abstraction for greater than 20 years by two dams that have a storage capacity of ca. 133% of the mean annual runoff (MAR) of about  $105.5 \times 10^6 \text{ m}^3$  (Reddering and Esterhuysen, 1983). The Mpopu Dam, completed in 1982, is only 4 km from the tidal head of the Kromme Estuary which only receives freshwater after rains when overtopping of both dams occurs. Nutrient additions to the estuary occur when

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