

The hydrodynamics of the Bot River Estuary revisited

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Abstract

For the past 20 years management of the Bot/Kleinmond estuarine system in the south-western Cape has been based on the premise that, barring intervention, the estuary was naturally evolving into a freshwater coastal lake. This paper presents evidence, based on a 20-year series of water-level data, updated runoff estimates from the catchment and dimensional data, that, in the absence of anthropogenic influences, the system is not progressing naturally, but artificially, towards becoming a freshwater system. It is concluded that the increasingly closed state of the Bot Estuary in recent years is most likely due to reduction in runoff from its tributaries and premature artificial breaching of the Kleinmond arm of the system. These findings, coupled with the high conservation importance of the Bot River Estuary, suggest that the current management plan needs urgent reevaluation and that the two estuaries cannot be managed separately.

Keywords: Bot River Estuary, estuary management, estuary breaching policy, closed estuary, estuarine dimensions, estuarine water levels, estuarine habitat

Introduction

Estuarine management is a complex task because it deals with the use and care of the interface between land, river and sea where a combination of terrestrial, freshwater and coastal management is essential. For example, estuaries are at the receiving end of a number of bad catchment practices, such as pollution, erosion, excessive water abstraction and impoundment. Because South Africa's rugged coastline has few sheltered embayments, estuaries have become the focus of coastal development (Morant and Quinn, 1999). Poorly regulated activities have destroyed many estuarine habitats by structural development such as mouth stabilisation, low-lying developments, canalisation, land reclamation, pollution and dredging (Boyd et al., 2000; Morant and Quinn, 1999).

Estuaries suffer the unique problem of a boundary location between the jurisdictions of management authorities, are often regarded as neither land nor sea and are consequently excluded from both river and coastal management (Attwood et al., 1997). In order to be effective, estuarine management should aim for best practices, which should be based on a sound understanding of estuarine functioning and guided by decision-making protocols on the use and care of estuaries (Boyd et al., 2000; Van Niekerk and Taljaard, 2003).

In the late 1970s there was considerable debate about whether or not the Bot River Estuary (also known as the Botvlei) was naturally turning into a freshwater coastal lake and whether or not the mouth should be artificially opened (Bally and Branch, 1986; Bally, 1987). An intensive six-year research programme followed, that mustered input from a range of disciplines and culminated in a symposium held in Cape Town during November 1983 where what in essence became the current management plan was drafted (Sloan et al., 1985). The estuary has since become recognised as a vital contributor in the minimum set of estuaries identified for the

preservation of estuarine biodiversity in South Africa (Turpie et al., 2002; Maree et al., 2003), bringing some new urgency to the need for a sound management plan.

This paper reviews past management practices and the data on which they were based. The paper also proposes future management options in the light of new findings.

Study area and methods

South Africa has 250 functional estuaries classified into five types: Estuarine bay, permanently open, river mouth, estuarine lake and temporarily open/closed (Whitfield, 1992; 1998). Permanently open systems constitute 19%, while estuarine bays, estuarine lakes and river mouths constitute 1%, 3% and 5% of South African estuarine systems respectively (Maree et al., 2003). The majority (72%) of South African estuaries are temporarily open/closed systems, which means that they are isolated from the sea by the formation of a sand berm across the mouth during periods of low or no river inflow (Maree et al., 2003). Such estuaries stay closed until their basins fill up and their berms are breached by increased river flow.

The Bot River Estuary is a relatively shallow (-1.5 m MSL) triangular temporarily open/closed estuarine lake, roughly 7 km long and about 2 km at its widest (Fig. 1) (Willis, 1985; Koop, 1982). It is located between 34°18'30" to 34°22'30"S and 19°04' to 19°09'E on the south-western coast of South Africa some 110 km south-east of Cape Town (Koop, 1982; Rogers, 1985).

The Bot Estuary mouth has in recent years been mostly closed (or "blind"), since it is cut off from the sea by a berm and an adjacent belt of coastal dunes. The valleys between the dunes are sufficiently low in some places to permit occasional wave overtopping from the sea during exceptionally high tides. The coastal dune belt is shifting landward due to the deliberate stabilisation projects through the introduction of mainly *Acacia cyclops* since the 1940s (Bally, 1985). The Bot and Kleinmond Estuaries are connected via a natural overflow channel at a water level of approximately 1.7 m MSL through the Lamloch swamps and in the dune slacks (Branch et al.,

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