Salt-water intrusion from the Mzingazi River and its effects on adjacent swamp forest at Richards Bay, Zululand, South Africa

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Abstract

Drought conditions in the Richards Bay area coupled with abstraction for domestic and industrial use caused freshwater outflow from Lake Mzingazi to cease in February 1992. This led to the tidal intrusion of saline water from Richards Bay into the Mzingazi River. The extent of the intrusion up the river and into the groundwater was determined and the impact on the adjacent flora recorded. Results showed that saline water penetrated the groundwater for up to 20 m from the river bank and that this had caused the death of a number of swamp forest trees as well as the defoliation of others. Spring tides and particularly a very high equinox tide had further aggravated the situation causing damage to, and the death of, numerous plants in herbaceous swamp areas.

Introduction

Prolonged drought conditions during 1990 and 1991 coupled with daily abstraction of water by the Borough of Richards Bay for domestic and industrial use resulted in a decrease in the level of Lake Mzingazi at Richards Bay (28°49'S, 32°05'E) and a consequent cessation of freshwater outflow over the weir into the Mzingazi River on 02/02/92. Overflow from the weir to the sea is via the Mzingazi River (Fig. 1), then a dredged section of the river known as the Mzingazi Canal and the harbour section of Richards Bay. As a result of the lack of freshwater, the Mzingazi River attained salinities close to that of sea water. Only a small freshwater input occurred, due to seepage from Lake Mzingazi in the vicinity of the weir (Fig. 1). The latter was built some time during 1942/43, raised by 1.75 m in 1945 with subsequent modifications in the 1980s to make more water available for abstraction for domestic and industrial use. At the beginning of 1992 officials of the Borough of Richards Bay noted that portions of the swamp forest and herbaceous marsh in the low-lying land adjacent to the river were showing signs of severe degradation with some trees having died and many others having become defoliated.

The destruction of plant communities as a result of increased water salinities in the Richards Bay area during 1975 to 1977 has previously been reported on by Weisser and Ward (1982). In this case the increase in salinity killed the *Phoenix reclinata/Hibiscus tiliaceus* and *Barringtonia racemosa* communities. This was brought about by the opening of the "new mouth" in the "sanctuary" area of Richards Bay during harbour development, and the associated increases in tidal range and water salinities. Other water-associated tree mortalities along the Zululand coast have been reported by Breen and Hill (1969) and Bruton and Appleton (1975, in Begg 1978). However, both described the death of mangroves as being due to a reduction in the tidal exchange of saltwater into the swamps, the former at the Kosi Estuary and the latter at Lake Mgoboseleni near Sodwana Bay.

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Aims

At the request of the Borough of Richards Bay the Coastal Research Unit of Zululand (CRUZ) conducted an investigation during April and May 1992. This looked at the effects of level changes in the groundwater, salt-water intrusion from the Mzingazi River into the adjacent swamp forest and herbaceous swamp, and the impact of these factors on the environment. This paper is based on results presented in the unpublished report by Cyrus and Martin (1992). The specific objectives of the study were to:

(i) Measure salinity, pH and level of the water table in the study area under varying tidal conditions.
(ii) Determine fluctuations in salinity levels, current velocity, water levels and residence time of salt water over neap and spring tides in the study area.
(iii) Record the plant communities and their dominant species in the study area adjacent to the river, assess the degree of salt-water intrusion into the soil and its effect on the plant life,
(vi) Report on the status of salt-water intrusion in the study area and provide management recommendations for the area related to findings from objectives (i), (ii) and (iii) above.

Study site

The study site lay north of the Richards Bay Harbour and extended from the point where the Mzingazi River is crossed by the Empangeni/Richards Bay road near Meerensee, to the outlet weir on Lake Mzingazi (Fig. 1). A 12-h sampling station was established 950 m downstream from the outflow point. Other sampling points (1 to 8) and the position and number of auger boreholes (A to E) are also shown on Fig. 1.

Methods and materials

Several methods were employed in order to achieve the objectives of the study. These were as follows:

- Surface and bottom salinity, oxygen and temperature, water depth and mid-water current velocity and turbidity were recorded in the study area at regular intervals over a 12-h period during a neap tide on 10/04/92 and a spring tide on 04/05/92.