

# Management of a shallow estuarine lake for recreation and as a fish nursery: Zandvlei, Cape Town, South Africa

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## Abstract

The estuarine Zandvlei lake is an important regional recreation resource in the SW Cape, South Africa. It is also an important nursery for migrant juvenile marine fish species in the False Bay area. Extensive urbanisation in the catchment, and the regulation of lake water levels, have brought about changes to the water chemistry, hydrology and biota of the system. These perturbations have compromised the fish-nursery role of the estuary and pose water quality-related health and aesthetic threats to the sustained recreational use of the lake system. Optimisation of the existing management practices should be directed towards enhancing water quality and the user-orientated roles of the lake. These include:

- effective stormwater and river management in the catchment to reduce bacteriological and nutrient loading;
- containing peak runoff flows;
- manipulation of the outlet channel to maximise seawater intrusion and allow access for migratory marine fish in early summer;
- control of the macrophyte standing stock to ensure that its vital role is unimpaired; and
- improved education of both users and managers.

## Introduction

Zandvlei, an estuarine lake which is the focus of an intensively utilised regional recreation area (Cape Town City Council, 1988; Thornton et al, 1989), is situated on the northwest shore of False Bay, Cape Town. The lake is 2.6 km long, 0.5 km at its widest point and has a maximum depth of approximately 2 m (Harding, 1994). The 93 km<sup>2</sup> catchment, which is under the jurisdiction of 3 authorities, consists mainly of residential development, but also has areas of viticulture, agriculture, forestry and undeveloped land (Fig. 1). The lake level is artificially maintained with a weir, and the mouth remains closed in summer through the natural formation of a beach sandbar.

During the last 60 years, major man-made changes have occurred in and around the Zandvlei estuary. Modifications to the estuary include a promenade and road bridge which were built over the mouth, and a rubble weir near the mouth which was constructed to control water levels. In 1948, 1950 and during the early 1960s the lake was dredged, and during the mid 1970s the Marina da Gama housing scheme was constructed on the eastern shore (Begg, 1975).

Extensive urbanisation, with a concomitant increase in impervious surface area, has occurred in the Zandvlei catchment. This has resulted in increased runoff and nutrient loading via the influent rivers (Harding, 1994). Together with the raising of the lake's water level, which has reduced the degree of sea water intrusion during late winter and early summer, these urban impacts have caused changes in the water quality (Harding, 1993; 1994), ecological functioning (Stewart and Davies, 1986; Davies et al, 1989; Quick and Bennett, 1989; Dick, 1992; Harding, 1994) and recreational use (Thornton et al, 1989; Harding, 1993) of the lake.

The aims of this paper are to describe the key aspects pertaining to the hydraulic, water quality and biotic characteristics of the lake and its influent rivers, as they affect the recreational use of the lake

and its role as a fish nursery for False Bay. This knowledge will be directed towards the optimal management of the lake and its catchment.

## Description of the Zandvlei system

### Hydrology

Zandvlei's water level is artificially controlled by means of a rubble weir (crest height 0.8 m above mean sea level) situated in the outlet channel. Typical mean annual lake water levels are 0.83 m above mean sea level (AMSL) in winter and 0.92 m AMSL in summer. The bed of the main water body is 0.48 m below MSL (BMSL), the marina canal base is 0.92 m BMSL, and the outlet channel is 0.06 m AMSL.

The mouth of the outlet channel is open to the sea during the winter months, and closes naturally with the formation of a sandbar towards the end of the winter rainfall season. The closure coincides with a seasonal change in the region's prevailing winds from northwesterly to southerly. Mechanical opening of the mouth is occasionally required to allow egress of stormwater and prevent flooding of residential properties in the marina.

Mean annual freshwater inflow to Zandvlei during 1983 to 1987 was estimated using continuous lake level records and data from a calibrated weir in the Sand River subcatchment to be 10<sup>9</sup> m<sup>3</sup>-a-1 (unpublished information, Scientific Services Branch, Cape Town City Council). The relative contributions of the individual rivers to the total flow were: Keyzers River 45%, Sand River 43% and the Westlake River 12% (Harding, 1994). The total volume of Zandvlei (including the Marina and the outlet channel) has been estimated to be 1.33 x 10<sup>6</sup> m<sup>3</sup> (Harding, 1994).

An extensive system of floodwater detention ponds has been constructed upstream of the lake to reduce the risk of flooding in the lower reaches of the system. In addition, upgrading of the Zandvlei mouth to facilitate more rapid outflow of water has been proposed by the Cape Town City Council as the final part of this flood control programme.

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