

# Flood-associated mass mortality of fishes in the Sundays Estuary

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## Abstract

Mass mortalities of fishes in South African estuaries have been linked to changes in salinity, temperature and dissolved oxygen concentrations. This short communication documents two fish kills which were associated with high suspended levels during flash floods in January 1995. A total of 16 fish species, belonging to freshwater, estuarine and marine taxa, were recorded dying in the Sundays Estuary. Both juvenile and adult fish appeared to be affected by the high levels of silt and clay carried by the flood waters. Although the available evidence suggests that clogging of the fish gill filaments by suspended sediments was primarily responsible for the mass mortalities on 16 January 1995, osmoregulatory and other stress factors (e.g. reduced dissolved oxygen levels associated with the flood waters) may also have contributed to the fish kills.

## Introduction

Heavy rains over the Eastern Cape on 14 January caused the Sundays and other rivers to come down in flood on 15 and 16 January 1995. The water level at Addo Bridge (Department of Water Affairs and Forestry Recorder N4H003), less than 20 km from the head of the Sundays Estuary (33°43'S; 25°51'E), increased by 3.4 m (i.e. from 0.6 m to 4.0 m) between 08:30 and 10:30 on 15 January, with the initial 2.4 m rise occurring in less than 20 min. The water level then continued to rise at a slower rate, reaching a gauge plate peak reading of 4.98 m at 08:00 on 16 January. The initial flood waters carried large amounts of silt into the Sundays Estuary, creating an environment which resembled "liquid chocolate" according to one observer. Reports of dying fishes, their gills clogged with silt, were first received on Monday 16 January. Fishes were observed gulping air at the surface and attempting to leave the water along the supratidal estuary margins. By the end of the day thousands of dead fishes of all sizes were left stranded as the flood waters receded.

On Tuesday 17 January no further mortalities were observed, but thousands of dead fishes floated down the estuary towards the sea. Hundreds of kelp gulls (*Lams dominicanus*) descended on the estuary to feed on the decomposing fish. Most of the fishes which died were concentrated in the lower reaches of the estuary, with decreasing numbers in the middle reaches and none recorded in the upper reaches. Fishes which may have died in the channel-like upper reaches would have been transported into the middle and lower reaches by the flood waters. Those fishes which survived the flood appeared to have remained in the estuary because fish activity was observed in the lower reaches of the system on 8 January.

Great Fish River discharge at Outspan (Department of Water Affairs and Forestry Recorder Q9H018), less than 30 km from the head of the estuary, increased from 23 m<sup>3</sup>-s<sup>-1</sup> at 11:00 on 15 January 1995 to 270 m<sup>3</sup>-s<sup>-1</sup> an hour later. At the peak of the flood on 16 January 1995, 1 190 m<sup>3</sup>-s<sup>-1</sup> flowed down the system and a radio report indicated that weir sluices on the Great Fish River were being opened because of the excessively high sediment loads being

carried by the flood waters (Cowley, pers. comm.). In the estuary, spotted grunter (*Pomadasys commersonnii*), kob (*Argyrosomus holotepidotus*), mullet (Mugilidae), carp (*Cyprinus carpio*) and Mozambique tilapia (*Oreochromis mossambicus*) exhibited the same stress symptoms (gulping air at the water surface) observed in the Sundays Estuary. Large numbers of the above taxa were collected by hand in the mouth region of the Great Fish Estuary (33°30'S; 27°08'E) on 16 January 1995 (Cowley, pers. comm.). All the above species, including the marine taxa, are regularly recorded in freshwater areas immediately above the estuary (Ter Morshuizen, 1994) and are therefore acclimatised to riverine conditions.

The aim of this paper is to document the findings of the Estuarine Research Group at the JLB Smith Institute of Ichthyology, based on a field visit to the Sundays Estuary on 18 January 1995 and interviews with eyewitnesses to the flood event and subsequent fish kill.

## Materials and methods

Samples of fishes were examined in the lower reaches (4 sites) and middle reaches (3 sites) of the Sundays Estuary (Fig. 1) on 18 January 1995. No dead fishes were observed in the upper reaches during a boat survey of the area. Each specimen was identified and measured to the nearest 5 mm total length (TL).

Selected physico-chemical measurements were conducted at 10 channel stations (Whitfield, 1994) between the head (Station 1) and mouth (Station 10) of the estuary on 18 January 1995. Water temperatures 30 cm below the surface were determined *in situ*, with salinity and turbidity samples collected in glass containers for subsequent laboratory analysis. Salinity was measured using a temperature compensated optical salinometer and turbidities (nephelometric turbidity units) with a calibrated turbidimeter.

## Results and discussion

A total of 16 fish species, belonging to freshwater, estuarine and marine groups (Table 1), were recorded dying in the Sundays Estuary (Fig. 2). Most of the taxa which were adversely affected by the flood event are demersal species which feed on benthic organisms or detritus. However, some pelagic species such as *Monodactylus falciformis* also suffered extensive mortalities. Indications are that

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