

# The effect of dredging on light penetration in the Boro River, Okavango Delta, Botswana, from 1972 to 1975

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## Abstract

This paper presents data on the effects of dredging on light penetration along the lower 4.5 km of the Boro and Thamalakane Rivers, between 1972 and 1975. The short-term effects of dredging were a decrease in light penetration by 25 to 50% for a river distance of 12 km. This effect was evident up to 18 months after the dredging had ceased. This could be ascribed to wash-in of silt and clay colloids from unvegetated spoil heaps.

## Introduction

In 1971, the former De Beers Consolidated Mines Limited (now Debswana Diamond Company Limited) opened a diamond mine at Orapa in Botswana. In order to provide a regular supply of fresh-water to the mine, an attempt was made to canalise the Boro River, which is the main drainage channel of the Okavango Delta (Fig. 1), by deepening the channel bed to a depth of between 2 and 5 m, straightening river meanders, and preventing water loss to surrounding flood plains ("melapos") (Dye, 1975; Dye et al., 1976; Lubke et al., 1984).

A suction dredge and Poclair digger were installed at the junction of the Boro and Thamalakane Rivers in June 1971 (Lubke et al., 1984). In 1972 four bunds were constructed in order to confine the flow to the Boro channel (Fig. 2). This engineering operation was intended to supply  $45.5 \times 10^3 \text{ m}^3\text{yr}$  to Mopipi Reservoir at the Orapa Mine 193 km below the Boro River mouth (Dye et al., 1976; Lubke et al., 1981; Lubke et al., 1984). The dredge which had a capacity of  $\pm 40 \text{ m}^3\text{h}^{-1}$ , moved from the Boro River mouth to a point 4.5 km up-channel between January 1972 and January 1973, after which it was decommissioned (Dye et al., 1976), due to technical problems. The Poclair excavator cut a channel down the Boro River, then the channel was deepened from 4 to 5 m in April 1972 (Dye, 1975). The dredger dispersed large amounts of clay and silt into the water, due to a suction and dispersal system which homogenised the water, silt and clay (White et al., 1973a, Reavell et al., 1973). The major source of the silt and clay was the effluent from the sludge disposal system (White et al., 1973a), which was deposited in spoil heaps along the banks of the Boro River. These were levelled off by bulldozer in June 1972 (Raynham, 1979). The suspensoids were also released by the dredger from excavation of the channel sediments, as well as wash-in from spoil heaps of the floodplains. Between February 1972 and September 1975, water quality, sediment particle size and phytoplankton ecology were studied to assess the impact of dredging on the Boro River. The water quality and phytoplankton studies were presented in published (Reavell, 1978) and in unpublished form (Reavell et al., 1972; Reavell, 1973; Reavell, 1981 and Reavell et al., 1976). Much information on the effects of dredging on the submerged and floodplain

macrophytes is available in published form (Reavell, et al., 1973; Dye, 1975; Dye et al., 1976; Lubke et al., 1981; 1984; and Reavell, 1984).

There has been a recent recommendation for further dredging of the Boro River, which was not supported by the World Wildlife Fund (IUCN) (Williamson, 1994). However, it is expected that there may be future attempts to abstract the water resources from the Okavango Delta for development in this semi-arid country.

Although this study was done between March 1972 and August 1974, this paper presents data on the effect of dredging on water clarity, as few such studies have been documented for Southern Africa (Dallas and Day, 1993), and provides useful archival data.

## Study area

The Okavango Delta lies between  $18^{\circ}45'S$ ,  $22^{\circ}10'E$  and  $20^{\circ}15'S$ ,  $23^{\circ}40'E$  (Fig. 1). It is an alluvial fan which was instigated by tectonic activity about one million years ago and lies in a graben (McCarthy et al., 1988). The inflowing rivers, Cuito and Cubango, drain the Angolan highlands with the out-flowing Boro River carrying 45% of the total inflow. The Thamalakane fault impedes the flow of the Boro at the toe of the Delta. Downstream of the Boro junction the Thamalakane River bifurcates into the two rivers which end as endorheic outflows to Lake Ngami and the Makgadikgadi pans (Figs. 1 and 2).

The study area is situated in the seasonally inundated lower region of the Delta along the lower Boro and upper Thamalakane Rivers, between the Kunyere and Thamalakane fault lines (Fig. 2). The terrain between the floodplains represents ancient dunes which were active during periods of extreme aridity (Stanistreet and McCarthy, 1993).

Thirty-one sites were established to study the effect of dredging; fifteen above the dredge, one at the dredge and fifteen below the dredge, some of the sites chosen were from Thokatsebe village in the Xaraxlau flats 20 km down to the Boro mouth and the rest were located along the Thamalakane River down to its divergence (Fig. 2). The study period was from March 1972 until August 1974 and consisted of nine sampling periods; three in 1972, four in 1973 and two in 1974. During 1973, two sampling periods were omitted from this study as they fell during a severe drought when the channel water dried up into a series of residual channel bed pools.

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