Fish distribution in relation to turbidity gradients in a man-made lake, Sterkfontein Dam (South Africa)

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Abstract

The objective of the study was to investigate the distribution of fish in relation to turbidity in Sterkfontein Dam. *Oncorhynchus mykiss* was found mainly in the limnetic zone of the clear-water section of the reservoir (10 NTU in 80% of the surface area). *Barbus aeneus* and *Labeo capensis* were caught predominantly in the most turbid area (mean 28.32 NTU). *Labeo umbratus* and *Claims gariepinus* preferred a sheltered, well-vegetated bay in the clear-water area. Total catches indicated that the turbidity pattern found in the reservoir did not influence the distribution of indigenous fish species. Other factors such as availability of breeding and feeding habitats were probably more important.

Introduction

Sterkfontein Dam in the E. Free State can be considered a clear-water reservoir, with a mean turbidity of 10 nephelometric turbidity units (NTU) for about 80% of the surface area and a Secchi disc transparency of about 2 m (Dörgeloh et al., 1993). In contrast, most reservoirs in South Africa are turbid (Walmsley and Bruwer, 1980) with Secchi disc transparencies of about 1 m caused mainly by silty suspensoids (Allanson et al., 1990).

The low turbidity, relatively cold water temperatures, and well-oxygenated water made Sterkfontein Dam (Dörgeloh et al., 1993) a potential site for stocking the alien *Oncorhynchus mykiss* (rainbow trout). Juvenile *O. mykiss* (n = 36 000) were released near the dam wall during February 1984 by staff of the Directorate of Nature and Environmental Conservation of the Free State.

Some of the fish species occurring in Sterkfontein Dam, *Barbus aeneus* (smallmouth yellowfish), *Labeo capensis* (Orange River labeo), *Labeo umbratus* (moggel) and *Clarias gariepinus* (sharptooth catfish) (Dörgeloh, 1987), are indigenous to the Orange-Vaal River system and are also found in Le Roux Dam (Jackson et al., 1983), which is highly turbid (Walmsley and Bruwer, 1980).

High turbidities have a suppressing effect on primary production (Maitland, 1990) and zooplankton production (Walmsley and Bruwer, 1980), and subsequently reduce the food availability for fish (Newcombe and MacDonald, 1991). A lower food availability may in turn affect the distribution and habitat selection offish. Information on the effects of suspensoids on fish in lentic freshwater environments in the Southern African subregion is limited (Allanson et al., 1990) and in particular on fish distribution. Some work on the influence of turbidity on juvenile marine species present in estuaries has been done (Cyrus and Blaber, 1987).

This study formed part of a larger ecological study in Sterkfontein Dam. The variations in turbidity made this reservoir a suitable site to investigate the effect of turbidity on the distribution of fish for comparison with those fish in a turbid environment such as Le Roux Dam. The objective of this study was to investigate the initial dispersion and ultimate distribution of *O. mykiss*, and the distribution of indigenous fish species in relation to turbidity.

Study area

Sterkfontein Dam (28°23' - 28°35'S and 28°58' - 29°04'E) is situated in the E. Free State at an altitude of 1 620 m (Fig. 1). It forms part of the Tugela-Vaal Scheme. The main water supply of Sterkfontein Dam is pumped from the Tugela River (Natal) over the lower Drakensberg escarpment into the Driekloof Dam from where it flows over a spillway into Sterkfontein Dam (Dept. of Water Affairs, 1986). Siltation takes place in the Driekloof Dam and in the upper reaches of Sterkfontein Dam.

Methods

The study was conducted from March 1984 to February 1985 at Sites 1 to 4 (Fig. 1) in Sterkfontein Dam. Sites 1 and 2 were situated in the clear-water section (≤10 NTU), sampling the limnetic and littoral zones respectively. The limnetic and littoral zones in the turbid section of the reservoir (>10 NTU) were sampled at sampling Sites 3 and 4 respectively.

Fish were caught each month with multifilament gill nets (25 m x 2 m) with stretched mesh sizes of 35, 50, 65, 73, 85, 100, 120 and 150 mm. Gill nets were connected in series with spaces of 2 m between them. The gill nets were left in the surface water overnight for 16 h at each sampling site.

The site and mesh size where each fish was collected, were recorded. Each fish was analysed for species, fork length and mass, sex and gonadal stage. Stomach samples were collected of fish in each length class. Turbidity and water temperature were measured over a period of 30 months at each sampling site. Methods are described by Dörgeloh et al. (1993).

In the analysis, only total numbers of fish (both sexes of adult fish and all reproductive stages combined) were used. Differences in the relative distribution of fish, based on total catches, between sampling sites and seasons were analysed using the Chi-square test and Tukey's t-test ($p > 0.05$).

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