

# Food overlap between the alien *Oncorhynchus mykiss* and the indigenous fish species *Barbus aeneus* and *Clarias gariepinus* in a man-made lake, South Africa

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## Abstract

The introduction of *Oncorhynchus mykiss* into the Sterkfontein Dam necessitated an investigation of the food overlap between this fish species and the indigenous fish species. The Schoener index of similarity was used to determine possible food overlap between adult fish of three fish species in the Sterkfontein Dam, part of the Tugela-Vaal Water Transfer Scheme. Although the data are incomplete, indications are that the intra- and interspecific food overlap between adult fish of the fish species *Oncorhynchus mykiss*, *Barbus aeneus* and *Clarias gariepinus* was generally large.

## Introduction

Sterkfontein Dam serves as a storage reservoir for the Tugela-Vaal inter-catchment transfer scheme. About 36 000 (5.04 fish/ha) juvenile *Oncorhynchus mykiss* (rainbow trout) with a mean fork length of 18.3 cm (SD 2.25) and a mean mass of 78.5 g (SD 27.03) were released into the Sterkfontein Dam during February 1984 for fishing purposes (Dörgeloh, 1986).

The introduction of alien fish species often poses threats to native species and community stability in natural environments (Prout et al., 1990). The ecological relationship of a species with the aquatic community is partly influenced by its feeding pattern (Beauchamp, 1990). If a newly introduced fish species is a more efficient predator than the indigenous species, it may effect changes in the structure of the food resource (Lammens et al., 1985) and may competitively "exclude" these species from a common resource. Seasonal shifts in abundance, availability or vulnerability of prey species are often reflected in the diet of a predator (Beauchamp, 1990) and therefore affect the food overlap between species.

A literature review and a study of the feeding habits of three fish species (Dörgeloh, 1994), i.e. the alien *O. mykiss*, and the indigenous *Barbus aeneus* (smallmouth yellowfish) and *Clarias gariepinus* (sharp-toothed catfish), suggested a degree of overlap for food resources. *O. mykiss* has wide-ranging feeding habits extending from planktivory to piscivory (Beauchamp, 1990; Hubert et al., 1994; Swartzman and Beauchamp, 1990). Reservoir populations of *B. aeneus* may change from a primarily planktivorous to a herbivorous diet during their life-cycle (Eccles, 1983; Gaigher and Fourie, 1984), while *C. gariepinus* is euryphagous (Bruton, 1977).

Few studies on food overlap have been conducted in South Africa (e.g. Heeg and Kok, 1988). The objective of this study was to investigate the degree of food overlap between an introduced, alien fish species and two indigenous species in Sterkfontein Dam and to serve as baseline data for further, more in-depth feeding studies.

## Study area

Sterkfontein Dam (28°23'-28°35'S and 28°58'-29°04'E) is situated in the eastern part of the Free State province (South Africa), near the summit of the lower Drakensberg escarpment, at an altitude of 1 620 m (Fig. 1). It is located on the Nuwejaar Spruit, which is a tributary of the Vaal River system. This clear water reservoir (10 NTU for about 80% of the total surface area (Dörgeloh et al., 1993) has a capacity at full supply level of 2 656 x 10<sup>6</sup> m<sup>3</sup> a total surface area of 6 940 ha and a maximum depth of 82 m. Sterkfontein Dam forms part of the Tugela-Vaal Water Transfer Scheme (Dept. of Water Affairs, 1986) and serves as a storage reservoir for the Vaal Dam. Its entire water supply is pumped from the Tugela River.

## Materials and methods

Fish were collected monthly from March 1984 to March 1986 at four sites (Fig. 1) with gill nets of stretched mesh sizes 35, 50, 65, 73, 85, 100, 120 and 150 mm respectively. The contents of the oesophagi and stomachs of *O. mykiss* (n = 374) and *C. gariepinus* (n = 167), and the oesophagi and foreguts of *B. aeneus* (n = 286) were removed and analysed under a stereo microscope (Dörgeloh, 1994). The seasonal food overlap between species was determined of length groups with at least 20 fish per length group (Table 1) presented in Dörgeloh (1994).

It is recommended that at least 20 stomachs or foreguts of each group (e.g. length or sex) are examined to detect gross changes in overlap (Smith, 1985). This sample size was not achieved in all length groups and seasons, especially of fish <30 cm from indigenous species and <20 cm from *O. mykiss*. Less than 1% of all fish caught fell in these length groups. Therefore, the length intervals had to be enlarged to include 20 or more fish, or omitted from the calculations where less than 20 fish were sampled. However, it is recognised that variations in diet with size cannot be assessed accurately by combining length groups.

For the measure of food overlap among length groups of each fish species, the Schoener index of similarity (Colwell and Fuluyama, 1971; Sale, 1974; Schoener, 1968) based on percentage mass was used:

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