

Fish population assessment in a temperate Lowveld impoundment of the Transvaal, South Africa

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Abstract

As part of a wider fish ecological study of a temperate North-Eastern Transvaal impoundment, an assessment of the fish stock was made employing three methods of mark-recapture population estimation. During the experiment a total of 21 217 fish were captured, marked and released. Of these, 1 204 were recaptured. With the exception of three of the seven numerically important species studied, the recapture success was statistically sound, providing representative estimates of numbers and mass which can be expected to approximate those of the actual populations. Results showed *Oreochromis mossambicus* to be the dominant species in the impoundment.

Introduction

The construction of impoundments in the major river basins in Southern Africa was originally aimed at the storage of rain water for agricultural and domestic purposes. The development of fish populations in these impounded water bodies led to the intensification of recreational fishing (Cadieux, 1980; Koch and Schoonbee, 1980). To assess the possible impact of anglers on these fish populations, a number of studies were conducted using intensive mark-recapture surveys in selected natural and man-made lakes in Southern Africa (Goldner, 1967; Goldner et al., 1972; Batchelor, 1978; Koch and Schoonbee, 1980). Information obtained on the status of various fish stocks, emphasised the exploitation potential of some of these species on a sustainable yield basis, in particular in the rural areas where numerous impoundments exist and where there is a need for animal protein as food to combat some of the prevailing nutritional diseases (Steyn et al., 1992). The marketing of exploitable fish from such impoundments in the Northern Transvaal (Taylor and Van der Walt, 1985; Saayman et al., 1986) further emphasised the importance of this kind of investigation within the rural areas of the country.

The present study deals with an ecological survey of the Piet Gouws Dam in the Northern Transvaal with emphasis on intensive mark-recapture of the exploitable fish species. This impoundment is located in the Ngwaritsi River, a tributary of the Olifants River and has a catchment area of 650 km². When full, it covers a surface area of approximately 80 ha with a capacity of 7.361 x 10⁶ m³. It is situated between latitudes 24° and 25°S and longitudes 29° and 30°E (Fig. 1). Attention was also given to aspects of the water chemistry of this impoundment. Although this investigation was conducted from 1979 to 1980, the increasing importance of the utilisation of fish stocks for human consumption, from this and other water bodies, necessitated the publication of the present research findings.

Materials and methods

Selected physical and chemical conditions of the water were monitored at ten sampling stations (Fig.1). Analyses were done according to *Standard Methods* (1974).

For the population study itself, which took place over a period of 14 days in spring (17 September to 3 October 1979), a total of nine localities were selected in the littoral zone around Piet Gouws Dam (Fig. 1). Five fish samples were taken at each locality, using a beach seine net (122 m long with a net and bag mesh of 25 mm and 10 mm respectively) giving a total of 45 hauls.

This time of the year was specifically chosen to coincide with the onset of the breeding season of most of the fish species (Goldner et al., 1972; Koch and Schoonbee, 1980) in the dam. At this time the fish not only tend to migrate closer to the shallower littoral region of impoundments, from where they can then easily be sampled, but also most of the larvae and fry of this spawning season can still escape through the mesh of the seine nets used. It was, however, important that juveniles from spawns of the previous year should be caught in the nets, thus being included in the population census statistics.

Although there are several ways of marking fish, such as the use of tags (Ricker, 1968), antibiotics (Weber and Ridgeway, 1962), branding of fish with a heated wire (Gerking, 1963), injection of latex under the skin (Davis, 1955) or the use of dyes (Loeb, 1962), the fin clipping technique, whereby part of the anal, pectoral or tail fin of fish is removed (Ricker, 1968; Goldner et al., 1972; Koch and Schoonbee, 1980), was adopted. It is the least time-consuming way of marking fish and large numbers of fish can be handled in a short period of time, thereby reducing the mortality rate of fish caught. Marked fish can be recognised for a period of at least three months, allowing ample time for fish population size investigations to be carried out in a water mass such as the Piet Gouws Dam. The removal of part of the dorsal branch of the tail fin was considered to be the least harmful, as well as one of the quickest ways of marking the fish before returning it to the water.

Mark and recapture methods for the estimation of population size, originally developed from that of Petersen (1896), by Schnabel (1938) and Schumacher and Eschmeyer (1943) and described in detail by Ricker (1958; 1975) are used in the present study. Since the statistical approach of the latter two methods is somewhat different, the population estimates of all three methods obtained are

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