

Freshwater fishes of Bontebok National Park

I.A. RUSSELL

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Fish assemblages were sampled at six sites in the Breede River in the Bontebok National Park during 1999 and 2000. A total of 380 fish from 12 species was recorded. Indigenous fish collected included one freshwater species (*Barbus andrewi*), two catadromous species (*Anguilla mossambica*, *Myxus capensis*), and three estuarine species (*Gilchristella aestuaria*, *Monodactylus falciformis*, *Mugil cephalus*). Four of the species recorded were aliens (*Tinca tinca*, *Lepomis macrochirus*, *Micropterus salmoides*, *Micropterus dolomieu*) and two species translocated from other South African rivers (*Tilapia sparamanii*, *Clarias gariepinus*). A further two indigenous species (*Sandelia capensis*, *Pseudobarbus burchelli*) could potentially occur within the park, though the high abundance of alien predators means that there is little chance for recolonisation from tributaries higher in the Breede River system. There is little opportunity to meaningfully conserve most indigenous freshwater fish in Bontebok National Park.

Key words: freshwater fish, diversity, alien fishes, Bontebok National Park.

I.A. Russell, South African National Parks, P.O. Box 176, Sedgefield, 6573, Republic of South Africa.

Introduction

Guides to the freshwater fish of South Africa suggest that the Breede River, which flows through the Bontebok National Park (BNP), supports a diverse ichthyofauna (Jubb 1967; Bruton *et al.* 1982; Skelton 1993). There are, however, few published accounts of the distribution of fish within the Breede River or its tributaries, and none that describe the relative abundance of species within this system. Braack (1980) has described the occurrence of fish in the section of the Breede River in the BNP, and aspects of surveys undertaken by the Cape Department of Nature and Environmental Conservation between 1978 and 1983 have been used by Cambray & Stuart (1985) to describe the frequency of collection in the mainstream and 30 tributaries. These same records are used by Cambray & Stuart (1985) to provide a detailed description of the distribution of *Pseudobarbus burchelli* within the Breede River system. The distribution and abundance of most species, however, remains unrecorded in the open literature.

A long-term research program to assess the value of national parks in South Africa as refugia for freshwater fish has been described by Russell (1997, 1998/1999, 1999). This program entails assessment of fish species richness, distribution and abundance in portions of rivers flowing through national parks, and where historical data are available, assessment of long-term changes in ichthyofauna. The surveys described in this study form part of this program, the objective being to describe the distribution and abundance of freshwater fish in the BNP, and where possible, describe changes that have occurred in the diversity of the ichthyofauna.

Study Area

The Breede River has a catchment area of 15658 km², and with a MAP of 604 mm contributes 4.2 % of South Africa's total MAR (South African Department of Water Affairs 1986). Geological type is primarily Table Mountain sandstone, as well as Cape gran-

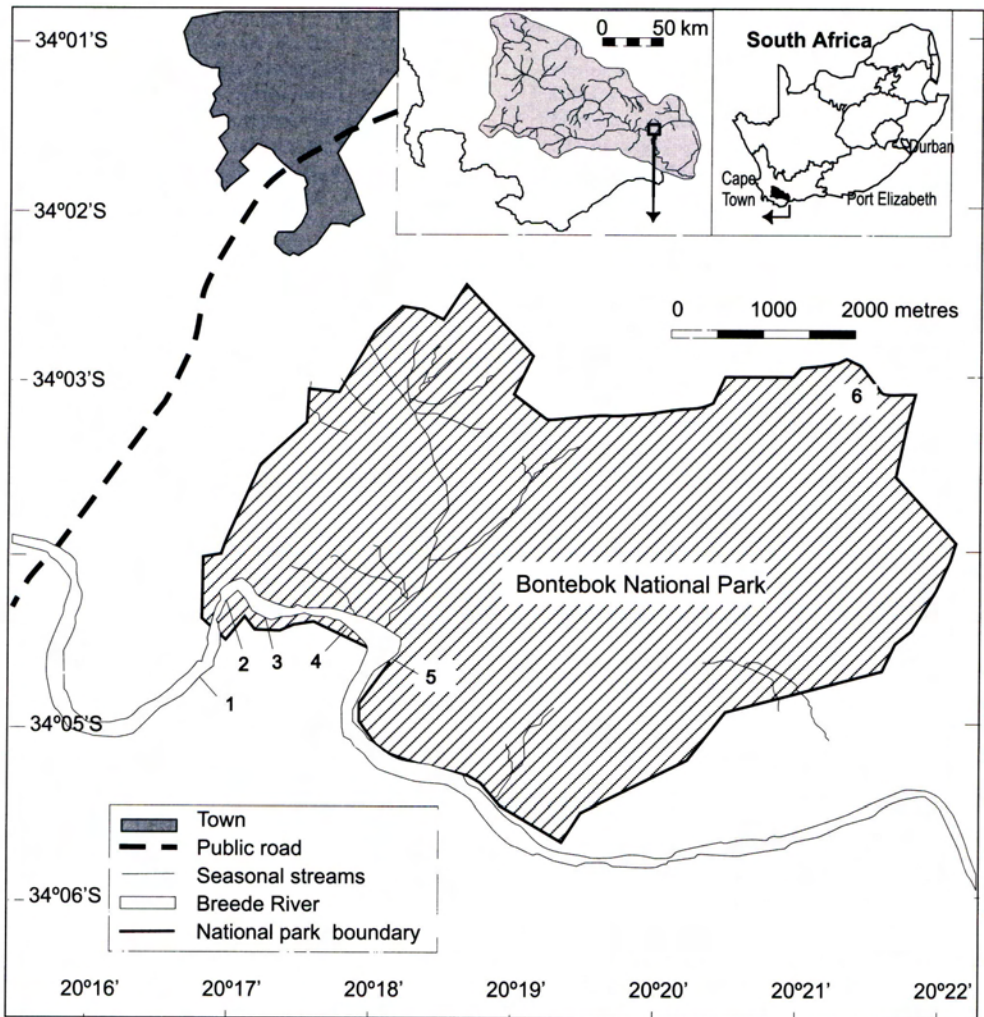


Fig. 1. Location of the Bontebok National Park relative to major centres and geographical features, and location of study sites in the Breeder River in the Bontebok National Park. The location of the Breede River catchment is shown in the insets.

ites, Bokkeveld and Witteberg shale (Carter 1983), with indigenous vegetation being predominantly Macchia (Fynbos) in the upper catchment, and Karroid Broken Veld and Coastal Renosterveld in the lower reaches (Dallas *et al.* 1998). Agricultural development in the lowland areas is extensive, consisting mainly of fruit orchards, vineyards and wheat fields (Carter 1983; South African

Department of Water Affairs 1986). Water quantity and quality, particularly in the lower reaches, is significantly modified by impoundment, abstraction, and runoff from agricultural lands (South African Department of Water Affairs 1986; Carter 1983) resulting in loss of natural habitat, biota and ecosystem functioning (Noble & Hemens 1978; Dallas *et al.* 1998).

The BNP (34°03'S, 20°30'E) is situated approximately 6 km from the town Swellendam in the lowland area of the Breede River catchment. Total land area is 2 786 ha, with approximately 6.5 km of the Breede River forming the south-western boundary (Fig. 1).

The Breede River in BNP runs in a series of long (>1 km), broad (50 m–150 m) channels with deep (>2 m) pools, separated by narrow rapids and stony runs. The south bank is bounded predominantly by scrub-covered hills with occasional rock outcrops. The north bank consists predominantly of gently sloping sandy soils, supporting mature woody vegetation in a well established riparian strip. Both banks are bounded by beds of *Phragmites australis* and *Typha capensis*, with limited growth of other aquatic species. The substratum in channels and pools consisted predominantly of sand and silt, with some small stony patches. In rapids and runs substratum consisted predominantly of cobble and sand, with the bedrock exposed in places.

Methods

The fish assemblages of the Breede River in and adjacent to BNP were sampled on two occasions, firstly from 28 June 1999 to 2 July 1999, and secondly from 28 February 2000 to 3 March 2000. Two sampling periods were used because high flow levels experienced during the 1999 sample period were thought to have reduced sampling efficiency, resulting in fewer species and individuals being collected. Thus a second sample was undertaken to increase representivity of catch returns. Six study sites were used (Fig. 1), the location of which was determined primarily by the availability of road access to portions of the Breede River where sampling apparatus could be operated effectively.

In deep pools and open channels, sampling was undertaken with a fleet of multifilament gillnets (30 m x 2 m x 55 mm—1999 survey only; 40 m x 2 m x 55 mm and 40 m x 2 m x 80 mm—2000 survey only) and a monofilament net (20 m x 2 m x 100 mm—both surveys), a purse seine net (40 m x 3 m x 3 mm) with 50 m warps, and baited longlines (two 20 m lines each with 20 hooks). Gillnets and longlines were set overnight from 17h00 to 08h00. In rapids, stony runs and along channel margins fish sampling was undertaken with a hand-held electro-

fishing apparatus, powered by a 220 V AC, 2 kva portable generator.

All fish collected were identified using identification keys in Skelton (1993), measured (fork length), and weighed to the nearest 0.01 g on a Metler electronic balance. Voucher specimens were preserved in 10 % formalin and housed at the South African National Parks' research laboratories at Rondevlei and J.L.B. Smith Institute of Ichthyology in Grahamstown (*Lepomis macrochirus* = RUSI 62000; *Tilapia sparrmanii* = RUSI 62001; *Monodactylus falciformis* = RUSI 62002; *Myxus capensis* = RUSI 62003; *Gilchristella aestuaria* = RUSI 62004; *Micropterus salmoides* = RUSI 62005; *Tinca tinca* = RUSI 62006; *Clarias gariepinus* = RUSI 62007).

Results

A total of 380 fish from 12 species was recorded during both sampling periods (Tables 1&2). Seven species (*Gilchristella aestuaria*, *Tinca tinca*, *Lepomis macrochirus*, *Micropterus salmoides*, *Tilapia sparrmanii*, *Myxus capensis*, *Monodactylus falciformis*) and 57 % of the total individuals were collected with seine nets, with the former two species collected only by this method. Gill netting collected six species and 13 % of the total individuals. Three species collected in gill nets (*Barbus andrewi*, *Micropterus dolomieu*, *Mugil cephalus*) were not collected by other fishing methods. Electro-fishing collected six species and 29 % of the total individuals, and long-lines one species and one percent of the total individuals. Only one new species, *Anguilla mossambica*, was collected by both electro-fishing and long-lines. Eighty-nine percent of the total catch was comprised of only three species (*L. macrochirus*, *M. capensis* and *T. sparrmanii*).

Fishing with a hand-line undertaken by South African National Parks personnel on 6 September 1999 at sample site 1 resulted in the capture of one specimen of *C. gariepinus*. Although not part of the formal ichthyological survey, this capture is recorded here to provide a more complete description of the ichthyofauna of the Breede River in Bontebok National Park.

Table 1
 Number of fish specimens per species collected per site in the
 Bontebok National Park from June to September 1999. Site numbers as per Fig. 1.
 Sample methods: EF = electro-fishing, GN = gill net, LL = long lines, HL = hand line.
 Sample effort = minutes electro-fishing, number of overnight settings for gill nets and long lines,
 and number of effective seine net pulls.

Site number	1	2	2	3	3	3	4	5	5	5	5	6	6	
Sampling Method	HL	GN	SN	EF	GN	LL	EF	EF	GN	LL	SN	EF	SN	Total
Sampling Effort	-	1	2	45	1	1	15	60	1	1	2	60	2	
<i>Anguilla mossambica</i>	-	-	-	-	-	-	-	2	-	1	-	-	-	3
<i>Gilchristella aestuaria</i>	-	-	2	-	-	-	-	-	-	-	-	-	-	2
<i>Clarias gariepinus</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	1
<i>Lepomis macrochirus</i>	-	-	-	-	-	-	-	2	-	-	-	63	139	204
<i>Micropterus salmoides</i>	-	-	1	-	-	-	-	-	-	-	-	1	2	4
<i>Tilapia sparrmanii</i>	-	-	-	-	-	-	-	-	-	-	-	2	-	2
<i>Myxus capensis</i>	-	-	2	2	5	-	-	-	-	-	-	-	-	9
<i>Monodactylus falciformis</i>	-	-	-	-	-	-	-	2	-	-	-	-	-	2
Total number of individuals	1	0	5	2	5	0	0	6	0	1	0	66	141	227
Total number of species	1	0	3	1	1	0	0	3	0	1	0	3	2	

The species composition shows a strong marine influence with the collection of, firstly, two catadromous species (*A. mossambica*, *M. capensis*), and secondly, three species (*G. aestuaria*, *M. falciformis*, *M. cephalus*) which although occasionally found in coastal rivers occur predominantly in estuaries or inshore coastal waters (Skelton 1993).

Four of the twelve species recorded are aliens (*T. tinca*, *L. macrochirus*, *M. salmoides*, *M. dolomieu*) and two species (*T. sparrmanii*, *C. gariepinus*) translocated from more northern rivers in southern Africa. These comprise 50 % of the species, and 38 % of the total individuals collected in the Breede River (sites 1–5), and 100 % of individuals collected in impoundments (site 6), emphasising the prominence of alien and translocated species in the ichthyofauna of this section of the Breede River system.

Discussion

There are no published quantitative data on ichthyofauna in the Breede River within the Bontebok National Park. Therefore, comparisons with earlier work are limited to descriptions of change in species composi-

tion, and in some cases, distribution. These surveys resulted in three new distribution records for the BNP, namely *G. aestuaria*, *M. salmoides* and *C. gariepinus*.

Despite neither Braack (1981) nor Stuart & Cambray (1985) having recorded *G. aestuaria* in the Breede River, its occurrence in the BNP is not unexpected as it is widespread in coastal rivers (Skelton 1993) and has been recorded by both Day (1981) and Ratte (1982) in the Breede River estuary. Only adult specimens (>50 mm SL) were collected therefore it is unknown whether *G. aestuaria* breeds in the Breede River or is only a peripheral species which migrates up from the estuarine environment.

Cambray & Stuart (1985) report that from more than 50 surveys undertaken by provincial conservation authorities in the Breede River system between 1978 and 1983, *M. salmoides* was collected on only two occasions, of which one was in the Breede mainstream. Braack (1981) did not record *M. salmoides* in the Breede River. Thus results of past surveys suggest that *M. salmoides* was not abundant in the Breede River. *Micropterus salmoides* is described by De Moor & Bruton (1988) as being scarce in the

Table 2

Number of fish specimens per species collected per site in the Bontebok National Park during February and March 2000. Site numbers as per Figure 1.

Sample methods: EF = electro-fishing, GN = gill net, LL = long lines.

Sample effort = minutes electro-fishing, number of overnight settings for gill nets and long lines, and number of effective seine net pulls.

Site number	1	1	2	2	3	3	3	4	4	5	5	5	5	
Sampling Method	EF	SN	GN	SN	EF	GN	LL	GN	LL	EF	GN	LL	SN	Total
Sampling Effort	40	4	1	3	40	1	1	1	1	15	1	1	1	
<i>Anguilla mossambica</i>	-	-	-	-	-	-	1	-	1	-	-	-	-	2
<i>Barbus andrewi</i>	-	-	-	-	-	1	-	-	-	-	-	-	-	1
<i>Tinca tinca</i>	-	6	-	-	-	-	-	-	-	-	-	-	-	6
<i>Lepomis macrochirus</i>	-	2	-	8	2	-	-	-	1	-	-	-	-	13
<i>Micropterus salmoides</i>	4	-	-	-	2	-	-	-	-	-	-	-	-	6
<i>Micropterus dolomieu</i>	-	-	-	-	-	-	-	1	-	-	-	-	-	1
<i>Tilapia sparrmanii</i>	4	16	-	-	11	-	-	1	-	4	-	-	-	36
<i>Myxus capensis</i>	2	1	7	32	7	14	-	8	-	2	-	-	-	73
<i>Mugil cephalus</i>	-	-	-	-	-	1	-	1	-	-	-	-	-	2
<i>Monodactylus falciformis</i>	-	-	2	3	-	1	-	2	-	3	-	2	2	13
Total	10	25	9	43	22	17	1	13	1	5	5	0	2	153
Total number of species	3	4	2	3	4	4	1	5	1	2	2	0	1	

Breede River, with a population decline having occurred following the introduction of *M. dolomieu* (Harrison 1963). The high abundance of *L. macrochirus* could also have contributed to the past scarcity of *M. salmoides*, which in southern Africa are often absent from areas where heavy populations of *L. macrochirus* occur (Jubb 1973). Environmental conditions in the Breede River, however, appear to have become more favourable for *M. salmoides* as evidenced by its abundance in the BNP, where it was collected more frequently than *M. dolomieu*.

Jubb (1967) describes the native range of *C. gariepinus* in southern Africa as being as far south as the Orange River system in the west and the Umtamvuna River in the east. It has been translocated to several rivers in the Eastern Cape (Sundays, Fish, Keiskamma) and south western Cape (Eerste) (Skelton 1993; De Moor & Bruton 1988). Local recreational fishermen claim to have been aware of the presence of "catfish" for a "few years", however, this constitutes the first official record of *C. gariepinus* in the Breede River system. De Moor & Bruton (1988) have emphasised that the introduction of *C.*

gariepinus into the southerly draining rivers of the southern Cape coast will severely threaten indigenous fish, particularly redbfin minnows. *Pseudobarbus burchelli* is thus likely to be at risk, and given that its distribution is confined to the Breede River system and four small adjacent systems (Cambray & Stuart 1985; Skelton 1987) the conservation status of this species, currently listed as Endangered (Hilton-Taylor 2000), is likely to be further compromised.

Four species have previously been reported to occur, or potentially occur in the BNP though were not recorded during these surveys, namely *C. carpio*, *A. bengalensis labiata*, *Salmo trutta* and *S. capensis*.

Although *C. carpio* was not collected in these surveys, anglers' reports indicate that it does occur in the study area. Standard fish sampling equipment appears to be inefficient for sampling *C. carpio* (Benade 1993; Russell 1997), and poor catch returns in this and earlier surveys reported by Cambray & Stuart (1985) may not accurately reflect the abundance of this species in the Breede River.

Braack (1981) reported collecting *Anguilla bengalensis labiata* (recent synonym: *A. nebulosa labiata*) in the park. The Breede River, however, falls outside of the expected range of this species (Skelton 1993; Castle 1986; Cape Department of Nature and Environmental Conservation 1984). It is thus unlikely to occur in the park. A more probable species is *Anguilla marmorata*, which is common on South Africa's east coast (Skelton 1993), extending down as far as the Western Cape Province (Castle 1986).

Salmo trutta are reported to have become established in the Breede River system (Skelton 1987; De Moor & Bruton 1988), particularly in dams (Cape Department of Nature and Environmental Conservation 1984) with unconfirmed reports of them occurring in the BNP (Braack 1981). The warm, turbid waters in the Breede River in the park are, however, unlikely to be favourable for *S. trutta* (Mc Veigh 1979) which requires cold well-oxygenated water (Bruton *et al.* 1982) and hence favours large mountain streams (Crass 1969a, 1986). *Salmo trutta* is thus unlikely to occur in the park.

Braack (1981) reported that re-establishment of *S. capensis* in the BNP was attempted with the release of individuals from the Swellendam area into dams. These surveys show that this attempted introduction was not successful. *Sandelia capensis* has been displaced from some of the streams in its native range due to environmental degradation and the presence of alien predators (Cambray & Stuart 1985), particularly *M. salmoides* (King & Bok 1984). Although *S. capensis* has previously been collected in the mainstream of the Breede River (Cambray & Stuart 1985) the abundance of alien predators suggest that this species is unlikely to be abundant.

Conclusions

From a conservation standpoint there are both positive and negative aspects to the ichthyofauna in Bontebok National Park. A

positive aspect is that the red-data listed *B. andrewi* (Vulnerable) (Hilton-Taylor 2000) as well as the previously red-data listed *M. capensis* (Rare) (Skelton 1987) still occur within the park despite the high incidence of alien predatory species. *Myxus capensis* is abundant, which along with the occurrence of several species usually found in estuaries or inshore coastal waters, demonstrates that there are no major physical barriers to fish migration downstream of the park.

Of conservation concern is the domination of the ichthyofauna by alien and translocated species. *Tinca tinca* has not been a very successful coloniser in southern Africa (DeMoor & Bruton 1988), yet remains established in the Breede River. There has also been an apparent increase in the abundance of *M. salmoides*, and *C. gariepinus* has now been introduced into the Breede River. The redfin minnow *P. burchelli* was not recorded in the BNP, which is consistent with earlier distribution records (Cambray & Stuart 1985). Although suitable habitat for *P. burchelli* may exist within the park, namely pools and deeper flowing stretches of larger tributaries and mainstreams (Skelton 1993), predation by alien fish probably means that there is little chance for recolonisation from tributaries higher in the Breede River system.

There is little opportunity to meaningfully conserve indigenous freshwater fish in the park. Conservation authorities have little influence over the quantity or quality of water in the Breede River, which are significantly modified by upstream influences such as abstraction for agricultural irrigation and runoff from agricultural lands. Invasive fish are so abundant that attempted reduction in numbers would be virtually futile, particularly as recruitment could freely take place from outside the parks boundaries. There is no possibility that alien species will ever be eliminated from the Breede River system, and as many are piscivorous, they pose a severe threat to indigenous species. The only feasible conservation measures currently available are firstly, the protection of riparian and aquatic vegetation to provide suitable

habitat for indigenous species and cover from predation, and secondly to encourage angling and removal of alien species to temporarily reduce predation and competitive pressure, whilst preventing the removal of indigenous species, particularly *B. andrewi*, which may be captured by anglers.

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