Freshwater fish of the Wilderness National Park

I.A. Russell

Russell, I.A. 1999. Freshwater fish of the Wilderness National Park. *Koedoe* 42(1): 73–78. ISSN 0075-6458.

The study aimed to determine the distribution and relative abundance of freshwater fish in the Wilderness National Park. Fish assemblages in the Touw and Duiwe rivers were sampled in 1997 and 1998, with a total of 327 fish from nine species recorded. Indigenous species included two freshwater species (*Pseudobarbus afer*, *Sandelia capensis*), two catadromous species (*Anguilla mossambicus*, *Myxus capensis*), and two estuarine species (*Monodactylus falciformis*, *Caffrogobius multifasciatus*). Three of the nine recorded species were alien (*Micropterus dolomieu*, *Micropterus salmoides*, *Gambusia affinis*), with the *Micropterus* spp., in particular, likely to have a substantial negative influence on indigenous species. A further one indigenous species, two translocated indigenous species, and five estuarine species could potentially be recorded in these rivers. River catchment management actions to restore perennial flow to the Duiwe River, to prevent the attenuation of floods, and to prevent further establishment and spread of alien and translocated biota are required to conserve indigenous fish assemblages.

Key words: freshwater fish, diversity, alien, Wilderness National Park.

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

Introduction

Assessment of the diversity of freshwater ichthyofauna in the national parks of South Africa has, in the past, been neglected to the extent that, in parks such as Wilderness National Park (WNP), there are few accurate records of the occurrence or abundance of species. Assessment of the freshwater ichthyofauna likely to occur in WNP can be made from published accounts of species distributions in broad geographical areas (Jubb 1965, 1967; Gaigher *et al.* 1980; Hamman 1988; Skelton 1993). Few published accounts, however, exist of the freshwater ichthyofauna in smaller rivers in the southern Cape (for example Cape Department of Nature and Environmental Conservation 1984), and none exist specifically for the WNP.

The Conservation Development section of the South African National Parks (SANP) is undertaking a research programme whereby the freshwater ichthyofauna in national parks will be surveyed. These data will be used to compile species lists for parks that have not previously been surveyed, and to describe changes in parks where surveys have previously been undertaken. The surveys described in this study form part of this programme, with the objective being to describe the diversity and distribution of freshwater fish in WNP.

Study Area

The Wilderness National Park is situated on the Cape south coast (33°59'S – 34°02'S and 22°35'E – 22°46'E) approximately midway between George and Knysna. The national park incorporates two saline lake systems (Wilderness and Swartvlei) into which seven rivers flow – the Touw River, Duiwe River and Langvlei Spruit into the Wilderness system, and Diep, Klein Wolwe, Hoëkraal and Karatara rivers into the Swartvlei system

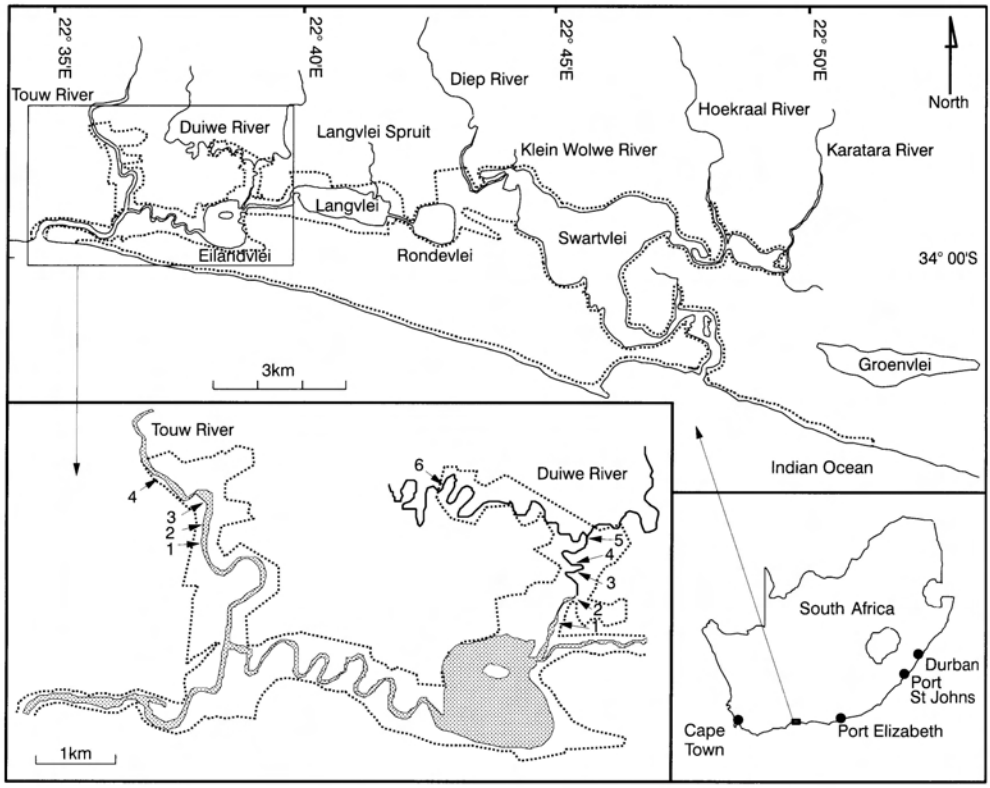

Fig. 1. Location of the Wilderness National Park relative to major centres and geographical features, and location of study sites in the Touw and Duiwe rivers in the Wilderness National Park. Boundary of the national park indicated by stippled lines

(Fig. 1). Portions of only the Touw and Duiwe rivers, however, fall within the park boundaries. Total land area in the Touw and Duiwe river catchments are 89.1 km² and 32.5 km² respectively, of which only 2.1 km² (2.4 %) (Touw) and 1.8 km² (5.5 %) (Duiwe) fall within the WNP. The headwaters of both rivers lie in the highly contorted Table Mountain Sandstones of the Outeniqua Mountains (Martin 1962; Birch & Du Plessis 1977). A substantial portion of the catchment area of the Duiwe River also comprises Cape granite (Tyson 1971). The upper slopes of the river catchments are covered with fynbos vegetation, which gives way to forest lower down. Water in the Touw River is characteristically stained brown by the humic matter from the vegetation of the area, is low in electrolytes, and can be classified as acid (pH 3.6–5.4–6.6 min-mean-max; n = 63) (SANP unpublished data). Water in the Duiwe River has a lower dissolved organic matter concentration, and is less acidic (pH 4.8–6.5–7.4 min-mean-max; n=55) (SANP unpublished data), which reflects the geology of the catchment area.

Mean annual precipitation in the upper catchments is between 900 and 1000 mm/yr (Adamson 1975) with a year-round rainfall regime, which results in no distinct seasonality in river flow. Natural flow is perennial, with periodic high rainfall events causing short-lived peak flow periods. Natural flow

patterns have been altered, particularly in the Duiwe River, where zero flow conditions occur periodically. Changes in flow patterns are ascribed to land-use practices, with approximately 63 % of the Duiwe River catchment given over to agriculture, silviculture and human settlement (Filmalter & O'Keeffe 1997). Smaller land-use changes have occurred in the Touw River catchment with approximately 21 % of the land area no longer supporting indigenous vegetation due to anthropogenic activities (Filmalter & O'Keeffe 1997). The Duiwe River is heavily impounded with 26 farm dams recorded in 1991, compared to four in the Touw River catchment (Filmalter & O'Keeffe 1997).

Methods

Six study sites were located in the Duiwe River, and four sites in the Touw River in the Wilderness National Park (Fig. 1). The major portion of these rivers are only accessible by a hiking trail. Therefore the position of sample sites was dictated largely by how far sampling equipment could be portaged, but covered the range of habitats (stony runs, channel margins, pools) within the river section. Stony runs and channel margins were sampled at all sites; pools at sites 1 and 6 in the Duiwe River; and sites 1 and 4 in the Touw River. Fish sampling was undertaken in the Duiwe River on 13 November 1997 (sites 1 to 3), 14 November 1997 (sites 4 & 5) and 4 May 1998 (site 6), and in the Touw River on 13 March 1998 (sites 1 to 3) and 18 May 1998 (site 4). A hand-held electro-fishing apparatus, powered by a 220v AC 2kva portable generator was used at all sample sites in pools, channel margins and stony runs. Sampling effort is indicated on Table 1. Fishing in the deeper (>1m deep) portions of a pool at site 1 in the Duiwe River was undertaken by trolling an artificial lure with a rod and reel.

All fish collected were identified using identification keys in Skelton (1993) and Smith & Heemstra (1991). Specimens of Cyprinidae and Centrarchidae were sent to the J.L.B. Smith Institute of Ichthyology for confirmation of identification. 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 (*Pseudobarbus afer* = RUSI 57448, 57449, *Micropterus dolomieu* = RUSI 57445).

Mean pH values for waters in the Touw and Duiwe rivers for the period 1991–1997 were obtained by averaging the antilog of the reciprocals of recorded monthly pH values.

Results and Discussion

A total of 327 fish from nine species was recorded (Table 1). Eight species (*Anguilla mossambicus*, *Pseudobarbus afer*, *Sandelia capensis*, *Myxus capensis*, *Monodactylus falciformis*, *Caffrogobius multifasciatus*,

Table 1
Number of freshwater fish collected at different sample sites in the Duiwe and Touw Rivers in the Wilderness National Park

		Duiwe River						Touw River			
Name	Common name	1	2	3	4	5	6	1	2	3	4
Anguilla mossambicus	Longfin eel	-	2	1	-	-	-	-	-	-	3
Pseudobarbus afer	Eastern Cape redfin	-	-	-	148	10	35	3	-	12	38
Sandelia capensis	Cape kurper	1	-	-	-	-	-	11	-	2	11
Myxus capensis	Freshwater mullet	3	-	-	-	-	-	5	-	1	-
Monodactylus falciformis	Cape moony	-	-	-	-	-	-	-	-	2	10
Caffrogobius multifasciatus	Prison goby	1	-	-	-	-	-	-	-	-	-
Micropterus dolomieu	Smallmouth bass	-	-	6	-	3	-	-	-	-	-
Micropterus salmoides	Largemouth bass	6	-	-	-	-	-	-	-	-	-
Gambusia affinis	Mosquito fish	7	-	-	-	-	-	5	-	1	-
Sample effort - minutes electro-fishing		30	30	25	60	35	90	90	25	60	120
- minutes trolling artificial lure		60	-	-	-	-	-	-	-	-	-

Micropterus dolomieu, *Gambusia affinis*) were collected by electro-fishing, and one species (*Micropterus salmoides*) by trolling an artificial lure.

The species composition shows a strong marine influence with two catadromous species (*A. mossambicus*, *M. capensis*), one species which is usually found in estuaries or inshore coastal waters (*M. falciformis*) though also occasionally occurs in fresh waters (Skelton 1993), and one species (*C. multifasciatus*) which is primarily estuarine (Whitfield 1994) and should be considered an unusual vagrant.

Three of the nine recorded species are alien (*M. dolomieu*, *M. salmoides*, *G. affinis*) emphasising the degraded conservation status of the rivers. *Micropterus salmoides* were recorded only in deep pools in the lower reaches of the Duiwe River, whereas *M. dolomieu* were collected in shallow (< 30 cm), stony, strongly flowing channels higher up the river. No *Micropterus* spp. were recorded in the Touw River (Table 1). Predation by alien fish, particularly *Micropterus* spp., is considered to be a serious threat to many indigenous fish species (Skelton 1987), with the disappearance of *S. capensis* and *Pseudobarbus* spp. in several South African rivers following the introduction of *M. dolomieu* (Harrison 1952; Gaigher 1973; Gaigher *et al.* 1980; Cambray & Stuart 1985; Skelton 1993). The probable negative effect of *Micropterus* spp. on indigenous fish in WNP rivers, and in particular *P. afer* and *S. capensis*, is demonstrated by large numbers of indigenous species being recorded only at sites where *Micropterus* spp. are absent (Table 1).

The co-occurance of *M. dolomieu* and *P. afer* in the Duiwe River suggests either the recent introduction of *M. dolomieu*, or that environmental conditions do not enable *M. dolomieu* to proliferate to the extent that it can eliminate *P. afer*. Both *M. dolomieu* and *M. salmoides* are reported to be adversely affected by heavy floods (Harrison 1940; Crass 1964; Heard & King 1982), and high flows recorded in 1993 and 1996 (SANP unpublished records) may have reduced their abundance. Attenuation of floods through further impoundment of the Duiwe River catchment could facilitate the survival of bass, in particular *M. dolomieu*, which favours fluvial conditions (Harrison 1963; Skelton 1993), to the detriment of indigenous species.

The effect of *G. affinis* on indigenous fish species in WNP is unknown. In some countries where *G. affinis* have been introduced they are thought to have been responsible for the local extinction of native fish (Contreras & Escalante 1984; MacKay 1984). De Moor & Bruton (1988), however, suggest that their impact in southern Africa has not been severely detrimental to native fish populations. The predatory habits of *G. affinis*, particularly on fish larvae (MacKay 1984; Skelton 1993), however, would suggests an ability to significantly affect native fish species, and it is possible that their presence in rivers in WNP is having a detrimental effect of indigenous species.

Several additional species could be expected in the Duiwe and Touw rivers. For example, the Wilderness lakes fall within the distribution range of the *Galaxias zebratus* (Cape galaxias) (Skelton 1993), which has been recorded in both the Keurbooms River, 80 km to the east, and Kaaimans River, four kilometres to the west (Cape Department of Nature and Environmental Conservation 1984). Thus it is likely that *G. zebratus* would also occur in the rivers draining into the Wilderness and Swartvlei lake systems. Another species likely to occur in these rivers is *Oreochromis mossambicus* (Mozambique tilapia) which is widespread and abundant in the Wilderness lake system (Hall *et al.* 1987). Cape Department of Nature and Environmental Conservation (1984) record *O. mossambicus* as having been introduced into the Touw River.

Whitfield *et al.* (1983) state that *Tilapia sparrmanii* (banded tilapia) have been recorded in the Swartvlei catchment, though this has not been confirmed by later species distribution accounts (Cape Department of

Nature and Environmental Conservation 1984; De Moor & Bruton 1988). Whitfield *et al.* (1983) also describe the occurrence of *Glossogobius giuris* (tank goby) in the Swartvlei system, though both Skelton (1993) and Smith & Heemstra (1991) suggest that the *G. giuris* extends down the east coast only as far as Port St. Johns in the eastern Cape, and the southern limit of the morphologically similar *Glossogobius callidus* (river goby) being the Krom River near Port Elizabeth. If these species are resident in the lake systems it is probable that they would also occur in freshwater systems in the WNP.

Finally, there are several estuarine species in the lake systems (Whitfield *et al.* 1983; Hall *et al.* 1987; Russell 1996) which are periodically recorded in freshwater systems (Skelton 1993). These include *Gilchristella aestuaria* (estuarine round-herring), *Atherina breviceps* (Cape silverside), *Mugil cephalus* (flathead mullet) and *Monodactylus argenteus* (Natal moony). It is likely that these species would, on occasions, be recorded as vagrants in the river systems.

Conclusions

Current legislation does provide SANP managers some measure of influence over the quality of water in rivers that flow into the Wilderness and Swartvlei lake systems. Few opportunities exist, however, to influence decisions on river impoundment and water abstraction, and consequent changes in the quantity and timing of flow. Similarly, conservation authorities have been ineffective in controlling the introduction and spread of several alien and translocated indigenous fish in the region. The alteration of flow patterns and spread of alien species pose significant threats to the indigenous freshwater fish in WNP, particularly in the Duiwe River. Future increased demands on water resources are likely to exacerbate this situation. In reality, SANP has little opportunity to effectively manage and conserve freshwater fish in WNP. Threats to these fish assemblages originate largely from activities undertaken outside the park boundaries over which SANP authorities having little or no control. The National Water Act (Act No 36 of 1998) provides the opportunity for integrated management of river catchments by catchment management agencies. It is recommended that future management agencies institute decisive measures to conserve indigenous fish assemblages, particularly in the premier conservation areas of South Africa, such as national parks.

Acknowledgements

Assistance with fieldwork provided by Mr. E. Kivett, Ms. W. Wilkinson, Mr. P. Fourie and Ms. M. Fick is gratefully acknowledged.

References

ADAMSON, P.T. 1975. Extension of monthly runoff records in the catchments of the Wit Els, Diep and Karatara rivers – Wilderness – Cape Province. Report to the Chief of the Division of Hydrology, Department of Water Affairs, Pretoria.

BIRCH, G.F. & A. DU PLESSIS. 1977. Offshore and onland geological and geophysical investigations in the Wilderness lakes region. Joint Geological Survey/UCT Marine Geoscience Unit, University of Cape Town Publications GH 2268.

CAMBRAY, J.A. & C.T. STUART. 1985. Aspects of the biology of a rare redfin minnow, *Barbus burchelli* (Pisces: Cyprinidae) from South Africa. *South African Journal of Zoology* 20(3): 155–165.

CAPE DEPARTMENT OF NATURE AND ENVIRONMENTAL CONSERVATION. 1984. *Freshwater Fishes of the Cape*. Cape Town : Cape Department of Nature and Environmental Conservation (Cape Conservation Series 5).

CONTRERAS, B.S. & C.M.A. ESCALANTE. 1984. Distribution and known impacts of exotic fishes in Mexico. Pp. 102–130. *In:* COURTENAY, W.R. & J.R. STAUFFER (eds.) *Distribution, biology and management of exotic fishes*. London: John Hopkins University Press.

CRASS, R.S. 1964. *Freshwater fishes of Natal*. Pietermaritzburg: Shuter and Shooter.

DE MOOR, I.J. & M.N. BRUTON. 1988. *Atlas of alien and translocated indigenous aquatic animals in southern Africa*. Pretoria: Council for Scientific

and Industrial Research. (South African National Scientific Programmes report; no.144).

FILMALTER, E. & J.H. O'KEEFFE. 1997. *Effects of land-use changes on the rivers of the Wilderness lakes*. Grahamstown: Institute for Water Research. Rhodes University.

GAIGHER, C.M. 1973. The Clanwilliam River: is it not yet too late? *Piscator* 88: 75–78.

GAIGHER, I.G., K.C.D. HAMMAN, K.C.D. & S.C. THORNE. 1980. The distribution, conservation status and factors affecting the survival of indigenous freshwater fishes in the Cape Province. *Koedoe* 23: 57–88.

HALL, C.M., A.K. WHITFIELD & B.R. ALLANSON. 1987. Recruitment, diversity and the influence of constrictions on the distribution of fishes in the Wilderness lakes system, South Africa. *South African Journal of Zoology* 22(2): 163–169.

HAMMAN, K.C.D. 1988. Freshwater Fish. Pp. 27–31. *In:* KING, J.M. (ed.) *Hydrology and hydrobiology in the fynbos biome*. Pretoria: Council for Scientific and Industrial Research (Ecosystems Programmes Occasional report; no 26).

HARRISON, A.C. 1940. The acclimation of freshwater game fish in the Cape Province and its relation to forest areas. *Journal of the South African Forestry Association* 4: 5–14.

HARRISON, A.C. 1952. The Cape kurper. *Piscator* 23. 82–91.

HARRISON, A.C. 1963. The Olifants/Doorn River system and its fishes. *Piscator* 57: 25–39.

HEARD, H.W. & M.J. KING. 1982. Fish populations and ecology of the Baakens River. *The Naturalist* 26(2): 21–24.

JUBB, R.A. 1965. Freshwater fishes of the Cape Province. *Annals of the Cape Provincial Museums* 4: 1–72

JUBB, R.A. 1967. *The freshwater fishes of southern Africa*. Cape Town: Balkema,

MACKAY, R.J. 1984. Introductions of exotic fishes in Australia. Pp. 177–199. *In:* COURTENAY, W.R. & J.R. STAUFFER (eds.) *Distribution, biology and management of exotic fishes*. London: John Hopkins University Press.

MARTIN, A.R.H. 1962. Evidence relating to the Quaternary history of the Wilderness lakes. *Transactions of the Geological Society of South Africa* 65: 19–42.

RUSSELL, I.A. 1996. Fish abundance in the Wilderness and Swartvlei lake systems: changes relative to environmental factors. *South African Journal of Zoology* 31(1): 1–9.

SKELTON, P.H. 1987. *South African Red Data Book – Fishes*. Pretoria: Council for Scientific and Industrial Research (South African National Scientific Programmes report; no 137).

SKELTON, P.H. 1993. *A complete guide to the freshwater fishes of southern Africa*. Johannesburg: Southern Books.

SMITH, M.M. & P.C. HEEMSTRA (eds.) 1991. *Smiths' Sea Fishes*. Johannesburg: Southern Books.

TYSON, P.D. 1971. *Outeniqualand: The George and Knysna area*. Braamfontein: South African Geographical Society (The South African Landscape Series).

WHITFIELD, A.K., B.R. ALLANSON & T.J.E. HEINECKEN. 1983. *Estuaries of the Cape. Part II. Research Synopses of available information on individual systems*. Report No 22: Swartvlei (CMS 11). Stellenbosch: Council for Scientific and Industrial Research (CSIR Research report; no 421).

Whitfield, A.K. 1994. An estuary-association classification for the fishes of southern Africa. *South African Journal of Science* 90: 411–417.