Freshwater fishes of Golden Gate Highlands National Park

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Russell, I.A. and P.H. Skelton. 2005. Freshwater fishes of Golden Gate Highlands National Park. *Koedoe* 48(1): 87–94. Pretoria. ISSN 0075-6458.

The study aimed to determine the distribution and relative abundance of freshwater fishes in the Golden Gate Highlands National Park. A total of 1778 fish specimens from three species were collected during surveys carried out in the Little Caledon River during 2002. The chubbyhead barb *Barbus anoplus* was the only indigenous species recorded, and comprised 99.5 % of the total catch. Two of the three recorded species were alien (*Cyprinus carpio*, *Oncorhynchus mykiss*). A further nine indigenous species could potentially occur within the park, though are unlikely to be permanent residents. Barriers formed by instream impoundments may prevent temporary immigration of indigenous fishes, but also limit the further spread of alien species in the park's rivers.

Key words : diversity, alien fish, conservation, Little Caledon River, *Barbus anoplus*.

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Introduction

A primary function of many conservation areas is to maintain the form and function of natural ecosystems and processes (Lombard 1995). As such they may act as refugia for various biota (Siegfried 1989; Rebelo & Siegfried 1992) including freshwater fishes (Skelton 1990; Skelton *et al.* 1995). The Golden Gate Highlands National Park (GGHNP) encompasses the headwaters of the Little Caledon River in the Orange/Vaal system. The park has several of the attributes identified by Skelton *et al.* (1995) as necessary for effective conservation of riverine fishes, namely (i) positioned high in the catchment, (ii) encompasses the entire upper catchment area, (iii) natural hydrological cycles are maintained, and (iv) minimum water quantity and quality requirements for aquatic biota are achieved. Assessment of the value of GGHNP for the conservation of fishes required information on the occurrence and distribution of both indigenous and alien species.

Most past ichthyological surveys in the Orange River system have concentrated on the middle and lower altitude portions of rivers (Van Schoor 1968; Skelton & Cambray 1981; Cambray 1984; Benade 1993), with particular emphasis placed on species in large impoundments (Cambray *et al.* 1978; Gaigher *et al.* 1980, 1981; Hamman 1980; Jubb 1972). Unpublished records indicate that two earlier fish surveys have been undertaken in GGHNP, one in the 1960s, and a second in 1974 (Skelton 1974). The objective of this study was to describe the current diversity and distribution of freshwater fish in GGHNP, which together with past survey results, could be used to assess the contribution this park makes towards the conservation of South African freshwater fishes.

Study Area

The GGHNP is situated between latitude 28°27'S–28°37'S and longitude 28°33'E–28°42'E in the north-eastern Free State, and covers an area of approximately 11680 ha. Altitude ranges from 1840 m to 2837 m amsl. Average rainfall is 764 mm/y falling mainly from November to April (Groenewald 1986). Summers are mild while winters are usually very cold, with frost and occasional snow on the mountains. The vegetation on the mountain slopes is mainly Highveld Sourveld with

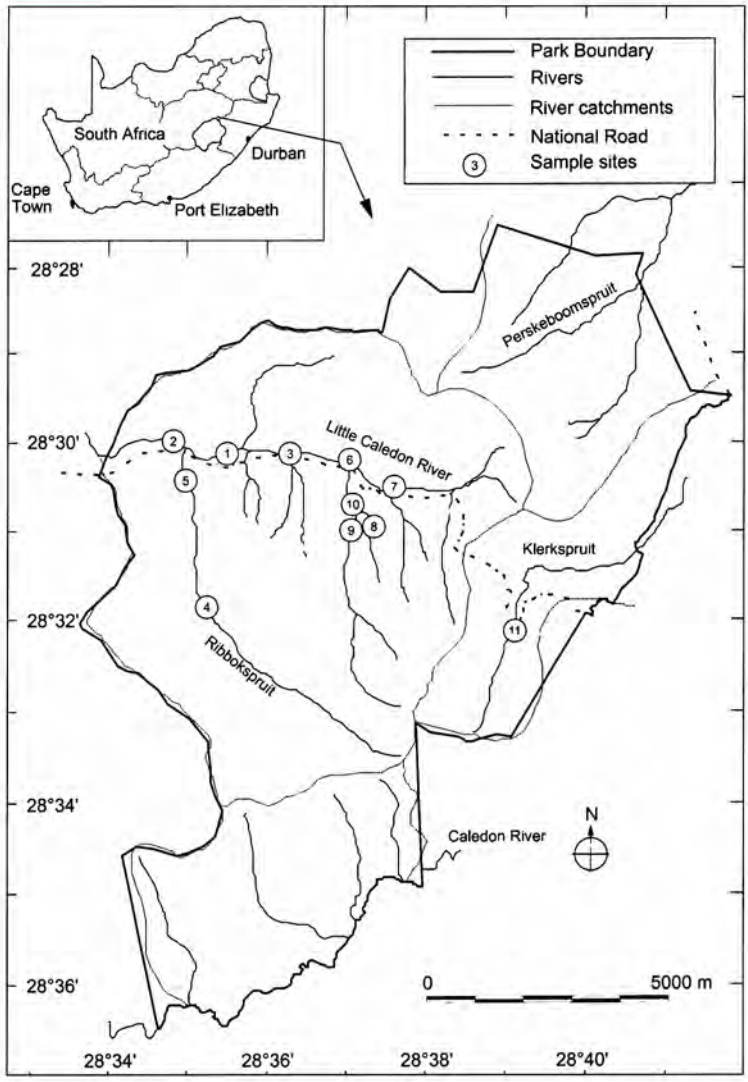

Fig. 1. Map of the Golden Gate Highlands National Park indicating sites used to sample fish assemblages.

Themeda-Festuca Alpine grassland (Acocks 1988), whereas in sheltered gorges Ouhout trees *Leucosidea sericea* dominate (Earlé & Lawson 1988).

The southern portions of GGHNP drain into the Caledon River. In the north-eastern sections of the park (Fig. 1) the Perskeboomspruit and Klerkspruit are tributaries of the Vaal system. The largest river is the Little Caledon, which arises at an altitude of about 2025 m amsl and flows for about 8 km through the park. The mainstream of the Little Caledon in GGHNP consists of shallow channels with a sand or gravel substratum, interrupted with rocky sections and pools >1 m deep in the lower reaches. At its source, the Little Caledon is < 1 m wide,

though in the lower reaches of the park is up to 7 m wide. There are two main tributaries, both arising in the park (Fig. 1), the game camp stream (no official name) and the Ribbokspruit. The game camp stream has a very steep profile for the first 2.5 km, thereafter the slope decreases to about 1:36 till its confluence with the main stream. In its upper reaches the substratum is coarse sand with rocks, whereas in the lower reaches flow is predominantly over bedrock (intrusive amygdaliod basaltic lavas) (Spies 1965). The Ribbokspruit is seasonal, with the substratum consisting predominantly of sand and cobble.

There are two substantial impoundments in GGHNP, namely the Langtoon Dam located on the game camp stream, and Golden Gate Dam in the lower reaches of the Little Caledon. Marginal vegetation is most frequently associated with these and other minor impoundments, where dense stands of *Phragmites* reeds have become established.

Methods

The fish assemblages in rivers in GGHNP were sampled from 28 February 2002 to 6 March 2002. Twelve study sites were used (Fig.1), of which 11 were located in the Little Caledon system, and one in the upper reaches of the Klerkspruit. Minor streams in the southern reaches of GGHNP flowing into the Caledon River were inaccessible, and streams of the Perskeboomspruit in the north-east of GGHNP were not flowing at the time of surveys. Sample sites in the Little Caledon were the same as those used in surveys undertaken in 1974 (Skelton 1974) to enable comparison of results.

Sampling in deep impoundments was done with two multifilament gillnets (40 m x 2 m x 55 mm and 40 m x 2 m x 80 mm) and one monofilament gillnet (20 m x 2 m x 100 mm), a beach 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 16:00 to 09:00. In the mainstream of rivers, including riffles, stony runs and vegetated channel margins, fish were collected with a hand-held electro-fishing apparatus, powered by a 220V AC, 1.8 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.

Results

Three fish species were collected in GGHNP (Table 1). *Barbus anoplus* Weber, 1897 (chubbyhead barb) was collected at seven of the 10 sample sites in the Little Caledon system. No specimens were collected in the Klerkspruit. *Cyprinus carpio* Linnaeus, 1758 (carp) was collected in the Golden Gate Dam

Table 1

Number of fish specimens per species collected in the Golden Gate Highlands National Park during February and March 2002. Site numbers as per Fig. 1

Site number	1	2	3	4	5	6	7	8	9	10	11	Total
Electrofishing (min)	-	60	60	50	30	40	20	20	-	40	40	360
Gill nets	1	-	-	-	-	-	-	-	1	-	-	2
Seine net	1	-	-	-	-	-	-	-	2	-	-	3
Long lines	1	-	-	-	-	-	-	-	1	-	-	2
Barbus anoplus	1252[a]	27[a]	72[a]	-	-	20	7	-	342[a]	49[a]	-	1769
Oncohynchus mykiss	-	7	-	-	1	-	-	-	-	-	-	8
Cyprinus carpio	1	-	-	-	-	-	-	-	-	-	-	1

[a]*Sites sampled and species collected during surveys undertaken in 1974*

(site # 1), and *Oncorhynchus mykiss* (Walbaum, 1792) (rainbow trout) in the Little Caledon below Golden Gate Dam (site # 2), and in Ribbokspruit (site # 5).

Length frequency distribution of *B. anoplus* indicated that the population in Golden Gate Dam (site # 1) consisted predominantly of juveniles less than 1 year old (Fig. 2a), with most individuals being young-of-the-year (<30 mm FL) spawned during 2001-2002 summer. Length frequency distribution of *B. anoplus* in Langtoon Dam (site # 9) was polymodal (Fig. 2b) indicating a high relative abundance of juveniles from both 2000-2001 and 2001-2002 summer spawnings, as well as adults >1 year old. *Barbus anoplus* populations collected in the mainstream of the Little Caledon River (Fig. 2c) indicated a virtual complete absence of juveniles spawned during the 2001-2002 summer, with populations dominated by juveniles spawned during 2000-2001 summer, and in particular, adult fish >1 year old.

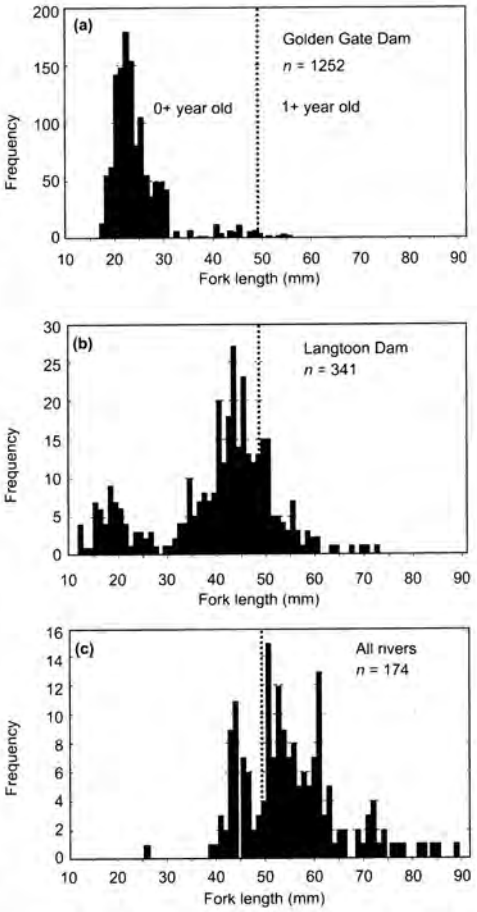

Fig. 2. Length frequency distribution of *Barbus anoplus* in the Golden Gate Dam (a), Langtoon Dam (b), and the mainstream of the Little Caledon River (c) in the Golden Gate Highlands National Park. Vertical dashed line indicates approximate division between 0+ and 1+ year age classes based on growth rates given in Cambray (1982).

Discussion

Two fish surveys have previously been undertaken within GGHNP. The first in 1965 (Jubb *pers comm.*) revealed the presence of *B. anoplus* and *Labeobarbus aeneus* (Burchell, 1822). The second survey undertaken in 1974 (Skelton 1974) resulted in the collection of only *B. anoplus*. Thus both past and present surveys suggest that *B. anoplus* is the only permanently resident indigenous freshwater fish in the park.

Several indigenous fish species could potentially occur within the park. In addition to *B. anoplus*, there are a further 13 indigenous fish species which have been recorded in the Orange River system above the Augrabies Falls, viz., *Labeobarbus aeneus*, *Labeobarbus kimberleyensis* (Gilchrist & Thompson, 1913), *Barbus trimaculatus* Peters, 1952, *Barbus paludinosus* Peters, 1852, *Barbus pallidus* A. Smith, 1841, *Labeo umbratus* (A. Smith, 1841), *Labeo capensis* (A. Smith, 1841), *Pseudobarbus quathlambae* (Barnard, 1938), *Anguilla mossambica* Peters, 1852, *Austroglanis sclateri* (Boulenger, 1901), *Clarias gariepinus* (Burchell, 1822), *Pseudocrenilabrus philander* (Weber, 1897), and *Tilapia sparrmanii* A. Smith, 1840) (Skelton & Cambray 1981; Skelton 1986; Benade 1993). One or more of these might therefore be expected to occur in the park.

Labeo umbratus occur predominantly in slow flowing waters over soft sediments

(Skelton 1993) characteristic of impoundments and the low altitude portions of rivers. They have not been recorded in the high altitude portions of rivers in which they occur, and hence are unlikely to occur in GGHNP. *Barbus pallidus* has a divided distribution, and in the Orange-Vaal system occurs only in the tributaries of the Vaal River (Skelton 1986, 1993). Thus it is unlikely to occur in GGHNP which encompasses a portion of the upper catchment of the Orange River.

Barbus trimaculatus, *B. paludinosus*, *C. gariepinus*, *T. sparrmanii*, and *P. philander* have been recorded in rivers in the Limpopo system above 1200 m amsl (Gaigher 1969) but have yet to be recorded in the high altitude portions of the Orange River system (Skelton 1974, 1986; Eccles 1989; LVA 1993; Skelton 1996). In the Vaal River these species were found to occur predominantly in river sections characterised by deep, slow flowing water, over predominantly a soft substratum and abundant aquatic plants (Russell 1997). Environmental conditions in GGHNP rivers are unlikely to be favourable for these species, particularly during cold winter months. Although these species could potentially survive in the instream impoundments, occurrence in rivers in GGHNP is likely to be only as summer vagrants.

Anguilla mossambica frequently occurs in the headwaters of streams, and altitude is unlikely to be a limiting factor in its distribution. Typical distribution of *A. mossambica* is the eastward flowing rivers systems draining into the Indian Ocean (Bruton *et al.* 1987). Occasional specimens have been collected in the Orange River system (Jubb 1959), though Bruton *et al.* (1987) consider it to be absent from the high altitude catchment areas. This species is extremely uncommon in the Orange River, with recorded species thought to have resulted from migration between catchments, and/or occasional vagrants entering the Orange River mouth on the west coast of South Africa (Jubb 1959). *Anguilla mossambica* is unlikely to occur in GGHNP other than as an occasional vagrant.

Species which have been found to frequent high altitude portions of the Orange River system in Lesotho include *P. quathlambae*, *L. aeneus*, *L. capensis*, and low abundances of *A. sclateri*, and *L. kimberleyensis* (Gephard 1978; Eccles 1989; LVA 1993; Skelton 1996; Tweddle & Davies 1997). The known current distribution of *P. quathlambae* is nine rivers in Lesotho draining in a south-westerly direction off the Maloti and Drakensberg ranges, excluding the Little Caledon River. The type locality of *P. quathlambae* is the Umkomazana River in KwaZulu-Natal (Pike & Tedder 1973), indicating it has not always been restricted to the inland portions of Lesotho, and hence could potentially occur in the Caledon system. Skelton (1974) assessed the suitability of aquatic habitat in GGHNP for *P. quathlambae*, and concluded that there was insufficient suitable habitat to support a viable population. *Pseudobarbus quathlambae* is thus unlikely to occur in GGHNP.

Labeo capensis favours flowing water in large rivers, though it also does well in large impoundments (Skelton 1993) which could account for its abundance in high altitude impoundments in Lesotho (Tweddle & Davies 1997). Rivers in GGHNP are mostly small and shallow (<50 cm deep) and hence possibly unsuitable for permanent occupation by *L. capensis*. Impoundment in GGHNP may be suitable for *L. capensis*, though it appears to have been unable to colonise this habitat. Barriers posed by impoundment walls are likely to have prevented upstream migrations of fish, including *L. capensis*, within GGHNP.

Previous collections of *L. aeneus* in GGHNP during the rainy season (Jubb *pers. comm.*) indicate that it can periodically occur in the park. Local fishermen refer to, in the past, having observed yellowfish (*Labeobarbus* spp.) in the Little Caledon, though it is unclear whether these were either *L. aeneus* or *L. kimberleyensis*. There are no records of yellowfish species being either observed or collected in GGHNP following the construction of impoundments. Specimens collected by Jubb in the 1960s were unlikely to have

been permanently resident within the rivers of GGHNP. This conclusion is based on the observation by Jubb that collected specimens were heavily parasitised by helminth metacercaria, yet the intermediate host molluscs were not recorded in GGHNP at the time of sampling. Collected specimens thus appear to have migrated into the park. Existing impoundments are likely to impede periodic movement of *L. aeneus* and possibly *L. kimberleyensis* into GGHNP.

The environmental preferences of *A. sclateri*, namely rocky habitats in flowing water, (Skelton & Cambray 1981; Cambray 1984; Skelton 1993) suggest that rivers in GGHNP could provide suitable habitat. *Austroglanis sclateri* is thought to occur predominantly in the mainstream and larger tributaries of the Orange-Vaal system (Janse van Vuren 1978; Gaigher *et al.* 1980; Skelton & Cambray 1981; Cambray 1984), and is uncommon in the high altitude portions of the Orange River in Lesotho (Eccles 1989; LVA 1993; Skelton 1996). Habitat destruction through sedimentation is thought to have resulted in the scarcity of *A. sclateri* in the Caledon River system (Marshall 1972). *Austroglanis sclateri* could potentially occur within GGHNP, though as elsewhere within its range, it is unlikely to be common. Barriers imposed by instream impoundments would, however, limit its distribution within the park.

Barbus anoplus is the only resident indigenous freshwater fish in GGHNP. Cambray (1983) lists a number of physical and behavioural characteristics of *B. anoplus* which enable it to successfully colonise shallow unstable rivers and lotic habitats, including rapid embryo development and growth in the first year, early age of sexual maturity, high fecundity and tolerance of low temperatures. The high abundance of juvenile *B. anoplus* in impoundments in GGHNP indicates that the creation of lotic habitats has been beneficial for this species. The contrasting low abundance of juvenile *B. anoplus* in rivers suggests either that breeding and maturation occurs predominantly in impoundments, or that mortality of juveniles is higher in rivers. Differences in recorded length-frequency of *B. anoplus* indicate that impoundments in GGHNP differ in terms of their suitability for breeding and/or successful recruitment of this minnow, with delayed though more consistently successful recruitment occurring in the higher altitude Langtoon Dam (site # 9). There are, unfortunately, no data on environmental conditions within these impoundments, though it is suggested that factors such as altitude and in turn water temperature, the abundance of aquatic plants acting as a substrate for adhesive eggs and fry (Cambray 1982) and cover for fry, and the occurrence of alien fish, both as predators and habitat modifiers, may play a role.

Barbus anoplus have not been able to colonise the upper reaches of the Ribbokspruit in GGHNP. Local knowledge suggests that flow in this tributary of the Little Caledon is seasonal, and conditions may thus be unsuitable for long-term habitation by *B. anoplus*. A low waterfall (± 4 m high) occurs in the Ribbokspruit upstream of site # 5 that is likely to prevent upstream migration of fish.

Conclusions and recommendations

Barbus anoplus is the most widespread freshwater fish species in South Africa (Skelton 1993), and as the only resident indigenous species in GGHNP indicates that this park makes only a minor contribution to the conservation of South African ichthyofauna. There seems little point in trying to alter this status by re-introducing species previously recorded in the area, notably *L. aeneus*, as there is some doubt as to whether they are permanent residents in the cold headwaters of the Little Caledon River.

Control over the introduction and spread of alien fish is essential for the conservation of rivers in GGHNP. No further introduction of alien species should occur. Areas downstream of GGHNP support an active trout industry, and escapees will continue to pose a threat. Current surveys suggest that trout are restricted to areas below Golden Gate dam, and trout fishing with removal should

be encouraged in this area. Similarly, fishing for carp should be permitted in the Golden Gate Dam, which, in conjunction with a periodic netting program should help reduce numbers of this species. Rivers in GGHNP have previously been assessed in terms of their suitability as a refuge for *P. quathlambae* (Skelton 1974). There is no history of this species ever occurring in the upper reaches of the Little Caledon River, and to introduce it into this system, despite the limited availability of suitable habitat, would be contrary the conservation policies of South African National Parks.

No further impoundment of the Little Caledon River in GGHNP should take place, including replacement of defunct structures. The Golden Gate Dam appears to serve as a barrier to the upstream migration of trout, and hence should be retained.

Finally, it is recommended that biotic surveys in GGHNP rivers be expanded to include aquatic macroinvertebrates. Such surveys would facilitate aquatic bioassessment, and could potentially yield valuable information on the effects of alien fish, and in particular rainbow trout, on upland macroinvertebrate assemblages.

Acknowledgements

Thanks are due to Ruth Livesey-Goldblatt, Stevenson Mkhulise, Eddy Kivett, and Gwen Hannay for assistance with the 2002 field surveys. We are also grateful to the two anonymous reviewers for their critical comments.

References

Acocks, J.P.H. 1988. Veld types of South Africa. 3rd ed. *Memoirs of the botanical Survey of South Africa* 57: 1–146

Benade, C.B. 1993. Studies on fish populations in the regulated Orange River system within the borders of the Cape Province. MSc. thesis, University of the Orange Free State, Bloemfontein.

Bruton, M.N., A.H. Bok & M.T.T. Davies. 1987. Life history styles of diadromous fishes in inland waters of southern Africa. *American Fisheries Society Symposium* 1: 104–121.

Cambray, J.A. 1982. The life history strategy of a minnow, *Barbus anoplus*, in a man-made lake in South Africa. M.Sc. thesis, Rhodes University, Grahamstown.

Cambray, J.A. 1983. Early development and larval behaviour of a minnow, *Barbus anoplus* (Pisces: Cyprinidae). *South African Journal of Zoology* 18(4): 331–336.

Cambray, J.A. 1984. Fish populations in the middle and lower Orange River, with special reference to the effects of stream regulation. *Journal of the Limnological Society of Southern Africa* 10(2): 37–49.

Cambray, J.A., S. Hahndiek & Q. Hahndiek. 1978. The juvenile fish populations in the marginal areas of the Hendrik Verwoerd Dam. *Journal of the Limnological Society of Southern Africa* 4(1): 21–33.

Earle, R.A. & A.B. Lawson. 1988. An annotated check list of the birds of Golden Gate Highlands National Park. *Koedoe* 31: 227 243.

Eccles, D.H. 1989. Fisheries Biology/Aquatic Communities. Lesotho Highlands Water Project Environmental Study. Report of an assignment comprising part of sixth European Development Fund Project No. 6200.16.33.001. Environmental Resources Ltd. in association with Sir M. MacDonald and Partners Ltd.

Gaigher, I.G. 1973. The habitat preferences of fishes from the Limpopo River system, Transvaal and Mozambique. *Koedoe* 16: 103–116.

Gaigher, I.G., K.C.D. Hamman & 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.

Gaigher, I.G., K.C.D. Hamman & S.C Thorne. 1981. Relative fish population density changes in the P.K. le Roux Dam during the first three years of inundation. *Journal of the Limnological Society of southern Africa* 7: 37–41.

Gephard, S.R. 1978. Observations on the three allopatric populations of the Maluti minnow, *Oreodaimon quathlambae* (Barnard) with notes on its evolution, ecology, spawning and conservation. *Journal of the Limnological Society of southern Africa* 4(2): 105–111.

Groenewald, G.H. 1986. Geology of the Golden Gate Highlands National Park. *Koedoe* 29: 165–181.

Hamman, K.C.H. 1980. Post-impoundment trends in the fish populations of the Hendrik Verwoerd Dam, South Africa. *Journal of the Limnological Society of southern Africa* 6: 101–108.

Janse van Vuren, C.J. 1978. Die verspruiding van vis in die rivier-sisteme in die Oranje-Vrystaat. Unpublished Report. OVS Provinsiale Administrasie, Afdeling Natuurbewaring.

JUBB, R.A. 1959. Eels of the Orange-Vaal River system. *Piscator* 13(45): 28–29.

JUBB, R.A. 1972. The Hendrik Verwoerd Dam and Orange River fishes. *Piscator* 84: 22–26.

LOMBARD, A.T. 1995. The problems with multispecies conservation: do hotspots, ideal reserves and existing reserves coincide? *South African Journal of Zoology* 30(3): 145–163.

LVA. 1993. Baseline biological survey, fauna and flora. Lesotho Highlands Water Project Phase 1A. Contract No. 75. Final Report, Volume 3, Amphibia and Fish. Unpublished Report. Loxton, Venn and Associates.

MARSHALL, R.D. 1972. A preliminary fish survey of the Caledon River system. *The Civil Engineer in South Africa* 14(2): 96–97.

PIKE, T. & A.J. TEDDER. 1973. Rediscovery of Oreodaimon quathlambae. *Lammergeyer* 19: 9–15.

REBELO, A.G. & W.R. SIEGFRIED. 1992. Where should nature reserves be located in the Cape floristic region, South Africa? Models for the spatial configuration of a reserve network aimed at maximizing the protection of floral diversity. *Conservation Biology* 6: 243–252.

RUSSELL, I.A. 1997. Spatial variation in the structure of fish assemblages in the Vaalbos National Park, South Africa. *Koedoe* 40(1): 113–123.

SIEGFRIED, W.R. 1989. Preservation of species in southern African nature reserves. Pp. 186–201. *In*: HUNTLEY, B.J. (ed.) *Biotic Diversity in southern Africa Concepts and Conservation*. Cape Town: Oxford University Press.

SKELTON, P.H. 1974. A fish survey of the Golden Gate Highlands National Park. Unpublished Report. Albany Museum, Grahamstown.

SKELTON, P.H. 1986. Fish of the Orange-Vaal system. Pp. 143–161. *In*: DAVIES, B.R. & K.F. WALKER (eds.) *The Ecology of River Systems*. Dordrecht: Junk.

SKELTON, P.H. 1990. The conservation and status of threatened fishes in southern Africa. *Journal of Fish Biology* 37 (supplement A): 87–95

SKELTON, P.H. 1993. *A complete guide to the freshwater fishes of southern Africa*. Halfway House: Southern Book Publishers.

SKELTON, P.H. 1996. Lesotho Highlands Development Authority. Fisheries Consultancy, Contract No. 625: Part 1, Final Report. J.L.B. Smith Institute of Ichthyology Investigational (unpubl.) report; no. 54.

SKELTON, P.H. & J.A. CAMBRAY. 1981. The freshwater fishes of the middle and lower Orange River. *Koedoe* 24: 51–66.

SKELTON, P.H., J.A. CAMBRAY, A. LOMBARD & G.A. BENN. 1995. Patterns of distribution and conservation status of freshwater fish in South Africa. *South African Journal of Zoology* 30(3): 71–81.

SPIES, J.J. 1965. Die geologiese en geomorfologiese geskiedenis van Golden Gate Hoogland Nasionale Park. *Koedoe* 12: 128–198.

TWEDDLE, D. & M.T.T. DAVIES. 1997. Preliminary observations on the fish populations of the recently-impounded Katse Reservoir, Lesotho. *Southern African Journal of Aquatic Sciences* 23(2): 7–20.

VAN DER BANK, F.H., J.L. RALL & G.J. STEYN. 2001. Genetic variation within and differentiation between *Pseudobarbus quathlambae* (Pisces, Cyprinidae) populations from the Senqunyane, Jordane and Bokong Rivers (Central Lesotho). *African Journal of Aquatic Science* 26: 23–29.

VAN SCHOOR, D.A. 1968. Survey of the fishes in the Orange and Vaal Rivers from Aliwal North to Douglas. *News Bulletin of the Zoological Society of southern Africa* 9: 8–9.