

The current distribution of the Southern Barred Minnow, *Opsaridium peringueyi* (Pisces: Cyprinidae) in South Africa: Is the reason for concern?

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ABSTRACT

The current distribution of *Opsaridium peringueyi* in South Africa was investigated. We found that there are still healthy, but relatively small populations left in the middle reaches of the Luvuvhu, Blyde, Sabie and Pongolo Rivers. The species seems to have become extinct in some rivers like the Shingwedzi and lower Olifants and its status is uncertain in the Crocodile and lower Komati/Mumati Rivers. In many cases the rivers are transformed by the combined impact of alien species, dams and weirs, water abstraction, water regulation, pollution from industrial, agricultural, mining, forestry and urban areas and sedimentation. These factors caused the species distribution to become fragmented and made it vulnerable to possible extinction.

Table 1: The frequency in which *O. peringueyi* and other fish species were encountered in the four data sets: South African Institute of Aquatic Biodiversity, the Kruger National Park, the old Transvaal Provincial Administration and the data set derived from this research

	Pre-1990	1990-2000	Post-2000
<i>Opsaridium peringueyi</i>	12	1	0
Other fish species	112	11	375
Shingwedzi	1	1	0
Blyde	1	1	0
Sabie	1	1	0
Pongolo	1	1	0
Crocodile	1	1	0
Komati/Mumati	1	1	0
Olifants	1	1	0
Other fish species	112	11	375

RESULTS AND DISCUSSION

A total of 64 sites were sampled and specimens of *O. peringueyi* were found at 14 (22%) of the sample sites. Historically the Luvuvhu River was well sampled. *O. peringueyi* were present in the Mukuase River, the Mutale River. These rivers are all tributaries of the Luvuvhu River and no specimens were found in the main stem of the river. The scores calculated for the species encounter rate index are similar for the time periods pre-1990 and 1990-2000, with an increase post-2000 (Fig. 2). Only one historical record for *O. peringueyi* exists in the Shingwedzi River (pre-1990) (Fig. 1) and table 1 show that sampling effort in this river was low over the years. The absence of the species was confirmed by the work of Pouché and Vlok (2009). Although there has been reasonable sampling effort over the years (Table 1), historical data shows that the species has never been recorded in the Letaba River. Anecdotal information however indicated the presence of the species at one site in the upper catchment (Vlok pers. com.). This site was included as sample site and the presence of the species was confirmed (Fig. 1D). The population at this site, and therefore within the river reaches isolated between the Ebenezer and the Tzaneen dams. Of the eight sites sampled in the Olifants River, *O. peringueyi* was only recorded at one of the sites. This site is located in the Blyde River, a tributary of the Olifants River (Fig. 2B). Although the Olifants River has been sampled extensively in the past, the species encounter rate index score decreased to zero during the 1990-2000 period with a slight increase in the post-2000 period (Table 1) and Fig. 2). It should be observed that no specimens of *O. peringueyi* have been encountered in the lower Olifants River (below the Olifants-Blyde confluence) since 1990. Except for the Blyde River population and the possible occurrence of the species in the Spekkooim, Steepoort and Waterhoek Rivers, indications are that the species is locally extinct or near-extinct in the main stem of the Olifants River. A total of 22 historical sites were sampled in the Sabie and Pongolo River system and specimens of *O. peringueyi* were collected at only five sites. Four of these sites were at tributaries of the Sabie River namely the Mac Mac, Sabane and Marke Rivers and at the Sabie-Mac Mac confluence (Fig. 1D). The fifth site was lower down in the Sabie River at the Hoxakwekwe (Fig. 1D). The Sabie and Pongolo River system has been sampled well during all three historical survey periods (Table 1). The calculated score for the species encounter index for *O. peringueyi* increased slightly over the three time categories (Fig. 2).

MATERIALS AND METHODS

Historical distribution data

Historical distribution data were collected from various academic institutions, museums, conservation organizations and literature sources. Data sets were obtained from the National Herbarium, the National Institute for Aquatic Biodiversity, Albany Museum, from the Weeks et al. (1996) and Russell (1997) studies. Data was also obtained from Kruger National Park (KNP) which consists mainly of data sampled by A. Deacon and D. P. Naas. Other inputs originated from the data base of Limpopo Department of Economic Development, Environment and Tourism; Eastern Cape Provincial Administration; University of Venda; Mpumalanga Parks and Tourism Agency and old Transvaal Provincial Administration data.

Sampling of historic distribution sites

In an attempt to determine the current distribution of *O. peringueyi*, selected historic sites were revisited and re-sampled.

Measuring change in distribution

The historic distribution data and new data derived from sampling for this project was categorized into four groups (Figure 1). A species encounter rate index was used to establish whether the visual change in spatial distribution observed was valid or due to sample bias.

For category 1A, the species encounter rate index (di) was calculated as:

$$di = n_i / t$$

where n_i is the number of times where *O. peringueyi* was encountered and t is the number of times all fish species was encountered.

Creating a current distribution map

The historic distribution and current distribution were mapped using tertiary catchments as spatial units.

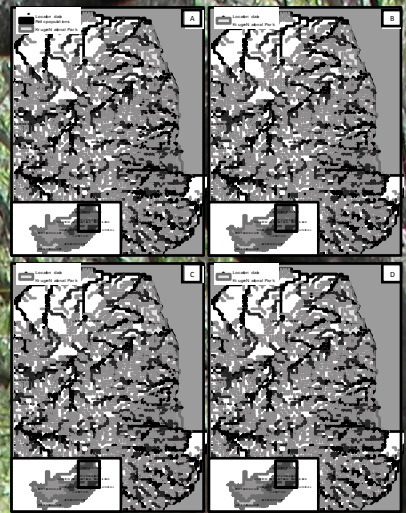


Figure 1: The sample sites where *O. peringueyi* has been found over time, categorized into three periods: A) locations where *O. peringueyi* was found before 1990; B) locations where *O. peringueyi* was found between 1990 and 2000; C) locations where *O. peringueyi* was found post-2000; and D) locations where *O. peringueyi* was found during the research.

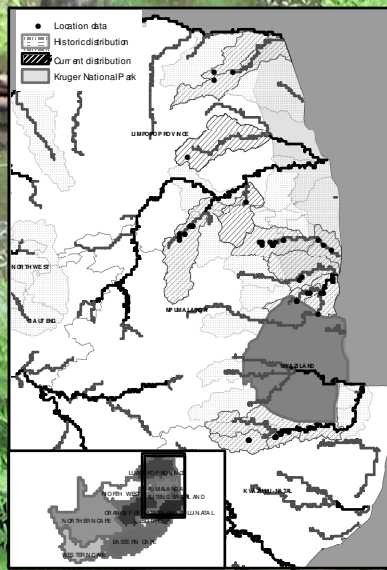


Figure 3: The historical and current distribution of *O. peringueyi* in South Africa mapped using tertiary catchments as spatial units.

RESULTS AND DISCUSSION (continued)

Six historic sites were sampled in the Crocodile River and *O. peringueyi* was absent at all of the sites. Sampling effort was high during the pre-1990 period, river in the 1990-2000 period and at its lowest during the post-2000 period (Table 1). The scores for the species encounter rate index increased between the pre-1990 and 1990-2000 surveys, but decreased to zero during the post-2000 survey period (Fig. 2). The *O. peringueyi* population in the Crocodile River may be already at a very low level, at risk of extinction, in the near future. A total of four historical sites were sampled in the middle and lower reaches of the Komati/Mumati River system. The sites of the upper reaches are in Swaziland and these were outside the project domain. No specimens were collected at any of the four sample sites. Expert mapping based on data from the Mpumalanga Parks and Tourism Board indicated some sites where *O. peringueyi* were collected during the post-2000 surveys (Fig. 1C). From the historical data it is clear that the sampling effort was high during the pre-1990 and post-2000 surveys compared to the lower sampling effort during the 1990-2000 period (Table 1). The species encounter rate score for *O. peringueyi* increased from the pre-1990 to the 1990-2000 surveys, but decreased to zero during the post-2000 survey period (Fig. 2).

Three sites were sampled in the Ushuthu River of which two were in the upper reaches of the catchment in the Assegas and Mgwemisi Rivers and one site in the lower reaches of the system in the Nduma Nature Reserve. *O. peringueyi* was only collected at one of these sites. There was low sampling effort during the pre-1990 and post-2000 surveys and a very low sampling effort during 1990-2000 surveys (Table 1). The scores calculated for the species encounter rate index is zero for the pre-1990 and post-2000 time categories but increased to 0.11 for the 1990-2000 time category (Fig. 2).

A total of ten historical sites were sampled in the Pongolo River system. *O. peringueyi* were present at the four sites all within the boundaries of the Mkhazi Nature Reserve. There was a high sampling effort in the pre-1990 and lower sampling effort during the 1990-2000 and post-2000 surveys (Table 1). Encounter scores were calculated for the species encounter rate index during the pre-1990 and 1990-2000 survey periods with an increase in the score for the post-2000 time category (Fig. 2).

Based on the results presented it would appear as if the overall distribution of *O. peringueyi* in South Africa has decreased substantially (Fig. 3). The current distribution further shows fragmentation of populations caused by a general decrease in connectivity between the different populations.

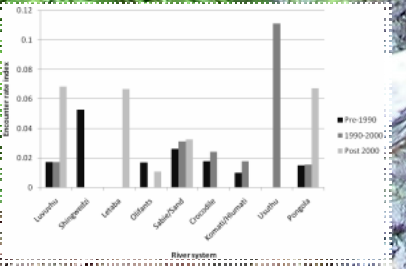


Figure 2: The species encounter rate index scores for the different river systems in the three time categories.

CONCLUSION

The majority of the South African rivers with *O. peringueyi* historical distribution range are under severe pressure. Factors such as alien aquatic species, water abstraction, water regulation, pollution from industrial and urban areas, widespread agricultural pollution and sedimentation have resulted in the distribution of a previously widespread species to shrink and become fragmented. The only seemingly healthy, but small populations are present in the middle reaches of the Luvuvhu, Blyde, Sabie, Pongolo and Pongolo Rivers. The status of populations in the upper reaches, lower Crocodile and lower Komati/Mumati Rivers are uncertain. This is a concern as it has been shown that small fragmented populations are at a greater risk of extinction (Fagan et al. 2005; Fagan et al. 2002). The status of the species *O. peringueyi* in Zimbabwe seems to be critically endangered or possibly extinct (Marshall & Gray-Weaver 1999). Little information regarding its distribution in Mozambique is available but there are clear indications that a healthy population is present in Swaziland (Birk et al. 2007). The largest proportion of the distribution range of the species is within South Africa. This study shows that *O. peringueyi* populations in South Africa are under pressure as it is *inter alia* extinct in some rivers and may be at risk of extinction where they still occur. It also highlights that, due to the transformed nature of river systems in South Africa, the use of historical data (older than a decade), for biodiversity planning and conservation assessments, might increase the risk of underrating conservation status and risks. From the recent study it can be concluded that the current IUCN category of *O. peringueyi* is inappropriate and it is therefore recommended that the conservation status of the species be re-assessed.

Opsaridium peringueyi is a small-bodied fish with a maximum length of 100 mm. It is a generalist feeder, consuming a wide variety of invertebrates and plant material. The species is highly adaptable to different river environments, but its distribution is highly fragmented due to human activities. The current study highlights the need for urgent conservation action to protect the remaining populations of this species in South Africa.