PROJECT SUMMARY: THEE RIVER REHABILITATION AND MANUAL ERADICATION OF SPOTTED BASS *MICROPTERUS PUNCTULATUS* IN THE THEE RIVER, WESTERN CAPE PROVINCE.

Riaan van der Walt
Greater Cederberg Biodiversity Corridor, CapeNature P.O. Box 26, Porterville 6810, South Africa. E-mail: rvanderwalt@capenature.co.za

1. Introduction

The rivers of the Cape Floristic Region (CFR) are known for their unique and largely endemic fish fauna, which exists within very restricted ranges (Skelton 2001). Nineteen endemic fish species are associated with the CFR of which 15 are threatened with extinction, primarily due to the impacts of invasive alien sport fish species and habitat degradation (Impson *et al*., 2002). The Olifants-Doorn River system, which includes the Thee River, is arguably South Africa's most important catchment for the conservation of freshwater fishes, as eight of its 10 species are both endemic and threatened (Impson *et al*. 2002). Certain freshwater fish species used for recreational angling have been transported around the globe and placed in rivers, dams and lakes, frequently without environmental impact assessments or monitoring, for the sole purpose of providing 'enjoyment' for anglers (Cambray 2003). Spotted bass, *Micropterus punctulatus* was introduced into South Africa in 1939 for angling purposes (Shelton, 2001). North American freshwater bass, *Micropterus spp.* are regarded as the species with the highest impact on the fishes of the Cape Floral Kingdom (Skelton 2001) and numerous local studies have shown that *Micropterus spp.* have a negative effect on the indigenous fish population when introduced out its native range (de Moor & Bruton 1988, Shelton 2001, Woodford *et al.* 2005, Weyl *et al.* 2010). *Micropterus* spp. are also listed on the IUCN list of 100 of the world's worst invasive alien species (Lowe *et al*. 2000).

During a knowledge exchange trip by Riaan van der Walt and Martine Jordaan of CapeNature to the South African Institute for Aquatic Biodiversity (SAIAB), various documents were received from Roger Bills regarding conservation priorities in the Groot Winterhoek Freshwater Corridor. In one report (WRC project K8/592: Conservation biology of endangered freshwater fishes. Linking conservation of endangered freshwater fishes with river conservation, focusing on the Cederberg), Roger Bills highlighted that bass had been first reported in the Thee River in 2007. This was following a report to CapeNature by Craig Garrow, a private individual from Cape Town with a passion for freshwater fishes, noting that he had recorded the first known sighting of bass from a formerly un-invaded river system. The source of the bass invasion was not identified but it is most likely the result of human introduction because the Thee River is cut off from the main Olifants River during the dry season. Further, the dominant bass species in the Olifants River mainstream are largemouth and smallmouth bass (*Micropterus salmoides* and *M. dolomieu*) while the species recorded in the Thee River are spotted bass (*M. punctulatus*).

Table 1 Indigenous fish species of the Thee River

Species	Common name	Status
Barbus calidus	Clanwilliam redfin	Vulnerable
Austroglanis barnardi	Spotted rock catfish	Endangered
Austroglanis gilli	Clanwilliam rock catfish	Vulnerable
Pseudobarbus phlegethon	Fiery redfin	Endangered
Labeobarbus capensis	Clanwilliam yellowfish	Vulnerable
Galaxias zebratus	Cape galaxias	Data Deficient

2. Project area: Thee River

The Thee River is a perennial tributary of the Olifants River in the Western Cape, South Africa. Its headwaters lies at a altitude of 1 500 m in the Koue Bokkeveld mountains from where it flows in a westerly direction for 10 km before joining the mainstream of the Olifants River (Figure 1). The climate is classified as Mediterranean with dry summers and wet winters while the Thee River catchment is characterized by quartzite sandstones of the Table Mountain series (Mucina & Rutherford 2006). The vegetation is dominated by woody proteoid shrubs and restios with a large component of fine leaved fynbos and dwarf shrubs. Riverine components form medium to tall closed scrub in which water white alder *(Brachylaena neriifolia),* lance-leaved myrtle *(Metrosideros angustifolia),* waxberry *(Morella serrate)* and water heath *(Erica caffra)* tend to dominate. The wetter more open lower riverbanks and stream edges are generally colonised by palmiet *(Prionium serratum)* and *Elegia capensis*, with *Isolepis digitata* one of the few species to establish itself in the high energy midstream (Mucina & Rutherford 2006). The majority of the catchment is in a near pristine condition with only prickly pear (*Opuntia humifusa*) recorded as an alien plant species. The study area includes a 3 km stretch of the lower Thee River. The downstream border of the study area is an artificial barrier built by local farmers to abstract water from the Thee River. The *M. punctulatus* invaded area of the study area stretches 2.2 km upstream to another artificial gabion barrier built to stop the upstream invasion of *M. punctulatus*. The *M. punctulatus* free study area stretches for 1.5 km upstream of this gabion barrier. The study area is a low gradient area characterized by shallow pools up to 80 m long connected by shallow cobble rifle areas. Six indigenous fish species have been recorded in the Thee River (Table 1). Until 2007 the Thee River has remained largely un-impacted by human activity including the introduction of alien fish. The Thee River is also one of only three rivers where the endangered spotted rock catfish (*Austroglanis barnardi*) has been recorded (Impson *et al.* 2002). The river is therefore of high conservation value and of particular importance for the survival of this species. The Thee River is also one of the few remaining sites where recruitment of Clanwilliam yellowfish (*Labeobarbus capensis*) is currently taking place and where the fish assemblages are dominated by indigenous species (Impson *et al.* 2002).

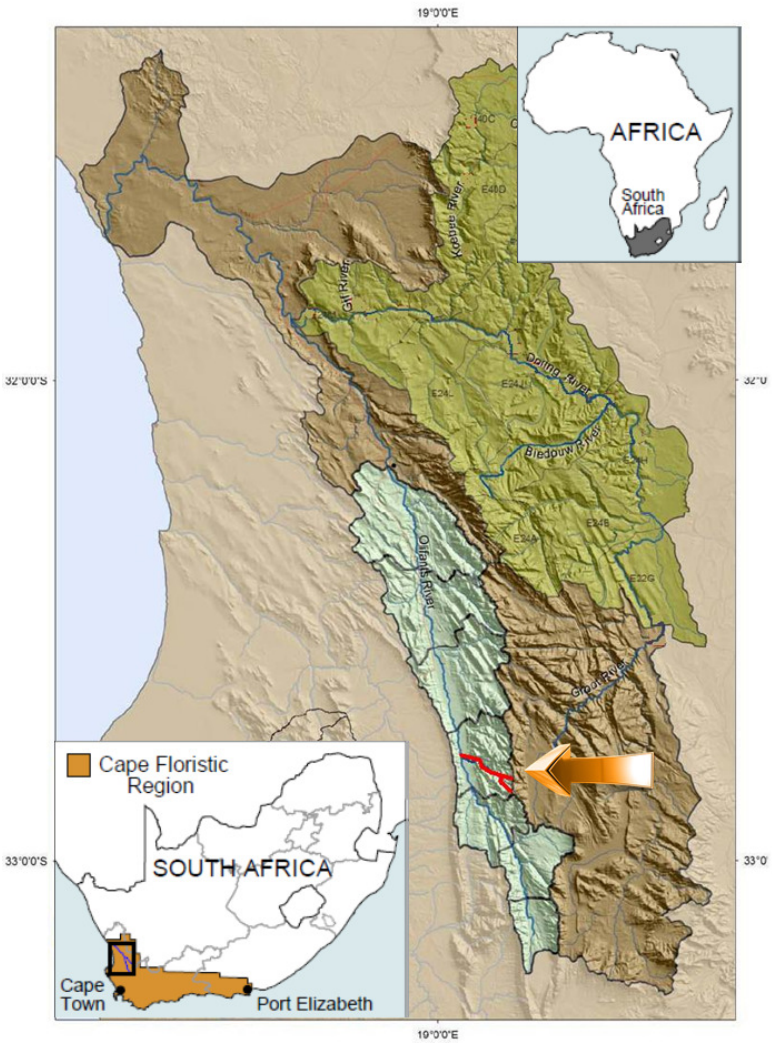

Figure 1 Location of the Thee River in the Olifants – Doorn River catchment

3. Project Actions

3.1 Initial Survey of the Thee River

On September 2010 the potential for the removal of bass from the lower Thee River was discussed by Riaan van der Walt and Martine Jordaan of CapeNature, and Sean Marr of the University of Cape Town (UCT). During October 2010, a temporary barrier (gabion weir) was constructed above the known upper limit of the bass invasion by the land owner, Mr. Joepie Burger and Craig Garrow, a concerned private individual from Cape Town who also sponsored the gabion and construction cost . The location of the barrier was decided following numerous snorkel surveys by Craig Garrow. To date, bass have not been found above the barrier site.

On the 18th and 19th of November 2010, Riaan van der Walt, Sean Marr and Craig Garrow conducted a snorkel survey of the Thee River from the 3rd road crossing to the temporary barrier. The size of all bass observed was estimated and their location recorded using a GPS. In total, 2.65 km was surveyed over two days. In addition, the reaches immediately above the temporary barrier were surveyed but no bass were observed. It was evident that the bass density in the sectioned surveyed was very low and very few bass were observed during the survey. The impact of the bass was greatest at the lower section of the survey area and very few indigenous fish were observed in the lower reaches. The density of indigenous fishes increased dramatically

up the river towards the temporary barrier. The reaches between the 6th road crossing and the barrier weir held exceptionally high densities of indigenous fish, highlighting the impact of bass in the first reaches surveyed above the 3rd road crossing where, in apparently optimal habitat, very few indigenous fish were observed.

All the spotted bass were recorded in pools while the three banded tilapia observed were recorded in a fast flowing section above a pool. Of particular concern is the close proximity of one large female spotted bass to the barrier weir. This bass (30cm) was captured using a seine net and removed from the river.

The number of bass observed during the survey was low, only about 20 individuals recorded. It is understood that the number of bass in the survey reach is significantly higher since snorkel surveys usually underestimate the number of individuals present. The low density of bass in the survey reaches and their associated decimation of the indigenous fish population in the reaches just above the 3rd road crossing highlights the high impact of the species on the indigenous fishes.

3.2 Eradication phase

First season

Between 19 November 2010 and 10 April 2011 two hundred and eight *M. punctulatus* were removed from the invaded area of the Thee River. One year old *M. punctulatus* was the most abundant (n=130) followed by young of year (n=58), two year old *M. punctulatus* (n=11) and older than two years (n=9). Most of the *M. punctulatus* was removed by means of 28 and 35 mm meze size gill nets.

Second season

Between 18 October 2011 and 30 March 2102 one hundred and thirty five *M. punctulatus* were removed from the invaded area of the Thee River. One year old *M. punctulatus* was the most abundant (n=90) followed by young of year (n=24), two year old *M. punctulatus* (n=21) and bass older than two years were absent). Most of the *M. punctulatus* was removed by means of day and night snorkeling using hand held scoop nets. Some small bass was also removed using electro fishing in shallow pools and rifles.

From 1 to 3 April 2012 three days of day and night snorkeling yielded no bass and it was considered that no bass remained in the Thee River.

4. Discussion

This project has also demonstrated that manual eradication can be a viable option for eradication of alien fish in the CFR. To successfully manually eradicate alien from a river the river must confirm to the following criteria:

- Visibility: Minimum 3 metres
- Depth: Not pools deeper than three metres
- Aquatic vegetation: No thick aquatic vegetation
- Barrier: To stop re- introduction of alien fish

Best methods for manual eradication of bass

- Gill nets 35 and 50 mm for larger bass
- Electro shocking of riffles and shallow pools (small fyke nets can be used as block nets)
- Snorkelling with hand nets for YOY to 2 year old bass
- Night snorkelling with hand nets
- Catch all breeding bass in first season
- Commitment and dedicated funding

The only method that has been used in the CFR for eradication of alien freshwater fish has been by using the piscicides rotenone (Impson 2005). The use of rotenone was recently successfully used to eradicate bass from the Rondegat River in the Cederberg but was not considered for the Thee River because of the high numbers of indigenous fish in the invaded stretch of the river. Rotenone is a natural compound extracted from leaves in the Leguminosae family and effects toxicity by disrupting cellular respiration in the mitochondria (Vinson *et al.* 2010). The application of rotenone is also not host specific and will lead to eradication of non-target fish. This fact can lead to opposition from the public that find the use of piscicides ethically questionable (Gozlan *et al.* 2010). The major concern of the use of these piscicides is that it is also lethal to invertebrates and amphibians (Vinson *et al.* 2010). The use of artificial barriers in alien fish management proved to be a cost effective and a successful management tool. It is also recommended that there is ongoing monitoring of the study area to document the recovery of the indigenous fish species and potential re- introduction of alien fish. To address and monitor the threat of re-introductions a public and landowner awareness program should be implemented because most often the spread of alien and extra-limital species occurs through ignorance or the misguided actions of private individuals. The awareness campaign should also be targeting anglers and this can be achieved through articles in angling magazines and also involving anglers in the management of alien fish.

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