RESTORATION OF NATIVE FISHES IN THE LOWER RONDEGAT RIVER AFTER ALIEN FISH ERADICATION: OVERVIEW OF A SUCCESSFUL CONSERVATION INTERVENTION

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The freshwater fishes of the Cape Floristic Region (CFR) are characterised by high endemism and restricted ranges, which makes them vulnerable to environmental threats such as pollution, habitat destruction, and alien invasive fishes (Tweddle et al. 2009). Since the majority of headwater streams in the CFR contain threatened native freshwater species, these water bodies are priorities for conservation management (Impson et al. 2002). The CFR is an freshwater fish invasions hotspot (Leprieur et al. 2008), with the majority of the environmentally damaging species being introduced for recreational angling (Cambray 2003). The Rondegat River, a second order tributary of the Olifants-Doring river system, provides a classic example of the problems caused by invasive sport fishes, as well as a unique example of a direct intervention by conservation authorities to remove the invasive fishes and rehabilitate the threatened fish community.

The Rondegat River is home to five native fish species, namely the Clanwilliam yellowfish (*Labeobarbus capensis*), the Clanwilliam redfin (*Barbus calidus*), the fiery redfin (*Pseudobarbus phlegethon*), the Clanwilliam rock catfish (*Austroglanis gilli*) and the Cape galaxias (*Galaxias zebratus*). Surveys conducted in 2003 and 2011 showed the lower 4km of the river to be invaded by the North American smallmouth bass (*Micropterus salmoides*), with all but large adult Clanwilliam yellowfish excluded from the invaded reach as a result of decades of predation by the bass (Woodford et al. 2005, Weyl et al. 2013). Due to the relatively small length of the invaded reach (four kilometres) and the fact that it was bounded by two barriers to upstream movement (a waterfall that prevented the further encroachment of bass, and an abstraction weir that could block re-invasion), CapeNature embarked on a programme to eradicate the bass from the Rondegat River, a process that included a comprehensive EIA (Marr et al. 2012) and a biological monitoring programme. The monitoring programme was undertaken by the South African Institute for Aquatic Biodiversity (SAIAB) with funding from the Water Research Commission (Project K8-922). Comprehensive surveys of the fish and aquatic macroinvertebrates were carried out in the stream before and after the rotenone treatment, so that the collateral impacts and long term effect of the piscicide on the stream ecosystem could be addressed.

On 29 February 2012, rotenone was applied to the stream from multiple drip cans for a period of six hours. In the days following the rotenone treatment, it was confirmed that no live fish were present in the treated area (Weyl et al. 2013). Pre-treatment monitoring had revealed significant natural variability in the invertebrate diversity of the treated reaches, but an assessment of statistically rarefied species counts did show a significant decline in diversity immediately following the rotenone treatment (Woodford et al. 2013). Half of the apparently extirpated insect species had returned to the monitoring sites by May 2012, though data analysis of insect diversity is still on-going.

Assessment of insect densities on individually sampled stones revealed a significant decline in the abundance of Ephemeroptera (mayfly nymphs), whereas other groups did not significantly decline in abundance in response to the piscicide treatment (Woodford et al. 2013). Follow-up surveys in May 2012 revealed mayfly densities to have returned to pre-treatment levels (Figure 1). These data indicate that the mayflies were resilient to the impact of rotenone, while other groups

such as aquatic beetles, caddisfly larvae and other fly larvae were generally resistant to the piscicide (Woodford et al. 2012).

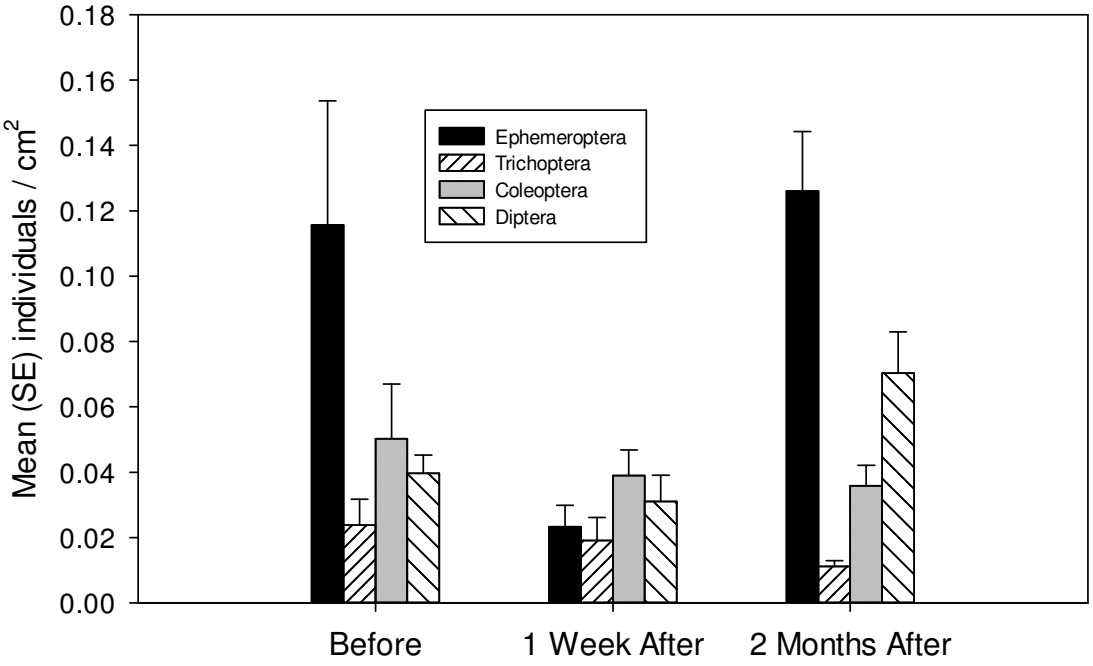

Figure 1: Invertebrate densities on stones before and after rotenone treatment, indicating decline followed by rapid recovery in numbers of Ephemeroptera occurring on the stones.

One year after the first rotenone treatment, a comprehensive follow-up survey assessed fish densities and diversity above, within and below the treated reach. Snorkelling, electrofishing and underwater video analyses showed no smallmouth bass remaining in the treated reach, and that large numbers of juvenile Clanwilliam yellowfish, together with smaller numbers of other native fish, had successfully colonised the formerly invaded sites (Weyl et al. 2014; Figure 2). A second rotenone treatment in March 2013 confirmed the total absence of bass from the Rondegat River, indicating the operation to have been a success. On-going monitoring under a new Water Research Commission project (K5-2261) will assess the long-term recovery of the fish and insect communities following the successful eradication of bass.

The Rondegat River provides a good example of a comprehensively planned, well executed, and properly followed-up conservation intervention, which has resulted in range expansions for several threatened fish species with a CFR mountain stream. It is hoped that this success story can serve as a comprehensive case study on which to base future alien fish eradication projects in small mountain streams, many of which represent the last refuge for some of South Africa's most threatened native fishes. Only through active management will these streams remain refuges for our national biodiversity heritage, and the Rondegat River rehabilitation programme represents a significant first step in this long and difficult task.

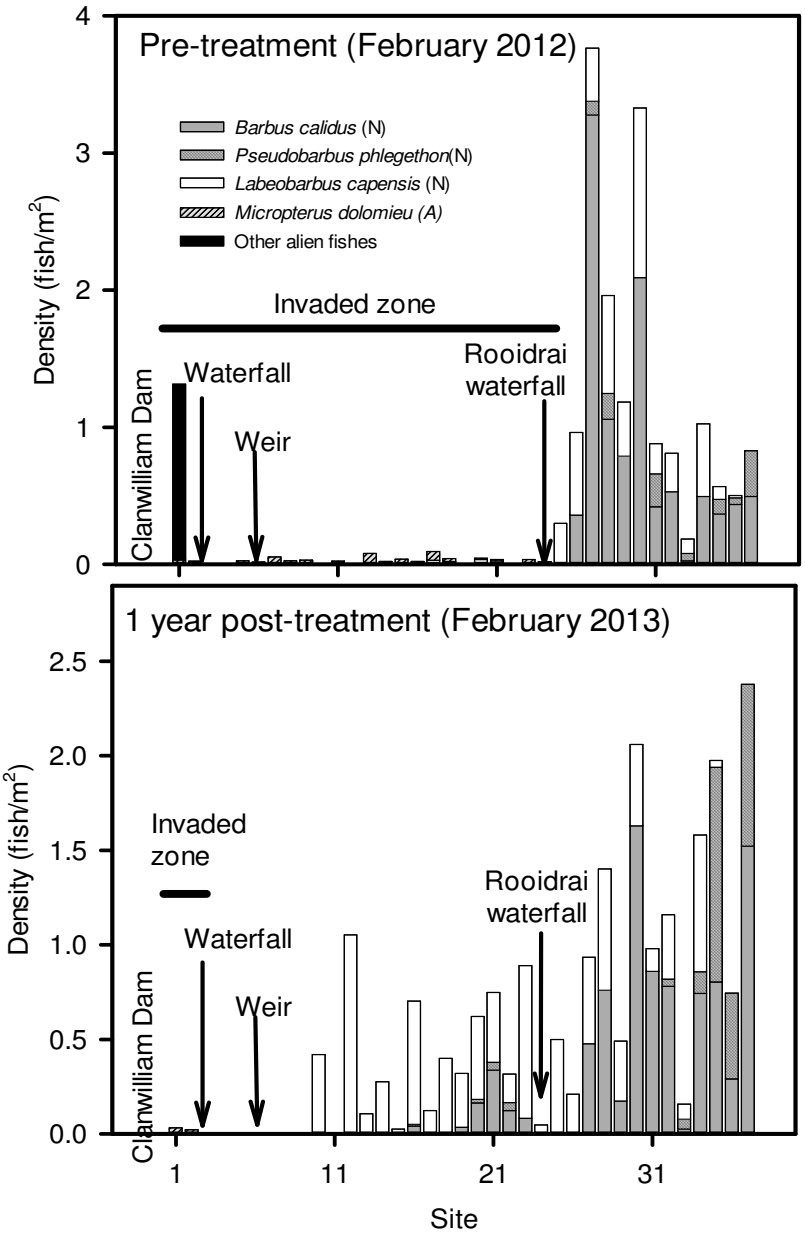

Figure 2: Densities of fish species at monitoring sites in the Rondegat River before and after rotenone treatment, indicating contraction of the invaded reach to below the barrier weir and the recoloisation of the treated reach by native fishes (from Weyl et al. 2014).

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